

THE SPECTRUM MONITOR®

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

Volume 3

Number 5

May 2016



Wi-Fi Radio Report



Plus:

Comet CA-500 Antenna Analyzer
Headsets for your Radio Room
Mobile Hamming Done Right
Saving AM Broadcasting

THE **SPECTRUM MONITOR**[®]

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

Volume 3 Number 5

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By Thomas Witherspoon K4SWL

Wi-Fi radios, by and large, look like traditional radios; they typically have backlit digital displays, front panel buttons to recall memories, and an internal speaker. They function like them, too, in that they play radio stations—but there's where the resemblance stops. Streaming Internet audio, and their dependence upon an aggregator to do this, sets them entirely apart. This month Thomas looks closely at some popular Wi-Fi radio choices to find the good, the better and the expensive.

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By Cory GB Sickles WA3UVV

Last month, Cory introduced you to the possibilities of getting involved and having fun with ham radio on the HF bands—using (among other things) CW (Morse code), some ingenuity and networking with fellow hams to get started—all within a target budget of less than \$100. This month, he explores some of the details of putting together your first station, including a simple antenna you can build, complete with an inexpensive QRP tuner for just \$25 as well as tips on making that first CW contact.

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By Mike Kohl

For decades the AM broadcast industry has slipped further and further behind what it thought was its main competition: FM broadcast radio. Now, with satellite radio and Internet streaming taking more market share with each passing year, AM radio is frantically looking for a way to bail out a sinking ship. Mike outlines some of the options available to the oldest sector of the broadcast industry through regulation and market incentives. But, will any or all options be enough?

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By Richard Fisher KI6SN

Many hams spend more time in their cars than in their shacks, leading to the notion of going mobile and not just for 2-meters. But it's not nearly as easy as you might think. Trying to get an HF signal out of a moving, noisy, metal shack using impossibly short antennas are only a few of the difficulties to be overcome. Richard examines the mobile operations of a few of the most successful road operators to find out how to do it right.

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By Mark Haverstock K8MSH

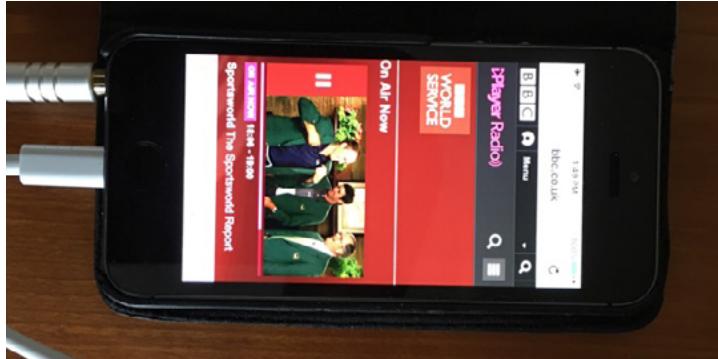
There's an old saying in ham radio: if you can't hear 'em, you can't work 'em! A good pair of headphones (sometimes referred to as "cans") can make the difference in working DX or just enjoying a QSO in a noisy home environment. Mark takes a look at two popular headphone sets: Audio Technica's BPH1S broadcast headset and Heil Sound's Proset Elite amateur radio headset. Both have their advantages and both are under \$200.

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Dear TSM:

Comments, Advice, Kudos and Questions from Readers



Using an older iPhone as a Wi-Fi radio to get around using an aggregator. (Photo courtesy of Bill Hole AC8FD)

Satellite Radio vs. Wi-Fi Radio

"I am delighted each time I open a new issue! Thanks to all involved! I have two comments:

"1) SkiFi and XM: My own long-serving SkiFi2, which offers all you mentioned ['The Case for Satellite Radio,' *TSM*, February 2016] plus it has a built-in FM modulator, which makes it easy to use with any FM radio within the satisfactory range. Some are available on eBay, where I got a backup unit. One possible advantage for disaster preparedness might be its use when infrastructure fails or news is scarce (nationally or internationally). I set mine up for 12V DC.

"2) Wonderful WiFi Radio Primer! ['Wi-Fi Primer: The Quest for Global Content,' by Thomas Witherspoon K4SWL, April 2016 *TSM*] I await the further sections! Re: Streaming vs. OTA - Great series! Thanks to Tom Witherspoon! I have been fascinated by the improvements in streaming which make it a viable alternative to OTA FM in my retirement community QTH 20 miles from Cleveland, where outside antennas are a problem. OTA here suffers from shifting multi-path with weather changes and when people and objects move! While OTA at its best gives better audio, it is usually worse—rare intermittent dropouts are the main streaming problem.

"And, regarding aggregation: I've tried setting up an older iPhone (and am trying an older Touch) to get around using an aggregator. I've certainly found many apps, which go to stream sources and can be updated. I even was pondering building a Raspberry Pi 3 system to browse for audio. I recently bought a Yamaha stereo receiver, with "Internet radio," but it uses an obscure aggregator. Thanks again!"
– Bill AC8FD, Oberlin, Ohio

*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.*



Everett Wittig WB7VNF shows how antenna/house entry is done right. (Photo courtesy of Everett Wittig)

Antenna Entry Done Right

"I read with interest the discussion in the April 2016 issue of *The Spectrum Monitor* detailing the window-type panels that allow antennas and other cables to feed into the radio shack. I had attempted to use numerous of these solutions over the course of nearly 50 years as a licensed amateur radio operator and scanner enthusiast. While they worked, when I moved into my current home I decided the time had come to 'do it right.' The accompanying photographs show how all of the antennas from my three towers enter my shack. This system has fully overcome a lot of the shortfalls with all of the entries that I have used over the years.

The above photo shows me standing next to the waterproof box into which all of the feed lines that are buried in the conduit entry.

"The second image (next page left) shows the inside of the box that has the PolyPhaser lightning protection. There are two 8-foot ground rods attached to the bus bar onto which the PolyPhasers are mounted. The ground bus from inside the shack also connects to this bar (green wire).

"One more item that may give a more complete picture to your readers is how I handled the feed line shield grounds (the previous entry panel photograph showed the coax center conductor protection via the PolyPhaser lightning protection devices). All three towers are handled identically, but the other photo (next page right) is the VHF/UHF/Scanner antenna tower. Each of the towers has at least three 8-foot



Inside the antenna cable panel. (Photo courtesy of Everett Wittig)

ground rods driven completely into the ground (the TX455 has six 8-foot ground rods). These are CAD welded both to the tower and to the 8-foot copper ground rod.

“Also shown in this image is how the feed lines enter the conduit. This was done to prevent rodents from gnawing on the feed lines since we live in a fairly rural area and had information that pack rats and other rodents could present a potential problem to unprotected wiring.

“I purchased 1,500-feet of Times Microwave LMR400 for the feed lines for my station when I installed it as well as top-of-the line Times Microwave 400EZ connectors (‘N’ and ‘UHF’). The antenna farm includes three towers (two Rohn 40-foot 45G and the TX455 55-foot crank-up shown nested with the KLM KT34 and KLM 5-element 6-meter beam). The VHF/UHF/Scanner antenna tower is located closest to the shack and the HF BWD90 folded dipole has the longest feed line at 160-feet, however, the loss in the LMR400 is negligible at HF and the antenna performs very well across the entire 1.6 MHz to 30 MHz spectrum (I use it for both amateur NVIS and HF SWLing).” – Everett Wittig WB7VNF, Sierra Vista, Arizona

Well done, Everett! Thanks for sharing your expertise with TSM readers. – Editor

Making Old Radios Safe

“Ever since subscribing to *TSM* with the very first issue virtually every month has something of interest to me. Most recently the February 2016 issue with the transistor radio article [‘Solid State Gems: Discovering Transistor Radios,’ by Michael Jack]. Yes, I have a collection of those as well as a few multiband transistor portables. The resources mentioned in the article listed Eric Wrobbel’s collection website and I thought I’d mention that I have several of his booklet-style collector guides and find them to be very well done with lots



Antenna grounds at WB7VNF antenna farm. (Courtesy: Everett Wittig)

of info and great photos [<http://www.ericwrobbel.com/books>].

“The March issue opened my eyes to ‘The Goodwill Radio Connection’ [Radio 101] of which I had no idea, thanks for that info (one of two Goodwill stores locally is gone but I never found much of interest there). I recently checked the Goodwill auction site [<http://shopgoodwill.com>] and, while I found some neat stuff, there was nothing I had to have (though a vintage Heathkit amateur transmitter was on there recently, but I’m not a ham). Oh well, the Kutztown antique radio show is coming up so I’ll be there likely both days.

“On a note about antique radio safety—much has been said here in *TSM* and online of using safety capacitors to replace line filter caps in old sets. That goes without saying, but I haven’t seen much about the chassis to cabinet cap often found in All American 5-type (a.k.a. series strung or AC/DC) sets with metal cabinets. Often some of these sets isolate the chassis from the cabinet with rubber grommets, wood blocks or some other means but often have a paper capacitor connected between the two. So recently, I opted to replace those capacitors with safety caps too since, depending on the set’s wiring, the chassis could be hot with the power switch on or even off.

“In the March issue, ‘Adventures in Radio Restoration,’ Geoff B. mentioned that Lowe’s has cloth covered cord that I wasn’t aware of, and I’d like to add that my local Lowe’s has ball-handle type toggle switches like those used on Hallcrafters S20-R. I used one to replace an intermittent power switch on an old Jackson tube tester and it was virtually identical to the original, but the switches have wire leads not solder tabs or screw terminals. The switches were located in a cabinet with tilt-out bins along with table lamp sockets and miscellaneous electrical hardware. It is on an end cap in the electrical department.

“I have one question for you: I’ve seen comments on-



Keeping old radios safe for operating today. (Photo courtesy of Rich Post KB8TAD)

line in some radio restoration articles that they are noticing the mica caps (domino type) going bad. I realize this might be rare, but I've noticed more comments like this recently. Is it possible that these components are reaching the end of their useful lives now? I ask because I have a Hallicrafters SX43 that I got at Kutztown last spring. It receives on all bands and I did the usual paper cap change-out and replaced the out-of-tolerance resistors (which was almost all of them) but I get a persistent random crashing sound on all bands sounding like a nearby thunderstorm, without antenna. Other radios were quiet so I believe it is internally generated. I hear it even on FM and VHF bands in FM mode but it is much more attenuated.

"I hope it's not a failed mica cap in an IF can. I will pull the tubes to see if I can isolate it to a section. I did see an online article on someone removing the micas from the IF transformer in an S-38 and placing new ones under the chassis, values were I believe 100-150pF." – Wayne Wlocka

Rich Post Responds:

Insulated mica failures are not that common but do occur. I have encountered several bad mica capacitors, not necessarily because of the insulation but because of moisture penetration by way of the wire leads to the contacts inside. So the answer like so many questions is, it depends. Factors include how the mica cap was manufactured, how the radio was stored, and possible high voltage transients the caps may have experienced.

Regarding radio safety: Yes, there are a number of AC-DC radios with metal cabinets that have the "hot-chassis" insulated from the cabinet using rubber, fiber, or nylon insulators with a factory-installed capacitor connected between that chassis and the metal cabinet. Those include the Hallicrafters S-38, S-38A, S-38B, SR-75, and S-41, the Echophone EC-1, EC-1A, and EC-1B, the Minerva Tropic Master, the National NC-44 and some other metal cabinet radios that were built before the "floating ground" circuitry

became the standard for AC-DC radios. The cabinet-to-chassis insulators in those sets should be replaced if they have deteriorated to make sure there is no electrical continuity between the cabinet and chassis. In addition, the fiber back on those sets should be checked to make sure that the chassis cannot be touched. I have seen some of those sets with the back badly torn or completely missing.

Other AC-DC radios with a "floating ground" use a capacitor and typically a parallel resistor between the B- (which is connected to one side of the power line) and the chassis. Those are a bit safer than the ones to which you refer that have the chassis directly connected to the power line and are "hot" either when switched on or when switched off.

As a stickler for safety, I strongly concur with your action of replacing the cap to the metal cabinet of a hot-chassis set with a Y-rated safety cap. The cap used for "floating ground" circuitry in other AC-DC radios should likewise be replaced with a Y-rated safety cap. In addition, any cap that crosses the power line should be replaced with an X-rated safety capacitor.

However, I often go two steps further. The first step is to modify the wiring to an AC-DC set with a polarized line cord so that the neutral (the wide blade on the power plug) goes directly to the B-, which in the case of a hot-chassis set as described, goes directly to the chassis. The power switch is then rewired to switch the line side only (by way of an added fuse) with the switch wiring then going directly to the rectifier, typically a 35Z5 or 35W4. With that change, the chassis or B- is always only connected to the neutral side of the power line. In the April issue of my column in which I describe the restoration of the Lunitone 1260, I could not do that because of the unique power switch. However, I took the second step and replaced the power cord with an ALCI plug and cord repurposed from a hair appliance. The ALCI will shut off power if it detects any leakage from about 4 to 6 millamps, making the Lunitone much safer than any other change except for adding an isolation transformer for which there was no room. Plugging into a GFCI will of course

COMMUNICATIONS CENTER
DALLAS, TEXAS 75202

Date Aug 25, 1966 196

Aug 21, 1966

Thank you for your DX reception report on _____

WFAA Radio operates half-time on 820, [NBC] a 50,000-watt nationally cleared channel, and half-time on 570, [ABC] a 5,000-watt regional channel, [directional night]. WFAA-FM operates full time on 97.9 megacycles.

WFAA RADIO DX

BOB BRUTON
Program Manager

QSL card from WFAA, Dallas, Texas, from 1966 alludes to but doesn't explain why they are on two frequencies or when exactly they switch. The card also fails to mention which of the two frequencies is being confirmed. (From the KS4ZR collection)

provide the same protection, but I prefer the more permanent solution.

Besides changing any line to chassis or hot-chassis to metal cabinet capacitor to a Y-type safety cap, I advocate modifying a set with an isolation transformer if there is room such as in my National NC-44 or to change the power cord to an ALCI such as I have done to my Hallicrafters S-38, Echophone EC-1, Minerva Tropic Master, and Hallicrafters S-41, as shown in the accompanying photo, which was first published in the December 2013 issue of *Monitoring Times* in an article describing the use of an ALCI for safety improvement. That article is available on the web at http://www.ohio.edu/people/postr/bapix/GFCI_.htm

A large antique radio club has requested and been granted permission to provide a copy of that article with the sale of hot-chassis AC-DC radios. Here's a link to the toggle switch that Wayne found at Lowes: http://www.lowes.com/pd_87179-1781-GSW-125__?productId=3379562 Be safe, and thanks for writing! – Rich Post KB8TAD

Mystery of WBAP/WFAA

"This past winter we went for Christmas to Marco Island, Florida, and the warm weather made medium wave DXing to the north about impossible. I was lucky to receive WBAP and WWL, even PJB hardly came in—given our location. Back in 1971 in my first Christmas trip to Fort Lauderdale, PJB came in very clearly. But that was before the reduction from 500 kW to 50 kW.

"Did you or Doug Smith ever do an article on WBAP/WFAA transmitter sharing? They shared two frequencies, which I guess ended in the 1970s. 820 kHz and 570 kHz were assigned to both Dallas and Fort Worth—820 was NBC, 570 was ABC. The switch was every six hours. In Erie, Pennsylvania, I could receive 820 but not 570. At the switch times, I would hear:

"‘This is WFAA 820 radio Fort Worth. NBC news is on the hour.’ A cowbell would sound, then, ‘This is WBAP 820 radio Dallas. NBC news is on the hour.’ I would hear

CHANNEL	5
POWER	100 KW ERP
ANTENNA	RCA Super Turnstile
TOWER	2349' above sea level
TRANSMITTER	RCA TT-250L & RCA TT-250L
ON AIR SINCE	28 September 1948

WBAP-TV NBC

FREQUENCY	96.3 MC
POWER	88 KW ERP Horizontal, 38 KW Vertical
ANTENNA	RCA Ring 1440 feet on TV Tower
TRANSMITTER	Collins 830H (20 KW)
ON AIR SINCE	8 March 1949

WBAP FM

FREQUENCY	820 KC
POWER	50 KW Clear Channel
ANTENNA	454 Feet Vertical Radiator
TRANSMITTER	RCA BTA-50 F
ON AIR SINCE	2 May 1922

WBAP 820 NBC

FREQUENCY	570 KC
POWER	5 KW D-N
ANTENNA	3 654-Feet Vertical Radiator
TRANSMITTER	RCA BTA-SF
ON AIR SINCE	1 May 1928

WBAP 570 ABC

Howdy, Pardner:

Your report is confirmed. Thank you for tuning in WBAP. We are happy to learn that you are one of our listeners.

Ray Bacus
General Manager
WBAP AM-FM-TV

PS: We hope you'll come down our way and enjoy yourself in Texas, a fabulous land of outdoor sport and informal living. Plan to spend your next vacation in Texas. You'll love it!

QSL from WBAP, Ft. Worth, Texas, which alternately shared frequencies with WFAA as it had done for decades. It serves as an all-purpose QSL for its two AM frequencies as well as WBAP's FM and TV stations. The card is postmarked July, 1965 and is one of many over-sized QSL cards sent to listeners at the time. It measures 6 x 9 inches. Despite the extra size, the station paid only 5 cents postage. Postage for the normal sized WFAA QSL card was 4 cents. (From the KS4ZR collection)

the converse when 820 went from WBAP to WFAA. Similar occurred for 570, except it was ABC news on the hour. Why was the sharing done? Why was it ended?" – Tim Kuryla, Lexington, Kentucky

Both WBAP and WFAA go back to the 1920s and, while it wasn't that uncommon to have to share frequencies in those days, the case of WBAP and WFAA is an extraordinary one. According to the entry in Wikipedia, part of which is based on a book by Richard Schroeder from 1998 titled, "Texas Signs On: The Early Days of Radio and Television," the two stations moved to 800 kHz between November 1928 and June 1929.

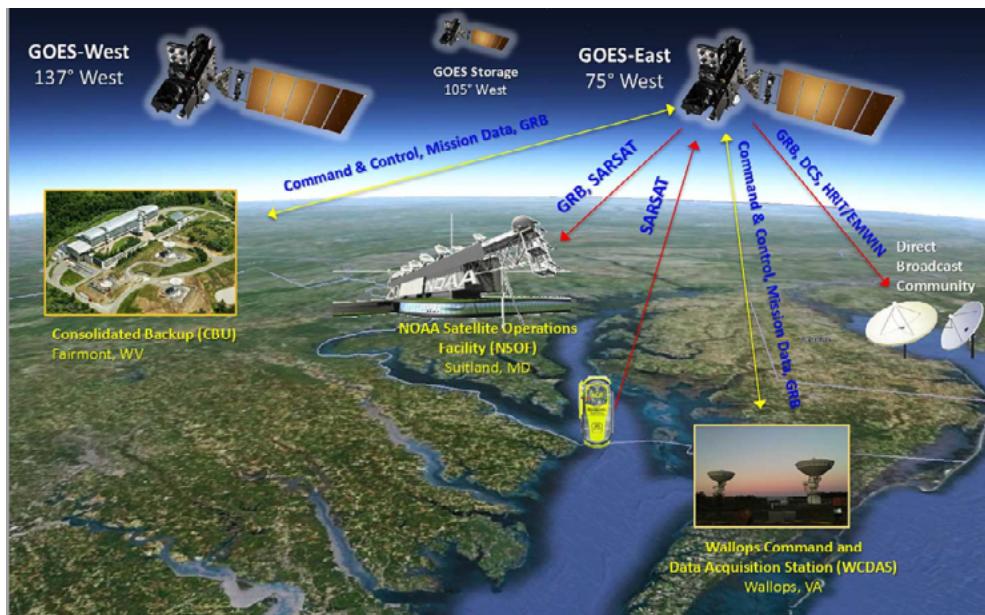
The story gets completely tangled in 1935 when the owner of WBAP purchased another station in Texas at 570 kHz and had it moved to Ft. Worth for use when WFAA was using the 800 kHz frequency. With the Treaty of Havana of 1941 the two were finally relocated at 820 kHz. The agreement (and endless confusion for those working at the station and those listening) ended May 1, 1970 when WBAP reportedly paid WFAA \$3.5 million (almost \$8 million in today's money) to give up their rights to 820 kHz. WBAP got the 820 kHz slot, 50 kW clear channel status and NBC network affiliation while WFAA got exclusive use of 570 kHz in Dallas (but with only 5 kW), ABC network affiliation and, of course, the cash. This information is slightly different from the home pages of either station, but the sources in Wikipedia seem more accurate. Both QSL cards shown above mention both frequencies but not the relationship to the other on those frequencies. – 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



GOES System Architecture. New GOES-R geostationary weather satellite is set to launch this fall for a 15 year hitch in space with a host of platforms from direct broadcast satellites to handheld devices. (Courtesy: NASA/NOAA)

GOES-R to Debut Fall 2016

NASA and NOAA are preparing for the fall launch of the newest GOES geostationary weather satellite, designed for 15 years of on-orbit life. According to NASA, "GOES-R will help meteorologists observe and predict local weather events, including thunderstorms, tornadoes, fog, flash floods, and other severe weather. In addition, GOES-R will monitor hazards such as aerosols, dust storms, volcanic eruptions, and forest fires and will also be used for space weather, oceanography, climate monitoring, in-situ data collection, and for search and rescue." GOES-R will be launched from Cape Canaveral Air Force Station in Florida aboard an Atlas V 541 expendable launch vehicle.

The GOES system currently consists of GOES-13 operating as GOES-East in the eastern part of the constellation and GOES-15, operating as GOES-West. The GOES-R series will maintain the 2-satellite system implemented by the current GOES series. The GOES-R Series operational lifetime extends through December 2036.

Ultra HD via Satellite Poised for Big Market Penetration

A report from Northern Sky Research (NSR), released March 30 called 2016 "a key inflection point for the rollout of UltraHD via satellite...forecasting 785 UltraHD channels by 2025." NSR predicts: "By next year, almost all regions worldwide will have UltraHD channels available, and even developing regions see content by the end of the decade. Furthermore, the plunging price of 4K TV sets accelerates interest and demand in the new format, setting 4K TV penetration rates

to rise faster than the initial introduction of HD TVs."

The NSR report admits that right now UltraHD constitutes about 1 percent of overall channel count but notes that, "the impact to the bottom line of pay TV platforms and satellite operators alike is disproportionately large, through both direct and indirect returns. Short term ROI [Return on Investment] challenges remain for broadcasters; however, longer term, UltraHD is expected to pay dividends to pay TV providers and will form a critical component of most platforms by 2025. Those without it will be viewed the same way SD-only [Standard Definition] platforms are viewed in the market today."

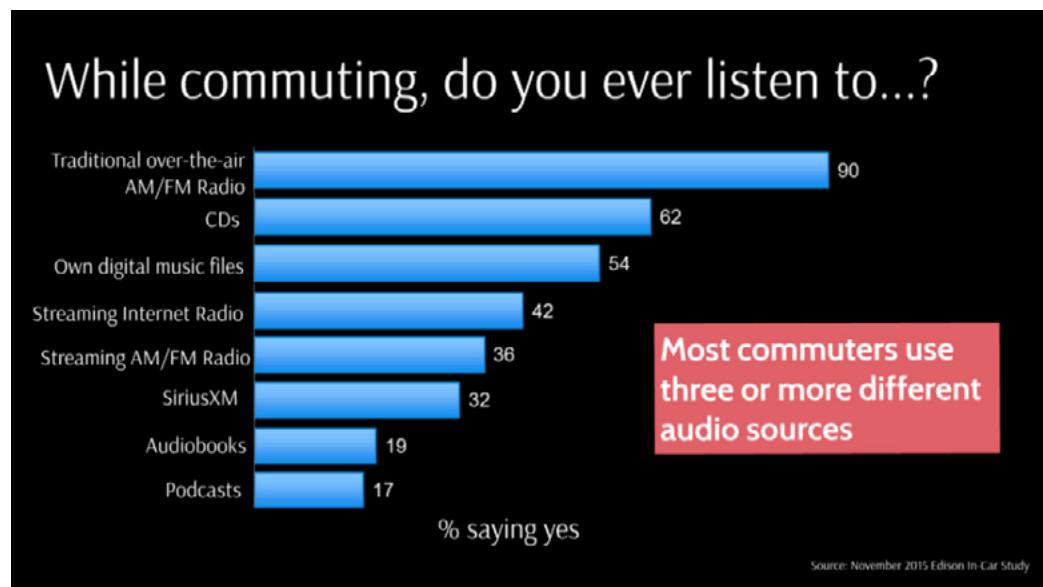
WBUR-FM Pledge Drive: \$1,000,000 in 26.2 Hours

Numerous and interminable fund-raisers for public radio stations are loathed by broadcasters and listeners alike. What if a station could raise all they need in just one day? Is that even possible? Yes, according to an article in Current.org., WBUR, Boston University's public station, tied the record-setting fund raiser to the city's other more famous marathon; the Boston Marathon. Further tying itself to the running marathon, WBUR planned to raise the money in 26.2 hours, which cleverly gave it access to three crucial drive-time periods—traditionally the most lucrative time to ask for pledges during any radio pledge drive. In the final hour the station raised \$178,000 to clinch the million-dollar mark.

Chicago Police Radio Traffic Interrupted with Racial Slurs

A report on Chicago's CBS-TV affiliate Channel 2, March 15, noted that

Edison Research conducted a national survey of 1,117 adults ages 18+ who are employed full or part time, commute to work at least twenty minutes in a car or truck they drive themselves, and listen to any type of audio (AM/FM radio, Streaming Internet Radio, CDs, digital audio files/MP3s, satellite radio, podcasts, etc.) during that commute. Edison recruited an additional 101 commuters nationwide and asked them to mount a GoPro camera in their cars and record their commutes. Both phases of this study were conducted in the fall of 2015. (Graphic courtesy of Edison Research "Share the Ear" project)



the city's police department had launched an investigation after several episodes of racial slurs were heard on the city's police scanner frequencies. According to the TV report, "A spokeswoman for the Office of Emergency Management and Communications says OEMC officials have reviewed the audio and don't believe a city-programmed radio was used because the audio lacks the identifying characteristics of an official police radio."

Edison Research: What Commuters are Listening to in their Cars

A report released April 8 from Edison Research as part of their "Share the Ear" study showed that commuters "use a lot of different platforms for audio in their cars. Traditional broadcast radio is the overwhelming leader, with 90% of respondents saying they use it. There's a huge drop off down to the CD player, which is being used by 62% of commuters. Over half listen to their own digital music files, 42% listen to streaming Internet radio services such as Pandora, and 36% listen to streamed AM/FM radio. Just over one in three listen to SiriusXM while commuting; 19% of respondents listen to Audiobooks, and 17% listen to podcasts. If you're wondering how there are eight different platforms on this list being used in the car, it's because there's a lot of switching going on in the car. On average, commuters told us they (at least sometimes) use more than three different audio platforms while they are commuting" and will typically switch 18 times among the various audio sources available during a commute.

Respondents, when asked what they do when a commercial comes on, 71 percent said they either switch immediately (23 percent), listen to part of one commercial (25 percent), or listen to at least one commercial (23 percent). Twenty-nine percent do not typically switch when commercials come on, according to the study.

Edison conducted a national survey of 1,117 adults ages 18+ who are employed full or part time, commute to work at

least twenty minutes in a car or truck they drive themselves, and listen to any type of audio (AM/FM radio, Streaming Internet Radio, CDs, digital audio files/MP3s, satellite radio, podcasts, etc.) during that commute. Edison recruited an additional 101 commuters nationwide and asked them to mount a GoPro camera in their cars and record their commutes. Both phases of this study were conducted in the fall of 2015.

Philadelphia TV Station Fined \$89,000 for Refusing Inspection

March 30 the FCC issued a Forfeiture Order (FO) in the amount of \$89,000 to an uncooperative TV station in Philadelphia, Pennsylvania, for "failing to make the station available for inspection by FCC agents on multiple occasions, maintain a fully staffed main studio for the station, and operate the station's transmitter from its authorized location."

For its part, the station didn't deny any of its failings, including the part about operating the station's transmitter from an unauthorized location for eight years! Even so, the station found nerve enough to suggest the FCC dismiss the Forfeiture Order for "medical considerations," "miss-communications" with FCC agents and claims that the station has insufficient funds to pay the imposed penalty. The FCC was unmoved by such spurious claims and pointed out that the station in question failed to mention the "pending sale of the station, which will yield it \$6,400,000 in a transaction that has already been approved by the Media Bureau," according to FCC records.



Left: The front panel of the CC WiFi is simple and intuitive. The main knob acts as both a selection dial and volume control. Right: The WFR-28 has a simple front panel with a dedicated volume control, mute button, function buttons and 5 memory presets. The color display is backlit and easy to read. (Photos courtesy of the author)

Wi-Fi Radio Primer Part 2: Review of Stand-Alone Wi-Fi Radios

By Thomas Witherspoon K4SWL

As I mentioned last month in the first of this three-part primer on Wi-Fi radios, I never thought a Wi-Fi radio was something I'd ever acquire. By "Wi-Fi radios," of course, I mean Internet radio devices that have the sole purpose and dedicated function of streaming radio audio, and so, as a die-hard ham with a penchant for a well-balanced tuning knob, I just couldn't see the need for what I thought of as an overly-simple, perhaps even redundant, device.

Indeed, until I began the as a search for the perfect radio for my family and XYL ("ex-young lady," old ham radio speak for wife), I had used only an app on my smartphone (with headphones), and on tablet PCs connected to amplified speakers, in place of a dedicated Wi-Fi radio. And I was fine with that. Or so I thought...

Fast-forward several months. Now that the XYL and kids have been using Wi-Fi radios for a while, I don't think they'll go back. As for myself? Yes, I've crossed that no-return boundary, too. Our whole family's now joined the Wi-Fi radio club, and the truth is, we're all enjoying the Wi-Fi's simplicity and unique benefits.

In Part 1 of our Wi-Fi Radio Primer (*TSM*, April 2016) I discussed what makes Wi-Fi radios tick—their ability to find radio stations via radio station aggregators. I also discussed the comparative merits of the most dominant aggregators on the market, and took a look at one easy alternative to the Wi-

Fi radio, namely, streaming from your smartphone or tablet. Now I'll take an in-depth look at some of my picks from the current market.

Wi-Fi radios: an Overview

Wi-Fi radios, by and large, look like traditional radios; they typically have backlit digital displays, front panel buttons to recall memories, and an internal speaker. They function like them, too, in that they play radio stations—but there's where the resemblance stops. Streaming Internet audio, and their dependence upon an aggregator to do this, sets them entirely apart.

The market for Wi-Fi radios is actually not as broad and diverse as the shortwave radio market. If you're seeking a quality device that uses a well-known and properly curated station aggregator (again, see Part 1 for more on this), you'll be looking at about a dozen (or so) radios currently on the market.

Here's a short list of the current market's most popular Wi-Fi radios. Note that this is by no means a comprehensive list—it's a curated list of Wi-Fi radios that are in wide use, are relatively simple to operate, have built-in speakers, and that use reliable aggregators. I've noted the aggregator in parentheses as well as the average US purchase price.



The two-line monochrome backlit display packs a lot of information in a compact space. Station selections and descriptions scroll horizontally. (Photo courtesy of the author)

Amazon: Echo (TuneIn): \$179

CCrane Company: CC Wi-Fi (Reciva): \$120
CC Wi-Fi 2 (TuneIn): \$130

Grace Digital

Grace Digital Mondo GDI-IRC6000 (Reciva): \$145
Grace Digital GDI-IRC7500 Stereo (Reciva): \$180

Pure

EVOKE Flow (Pure): \$155
EVOKE F4 (Pure): \$225

Sangean

WFR-28 (Frontier Silicon): \$122
WFR-20 (Frontier Silicon): \$275

And Now, Let's Meet our Real Contenders

After much research and head scratching, I chose four Wi-Fi radios from the above list: the C.Crane CC Wi-Fi, the Sangean WFR-28, the Grace Digital Mondo and the Amazon Echo.

FYI—and in full disclosure—here's how I obtain my review radios. To keep my review budget within reason, I contact a supplier and request a loaner unit for review that I may return or purchase afterward; otherwise, I purchase the unit(s) outright. In this case, I purchased the Amazon Echo (\$179), Grace Digital Mondo (\$150), and rechargeable "D" cells for the WFR-28 (\$30), while both C.Crane and Sangean kindly opted to send sample review radios, this being a less expensive route for these retailers. When I receive samples, my policy is to give away those I don't wish to keep; for those I do decide to keep, I donate the full retail price to Ears



The Sangean utilizes standard D size batteries. I use NiMH cells that the WFR-28 can be set to recharge internally. (Photo courtesy of the author)

To Our World, a 501(c)(3) non-profit which sends self-powered shortwave radios to teachers in off-grid developing world communities.

The decision process, this time, was a particularly difficult one. Every model has its advantages and disadvantages; and there are no "perfect" Wi-Fi radios—at least, none that satisfied all of my stringent requirements:

- Handy size
- Intuitive display
- Dedicated memory buttons on front panel
- Clear, robust audio
- External connections
- An internal rechargeable battery option (for portability)
- Easy setup
- Remote control
- Traditional FM and/or AM radio tuner

Several friends urged me consider the Pure EVOKE F4, which reportedly has excellent audio, a simple interface, and superb customer support. Plus, it's a sleek little device, and...well, frankly, cute. Many have also touted Pure's own proprietary aggregator, as well. But I just couldn't justify purchasing and reviewing a Wi-Fi radio with such a hefty price tag (\$225), especially knowing that I would also need to purchase the optional battery pack (\$50) for a total performance picture.

Reviews

Here are summary reviews of each radio I tested. These are not comprehensive reviews covering every feature; rather, in these summaries, I focus my analysis on their ability to tune stations, on audio quality, on portability, and simply on general usability.



Left: All of the external ports are on the rear panel of the CC Wi-Fi and include an Ethernet connection, headphone jack, line out jack and power port (7.5 VDC). Right: All of the external ports are on the left side (facing) of the radio. The WFR-28 has an auxiliary in, line out, headphone jack and power port (7.5 VDC). (Photos courtesy of the author)

The C.Crane CC Wi-Fi

I've had many C.Crane radios in the past. I love C.Crane products because they're typically well designed, effective, and because C.Crane offers excellent customer support.

The CC Wi-Fi radio has been on the market longer than any other Wi-Fi radio reviewed here. When I first unboxed the CC Wi-Fi, I was a little surprised by its diminutive size: it is, perhaps, 30% smaller than I expected (based solely on web images and from the catalog). It comes with a small remote control with blister/membrane style buttons. The front panel on the CC Wi-Fi is very simple: one large knob, six buttons, and a monochrome backlit two-line alphanumeric display. Setup is fairly easy; the accompanying owner's manual walks you through the process (another C.Crane strength is their production of good-quality manuals). Once I had set up the radio and registered it with the Reciva aggregator, I was tuning in the world.

The CC Wi-Fi's plastic case feels rather thin—at least, thinner than I would have expected. But the radio is surprisingly lightweight, perhaps as a result of this. Fortunately, I was pleasantly surprised by the audio from the internal speaker. It provides a full sound and is more than adequate for medium-sized rooms. Bass tones are present, though not especially deep. It's wonderfully balanced for the spoken word.

The CC Wi-Fi only has three buttons on the front panel of the radio that act as dedicated memory presets. I wish this number were, at the very least, doubled. With the provided remote control, of course, memory presets are expanded to 99 allocations. Fortunately, you can pretty much operate the CC Wi-Fi's functions without the remote control (a bonus for

those of us who tend to misplace tiny remote controls).

There are a few updates that I think would make the CC Wi-Fi shine:

To help with portability, it would make sense to add a carry handle and capacity for internal rechargeable batteries. The CC Wi-Fi requires a DC power supply to operate; this is a shame because I suspect other listeners, like me, often enjoy radio away from home where there are no main power outlets. The unit is small enough, and lightweight enough, that it would lend itself very well to portability.

Though I'm sure the two-line backlit display was among the best in its class when the CC Wi-Fi was introduced, I now find myself wishing this display could be a bit wider, taller, and (ideally) in color. The display is small enough that if you're browsing stations with the accompanying remote control, you need to be within a few feet of the radio. If it's across the room, however, it's very difficult to navigate.

Additionally, the display width is not sufficient for longer Reciva station names/labels. As an example, I have a folder with local CBC stations from across Canada. Stations are labeled with the town or city name following, for example, "CBC Radio One - Toronto" or "CBC Radio One - Charlottetown." When I'm browsing the folder of CBC stations, the display merely shows me a long list of "CBC Radio One" stations—which is to say, the truncated display cuts off the city's name. Of course, I can press the right arrow on the remote to have the station name slowly scroll into view, but this is a cumbersome process when browsing the list. There are, of course, work-arounds for this—I could, for example, create folders for each city, or assign the station to a dedicated memory position—but then I would have to drill down another level to find my station. "Work" around is the operative term, in either case.



Left: If you have a USB memory stick with audio content, you can play it through the WFR-28 via this handy, dedicated USB port on the top of the unit. Right: The WFR-28 has a dedicated tuning/selection knob. (Photos courtesy of the author)

Pros:

- Small size
- Ethernet connection
- Line-out audio
- Headphone jack (on back)
- Included IR remote control
- Affordable
- Audio quite good for size of unit (bass, see con)
- Extras include:
- Pandora connect
- Live365 (now defunct)
- Dar.fm

Cons:

- No battery-power option
- Thin, “plasticky” feel to the case, seems less durable
- Occasional slow connection time to Wi-Fi
- Internal speaker generates (comparatively) weak bass
- No EQ for audio
- Only three memory buttons on front panel
- No smartphone/tablet app

Overall, I think the CC Wi-Fi is a good value and is currently one of the least expensive Wi-Fi radios using the excellent Reciva aggregator. The CC Wi-Fi has a surprising number of features for its price class. None of the criticisms above are necessarily deal-breakers, but some strategic upgrades to this radio would keep it competitive for many years to come.

The CC Wi-Fi can be purchased from the following retailers:

C.Crane Company (<http://www.ccrane.com/CC-Wi-Fi-Internet-Radio-w-Clock-Alarm-99-Memory-Presets>)

Universal Radio (<http://www.universal-radio.com/catalog/specialty/5181.html>)

Amazon.com (<http://www.amazon.com/Crane-CWF-Wi-Fi-Internet-Radio/dp/B0018782QI>)

The Sangean WFR-28

When I first unboxed the Sangean WFR-28, I immediately noticed its design, which bore a striking similarity to other Sangean AM/FM portables like the Sangean PR-D7. The WFR-28 has a glossy hard plastic body that feels durable. The buttons are spaced well across the front panel and have a tactile responsiveness and weight that speaks of quality. There is a dedicated volume rocker button, five memory preset buttons, as well as a dedicated tuning knob and five function buttons.

The WFR-28 also has an easy-to-read square color screen that provides about five lines of text and can display any broadcaster artwork/logos provided. You can access all of the WFR-28’s functions by using the front panel buttons and tuning controls. As with most Wi-Fi radios, doing so is not as enjoyable an experience as with most traditional radios, since you’re using a tuning control to move up or down through selections on a small display.

The Sangean WFR-28 does not ship with a remote; however, if you have an iOS or Android smartphone or tablet, you can download a free “remote control” app to control your radio. I find that this is actually more convenient than with a traditional IR remote, because you can control the radio functions from anywhere within your Wi-Fi network. Not to mention, it’s great to be able to turn the volume up from another room in the house! What I really appreciate is the ability to browse the full Frontier Silicon database from the app—so much easier than browsing through the radio’s front panel. I do wish there was a way, however, to add stations to memory allocations via the smartphone app (take note of this for a future app update, Sangean!).



CCWiFi's limited display features monochrome text-only screen.
(Courtesy of the author)

The Sangean remote app even allows you to control the various player modes: Internet Radio, USB, AUX in, and the traditional FM tuner.

Speaking of which, yes, the WFR-28 has a very good FM tuner. I can easily receive one of my benchmark distant-FM stations, and even successfully decode the RDS data—both the remote app, and the radio display FM station information. Nice touch, Sangean!

The WFR-28 doesn't ship with a battery pack: rather, it takes traditional D cells in either Alkaline or NiMH form. I purchased a four-pack of high-quality, high-capacity NiMH D cells—they'll set you back \$25-30, but are well worth the investment. The WFR-28 will internally recharge the cells when plugged into an outlet. Once fully charged, you'll have hours upon hours of playtime. I haven't measured the total playtime after a full charge, but I imagine it to be in excess of 24 hours.

What is the WFR-28 missing? One obvious thing is a carry handle or strap, always useful. Other than that, it really packs a lot for a \$122 radio.

Pros:

- Good audio fidelity from internal speaker
- Preset EQ settings
- Customizable EQ
- Crisp with noticeable bass tones
- Affordable
- One-touch preset buttons (see con)
- iOS/Android app/remote control
- Accepts and charges standard NiMH D cells
- Very good FM receiver/displays RDS information
- Superb playtime from 4 D cells/batteries
- USB MP3 playback (MP3 and WMA compatible)
- Stream Spotify music channels and selections



Close-up of Sangean WFR-28 display shows its versatility: multi-color, multi-line text with imagery. (Photo courtesy of the author)

Cons:

- Only five preset buttons
- No carry handle
- If unplugged to go portable, radio shuts down and restarts on battery power, rather than remaining on
- No battery indicator on display
- On a few occasions the audio has failed after being woken up from standby (turning the radio off, then on again, is the fix for this)

Overall, I believe the Sangean WFR-28 is an excellent Wi-Fi radio; when combined with rechargeable D cells, you have a portable multi-function audio entertainment system that's simple to use. I should note that I've also been pleased with the Frontier Silicon station aggregator, as well; although more simple than other aggregators, FS just happens to provide all of my favorite stations and networks (do check for your favorites before you buy).

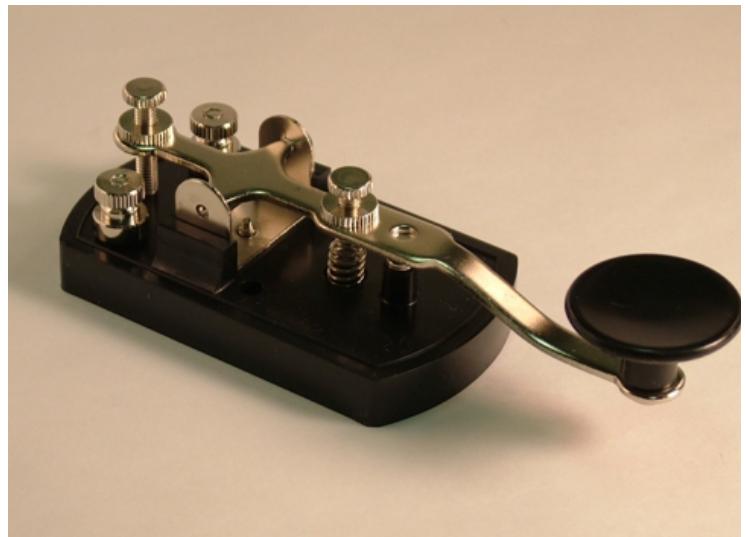
The Sangean WFR-28 can be purchased from the following retailers:

Universal Radio (<http://www.universal-radio.com/catalog/Wi-Fi/4028.html>)

WalMart (<http://www.walmart.com/ip/Sangean-WFR-28-Wi-Fi-Internet-FM-RDS-Network-Player/21106828>)

Amazon.com (<http://www.amazon.com/Sangean-WFR-28-Internet-Radio/dp/B0085H18W4>)

Stay tuned! Next month I'll take a look at two more Wi-Fi radios, the Grace Digital Mondo and the Amazon Echo.



Left: MFJ's line of QRP rigs includes the six-band MFJ-9296. With plug-in band modules and digital VFO, it's a good option for higher budgets. (Courtesy: MFJ Enterprises) Right: The Ameco K-1 is a good entry-level key. With some L brackets, you can even mount two of them against each other for an inexpensive set of paddles. (Courtesy: Morse Express)

Piggy Bank Ham Radio – Part 2

By Cory GB Sickles WA3UVV

Last time, I introduced you to the possibilities of getting involved and having fun with ham radio on the HF bands—using (among other things) CW (Morse code), some ingenuity and networking with fellow hams to get started—all within a target budget of less than \$100. This month, we'll explore some of the details of putting together your first station.

Before you go too far into this installment, you may want to review Part 1 – in the April 2016 issue of TSM. Also, I hope your bundle of one-dollar bills and spare change is continuing to grow.

By now, I'm sure you've figured out that you'll need a straight key to be able to send CW. Custom and precision designed keys can range into the hundreds of dollars, but thankfully there are many less expensive alternatives. MFJ Enterprises markets some "beginner" keys for reasonable prices or you can pick up the Ameco K-1 from MORSE Express for about \$13. As the gear being discussed is small and light, it could all conceivably be mounted on a clipboard. Think about that for a moment, as it takes care of any base requirement for your key. For a few dollars or less, a blank plastic light switch plate, screws and some rubber feet, all from your neighborhood hardware store, can serve as a cheap base, too.

Admittedly, I'm a purist when it comes to straight keys. I think everyone should learn to use one well and not even think of incorporating a bug or set of paddles, until you have a good fist at 18 WPM (words per minute). However, I acknowledge that's not an attitude shared by everyone. If you find a "killer deal" on a used bug, side-swiper key or paddles; then, buy them.

Paddles require some electronics to function "normal-

ly," but they can be wired and used as a side-swiper. Bugs can have extra weights and/or arms to slow down the dits, until you get your speed up. I've also seen bugs turned on their side and adjusted to allow only the dah side of things to initiate contact closures. While a basic key (I've found some nice ones for \$5) is typically less expensive, sometimes a dirty-but-functional set of paddles or older bug can be found at a hamfest. I paid \$25 for a neglected Vibroplex bug a few years back. Once cleaned up and properly adjusted, it worked wonderfully.

Now we come to antennas. The simplest one is the dipole. This is nothing more than two quarter-wavelength pieces of wire, insulated and fed in the center, with other insulators at each end, going to some suitable supports. For the CW sub-band of 40-meters, we're looking at a length of about 33 feet for each element. The wire needs to be strong enough to stay up on windy days, but doesn't have to be too massive. Hardware stores are good sources of wire, as are thrift stores and such. In whatever section they devote to building and electrical items, I have found spools of hundreds of feet of wire for just a few dollars. Rope can be found here as well (useful for going to trees or whatever is available, and safe, to use). Ideally, your dipole should be up at least 33 feet, but don't sweat it if circumstances are not ideal. It will still work.

Insulators can be made from large pill bottles, solid strips of plastic, a few links of plastic chain or pretty much anything else that is non-conductive and strong enough. This is another example of a good time to think outside the proverbial box and see everyday items as having possible uses with ham radio.

Feedline is going to be in the form of coaxial cable.



Left: With 2 watts out and plug-in band options, the Super Tuna II from QRPME represents a good choice for a simple transmitter to accompany your existing communications receiver. (*Courtesy: QRPME*) **Right:** If you decide an end-fed half wave antenna is for you, this inexpensive tuner from newcomer QRP Guys performs well. -- *QRP Guys*

Both 50 and 75-ohm varieties can be used, although the latter is more suitable if you have a tuner or tube-based transmitter. RG-58 is thin and while not great for VHF work, it's acceptable for 40-meters. RG-58 is a 50-ohm cable and was once used for 10Base-2 Ethernet runs, so you might find some leftover on a spool in an older computer store. RG-59 is a 75-ohm cable, most commonly used for cable TV. It has slightly less loss than RG-58 and may also be found in reasonable lengths and prices at thrift stores. Using a tuner with 75-ohm cable can give you better efficiency, but isn't always necessary.

Using a SWR meter or antenna analyzer is best. You can cut the antenna "blind" and hope for the best, or ask one of your new friends for some help. Along the way, you'll have a better appreciation for impedances, line losses and standing wave ratios.

While not needed at the antenna feed point, your cable will also require connectors on the transmitter end. The RG-59 you find may already have F-connectors attached. They work fine in the HF range, and they're cheap. Likewise, RCA or phono (they're the same thing) plug/jack combinations are also easily found and cheap. The transceiver in question comes with a BNC jack, but that's easily changed while building it. The transmitter includes a phono jack - but again – an F-connector will work, too. The same goes for any tuner you might build. A cost difference is that male F connectors usually require a crimp tool, but phono connectors can simply be soldered. For your own sanity though, standardize on "something" and stay with it. You'd be amazed at just how much money you can tie up in adapters.

If you already have a receiver and end-fed wire antenna for it, then keep things as they are and build the dipole for the transmitter; ideally oriented perpendicular to the receive antenna. This way, you can avoid the additional expense of a transmit/receive (T/R) switch. The transceiver already has that circuitry built-in.

Oh, while you're picking up ear buds or headphones, look on the racks for miniature phone plug terminated cables. Stereo versions are more available and versatile. Cutting one in half will give you a quick way to connect your key's terminals to your rig.

Now I think we're down to some sort of power source. Note that both options specify 12-volts—not 13.8—which is a more common standard for communications gear. There are so many different ways to come up with 12V, but here are a few. While you're at the computer store, trying to scrounge for some RG-58, see if they have any older power supplies. I've picked up such things for \$5 or less. Disk drives and other storage peripherals like 12V and the typical supply will give you more than enough current to drive your rig and any station accessories that may come into play later. If you have a desktop computer nearby, you might just want to tap into one of its connectors for 12V – normally found using a yellow wire (they use red for the 5V side of things).

An old car battery or something routinely swapped out from an alarm system can yield a nice power source that will keep you on the air for hours at a time. They need to be charged of course, but charging sources aren't too difficult to find. The only thing I would caution you not to use as a power supply is any sort of "wall wart" power cube. These are notoriously bad choices, as they have no regulation to speak of and the voltage coming out is typically higher than listed, until a heavy enough current drain is in place. The Banggood site offers suitable power supply boards (already assembled) for less than \$5, so this is a reasonable alternative, too.

I would like to see you standardize on Anderson PowerPole connectors right from the start, but as we are trying to do all this as inexpensively as possible, I suppose they can wait for a while. Phono connectors can also be used for power, but make double sure you don't mistake an audio or RF connection for a power connection. The results can be ugly.

Now at this point, we have covered enough to build a transmitter and/or transceiver, antenna system, power supply and straight key (or other way to generate CW). With some help from your Elmer, you should have tuned your antenna for resonance, eliminating the need for a tuner, and have all the hardware essential to putting your minimalist station on the air.

With some consistent study of Morse code, you should also be ready in the "software" department. With all this in place, there is one more consideration to cover: how do you feel?

If you are nervous about getting on

the air for the first time, allow me to assure you that it's a normal feeling. It's been 40+ years since I was first licensed. I still have some memory of how anxious and unsure I was when I first called CQ. Thankfully, there was a very patient ham on the other end of that QSO. What I would learn later is that there are many patient hams out there. Once again, members of your club can make that first contact a more relaxed moment.

Give someone you know a telephone call and see when you can both spend some time on the air. Take it easy and stick to the basics: RST (Readability, Strength, Tone), name, QTH, rig and so on. If all is going well, then proceed on with other things, until you are ready to sign off. After that, do what the shampoo bottle says – “repeat.” Then repeat again and again and again with every opportunity. Soon, you'll be on the air enjoying yourself and amazing everyone with your QRP signal and simple station.

When you have a chance, I'd like to have you send along some pictures of your setup and a few lines about how much fun you're having; funded with spare change and some stray “Washingtons.”

From the time I first conceived of this article until the time I submitted Part 2, I managed to put away close to \$300. That kind of budget allows for the possibility of a multi-band QRP station with a transceiver kit that's a bit more sophisticated or one that's already wired and tested. If you have some patience and good luck disciplining yourself, then lets explore the idea of having a even better station.

Moving from fixed-frequency crystals to a frequency-agile VFO opens up many possibilities. Also, the ability to explore additional bands encourages you to spend more time on the air. One choice for such a rig might be the MFJ-9296. This QRP transceiver (typically 8W @14V) uses plug-in modules for each band – 80, 40, 30, 20, 17 and 15 meters.

It's hard to imagine what ham shacks would look like without at least some MFJ gear in them. For over 40 years, they have supplied station accessories, test equipment and more; including a long-lived line of CW and SSB low-power radios. The MFJ-9296 continues this tradition and sells for \$230.

As a Tech, you'll be able to make use of the 80, 40 and 15-meter bands right away. Upgrading to General will reward you with the privileges to enjoy the other bands. When I was a Novice, 15-meters rewarded me with many surprising DX opportunities. An appropriate 40-meter dipole can work on 15M, although you may want to employ a tuner.

Another antenna alternative, since we're “moving up” is a loop antenna. Here again, MFJ makes a suitable tuner to match this radio – the MFJ-9232. For \$60, some lengths of 2 x 2-inch lumber and a bit of wire, you can make your station portable and enjoy ham radio in the field. Here again, an SWR meter would be nice, but listening to signal strength and noise levels while adjusting the tuner, will get you into a reasonable “ball park” for good antenna efficiency.

At this point, we get into all sorts of possibilities for stations. Used gear, the discussion of which could be a series



MFJ-9232 Pocket Loop Tuner. (Courtesy: MFJ Enterprises)

of articles, is another approach, once we bring our budget up to a higher number.

Certainly, the low cost approach proves that amateur radio is not an expensive hobby. With a bit of research and some effort on your part, you can be licensed, learn code, make new friends and put together a starter station for less than \$100.

The topics of CW, building and QRP have combined to be the fastest growing and most vibrant part of ham radio today. So the next time someone says that ham radio costs too much, hams don't build anything or CW is an old fashioned mode that no one uses anymore, you'll be able to correct their impressions and show them all that you've accomplished.

Resources: The Online QRP Mall

Here's a relatively short list of web sites to visit while shopping around for kits, information ways to enjoy amateur radio.

- www.4sqrp.com
- www.73radiorow.com
- www.af4k.com
- www.americannmorse.com
- www.arrl.org
- www.banggood.com
- www.bencher.com
- www.expandedspectrumsystems.com
- www.fists.org
- www.g4fon.net
- www.mfjenterprises.com
- www.mtechnologies.com
- www.njqrp.org
- www.qrparci.org
- www.qrpguys.com
- www.qrpkits.com
- www.qrpme.com
- www.radioshack.com
- www.skccgroup.com
- www.vibroplex.com



Best Buy's Insignia HD-Radio (see TSM September 2014 for review); last of the table-top HD-capable radios now just \$40. The future of AM radio could be FM via a translator or becoming a subchannel on an HD-Radio FM station. (KS4ZR photo)

Saving AM Broadcasting in North America

By Mike Kohl

This month I'm going to attempt a recent history and analysis of the AM broadcasting business. Specifically, things that are being done in an attempt to allow existing AM broadcasters to stay in business. During the last several decades, the ability of most AM broadcasters to provide a clear signal to the general public has been challenged by an increase in electromagnetic interference from the profusion of many new electronic devices. Computers are the biggest offender, causing electromagnetic interference in general.

The trend for manufacturers to cut costs to the bone when specifying power supplies for many electronic devices has virtually trashed the radio spectrum environment with electromagnetic interference beyond belief. It is a situation that is not going to improve anytime soon, for the sake of saving a few pennies per device in many cases, in the production of electronics. Office buildings are built with mostly metal and other dense walls, so radio signals of all types are blocked in most indoor locations that are not situated next to a window.

The combination of shielding by building design along with a lot of electronic devices in close proximity with each other has been especially damaging to anyone trying to reach an audience via the AM broadcast band. Mobile radio listeners in vehicles are often irritated by interference and complete loss of signal on bridges and within tunnels. Little imagination is needed to realize that the odds are stacked against using the traditional AM broadcast signal as a medium to reach the public.

The difference between daytime and nighttime coverage is another factor in the demise of the AM band. Six so-

called "graveyard" frequencies, at 1230, 1240, 1340, 1400, 1450 and 1490 kHz have been the home for local channels, intended for a 30 or 40 mile daytime range with a power of 1000 watts, and an equal or lesser power at night. Nighttime coverage in many places is limited to just a few miles. Regional channels have typically had between 5,000 and 10,000 watts daytime, and 1,000 to 5,000 watts at night.

The numbers of channels using regional allocations is limited, and many stations have extremely directional coverage patterns, to maximize coverage to specific areas while protecting nearby stations sharing that or an adjacent frequency. Canada, the U.S., and Mexico all have a limited number of clear channel frequencies, where nighttime operation was previously limited to a handful of stations across the continent sharing a frequency. The luckiest of this class were allowed to transmit 50,000 watts day and night, with a few stations commanding a third or half of North America at certain times of the night, depending upon propagation conditions.

Challenging conditions have brought technical solutions to assist broadcasters in cutting through the electromagnetic noise. Rethinking of power outputs has been the first solution, and many regional channels have seen their 1000 to 5000 watt daytime powers allowed to be increased to as much as 50,000 watts in the daytime. Nighttime power levels have either been increased for a lucky few, or extremely directional antenna patterns have been engineered to pack in as many users as possible. Quite a few years ago, the FCC started allowing extremely low powered nighttime outputs from anywhere between 5 and 500 watts to be used by former daytime-only operations, to allow coverage of at

least the city of license for a few miles from the transmitter. This was a great help for many stations, but they were still at an extreme disadvantage when compared to competing local FM stations, who had no time-of-day restrictions, much better fidelity, and steady predictable coverage day and night.

During the early 1980s, America's FCC as well as Canada's CRTC allowed stereo AM transmission. In 1980, the FCC selected the Magnavox system as the official AM stereo standard. Two years later, lawsuits and other distractions caused the FCC to revisit the subject and revoke the exclusive status granted to Magnavox, and let the marketplace decide from among several competing systems that included Harris, Magnavox, Motorola, and Kahn/Hazeltine. Early leaders in the market were the Motorola C-QUAM and Kahn/Hazeltine systems.

Major automakers voted their choice by selecting the C-QUAM system as the standard for car and truck radios in 1984. Motorola's C-QUAM system became the government AM stereo radio standard for Australia in 1985, with Canada and Mexico following in 1988, Japan in 1992, and finally the United States in 1993.

During the 1980s, the lack of a single standard created confusion for consumers, with stations adopting one of the four competing systems. Receiver manufacturers did not help, with most companies making models either exclusively for one of those systems, or one that was compatible with all four standards. While Motorola C-QUAM took over the automotive market, actual consumer interest in AM stereo dwindled because of a lack of equipment. The result was an increase in listening to the FM band.

1993 was also the year that the FCC made a push for expanding the AM band to add channels between 1610 and 1700 KHz. With the Motorola C-QUAM system in place as the stereo standard, any existing station requesting a move to the new expanded band was also given preference if they agreed to transmit in AM stereo. They were never actually required to do so.

The NAB (National Association of Broadcasters) and the EIA (Electronic Industries Association) saw a need to have uniformity in audio quality between stereo AM stations, and so created the AMAX certification system in 1993. Worldwide use of AM stereo peaked in the 1990s, but other factors have reduced its use since that time. North American AM allocations are spaced 10 kHz apart. Much of the rest of the world is spaced at 9 kHz. This crowding of spectrum has decreased the attractiveness of the AM band for stereo reception, especially for stations transmitting music.

Those who remember the Sixties and early 1970s as a time when music programming dominated the AM band will probably also remember that many of those stations moved to a simulcast on FM, if not completely transitioning to the FM band while leaving AM. Remaining clear channel operations with 50,000 watt outputs have used their coverage range as an advantage over FM, but programming has shifted to news/talk or less popular musical formats. Some AM stations still retain AM stereo characteristics, but programming



With the Yamaha Aventage RX-A1030 (\$900) AM/FM/HD-Radio tuner, home theater receiver/amplifier you're prepared for AM radio's future if it's AM, FM via translator, HD-Radio subchannel or Wi-Fi via Yamaha's YWA-10 adaptor (\$60). (Courtesy: Crutchfield.com)

is actually transmitted in mono. Ask yourself if you need stereo to listen to talk radio.

Canada has encouraged previous AM broadcasters to shift to the FM band, often providing a full class C allocation with 100,000 watts on the FM to early adopters, with lesser power outputs given to later entrants. Given the enviable coverage of many AM operations, such a high power facility on FM was needed as a carrot to convince broadcasters to shut down their AM station completely, as part of the deal. Once permanently transmitting on FM, stations were typically given 60 days or less to cease AM operation.

A curious situation has seen the CRTC re-issue shutdown AM frequencies to new players, especially with the shift of clear channel AM frequencies formerly used by public broadcasters CBC and French language Radio-Canada. Examples include AM-740, now known as oldies formatted Zoomer Radio in Toronto, and private news channels in French and English replacing former public channels at 690 and 940 kHz in Montreal. However, the huge majority of new radio allocations in Canada are on FM frequencies.

America's FCC has had its share of initiatives to help beleaguered AM broadcasters survive by simulcasting on the FM band in one way or another. The year 2002 brought selection of a standard for an in-band digital radio system known as HD Radio, produced by a company called iBiquity. It is available to be set up on both AM as well as FM stations, but the FM version predominates our market. This is likely due to some negative effects on the AM system that cause a noticeable splatter on adjacent side frequencies. Note that the use of the word HD Radio has nothing to do with High Definition as TV viewers may understand, but is solely a marketing term.

There is an improvement in audio quality over an analog signal, because programming can be provided using the Dolby 5.1 audio system. The manufacturer of the system

claims that quality approaching that of compact discs (CDs). A bonus is that the primary audio signal, known as HD-1, is simulcast in analog as well as digital. If the digital signal fails, the HD-1 transmission reverts to analog as a backup. In its most basic form, transmitting an HD-1 signal (whether on AM or FM) is a way to provide improved audio quality in digital. Once the system is in place, HD2 and HD3 channels can be added, but they are only in digital mode. A station can opt to simply have one HD signal—which will digitally simulcast the primary service and be called HD-1. When equipped for more, HD2 and HD3 channels will mute out, while HD1 may still play in analog.

Another benefit of the digital system is the availability of a data stream that can provide song and artist information on HD Radio receivers, which are commonly available in both portable as well as automotive versions.

The additional two-channel capacity of the HD Radio system has led to some creativity among radio station owners, especially those in the largest listener markets. Public radio systems across the country have combined their news/talk and classical as well as alternative radio channels onto one station, making it possible to serve more listeners and thus solicit additional contributions. Sports channels can offer distant talk radio stations from other radio markets to supplement listener demand for variety.

While the FCC demands that at least one of the channels in the HD Radio system actually transmit the primary station, many AM stations have been added to the HD2 and HD3 positions, greatly improving their audio quality and reception throughout metropolitan areas. This has had positive results for previously dying stations solely on the AM band, struggling for the almighty drive time listener. The increased audio quality and less signal interruptions from interference have leveled the playing field between AM and FM radio stations. A recent development in larger radio markets has been the addition of an HD-4 channel, primarily for talk and sports formats that can accept a lower audio quality than music-formatted channels.

Back in 2009 I noticed a new phenomenon while doing a commute throughout Minnesota and Wisconsin that approached 1000 miles a week. The FCC had started allowing a few AM stations to transmit on the FM band using brand new translator allocations with power levels at up to 250 watts. This greatly improved the sound quality when compared to the average 500 or 1000 watt AM signal, and often allowed stereo reception 20 miles out, and sometimes listenable mono from a 30-35 mile distance. It also gave any AM station a predictable 24-hour availability in stereo for its core audience.

Since that time a number of former daytime only AM stations have applied for and received such FM translator simulcast authorizations. The concept works, as many of these stations are now highlighting their FM frequency on local promotions, with both advertising revenue and listener numbers reflecting a rebound into profit. Several speculators who had construction permits (CP) for



Ford's SYNC in-dash radio system brings HD Radio™ Technology to its Fiesta, Focus, Fusion, C-Max, Taurus, Escape, Edge, Flex, F-150, Super Duty, Mustang, Expedition, Transit, Transit Connect, and E-Series Wagon. Available features include; Digital Sound, HD2/HD3, PSD, and iTunes Tagging. (Courtesy: HD-Radio.com)

FM translators have made a windfall during a recent FCC window that allowed certain AM broadcasters to purchase an existing CP, and move it up to 250 miles away, to begin transmitting an FM simulcast. Typical transaction price was between \$20,000 and \$50,000, and over 400 eligible stations (out of the existing over 4000 AM stations in the U.S.) applied during the first day of the FCC window. Most applications were approved by the FCC in less than a month after submission. A second similar FCC window will open for previously ineligible larger stations in more urban markets later this year. It is hoped that all existing AM stations that want to add this FM simulcast ability will be allowed to do so before any new Low Power FM stations are allowed on the air, as the number of open frequencies available in larger cities is becoming very limited. In any case, the FCC appears to be doing a great job at throwing a life preserver to broadcasters in the smallest rural markets, where help is needed to keep stations on the air.

AM Stations wanting to upgrade to the higher quality of FM radio need to consider a relatively high cost to set up the HD Radio system. What is usually done in larger markets is for an FM station to first transmit its main channel in digital. Then additional audio sources are economical to add to the system, which is when you can either partner with an existing facility to add your signal, or in the case of one of the larger radio chains, add other co-owned stations, especially AM, to the facility. This may be much too large of an investment for smaller stations on their own, and the economics of adding the cost of getting a license through the FCC, purchasing someone else's construction permit or license, plus the actual cost of the hardware to set up an FM translator may be a better idea.

Listed below are two charts to show how things are working in the upper Midwest. First is a list of all AM stations in Minnesota that are also transmitting an auxiliary FM translator signal. Second is a list of HD-Radio stations from several selected markets in North Dakota, Minnesota, and Wisconsin. Comments are appreciated.

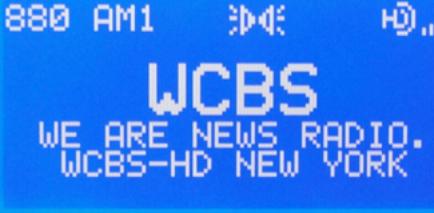
TSM

MINNESOTA AM Radio Stations with FM Translators

AM Station	Community	FM Translator	Format
540 WXYG	Sauk Rapids - St Cloud	FM - 107.3	Album Rock
560 WEBC	Duluth	FM - 106.5	Classic Rock
630 WREY	Hudson WI - Twin Cities	FM - 105.5	Regional Mexican
730 KWQA	Worthington	FM - 100.3	Soft Oldies
740 WDGY	Hudson WI - Twin Cities	FM - 103.7	Oldies
770 KUOM	Minneapolis	FM - 100.7 Falcon Hts FM - 104.5 Minneapolis	Alternative
970 WDUL	Superior WI	FM - 98.1	Sports
1010 WMIN	Sauk Rapids - St Cloud	FM - 106.5	Adult Standards
1050 KLOH	Pipestone	FM - 99.3	Farm, Country
1070 KSKK	Verndale	FM - 94.7 Staples	Adult Contemporary
1150 KASM	Albany	FM - 107.7	Farm, CW, Old Time
1170 KOWZ	Waseca	FM - 106.3	Oldies
1190 WBHA	Wabasha	FM - 99.7	Country
1230 KFSP	Mankato	FM - 103.1	Sports
1230 KWNO	Winona	FM - 98.7	News, Talk, Oldies
1250 KCUF	Red Wing	FM - 98.9	News, Classic Country
1260 KROX	Crookston	FM - 105.7 Grand Forks	News, Oldies, CW, Talk
1300 KQPM	Princeton	FM - 106.9	Oldies
1310 KNOX	Grand Forks ND	FM - 107.9	News, Talk
1340 KDLR	Detroit Lakes	FM - 93.1	News, AC, Talk
1340 KWLM	Willmar	FM - 96.3	News, Talk
1400 KMHL	Marshall	FM - 103.3 Russell	News, Variety
1400 KMNV	St Paul	FM - 95.7 Minneapolis	Regional Mexican
1410 KLFM	Litchfield	FM - 95.9	News, Oldies
1420 KTQE	Mankato	FM - 102.7	News, Talk, Variety
1450 KBUN	Bemidji	FM - 94.9	Sports
1450 KBMW	Breckenridge	FM - 94.3	News, Country
1450 KNSI	St Cloud	FM - 103.3 Brainerd	News, Talk
1460 KDWA	Hastings	FM - 97.9	News, Talk, Sports
1480 KKCQ	Fosston	FM - 107.9	News, Talk
1490 KXRA	Alexandria	FM - 100.3	News, Talk
1490 KLGR	Redwood Falls	FM - 95.9	News, Country
1570 KAKK	Walker	FM - 96.3	Classic Hits, Oldies
1590 KGFK	Grand Forks ND	FM - 95.7	Rock, Variety
1590 WIXK	New Richmond Wi	FM - 103.3	Classic Country

UPPER MIDWEST HD RADIO STATIONS

FARGO, ND - MOORHEAD, MN				
90.3 HD1	KCCD-FM	MPR News & Ideas	Moorhead	News/Talk
91.1 HD1	KCCM-FM	MPR Classical	Moorhead	Classical
91.9 HD1	KDSU-FM	Prairie Public	Fargo	World/Variety
95.1 HD1	KBVB-FM	Bob 95 FM	Fargo	New Country
95.1 HD2	KDLB-FM	The City At 94.5	Fargo	Rock
95.1 HD3	KQWB-AM	Fox Sports 1660	Fargo	Sports Talk
98.7 HD1	KLTA-FM	Big 98.7	Fargo	Contemporary Hits
98.7 HD2	W245CM	96.9 Hits FM	Moorhead	Rhythmic Contemp
107.9 HD1	KPFX-FM	The Fox	Fargo	Classic Rock
ST CLOUD, MN				
88.1 HD1	KVSC-FM	88.1 FM	St Cloud	Alternative
88.1 HD2		97.5 - Radio X	St Cloud	90s Alt Rock
88.1 HD3		Local Sports Talk	St Cloud	Variety
88.9 HD1	KNSR-FM	MPR News & Ideas	St Paul	News/Talk
88.9 HD2	KCMP-FM	The Current-89.3	St Paul	Alternative
90.1 HD1	KJSR-FM	MPR Classical	St Paul	Classical
101.7 HD1	WHMH-FM	Rockin' 101	St Cloud	Rock
101.7 HD2	WXYG-AM	Album Rock 540-The Goat	St Cloud	Album Rock
101.7 HD3	WVAL-AM	800- MN's Country Legend	Sauk Rapids	Classic Country
101.7 HD4	WMIN-AM	1010-WMIN	St Cloud	Adult Standards
105.5 HD1	KDDG-FM	Bob Country-105.5	Albany	Country
105.5 HD2	KASM-AM	AM-1150	Albany	Full Service
105.5 HD3	WQPM-AM	AM-1300	Princeton	Oldies
105.5 HD4		La Nueva Vida		Spanish Christian
MINNEAPOLIS - ST PAUL, MN				
740-AM HD1	WDGY-AM	Oldies Radio WDGY-HD	Hudson-WI	Oldies
830-AM HD1	WCCO-AM	830-AM	Twin Cities	Local Full Service
1130-AM HD1	KTLP-AM	News Talk 1130	Twin Cities	Conservative Talk
1440-AM HD1	KYCR-AM	Wall Street Radio Network	Twin Cities	Business Talk
89.3 HD1	KCMP-FM	89.3 - The Current	Twin Cities	Alternative
89.3 HD2		Local Current		World/Variety
89.9 HD1	KMOJ-FM	The People's Station	Twin Cities	Adult R&B, Soul
90.3 HD1	KFAI-FM	Radio Without Boundaries	Twin Cities	Community Radio
91.1 HD1	KNOW-FM	MPR News & Ideas	Twin Cities	News/Talk
91.1 HD2		Radio Heartland		Folk/Bluegrass/Ballads
91.1 HD3		BBC News		International News
92.5 HD1	KQRS-FM	92-KQRS	Twin Cities	Classic Rock
93.7 HD1	KXXR-FM	93X	Twin Cities	Album Rock
93.7 HD2		The Machine	Twin Cities	Top 40/Pop
94.5 HD1	KSTP-FM	KS 95	St Paul	Best Variety-Pop
94.5 HD2	KSTP-AM	1500-KSTP ESPN Radio	St Paul	Sports Talk
96.3 HD1	KTWN-FM	Go 96.3	Twin Cities	Alternative Rock



HD-Radio displays via Sangean HDT-1X FM receiver. (KS4ZR photos)

AM Radio's Future can be Interesting and Complicated

Those AM stations lucky enough to have a 50,000 watt clear channel nighttime designation can even spread their HD-Radio joy when conditions are just right. Above left, WCBS-AM's 880 kHz signal was strong enough one night to lock in the HD signal delivering "FM quality" audio from over three hundred miles away, at least for a while.

At center, Richmond, Virginia, WRVA's analog AM signal during the daytime can be received from 40 miles away, but it's just not strong enough to lock the HD signal.

At right, no worries though, WRVA's AM programming is carried on the FM band via the HD2 channel of Richmond's WTVA-FM 98.1 MHz HD-Radio signal, giving WRVA-AM "FM quality" audio and much greater coverage area than it could get via AM on its own.

Of course, you'll need to have an HD-capable radio to tune in. If you are driving certain late models cars, that's easily

done. But, to listen at home or in an older vehicle—not so easy.

In addition, hosting HD-transmitting FM stations seem to be searching for a winning combination and that results in HD2, HD3 and HD4 channels changing often enough to confuse listeners. This switching process is done because the bottom line is that ratings matter, even in the world of non-commercial radio broadcasting. And, as if all of the above wasn't enough, the FCC requires FM stations transmitting HD signals to do so at 10 percent of the output power of their analog signal.

So, even if an AM station gets a slot on an HD subchannel of a friendly FM station, it will take some effort on the part of listeners outside the primary reception contours to hear it. That's one reason that the initial HD-Radio push some ten years ago went flat; consumers were unhappy with HD reception without using an outside antenna. – Ken Reitz KS4ZR

TSM



Here's a look at N7HRK's ICOM IC-7000 with heads-up display on the dashboard. At this angle we are looking down the barrel of the station's custom mount, with the key in the opening below the transceiver. (Courtesy of N7HRK)

Becoming Radio Active When the Rubber Hits the Road

By Richard Fisher KI6SN

What drives communications hobbyists to turn a vehicle into a rolling amateur radio station or listening post is as varied as the makes and models of the cars coming off assembly lines in Detroit.

Consider the suffocating impact of CC&R (Covenants, Conditions and Restrictions) imposed by many Home Owners Associations (HOAs) and local and municipal authorities with a phobia of HF antennas. (1)

Also, think about the decades-long trend of shrinking lot size in neighborhoods outlying cities where HF wire antennas used to grow, and the antenna restrictions imposed by many municipalities.

Cramped urban apartment living is a particular challenge to operators struggling to get an HF signal outside their concrete jungle.

There is the interference to TV and radio found commonly in aging technology. Yes, in many areas this is still a serious problem. Thankfully, it is diminishing with the explosive growth of cable television and radio listeners tuning in via the Internet.

But a reason unto itself, no doubt a byproduct of all the above, is the sheer challenge and fun of operating mobile – or “/m.” There is magic in making amateur radio contacts from the driver’s seat with operators on the other side of the

planet on say, 15, 17, 20 or 10 meters. There is a thrill, too, of logging that rare shortwave station while barreling down the Interstate.

A highly efficient mobile setup for VHF – 50 MHz and above – could have you sitting up in your seat when you are able to make simplex or repeater contacts with distant operators—meaning hundreds or even thousands of miles.

The Adventures of Rick Klin N7HRK

One of the things that drives Rick Klin N7HRK to operate mobile on HF CW is his grandchildren. He chauffeurs them to school Monday through Friday, fitting in time to QSO with 40-meter CW stations around the western United States from Libby, Montana. Yes, by Morse code.

He does this from an amateur station in a 1993 Buick sedan using techniques he has been honing for 50+ years. “I first got into /m CW back in Indiana around 1964 when I bought a brand new VW Bug, <http://bit.ly/1S7y7kf>.” He installed a new Galaxy III (transceiver) running 300 watts, with a pair of 6146 beam power tubes in the final. “It required an inverter to supply the 120-volts AC to power it. That was before the 12-volt (solid state) rigs came along.” In ’64, the Bug was still 6-volts DC, “so I ended up installing



The control head of either an ICOM IC-703 or IC-7000 sits on the custom-made rig and paddle mount in Rick Klin N7HRK's 1993 Buick sedan. Even the added armrest between the driver's and passenger's seat, prove that going mobile can be really tidy. His vintage 1963 single-paddle Vibroplex VibroKey sits in the mount at a perfect angle for operation while on the road. "The key / control-head mount slides in and out of the arm rest and can be removed from the car "in a matter of seconds." (Courtesy of N7HRK)

a separate 12-volt alternator-and-battery combo to run the rig," Klin said. That is tenaciousness to the max.

"I built an electronic keyer out of the ARRL Handbook and bought a single-lever Vibroplex VibroKey paddle, which I am still using today . . . It sat in the glove compartment. The door acted like a shelf for me to rest my hand on while sending.

"I was using a Hustler multi-band mobile (HF) antenna, but running 300 watts would cause the coil coverings to melt and bubble up. It smoked a lot.

"I only used CW and never did hook up a mike to it. I guess the only thing I should have done was research other mobile setups to see how-and-what I needed to do, but I came up with all these ideas without that knowledge."

For five decades N7HRK has been building on those formative years—both figuratively and literally. In designing an ICOM IC-735 transceiver mobile station, <http://bit.ly/1UYzQfk>, "I decided early that all my controls for the radio had to be at my fingertips," he said, "so I modified the radio and built the control setup" being used today.

"I used that setup in two different cars and it still works, but I have no need for it now, since it has been replaced and I can only drive one car at a time. I feel that at that time, I had a one-of-a-kind setup with the 16 controls of the radio around my key paddle. I didn't have to take my eyes off of my driving."

Subsequently, N7HRK decided to re-work his setup using his ICOM IC-7000, <http://bit.ly/1VIObD6> or IC-703 <http://bit.ly/1S7zcZf> – both fit with no modifications to his custom mount. "I keep adding small items when a light bulb goes off in my head like the most recent idea of installing an MFJ code reader in the passenger side of the car. This is so my passengers can be a part of what I am doing by reading



An MFJ Enterprises code reader allows passengers to "listen in" on an N7HRK/m CW QSO. So there is no need to translate for people along for the ride. (Courtesy of N7HRK)

copy from the reader, <http://bit.ly/1IgAobo>.

"My grandkids really enjoy riding with me now and I don't have to keep telling them what is being said. Plus it tells the speed of the code being sent or received. I built a night light for it so it can be read in the dark."

In his meticulous design, Klin made cardboard templates of how he wanted the control head to fit in the car. "I took it to my local welding shop and they fabricated it to match my design. Again, this design is totally mine without any outside help."

He said, "I made the armrest to hold the control head by removing the one that came with the car and building one, having an upholstery shop cover it."

An Internet Bible for Mobile Ops

While N7HRK operates 40-meter CW exclusively, the mobiling principles covered by Alan Applegate K0BG of Roswell, New Mexico, apply to voice operations as well. He is recognized as one of the leading experts on amateur radio mobile operation in the world. His website, <http://www.K0BG.com>, could be a doctoral thesis on going mobile—in terms just about anyone can understand.

It has sage advice in subsections addresses everything mobile from A to almost Z – alternators and batteries to grounding and wiring. There are nine sections alone devoted to aspects of mobile antennas.

"Without any doubt," Applegate writes, "the single most important mobile purchase you'll ever make is the antenna! If you haven't already purchased one, don't – at least until you've read this article," <http://bit.ly/1MrPSM7>.

Safety: First and Foremost

The K0BG website has a robust section on operating a mobile station safely. In addition to the common-sense basics, it touches on a ton of safety-oriented considerations if you plan on going mobile-in-motion, such as operating in the rain. He touches on headsets, VOX and speech compres-



Left: This tidy HF antenna setup is in the bed of K0BG's Honda Ridgeline truck. Right: This longer view shows the extent of K0BG's mobile truck antenna farm. (Courtesy of K0BG)

sion, and maintaining contacts. He covers abbreviations to know, operating menus, logging and much more. Becoming a first-rate mobile radio should be no accident. Assembling an operator-friendly /m setup is key.

Suggestions for Developing your Mobile Profile

Underscoring that these opinions are his own, K0BG urges newcomers going mobile to consider these declaratives:

- Don't put any faith in on-line reviews!
- Don't consider any transceiver older than 15 years, unless you know repair parts are available and that you can do the job yourself.
- Don't buy a transceiver you can't play with first! This eliminates auction sites as a source.
- Don't buy a transceiver that has been modified in any way, shape or form!
- Be very leery of bundled deals, particularly transceiver/antenna combinations.
- Built-in auto-couplers are not a basic requirement of any mobile transceiver!
- Don't buy an antenna with a coil larger than 3.5 inches.
- Don't buy an antenna with a coil smaller than 1.75 inches.
- Don't buy an antenna with large metal end caps.
- Don't buy an antenna that requires an external tuner, or advertised as automatic tuning!
- Any antenna that doesn't require matching will be much more lossy than one that does.
- Any antennas mounted on clip, lip, and mag mounts will be more lossy than those permanently (through hole) mounted.

All antennas, especially ones mounted on clip, lip, and

mag mounts, will require an extra-high impedance common mode choke—bar none. Link to: <http://www.k0bg.com/common.html>.

All remotely-tuned (motorized) antennas will require an adequately-sized motor-lead choke – bar none. See: <http://www.k0bg.com/choke.html>.

Overall-length matters! Radiation resistance (efficiency) is directly related to the square of the electrical length. Thus, the longer the antenna, the more efficient it is.

VHF Operation and Listening

A good place to start your mobile-operation adventure is on the very high frequencies: VHF. This is the spectrum at 50 MHz (6 meters) and above, requiring relatively small antennas and low RF power output.

Here's what not to do: throw your FM transceiver or scanner into the passenger seat, plug it into the cigarette lighter, slap a whip antenna on the roof and away you go.

K0BG points out a bunch of areas to be looked into before, and during the setup, covering the raw basics and: antennas; multiband “wonder” antennas; magnetic mounts; glass-and-other mounts; hole saws; transceiver mounts; coaxial cable; SWR; AM RF interference; transceivers; handhelds; APRS; power considerations; power amplifiers; SSB and more. Visit <http://www.k0bg.com/options.html>.

Don't be intimidated by the depth to which Applegate digs on this stuff. If you are serious about getting into mobile operation and having a great experience, it is well worth reading.

KI6SN/QRP to N7HRK/m, Solid Copy



Given the physical size of VHF/UHF gear, it is quite possible to fit several radios comfortably inside a vehicle. (Courtesy of AD6SW and K0BG)

It is one thing to share your accomplishments with pictures and narratives on websites such as QRZ.com, as Klin does – <http://www.QRZ.com/db/N7HRK>. But the proof of success is when the rubber hits the road. How are you doing on the air? I know N7HRK/m is doing a whole lot of things right because I have actually had the pleasure of QSO’ing him.

The distance between Libby, Montana and Riverside, California is a bit over 1,000 miles. That is a long haul for daytime operation on 7 MHz. But from my 5-watt QRP station with a G5RV antenna, we had a very pleasant chat on CW while he was parked in his driveway before heading to work.

We had a solid 25-minute long Morse chat that says two important things about Klin’s mobile station: it plays really well in both transmit and receive modes. His signal peaked at 599 (very strong) on my tiny Yaesu FT-817 transceiver, and with very little trouble he copied my peanut-of-a-signal. My RF output is one-eighth of the power of the lightbulb inside your refrigerator.

On this morning, 40-meter band conditions were not particularly good. But the contact added even more wonder to our key-tapping adventure. Written all over it were the marks of a superb mobile HF operation.

Other Resources and Activities

Suffice to say, the Web is loaded with information on mobile operating. It is important, though, to consider the source. Is it credible?

In the meantime, keep an eye out for the American Radio Relay League’s new handbook on HF mobile operation, <http://www.arrl.org/automobile>.

Once you have happily fallen into the black hole of going mobile – whether operating or shortwave / scanner



The compact size of antennas at upper frequencies allowed this operator to mount three antennas on the pickup truck. (Courtesy of KI6SN)

listening – perhaps challenge yourself by participating in the Mobile Amateur Radio Awards Club program, <http://marac.org>.

You may, as well, look into County Hunter Dot Com, <http://www.countyhunter.com>, a great organization with the goal of helping hams make contacts in each of the United States’ 3,000+ counties.

In every case, you will likely be in the company of people who share your enthusiasm of being radio-active on the road.

Footnote:

(1) With luck, the U.S. House of Representatives will smile upon H.R. 1301 and Senate upon S 1685 which would give radio operators a fighting chance in “Antenna Wars – the Wrath of CC&Rs.” TSM touched on the early skirmishes in February, 2015 with a story under the headline “The Amateur Radio Parity Act is Down – But Certainly Not Out.” Lately, things have been moving in a positive direction, <http://bit.ly/1XsZHtA>. Until the battle is won, though, communications hobbyists have to live under constraints imposed by HOAs and cities and municipalities.

K0BG Mobiling Quick Links

Here’s a link that leads to many specific subjects covered at <http://www.k0bg.com>. Many express the preferences of K0BG both in mobile operation style and substance. He takes pains to point this out. The information can be a great starting point for zeroing in on the kind of setup you aspire to.

TSM Reviews:

Comet CA-500 MK II Antenna Analyzer

By Mark Haverstock K8MSH

Whether it's at home or Field Day, amateur radio operators often need to tune and adjust antennas. Rig SWR meters and external watt meters can do a passable job when it comes to basic readings, but nothing's more convenient than having a portable analyzer right where you're working.

An antenna analyzer makes the task more accurate and much easier to complete. A built-in low-level signal source prevents harmful interference on the air and will let you go outside the amateur bands to find readings when necessary. Battery power makes them easy to carry to the roof, on top of a tower, or to a remote Field Day site.

Upping Their Game

Comet's CA-500 MK II is the newest incarnation of the original CA-500, replacing the 7-digit frequency counter with a 1.8-inch TFT 5-color LCD screen. Comet likely added this display to compete with the newer analyzers from MFJ, Rig Expert, and others. The graphic display not only shows the current frequency, but it also the current band as well. SWR is displayed both numerically and graphically to two decimal places. R and X absolute values appear both numerically and in bar graph format through 190 MHz. Like its predecessor, the analog meters display both SWR and impedance simultaneously.

Two graphic modes are available on this meter. You can set a predetermined center frequency and bandwidth to do an SWR sweep. Pressing the SWEEP/CENTER button starts the automatic sweep, based on the band that's selected. A band sweep usually takes about 25 seconds, and saves the trouble of doing several individual readings and manually plotting them in a graph.

If you want, you may set an arbitrary center frequency and bandwidth to perform a manual SWR plot. Set the center frequency and use the FREQ knob to set the sweep limits. Once the setup is completed, you rotate the FREQ knob to perform the manual sweep. Pressing the AP-OFF button during the sweep will let you change to alternate colors: red, blue, green, purple or orange.

Two coaxial connectors are provided. The SO-239 is used for the lower range, 1.53 MHz to 300MHz. An "N" socket is used for UHF from 300-500 MHz.

The analyzer can be powered by 6 AA alkaline batteries; Ni-NM rechargeable batteries, or an external DC power supply rated at 8-16 volts DC. The DC supply can also act as a trickle charger for the Ni-MH cells. A programmable auto-power off preserves the battery charge in case you forget to turn the meter off. An external DC cable is provided, and an optional soft case is available.

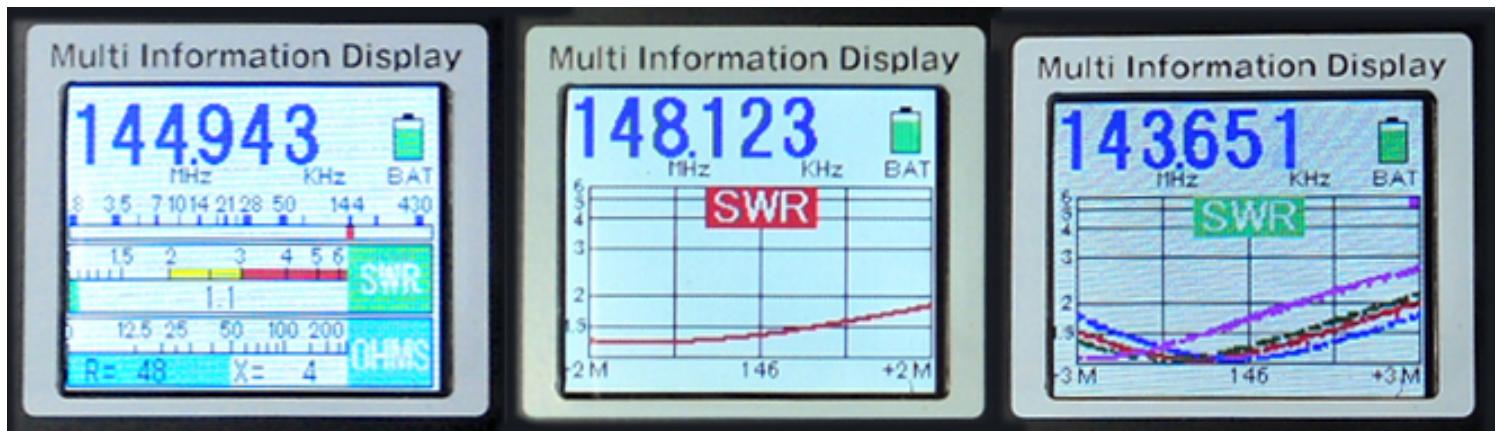


Comet CA-500 MKII antenna analyzer. (Photo courtesy of NCG Company)

Documentation is a clearly written 8-page manual that includes identification of the analyzer's controls and features, operation instructions, and specs. A list of FAQ's provides additional information.

Using the Analyzer

The first thing you will notice about the CA-500 MKII is the build quality. It's a fairly substantial unit with a heavy-duty metal case. Frequency accuracy is excellent, within a few Hz, and reasonably easy to set—especially on the lower bands. It's a bit trickier in the UHF range and takes a steady hand. Frequency stability is similar—steady in the lower range, but with some drift on the higher range. However, this didn't significantly affect usability, as the display would



The new COMET CAA-500MarkII retains the cross-needle analog function and adds a full-color TFT LCD screen providing graphic and numerical SWR and total impedance with R and X values. The normal screen displays a wealth of information simultaneously. The controls are easy to operate. You can press the Sweep Center button to automatically sweep an amateur band of choice and the SWR is graphed in seconds. The multiple manual sweep graph will overlay manual sweeps in 5 different colors. You can make antenna length, position, height above ground, gamma match adjustments etc., and graph each adjustment in seconds in a new color without losing the previous graph. (Text and graphic courtesy of Universal Radio)

follow any frequency change. It also makes a fairly accurate frequency generator.

Using the meter to check SWR is easy—just connect a short cable between the antenna and the meter. Set the band and frequency and read either display. Having owned the first version of the CA-500, I often find myself looking at the meters before I remember there's an LCD display as well. The ohms scale displays show both resistive (R) and reactance (X). The values are absolute, so it does not display the polarity +/-.

To find an unknown resonance, set the band switch to the frequency range where you want to start—a guesstimate. Rotate the FREQ knob to where you reach minimum SWR and this is approximately the resonant frequency. If you don't reach a minimum, switch to another band and repeat the procedure.

Because of stray inductance and capacitance, it's possible the meter may show a "quasi" resonant frequency you may not expect. This is when you need to check the antenna system and coax for possible issues. To get the most accurate readings, the meter should be right at the antenna, but this is not always practical. Realize that even short feedlines will affect readings to some extent, both SWR and impedance.

The Competition

There are several popular analyzers in roughly the same price range on the market today. The MFJ-269C covers almost the same frequency range with a gap between 230 and 415 MHz. It also has both conventional meters and a display—but a basic monochrome one. However, the 269C has some additional features, such as a frequency counter function, balun and coax calculations, to name a few. The Rig Expert AA-54 doesn't have the same frequency range, but shares the CA-500 MK II's graphing capability—though not in color. It adds a multi-SWR mode that can

collect data on multiple frequencies, which is useful when dealing with multiband antennas. It also has inboard memory and interfaces with a PC.

The Bottom Line

Though the CA-500 MK II doesn't offer all the same measurement/interface capabilities of other models, such as the MFJ-259C or AA-54, it does what it does quite well, especially considering its generous frequency coverage. Readings can be done on HF antenna systems, as well as VHF/UHF mobile installations.

It's also easy to set and easy to read with both the analog meters and the multi-function LCD display. For the average amateur radio operator's needs, it's more than sufficient for the process of building antennas, tuning them, and plotting SWR curves over a given frequency range.

Specifications (Provided by the manufacturer)

Operating Range:	1.8 - 500 MHz in 35 range segments
Impedance Range:	12.5 - 300 ohms
VSWR Range:	1:1 to infinity
Oscillator Output:	113 dB μ /50 ohm
Display Type:	1.8 inch TFT Color LCD
External Power:	8-16 VDC 185 mA
Size:	3.5 x 7.75 x 2.65 inches (80x170x60 mm)
Weight:	28 oz. (800 g)
Dimensions:	3.5 x 7.75 x 2.65 inches (W x H x D)

NCG Company, 15036 Sierra Bonita Ln., Chino, CA 91710

With a list price of \$449, the CA500MKII is available from Universal Radio at \$399. <http://www.universal-radio.com/catalog/meters/6478.html>

TSM



Two for the ears. Left: Audio Technica BPHS1 broadcast headset is equally at home in the ham shack. (Courtesy: Audio Technica) Right: Heil Proset Elite, designed for amateur radio use by audio guru Bob Heil K9EID. (Courtesy: Heil Sound)

TSM Reviews

A Pair of Cans for Your Radio Pleasure

By Mark Haverstock K8MSH

There's an old saying in ham radio: If you can't hear 'em, you can't work 'em. I'd like to add another one to the list: There's no reason why you can't hear them well or they can't hear you well. A quality set of cans (headset in radio-speak) could significantly improve communications on the air.

A headset can keep out many of the distractions around you while you engage in radio contacts. I can think of many times the sound of barking dogs or loud kids were easily blocked by a good headset. When the rain poured during last Field Day and all the radio operators were huddled in a small barn, headphones made our on-the-air communications much easier in close quarters.

The choices of headsets are overwhelming. Many are designed for computer or console gaming, while others are intended for broadcast or communications. They range in price from under \$25 to several hundred dollars and come in a variety of sizes and colors. Some are well suited for communication use, others are not.

This review looks at two headsets that have found favor among the ham community for features, functionality, and good audio quality. They tend to be at the mid to higher end of the price spectrum, ranging from \$160-\$199 from most radio dealers. Both tend to have good receive and transmit audio characteristics, so the choice comes down to build, features and price.

Audio Technica BPHS1 Broadcast Headset

As the product description suggests, the BPHS1 was

created as a professional broadcast headset, especially for on-air news and sports broadcasting, announcing and interviews. For this application, it's been tailored to reproduce speech with maximum fidelity and intelligibility.

These features translate well into ham radio applications. The headset's dynamic microphone element has a cardioid polar pattern, which makes it more sensitive to sound originating directly in front of the element, reducing the pickup of unwanted sounds from the sides. The flexible goose-neck boom swivels for easy positioning on either the right or left side of the face—a feature that few headsets offer.

For listening, the BPHS1 offers natural, highly intelligible voice reproduction—considerably better than the built-in speakers found in most radios. Closed-back, around-the-ear cups seal out background noise, which reduces ambient noise when trying to copy weak signals. Usually, people have to tap me on the shoulder or wave a hand in front of my face to get my attention when wearing them.

Construction of the BPHS1 is rugged, yet lightweight at 9.3 ounces, making it the lightest of the two. The padded headset is fully adjustable, with the ear pads providing long-wearing comfort—definitely a plus for contesting. Replacement earpieces, foam windscreens and cables are readily available and easily replaced.

The only gotcha is the connectors provided, which are tailored to the broadcast industry. The 1/4-inch stereo jack will match most transceivers, but the mic output is terminated with a 3-pin XLR jack. It's easy enough to remove the XLR jack and fashion your own connector, but for those who don't like soldering, the Heil 3-pin adapter cables (CC-1-



Heil headset adapters for a variety of microphone options made for most popular transceiver makes and models, cost between \$23 and \$29. (Courtesy: Heil Sound)

XLR series) are a quick and easy solution. The cord is a bit long—a coiled one would be better for amateur applications. Reports on the air were always positive—mic response is essentially flat without coloration. The mic has a relatively low output, so keep this in mind when adjusting audio levels. Though it seemed to work well with all my transceivers, it was a particularly good match for my Ten-Tec Omni VII and Yaesu FT-991. Icom users take note—you'll need to remove the bias voltage on the mic connector. It's not needed for the dynamic element.

Priced at \$199, it's a good investment in quality audio and comfort. Choose this one for the flexible boom positioning and featherweight design.

Heil Proset Elite

Heil products have been a fixture in music and amateur radio circles for decades, with quality microphones and audio products. Among these products are eight different headsets, including the Heil Proset Elite.

One thing you immediately notice is an abundance of padding in both headband and ear cups, as well as the build quality. Heil's Pro Elite tips the scales at 13.8 ounces, slightly heavier than the Audio Technica BPHS1. The steel headband is adjustable with “click” detents.

Vinyl ear cushions come with cotton covers, which are removable and easily washable—and you can also use the ear cushions alone. Short term, the headset is comfortable. But with my oversized ears, I found myself periodically shifting the headphones to alleviate pinched ears during prolonged contesting.

The mic boom only works from the left side, since it is mounted on a forward facing goose-neck rather than a pivot. Adjusting the position of the boom is done by bending it into position. A coiled cord is attached just below the boom and conveniently takes up the slack when you're sitting close to the radio.

Phase reverse is a cool feature that appears in both the Proset Elite and the top of the line Pro 7. By flipping the switch, you acoustically move the signal, which can help with intelligibility under noisy conditions. When the phase kicks in, it sounds like the signal is centered between the ears—in the middle of your head, so to speak. The closed back helps keep out distracting noise.

Both receive and transmit audio were pleasing according to on-the-air trials. The HC-6 dynamic mic element slightly enhances the 2000-3000 Hz range to improve articulation on SSB. Receive audio levels were higher than the standard model Proset, and I found the phase reverse actually helped me sort out stations in crowded band situations.

Matching these headphones to any transceiver is an easy proposition. The AD-1 series adapters interface with most major brands and are color coded: red for Kenwood and Elecraft, yellow for Yaesu and Flex, blue for Icom, and so on. An IC version is available for Icom, and personally I found this version also seems to be a good match for the Elecraft K3—you can use the standard Kenwood adapter and turn on the mic bias setting in the K3 menu.

Priced at \$160 (\$170 for IC version), this durable headset is a good choice, especially if you like the Phase Reverse feature and coiled cord.

BPHS1 Specs:

Frequency Response: 20-20,000 Hz (Headphone); 40-20,000 Hz (Microphone)

Sensitivity: 100 dB (Headphone); -57 dB (1.4 mV) re 1V at 1 Pa (Microphone)

Impedance: 65 ohms (Headphone); 560 ohms (Microphone)

Weight: 9.3 oz

Cable: 3.3 m (10.8') long with 8-pin connector at headset end; 3-pin XLRM-type connector

(microphone) and 6.3 mm (1/4") phone plug (headphone) outputs

Accessories Included: 3 windscreens; spare connector screw
<http://www.amazon.com/Audio-Technica-Broadcast-Stereo-Headset-Dynamic/dp/B003D87JI2>

Proset Elite Specs:

Frequency Response: PSE 6- 100 Hz - 12.5 kHz PSE iC- 35 Hz - 12 kHz

Polar Pattern: Cardioid

Impedance: PSE-6- 600 Ohms PSE-iC- 1.5 k ohms

Output Level: PSE-6: -57 dB at 1 kHz PSE-iC: -48dB at 1 kHz

Weight: 13.8 oz

Required Adapter: AD-1 series (included with iC version)

<http://www.universal-radio.com/catalog/mics/5477.html>

SCANNING AMERICA

By Dan Veeneman

dan@signalharbor.com

Calvert, St. Mary's (MD) and Lewis Counties (NY)

New radio systems are being installed in smaller jurisdictions as well as larger municipalities. This month we take a look at three systems in less populated areas and remind readers about a popular and long-running radio convention.

Calvert County, Maryland

In March, Calvert County, Maryland awarded a \$21 million contract to Motorola Solutions, Inc. for a new public safety radio system. This is the largest single contract ever awarded by the county.

Calvert County is in the southern part of Maryland, located on a peninsula between the Patuxent River and the Chesapeake Bay. It has a population of nearly 90,000 and covers an area of 345 square miles, a third of which is water.

The new system will replace an old analog system currently operating on five radio channels from five repeater sites located in the towns of Dunkirk, Island Creek, Lusby, Prince Frederick and Sunderland. This analog system has been in service since 1997 and is the oldest 800 MHz system in Maryland. It provides street-level coverage in most areas of the county, however in-building coverage is limited and some coastal areas have coverage gaps.

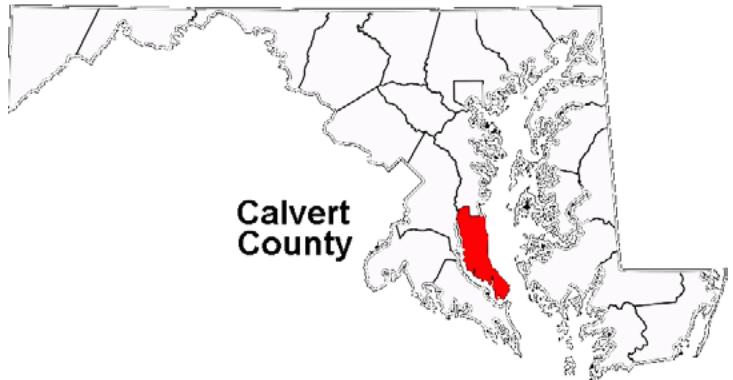
The county issued a Request for Proposal (RFP) last year and received two proposals, one from Harris and one from Motorola, both of which were reviewed by numerous agencies within the county government. The county determined that the bid from Motorola was the most responsive.

The Motorola bid includes a 20-year plan for construction, maintenance and support of the new system. Maintenance is expected to average \$250,000 per year, which includes repair or replacement of failed or outdated equipment as well as all software and hardware upgrades to more than 1,100 portable and mobile radios during the life of the contract.

The contract provides for a Project 25 (P25) compliant system and 20 years of service and support. Adhering to P25 standards will allow police and fire departments throughout the county to more easily communicate with other county, state and federal agencies when mutual aid is needed.

The new system will operate on ten channels, increasing the number of possible simultaneous transmissions and reducing the likelihood of a first responder getting a "busy signal" when trying to transmit a message.

MARYLAND



The new system will also double the number of repeater sites to a total of ten, providing much better coverage, including inside buildings and along coastal areas. These sites will be controlled by the county, rather than leased from commercial operators as they are now, enabling the use of dedicated, mission-critical equipment and power sources. These new sites are scheduled to be built out over the next year, with foliage testing next summer and full operation by the end of 2017.

The contract also includes a new voice paging system for fire departments which will operate in the VHF (Very High Frequency) band.

New radios will have encryption capability and the ability to automatically report their location.

Along with new radios, dispatch centers will receive updated consoles and access to a new mobile command vehicle.

The county currently operates a Motorola Type II SmartNet system on the following frequencies: 851.9125, 852.1375, 852.1875, 852.2500 and 853.3500 MHz.

Decimal	Hex	Description
1616	065	Sheriff (Dispatch)
1648	067	Sheriff (Tactical 1)
1680	069	Sheriff (Tactical 2)
1712	06B	Sheriff (Tactical 3)
1744	06D	Sheriff (Training)
1808	071	County Police/Fire
1840	073	County Fire and Emergency Medi-

cal Services Dispatch (Patched to 33.82 MHz)		
1872 075 County Fire (Tactical 1)		
1904 077 County Fire (Tactical 2)		
1936 079 County Fire and Emergency Medi-		
cal Services (Tactical 3)		
1968 07B County Fire Mutual Aid		
2032 07F County Fire Training		
2064 081 County Detention Center		
2128 085 Calvert Control		
2160 087 Transit Transportation		
2192 089 Health Department		
2224 08B Highway		
2256 08D Solid Waste		
2288 08F Permits		
2320 091 Water		
2352 093 General Services		
2416 097 Animal Control		
2448 099 Baltimore Gas and Electric		
2480 09B County Fire Meet		
2512 09D County Fire Training		
2544 09F County Fire Emergency		
2704 0A9 Charles County Fire Units ("Bene-		
dict")		
2576 0A1 Maryland State Police (Prince Fred-		
erick)		

The county also operates on several conventional (non-trunked) analog frequencies:

Frequency	Description
33.60	County Fire (Tactical)
33.82	County Fire and Emergency Medical Services Dispatch (Patch to Talkgroup 1840)
154.2800	Fire Mutual Aid Coordination
154.2950	Mutual Aid (Alternate)
154.3925	County Fire Paging
154.0250	County School Buses
155.0400	County School Buses

The Federal Communications Commission (FCC) database shows seven additional frequencies under two different call signs licensed to operate from the current repeater sites in Dunkirk, Island Creek, Lusby, Prince Frederick and Lusby. These frequencies are 856.0375, 857.0875, 857.1375, 858.1375, 858.5125, 859.1125 and 859.5125 MHz. It is expected these frequencies will be used on the new P25 system.

Calvert County has a Memorandum of Understanding (MoU) with St. Mary's County, located immediately to the southwest, regarding mutual aid. The MoU, requested by St. Mary's County when they were transitioning to their own P25 system in 2013, establishes dispatch requirements and coordinates frequencies and other operational issues between the two counties.

Calvert County and St. Mary's County radios are all capable of operating on P25 systems, the MoU allows

personnel from both counties to operate on the St. Mary's County system and the new Calvert County system. Each P25 radio is programmed with a unique 24-bit identification number. St. Mary's County radios use identifiers between 2,580,000 and 2,599,999 and Calvert County will use the range 2,280,000 to 2,299,999 for their radio identifiers.

The two counties will also exchange system encryption keys, allowing radios to interoperate between counties while maintaining cryptographic security.

St. Mary's County, Maryland

Three years ago, St. Mary's County replaced a four-site, 10-channel EDACS (Enhanced Digital Access Communications System) operating in the 800 MHz band with a Project 25 Phase 2 system. It operates on the following frequencies: 851.1625, 851.4375, 851.7625, 852.4750, 852.6375, 852.7750, 852.9375, 853.1500, 853.7250 and 853.7875 MHz. The final phase of the "NextGen" project brings the total number of repeater sites to 13. Unfortunately for listeners, many of the law enforcement talkgroups are reported to be encrypted.

The county maintains a description and some detailed information about the system on the county website at www.stmarysmd.com/est/Radio.asp.

Decimal	Hex	Description
1001	3E9	Sheriff (Dispatch North)
1002	3EA	Sheriff (Dispatch South)
1003	3EB	Sheriff (Dispatch Central)
1012	3F4	Sheriff (Tactical 1)
1013	3F5	Sheriff (Tactical 2)
1014	3F6	Sheriff (Tactical 3)
1015	3F7	Sheriff (Tactical 4)
1016	3F8	Sheriff (Tactical 5)
1017	3F9	Sheriff (Tactical 6)
1019	3FB	County Detention Center
1021	3FD	County Courthouse
2001	7D1	Fire and Emergency Medical Services (Dispatch)
2002	7D2	Emergency Medical Services Tactical
2003	7D3	Fire and Emergency Medical Services Meet 1
2004	7D4	Fire and Emergency Medical Services Meet 2
2005	7D5	Hazardous Materials
2007	7D7	County Fire Tactical 1
2008	7D8	County Fire Tactical 5
2009	7D9	County Fire Tactical 6
2010	7DA	County Fire Tactical 7
2011	7DB	County Fire Tactical 2
2012	7DC	County Fire Tactical 8
2013	7DD	County Fire Tactical 9
2014	7DE	County Fire Tactical 10

2015	7DF	County Fire Tactical 3
2016	7E0	County Fire Tactical 11
2017	7E1	County Fire Tactical 12
2018	7E2	County Fire Tactical 13
2019	7E3	County Fire Tactical 4
2021	7E5	St. Mary's Hospital 1
2022	7E6	St. Mary's Hospital 2
2023	7E7	St. Mary's Hospital 3
2027	7EB	County EMS 1
2028	7EC	County EMS 2
2029	7ED	County Fire Training 1
2030	7EE	County Fire Training 2
2031	7EF	County Fire Training 3
2032	7F0	County Fire Training 4
2033	7F1	County Fire Training 5
2034	7F2	County Fire Training 6
2035	7F3	County Fire Training 7
2036	7F4	County Fire Training 8
2037	7F5	County Fire Training 9
2038	7F6	County Fire Training 10
3001	BB9	County Public Works (Dispatch)
3002	BBA	Public Works A
3003	BBB	Public Works B
3004	BBC	Public Works C
3005	BBD	Public Works D
3006	BBE	County Transit
3007	BBF	Building Services
3008	BC0	Recreation and Parks
3009	BC1	Permits and Inspections
3010	BC2	Metropolitan Commission (Water Utility)
3011	BC3	County Health Department
3014	BC6	County Public Schools (Buses)
3015	BC7	County Public Schools (Maintenance)
3016	BC8	County Public Schools (Administration)
3017	BC9	Leonardtown High School
3012	BC4	County Administration
3018	BCA	St. Mary's College Public Safety
(Dispatch)		
3019	BCB	St. Mary's College Public Safety
(Tactical 1)		
3020	BCC	St. Mary's College Public Safety
(Tactical 2)		
3021	BCD	St. Mary's College Public Safety
(Tactical 3)		
3022	BCE	Recreation and Parks (Museum)
4001	FA1	County Emergency Services 1
4002	FA2	County Emergency Services 2
4003	FA3	County Emergency Services 3
4004	FA4	County Emergency Services 4
4006	FA6	Emergency Communications Center
4007	FA7	Countywide Mutual Aid 1
4008	FA8	Countywide Mutual Aid 2
4009	FA9	Countywide Mutual Aid 3



NEW YORK

4010	FAA	Countywide Mutual Aid 4
6001	1771	State Police Barrack T (Dispatch, Patched to 39.38 MHz)
6002	1772	State Police Barrack T (Tactical 1)
6003	1773	State Police Barrack T (Tactical 2)
6004	1774	State Police Barrack T (Tactical 3)
6007	1777	State Highway Administration
6008	1778	State Police Aviation (Calling)
6009	1779	State Police Aviation (Tactical 1)
6010	177A	State Police Aviation (Tactical 2)

Fire and Emergency Medical Services paging is independent of the trunked radio system and can be heard, in analog and unencrypted, on 154.980 MHz.

Lewis County, New York

A new countywide Project 25 network has been built in Lewis County, New York, to serve county law enforcement, fire and emergency medical services, as well as State Police and forest rangers.

Lewis County is located in upstate New York, some 250 miles or so north of New York City. It is home to about 27,000 people, nearly 4,000 of who live in the county seat of Lowville. The county covers 1,290 square miles.

The new county system is trunked and operates in the UHF band from nine repeater sites, replacing a patchwork of old analog systems that suffered from poor coverage, optimistically estimated at 60 percent throughout the county. Along with the new system, the county purchased 500 mobile and portable radios from EF Johnson.

Final acceptance of the new system is expected later this year, after testing coverage when trees have full foliage. In the meantime, the following analog frequencies will continue to operate.

Frequency	Description
37.90	Lyonsdale Highway Department
37.94	Leyden Highway Department
46.12	County Fire (Dispatch)
46.08	County Fireground
46.22	County Fire (Command Primary)

46.18	County Fire (Command Alternate)
46.28	County Fire Police
151.4150	County Fire and Emergency Medical Services
154.5400	County Fire Mobile Repeater (Patched to 46.12 MHz)
155.1600	Lewis County Search and Rescue (Secondary)
155.1900	County Sheriff (Dispatch)
155.2950	Lewis County Search and Rescue (Primary)
155.6925	County Sheriff
156.0300	County Sheriff (Car-to-Car)
156.1350	New Bremen Highway Department
156.1650	Martinsburg Highway Department
156.1800	Lowville Highway Department
156.1950	Denmark Highway Department
453.1000	Lewis County Search and Rescue (linked to 155.340 MHz)
453.6000	Lewis County Search and Rescue (linked to 155.295 MHz)

JLENS Update

In our July and November columns we discussed a Raytheon defense product called the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), essentially a pair of tethered 240-foot helium-filled balloons equipped with air defense radar and communications equipment.

It appears JLENS may not be available for monitoring after the 2017 defense policy bill came out last month. While the Army had requested \$45 million to continue testing the aerostat, the bill provides only \$2.5 million in funding. JLENS became the object of ridicule in Congress after it broke free from its Maryland moorings last October and floated into Pennsylvania, dragging the steel tether across power lines and triggering multiple power outages.

The lack of funding means the Army will keep JLENS in storage rather than continue operational testing. It remains to be seen whether lobbyists can restore enough funding to continue the program.

Hamvention

The largest annual gathering of radio enthusiasts will be held at the Hara Arena in Dayton, Ohio, from Friday May 20 through Sunday, May 22. This is the 65th year of the ham radio convention (“Hamvention”), with attendance averaging about 25,000 people over the past few years.

A number of planned events are scheduled to occur over the weekend, including amateur satellite operation demonstrations and high altitude balloon launches. For those who would like to become a licensed ham radio operator, a one-day Technician class will be held on Saturday.

The Hamvention will also host more than two dozen forums covering a variety of topics during the long weekend.

These forums are generally held in meeting rooms inside Hara Arena and provide an opportunity for attendees to learn more about various aspects of the radio hobby. These topics include Software Defined Radio (SDR), Morse Code, antennas and radio signal propagation, kit building, Digital Mobile Radio (DMR), D-STAR, radio teletype (RTTY) and amateur radio digital modes. Sessions also cover operating procedures and planning, including the use of amateur radio during emergencies.

Aficionados of particular radio manufacturers, including Collins, Drake and Kenwood, get together during the Hamvention to discuss and learn about their favorite products.

Vendors

Hundreds of vendors will offer products and services in the six main indoor areas within Hara Arena. These vendors include Alpha Antenna, American Radio Relay League, Begali Keys, Bird Technologies, Byonics, Cushecraft, DX Engineering, Davis Instruments, Diamond Antenna, Elecraft, FlexRadio Systems, Heil Sound, Ham Radio Outlet, Hy-Gain, ICOM America, M2 Antenna Systems, MCM Electronics, MFJ Enterprises, Mini-Circuits, National Weather Service, Nuts and Volts Magazine, Radio Club of America, RigExpert, Tuscon Amateur Packet Radio (TAPR), Tarheel Antennas, The Whistler Group, Timewave Technology, Tower Electronics, Universal Radio, Vibroplex, and Yaesu, along with hundreds of others.

With thousands of attendees passing through Hara Arena each day of the Hamvention, vendors often announce new products and demonstrate hardware and software to potential customers.

Many of these vendors also donate prizes to be given away during the Hamvention.

In the parking lot surrounding Hara Arena is an open-air flea market with thousands of spaces for average folks to set up shop and sell all kinds of radio-related items. Old and new radios, teletype gear, scientific and laboratory equipment, books and manuals, and parts galore are just a few of the bargains, treasures, and historical artifacts that can be found on the tables and in the stalls of these flea market vendors. Be sure to wear comfortable shoes and dress for the weather, which can vary from 80 degrees and sunny to 50 degrees and heavy rain, with everything in between. The UPS Store and the United States Postal Service will also have booths inside Hara Arena if you decide to ship your purchases home.

There are also sights to see beyond the Hamvention. As the home of Orville and Wilbur Wright, Dayton maintains an Aviation Trail featuring a number of historical sites around the city. Nearby is Wright-Patterson Air Force Base, featuring the National Museum of the U.S. Air Force. You can read more about the Hamvention at www.hamvention.org.

TSM

FEDERAL WAVELENGTHS

By Chris Parris

cparris@thefedfiles.com

Summer Vacation Scanning

Since the summer travel season will soon be upon us, I thought I would concentrate on some of the travel related federal frequencies you might try monitoring while on vacation.

Some hobbyists might consider their vacation a time to get away from the chatter and noise of scanner monitoring. But I've always enjoyed the challenges of being in a new or unfamiliar area and trying to figure out what radio frequencies or trunked systems are in use. And, in some cases, having a scanner with you while traveling may get you some inside information as to what is going on with your flight, train or cruise ship.

Tuning In The TSA

While most people equate the Transportation Security Administration (TSA) and their blue-shirted officers with air travel, many are surprised that the TSA is involved with all forms of transportation, not just commercial airlines. In some cases, you can tune in and listen to the TSA in operation while you are traveling to your vacation destination.

But first a bit of history. It doesn't seem that long, but the TSA was formed over 15 years ago in direct response to the September 11, 2001 terror attacks. Initially, the agency was formed as part of the Department of Transportation, and later would become part of the Department of Homeland Security when DHS came into existence in early 2003. When the TSA first started appearing at airports, they used a mash up of whatever radio equipment was easily available at the time. Eventually, a group of federal VHF radio frequencies were allocated and radio equipment was purchased for all TSA airport operations.

Not all commercial airports in the United States have TSA security. Some airports have opted out and utilize private screening companies, but these companies must meet minimum training standards for their screeners. These private screeners often wear uniforms that make them look a lot like TSA screeners, but the uniforms will not have the actual TSA logo on them. And, even if private company screeners are working at the security checkpoints, there are still likely some TSA personnel supervising behind the scenes.

The "T" in TSA stands for Transportation, so they are involved in not just air travel, but ship and rail transportation as well. Several sources have reported to me that they have spotted TSA Behavioral Detection Units (BDU) or K-9



A TSA explosives detection canine team at Washington Dulles International Airport (Courtesy: TSA)

Explosive Detection units working passenger rail terminals and riding trains. The TSA provides specially trained officers to work large-scale public events, such as Super Bowls, NBA Playoff games, and New Years Eve celebrations. And the TSA is often seen at cruise ship terminals in Florida and other ports of call in the U.S.

When the TSA first purchased radio systems for their operations, they used a standard channel plan that consisted of frequencies previously allocated to the Federal Aviation Administration (FAA). The first TSA radios were all APCO P-25 with encryption. The TSA has always had encryption capabilities, but their use of the secure mode has varied by location. In some airports, the TSA is encrypted full time, San Diego being one of the first locations I ran into that was secure all the time. Other locations seem to use it as needed or randomly.

Back in 2008, the TSA began using a variety of secondary VHF frequencies, and they purchased a number of small Icom F-50V radios for use by the screeners at security checkpoints, to communicate with each other. These radios are all analog, with voice-inversion security. They were a cheaper alternative to purchasing larger, heavier and more expensive P-25 radios for low-power, short-range use.

A recent posting on Radio Reference by someone claiming to be doing radio equipment maintenance for the

TSA in Florida posted a picture of a new Relm P-25 radio showing that the secured voice mode was enabled. The post claimed that all of the TSA nationwide would soon be encrypted. At least in my travels, I have not found that to be true yet.

As I mentioned earlier, the TSA first received a set of federal channels from the allocations of the FAA. Here are those first TSA allocations. When searching for TSA activity, always assume that the TSA at your local airports will have some of these four frequencies in use:

166.4625
169.3000
172.1500
172.9000

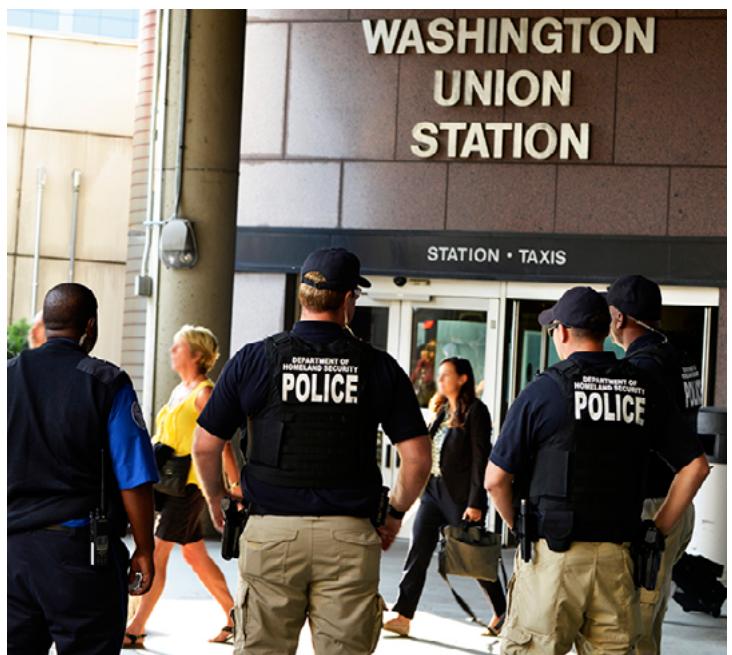
In addition, here are some of the “secondary” frequencies that have been identified as TSA at various airports. These can be in APCO P-25 digital mode with various Network Access Codes (NACs), or they might be used in analog with simple voice inversion:

162.2750
163.3125
163.6250
165.0750
166.2875
166.7875
168.0875
168.6000
168.8375
168.9625
169.1625
169.2625
169.3875
169.4125
169.9125
170.3375
170.9375
171.7625
173.0875
173.7750

Traveling with Your Radios

One question I see asked all the time on Internet scanner forums is “Can I take my scanner on board when I fly?” The answer is certainly yes, but with some caveats. I travel well over 100,000 miles a year for work, and have always had two or three radios, antennas, spare batteries, etc. with me and never had any issues. As you go through the security checkpoint, the TSA may show some interest, but I’ve only been asked about my scanners once, and that was by a TSA officer who was interested in what radios I had because he was also a scanner fan.

Once you get through airport security, you are free to



TSA VIPR team patrols Union Station as part of their Operation RAILSAFE. (Courtesy: TSA)

use your radio, but do so discreetly. I have used my radios while waiting to board the plane, but I do so with ear buds and have the radio in a pocket or in a holster on my belt. I have never had anyone question my using the radio in the terminal, but some travelers may not know what you are doing or why and may consider your behavior suspicious.

When it comes time to board your flight, put all the radios away. Once you get on board, leave your radios in your carry on bag and don’t attempt to use them while in flight. Even though the rules regarding the use of electronic equipment on commercial flights have been relaxed somewhat, scanners and two-way radios are still on the no-no list.

There were some recent postings on a scanner mail list that reported a member of the list who was flying commercially had a run-in with a flight attendant and was forced to surrender his ham radio and scanner and reportedly had to ship them to his destination rather than carry them with his bags. The story was only reported from the passenger’s amateur radio operator’s point of view, but the details as he reported clearly indicated there was more to this than meets the eye. It appeared that he was attempting to use the radio while on board the plane, while still on the ground. When the flight attendant asked him to discontinue using the device, he attempted to argue with her about his amateur radio license and the privileges it gave him. He lost the argument and was asked to remove the communications device from the flight.

The original post stated that the airline had a policy against amateur radios or scanners even being carried on board in carry-on luggage. This is definitely not true and the policy can be found posted on any major air carrier’s web site.

Once you get up in the air, please resist the temptation to pull the scanner out and try to listen. If the cautionary tale told previously isn’t enough reason, another is that you

probably won't hear much. You are in a large metal tube with some small openings in the sides. While you may be flying at over 35,000 feet, about the only thing you will catch are the ACARS data transmissions from the airplane itself. But, once you get to your destination, feel free to pull the radios out and start scanning!

Cruising with the Coast Guard

If your summer time travels take you anywhere nears the water, be sure and keep an ear on frequencies used by the U.S. Coast Guard. Their communications can be extremely interesting in the case of boaters needing assistance.

Long-range communications by the Coast Guard can occur over many different frequencies and radio systems. For as long as I can remember, the Coast Guard utilized many of its own high frequency (HF) or shortwave single-sideband frequencies for operations over the open ocean. While these channels still have some activity, much of the Coast Guard operations have moved to the COTHEN HF radio system, as well as UHF military satellite communications.

COTHEN stands for Customs Over the Horizon Enforcement Network, originally being built for the U.S. Customs Service and their interdiction activities. More recent documentation shows the "C" standing for CBP or Cellular. Voice transmissions on the COTHEN system can be monitored using a shortwave receiver. There are several good sources on line for detailed information on the COTHEN system. Here is a link to the basic system information on the Radio Reference site:

http://wiki.radioreference.com/index.php/Customs_Over_The_Horizon_Enforcement_Network

A very good write-up on the COTHEN and Automatic Link Establishment (ALE) usage on the system is available on Larry Van Horn's Milcom blog site:

<http://mt-milcom.blogspot.com/p/us-cbp-cothen-net-updated-9302012.html>

<http://www.ominous-valve.com/CothenALE.pdf>

http://www.hfindustry.com/meetings_presentations/presentation_materials/2007_feb_hfia/presentations/07_cothen_hfia_presentation_part1.pdf

Most of the domestic land-mobile channels used by the Coast Guard are now P-25 digital and, in many cases, encrypted. Why encrypt Coast Guard communications? Although much of the Coast Guard operations involve public safety, they also function as a law-enforcement agency, and operate under the Department of Homeland Security. DHS has long had a policy of encrypting critical communications systems, so Coast Guard operations would fall under that.

As with many federal agencies, however, there are



Coast Guard Cutter Valiant (WMEC-612) underway. (Photo courtesy of USCG)

some exceptions. Some areas use encryption only as needed, while some have the field units encrypted, while the Coast Guard dispatcher is in the clear. And so far, all of the USCG communications on the dedicated Marine VHF channels have been in the clear.

156.8000	MARINE CH 16
157.0500	MARINE CH 21A
157.0750	MARINE CH 81A
157.1000	MARINE CH 22A
157.1250	MARINE CH 82A
157.1500	MARINE CH 23A
157.1750	MARINE CH 83A

Here is the most recent list of the P-25 USCG NET channels. The UHF NET channels appear to be mainly used by Coast Guard air assets for communications with their base dispatcher:

139.9750	N293	NET 101
140.4750	N293	NET 102
140.7250	N293	NET 103
141.5500	N293	NET 106
141.6125	N293	NET 104
150.3000	N293	NET 107
150.7250	N293	NET 105
162.0500	N293	NET 108
162.1250	N293	NET 109
162.2500	N293	NET 110
162.3250	N293	NET 111
163.0500	N293	NET 112
163.1375	N293	NET 113
164.3000	N293	NET 114
164.3125	N293	NET 115
164.5500	N293	NET 116
164.5625	N293	NET 117

164.9000	N293	NET 118			
164.9125	N293	NET 119			
165.2625	N293	NET 120			
165.2750	N293	NET 129			
165.3125	N293	NET 121			
165.3250	N293	NET 122			
165.3375	N293	NET 123			
165.4625	N293	NET 151			
166.1875	N293	NET 124			
167.1125	N293	AG-101			
167.6250	N293	AG-102			
167.9000	N293	NET 125			
168.8625	N293	NET 126			
171.2125	N293	NET 130			
171.2375	N293	NET 127			
171.3125	N293	NET 131			
171.3625	N293	NET 132			
171.3500	N293	NET 133			
171.3625	N293	NET 134	413.0250	N293	NET 411
172.0375	N293	NET 150	413.0375		
172.3125	N293	NET 128	414.7625		
173.1000	N293	AG-XXX	415.6250		
173.5375	N293	AG-113	415.7750		
			415.8250		
237.9000	AM	Air Operations (secondary)	415.9250		
326.1500	AM	Air-to-Ground (primary)	416.2250	N293	NET 421
345.0000	AM	Air Operations (primary)	416.3875		
379.0500	AM	Air-to-Ground (secondary)	416.4750		
381.7000	AM	Air Operations (deprecated)	416.5500	N293	NET 422
381.8000	AM	Air Operations (deprecated)	416.5750		
383.9000	AM	Air Operations (deprecated)	416.5875		
			416.6000		
406.5000			416.6375		
406.5625			416.7000		
406.5750			416.7125		
406.6000			416.8500		
406.8000			416.9250		
406.8125	N293	NET 414	416.9375		
406.9750			417.0000	N293	NET 423
407.6250			418.3500		
407.9250			418.4375		
407.9750			418.4500		
408.4000			419.1250		
409.0000			419.6000		
409.1875			419.6500		
409.2000			419.8000		
409.3500			419.8250		
409.8250			419.8500		
410.0250			419.9750		
410.3750	N293	NET 401			
411.3750					
411.7875	N293	NET 402			
412.9250	N293	NET 407			
412.9500	N293	NET 408			
412.9750	N293	NET 409			
413.0000	N293	NET 410			



*A formation of US Coast Guard MH-60J Jayhawk helicopters.
(Photo courtesy of USCG)*

In addition to the Coast Guard P-25 NET frequencies, their radios also contain the VHF federal interoperability frequencies that have been made available to all federal agencies. It's a good idea to keep these in your active scan list all the time, as you never know when these might be used:

Law Enforcement (LE)		1	430.5250
167.0875	LE-A (simplex)	2	431.5250
167.0875	LE-1	3	432.7350
167.2500	LE-2	4	434.5250
167.7500	LE-3	5	436.7650
168.1125	LE-4	6	437.6250
168.4625	LE-6	7	438.5750
167.2500	LE-6 (simplex)	8	440.5625
167.7500	LE-7 (simplex)	9	440.5850
168.1125	LE-8 (simplex)	10	449.7125
168.4625	LE-9 (simplex)	11	450.5250
		12	451.7625
Incident Response (IR)		13	455.5150
169.5375	IR-CALL	14	460.7750
170.0125	IR-1	15	465.5250
170.4125	IR-2	16	461.5250
170.6875	IR-3		
173.0375	IR-4		
169.5375	IR-5 (simplex)		
170.0125	IR-6 (simplex)		
170.4125	IR-7 (simplex)		
170.6875	IR-8 (simplex)		
173.0375	IR-9 (simplex)		

If you happen to be near a Coast Guard dock or near where Coast Guard cutters operate, be sure and keep your scanner's near-field searching capabilities going. The CG cutters have a history of using anything and everything for on-board radios. Some use UHF business channels, some use FRS radios and some use oddball, non-standard channels for hand held radios on the boat. Here are a few that were found in a Coast Guard radio-programming template. There was nothing specified for CTCSS or DCS squelch tones. The frequencies listed are rather a strange mix:

I'll have more summer vacation travel and destination frequencies in the next edition of the Federal Wavelengths column, so be sure and check back next month!

Federal Wavelengths Frequency List Legend

Unless otherwise noted, frequencies listed are FM and frequencies are shown in Megahertz (MHz). Frequencies listed will show additional information as follows:

PL	CTCSS Tone Squelch
D	DCS Digital Coded Squelch
RID	APCO P25 Radio Identification Number
CSQ	Carrier Squelch, no squelch tone
N	APCO P25 digital Network Access Code (NAC)
DMR	Digital Mobile Radio, a.k.a. MotoTRBO digital
WACN	Wide Area Communications Network, an APCO P25 trunked network Identifier

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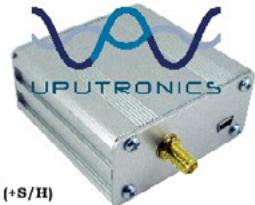
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UTILITY PLANET

By Hugh Stegman

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HF in Death Valley

If you're an active emergency-communications ham in Southern California, you've probably heard of the annual Baker to Vegas Challenge Cup Relay in late March. It's an epic competition involving over 250 teams of 20 runners each, all from law enforcement agencies in several different countries. That's why it's been billed as "the world's largest police chase." When support personnel are included, the number of people involved goes well over 6,000.

The race's 20 sections stretch for 120 miles, through desolate desert and over steep mountain passes prone to snow storms. It starts in the absolute middle of nowhere, just south of Death Valley. The nearest sign of habitation is Baker, California (population 735), and even that's 25 miles away. The rest of the year, Baker is known mostly for its temperature extremes, as proudly displayed on the world's largest thermometer. 13 to 24 hours later, teams reach the finish line in Las Vegas.

Due to terrain and long distances, the communication challenges are immense. Most of the support comes from ham volunteers with mobile radios, using strings of VHF/UHF repeaters. It's a massive undertaking. Repeaters are no longer linked, due to technical problems in the past.

This year, however, comm support also came from NVIS Communications, on shortwave radio (HF). NVIS is the commercial radio consulting firm operating those mysterious WQLE815 stations heard on Automatic Link Establishment (ALE). Typical was the ALE-initiated USB voice between WQLE815SJCLIENT, identifying at a temporary location in "Mountain Springs" and WQLE815CVLCLIENT, temporary in Pahrump, Nevada. There were also soundings on 7549.0 kHz USB ALE.

The rest of the year, Pahrump is known mostly for Art Bell, the retired talk show host who (for better or worse) defined late night AM radio for a generation. He's an Extra Class ham (W6OBB/ 4F1AB), with a large antenna farm out in the desert. The latter call is used in the Philippines, where he lived for a time.

The name NVIS undoubtedly refers to Near-Vertical Incidence Skywave; a skip mode that's perfect for the kind of situation seen in this race. Antennas are configured to radiate almost straight up, and the result is very even coverage in a radius of about 500 miles. Terrain becomes less of an issue, as does antenna gain. This mode is becoming common for military operations. At least on the Baker to Vegas race, it seems like a good match of capability to the task at hand.

In this case, the mobiles were using Barrett radios,



Barrett NVIS antenna, in deployed position (Courtesy: Barrett Communications)

feeding special NVIS antennas resembling luggage racks on the vehicle roofs. Barrett is an Australian company, generally associated with robust communication solutions for very remote areas. It is represented in the U.S. by a division of NVIS called Barrett Communications Consulting.

Barrett and NVIS have also worked with some other consulting firms in developing a Tactical Communications Unit (TCU) for the new Los Angeles County interoperability initiative known as LA-RICS. The TCU is an ominous-looking comm trailer that is much smaller than most, and operated by one person. An EMP-hardened shelter encloses several racks of radios, plus a generator and four days' worth of fuel. Antennas are mounted on a crank-up mast. Turnkey cellular, phone patch, and public safety radio capability are provided over networks on VHF and UHF. Two HF networks are provided as an absolute fall-back when all other modes fail.

Hopefully, we'll be hearing more from WQLE815 radios in California. The frequencies shown in the FCC license are: 2194-2495, 3155-3400, 4438-4650, 5005-5450, 6765-7000, 7300-8100, 9497.4, 11452.4, 12225, 14360, 15604.4, 18035, 20095, and possibly 27490 kHz. The lower frequencies are shown as ranges because they are authorized for frequency hopping spread spectrum. As we've seen, though, some identifiers and operator chatter occur on single frequencies, usually near the center of the range.

DVA Build Progresses

The new U.S. Department of Veterans Affairs (DVA)

HF system has begun serious testing of equipment. Like spring, it's busting out all over. Many frequencies and stations are active nationwide on ALE, with new identifiers heard daily. Most are soundings, though I have heard some link checks with other stations. A few lucky people have also heard voice comms. These are typically engineering chatter, as things are set up, but they sometimes reveal locations.

All of this is part of a DVA Strategic Spectrum Plan, in response to post-9/11 and post-Sandy national initiatives. The goal is to beef up local Continuity of Operations (COOP) and Continuity of Government (COG). As noted in a 2007 document, "VA expects to see a significant increase in the use of HF radio on current VA assigned frequencies, Shared Resources (SHARES), an increase in Federal emergency preparedness exercises, and other Federal HF Networks as a result of National Communications System (NCS), Directive 3-10. VA expects that during these exercises the need for additional HF frequency allocations to support VA regional HF networks will be discovered."

The NCS has since been absorbed into the U.S. Department of Homeland Security (DHS), and HF is indeed a major priority. SHARES seems to be adding nets, and everything else in the 2007 document has pretty much happened. The new DVA system has bases at 160 facilities, and an unknown number of man-packs and/or mobiles. By Light, the lead contractor, went with the Envoy HF system made by Codan Radio Communications, another Australian company.

We've all heard Codan radios on the air. They use 2G ALE, per the U.S. standards (FED-STD-1045 and MIL-STD-188-141B). Data comms are provided with the U.S. military standard serial modem (MIL-STD-188-110A). Digital voice uses the NATO STANAG 4591 standard, and it can be encrypted. Plain old USB is available for when people actually want to talk to each other. There are also a couple of unique-sounding proprietary modes such as Codan Chirp, but I have no idea whether they are being used here.

OK, let's talk about listening on the radio. I've put in a lot of time on this one, and the ALE frequency list grows longer by the day. Right now, we have confirmed the following: 2025.6, 2414.0*, 2726.0, 2804.0, 3355.1, 3393.6, 5140.0, 5038.5, 5135.0*, 5192.0*, 5217.0, 6981.1, 7362.5, 7477.0*, 7480.0*, 10389.6, 12076.0, 14441.6, 14453.5, 17492.6, 20200.1, 20256.0, 22921.6, and 23355.5.

Frequencies with the star (*) come from the Operation SECURE frequency pool. We've talked about SECURE, which stands for "State Emergency Capability Using Radio Effectively." It's an FCC allocation, but the authorized state emergency agencies are in charge of the actual management of the channels. National systems did not use these in the past. However, some others are being used by the Rockwell Collins "ARINC UrgentLink" as well. Is this some kind of interoperability initiative? I don't know.

So far, all the ALE addresses use numbers of three to five digits. Most of them have four. The leading digit seems to have something to do with regions, though not even that is



Codan Envoy mobile radio (Courtesy: Codan Radio)

known for sure. Here in Southern California, several of the ones beginning in "6" have good signals on many frequencies. One of them, "6640," remains strong on the 2-3 MHz range during the day, while falling off on the high end of HF where large skip zones kick in. San Diego is a good first guess for this one, but it is still just a first guess.

UK Search and Rescue Changes

European listeners might have noticed that "Kinloss Rescue" has changed its identifier to "UK Rescue." This is because it is no longer operated from the Kinloss Barracks, a former Royal Air Force base in Scotland. The control center has moved south into England, at the National Maritime Operations Centre (NMOC) in Fareham, Hampshire. This shiny new complex, housed in a nondescript business park far from the water, is also the new nerve center for Her Majesty's Coast Guard.

This completes the transition of the UK aeronautical search and rescue (SAR) mission from the RAF to a combined air and sea agency. In addition, many former Ministry of Defence radio assets, including most UK government and military transmitters, have been contracted out to a facility operations company known as Babcock International Group. They also run the control center for the UK's Defence High Frequency Communications System (DHFCs), in Forest Moor. This is often heard on ALE as XSS, and on various modes as TASCOMM (Terrestrial Air-Sea Communications).

The new ID is "UK Rescue." While it is no longer an RAF facility, listeners have heard at least one of the same voices at the mike. Frequencies stay the same, with the UK Rescue primary on 5680 kHz USB, and the night secondary channel of 4718 kHz. Ground operators work helicopters on all sorts of SAR operations in the UK's area of responsibility.

DigiDX

We have another source of ham radio digital modes over old-school AM broadcast transmitters. This time, it's a program named "DigiDX." As the name implies, its con-

tent is usually related to the shortwave DX hobby. Text and images are sent in 32-tone Multiple Frequency Shift Keying (MFSK32). One interesting new wrinkle is that most programs also include small MIDI files of tunes from the good old days of HF broadcasting. One example is "Lilliburlero," the historic folk tune once heard hourly on the BBC World Service.

Unfortunately, the schedule for DigiDX changes frequently. Several transmissions were on "Channel 292," a German station, until that government briefly banned digital modes over broadcast transmitters. This decision also stopped DigiDX on "Radio 700," and the brief digital transmissions from "The Mighty KBC." VOA Radiogram, with transmitters in North Carolina, was not affected.

A week or so later, the German agency decided that it was all a misunderstanding. They'd thought the stations were violating their licenses by switching to USB mode. Nope, it's still Ancient Modulation, just with funny beeps instead of voices and music in the audio. A free decode program called fldigi works great for these modes.

Right now, it's a good idea to check the web site (below) for the schedule. U.S. listeners might get the best results from the transmissions on WRMI, Radio Miami International, from the former WYFR transmitter farm in Okeechobee, Florida. These are both on Sunday (UTC), over 15770 kHz AM at 2130, and 11850 kHz at 2330.

Icom Discontinues the R-75

Icom has suddenly discontinued its venerable IC-R75 tabletop communications receiver. This one was among the last of what used to be a popular radio type, made by many manufacturers. Today, though, it's generally considered to be a legacy product. Most of the excitement has shifted to the various software-defined radios (SDRs), which usually must be used with a computer. The word "usually" is used because of the CommRadio CR-1a, an interesting little SDR with the traditional front panel and audio. It can be used all alone, as well as with a computer.

The R-75 was made for 16 years. Its product line, going back to the original R-70, lasted a millennium by the standards of our instant-obsolescence electronic industry. Recently, the R-75 came with the digital signal processing (DSP) option already installed at no extra charge. In general, this was a very good box at something of a bargain price.

It seems likely that the remaining dealer stocks of R-75s are being cleaned out fast. Universal Radio is out of new ones as of April, though they show used ones at times. The only other traditional tabletop receiver currently in their catalog is the Ten-Tec RX-340, a rack-mount, surveillance-class unit selling for just under \$5,000 US. It's obviously aimed at a much different market.

Back in the hobby world, the closest thing left to the old-school tabletop unit would be the receiver section of a ham radio transceiver. At first, this seems crazy, but there are people doing it. Most newer transceivers have general-cov-



The venerable ICOM R-75, now out of production. (Courtesy: Icom America)

erage receivers, though it's important to make sure before plunking down money for one of them. Also make sure it allows USB receiving below 10 MHz (hams use LSB). Ham radio HF signals are mostly single-sideband voice, CW Morse code, RTTY, and a whole gaggle of narrowband digital waveforms. So are most of today's utilities. The overall listening experience, and the designs used, are quite similar.

There are issues, however, since these radios have transmitters in them. I have a ham radio license, but if you don't and you're a real radio geek, you might go crazy from staring at all those extra knobs and buttons that you've paid for. Of course, actually putting the radio into transmit mode would be illegal, and also quite expensive. It would instantly zap most of the receive-only antennas used in the utility hobby. More than one person has told me, however, that they consider it an incentive to finally buckle down and get their ham ticket. If that's you, go for it. Ham radio is a blast and a half.

As I dig utilities out of the noise floor with my fancy SDR, squinting at the waterfall until my eyes hurt, I'll still hoist one for the old receivers. A few things still sound better through a well-designed analog superheterodyne. The best ones also have big, solid knobs, switches that clunk convincingly into position, and dials you can read without getting a headache. There's life in the old boxes yet.

Resources:

Token's nice video of WQLE815 spread spectrum:

<https://youtu.be/BiJY6gEiqNU>

News story about Kinloss closure:

<http://stv.tv/news/north/314432-mod-to-move-scotlands-kinloss-arcc-to-fareham-in-england-in-2016>

DigiDX schedule:

<http://www.digidx.uk>

DIGITAL HF: INTERCEPT AND ANALYZE

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International ALE Networks

Last month we focused on US-based networks that use the MIL-STD-188-141A/B 2G ALE (2nd Generation Automatic Link Establishment) protocol to keep things in order. I had a lot of great feedback on that column, so thought it would be a good idea to focus on networks from further afield. As in the US, ALE supports the networks of armies, navies, air forces, ministries of the interior agencies and humanitarian organizations in other countries.

If ALE reception is new to you and you want to know how to get going, see the June 2014 issue of this column "Getting Started with MIL-STD-188-141A ALE Decoding," which is also available to read in the 2014 edition of Digital Digest on Amazon Kindle (see the link on the closing pages of this issue).

So, let's see which networks are strong, regular catches here in the US that you can dial into your radio and feed your decoder.

Algerian Air Force

With more than 14,000 personnel and an inventory of both Western and Russian-made aircraft, the Algerian Air Force operates an extensive HF ALE network that is easily heard in the US. The majority of traffic consists of link checks (LQAs) between airfields, often shared civilian and military, as well as a number of regional headquarters bases. From the frequencies used, you can see series of clusters nearly every megahertz centered around 10 MHz, suggesting a regionally-based NVIS (Near Vertical Incidence System) arrangement. Follow-on traffic is often 2400bd MIL-188-110A/B-based CITADEL digital voice. If you decode the 2400 bd data, Sorcerer shows the traffic as VOICE and all decoders will show the distinctive "VVV[[[" lead-in characters.

Identifiers:

7xx	Aircraft
CNC, COF, CTF	Headquarters, Cheragi AFB
CM1..CM6	Regional HQs Blida, Oran, Bechar, Ouargla, Constantine & Tamanrasset
BLD	Blida Airport
BSK	Biskra Airport
DJT	Djanet Airport
ESA	Pilot School, Tafraoui
ILZ	Illizi Airport
OEB	Oum El Bouaghi Airport



Map of Algeria (Courtesy: CIA Factbook)

REG
TDF

Reggane Airport
Tindouf Airport

Frequencies:

3155, 4590, 4600, 4650, 4730, 4750, 4785, 4850, 5460, 5460, 5462, 5467, 5470, 6450, 6565, 6655, 6698, 6703, 6738, 6765, 6825, 6921, 6964, 6980, 6985, 7476, 7509, 7568, 7595, 7616, 7647, 7633, 7716, 7754, 7808, 7897, 7925, 7935, 7938, 8061, 8080, 8084, 8153, 8156, 8965, 9053, 9055, 9070, 9074, 9106, 9180, 9189, 9257, 9262, 9281, 9288, 9300, 9306, 9348, 9364, 9438, 9903, 9913, 9931, 10031, 10123, 10129, 10134, 10141, 10146, 10180, 10184, 10221, 10193, 10519, 10544, 10528, 10535, 10544, 10552, 10583, 10719, 10785, 11010, 11025, 11114, 11120, 11125, 11129, 11154, 11156, 11163, 11171, 11415, 11425, 11476, 11651, 12167, 12197, 13208, 13324, 13327, 13348, 13368, 13369, 13377, 13393, 13399, 13522, 13544, 13802, 13894, 13984, 14223, 14423, 14428, 14430, 14432, 14435, 14437, 14438, 14441, 14448, 14456, 14457, 14458, 14463, 14466, 14475, 14640, 14970, 15834, 15801, 15852, 18600,

Algerian Army

And, as with their colleagues in the Air Force, the Algerian Army operates an extensive ALE-based network which also appears to be an NVIS arrangement. However, the Army network uses tactical identifiers that for many years have been of the form of Letter-Letter-Digit-Digit. The two letters change every few months. HA, YG, RM, FS, EH, FQ and many more combinations have been used. Current pairs are ND, AC, UL and PY. Follow-on data is often 2400bd using the MIL-188-110A/B 39 tone modem, for both data and digital voice.

Frequencies:

3205, 3250, 3260, 3271.4, 3291, 3300, 3304, 3313, 3354, 3390, 3503, 3545, 3702, 3850, 3857, 3934.4, 4010, 4035, 4390, 4420, 4460, 4486, 4505, 4536, 4570, 4717.5, 4812, 4825, 4835, 4970, 5020, 5035, 5065, 5070, 5094, 5115, 5120, 5145, 5165, 5260, 5266, 5280, 5295, 5365, 5374.5, 5380, 5414, 5424, 5427, 5443, 5444, 5447, 5450, 5464, 5470, 5712, 5752, 5756, 5770, 5775, 5781, 5790, 5795, 5805, 5820, 5875, 5879, 6390, 6427, 6454, 6460, 6464, 6500, 6505.4, 6745.5, 6751, 6753, 6758.4, 6838, 6840, 6845, 6847.5, 6859, 6915, 6925, 6940, 6945, 6955, 6975, 6986, 7512, 7525, 7530, 7647, 7650, 7705, 7720, 7752, 7830, 7845, 7950, 7955, 7996, 8010, 8020, 8059, 8061, 8070, 8080, 8115, 8189, 9060, 9135, 9175, 9180, 9234, 9250, 9306, 9380, 10550, 10851, 10910, 11185, 11202, 11211, 11218.4, 11309, 11415, 11500, 13420, 13450, 13650, 16106.5, 17489 & 19385 kHz USB

Mauritanian Gendarmerie

The Mauritanian gendarmes employ Codan radio and modem equipment with ALE to manage their network. ALE activity is often followed by a data exchange using the Codan 9001/3012 16 tone modem. Although the data is encrypted, the email system login prompts can often be seen in the clear. In fact, this is how the user behind this network was discovered. The ALE side of the network splits the identifiers for regular calls vs. data, a common arrangement on Codan networks. For example, station "1008" will use "908001" when setting up, sending or receiving data. If you see a 6-digit identifier, you can be sure that data is being used. The original number of identifiers used by the network suggested one station per state plus the capital. New stations were added in 2013 using 14xx-series 4 digit calls, probably from a new agency.

Identifiers:

1001	Nouakchott
1002 to 1016	Regional or State capitals
1400 to 1402	Unknown new agency
90100..908001, 940101, 940201 & 950101	Data calls



Map of Mauritania (Courtesy: CIA Factbook)

Frequencies:

6566, 6902, 8055, 9090, 9120, 10033, 11315 & 16112 kHz USB

Saudi Air Force

This interesting net appears to connect various major airports and/or air force bases in Saudi Arabia with ALE. Most unusually for any known ALE network, identifiers ending in "U" send on the upper sideband, those ending in "L" with the lower sideband and with "I" on both sidebands. There are ten stations involved with fixed circuits between each. Stations with identifiers starting with "R" originate in Riyadh and "J" from Jeddah, so the remaining identifiers are probably a number of other major airports or air force bases.

Identifiers

AAI, AAL, AAN, AAP, AAU
 DAI, DAL, DAN, DAP, DAU
 JAI, JAL, JAN, JAP, JAU, JCI, JCL, JCN, JCP, JCU
 NAI, NAL, NAN, NAP, NAU
 RCI, RCL, RCN, RCP, RCU, RDI, RDL, RDN, RDP, RDU,
 REI, REN, RFI, RFL, RFN, RFP, RFU, RHI, RHL, RHN,
 RHP, RHU, RGI, RGL, RGN, RGP, RGU,
 TAI, TAN

Frequencies

2287, 2655, 2820, 3175, 3241, 4457, 4555, 4557, 4593, 4880, 4900, 4910, 4953, 5125, 5305, 5391, 5404, 5405, 5420, 5750, 5770, 5846, 6743, 6815, 6924, 6933, 6944,

6982, 7150, 7482, 7690, 7765, 7950, 7976, 7990, 8045, 8085, 8127, 8133, 8160, 8172, 8190, 9085, 9086, 9106, 9117, 9120, 9147, 9160, 9176, 9183, 9199, 9210, 9271, 10134, 10135, 10240, 10282, 10299, 10333, 10345, 10366, 10384, 10468, 10544, 10677, 10883, 10970, 11090, 11138, 11161, 11469 & 13048 kHz USB, LSB or ISB

Brazilian Army & Navy

These two networks appear to be the 2G remnants of once much larger networks that have now transitioned to 3G (3rd Generation) protocols and are operated by the Brazilian Army and Navy. The locations of stations are not known.

Identifiers:

Army: 00011, 00013, 11011, 40011, 41001, 50011, 51001, 51011, 52001, 52011, 70012
Navy: GWE001, GWE011, GWT001, GWT002

Frequencies:

Army: 10982, 15876, 16090, 16333, 18172, 18218, 19200, 19677, 20100, 20300 & 20535 kHz USB
Navy: 12370, 14780 & 19427 kHz USB

German Coast Guard

Frequently heard after dark on the lower frequencies, the German Coast Guard operates an ALE network connecting various patrol vessels with the headquarters of a number of different civilian agencies that collectively undertake coast guard responsibilities. The Coast Guard is responsible for border protection, environmental controls, shipping and navigational safety, fishery and customs.

The equipment used is from German manufacturer Rohde & Schwarz and sends data using a proprietary 2400 bd modem, for which there is no known decoder.

Identifiers:

BPLEZS	Federal Police HQ, Cuxhaven
LEZSEE	Federal Police HQ, Cuxhaven
BP21..BP26	Police vessels Bredstedt, Neustrelitz, Bad Dueben, Bad Bremstedt, Bayreuth & Eschwege
SHKIEL	Water Protection Police HQ, Kiel
SHLIST	Water Protection Police HQ, Sylt
ZLST	Customs Receiving Point, Cuxhaven
ZBOR	Customs vessel Borkum
ZHAM	Customs vessel Hamburg
ZPRI	Customs vessel Priwall

Israeli Air Force

The Israeli Air Force still operates an extensive ALE network, linking aircraft with its strategic air bases. Pilots can frequently be heard chatting after contact is made using ALE. Like the US Air Force, an ALE scheme using tail numbers as a basis for the identifiers is also used. For exam-



Map of Brazil (Courtesy: CIA Factbook)

ple, "K20" corresponds to a KC130H aircraft, registration 4X-FBQ, tail number xx420,

Frequencies:

3178, 3823, 3824, 3865, 4681, 5123, 5129, 5163, 5209, 5269, 5360, 5478, 5531, 5563, 5581, 5720, 6224, 6256, 6265, 6288, 6330, 6487, 6504, 6533, 6562, 6581, 6621, 6631, 6728, 6736, 6742, 6743, 6748, 6878, 6920, 6921, 6925, 6933, 6980, 6992, 7390, 7392, 7651, 7655, 7712, 7757, 7848, 7857, 7898, 7950, 7957, 7961, 7965, 7967, 7976, 8063, 8135, 8234, 8323, 8341, 8521, 8526, 8556, 8622, 8797, 8805, 8841, 8845, 8847, 8858, 8877, 8917, 8993, 9057, 9135, 9137, 9219, 9265, 9297, 10004, 10216, 10352, 10614, 10642, 10900, 11246, 11472, 12251, 13367, 13972, 14595, 15808, 15940, 16202, 16730, 19602, 19606 & 22850 kHz USB

Identifiers:

AA1	Ben Gurion Air Base
AAA	Tel Aviv Air Base
BBB	Unknown Air Base
Cxx	Aircraft
Kxx	Boeing KC130H Aircraft
Mxx	Boeing KC707 Aircraft
Rxx	Aircraft
Sxx	Aircraft
Txx	Aircraft
Wxx	Aircraft
Yxx	Aircraft

That's all for this month. Enjoy looking for these interesting ALE networks!

TSM

SHORTWAVE UTILITY LOGS

Recent Shortwave Utility Logs Compiled by Mike Chace-Ortiz

Frequency (kHz)	Callsign	Time (UTC)	User, Location	System Details
10389.60	7570***	0032	US Department of Veterans Affairs, ?	125bd/1750 MIL-188-141A, ALE sounding (on USB)
10620.20	MKD	2239	UK MIL DHFCS, Akrotiri	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
12015.00	NAU	1150	US Navy, Isabela PR	50bd/850 STANAG4481 FSK, sync, cont, ACF=0
12026.00	CAJAP***	2158	Taiwanese Navy, ???	125bd/1750 MIL-188-141A, ALE LQA with "CSYNI", "CTCSM" (on LSB)
12713.00	FUV	1955	French Navy, Djibouti	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
12750.00	NMF	2155	US Coast Guard, Boston MA	120lpm/576/800 FAX, wx pix
12776.00	???	2043	Russian Navy, ???	50bd/250 BEE, tfc
12811.20	CFH	1730	Canadian Forces, Halifax	300bps/L STANAG4285 HF modem, crypto tfc (on USB)
12982.20	CFH	1130	Canadian Forces, Halifax	300bps/L STANAG4285 HF modem, crypto tfc (on USB)
13042.50	FUV	2356	French Navy, Djibouti	600bps/L STANAG4285 HF modem, "voyez le brick" marker in ITA2 (on USB)
13174.50	KKL23	2150	Global Link, Vashon WA	100bd/200 PacTOR, channel free marker w/ CWID "cq de kkl"
13264.00	EIP	2148	Shannon Volmet, Ireland	USB, YL/EE synthesized with METAR WX for EU airports
13315.00	???	2000	ARINC, Santa Cruz Bolivia	HF Datalink, squitter every 32s (ID=013) (on USB)
13410.00	FUF	0720	French Forces, Fort de France	1200bps/L STANAG4285 HF Modem, crypto tfc (on USB)
13415.00	???	2250	Australian MHFCS, Various Sites	MIL-188-110A HF modem, continuous mode tfc (on USB)
13420.00	???	2337	Algerian MIL, ???	Thales Systeme 3000 HF modem, 8MFSK data bursts (on USB)
13449.50	???	1123	UK MIL, St Eval	Modified WinDRM51 OFDM HF Modem, tfc (on USB)
13548.00	9Z4DH	0016	SailMail, Trinidad	PacTOR-III HF modem, tfc with CWID "9Z4DH" after
13870.00	NPG	2212	US Navy, Dixon CA	50bd/850 STANAG4481 FSK, sync, cont, ACF=0
13921.80	OVK	2220	Danish Navy, Aarhus	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
14416.00	???	1220	Russian MFA, Moscow	66 tone MFSK UNID HF modem, tfc (on USB)
14416.00	???	1221	Russian MFA, Moscow	3000bd PSK UNID HF modem, tfc (on USB)
14436.00	RCV	2100	Russian Navy, Sevastopol	50bd/200 BEE, tfc on sync=[0x1eb41eb2952]
14582.00	00012***	1200	Brazilian Forces, ???	125bd/1750 MIL-188-141A, ALE LQA with "60011" (on USB)
14716.00	???	1711	Russian MIL, Krasnovarsk	75bd/250 FSK UNID System, sync, cont, ACF=0
14803.00	???	2355	NATO MIL, ???	LINK-11 CLEW, tfc (on USB)
14922.00	EIB***	1238	Colombian Navy, ???	125bd/1750 MIL-188-141A, ALE LQA with "KM2" (on USB)
14938.50	???	1700	???, ???	1800bd ECHOTEL FARCOS HF modem, tfc (on USB)
16012.00	???	1853	Russian MIL, ???	50bd/500 BEE, idle on reversals
16096.00	400012***	1600	Mauritanian MIL, ???	125bd/1750 MIL-188-141A, ALE LQA with "400001" (on USB)
16112.00	1007***	2040	Mauritanian Gendarmerie, ???	USB, OM/AA calling "1001" with Codan +1200Hz PTT release tone after ALE
16112.00	RDL	2040	Russian Navy, Moscow	50bd/250 BEE, tfc sync on [0x1414bebe952] & [0x1414bebe64c]
16200.00	RDL	1840	Russian Navy, Moscow	50bd/200 BEE, tfc on sync=[0x1eb41eb2952] (idles on 50bd reversals)
16207.00	RIT	2015	Russian Navy, Severomorsk	50bd/200 BEE, tfc on sync=[0x1eb41eb2952]
16213.70	AQP	1214	Pakistani Navy, HQ Karachi	PacTOR-II FEC HF modem, idle (CRC=44476)
16468.10	PHR***	2200	US Marines, Camp Lejeune NC	125bd/1750 MIL-188-141A, ALE LQA with "GUC", "GUN", "SHL" (on USB)
16468.10	SHL***	1626	US Marines, Camp Lejeune NC	125bd/1750 MIL-188-141A, ALE LQA with "PHR" (on USB)
16468.10	GUN***	1626	US Marines, Camp Lejeune NC	125bd/1750 MIL-188-141A, ALE LQA with "PHR" (on USB)
16473.60	DHM85	2030	German Navy, Marlow	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
16663.00	???	1708	Norwegian Navy, Bergen	600bps/L STANAG4285 HF Modem, crypto tfc (on USB)
16780.50	???	1708	UNID Ship, ???	100bd/170/E SITOR-A, selcall to "QVXV" (Shanghai Radio)
16966.00	FUB	1627	French Navy, Saissac	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
16971.00	JJC	1520	Kyodo News, Tokyo	60lpm/576/800 Fax, newspaper pages
17063.40	FUG	1730	French Navy, La Regine (Saissac)	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17069.60	JJC	0040	Kyodo News, Tokyo	60lpm/576/800 Fax, newspaper pages
17082.20	CFH	2030	Canadian Forces, Halifax	600bps/L STANAG4285 HF Modem, crypto tfc (on USB)
17095.05	WHL27	1520	Global Link Network, St Augustine FL	100bd/200 PacTOR, channel free signal and CWID "de whl"
17106.60	FUF	2115	French Navy, Fort de France	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17121.00	FUO	1300	French Navy, Toulon	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17180.00	FUG17	1350	French Navy, La Regine	600bps/L STANAG4285 HF modem, "de fug17" marker in ITA2 (on USB)
17237.60	EBA	2256	Spanish Navy, Madrid	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
17928.00	???	1510	ARINC, Telde Canary Islands	HF Datalink, squitter every 32s on GND ID=017 (on USB)
17967.00	???	1508	ARINC, Bahrain	HF DataLink, squitter (GND ID=015)
18003.00	PLA***	1742	US Air Force, Lajes AFB	125bd/1750 MIL-188-141A, ALE sounding (on USB)
18403.50	XSS***	1929	UK MIL TASCOMM, Forest Moor	125bd/1750 MIL-188-141A, ALE sounding (on USB)
18493.50	FUV	2045	French Forces, Djibouti	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
19327.00	???	1247	Russian MFA, Moscow	50bd/500 FSK UNID System, ACF=128 tfc
20268.00	RDL	1245	Russian Navy, Moscow	50bd/250 BEE, tfc on sync=[0x1414bebe64c] & 36bd idles
21438.00	RCV	1600	Russian Navy, Sevastopol	CW, met reports
21982.00	???	1230	ARINC, Bahrain	HF DataLink, squitter with GND ID=015 (on USB)
21997.00	???	1515	ARINC, Santa Cruz	HF DataLink, squitter with GND ID=013 (on USB)

SHORTWAVE UTILITY LOGS

Recent Shortwave Utility Logs Compiled by Hugh Stegman

Frequency	Callsign	User, Location	Time	System Details
3356.50	KW7	Polish Military	0033	ALE link checks and data exchanges with DE1 and ZA4
3535.00	420	Russian Intelligence? (M01b)	1810	MCW (1100 Hz) callup and 5-figure-group message
3622.50	JMH	Japan Meterological Agency	1313	FAX (120/576) Coastal Wave Prognosis
3831.00	ZLST	German Customs, Cuxhaven	1709	ALE, working ZPRI, Customs Boat <i>Priwall</i>
4346.00	NMC	USCG Pt. Reyes, CA	0250	Very clear FAX Pacific upper level chart (120/576)
4455.00	771	Russian Intelligence? (M01b)	1915	MCW (1100 Hz) callup & message, parallel 3645.0
4491.40	Jill 11	USAF Air Mobility Command	2315	USB, working other aircraft in air drop exercise
4553.50	ZLST	German Customs, Cuxhaven	1519	ALE, working ZEMD, Customs Boat <i>Emden</i>
5135.00	D09IDOT	IL Dept of Transportation	0221	ALE, calling ILEAS2 (IL Law Enforcement Alarm System)
5442.00	947	Russian Intelligence (G06)	1930	USB, callup "947 317 90" and message in German
5745.00	Keystone	U.S. Navy vessel	1308	USB, testing clear and secure with SESEF Mobile
6218.20	Unid	NATO Joint Command, Italy	1419	STANAG 4285 (600L/5N1) channel bulletin
6348.00	FUE	French Navy, Brest	1426	STANAG 4285 (600L/5N1), INT ZBZ test loop
6712.00	VS009M	Virgin Atlantic A340 (G-VGAS)	1947	HFDL position (off Ireland) for stn. 3, Reykjavik
6961.00	CIW609	CFARS, Canada	0038	USB, working U.S. military and MARS stations
7351.00	524	Russian Intelligence? (HM02)	0445	FSK Morse and data (19.8/129), callup "524 72"
7692.00	QOP	Moroccan Gendarmerie	2019	ALE, calling XE2
7931.00	257	Russian Intelligence (M12)	1920	CW callup "257 1" and message, repeated 1940 on 6904
8058.00	TYMG1	Spanish Police	1029	ALE, calling TXFA5
8182.00	XBP	UK DHFCS	1124	ALE, calling XSS, Forest Moor HQ
8190.00	BARLETTA	Italian Financial Police	1505	ALE, Patrol Boat <i>Barletta</i> , working PALERMO
8345.00	RBES	Russian Navy vessel	2112	Salvage Tug <i>Paradoks</i> (SB-921), message for unknown station
8414.50	002371000	Olympia Radio, Greece	1412	DSC, calling 241003000 (Oil Tanker <i>Botafogo</i>)
8416.50	L2C	Buenos Aires Radio, Argentina	0409	Sitor-B, Navarea VI warnings in Spanish
8435.00	XSQ	Guangzhou Radio, China	2142	CW ID in Sitor-A burst marker
8439.00	PBB	Dutch Navy, Goeree	1900	RTTY (75/850R), channel availability marker
8453.00	FUG8	French Navy, La Regine	1416	STANAG 4285 (600L/5N1)loop & Voyer le brick
8462.40	CKN	Canadian Forces, Aldergrove, BC	0125	RTTY (75/200), "NAWS DE CKN" marker every 60 seconds
8473.00	WLO	ShipCom, AL	0604	RTTY (45.45/170R) and Sitor-B weather forecasts
8764.00	NMO	USCG, Honolulu, HI	0043	USB, loud "Iron Mike" Pacific weather & new Commcom ID
8806.00	XSG	Shanghai Radio, China	1702	USB, live female with weather & warnings in Chinese
8816.00	RJC38	Russian Navy, Murmansk	1722	CW, working transport aircraft 65399
8819.00	Tashkent	Tashkent Volmet, Uzbekistan	1922	USB, aviation weather in Russian
8847.00	Yarkasar	Russian Air Force	0602	USB, working Korsar, Yakaspa, and Klarnetist
8891.00	Iceland Radio	NAT-D air control, Iceland	2305	USB, selcal check AP-HL with Emirates 222, a B777 reg A6-ECU
8977.00	AT532X	Royal Air Maroc B737 reg CN-RGJ	0409	HFDL position for stn. 3, Reykjavik
9037.00	Papa Whiskey	U.S. Navy	1300	USB, working air defense players Whiskey and Delta
10081.00	VY7827	Vueling A320 reg EC-MCU	1614	HFDL log-on with stn. 7, Shannon
11175.00	Bareback	U.S. Military	1704	USB, 30-character EAM "For Pension"
11226.00	5RS	USAF 5th Recon, Korea	1621	ALE, calling 280329, U-2 number 68-10329
11279.00	Gander	NAT-D, Newfoundland	1845	USB, selcal check CR-JS with USAF AMC C-17A
11300.00	Mogadishu	MID-2 air control, Somalia	1912	USB, working Emirates 2606
11360.00	Korsar	Russian AF, Pskov	1903	USB, working Polis (Orenberg) and Davlenie (Taganrog) in Russian
12691.00	FUX	French Navy, Reunion	1637	STANAG 4285 (600L/5N1) loop & Voyer le brick
13270.00	KZR208	Air Astana A320 reg P4-KBB	1824	USB, HFDL position (over Uzbekistan) for Hat Yai, Thailand
13282.00	Hong Kong	Pacific Volmet, China	1818	USB, electronic-sounding weather for Taipei, Manila, etc
13324.00	EKO215	Emirates A380 reg A6-EOF	1838	Passing HFDL message to stn. 2, Molokai, HI
14396.50	KOL100	U.S. DHS, ID	1549	USB, SHARES net with NCS012 and KAH718
14467.30	DDH8	German Weather Office	1926	RTTY (50/425) ID, then weather info in German
15632.00	131	Polish Intelligence (E11)	1300	USB, callup 131/39, message in 5-figure groups
16114.00	Unid	Russian Intelligence (XPA2)	1920	MFSK16/20 Polytone, 5-figure-group message
16331.70	"D"	Russian Navy, Sevastopol, UKR	1925	CW cluster beacon, several others also heard
16951.50	6WW	French Navy, Dakar, Senegal	1438	STANAG 4285 (600L/5N1) loop & Voyer le brick
17180.00	FUG17	French Navy, La Regine	1430	STANAG 4285 (600L/5N1) loop & Voyer le brick
17462.00	Unid	Russian Intelligence (XPA2)	1900	MFSK16/20 Polytone, 5-figure-group message
17928.00	SU0270	Aeroflot B777 reg VQ-BQB	1858	HFDL position for stn. 17, Canarias
18665.00	KW	Pakistan Navy, Karachi	1349	USB, calling NRS, Islamabad
19041.00	404	Russian Intelligence (M12)	1520	CW, null-message callup with "000"
22376.03	NMO	USCG, Honolulu, HI	2054	Sitor-B, fading Pacific weather and Zika warning
22921.60	5400	U.S. Dept. of Veterans Affairs	1827	ALE, link check with 1616

DIGITALLY SPEAKING

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New DV Gear from the LMR World

Many of us are awaiting announcements of new gear and related products at the Dayton Hamvention, coming up later this month. ICOM dealers have the ID-880—an entry-level D-STAR dual band radio—listed for closeout pricing. This is fueling rumors of an upcoming replacement rig. Yaesu surprised everyone with the FTM-3200 (reviewed next month in *TSM*) VHF mono-band transceiver. Many hams are hoping for a UHF version (FTM-3400, perhaps?) of the radio, but given that Kenwood has never exported their TM-481 to North America, I'm not holding my breath.

As I'm planning to be there this year, I'll be paying attention to what's catching everyone's eyes and reporting on anything that fits into the growing DV (digital voice) category. A few weeks ago, a conceptual parallel to the Hamvention was held for the LMR world—known as the International Wireless Communications Expo or ICWE.

While new LMR gear is sometimes placed well out of a typical ham's budget, we can benefit from new product announcements and sales—as they drive the now-current generation of equipment into the used market—with significant savings for those of us with amateur callsigns.

More than a few of the exhibitors there are companies you would easily recognize, such as ICOM, Kenwood, Powerwerx, Motorola, NEC, Cisco, Remtronix (Alinco), Hytera and more. In addition, forums focused on different methodologies, like NXDN, P25 and DMR were front and center.

Vertex Standard—"Yaesu's cousin once removed"—announced some new products for the DMR world, expanding their EVX product line. Of special interest to hams may be the EVX-S24. This is a 3W portable with a full set of mixed-mode features; all in a very small package.

Vertex Standard, also celebrating their 60th anniversary, displayed a full line of analog gear, plus P25 and other DMR equipment. From what I understand, their digital repeaters are selling well. In the coming months, one will be placed on the air near me, providing a nearby DMR presence and making an EVX-S24 a desired item on my ever-updated wish list.

ICOM showed off their cool new IDAS (NXDN) IC-F3400D portable and IC-F3400D mobile "Smart" radios, with larger, color displays that support additional functions. ICOM continues to find success with their IC-FR5000 and IC-FR6000 repeaters that can handle mixed-mode (analog FM/NXDN) operation. Because these repeaters are a solid design and can be readily found for less than \$900, they have



ICOM's newest IDAS models sport sleeker lines and displays, than the current models. (Courtesy: ICOM Japan)

been popular replacements for older analog repeaters found in amateur service.

What that means is that a number of clubs already have a repeater capable of digital operation if they'd just flip the proverbial switch and enable DV operation. I know of one such club in South Jersey that could let their members (and surrounding hams) experiment with NXDN today. To quote from the memorable (for all the wrong reasons) science fiction classic, "Plan 9 From Outer Space," "Pull the string! Pull the string!"

Elsewhere in NXDN land, Remtronix is now a source for this interesting methodology, with the Alinco DJ-NX40T. This portable covers 450-512 MHz and a 403-470 MHz version is supposed to be on the way; a frequency range that is of more interest to hams. With a street price of \$300, this should prove to be a cost effective way to become active with NXDN—especially with those ICOM repeaters that aren't living up to their full potential.

Remtronix is also a source for a line of DMR transceivers, including the DP770 and DP660 portables, which are available as VHF or UHF models; including the range that covers ham radio.

Closer to home, Staley Communications in Greensburg, Pennsylvania, held an open house (with a very tasty barbecue lunch) to discuss and demonstrate the capabilities of Motorola's APX product line. Staley continues Motorola's presence in the area from 1959 into the future. Part of that future includes P25 communications; almost synonymous with Public Service.

While I'm perfectly happy with my Astro Saber P25

portables, it's been a long time since they were "current product." That's also why I (and you) can find them in excellent condition, with accessories, at prices well under \$200. The Astro Saber line was replaced with the XTS series, which has since been discontinued by APX radios.

In portables, you can find the APX 1000, 4000, 6000, 7000 and 8000 series models, each with increasing features and available bands. Among the interesting aspects of the APX line is its multiband capability. This includes VHF, UHF and 700/800 MHz coverage. Of even more interest, all such models have all of the needed hardware in the radio, with bands and options enabled through firmware upgrades.

While holding some of the \$2,000 to \$9,000 dollar (MSRP) portables, I knew they were out of my budget today, but look forward to acquiring one (or some) when they are cycled out of police, fire and EMS duty, having been replaced by whatever comes down the line to replace them in the future. After all, my Astro Sabers originally sold for much, much more than I'm buying them for today.

This also means that more and more of the XTS line will be available in the used market, for more and more reasonable prices. Check with the online auction sites and used LMR specialists like Sunny Communications (www.used-radios.com).

XTS and APX portables are also available in even further hardened, AKA "Fire Department" versions. Take a look at the picture of the APX 6000XE. Sure, the high-visibility green is cool, but it has a purpose: making the radio, and perhaps the firefighter it's attached to, easier to find in poorly lit situations. Note that the volume is now angled from the standard model, as well. This makes it easier to control the top knobs when you are wearing heavy gloves, which firefighters are likely to be doing.

While all public safety portables are water resistant, Staley (and the visiting Motorola representative) were demonstrating a working APX 6000XE (with IMPRES XE speaker mike) that was fully submerged in a small tank of bubbling water! Anyone want to try that with your amateur gear? Those IPX ratings we have on higher-end radios help with water resistance, so we can use them in the rain—but are you seriously going to test yours with a good dunking? Yeah, maybe not...

The speaker mike also has some interesting features we could use at times, with amateur radio. How about remote volume control, strobe light, flashlight and microphone with wind noise reduction?

One feature on the radio that sedentary hams would never want to use is the "Man Down" feature, where an audible alarm is sounded if there's no movement for too long, eventually resulting in an emergency signal being transmitted. I don't know about you, but I can think of many I know, whose lifestyle would cause the radio to always invoke Man Down...

To be sure, this is one tough radio. Of course, that's a fair statement about every radio Motorola makes—certainly going back to an HT200 I owned decades ago. They are de-



Waterproof in even harsh conditions, the APX6000XE is a solid P25 radio, in an easy to find enclosure. The knobs are separated so that use with heavy gloves is relatively effortless. (Courtesy: Motorola)

signed to be used in harsh environments and perform in life and death situations, right down to the design of the flexible whip antennas.

When some of my D-STAR and System Fusion portables have fallen from my hand or when the belt clip on a third-party battery pack has snapped, the radio survives the fall, but the third-party flex or ¼ wave whip usually does not. They bend where they come out of the lower assembly and break. The stock ICOM and Yaesu (actually Vertex Standard) antennas are certainly more rugged and stand up to such things, but nothing marketed for hams seems to be as tough as what Motorola offers for their public safety clientele. I just wish they were available in SMA versions, instead of "reverse" SMA.

I've found myself at a point where I tend to use one of my Motorola portables when performing a public service function with amateur radio whether I need P25/DMR functionality or not. If I accidentally drop one, the chance of damaging the case, antenna or battery pack is substantially less than with anything I own that's manufactured specifically for hams. Even if it's just for analog use, you might want to consider a used CT, HT or MT series radio – or – a good ol' (non Astro) Saber.

Some of the accessories I'd like to see "trickle down" from the LMR world to amateur radio are things like wireless Bluetooth speaker-microphones. The white LED strobe and flashlight capabilities would be nice, too.

In addition, there are speaker-mikes with antenna connectors on top; carrying RF up along with other signals. This is great for getting your antenna away from your body and out in the open. Problem is, this also requires a much different connector than we're used to in the ham world. That tends to make accessories more expensive. Do you think it would be worth it – or – should we just be happy to be able to use retired public safety radios for our purposes?

I mentioned previously that hamfests represent good opportunities to pick up used LMR gear at attractive prices. There are also opportunities to pick up used or "buyer's remorse" ham radio gear (digital too) if you look carefully.

When I pass through the flea market area at hamfests or conventions, I do a thorough scan, moving up and down the aisles. My tastes are still somewhat eclectic, as I may have as much interest in a DMR mobile as I do a well-preserved HW-16 (tube-based Novice CW transceiver) but I'm also a bit more selective.

At a recent gathering, I picked up half a dozen CB microphones, some test equipment, some odd hand tools (you can never have enough) and various connectors. One of the microphones has already been repurposed for use with an extra HF rig I own. A quick swap of connectors and some solder rewarded me with a nicely performing (almost new) hand mike for a total cost of four dollars. The others will wait to be used as needed.

As I was continuing to scan around, I saw a box for a Yaesu FTM-100DR, which is a System Fusion mobile transceiver. At first, I thought the guy at the table had just bought it, but then realized it was for sale. Seems he purchased it, decided he'd rather put the money toward an HF rig, but had waited too long to return it to the dealer.

The radio was still factory wrapped in plastic and looked as though it had never been turned on. After some questions and a bit of back and forth haggling, we settled on a price that made both of us happy. He got to turn the unwanted radio into cash for something else and I got to acquire something I wanted (though had not expected to buy that day) and save a significant sum of money, in the process.

Thus, it pays to keep a sharp eye out for unexpected bargains and ask questions—even when you think you already know the answers. Also, never be reluctant to make a “ridiculously low” initial offer; especially if you can justify the number. Just because someone paid more for something than what it is currently selling for when new, doesn’t mean you have to base your new/used discount factor on the old price. If the price of a used (no matter how new it looks) piece of equipment is close to what you can buy the same thing for when new, including warranty, then pass. But if you can negotiate a fair price and let the seller know why it’s fair, then everybody can walk away happy.

In my review of the FTM-3200, I mention wanting to eventually pick up an FTM-100 in the future, thinking of the upcoming Hamvention. Well, the future came earlier than expected, but I still have plenty of items on my Ohio shopping list.

Speaking of shopping, have you been to a Radio Shack lately? Yes, there are a lot less than there used to be and the parts prices are still higher than what you can find online, but there are still some opportunities to pick up the parts you need for a quick repair or project. Recently, I went to one of the “slightly less local” stores in my area and picked up a plastic project enclosure to house a large battery and AC power supply. With some creative use of the extra cover included, I’m in the process of making up something akin to what was considered a “portable” radio many years ago: the Motorola PT500.

Available in one, two and even eight frequency models,



Alinco, a more familiar brand to many hams is now offering an NXDN portable. Soon, it should be available for 400-470 MHz. Perhaps a VHF version will follow, as well. The street price of \$300 makes it rather attractive. (Courtesy: Alinco Japan)

covering VHF low, VHF High and UHF low ranges, they were essentially the guts of a hand-held radio, snapped onto a high-current über battery, plus whip antenna, speaker mike and a carrying handle. Depending on the “vintage,” the power out was in the 1-5W range. Essentially, they were portable (there’s a handle, after all) transceivers, designed for use in situations where an extravehicular communications asset was needed – for an extended period of time.

Every once in a while, I see one of these in poor to average condition. I fear that if I ever see one in excellent condition I will buy it, no matter how fiscally impractical a crystal-controlled radio is in today’s world. The real advantage of one lies in its ability to stay in service, without a battery swap.

Thus, the desire to build something of an homage to the PT500, with a DV radio at the foundation. Once I make a trip to the local hardware store, the old kind where you can find just about anything you’re looking for (and not have to buy a pack of eight), and be guided by knowledgeable folks who have seen a thing or two. I’ll be looking for a nice handle, some slightly longer screws than those supplied with the project enclosure and rubber feet. The latter will be acting to guide the radio’s belt clip, so it doesn’t slide around on the side.

Hopefully, this will all come together soon. When it does, I’ll have some pictures here, to give you something of an idea concerning what you can do with your DV radios when you use them for some public service function. Until then, you’ll just have to use your imagination.

On a final thought, I continue to get questions about implementing mixed mode repeaters for various methodologies. A few years back, I came up with a FAQ list and subsequently made it as generic as possible. If you would like a copy of this to help you gain supporters in your club for a mixed mode DV repeater, please email me with your name, location and what you have in mind. I’ll be happy to forward a copy to you.

TSM

VHF AND ABOVE

By Joe Lynch N6CL

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Summits on the Air

In late April 2005 my wife, Carol W6CL, and I travelled to Charlotte, North Carolina for the Southeast VHF Society's annual conference. After the conference, we took some suggestions from Ted Goldthorpe W4VHF (SK), to visit some of North Carolina's picturesque locations. Among them was Mount Mitchell, which at 6684 feet in elevation, is the highest peak east of the Mississippi River. Back then there was an old dilapidated tower (photo at right) that was torn down for a more modern monument.

While at the summit we met Ray Robert W4EJY, and his wife, Joanne K4EJY. Together we marveled at how as couples we had matching call signs. At that time Ray was active on 70-cm EME from his home in Florida. They now live in Tennessee and do not seem to be actively on the air.

After making their acquaintances, I got on the air on 40 meters and checked into the 7290 Traffic Net through the net control Jo Ann Keith KA5AZK. That contact intrigued me because of being on the summit and the distance between North Carolina and Northeast Texas. I made a mental note to check out more summit ham radio operations.

Unknown to me, a British group of hams had started an award for summit operations in March 2002, naming it, appropriately, Summits on the Air (SOTA). According to their website:

"SOTA has been carefully designed to make participation possible for all Radio Amateurs and Shortwave Listeners – this is not just for mountaineers! There are awards for activators (those who ascend to the summits) and chasers (who either operate from home, a local hilltop or are even Activators on other summits).

"SOTA is fully operational in nearly a hundred countries across the world. Each country has its own Association, which defines the recognized SOTA summits within that Association. Each summit earns the activators and chasers a score, which is related to the height of the summit. Certificates are available for various scores, leading to the prestigious 'Mountain Goat' and 'Shack Sloth' trophies. An Honor Roll for Activators and Chasers is maintained at the SOTA online database."

While much of the activity is on HF, there is a significant minority operation on VHF. One of the more active VHF operators is Bob Witte K0NR. Most recently he and his wife, Joyce K0JJW, operated from Kaufmann Ridge North.

After trekking through some snow, they reached the summit, which was snow free. Bob used his Yaesu FT-1DR to make a few QSOs on 2 meters. Bob prefers



Old tower on the peak of Mount Mitchell, North Carolina. (N6CL photo)

the FT-1DR because, as he stated on his blog (<http://www.k0nr.com/wordpress/2016/03/winter-sota-activation-kaufman-ridge-north>):

"It covers both 2 meters and 70 cm with dual-receiver capability. It has a built-in GPS receiver and APRS capability that facilitates easy APRS tracking. Joyce and I have a pair of these, which we've been using to track each other's positions on the few occasions we get separated on the trail."

Bob wrote an excellent article introducing SOTA for the Spring 2013 issue of *CQ VHF* magazine (see Photo 4, cover shot of K0NR). Below, with his permission are a few excerpts:

"The Summits On The Air (SOTA) program has really taken off in North America. SOTA originated in the UK in 2002, so it took a little while for it to make it across the Atlantic to this continent. The basic idea of SOTA is to operate from a designated list of summits or to work other radio operators when they activate the summits. The list of designated summits are assigned scoring points based on elevation and there are scoring systems for both activators (radio operators on a summit) and chasers (radio operators working someone on a summit).

"Most of the operating is on the HF bands but there are quite a few VHF contacts on SOTA. Obviously, HF has the advantage of being able to work longer distances without too much trouble. Typically, the HF station is your classic



Bob Witte K0NR, on the summit of Mt. Sneffels, Colorado.
(K0JJW photo)

portable QRP rig, portable antenna and battery power. (A portable power source is required and the use of fossil fuels is prohibited.) Being a VHF enthusiast, I prefer the challenge of making contacts above 50 MHz, so my SOTA contacts are usually on 2 Meters or 70 cm.

"To count as a SOTA activation, you need to make a minimum of 4 contacts from the summit. If I am hiking a summit within range of a major city, I can usually just make some random contacts by calling CQ on the National Simplex Calling Frequency, 146.52 MHz.

"However, operating in more remote areas requires a little more planning. I'd hate to hike all that way and come up short on the required contacts, so I use a few tactics to rustle up some VHF contacts. Of course, I will post my planned activation on the SOTA watch site in advance, to let people know that I'll be on the air.

"While this goes out worldwide, it may not reach the right radio amateurs within VHF range. The next thing I do is send an email to some of VHF-equipped hams I know will be within range. Many people respond to such a request to work a summit, even if they are active in SOTA. When on the summit, my first call is on 146.52 MHz or some other popular simplex frequency.

"If I don't raise anyone on the simplex frequency, I will make a call on a few of the 2-meter repeaters in the area to see if someone will come over to 'five two' to make a contact. SOTA does not recognize repeater contacts but it is OK to solicit simplex contacts using a repeater. These techniques and a little patience have always gotten me at least four contacts, and usually quite a few more."

Again, courtesy of Bob Witte K0NR, below are a few SOTA-related websites. Some of them are SOTA and SOTA affiliates. A couple are manufacturers and one is for a group in Colorado that regularly activates summits each summer:

SOTA Web Site <http://www.sota.org.uk>
 SOTA North America <http://na-sota.org>



Carol Lynch W6CL talking with Ray Roberts W4EJY and his wife, Joanne K4EJY near the peak of Mount Mitchell, North Carolina. (N6CL photo)

SOTA W0 Area	http://w0-sota.org
SOTA Database	http://www.sotadata.org.uk
SOTAwatch website:	http://sotawatch.org
SOTAmaps	http://sotamaps.org
SOTA Facebook:	https://www.facebook.com/groups/37631909313
Colorado 14er Event	http://www.14er.org
Elk Antennas	http://www.elkantennas.com
Arrow Antennas	http://www.arrowantennas.com

The May issue of *QST* has a couple of articles and a couple of review articles pertaining to SOTA operations. Check it out at: <http://www.arrl.org>.

In years past, operators have done a combined SOTA and VHF and above contest activity. In the next section I list the summer contest, beginning this month. Also, happening this year is the ARRL's National Parks on the Air (NPOTA) award for working a number of the America's 59 national parks during the 100th anniversary of the National Parks Service. Already this year there have been combined SOTA/NPOTA operations. There are others planned. For more information, see: the above SOTA watch website.

Along with handhelds, popular radios that have VHF and above frequencies are Yaesu's FT-817 and Elecraft's KX3. Yaesu's radio comes with the VHF and UHF bands. For the KX3, you have to order the 2-meter/70-cm add-on boards separately. A bit higher power drain is the ICOM IC-7000, which also has 2 meters and 70 cm built in.

SOTABEAMS (<http://www.sotabeams.co.uk>) has a wide variety of antennas and accessories for use on SOTA operations. Also, Buddipole (<http://www.buddipole.com>) has antennas and accessories that also are useful for SOTA operations. There are even plenty of backpacks for SOTA use. Here is a bit dated video by John Doogan KK4NQQ, in which he puts a lot of the above items, along with other accessories, into his backpacks: <https://www.youtube.com/watch?v=6cv5fShHULo>

SOTA Operating Opportunities

Between April 30 and May 1 is the San Bernardino Microwave Society 2.3 GHz and Up Contest and Club Challenge (<http://n6nb.com/sbmsrules.htm>). Also, this month sporadic-E should start showing up on the VHF and above frequencies. It will be a great time to get on the air from your nearest summit or your nearby rare summit/grid locator and make some contacts. The Memorial Day weekend is a great time to operate because a lot of people are on the air during the holiday.

Throughout the summer months there are VHF and above contest each month. Next month there will be a contest three out of four weekends, beginning with the ARRL VHF contest June 11-12. The Six Meter International Radio Klub (SMIRK: <http://www.smirk.org>) contest is the following weekend, followed by Field Day the last weekend. Then, July 16-17 is the CQ Worldwide VHF Contest (<http://www.cqww-vhf.com>).

Between August 20-21 is Round 1 of the 10 GHz and Up contest. Between September 10-12 is the September VHF Contest. Between September 17-19 is Round 2 of the 10 GHz and Up contest.

One Way to Europe on 2 Meters

The May issue of *QST* contains a fascinating article by Rich Pleniaszek VA1CHP, et al, titled “Across the North Atlantic on 2 Meters,” about his team’s attempt to claim the Brendan Plate for the first terrestrial QSO between North America and Europe. While they were not successful in their attempts, they did have a one-way “satellite contact” by bouncing their signal off the International Space Station (ISS), which was precisely where it needed to be during their transmission to Europe. Some fascinating detective work uncovered how it was possible for them to be heard in Europe but were not able to make a 2-way QSO.

HamVention Winners have VHF and above connections

Joe Taylor K1JT, has been named this years’ HamVention Ham of the Year. Joe has contributed to the advancement of VHF and above communication with his development of WSJT, JT65 and WSPR. John Birmingham W2XAB, is the Technical Achievement recipient. John is a member of AMSAT and TAPR. He is active in Digital Mobile Radios (DMR) and has published a guide you can find here: <http://guide.k4usd.org>. Stan Horzepa WA1LOU, is the recipient of the Special Achievement Award. Stan is the director and secretary of TAPR and serves as editor of TAPR’s newsletter. Rocky Mountain Ham Radio is the club of the year. Among its many attributes is a deployable communications command post that includes satellite Internet, terrestrial 4G Internet, D*Star, IP telephone, DMR, HF, VHF, UHF and packet/PACTOR. [An article about the club’s communications command post, written by Wayne Heinen N0POH, the club’s treasurer, appeared in the May 2014 issue of *TSM*] The recipients will receive their awards on Sunday at the

HamVention. The dates of the convention are May 20-22.

Free Amateur Television Magazine

Since February 2013 Ian Pawson G8IQU, has been publishing *CQ-DATV*. Issue 35 is available this month here: <http://www.cq-datv.mobi>. Links to all issues can be found at the website. While the title seems to imply that it is devoted only to digital amateur television, according to Ian: “I did think of CQ-ATV, but the term ATV seems to have been hijacked by people with quad bikes. So I went for CQ-DATV, although I want the magazine to cover all aspects of ATV not just DATV.”

Amateur Television Quarterly

While CQ-DATV provides European coverage of amateur television, stateside coverage is made available via *Amateur Television Quarterly* (ATVQ: <http://atvquarterly.com>). Published by Bill Brown WB8ELK, and Mike Collins WA6SVT, it is available by subscription for \$22 for one year or \$42 for two years in the U.S.

Pre-Teen Girls, Balloonsat Launchers in Science Fair 2016

Last September 9-year old Kimberly and 11-year-old Rebecca Yeung of Seattle, Washington, designed, built and launched a balloonsat made from archery arrows and wood scraps. You can see the video of their design, build, launch and recovery here: <https://www.youtube.com/watch?v=QCP5jZXoOhI>. Inspired by their science teacher and their father Winston Yeung KI7CSK, the two girls took on the project because they really love science.

Ironically, the girls were planning a second launch over their spring break but went to the White House instead. Catching the attention of the organizers of the White House’s Science Fair 2016, by way of a nomination by Budding STEM (<http://www.buddingstem.com>), the girls were invited to exhibit their balloonsat. Starting at around 17:00 on this video (<https://www.facebook.com/WhiteHouse/videos/10154293861509238>) you can see the girls being interviewed by President Obama. You can read more about their incredible story at their blog here: <https://lokilegolauncher.wordpress.com>.

Meteor Showers

This month’s showers and approximate peaks are: η-Aquariids, May 5; η-Lyrids, May 9; ε-Arietids, May 9; May Arietids, May 16; and o-Cetids, May 20.

For more information on the above meteor shower predictions please visit the International Meteor Organization’s website: <http://www.imo.net>, or download the 2016 calendar pdf at: <http://www.imo.net/files/data/calendar/cal2016.pdf>.

TSM

AMATEUR RADIO INSIGHTS

By Kirk Kleinschmidt NT0Z

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Forgotten Antenna Fundamentals and Other Curious Tidbits—Part 4

In 39 years of hamming, save for the occasional rubber ducky or mobile whip, I've never really used an honest-to-goodness vertical antenna on HF! Say what? Yes, it's true! I've owned HF verticals—I own one now that I acquired inexpensively on craigslist—but I've never deployed them (yet). As I write this I'm wracking my brain for evidence to the contrary, but am finding none. The reasons are somewhat interesting, but I suspect that upcoming changes in my QTH and solar cycle dynamics will force a change (for the better, I hope!).

When I was a kid, the club station at our high school had a 40-meter, Gotham-brand, quarter-wave vertical antenna on the roof above the electronics classrooms. Yes, it was an actual, factual Gotham antenna, in all of its substandard glory!

Essentially, we had a 33-foot aluminum pole installed (by kids) on an electrically busy commercial rooftop that was festooned with HVAC units, electrical transformers, and lots of nearby metal flashing. (It was an RF nightmare, but in a kinder, gentler, and much less litigious world!)

Using PVC pipe we successfully isolated the base of the vertical from the metal angle iron it was mounted to, attached a 50-ohm coaxial feed line, and succeeded in crafting non-conductive guy wires to keep the thing upright. But we didn't really know about radials, why they were important, and how to install and tune them properly. Oops!

The vertical antenna worked just great...as a dummy load! Heck, the SWR in our small classroom shack was good, as was the output of our National NCX-3 transceiver or our Heathkit DX-60B, but darn few QSOs went into the log, and almost all that did were locals.

At home I had a G5RV-style dipole and a vertically oriented 40-meter delta loop in my back yard. Although both antennas had their peaks at 45 to 50 feet, which is less than the minimum desired height above ground on 40 meters for horizontally polarized antennas (66 feet), at home I was working all continents on 40 meters, while at school I was barely working across town!

As I recall, that's the moment where I fell prey to the old adage, "A vertical is an antenna that radiates equally poorly in all directions."

After that one "bad" experience with a 40-meter vertical I continued to have many positive experiences with



As found in my local building supply store, this 5-foot-wide roll of heavy-duty, galvanized hardware cloth can be used to make high-quality ground screens that can replace or augment radial systems for ground-mounted vertical antennas. See text. Surprisingly, this stuff isn't expensive. (NT0Z photo.)

dipoles and loops (horizontal and vertical), and I never really felt the need to experiment with conventional HF verticals, even after I learned more about them—and why our High School Gotham vertical "failed."

Since college, my benchmark antenna has been a horizontal loop fed with open-wire line and/or an autocoupler installed at or near the feed point. At every QTH that allowed it, I installed a big triangular loop cut for 5 or 3.5 MHz (never had room for a 160-meter loop) as high as possible (always at least 30-50 feet). When fed with open-wire line, this antenna is the practical equivalent of a modest three-element Yagi on 20 through 10 meters. The pattern can't be steered—but it also doesn't need to be steered. And it easily outperforms a quarter-wave vertical or ground plane antenna for 99% of all QSO paths, which helps to explain why I never felt the need to experiment with verticals on the high bands.

On 40 and 30 meters, big horizontal loops DX well—better than any "lower than desirable" dipole I've ever used—and domestically they're almost impossible to beat without getting exotic. This is sometimes comical. In one HF round table I was running 20 W PEP on 40-meter SSB

from an SGC SG-2020 transceiver (which can only put out 20 W), when one of the other hams in the group freaked out, called me a liar and insisted that I had to be running at least a kilowatt!

I had heard this before, although not quite so emphatically, so I told him it was the loop antenna. He wasn't buying it until another ham from North Carolina broke in at about 30 dB over S9 on everyone's receivers. "I'm running 200 W to a 160-meter horizontal loop at 60 feet." That guy sounded like a shortwave broadcaster!

On 80 and 160, depending on the actual size of the loop, the antenna still works well, although not nearly as well as on the higher bands, and it's still killer in the continental USA, although the bigger the loop the better at this point.

When used conventionally, a big horizontal loop still gets my vote as the best single-wire multiband HF antenna hands down, but it can still be bested on low-band, low-angle, DX paths by a properly installed, properly sited, full-size vertical, hence my interest!

In certain situations, the horizontal loop can be operated as a top-loaded vertical. If the loop is at least 40 feet high and the feed line can drop straight down to the ground, the feed line wires can be shorted together and worked against a radial field (tuner or matching network probably required).

This makes the feed line a vertical antenna that's "top loaded" by the horizontal loop itself (somewhat like an inverted L with a "split" horizontal loading wire). If the radial field is suitable and the soil conditions are good, this can greatly improve the antenna's performance on 160 and 80 meters.

Better yet, if you use an autocoupler at that point (at ground level), the coupler can tune the antenna system in "loop" and "vertical" modes, and you can even switch modes remotely! (Leaving the radials permanently attached to the auto-coupler's chassis won't cause problems in either mode.)

I have briefly used a 40-meter horizontal loop as a top-loaded vertical to good effect, but I don't know how the loopy vertical stacks up against a "proper" vertical (but I intend to find out later this year and will report back).

The tricky thing is, the old adage about verticals isn't necessarily wrong! A poorly installed or sited quarter-wave vertical does radiate poorly in all directions. Just as a properly installed and sited quarter-wave vertical radiates pretty darn well in all directions! The devil is really in the details and, because solar activity may soon just slip away for years or decades to come, understanding vertical antennas may make all the difference for low-band DXers who can't install 250-foot towers (me included, unfortunately).

The bottom line is, because dipoles and loops fall prey to the dreaded "half wavelength above ground" rule, although properly built magnetic loops may also shine, the vertical antenna is a low-band DXer's building block of choice. We have covered some key issues in previous installations, but let's cover a few more vertical tidbits this month.



Similar to the galvanized hardware cloth shown in the other photo, this stuff is coated with a layer of protective vinyl, which may help it to last longer in the field. Because of the vinyl coating, however, I don't know whether the actual wire is galvanized, or whether the wire under the vinyl is electrically less conductive than standard galvanized wire (probably not good). More research is required, but this could be the deal of the century when it comes to long-lasting ground screens. See text. (NT0Z photo.)

Managing Expectations

Probably because of decades of HOAs and various deed restrictions, many new hams are being brought up in the hobby with greatly diminished expectations. Not too long ago a back yard dipole, vertical or even a tri-bander were reasonable expectations. Now, not so much. Many newcomers, therefore, are being sold—perhaps necessarily so—on tiny portable antenna systems, antennas that are just plain useless, and a variety of "compromised" antennas that are somewhere in-between.

This probably isn't the fault of the newcomers, but the reality of it is still undeniable. Antennas DEFINE our amateur radio experience. If your antenna can't hear the other station, you can't work that station, and that station might as well not exist. We need to use the right antenna for the right task, period. And if we can't muster the right antenna, whether we're using a \$40 home-brew rig or the latest and greatest super transceiver, the result is still the same—no QSO.

On the low HF bands, for example, verticals tend to excel over long-distance paths (say, 1,000 to 12,000 miles), but work poorly (or fail miserably) over shorter paths (say, 75 to 600 miles). Depending on the band, location and the season, the first time you listen to the low bands on a proper vertical antenna they might sound dead! There may be no close-in

stations at all. But if you dig deeper, you might hear faraway stations you've never heard before! That's probably the main benefit vertical antennas can bring to low-band operation, so make sure you're trying a vertical for the right reason.

Desire or Necessity?

As an adjunct thought, try to figure out whether you're trying a vertical antenna because you lust for its low-angle magnificence or its potential low profile amongst neighbors or homeowners associations. Why? Because just as you can install a miniature, multiband Yagi that can hide behind the peak of your roof, or a gigantic 6-element monobander that makes your house itself look small (both are still Yagis), verticals can be sized similarly!

There are many commercially made vertical antennas that claim to work well on every band from DC to daylight, with huge SWR bandwidths, low losses, and all from a single coaxial feed. Some even claim to be true half-wave verticals that require only three or four stubby radial rods (1-4 feet long) on some or all bands instead of full-size radials. The truth is, some of these work well, while others work not so well. It depends on frequency, size, radials, soil conditions, element loading technologies, and more. Some offerings are above board, while others seem almost entirely fraudulent!

Make Mine Full Size!

When it comes to amateur radio antennas, you can never go wrong with "full size." You can, however, go horribly astray with "shortened" antennas, regardless of type. For our discussion of vertical antennas, full size is at least a quarter wavelength, but not larger than five-eighths of a wavelength.

On the high bands, quarter-wave verticals range in height from 8 to 16 feet—no biggie—and a 5/8-wave vertical on 20 meters is 43 feet (hint, hint). On the low bands, however, things get challenging in a hurry. A quarter-wave vertical for 1.8 MHz is about 130 feet, which puts a 5/8-wave at that frequency just a smidgen over 300 feet! Unless you already happen to have a decommissioned broadcast tower in your back yard (as some hams do), because tower costs increase somewhat exponentially with height, it would cost a lot less to build an array of shorter verticals to achieve (or even exceed) the performance of a lone 5/8-wave vertical.

On 80 meters, a quarter-wave vertical is about 67 feet tall, with a 40-meter stick weighing in at a now-so-tiny 33 feet. This makes full-size verticals for 40 meters relatively easy, but the jump to 80 meters is a real challenge, which makes erecting a 130-footer for 160 impossible for most hams.

So, what's a ham to do? Shorten these verticals, of course, through the magic of loading coils, loading elements, capacitance hats, etc! Note: This is where advertising budgets soar, but antenna performance often falls into the abyss.

Can't manage a full-size 80-meter vertical? Put up a 30-foot vertical and add a large loading coil to make it resonant. Or put up a 20-foot vertical and add an even larger loading coil to also make it resonant. Your rig will happily provide power, and the vertical antenna will happily radiate that RF energy into space, right?

Absolutely! But! The efficiency of shortened antennas falls at a rate that correlates to the degree of "shortening." A small amount of shortening equals a small amount of lost efficiency. A massive amount of shortening equals a massive amount of lost efficiency! The worst-case examples are mobile (vehicle) antennas for 160 and 80 meters.

A 10-foot whip and a massive loading coil can be adjusted to produce a low SWR on 160 or 80 meters. Your rig will supply power and the antenna will radiate RF into space. But a 10-foot whip (vertical) is a lot shorter than 130- or 67-foot antennas (and a car chassis is a lot "worse" than a proper radial field), so the efficiencies come in at about 1% and 5%, respectively. Put in 100 W and get 1 W or 5 W radiated into space. Yikes!

As it turns out, there are a few things we can do to make loading coils, loading wires, and capacitance hats (tools used to make shortened antennas function) less lossy, but the measures soon run into the realities of diminishing returns. For example, a loading coil made from dime store speaker wire will have more loss than a loading coil made from 1/4-inch copper tubing. A silver-plated loading coil made from 3-inch-diameter tubing will work better still, but the coil will weigh many pounds and will block the view from your car's rear window in its entirety!

A good rule of thumb is the "two-thirds rule." With careful design and the use of appropriate loading materials we can make an antenna that's at least two-thirds of full size work well. Verticals for 160 and 80 meters can now measure 86 and 44 feet, respectively. Mechanically, that's a huge advantage! In general, efficiencies for properly designed short antennas (not smaller than 66% of full size) range from 40% to 70%. If full-size structures are impossible, these losses are generally tolerable.

Now that we're properly informed we can choose to make our antennas even smaller, all the while knowing that as we go below the magic 66% mark our losses will climb sharply. If an 86-foot vertical for 160 meters is still impossible (as it is for most hams), but a 50-footer is in the cards, do your best to make a maximally efficient 50-foot vertical. It will still work better than any horizontal dipole at that height, and will actually work quite well on 80, 60, 40 and 30 meters (if you can manage a flexible feed system).

Perhaps the biggest takeaway in this section is to apply what you now know when evaluating commercially made vertical antennas that claim to work efficiently on the low bands but may be impossibly small.

Commercial multiband verticals use a wild and confusing variety of loading and parallel excitation techniques to "make" multiband, multi-radiator verticals "work" on many bands from a single feed line. Some of these designs are tru-

ly ingenious, and as long as you have a suitable radial field, performance from 20 or 30 meters and up can be commensurate with that of a “benchmark” 1/4-wave vertical (or even better).

A lot of beginners are steered wrong, however, when it comes to the low-band performance claims of many of these antennas. For example, if a 24-foot-tall multiband vertical claims to offer “excellent efficiency” on 80 meters thanks to some new whiz-band loading technology, you can be sure that someone in the marketing department is pulling your leg. How can you instantly know that? Because 24 feet is a heck of a lot shorter than 44 feet, which is the shortest length conforming to the 66% rule as applied to an 80-meter vertical (67 feet). If an 80-meter vertical isn’t at least 44 feet tall, by the laws of physics it can’t offer “excellent efficiency.” (It can still “work,” however.) The 66% rule can really cut through the BS, so use it with impunity!

The Angle is Still Optimal

One of the worst characteristics of horizontal antennas such as dipoles and Vs is that they really have to be installed at least a half-wavelength above ground to achieve those textbook radiation patterns. Mount them too low to the ground and all of that RF energy goes skyward, making them generally excellent for close-in comms, but generally horrible for DXing.

Some of us can manage installing our 40-meter dipoles at 66 feet, but few of us can install 80 and 160-meter dipoles at 130 or 250 feet, respectively. Verticals offer much better coverage of low-angle signals, even when mounted at ground level, which is why most DXers use them on the low bands (but not the high bands, where horizontal gain antennas are cheap and easy).

Full-size verticals (see above) offer “full size” coverage of low-angle signals and, amazingly, so do shortened verticals! By using a variety of techniques to make a short vertical—even if it’s really short—doesn’t significantly impact its radiation pattern, only the signal intensity of that pattern! This makes even short verticals good for DX work. Yes, signal strengths may be down, but unlike horizontal dipoles and Vs, the low-angle coverage is still there.

Ground (Soil) Quality

Dipole performance is generally dependent on height above ground. One guy’s dipole works pretty much like another guy’s as long as it’s not too low to the ground. But verticals are often quite sensitive to the soil conductivity and soil quality at the base of the vertical. This means that one guy’s vertical may work great, while the same antenna at someone else’s house may perform poorly. This has only added to the mysteries and frustration surrounding vertical antennas over the years.

In general, the greater the soil conductivity, the better the performance of a ground-mounted vertical. And the per-

formance difference between best-case and worst-case soils can be rather extreme. The best “soil” for vertical antennas is seawater. The worst is dry, arid, rocky soil with little to no RF conductivity.

If your site has really poor soil conductivity, consider balanced antennas (dipoles, Vs and loops), which are “ground independent.” You can also use a massive number of ground-mounted radials or switch to a vertical that uses an elevated radial system (4 to 10 feet above ground).

Tuned Radials

Perhaps because the Gold Standard for ground-mounted radial systems was 120 1/4-wave radials, many ops believe that all ground-mounted radials must be 1/4-wave long, even if you’re using only a few. This isn’t necessarily so, as many experimenters have discovered that the use of “many” (36) short radials is more effective than the use of a few (4) quarter-wave radials. Some discovered that the simultaneous use of many short radials and a few long radials was a bit better still.

The thing is, once the radials are on the ground, they don’t need to be tuned (don’t need to be 1/4-wavelength). The proximity to the ground, whether right on top or buried an inch or two, “detunes” the radials, so any attempt to cut them to a precise, tuned length is futile.

So, when do radials need to be tuned? When they’re above ground! Elevated radials need to be tuned to an electrical quarter-wavelength. If they deviate significantly, so does their effectiveness. In this situation, opposing radials are best tuned in pairs, which makes trimming them much like trimming the ends of a dipole.

Two is Enough

It’s generally true that the use of four tuned, elevated, 1/4-wave radials is the functional equivalent of 120 ground-mounted, quarter-wave radials. But what’s also true is that, when it comes to elevated radials, you really only need two (but they have to be “in-line” like a dipole). The performance “hit” for using only two, tuned, in-line radials with any vertical antenna is too small to justify the mechanical difficulty and the required footprint on the ground. But doesn’t the pattern lose its perfect omnidirectional shape? Yes—but only to a completely insignificant degree. You couldn’t ever measure it, so forget about it!

A Ham of the Cloth

Speaking of ground-mounted radials, we learned in previous installments that the size of our radial wires doesn’t matter in any way, that insulation may only improve a radial wire’s corrosion resistance over time without affecting its electrical performance, and that it doesn’t matter whether radials are on top of the ground or slightly buried below the surface. (If a radial is buried too deep, however, that’s anoth-

er story. Don't do it.) But what if I told you that there might be a simpler way to create a super-duper ground screen that requires no radials at all?

As it turns out, galvanized "hardware cloth" used to make farm animal pens, garden-protection cages and temporary fences, may also make awesome "ground screens," a radial replacement that may even outperform traditional radials!

As shown in the photos, hardware cloth consists of a grid of soldered, galvanized wires that make a "fabric" that's typically two to five feet wide and 10 to 100 feet long (on a roll). Expert users suggest that a 300- to 500-square-foot screen centered on the vertical's ground mount may provide a full-performance ground system without the use of any radials at all!

Remember how, in previous segments, I likened a perfect RF ground to an infinite copper foil that covered the ground's surface? Well, a swath of hardware cloth approximates that infinite screen and may be easier to install (and periodically replace) than a ton of radials (because we know that "many" short radials approximates the performance of "fewer" long radials).

A 400-square-foot mat made from hardware cloth is smaller than the space taken up by a typical two-car garage. In terms of low-band radial fields, that's dainty! You could make it by cutting four 20-foot lengths of five-foot-wide hardware cloth.

Some ops consider each length as a separate "radial," running the four hardware cloth radials away from the antenna's mount point (like a "plus" sign). Others lay the lengths side by side, with the mount point poking through the seam between the two center-most lengths of hardware cloth (making a square mat).

The plus sign is super easy to install, even for portable/temporary work. The mat, which requires that some adjacent wires (seams) be soldered together here and there, reportedly performs a bit better, but doesn't lend itself to portable use. I have never soldered galvanized wires, although one Old-Timer assured me that it's easy if you use a massive, old-school soldering iron in the 150-300 W range.

I suspect that hardware cloth ground screens work really well, but it will be a few months before I can try one for myself. As others have done going back to the '70s, it's fairly easy to lay down four 1/4-wave radials (as a benchmark of sorts) before measuring the vertical's feed point impedance with a resistive bridge or a vector network analyzer.

Once the hardware cloth is in place (you could test a variety of configurations and quantities), the antenna's resulting feed point impedance (or change thereof) will directly correlate with the effectiveness of the radial field or the ground screen.

Tests such as this, done by others in the past, showed that 400 to 500 square feet of ground screen essentially provided "as much RF ground as practically possible" at several test sites. So, although 120 1/4-wave radials would have produced the best possible RF ground for a particular vertical

antenna—using 8,000 to 16,000 feet of wire for 80 and 160 meters, respectively—the use of 500 square feet of hardware cloth got the testers "close enough" to that performance level to make the extra time and money required to produce the perfect radial field completely unnecessary.

Experts recommend that hams use the "large" hardware cloth made from beefy, galvanized wire for ground screen use, avoiding the tiny-gauge, hexagonal "chicken wire" cloth and the "tiny square" cloth that looks like "window screening."

Depending on local soil and weather conditions, this stuff won't last forever, and you may have to replace it every few years. But large rolls of the stuff are priced between \$20 and \$40, and that's enough to build at least one large ground screen (or several smaller ones).

Compared to scrounging and installing three miles of wire, a \$50 ground screen that works just as well, but may have to be replaced every now and then, still sounds like a bargain! The antenna analyzer will know for sure, and it's a handy way to test your radials or your ground screen each year after the snow's melted. If you keep track of your feed point impedances you'll know when your radials or ground screen have degraded and need to be replaced.

I hope these vertical antenna tidbits provided an aha! moment or two. See you next month—perhaps in the hardware cloth section of your local home store?

RADIO 101

By Ken Reitz KS4ZR

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Winegard's FlatWave OTA-TV Antenna and Help for 3M's WorkTunes Radio

It's always irritating for consumers when a company has a great product, offers it for a while, then either drops it from its catalog or "updates" it with a lesser quality or capable product. We've all seen examples of that sort of business model for decades.

Years ago I reviewed Winegard's SquareShooter OTA-TV antenna in *Monitoring Times*. It was a fairly revolutionary design: an amplified UHF-TV antenna that measured only 16 inches square and which was mounted in a nondescript gray plastic case. It came with an offset mounting pole that allowed it to be placed just about anywhere, and the best part was that it was also impossible for Home Owner Association antenna snoops to spot. It looked more like some kind of high-tech security device than an OTA-TV antenna.

But, more than it's ability to disappear while mounted in plain sight was the fact that it really worked. Then it disappeared from Winegard's product lineup in favor of super cheap, flexible sheet plastic TV antennas designed to work in urban locations just miles from TV transmitters—forget about fringe area reception.

Then two years ago, came the SquareShooter's replacement, the **Winegard FlatWave Air**, and a few months ago I finally got around to ordering one. The FlatWave Air antenna is an amplified TV antenna and is actually smaller (14 inches square) than the SquareShooter and is now in a black ABS plastic case. Electronically, the design was changed to receive VHF as well as UHF-TV signals from multiple directions. It can also be powered from any TV set equipped with a USB port. On top of that, it's even less expensive than the SquareShooter: \$99, and, it's shipped free.

I was always happy with the performance of Winegard's Squareshooter. Being some 40-50 miles away from most TV stations that can be reliably received at my location, I had simply placed the Squareshooter flat on top of a shelf system that put it right at ceiling height or about 10 feet or so above ground. It had little trouble bringing in most network stations in my area of central Virginia. Would the FlatWave do as well?

To be fair, I had never mounted the Squareshooter outside at any potential elevation, such as the top of the roof, so I don't know how well it might have performed. But when I placed the FlatWave where the SquareShooter had been on the top shelf, I was disappointed. It didn't bring in half the channels.



*Hey, where's that big TV antenna you were bragging about?
(KS4ZR photo)*

To salvage the situation, I would have to mount the antenna outside and that meant routing an RG/6 coax from the TV, through the wall and to the antenna. I placed the FlatWave near the peak of the roof, which required a length of about 75 feet of coax. Once through the wall, the coax attaches to a powered amplifier, which can either be plugged into the back of your TV via a USB port or plugged into a convenient wall plug; an advantage over the SquareShooter, which had no option other than a wall plug.

One factor that has always been true, since the beginning of TV set production, is that all TVs do not have the same reception capability. The set I'm working with in this case is a fairly new Sony 36-inch smart-TV. But, since it's the same TV I had been using with the SquareShooter, that part of the test would remain the same. Still, if you are trying this with a TV that doesn't have the reception ability of this set, your results will definitely vary.

To find the potential that you could receive, regardless of what antenna you might be using, I recommend going to www.tvfool.com. Once you enter your latitude and longitude coordinates (or home address) and the height of your antenna, the site will create a list of all potential TV stations in your area along with a color code indicating what type of antenna you will need for best reception.

For instance, green indicates, "An indoor set-top antenna is probably sufficient to pick up these channels." Yellow indicates, "An attic-mounted antenna is probably needed to pick up channels at this level and above." Red indicates, "A



Up-close the Winegard FlatWave antenna is unassuming. It can be mounted on a balcony, flat exterior wall, or on the offset pole and bracket that comes with the antenna. All for \$99 and shipped free, direct from Winegard. (KS4ZR photo)

roof-top antenna is probably needed to pick up channels at this level and above.” And, gray indicates, “These channels are very weak and will most likely require extreme measures to try and pick them up.” By that it is meant that you’ll need the biggest antenna, with the most gain, mounted on a rotator on an absurdly big tower. In my location, only one channel shows up in the green.

One thing I particularly like about this website is that the list gives you the station’s call sign; channel number (both RF and virtual); network affiliation; distance in miles from your coordinates; type of path (contour edge or tropospheric) and noise margin in dB. The site explains that you have to have a noise margin of at least zero to have any chance of picking up a particular channel. You can print the list out for reference when you’re setting up your antenna.

Best of all, along with the list of channels, you get a map of your location and, when you click on the button next to any channel in your list, a pop-up is displayed on the map at the exact location of the transmitter for that channel. In the pop-up you can see the station’s call sign, network affiliation, maximum ERP (Effective Radiated Power), distance in air miles from your location, path, and compass headings. This makes it easy to see what you’re up against in trying to receive that particular station and lets you know where to point your rotator if you have one.

The generated list takes into account transmitter power, frequency, antenna pattern and height of each station’s antenna. It also takes into account propagation losses due to terrain and curvature of the Earth. However, it doesn’t take into account your antenna gain, whether or not your antenna is amplified, your TV set’s sensitivity, building obstructions, indoor penetration or multi-path distortion, which may be caused by nearby hills or buildings.

To let you know how high you have to have to mount your antenna, you can simply put a number in the square under the map labeled “antenna height.” This automatically updates the list to show what the possibilities are with the



You can mount the FlatWave antenna easily on its mount or mount it on a traditional TV antenna mast turned by a typical TV rotator. At just under 3 pounds, this is a very capable, lightweight antenna. (KS4ZR photo)

new height. For example, I would have to double the height of this antenna (to 40 feet) to get two stations in the green zone—both only 22 miles away. Even tripling the height to 60 feet adds no more channels to the red zone or green zone, though the number of station that now show up in the gray zone is greatly increased. There’s a limit to everything.

Even so, you can increase your chances of getting a reliable signal, despite the apparent limits of the list, by increasing the gain of your antenna, adding a mast-mounted preamplifier and mounting the antenna on a rotator. The rotator lets you pinpoint the transmitter much better than just aiming it in the general direction of the station. Remember, too, that the transmitter may be located a considerable distance in compass bearing from the city it serves. That’s an advantage to the list from TVFool which gives you compass headings for each station.

With the coming “repacking,” or consolidation of the TV band, this concept may become more important. There’s no telling yet where all of your local stations may end up. Some, of course, will leave the air entirely, cashing in their licenses for a one-time windfall profit for their owners.

With the new Winegard FlatWave antenna mounted on the roof, I now get 27 channels, including all of the sub-channels carried by the main local TV stations, a considerable improvement over the SquareShooter that was lying flat on top of the top shelf. However, despite its design, the FlatWave was not able to pick up the one VHF station in my area that is 44 miles away. Interestingly, the Mohu Sky 60, which is mounted on the other end of the house at about the same height, is able to pick up that station.

One thing that both the Mohu Sky 60 and Winegard’s FlatWave have in common is the ability to receive signals from two directions without apparent interference. The SquareShooter was decidedly unidirectional and this bi-directional ability is a real plus for the FlatWave, particularly if your desired TV stations are 180 degrees apart.



3M's WorkTunes digital edition: still the same poor radio reception, but more options make up for the shortfall. (KS4ZR photo)

Help for 3M's WorkTunes Headset Radio

Here's yet another instance of products changing through time. Many years ago in *Monitoring Times* I reviewed 3M's WorkTunes hearing protector/AM/FM radio. It had a number of shortcomings, many of which have been remedied in the current model, which sells for about \$50 at most DIY stores including Tractor Supply, Lowe's, Walmart and Home Depot.

The biggest problem I had with the earlier set was poor FM reception (poor AM reception is, of course, a given, though at night reception did improve, but who's working out in their yard at night?). The next biggest issue was analog tuning—it was difficult to tune with a small knob. And, it was easy to accidentally bump the tuner off the station you were listening too. There were no other options either, besides AM or FM radio listening. The big question for me was, "Is the new WorkTunes better, or is it still a bust?"

At the time, I used it mostly while on the lawn tractor mowing the yard. Because of its poor FM reception, I had mounted an XM satellite receiver to the tractor, using a mag-mount antenna on the hood of the tractor motor and auxiliary power plug connected to the tractor's battery. The audio from the XM receiver was fed into a small FM modulator, which was tuned in on the WorkTunes FM radio. It was a great setup and worked well for years.

Another problem with the old WorkTunes set was that it was easy to forget the set was on when I was done working and by the time I wanted to use the set again, the batteries were dead.

When I finally noticed last year that 3M had brought out a new digital version of their WorkTunes, I thought it was worth a \$50 gamble to see if it had been improved.

The biggest difference is the digital tuning. With easy to set presets, you can tune exactly to any station's frequency and by pressing a single button on the right ear cup, you can go through the five presets easily. There's now an automatic shutoff to prevent the batteries from dying while you're not using the set and there's a more secure battery compartment



Philips MP3 player, which I bought two years ago for less than \$20 has a pretty good built-in FM tuner. (KS4ZR photo)

cover. But, most importantly, there's an auxiliary/MP3 jack.

The radio in this ear protector is no better than the previous edition. But, the addition of the MP3 jack makes all the difference. It's interesting that even in its promotional material 3M mentions using the jack for an MP3 player or a scanner radio.

Plugging into the auxiliary jack disconnects the headset's internal amplifier and all other tuning functions. The ear protectors then become basically a passive headset; all volume adjustments have to be done via the device plugged into the headset. Yes, you can plug any radio—scanner, 2-meter HT, portable shortwave radio, MP3 player, you name it! I found that the best receiver I have, even for broadcast FM, is an Alinco 2-meter/440 cm HT.

I have also been using the small Philips MP3 player I bought at Walmart as a closeout several years ago for under \$20. I download podcasts from the BBC and other interesting sources and enjoy cutting the grass as much as anyone can enjoy cutting the grass.

What I also discovered was that the tiny Philips MP3 player actually has a better FM radio tuner built-in than the 3M WorkTunes and it has no fewer than 30 station presets! So now, I have the option of listening to shortwave podcasts or local FM radio stations all on the same MP3 player.

Other 3M WorkTunes ear protector features include a "vocal assist" mode, though my version did not. Automatic shutoff happens after two hours of inactivity but can be prevented by pressing the tuning button at least once. Two AA batteries are required but not included. For ear protection, WorkTunes reduces noise by 24 dB.

If you live in a suburban location, within 10 or 15 miles of most FM radio stations in your area, you may experience great radio reception. But, in more fringe areas, you'll be happy that 3M included the pass-through MP3 option.

So, the answer is, the new WorkTunes is better, though not because its radio is better.

THE WORLD OF SHORTWAVE LISTENING

By Jeff White, General Manager WRMI

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Spanning Two Continents and the Mediterranean: Turkey and Cyprus on Shortwave

January of this year was the second time that I had the opportunity to visit Istanbul, Turkey. The first time was several years ago when my wife and I arrived on a cruise ship. This year was the first time we arrived at the airport. And during the drive from the airport to the hotel with some Turkish Radio and Television colleagues, I realized once again what a beautiful city it is—the impressive ruins of the wall around the Old City, the modern buildings and skyscrapers in the newer parts of the city, the breathtaking Bosphorus and the bridges and ferries that cross it. Not to mention the wonderful Turkish cuisine.

Yes, Istanbul is one of the world's most majestic cities, located in both Europe and Asia. I was glad that our TRT friends had offered to host a global frequency coordination conference there, even though less than two weeks earlier Istanbul had made world headlines when a terrorist bomb killed several German tourists in the old city center area where the famous Blue Mosque, the Hagia Sophia Cathedral and the Topkapi Palace are located.

We had come here to eliminate, or at least mitigate, interference on the HF broadcasting bands—a process that the High Frequency Coordination Conference (HFCC), the Arab States Broadcasting Union and the Asia-Pacific Broadcasting Union have been able to do so successfully for the past 26 years. We had also come here to discuss the digital future of shortwave with colleagues from the Digital Radio Mondiale (DRM) Consortium.

TRT Background

Dr. Zeki Ciftci, Deputy General Director of Turkish Radio and Television, opened the HFCC Conference by welcoming everyone to Turkey and sharing his happiness that TRT was hosting the meeting in their country. "As TRT," he said, "we started radio broadcasting on May 6, 1927 and it continues in different transmission types and new technologies up to today. Our shortwave radio broadcasts which started in 1938 with a 20-kilowatt transmitter, continue with five 500-kilowatt transmitters in 2016 and 68 hours per day of broadcasts from our shortwave station in Emirler [near



Instanbul street scene. (Photo by Jeff White)

Ankara]."

Today, said Dr. Ciftci, TRT operates 14 television networks, over a dozen radio networks, as well as the Voice of Turkey international service. "We are currently using 11 satellites, close to 5000 terrestrial transmitters and cable networks to broadcast our programs nationally and internationally," he stated.

"Frequency planning and coordination issues are of great importance for shortwave broadcasts," noted Ciftci. "We are often criticized for still using shortwave broadcasts in a time when satellite broadcasts are so popular. However, our corporation has no doubt about the importance and necessity of shortwave broadcasts. We receive many phone calls, e-mails and letters from our listeners. They show us we are right on this issue. We know that people follow shortwave broadcasts as the only source of communication and information in very difficult circumstances. Especially in emergency situations like war and natural disasters, the only way of reaching people and giving information to them is with shortwave broadcasts. We at TRT are planning to continue shortwave broadcasting without any restriction."

The Voice of Turkey is part of TRT—Turkish Radio and Television—which is a state-owned company. As I learned



Delegates at work during the High Frequency Coordinating Conference in Istanbul.
(Photo by Jeff White)

when I visited Turkey in January for the HFCC Conference in Istanbul, the TRT is a very large organization, most of which, but not all, is geared to the domestic market. TRT operates the following television networks within Turkey:

- TRT1 HD - a family and entertainment channel
- TRT News HD - Turkish and international news
- TRT World - an international news channel only in English
- TRT4K - Europe's first ultra-HD TV channel
- TRT Turk - an international channel in the Turkish language
- TRT Sports HD - a 24/7 channel with European and world sports coverage
- TRT Kids - children's programs with mainly national productions
- TRT Documentary HD - programs about the cultural heritage of Turkey and the world
- TRT School - with educational programs for all ages
- TRT Religion - 24/7 religious programming
- TRT Muzik - with all musical genres from Turkey and around the world
- TRT Avaz - in 8 languages for audiences from Asia to the Balkans
- TRT El Arabia - round-the-clock broadcasts in the Arabic language
- TRT Kurdi - broadcasting in Kurdish and sub-dialects with a variety of programming

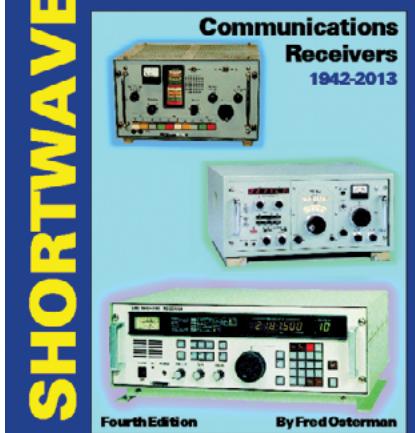
In the radio sector, TRT operates five national, three regional, three international and three local radio channels, including:

- TRT FM - a general-interest channel
- Radyo 3 - Western music
- TRT Turku - folk music from Anatolia
- TRT Nagme - traditional Turkish classical music
- Voice of Turkey - the worldwide radio service in 41 languages and dialects via shortwave and the web, reflecting the views of Turkey abroad
- TRT urban radios - in Ankara (105.6 FM), Istanbul (106.6 FM) and Izmir (99.1 FM), with traffic and weather, culture and art, daily life in the cities

Most of these radio transmissions are simulcast on the TRT websites. TRT is very involved in new media, with a variety of websites and apps for mobile phones, which are omnipresent in Turkey. TRT also produces movies for television,

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It is truly a masterpiece and will have a place of prominence on my library bookshelves.
- Joe Veras K9OCO

Amazing how heavy and well printed the luxury book is. - Serge Matveyev UA1OSM





The author monitoring shortwave in Turkey. (Photo by Jeff White)

and it has cultural services such as training programs for domestic and international media producers, children's song competitions and festivals such as TRT Radio Days.

TRT belongs to many international broadcasting organizations, including the HFCC and the Asia-Pacific Broadcasting Union. It says it has "taken its place among the most powerful broadcasting organizations in the world," having agreements with 168 countries and representatives in many of those countries.

The Voice of Turkey

The Ottoman Empire—precursor to modern day Turkey—stretched across a large portion of the world. If it had existed back then, the Voice of Turkey might have been used to communicate across this great empire and beyond, much as the BBC has done across the British Empire. Nonetheless, the Voice of Turkey covers the world today on shortwave radio, and is one of the world's major shortwave services, with no plans to scale back anytime soon.

At the recent HFCC Conference in Istanbul, Dr. Zekeriya Aydin, Deputy Head of TRT External Services, gave a presentation about the Voice of Turkey. He explained that the VOT began as the external service of Turkish Radio and Television in the Arabic language in 1937. Regular broadcasts started in four languages in 1938. The Voice of Turkey now transmits in 37 languages as of 2016.

- The Voice of Turkey is charged with promoting Turkey, Turkish traditions, and reporting news through Turkey's perspective via shortwave, satellite and the Internet. Besides reporting breaking news from Turkey and the world, the Voice of Turkey transmits Turkey's views on politics, economy and diplomacy. The station has radio programs on the web in 41 languages and dialects. It launched Hausa and Swahili websites in 2014; and Portuguese, Japanese and Malay sites in 2015. Its websites had 3 million visits in 2013 and 11 million in 2015.
- VOT uses seven satellites and five shortwave transmitters. The station has 120 hours of radio broadcasts per day, 72 of which are in foreign languages. They say that most listeners who interact with them are between the ages of 35 and 55.
- The Voice of Turkey broadcasts in 22 of its 37 languages on shortwave. The most popular languages are German, Spanish, French, Farsi, Urdu, Albanian, Pashto and Chinese. —VOT's Turkish-language service broadcasts around the

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Left: Portable shortwave radio purchased from an electronics store just down the street from the HFCC conference hotel. **Right:** Ruins of the ancient wall of the Old City in Istanbul, Turkey. (Photos by Jeff White)

clock over shortwave, satellite and the Internet.

- Memleketim FM is a new station for Turkish expatriates living abroad, broadcasting via the Internet and keeping alive the listeners' connection with the Turkish language.
- TRT has foreign-based news correspondents sending reports in Greek, Arabic, Albanian, Farsi, Spanish, Kyrgyz, Macedonian, Romanian, Tatar, Urdu, Turkmen and Russian.

The station launched a new printed magazine in 2015 called RadyoVizyon, which is published in English and Turkish. It's also available in e-magazine format on the web at <http://trtradyovizyondergisi.com/english>. The 21st and 22nd editions of the magazine, which can be read at this website, have some very interesting articles about the future of external broadcasting written by Turkish and foreign authors.

The Voice of Turkey receives about 92,000 e-mails from its shortwave broadcasts per year. It also receives nearly 15,000 telephone calls and 7000 letters.

A blind listener in Iran wrote to the Voice of Turkey: “—I love you and your broadcasts. Your programs are my best friend at home, and my eyes and ears opening out to the world. Because my eyes cannot see, you have become my closest friends. I tune in to your station on shortwave, because that's my only way.”

It was clear to me from the comments of the directors of both TRT and the Voice of Turkey that this country's external service, unlike many others nowadays, still has a strong commitment to shortwave broadcasting as an important part of its overall multimedia approach. And the station's current schedule confirms this. Here is the Voice of Turkey schedule in English for the A16 season (in effect until October 30, 2016), as published by the HFCC:

1230-1330 UTC on 15450 kHz to Europe
1630-1730 UTC on 15520 kHz to the Middle East, South

and Southeast Asia

1830-1930 UTC on 9785 kHz to Europe
2030-2130 UTC on 9620 kHz to the Middle East, South and Southeast Asia, Australia and New Zealand
2200-2300 UTC on 9830 kHz to North America and Europe
0300-0400 UTC on 6165 kHz to North Africa and the Middle East
0300-0400 UTC on 9515 kHz to North America and Europe

Incidentally, walking around the center of Istanbul, I was able to see how easy it is to obtain a shortwave receiver there. Only a couple of blocks from the hotel where the HFCC Conference was held, I found a small electronics store which sold mobile phones and a variety of Chinese-made shortwave receivers ranging from inexpensive models costing \$10 or so to a more expensive \$30 portable multiband analog receiver which had connections for a USB device and an SD card.

And On To Cyprus

After the HFCC Conference in Istanbul, we flew to Northern Cyprus for a few days. Northern Cyprus is the Turkish part of the island, officially known as the Turkish Republic of Northern Cyprus. The island is a former British colony. It has been divided into the Turkish northern part and the Greek southern part since Turkish troops invaded the north in 1974. The largely Greek portion in the south is an independent nation, although it has strong links to Greece. Turkey insists that Northern Cyprus is also an independent nation, but no country besides Turkey recognizes the Turkish Republic of Northern Cyprus. An infamous “Green Line” divides north from south and is patrolled by United Nations peace keepers. For many years, it was difficult or impossible to cross from one side to the other. Nowadays, it's quite easy to do so.

And that's what Nathan Morley did during our visit to the city of Girne, or “Kyrenia” in Greek, in Northern Cyprus. Nathan is the producer of a program called “FG Radio”





HFCC conference dinner gives delegates a chance to unwind and enjoy Turkish cuisine. (Photo by Jeff White)

which is heard on shortwave via WRMI in Florida, and via the Internet. It has been on other shortwave stations in the past. Nathan and his Finnish wife Sari live in the Republic of Cyprus, but they drove up to the North to have dinner with us one night. Sitting outdoors on the second floor of a very picturesque seafood restaurant overlooking the Girne harbor area, Nathan told me about his program.

The program began as the “European News Network,” sponsored by the Republic of Cyprus-based newspaper Famagusta Gazette, founded by Nathan and a fellow journalist. The newspaper was originally a print publication, but is now exclusively online. Nathan—who is also a correspondent for the German Deutsche Welle radio—and his partner Chris, felt that they should expand the scope of the Famagusta Gazette to international radio by using shortwave. He says they have received a lot of listener reports from around the world to their weekly 15-minute program, which focuses on news and features from Cyprus and around Europe.

The shortwave program has since changed its name to “FG Radio” to better represent its relationship to the Famagusta Gazette. Nathan says the radio program is not, until now at least, a commercial venture like the newspaper; but the response has been so positive that they plan to continue it indefinitely. You can hear FG Radio via WRMI several times per week, including 2100 UTC Wednesday on 15770 kHz. You can find the entire schedule at www.wrmi.net, and then click on “Programming.”

An “Aircraft Carrier of Radio”

Nathan Morley points out that Cyprus is located just about 50 miles from Turkey, 60 miles from Syria and 100 miles from Lebanon, making it a very strategic location. “This whole island,” he told me, “is like an aircraft carrier of radio. I mean, it’s a beautiful location not just for radio. This is also a huge station for listening. It’s a listening post. So we have your folks, the CIA, that have been here for years.



Nathan Morely, of Famagusta Gazette, and his wife Sari at dinner in Northern Cyprus. (Photo by Jeff White)

You have the British MI5 here. In fact, there’s a piece in the newspaper today that they were listening from here to Israeli jets monitoring Iran. Because we’re in the middle of the sea, surrounded by the Middle East and Southern Europe, I mean where else would you want to pick up a nice clean radio signal? They say that GCHQ, the British base here, can hear—the listening equipment is so sensitive—they can actually hear the taxi drivers in Baghdad. That’s how good it is.”

As far as international broadcasting goes, Nathan says Cyprus is also a hot spot. “We have the BBC station at Zygi—the British East Mediterranean relay station, who sadly are in the current process of decommissioning that after 70 years of broadcasting. They transmitted on shortwave and mediumwave. We have Radio Monte Carlo on Cape Greco. That’s also Voice of America, Radio Sawa.

“We have, here in the north of Cyprus, the shortwave transmitter for Radio Bayrak, which is the Northern Cyprus Broadcasting Company. And I think it’s somewhere on 6 MHz [6.150]. Actually, I think it’s somewhere around here [Girne]. I don’t think it’s a very strong transmitter. I know they certainly get their signal into Turkey. Twenty-four hours a day they beam the domestic FM program on shortwave. So there are a lot of stations that have a history here.”

But none of these stations really talk about Cyprus in English except for FG Radio. “To be honest with you, that has been the reason the Famagusta Gazette—FG—has worked,” says Nathan. “I’m not a Cypriot; I’m British. I’ve lived here for 20 years. I’m fascinated by Cyprus and by its history. I love to see Cyprus being represented on the international stage. I think FG Radio does that. And I think the Famagusta Gazette does that.”

[The author is the general manager of WRMI shortwave in Okeechobee, Florida.]

THE SHORTWAVE LISTENER

By Fred Waterer

programming_matters@yahoo.ca

“Isle of Music,” BBC, RHC and More

“From the Isle of Music” can now be heard Tuesdays from 1900-2000 UTC on Channel 292, 6070 KHz, a station in Germany, in addition to Tuesdays 0000 UTC (8-9pm EDT Mondays in the Americas) on WBCQ 7490, a station in the US.

“We are now able to send e-QSLs for reception reports for both options, they can be sent to tilfordproductions@gmail.com. Please be patient with us about response time as our resources are very limited.

“Since the addition of Channel 292 we are now getting excellent reception reports from as Far East as Moscow.

“Our April 11 (in the Americas) / April 12 (for the rest of the world) program will have more dance music than usual, with special guests Jesus Chappottin and Miguelito Cuni Jr. of Conjunto Chappottin, some classic dance tracks from Conjunto Los Bocucos and some Timba from El Niño y la Verdad. On the Jazz front, a new release by Brenda Navarrete, and more beautiful Cuban concert music from the album Danzas Para Piano de Ignacio Cervantes.

“There are two listening options on shortwave: WBCQ, 7490 KHz, Tuesdays 0000 UTC (8pm EDT Mondays); Channel 292, 6070 KHz, Tuesdays 1900 UTC (2100 CEST) See the NOTES section of our Facebook page for program updates and other information.” – From William “Bill” Tilford, Owner/Producer “From the Isle of Music.”

I am always pleased to promote new (and old) ventures on shortwave radio such as “From the Isle of Music.” Just drop the editor a line at the e-mail address indicated at the top of the column!

Radio 292, seems to be an interesting effort. “From the Isle of Music” has received reception reports from as far away as Moscow. Reception in North America is problematic because of CFRX, Toronto, is on the same frequency. It would be nice if they were able to broadcast on another frequency or at a time more conducive to hearing them on this side of the pond. And if CFRX goes down, perhaps they may make it through! I applaud all of those who keep shortwave broadcasting alive.

BBC News Program Explores a World on the Move

“We need to have a rational discussion that focuses on how we strengthen the systems designed to protect those fleeing war and persecution, while understanding and taking into account the concerns of citizens in host countries.” An-



“From the Isle of Music,” heard on WBCQ and Channel 292 Shortwave (Courtesy: “From the Isle of Music” Facebook page)

gelina Jolie Pitt, UNHCR Special Envoy.

“On 16 May, BBC News will host a day of special live coverage examining how the movement of people is changing the world we live in and how our economies develop. “BBC News World On The Move will be broadcast from the BBC Radio Theatre across some of the BBC’s best-known shows, including Radio 4’s “Today” program and “Start the Week,” alongside a live topical radio drama.

“As one of the most dominant, global issues of our time, the discussion will impartially cover how migration is changing our world, and draw the BBC’s global audience into the conversation on the day.

“A range of speakers from different sides of the arguments will set out the most important new ideas shaping our thinking on economic development, security and humanitarian assistance, live on TV, radio and online.

“The UNHCR’s Special Envoy Angelina Jolie Pitt will give a keynote address on the global refugee crisis at BBC Broadcasting House. The session will be hosted by Today presenter Mishal Husain and be broadcast live on Radio 4, BBC World Service and BBC World News.

“Former Director General of MI6 Sir Richard Dearlove will be discussing how a World on the Move impacts on security.

“The day, co-ordinated by the ‘Today’ program team, will be bookended by live Radio 4 outside broadcasts. In the morning, John Humphrys and Sarah Montague will look at how reverse migration has seen Asian people return to their countries of origin to promote economic growth, such as in India and Vietnam. In the evening, ‘The World Tonight’ will come live from California, looking at how multinational workforces are serving the creativity of the tech sector. It



Radio Habana Cuba logo (Courtesy: Radio Habana Cuba)

will also involve journalists from the BBC's 30 language services contributing original stories from their broadcasting regions.

"BBC Director of News and Current Affairs James Harding says: 'If the "Today" program ran all day on one story, what new insights would it throw up? We've put together a day of programming involving BBC News and some of Radio 4's biggest program strands to look at a key story of our time.'" – From BBC Media Centre

"Outlook, one of BBC World Service's longest-running radio programs, turns 50 this summer celebrating half a century on air on Monday 4 July 2016. To mark this milestone BBC World Service has launched Outlook Inspirations, a celebration of extraordinary people whose stories have inspired others around the world. The BBC is compiling a list of 50 of the most compelling personal stories, so-called Outlook Inspirations.

"An international judging panel, headed up by the BBC's Chief International Correspondent Lyse Doucet, [from New Brunswick, Canada by the way] will later select three winners from a final shortlist of 15. The three winners will be announced on Monday July 4, 2016, the day of Outlook's 50th birthday, during a live BBC World Service broadcast from the Radio Theatre in London." – From BBC Media Centre

Good news for Mighty KBC listeners. In April the 6040 kHz frequency was being reported with an excellent signal. Check them out between 0000 and 0300 UTC. The Giant Jukebox with Eric van Willegen can be heard from 0100-0300 and is really worth hearing.

With the apparent thaw in Cuba-US relations, what does the future hold for Radio



Radio Tamazuj logo (Courtesy: Radio Tamazuj)

Habana Cuba, Radio Marti and WRMI? Maybe Cuba is softening its tone now that President Obama visited Cuba?

"Twenty six years ago this Sunday, 27 March, the U.S. began illegal propaganda broadcasts against Cuba via the so-called Marti Television, a subject that was not touched upon by President Barak Obama during his recent visit to Havana—although on several occasions the U.S. president quoted statements and phrases by Cuba's National Hero Jose Marti.

"The misuse of the name of Jose Marti in the war waged by the United States against Cuba had begun earlier, on May 20th, 1985, with the creation of Radio Marti, a radio station out of Miami that broadcasts a daily, 'round the clock barrage of propaganda aimed at toppling the legitimate Government of Cuba. This effort costs the US taxpayers millions and millions of dollars every year, a useless expenditure that they should openly question."

"President Obama did not speak in Havana about Jose Marti's profound anti-imperialist thinking, nor did he refer to the outrage against the memory of the Cuban hero by successive U.S. administrations in creating, financing and operating up to today the ill-named Radio and TV Marti.

"The stations not only violate the sovereignty of Cuba but are also a major weapon in the huge arsenal launched by the United States against Cuba in a desperate –and vain – effort to topple the Cuban Revolution." – From Radio Havana Cuba

Radio Biafra Returns

According to the Biafra Herald, "Radio Biafra shortwave frequency changed over to 11,700 kHz in the 25-meter band on April 20, 2016." The station claims to also be heard on Free-to-Air satellite via Amos-5 at 17 degrees East, but this satellite appears to have lost contact with its ground operators.

Radio Tamazuj increases Broadcasts to Sudan and South Sudan.

According to Radio Tamazuj, the station, "plans to introduce additional programming focusing on peace-building, reconciliation, justice, political topics and local governance as well as programming for women and children."

Starting from March 27 the station will air programs from 6:30 to 7:30 on 11650 kHz on the 25 meter band and 9600 kHz on the 31 meter band, and 15150 kHz and 15550 kHz on the 19 meter band each evening from 17:30 to 18:30. This represents an increase from one hour daily airtime to two hours daily.

Radio Tamazuj is among the fastest growing radio stations in South Sudan, according to a survey carried out in five counties in 2015, which found that more than 20% of the station's listeners were new listeners, more than any other station. Tamazuj means 'intermingling' or 'mixing' in Arabic. – From Radio Tamazuj website

Once in a while, shortwave radio turns up in the mainstream press, or maybe a side road branching off the mainstream. OK. This is "Beam

me up, Scotty” territory. The Daily Star in the UK recently published a poorly written article about the so-called Numbers Stations. The first part of the article is actually quite reasonable, going over the background of these stations. Part way through the article they talk about alleged Russian spies arrested in Germany, who were listening to these broadcasts when their home was raided. Now I am sure there is more to the story, but if listening to numbers stations is criminal behavior, we should all await a knock on the door from the RCMP or the FBI.

Then the article swerves off the side of the road, suggesting the signals might be, gulp, interplanetary. Some, according to the article, suggest that Saturn’s rings are acting as a relay station, re-transmitting alien broadcasts. Perhaps our inter-galactic neighbors have seen Independence Day. The next challenge is to QSL these extra-planetary broadcasters. There is a video on YouTube, which presents a more balanced (less unbalanced?) survey of the subject. You can find it on YouTube by searching “BBC Radio 4 Broadcast of ‘Tracking The Lincolnshire Poacher.’” With the decline of shortwave radio broadcasting I wonder if the “numbers stations” are seeing a similar decline?

It is reported that North Korea is stepping up its game when it comes to jamming incoming shortwave signals. The Unification Media Group reports that their shortwave broadcasts on 7515 kHz were being heavily jammed. The broadcasts originate from transmitters in Dushanbe, Tajikistan.

“The blocking effort is being concentrated on the time period from 10 pm to midnight. Specifically, from 10-11pm the jamming is very strong. The signal jamming is undetectable from midnight to 1 am. The signal blocking became weaker at midnight on March 15, from which point onward the entire three-hour broadcast was audible. Starting on March 17, UMG moved the frequency, but the jamming operators seemed not to notice because the interference continued on the old wavelength.” – From an article on dailynk.com/English

It should also be noted that the organization is lobbying for more money and transmitters in the South to broadcast to the North. Pyongyang’s regime is one of the last orthodox Communist nations on the planet. Kim Jong Un is reportedly consolidating his grip on the levers of power, convening the first party congress in 36 years, accompanied by much bluster and sabre rattling with South Korea and the US. It’s a region worth keep an eye on, or an ear to, so to speak.

“A cement mixer collided with a prison van on the Kingston by-pass. Motorists are asked to be on the look-out for 16 hardened criminals.” This is just one of the thousands of jokes told by the late Ronnie Corbett over the years. Corbett died on March 31 at the age of 85. As a young man I got hooked on British comedy, largely through the broadcasts on CBC and PBS Television of “The Two Ronnies,” starring Corbett and the equally funny Ronnie Barker. Here in the Toronto-Buffalo region I am blessed that I had access to so many British comedies via the CBC and PBS. This engen-



BBC 4 Extra logo (Courtesy: BBC 4)

dered a great love of British humor. From television shows such as Monty Python, “Fawlty Towers,” “Dad’s Army,” “Allo, Allo” and so many more, I graduated to their predecessors in film and radio. I became a fan of the “Carry On” films, which starred many people who came to fame in radio. For instance, Syd James and Kenneth Williams were stars of “Hancock’s Half Hour” on radio. Hattie Jacques started with ITMA back in the forties.

Like North America, truly great comedy started on radio. One of the first radio comedies with a mass appeal was ITMA, an acronym for “It’s That Man Again.” The phrase was first used to refer to Hitler in a pre-war article. Tommy Handley, star of ITMA, appropriated it for himself. A few recordings remain of ITMA and, in my humble opinion, they are must-hear radio. ITMA begat programs such as “Much Binding in the Marsh” and “The Goon Show.” The former introduced Kenneth Horne, a stalwart on radio for the next 20 years. The Goon Show gave us people such as Peter Sellers, Spike Milligan and Harry Secombe. Next came programs including “Hancock’s Half Hour,” starring Tony Hancock, along with the aforementioned Syd James and Kenneth Williams. And in the late sixties shows such as “I’m Sorry I’ll Read That Again,” allowed John Cleese and others to explode into the public consciousness, presaging his work on television with Monty Python.

One of the real treasures of the BBC is Radio 4 Extra, a digital channel one can hear on the Internet. If you like British comedy and especially these classic gems, I would encourage you to check out this station. One can hear all of these old shows by listening to the live stream, or listening to the program archive. Check it out at bbc.co.uk/radio4extra. You will find more than classic comedy here; truly programming your ears will thank you for.

AMATEUR RADIO ASTRONOMY

By Stan Nelson KB5VL

stan.nelson@RoswellMeteor.com

Revisiting Radio Jove with a Low Cost Computer

Jupiter has been known for many years to generate radio emissions, generally in the 20 MHz range, which are caused by the interaction of Jupiter and its moons. They were discovered in the 1950s and are known to produce a variety of spectrum patterns called L (long) and S (short) waves. To successfully detect Jupiter requires good antenna gain and a sensitive receiver without any AGC (Automatic Gain Control).

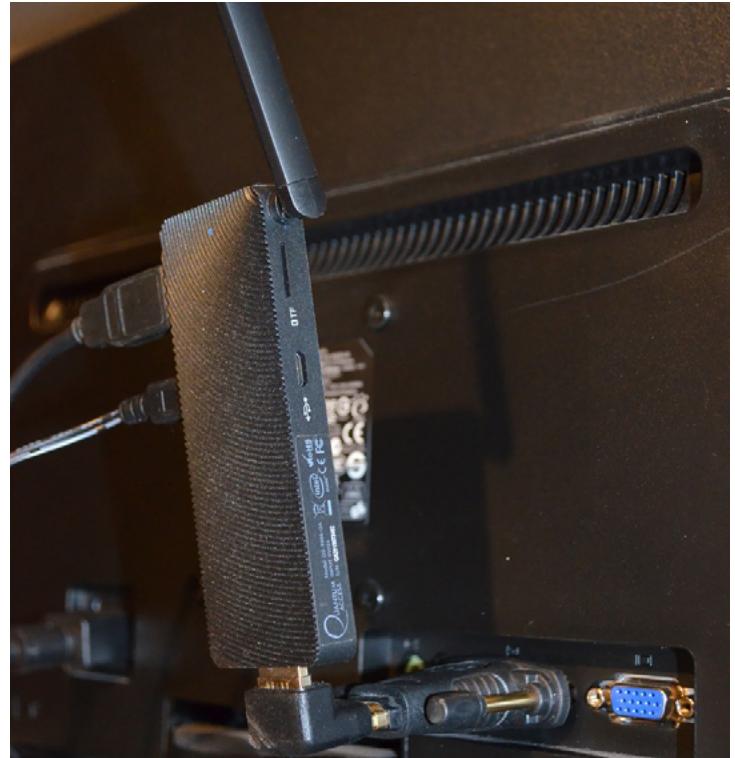
The Radio Jove project has been around for several years and is an excellent way to explore the radio astronomy hobby on a budget. Since the Radio Jove receiver is a project designed for use in schools, the kit is relatively easy to assemble with good soldering skills. The kit and other resources are available at the Radio Jove site: <http://radiojove.gsfc.nasa.gov>. A good source of details on the Radio Jove receiver and other projects is covered in a book by Steven Arnold titled "Getting Started in Radio Astronomy," published by Springer.

I have written about the Radio Jove receiver in past columns and have monitored the 20.1 MHz frequency using the Radio Jove kit. I had detected several solar storms with it but I never knowingly recorded any Jovian storms using the twin-dipole kit. The antenna took up backyard space and I had discarded it after a year or so. Since then, I have installed a LWA designed antenna which operates between 20 to 80 MHz with 35 dB gain pre-amps. I decided to hook up the Radio Jove radio recently and try recording the Jupiter's signals using Skypipe II. The setup is straightforward.

The PC

Since I monitor a number of frequencies with numerous PCs the electric bill tends to climb. I started looking for low cost PCs that would allow me to overcome using the old power hungry desktops. I recently saw an advertisement for the Azulle Quantum Access Mini PC Stick with Windows 8.1, Intel Atom Z3735F, and 2GB RAM+32GB storage. I ordered one since it offered a fairly small footprint and low power requirements.

The power supply is rated at 5 volts and 2 amps. Hooking up the Mini PC was easy but I found it somewhat inconvenient to plug it into a HDMI TV port. That may be a problem for some monitors. I used a DVI to HDMI adaptor and later added a short HDMI extension cable to allow the mini-PC to be moved around. There is only one USB port so I used a powered USB hub to connect a keyboard and a mouse. The audio is set up to feed through the HDMI port to



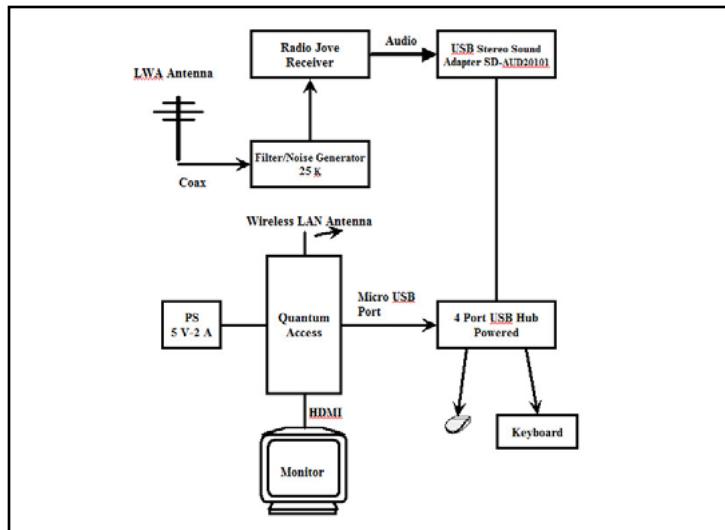
Quantum Access PC. (Photo courtesy of the author)

the TV. There is no microphone or line input to the software. I used an audio-microphone USB sound card by Syber SD-AUD20101 to feed the audio from the Radio Jove.

The Quantum Access mini-PC looks like an overgrown USB stick. The video output is a HDMI video/audio connector that plugs directly into a TV/monitor HDMI port. In the photo, I added a right-angle adaptor and then into a DVI/HDMI adaptor so it pointed up. The antenna is for the wireless LAN. You can see two ports on the side. One is for a micro-SD card. I stuck in a 32 GB card for storing the charts. The other is a micro-USB port. The mini-PC comes with Windows 8.1. I didn't have any problem loading the Radio-Sky programs. The sketch below shows how I did the connections. Nothing special here except the need for an audio input. The Syba USB Sound card that sells for about \$20 and is fairly easy to set up.

The Setup

On the next page (top left) is a sketch of the hook up. The LWA antenna (next page top right) is a dual dipole with dual preamp that provides 35 dB of gain. The antenna is designed for 20 to 80 MHz operation. I have been using it for



Radio Jove setup. (Courtesy of the author)

feeding a number of receivers for meteor, WWV, and other activities successfully using a couple of amplified splitters. However, to receive Jupiter with Radio-Jove, a dual half-wave dipole antenna is typically used and can be purchased with the Radio Jove kit.

The Radio Jove receiver (below left) is a fairly low-powered box. The box on top is a 25 K (Kelvin) noise source when turned on and becomes a band-pass filter to reduce shortwave broadcast interference. I used an HP signal generator to verify the settings and the weak signal response. I could see a signal as low as a 0.1 microvolt. To avoid power noise, I also use a well-regulated 12-volt DC wall-wart power supply to drive both units.

The Software

The Radio-Skypipe II software (screen shot below right) converts the audio signals into a digital reading and creates a digital strip chart. The software has been around for a number of years and is fairly easy to use. It can build daily charts and display shorter time spans as needed. It has a calibrator mode that was designed to accommodate the receiver. Its wizard takes you through the Radio Jove setup and even scales and labels the vertical "Y" axis automatically.

Radio Jove Receiver. (Courtesy of the author)



LWA antenna. (Courtesy of the author)

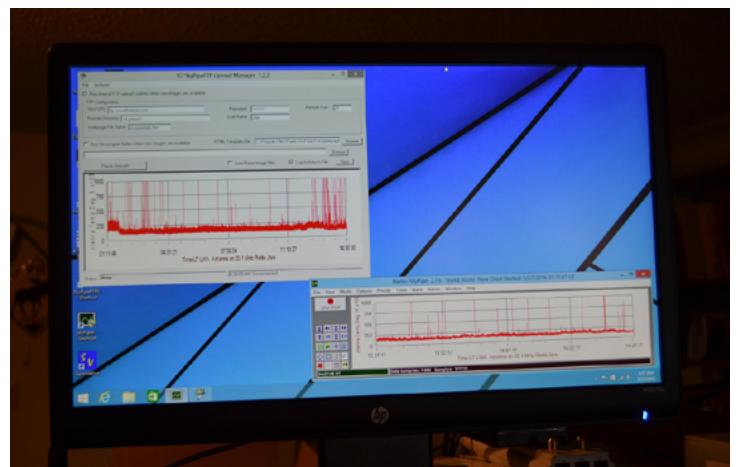
ly. The screen shows the Skypipe data being logged. The top chart is a 24-hour view and the lower chart I have set for an hour. This can be changed in the strip charts options to suit your needs.

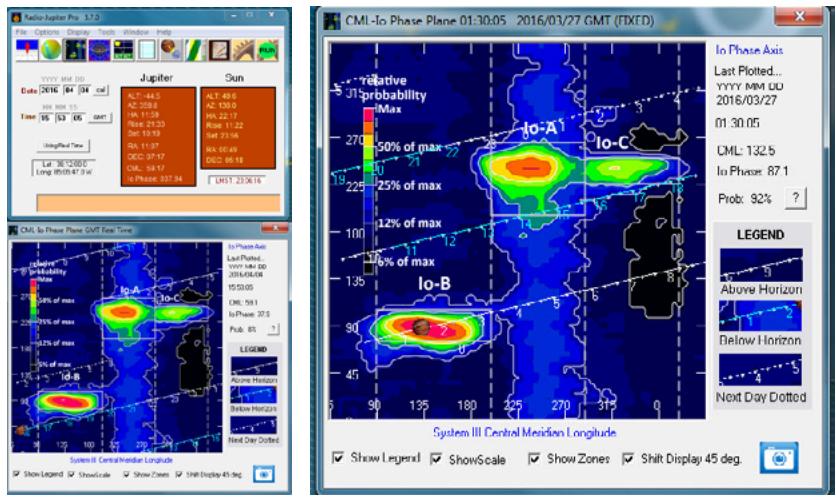
Radio Skypipe II charts on a Mini-PC screen.

Radio Jupiter Pro 3 can be obtained from Radio-Sky Publishers for \$20. It allows you to keep track of Jupiter's travels and predicts the best time to monitor potential storms. You can input your antenna parameters to show the approximate antenna pattern of your antenna. Keep in mind the Radio Jove receiver is designed for 20.1 MHz and will detect solar storms during the day. The chart on the next page (top left) shows the path Jupiter is taking in relation to the moons and the potential hot spots. Note that the chart indicates Jupiter's position above and below the horizon.

When I first hooked up this setup I started Radio Jupiter Pro and saw that Jupiter was in the middle of an Io-B potential hot spot. Jupiter was above the horizon. I checked the SkyPipe chart and saw a rise at the same time Radio Jupiter Pro indicated 92 percent probability of a storm. The screen on the next page at right shows the increasing signal at about 01:11 UT.

Radio-Skypipe II data screen. (Courtesy of the author)





Left: Radio Jupiter chart. **Center:** Jupiter Position Chart. **Right:** Radio Jove chart. (Courtesy of the author)

I haven't confirmed the activity was indeed a Jupiter storm. Here's a link to some contributed data for March, 2016: radiojove.org/cgi-bin/calendar/calendar.cgi?month=3&year=2016. There are some observations for the previous day. One of the nice things about the Radio Jupiter Pro software is the ability to backtrack the time to a recorded event such as this. Like most transient events in radio astronomy, it's a good idea to verify your observations.

Another neat way to observe solar and Jupiter storms is with a spectrograph approach. In previous columns I have discussed the use of an SDR USB receiver with Radio-Sky's Spectrograph. It also works well with RF-Space's SDR-14, but they have become somewhat obsolete.

After working with the Quantum Access PC I think it is a good option for low-powered operation. But when you add up all of the options, I believe a new low-end laptop is cheaper. You'll get a hard drive, monitor, keyboard, etc. And more than one USB port. The newer PCs are certainly getting more energy efficient except the Windows versions are mostly Windows 10. One bad feature of Windows 10 is that it doesn't like some versions of the old reliable software used in the hobby. Another, which is disastrous, is that it wants to download software updates and reboot. The only way to overcome that is go with a wireless LAN and tell it that you're on a metered (pay-as-you go) network. I run all of my PCs with the manual update option. Once in a while an update appears to do a reset and I have found a PC rebooted and no longer recording data.

Most of the software I have featured in past columns can be adapted for other interesting radio astronomy monitoring using a variety of receivers. Experimentation is where the fun is.

Radio Astronomy Hobby Book List

Here's a list of books of my shelves that may interest and assist your journey into the hobby. A search on ABE Books or other sellers often finds fairly inexpensive used copies. Though the books may be somewhat dated, they offer a good background in the concepts.

"The New Astronomy," by Paul and Lesley Murdin, published by Thomas Y. Crowell Co., 1978.

"Radio Astronomy," by Steinberg and Lequeux, published by McGraw-Hill Electronics Series, 1963.

"Big Ear," by John Kraus, published by Cygnus-Quasar Books, 1976.

"The Big Dish: The Fascinating Story of Radio Telescopes," by Roger Piper, published by Harcourt, Brace & World, Inc., 1963.

"The Radio Sky and How to Observe It," by Jeff Lashley, published by Springer,

"The Amateur Radio Astronomer's Handbook," by John Potter Shields, Crown Publishers, 1986

"Clocks in the Sky: The Story of Pulsars," by Geoff McNamara, published by Springer, 2008.

"Introduction to Radio Astronomy," by John Potter Shields, published by Howard Sams Pub., 1976.

"Amateur Radio Astronomy," by John Fielding, published by the Radio Society of Great Britain, 2011.

The hobby can take you in many directions over time and having a good reference library is handy. The web certainly provides the latest and greatest details, but there's nothing like a good book when your computer is busy monitoring Jupiter.

If you are new to the hobby or just contemplating giving it a try, you will generally find we love to share what we know or help you find answers. I often mention the Society of Amateur Radio Astronomers. Drop by their web site at www.radio-astronomy.org. They are the premier amateur radio astronomy group and they meet at great locations and get tours of facilities led by professionals. Check them out.

THE LONGWAVE ZONE

By Kevin O'Hern Carey WB2QMY

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Longwave Beacons: The Ideal DX Target

What do you look for in a DX target? What would the ideal transmitting station look like? How about this for a DXers dream list...

- 24-Hour, year 'round operation
- Omni-directional transmission pattern
- Repetitive ID sent every 10 seconds or so
- Published, verifiable ID information
- Distinctive ID formats to help indicate country of origin
- The ability to ID several stations on a given frequency, all in one listening session

Longwave beacons possess all of the above attributes. DXers sometimes dismiss them as unworthy of their efforts because they simply repeat themselves, and are a lot like listening to a broken recording. However, that is a key advantage! If you're interested in DXing, and not so much the content of transmissions, beacons may be for you! At the very least, they make a good alternative when you need a change of pace. Let's take a closer look at each of the points above.

24-Hour, year 'round operation—Beacons have to operate full time to be of much use to navigators. Planes are flown at all hours of the day and night, so the signals must be available for the use of all. Their continual operation is so crucial that airports often employ alarm receivers to alert them to any problems in the transmissions.

Omni-directional transmission pattern—Beacons are typically not intended for transmission in one particular direction. Users could be at any direction relative to the station, so it is highly desirable that transmitted signals radiate equally (or nearly so) in every direction of the compass. Accordingly, antennas systems at beacon sites are carefully designed to achieve this goal. Tophat verticals and wire verticals with a horizontal "T" section are used at most sites to achieve an essentially omni-directional transmission.

Repetitive ID sent every 10 seconds or so—A pilot using a beacon for navigation must know what station is being received, so the transmitted ID becomes paramount. For this reason, it is transmitted over and over again in slow Morse code. It is typically sent slow enough so that the dots and dashes can simply be jotted down and looked up on a chart, if necessary. You don't have to know Morse code to use them!



Unattended LF beacons like this one (AVN, 344 kHz near Rochester, NY) make ideal targets for DXing. (Photo by K.Carey)

Published, verifiable ID information—There are numerous lookup sources for beacons, both electronic/web-based, and conventional paper. This allows anyone to look up a beacon's ID and learn the location, technical specifications, and the operator/sponsor of a given station. One excellent online source is located at: www.classaxe.com/dx/ndb/rna. Information on another beacon guide (paper or electronic form) is available at: www.ndblist.info/beacons/NDBpublications2015.pdf.

Distinctive ID formats that help indicate country of origin—U.S. beacons typically use an ID tone of 1020 Hz while Canadian beacons typically employ 400 Hz. The tone pitch can serve as a quick indicator of the beacon's probable country of origin. There are a few exceptions where ID tones will be flip-flopped between U.S. and Canadian stations, but these are rare. Further, Canadian beacons use a long dash after their IDs, while U.S. stations do not.

Ability to ID several stations on a given frequency—Having multiple stations on a particular frequency usually results in mayhem and interference, but beacons offer a chance to use this fact to your advantage. Typically, you won't hear heterodyne squeals from multiple beacon signals because they will almost always be on the exact same carrier frequency (well, within a few Hertz of each other, anyway). What you will hear is their Morse IDs being sent on a defined cycle. It is this cycle that can allow you to "listen through" competing stations and eventually extract the ID of two, three, or even more stations.

Also, because of the differing ID tones (400 and 1020 Hz), it is often possible to use your receiver's filters to



Kriss Larsen's LF receiving setup used during his trip to Argentina and Antarctica (Photo by Kriss Larsen)

distinguish between one or the other signal. Some beacons also transmit on the upper sideband of their carrier frequency while others use the lower sideband. This fact can also be used to filter out one or the other and focus on a signal of interest. Using one or more of these techniques (not to mention listening at different times of the day) can net you dozens of signals without hardly moving your radio's tuning knob!

Mailbag

Many longwave listeners are also interested in the study of various Earth science topics, including Earthquakes. Reader Todd Dokey forwarded an article from a European journal for science teachers called Science in School which describes how you can build a seismograph with scrap materials. You can access the article at: www.scienceinschool.org/2012/issue23/earthquakes.

The ARRL Letter for April 7, 2016 makes the case for an ongoing research role after U.S. hams gain access to the 472-479 kHz band. You can read the entire article at: <http://www.arrl.org/news/arrl-mw-experiment-coordinator-sees-ongoing-research-role-after-hams-gain-472-479-khz>.

Carl Schmidt WA8ZTZ (MI) tallied up his totals from this past winter's DX season, and reports that in a total of 35 listening sessions of an hour or less each, spread from November through March, he logged a total of 136 NDBs (many heard multiple times). Here is a list of his best catches from his Michigan location:

kHz	ID	Location	Distance
212	YGX	Gillam, MB	1076 mi.
244	TH	Thompson, MB	1117 mi.
256	YXN	Whale Cove, NU	1223 mi.
257	SQT	Melbourne Florida	1020 mi.

263	QY	Sydney, NS	1154 mi.
305	YQ	Churchill, MB	1209 mi.
317	VC	LaRonge, SK	1314 mi.
329	YEK	Eskimo Point, NU	1353 mi.
332	FIS	Key West, FL	1256 mi.
360	PN	Port Menier, QC	1021 mi.
390	JT	Stephenville, NF	1249 mi.
391	DDP	Dorado, PR	1945 mi.
396	YPH	Port Harrison, QC	1112 mi.

Carl points out that his aim with the above loggings is not to boast, but rather to show that in spite of worries over many NDBs being decommissioned, there are still plenty of them to be heard with simple equipment. He uses just a 50 foot wire antenna and a simple portable receiver, nothing exotic.

Kriss Larsen KR6ISS enjoys international travel on a frequent basis, and usually manages to work radio into the itinerary wherever he goes in the world! In particular, he enjoys exploring longwave facilities and other utility communication sites. Kriss recently traveled to Argentina and Antarctica and sent along a summary of his trip. He has finished editing the photos from the trip, and here is a link to about 30 radio shots: www.dropbox.com/sh/w6o5wl5gdgitr30/AAAMLNw_bI7AHtsBr0icyXN1a/4%20Radio%20photos?dl=0

If you want to see all of the photos from the trip (tourist oriented, as well as radio) the top level link for them is: www.dropbox.com/sh/w6o5wl5gdgitr30/AABlnnPPIBrxXmd6VASRLXm2a?dl=0

Here is Kriss' summary of how he got there, what he did on the trip, and what he saw and heard:

"The normal procedure is to fly commercial to Buenos Aires, and then whatever cruise company you go with will

have a charter plane in Ushuaia down in Tierra del Fuego to take you to your ship. Then, two days across the rough Drake Passage, 7 days to see the sights, then 2 days back across the passage, and back to Buenos Aires. I added on a side trip to Iguazu Falls up by Brazil—world's largest (not tallest) waterfall.

“Radio wise, I only picked up one NDB in Buenos Aires—there should have been more. As luck would have it, it was within walking distance from my hotel over in a bunch of Argentine Navy headquarters buildings. It turned out it was on top of a building—not sure I've seen that before. A typical top-loaded mast.

“Radio installations at the stations and the ship were mainly satellite-oriented. The Norwegian weather service had a custom report for our ship every day from Norway by satellite, posted on a bulletin board. But all ships and stations monitor 2182 kHz full time, and VHF Marine Channel 16 (156.800 MHz). The stations also monitor 3100 kHz which is the common channel for Antarctic stations to talk to each other. Again, all the HF is back up to satellite.

“Like everywhere I go, I brought my VLF converter and wire antenna to do a longwave scan during the cruise, to see what I could pick up in Antarctica—figuring not much. You can't do it on the ship—all the metal kills reception.” So, when I told the expedition guides I wanted to do one on a landing, you can imagine the reaction. ‘You want to do what?!’ Turns out the tourist landing places are under heavy regulation under the environmental treaties the cruise companies have agreed to—radio scans aren't in there. Turned out they kicked my request upstairs to the Captain—if he can marry people, he can approve radio scans. So, I did an official radio scan on Deception Island, which means I have done longwave scans on ALL 7 continents. That's an obscure accomplishment, if there ever was one!

“So, what did I hear there? I was hoping at least one VLF submarine station would come through—and one did—NPM in Hawaii at 21.4 kHz. It was weak, but definitely there. That's over 7000 miles, but entirely over sea water. I also expected to hear NWC 19.78 kHz, which is closer at 6600 miles. But nothing was heard there. When I plotted the great circle from Exmouth to where I was, you could see it went right across the whole width of Antarctica, so the overland stretch may have killed the signal.

“Locally, I knew the only NDB in Antarctica was at the Chilean airport on King George Island, about 70 miles to the north. I heard it, but it was much weaker than its listed 1000 watts should have been. But besides its normal identifier (IRJ, 360 kHz), there was an extra dit (e), usually meaning that an emergency/auxiliary transmitter is being used. I believe this is the only solid surface airfield in Antarctica, and regular planes can land there. If someone on our ship needed to be medically evacuated, sailing over to that airport, and an ambulance jet back to Chile would be the only way out to a hospital.

“I also picked up an open carrier at 53 kHz. I have no idea what that was, and it is not normal to have an internal

image there. Obviously I was very far from any source of radio interference. Lightning-generated sferics were present, so I think reception conditions were good.

“Speaking of sferics, When we got to the British Port Lockroy Station, which is only a museum now, I was surprised to find out that back in the 1950s-1960s, that station was at the forefront of ELF-VLF radio propagation research down there. They had a whole exhibit about ELF whistlers. Much of the original radio equipment from then was still there in the radio room gathering dust. It was the last thing I expected to run into.

“I asked at all of the four stations we visited whether there were any hams on the crews, but came up blank. Looks like a DX-pedition opportunity going unused. They said at Port Lockroy back when it was an active station they did communicate with hams on CW from time to time.”

Rochester Hamfest

The hamfest season is here, and one of the very best in the northeast U.S. has always been the Rochester NY Hamfest, now in its 89th year. This year's event will be held on Saturday, May 28 at a new spacious location featuring both indoor and outdoor activities. Note that the event is no longer being held at the Barnard location some may be familiar in recent years. For complete information on this year's event, you can visit the Rochester Amateur Radio Association's official website at www.rochesterham.org. I hope to see you there!

TSM



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ADVENTURES IN RADIO RESTORATION

By Rich Post KB8TAD

kb8tad@gmail.com

Not Another Heavy Hammarlund HQ-129X?!

At the last hamfest of the year in 2015, I saw the HQ-129X along with several smaller pieces of gear in varying condition, some in decent shape and some that were best used as parts sources. The reseller had apparently acquired an estate and sold several of the pieces rather quickly. About half way through the morning, the HQ-129X and a Heathkit TC-3 tube tester were still sitting there. No prices were marked, so I made a proper offer on the TC-3.

The seller commented that he had hoped to sell the tube tester with the tube lot, but the buyer of the tubes did not want it. He wanted to sell the TC-3 together with the HQ-129X since that receiver was so heavy, he did not want to haul it home. He asked what I thought it was worth. I said, "Since it has all the right knobs and is fairly clean, about a hundred if there are no major problems." I also said I already had a couple and did not want or need another.(1)

I guess he had not expected that high a number for an estimate of value. I also noticed and mentioned the front panel modification with an extra switch that might de-value the set somewhat. I told him if he wanted to get rid of it quickly to put a price tag of 60 bucks on it and see how fast it would sell. He said he had offered the TC-3 and the HQ-129X together as a package to a couple of guys for \$50 who were still walking around the hamfest and thinking about it and then said, "You can have them for that price." I replied, "I don't need another HQ-129X, but I also don't need to walk around to think about that. Here's your fifty."

The HQ-129X is a good communication receiver for restoration because there are still so many around. It was a popular radio in its day, is relatively easy to work on, is innately robust, and tends to still be reasonably priced today because it is not scarce. It is high on my list for someone who is starting out with restoration of communication receivers because it is likely to be a successful effort assuming the person has acquired some restoration skills and success with smaller entertainment radios.

It had been occupying space in the trunk of my car for a couple of months since that hamfest awaiting a turn on the bench. I lifted it out carefully and carried it to the bench. Did you know that boat anchor radios keep you strong? Yes it is heavy; nearly 52 pounds. Despite its weight, the HQ-129X is



This picture shows a Hammarlund HQ-129X and matching speaker previously restored by the author. Note the non-original knobs. (KB8TAD photo)

one of my personal favorite post-war communication radios, the second in a line of four or so models of the large general coverage single conversion receivers built by Hammarlund.

The series started with the HQ-120X before the war. The "X" in that model number refers to the crystal filter, which was an option. The filter came standard with the HQ-129X. The HQ-140X and HQ-150 followed the HQ-129X. And I said, "four or so" purposely since there were variations of a couple of the models such as my WWII Navy RBG-2 with Navy band spread requirements and some other changes. It is a modified HQ-120X that has much in common with the postwar HQ-129X.

Besides the HQ-129X sets already holding down my radio shack, I also have an example of each of the others in the series, having always admired the build quality of these big-box Hammarlunds. The biggest Hammarlunds following the HQ-150 would grow to double or triple conversion like the HQ-180, a general-coverage set still highly prized by ham and shortwave listeners alike.



The first HQ-129X ad in the November 1945 Radio News. The set looks more like the pre-war HQ-120. Compare the picture to that in the December 1945 ad. (From KB8TAD collection)

Ads and Prices

The first ads proclaimed the HQ-129X to be "essentially the same as the HQ-120X but has several improvements and modifications," a refreshingly honest ad description. A prototype HQ-129X that looks like a modified HQ-120X appeared in the November 1945 full-page ad in *Radio News* magazine (page 24). The first picture of the HQ-129X as manufactured appeared the following month (December 1945, page 24).

The ad makes it obvious that the price of \$129 (\$1,706 in today's money) matches the model number. The speaker was an extra \$10.50. That price held for a couple of months as shown in an Allied Radio ad in *Radio News* of February 1946 but, with the inflation rate in the months following WWII, the price had climbed to \$173.35 including the speaker in an Allied Radio ad by December of that year.

The radio was designed with ham radio in mind with band spread calibrated for the 80, 40, 20, and 10-meter ham bands. Later ones also included the 15-meter band, which was first authorized for ham use in the USA starting in May 1952. The large heavy-duty multi-section variable capacitor and the tuning ranges were purposely designed by Hammarlund to favor ham frequencies. As a result, the broadcast



Here's the following month's ad, December 1945. (From KB-8TAD collection)

band is split covering 540 to 1320 kHz in one range and the rest in the next range to 3.3 MHz. The 80-meter ham band is in the lower part of the following range rather than pressed against the top of a longer range as in some of the competitors. The other ranges also favor the ham bands.

There is much to admire in this set. According to the manual (2) the variable capacitor uses three sets of solid silver contacts for the rotor. The set uses a voltage regulator tube for the oscillator and screens, as did the HQ-120X. Its simple but nice flywheel-weighted friction-drive tuning system for both the main and band spread dials that avoids dial cords and associated pulleys and springs has stood the test of time and has, in my experience, about the least backlash when compared with its competitors. It also has three IF sections compared to two for most of its competitors although that makes alignment more of a challenge. Very popular in its day, about the only failing of the HQ-129X was the choice of knobs. They seem too light for the size, weight, and stability of the receiver. This is especially true of the tuning and band spread knobs. Most owners replaced the light knobs with heavier-duty versions for at least the main tuning and band spread and sometimes for other functions as well, often with heavy military-surplus knobs. Very few examples of the HQ-129X still have the original knobs.



Cover picture from the December 1946 Radio News depicting the manufacture of the HQ-129X. (From KB8TAD collection)

First Look

This radio with all its original knobs was an exception to the rule. The radio also had a coating of dust on the tubes and the knobs. I like a layer of dust on the radios I buy. Dust that has been cleaned on some sections of the chassis or certain parts tells me someone may have been in there recently. The dust was also still on the exposed fuse on the chassis top, next to the power transformer. That fuse was intact, another good sign.

Nearly all of the HQ-129X sets show some wear in the front panel paint around the tuning and band spread knobs. This one showed some minor wear only around the band spread knob, indicating to me that the radio was primarily used for the ham bands as opposed to general shortwave listening. A crystal calibrator had been added to the left rear of the chassis. Hammarlund sold an accessory calibrator; model FS-135C that is often seen in that location on an HQ-129X, as recommended by Hammarlund. I suspected that the SPST switch modification on the front panel might lead to that calibrator, as also suggested by Hammarlund to switch the calibrator power.

Pulling the chassis is relatively easy. Ten screws on the front panel and three in the back and the chassis with its front panel pulls out of the case. I noticed a stain in the dust on the right side of the bottom of the cabinet and also some evidence of wax dripping from a capacitor. All the capacitors were original waxed paper types. The clamp-mounted electrolytic also appeared to be original. However, there were some added mica caps and some other components near the accessory socket. I remembered when buying the set, it had an unwieldy horizontal 6SN7 stuck in an accessory socket on



HQ-129X showing original knobs and capacitors. (KB8TAD photo)

the back panel. I removed it to avoid breaking it, wondering why anyone would stick a tube in a back panel accessory socket. Seeing the mods, I wasn't so sure. Not only that but I had forgotten that the HQ-129X didn't come with an octal accessory socket. The back panel socket was itself a modification. I will trace the wiring to see if I can figure out what the purpose of the modification might have been. I like to restore these sets to original wiring if possible unless a modification really makes sense.

The paper capacitor that had leaked a bit of wax was on the volume control power switch connection to chassis ground, dangerous if leaky or shorted. It was time for some preliminary safety and continuity checks for leakage from power line to chassis and for proper high resistance from B+ to chassis. It was on these checks that I found the first problem, no continuity between the blades of the power plug with the power switch turned on. Typically that means poor contacts on a long-dormant power switch but not this time. I traced the power cord connections. Hadn't I checked the fuse and found it dusty but intact? Was it the power transformer itself? I doubted that because the HQ-129X transformer, like the rest of the receiver, is tough, not as prone to failure as some others.

It turned out to be failed clips on the fuse holder that were not easy to see because of the dust. I also found a broken and intermittent contact inside the power plug itself. Either of those problems would have resulted in no power for the power transformer. Do you suppose the reseller plugged it in and saw no pilot lights or lit filaments and that was part of the incentive to be rid of it? That was certainly possible. I hadn't bothered to ask the "Does it light up?" question and seldom do. I prefer for vintage sets not to be plugged in without a thorough inspection and then only with careful monitoring so as not to cause possible further damage.

I debated removing the existing chassis-top fuse holder and replacing it with an inline holder below the chassis.

However, in the interest of originality, I ended up repairing the existing fuse holder after noticing that the rivets



Most of the wax had dripped off this cap, which was connected to the power switch. (KB8TAD photo)

holding the fuse clips to the phenolic body were hollow and extended down through the holder to the connections below the chassis. One side of each of the existing fuse clips had failed likely due to metal fatigue. I broke off the second side of each of the clips, took a short piece of 12 gauge solid copper house wire and soldered a piece into each of the deep rivet contacts and then soldered new fuse clips to a short stub of that heavy wire for a successful repair.

I also replaced the power cord and its grommet, using a three-wire grounded cord recycled from a computer. The fuse and switch were rewired to modern standards, feeding the neutral white wire directly to the transformer, the black wire to the fuse, and the fuse to the switch. The green wire safety ground was of course soldered to a nearby ground lug.

Critical Caps

I removed both of the power line to chassis capacitors since I was not sure those were needed with the chassis now connected to the safety ground, making a note to check later to see if those caps might still be needed for their original purpose, to reduce tunable hum. With those caps removed, I replaced the other critical cap, from the audio preamp, in this case one triode side of a 6SN7, to the input grid of the 6V6 output audio tube. Connecting a speaker, I checked for scratchy noise with my VOM on low ohms and the prods touching pin 4 and pin 3, the screen and plate connections of the 6V6, a test which assures that the output transformer and speaker connections are intact.

After doing this test often, it is easy to memorize which tube pins are connected to what elements of the typical audio tube. The pins for nearly all common octal audio output tubes including the 6V6, 6F6, 6K6, 6L6 and several others all use the same pin connections. To Hammarlund's credit, the secondary of the audio output transformer has a 27 ohm resistor across it, good engineering typical of Hammarlund, in this case providing a constant load on the transformer



The failed fuse holder being repaired. (KB8TAD photo)

should the speaker be disconnected thus avoiding high fly-back pulse voltages that can destroy an unloaded output transformer or output tube.

With the critical caps and power off safety tests taken care of, I decided to do a slow and gentle power up for the set, carefully watching the B+ as well as the wattage draw as voltage from the isolated variac was increased. The B+ voltage came up as expected and the wattmeter indicated a reasonable power draw. The electrolytic stayed nice and cold.

The Purpose of the Modification

However, there was no sound. That was not surprising since I had traced one of the modification wires to the input of the volume control. Based on that connection, I had a strong suspicion of what the modification might be, a product detector for Single Side Band reception. Plugging a 6SN7 into the added rear panel octal socket brought up band noise and signals. However, both the AVC and the BFO (Beat Frequency Oscillator) settings on the mode switch were dead. The SSB modification had been wired so as to be the only function for the set.

A number of the product detector modifications of older receivers included either a multi-pole switch or a relay to switch in SSB while still keeping the other functions, but not in this set. I wanted AM because the HQ-129X is such an excellent band cruiser for both AM broadcast and shortwave. I went back to the schematic to find out what might have been cut or cut out as part of the modification, tracing the original detector circuit in the set. Looking under some wiring while tracing the AM detector signal path, I finally found a hidden capacitor with one side cut off. That was it! I replaced the cap and connected the loose end to the input of the volume control. After warm-up of the set, my curiosity was satisfied when broadcast stations were coming in properly. The BFO was still dead, but I knew I was on the right track.

A 6SJ7 is used as the BFO tube. The tube has a round aluminum cover shielding the bottom of its socket. With

some difficulty, that aluminum shield can be twisted off. One wire exiting from that shield had been cut and fed to the SSB modification as would be required for a product detector. Were some BFO circuit parts changed or missing? I reconnected the feed wire from the BFO to the 6H6 detector tube after determining from the schematic the proper pin for the connection. Still no BFO.

My portable frequency counter also showed no oscillator function. The 6SJ7 tested as new on my emission tube tester. Voltages were present as expected when the BFO switch was turned on. The wiring from the BFO tuned circuit had the expected resistances but still no BFO. The circuit under the tube shield had two tubular capacitors and several resistors on a vertically mounted terminal strip. I decided to go ahead and replace those caps. One had been replaced earlier but with a lesser value.

Since it was a simple B+ decoupling cap, that would not have caused the BFO to quit. On removing the two caps, I saw a heavier wire under one of the caps that looked like it might have been added. Looking at it closely, I saw that it shorted out the mica cap in the feed line to the 6H6 detector, not a good thing. On removing the short, the “heavy wire” melted! Yes, the wire modification was a piece of solder! After removing the solder piece and replacing the capacitors, I tested the set again. This time was a success. I also found a broken wire leading to the electrolytic. Tracing it back led to the cathode of the 6V6 output tube.

The cathode bypass cap section had been disconnected whether on purpose or by mistake. I had wondered why the volume control had to be cranked a bit high for the volume levels of AM broadcast relative to a strong indication on the S-meter and had made a mental note to check the tubes and connections. The tubes had all tested well. Now I knew why the audio seemed a bit weak. Connecting that cap section increased the audio gain. Relaxing a bit with the now functional set, I tuned in several SSB conversations using the original BFO as it was designed. SSB tuning on sets without a product detector requires that the volume control be turned up and the signal level controlled by the manual RF gain control, labeled “Sensitivity” on the Hammarlund.

Capacitor Replacement

With the radio now working reasonably well, it was time to try bringing it to its best performance. Capacitor replacement would be a part of that and resistor checks as well. I did not expect any major gains in performance with cap replacement however. In a common AC-DC entertainment set, capacitor replacement is more critical partly because the manufacturers tended to use the cheapest capacitors available, often rated at only 200 volts. Not so in communication receivers such as the Hammarlund with capacitors typically rated at 500 or 600 volts. Although wax capacitors do tend to be somewhat leaky, unless the circuit is of critical high impedance such as for AVC or audio coupling to an input grid, a megohm of leakage will not affect most circuitry in typical



The modification with a horizontal 6SN7 mounted on the back of the chassis. (KB8TAD photo)

applications such as screen bypass or cathode bypass. I like to know the purpose of the capacitor in a circuit. In the past for the HQ-129X, I have replaced any capacitor that sees high voltage including all the screen bypass caps but not the cathode bypass caps that see only low voltage and low impedance. In the HQ-129X there is even a cap across the 6-ohm speaker connections that I typically have not changed because I could think of no logical reason to do so. I suspect its only purpose was to cut any RF that might otherwise leak onto the external speaker lines in the presence of an RF field from a nearby transmitter. Knowing the purpose of the capacitors, I am not disappointed when capacitor replacement does not noticeably improve performance.

Resistors, Volts, and Photofacts

On the other hand, screen resistors are important to performance. An underrated carbon resistor will deteriorate with time, usually increasing its resistance. A resistor that increases in value causing reduced screen voltage will definitely affect performance. The manual has a list of voltages to expect at each tube socket terminal using a 1000 ohms per volt meter, making it relatively easy to check for off-value resistors. Sams Photofact 8-18 (note 3) for this set lists both voltages and resistances at each socket. I recommend getting the Sams as a useful addition to the manual. Photographs of the chassis in the Photofact identify the location of each component. A list of the capacitors and resistors and their function is also included as well as specifications such as the voltage and current capacity for power transformer secondaries, choke values, and output transformer impedance. Photofact 8 is in the first bound volume published by Sams. Sams Photofacts, new in 1946-47, quickly took market share from Rider's Perpetual Troubleshooters Manuals because of the photos and the thoroughness, including suggested replacement components and specifications and often an independently drawn schematic and review of the circuits. For the HQ-129X, the

manual and Sams both list 27 tubular capacitors including eleven at 0.05 uFD, fourteen at 0.02 uFD and one each 0.1 and 0.01 uFD.

Choosing Capacitors

I remembered reading on the 'Net that a very knowledgeable person who was an experienced engineer for a major receiver manufacturing company had mentioned using mostly disc capacitors for restoration of an HQ-129X. His choice was immediately called into question by someone who said that, "I hope they're not Z5U caps (a Class 2 ceramic cap) which change value based on temperature." He was right of course, but the expert did not respond to the negative feedback. And that was because a change in the value of a ceramic cap makes little difference in bypass service. Most of the tubular caps in the HQ-129X, as I have noted, are used for bypass for the tube cathodes and screens.

What does "bypass" mean? That means the purpose of the caps is to short out radio frequencies to chassis ground while blocking DC. An increase in capacitance should make no discernible difference in performance when a cap is used for that function. In later versions of Hammarlund's SP-600, a high-end set also used for military applications, Hammarlund specifically chose to use mostly Class 2 ceramic disc caps because they are seldom leaky. It pays to know what a cap is supposed to be doing in a circuit. I typically use modern tubular caps unless physical space is a problem. Since modern caps are considerably smaller, space is seldom an issue.

Next month, more on the HQ-129X. Send your comments and questions to kb8tad@gmail.com and don't forget to identify yourself as a *TSM* subscriber.

Notes:

(1) Here are links to some before and after pictures of another HQ-129X restored about 5 years ago.

<http://www.ohio.edu/people/postr/bapix/HQ129Xb4.JPG>

http://www.ohio.edu/people/postr/bapix/HQ129_B4.JPG

<http://www.ohio.edu/people/postr/bapix/HQ129opn.JPG>

(2) HQ-129X manual and schematic in PDF format

http://www.ohio.edu/people/postr/bapix/TSM/Sams%208-18/Hammarlund_hq129x_manual.pdf

in djvu format <http://bama.edebris.com/manuals/hammarlu/hq129x/>

HQ-129X Schematic in GIF format <http://www.jvgavila.com/hq-129x.gif>

(3) Sams Photofacts number 8-18 for the HQ-129X is not available on the Net although the Chief Operating Officer of Sams Technical Publishing LLC several years ago confirmed that Sams Photofacts published before 1-1-1964 are now in



The circuitry under the BFO tube socket shield. (KB8TAD photo)

the public domain. Our thanks go to their COO for his honest response from a company well deserving of our business for newer material. I have scanned and made available number 8-18 on my website at <http://www.ohio.edu/people/postr/bapix/TSM/Sams%208-18/>

(4) For an interesting read on the history of the Hammarlund Manufacturing Company, see Les Locklear's article http://www.hammarlund.info/info/company_history/co_history.pdf. After reading that article, I was curious about the "Bango," an early Hammarlund product produced well before their radios.

Some of Locklear's information was taken from a June 1955 newspaper, the Marshall, North Carolina *News-Record*, which described the 'Bango,' as "a protection device inserted in windows so that if it were disturbed during the night by an outsider, a blank cartridge was set off to awaken the householders. (Imagine the shock of the man who rising to close his window in the night forgot to disconnect his 'Bango'!)" To which I will add, imagine the reaction to something like that today!

Pictures of Hammarlund's manufacturing facility circa 1958-59 in Mars Hill, North Carolina can be found at cdm15733.contentdm.oclc.org/cdm/search/collection/Photographs/searchterm/hammarlund, courtesy of the E. M. Ball Collection at the Ramsey Library, UNC-Ashville.

ANTENNA CONNECTIONS

By Dan Farber AC0LW

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Antenna Height Above Ground

Welcome back, my friends. Spring continues to spring, and we begin to look forward to band openings, opportunities to operate portable, the chance to put up antennas and install grounds in good weather. This time around, let's look at an issue that may cause some confusion at times—the issue of how high above ground an antenna is.

Multiple Perspectives

If you operate mainly MF/HF/lower VHF, or 1.8 to 54 MHz, the point you hear hammered home the most is the principle that horizontal antennas, such as dipoles, need to be at least a half-wave above ground. This is because lower heights cause some signal to be reflected from the ground, traveling up into the air rather than launching on the horizontal heading we really want. (One method of operation involves doing this deliberately—more on this later.) A horizontal takeoff maximizes our coverage of the immediate, ground wave area, and also maximizes our chances at DX, since the lower the angle of takeoff, the larger the angle at which the wave hits the ionosphere, giving us the most skip distance.

The same notion appears with ground-mounted verticals, but is now rotated to an issue of antenna length rather than antenna height. We can make a vertical longer than a quarter-wave, say half-wave, five-eighths wave or three-quarter wave, and due to the longer element we end up getting actual gain from the antenna (like longer dipoles for a given frequency have gain). Longer than three-quarter wave, though, the vertical's pattern begins to swing upwards, losing the bottom part of the lobe down at ground level, which, as in the too-low dipole example, limits DX capability. If we lengthen the vertical enough, we eventually reach a pattern directed entirely upward, much like lowering a dipole.

Usually we think of this as a sort of self-limiting factor at MF/HF. At 160 meters we'll need a dipole at least 260 feet long and 260 feet above ground, virtually impossible for any of us city dwellers to attain, or a vertical at least 130 feet tall, a difficult feat to engineer and accomplish no matter where you live.

This is why any DX worked on 160 meters generally uses a vertical to transmit; for most of us a high enough/



Big dipole 50 feet up. Clear of trees and houses, but less than $\frac{1}{2}$ wave up at 40 and 80 meters. (Photo by author)

long enough dipole is unattainable, while a 130-foot vertical, though also difficult to produce, can be substituted for by a shorter vertical with coil loading. Of course, at MF, the vertical is incredibly noisy to receive with, which is one reason many higher-end rigs have a connection for a separate receive antenna, such as a loop or even a Beverage wire. So 160 quickly becomes a huge challenge to operate effectively, simply due to the huge lengths and heights relative to wavelength required.

Moving up in frequency a few bands to 40 meters, we see a much more attainable group of parameters; a dipole 65 feet long and 65 or more feet up, while still challenging for some (especially us city dwellers), begins to look realistic. The vertical, too, now need be "only" about 32 feet long to reach a full-size quarter-wave vertical. Either of these antennas enables us to be real contenders at working DX, because they have the low takeoff angle (or in other words, right at the horizon) to maximize skip distance. Notice that in all of this discussion, I limit myself to dipoles and verticals for the sake of clarity; there is a large group of gain antennas such as Yagis, quads, rhombics and so forth that change the picture quite a bit. The simple half-wave dipole and quarter-wave vertical are not gain antennas, and thus they make excellent subjects to portray this whole issue of height, length, and height above ground.

At 15 meters, a new set of problems begins to creep in. The 22-foot dipole up 22 feet is pretty easy to accomplish,



Portable J-pole for 2 meters. Works great—if I hang it high in the air, like from a tree. (Photo by author)

as is the vertical 11 feet long. They should make fine DX antennas. And they will, if they are “in the clear.” Do you live in the city? Do you live in hilly terrain, with you closer to the bottom than the top? Go outside and look around. There are numerous obstructions (trees, houses, small hills, etc.) that are higher than 22 feet, and certainly higher than 11 feet. Aha! As we go up in frequency, we enter a new realm. Proper antenna length and height above ground becomes ridiculously easy to attain; but the surroundings put more and more obstacles between antenna and target. At lower frequencies, this was accomplished automatically, so to speak; if you raise a 40 meter dipole 65 feet above ground to satisfy the “at least a half-wave above ground” concept, you also raise it above a great many obstructions; your house, others’ houses, a great many trees, small hills, and so forth.

By the time we reach 6 meters, these truths become painfully obvious; a dipole 9 feet long and 9 feet above ground satisfies the requirements electrically, but is, well, only 9 feet above ground, which means there are more surrounding objects higher than it than there are objects lower.

The quarter-wave vertical at 6 meters is only four and a half feet long, meaning it is buried in a forest of much taller surrounding objects. (Even your flimsy little antenna columnist is six feet tall, 33 percent taller than the antenna.) At 6

meters, we reach the bottom frequency range of a new set of considerations; height above ground now becomes a serious factor, not in terms of wavelength at all, but in the sense of raising the antenna far enough above the surrounding physical and geographical clutter to get it “in the clear.”

Try these two images to help clarify the concept: our 160 meter dipole, 260 feet long, if raised 150 feet in the air, is higher above ground than 99.9% of the trees you’ll encounter, is as high as a fifteen-story building. It’s as “in the clear” as you could possibly hope for. Even so, since it is only a little more than a quarter-wave above ground, it bounces a lot of the signal off the ground and up into the air. Being long enough in terms of wavelength doesn’t redeem this; the inexorable “at least a half-wave above ground” rule still limits it.

Now consider a dipole cut for 2 meters, about 38 inches long. If we raise it twelve or thirteen feet in the air, it will be four half-waves above ground. It easily satisfies the electrical requirements of length and height above ground—but it is only twelve or thirteen feet off the ground! Virtually no rocket science is required to see how obstructed it is by its surroundings.

Before we leave this discussion of height relative to wavelength, it’s important to note that operation with a deliberately lowered dipole has become a science in and of itself. Recall that a dipole lower than a half-wave above ground reflects some of the signal off the ground and up into the sky, the lower the dipole, the higher (more “straight up”) the trajectory becomes. The intentional concept, called NVIS, or Near Vertical Incidence Skywave, generally sets the dipole from one-tenth to one-quarter wave above ground; instead of a wave headed for the horizon to give maximum DX, the wave is beamed higher into the sky, reflecting back to Earth much closer since the angle is so much smaller.

Thus this “short skip” is employed to work stations beyond line-of-sight yet not at what we think of as DX distances. It’s an effective method of reliably reaching stations within, say, 1000 miles or less, depending on antenna height and the band used. Military radio communications employ this method routinely.

Many of us have encountered this effect, perhaps unwittingly; again, most of us city dwellers can’t get a dipole for 160, 80 or 40 meters a full half-wave above ground, yet have been surprised and delighted by how this “short skip” effect fills in the missing states we need for, say, Worked All States on 80 or 40 meters. It’s something to think about. Ham radio is not entirely about working DX. Or, you can turn the picture around and say that this is DX on the lower frequencies. Anyone who has tried to work all 50 states on 80 or 40 meters knows what I mean!

To return to the discussion of what happens above HF, the height above ground relative to wavelength becomes ever more meaningless as we move higher in frequency. A half-wave at 432 MHz is about 12 inches or so; a killer Yagi for 432 MHz, with a long boom and 20 or 30 elements, and 20 or 30 dB gain, isn’t going to work anybody if it’s mounted



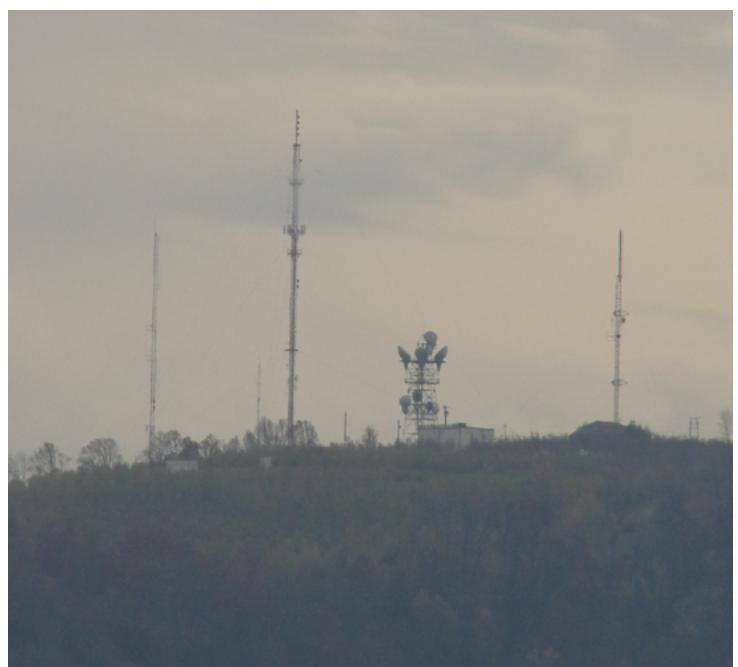
Parabolic dish's gain brings Dish Network to my house, overcoming huge path losses. (Photo by author)

12 inches off the ground. (Well, maybe fellow hams who live on your street.) Move it up into the air, into the clear, above houses and trees, and it becomes a potent weapon at 432 MHz.

That's why you don't see any ground-mounted verticals operating VHF or UHF; verticals on these bands are generally placed as high as we can get them, to put them into the clear. It has nothing to do with wavelength and everything to do with getting above all the ground clutter, those pesky houses and cars and trees that the world always seems to have more of.

That's also why your local repeaters have their antennas as high as possible, to maximize everyone's chance of accessing them. And that's why cellular towers are so high in the air, to pick out everyone's cell phone, down here amongst all the "ground clutter." The typical cell system runs at around 1800 MHz, where a half-wave is shorter than a cell phone's body, a cell phone, be it noted, that has a very stubby antenna and very low transmitting power. Cellular towers high in the air are all that enable these devices to communicate. Think of the cell towers as "civilian repeaters!"

And, more sobering, try to imagine these puny devices communicating directly, by line of sight. Across a room or the house? Maybe. Across the street? Possibly. Across town? Very unlikely. As with ham VHF and UHF repeaters, a big antenna high in the air is what enables a connected network of communication over distances far exceeding line-of-sight. The picture has inverted completely; instead of the situation at HF, where longer wavelength necessitates an antenna high in the air to obey the "half wave above ground" rule, VHF, UHF and above necessitate an antenna high in the air to give the much smaller wavelengths a chance to break out of the ground clutter and make contact. It's important to realize that, as we go higher in frequency, what we call path losses become an ever greater problem, simply because the wave is so small. A tree that looks like a minor obstruction to an 80-meter wave looks like a steel encased brick wall to a 2-meter wave, since the 80-meter wave (270 feet wide) is around 45 times as wide as the 2-meter wave (a little over



Mountaintop antenna farms give much needed height to all VHF transmitters from commercial FM radio stations to cell phones and include 2-meter and 440-cm repeaters. (KS4ZR photo)

six feet wide). This is why simple dipoles and verticals won't do at VHF and UHF. Gain antennas are routinely used to overcome path losses. Notice that your satellite TV system employs a parabolic dish antenna to receive, not a dipole or vertical—because path losses between a satellite in geo-synchronous orbit and your house are, well, astronomical. (Sorry, bad pun.)

So we see that antennas are placed high above ground for differing reasons—to satisfy the "at least a half wave above ground" rule, or to place the antenna above ground clutter. The problem is, as we've seen, largely self-solving at HF, since half-waves at these low frequencies are long enough to be above the ground clutter, at least in the lower end of HF. It might be good to point out that nothing is harmed by placing an HF antenna higher than a half wave above ground; there are many Yagis on towers out there in the world that sit higher above the ground than a half wave. For example, on a 70 foot tower, a 20 meter Yagi is a full wave above ground and a 10 meter Yagi is two full waves above ground, putting them even higher above the clutter and ensuring their path to the horizon—where long skip DX awaits them. At the higher frequencies, from VHF on up, it's more about being as in the clear as possible, to maximize the chances of the much smaller wavelengths overcoming path losses.

That's all for now, folks. I'll be back in June with another home brewed "poor man's antenna" you can build and use at home. Be careful out there, and happy operating!

RADIO HORIZONS

Product Announcements of Interest to *TSM* Readers

Channel Master Partners with Newsy to Expand Live TV Lineup with its DVR+



Channel Master's Over-the-Top (OTT) subscription-free, cable-style TV experience connects to the Web for customized channel guide and non-Over-the-Air (OTA) TV channels such as Newsy. Left: 16 GB DVR-TV tuner connects your antenna to your TV and lets you watch and record OTA-TV. With an external harddrive you could record up to 1 TB of TV shows. (Courtesy: Channel Master)

Channel Master, the nation's leading provider of alternative TV solutions, today announced the addition of over-the-top video news brand Newsy to its OTT platform. Newsy's daily news coverage is now available as a live, linear TV channel to DVR+ owners.

Channel Master provides a cable-like traditional TV experience to cord cutters who desire live TV, local channels and a DVR in addition to on-demand services. The DVR+ is a subscription-free DVR that allows customers to pause and record live TV, as well as access streaming services and live Internet channels.

Newsy is a popular digital news service with millennial audiences, providing up-to-the-minute and trending news coverage in brief curated segments covering world and national news, culture, technology, science, politics and more. Newsy is a wholly owned subsidiary of The E.W. Scripps Company (NYSE: SSP).

"The Channel Master OTT platform is unique, in that it allows our partners to create a branded live linear TV chan-

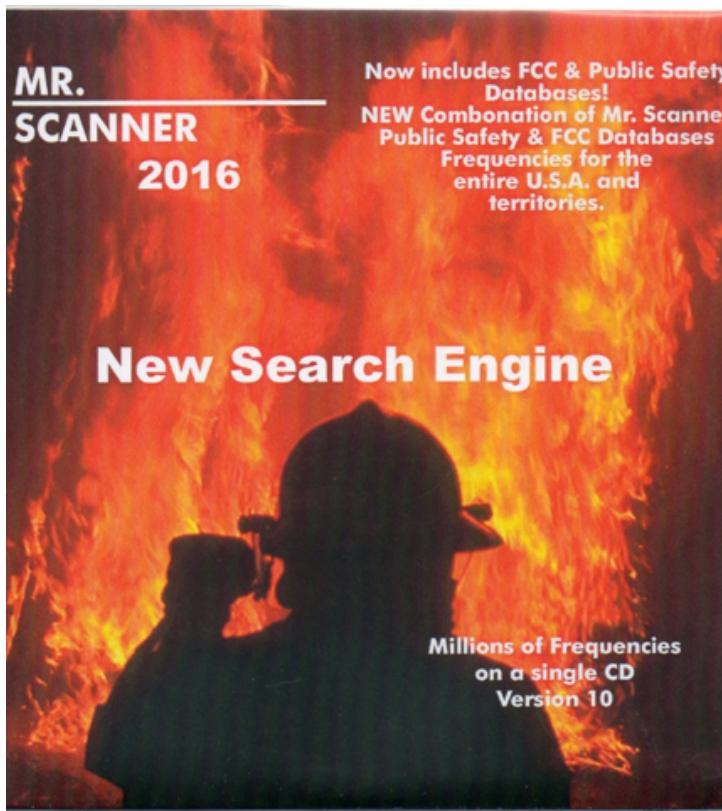
nel that appears in a traditional grid guide alongside over-the-air network channels such as ABC and CBS," said Joe Bingochea, EVP of product development at Channel Master. "Newsy's live feed is rich with relevant content presented in an exciting, modern format, a perfect fit for our cord-cutter customers and we're very excited to launch the channel today."

"Launching Newsy on Channel Master further expands our brand to a growing audience of viewers who prefer alternative TV solutions," said Blake Sabatinelli, general manager of Newsy. "Channel Master has a great base of customers and we're excited to introduce them to our fresh take on TV news, adding the much-needed perspective viewers don't get from old-school news brands."

You learn more about Channel Master's DVR+, which sells for \$250 with free shipping here:

http://www.channelmaster.com/Antenna_DVR_s/336.htm

[Text and graphics courtesy of Channel Master]



2016 MR. Scanner CD-ROM Database Released

The 2016 Mr. Scanner frequency database is completely new for 2016. It features a new search engine and combines both the Mr. Scanner FCC and Mr. Scanner Public Safety on to one CD ROM.

Simply install the program onto a Windows based computer (XP or higher) and you will be off and running with the many different types of searches the program offers.

The databases can be searched by Frequency, Call Sign, Service Code, Licensee, City, County, State, Latitude or Longitude. A search of frequencies can be accomplished by establishing a low and high frequency.

Results can be saved as a .rsd personal file (for Scan-cat users), .nff file (another Scan-cat format), .html file (web page), .csv (for Excel users), and a .txt (which can be also used in Excel and other formats). Additionally, the user has the choice of saving all records displayed or picking only selected records from the search.

The Mr. Scanner frequency database sells for only \$25.00 through select retail outlets or on line at www.bearcatoutlet.com.

For more information contact:

Hobby Radio Stop
PO Box 291918
Kettering, OH 45429
Phone: 937-299-722

[Text and graphic courtesy of Mr. Scanner]



Historic 'Radio Row' Finds a Home on the Internet

A new website designed for radio amateurs, SWL'ers, CB'ers and all communications hobbyists has launched on the Internet recreating the atmosphere of the famed Radio Row in Manhattan.

According to its founder, Richard Fisher KI6SN, “‘73 Radio Row’ takes its cue from an era when New York’s legendary radio district bustled with communications fanatics shopping for surplus and used gear along Cortlandt Street in Lower Manhattan.” 73 Radio Row’s Web address is: <http://www.73RadioRow.com>

The site features used radio receivers, transmitters and transceivers, as well as unbuilt kits, new/old stock antennas, Morse instruments and station accessories of all kinds.

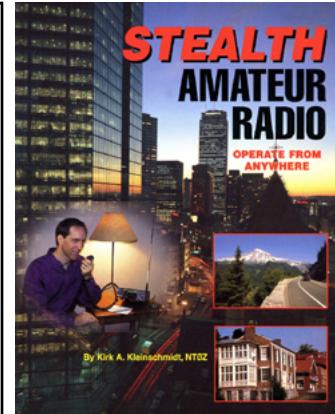
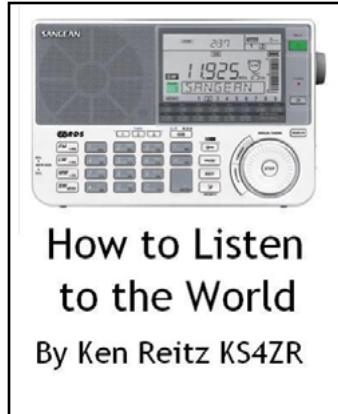
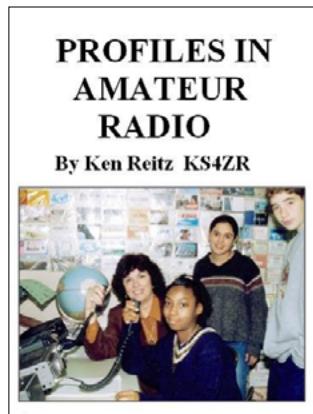
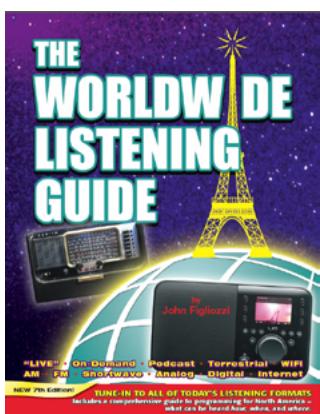
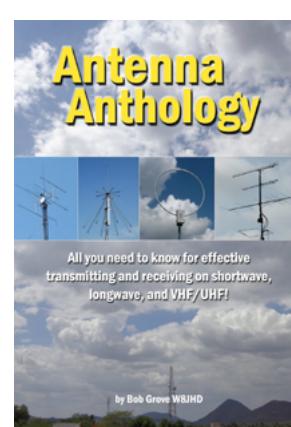
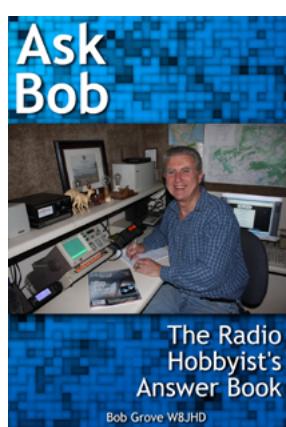
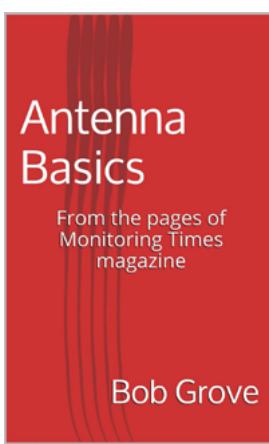
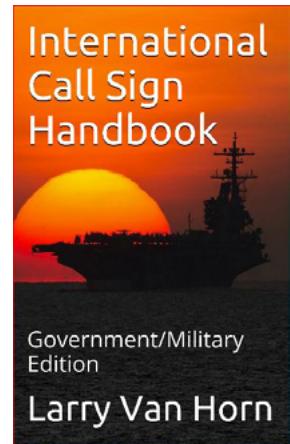
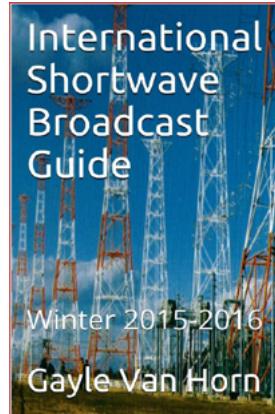
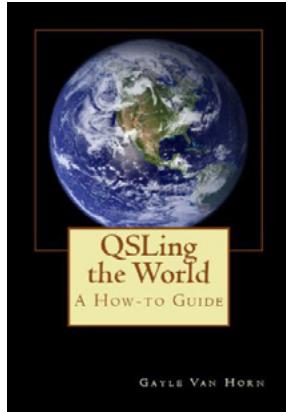
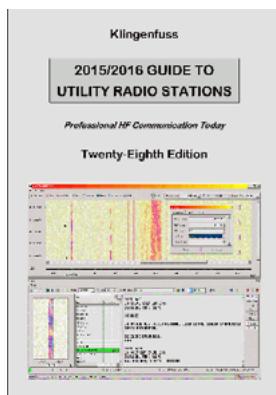
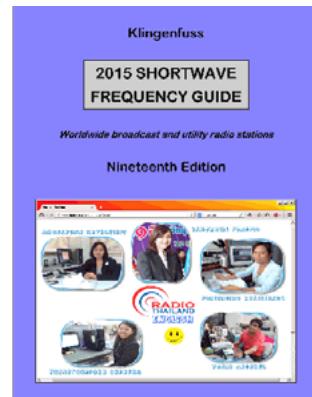
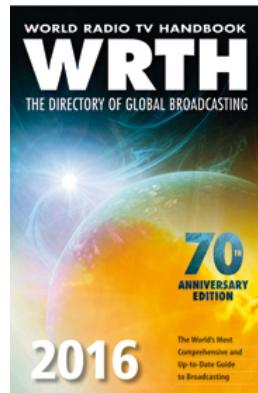
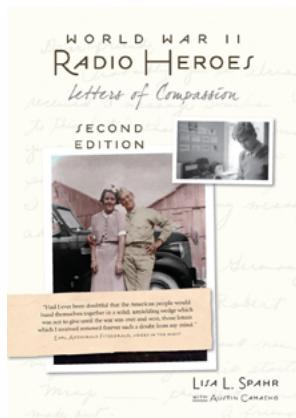
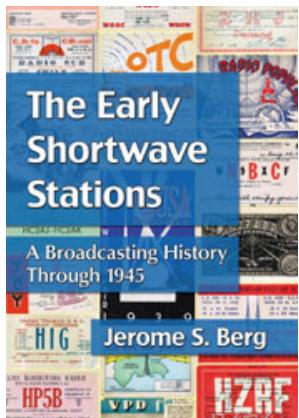
“We are crazy about radio, the same as everyone else,” Fisher said. “RETRO is NOWtro.” For complete details, visit: <http://www.73RadioRow.com> or write to: 73RadioRow@gmail.com. Call (951) 395-1923.

[Text and graphic courtesy of 73 Radio Row]

TSM

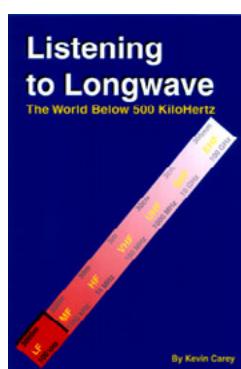
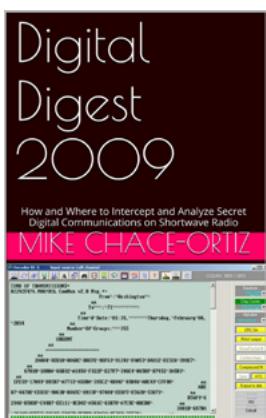
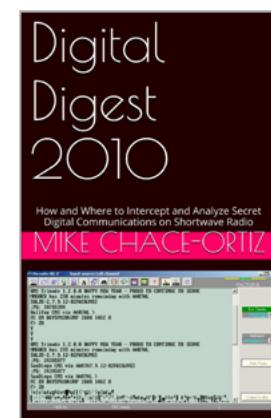
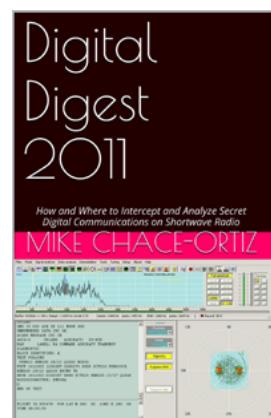
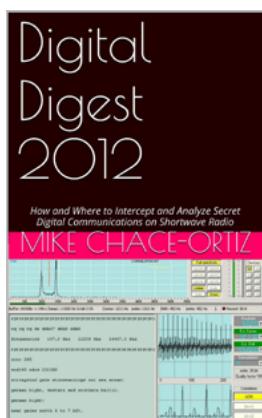
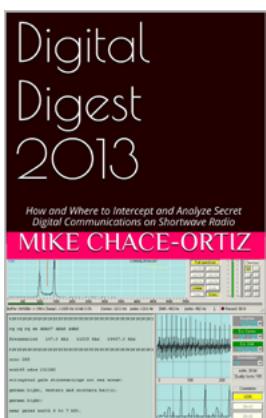
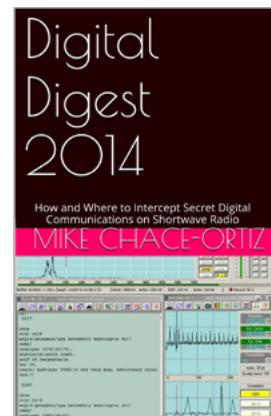
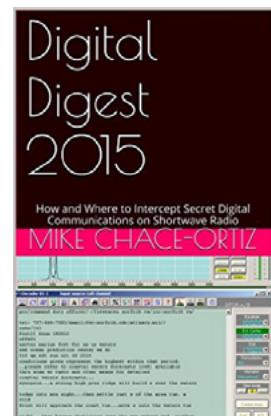
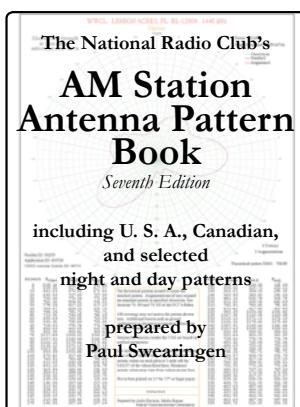
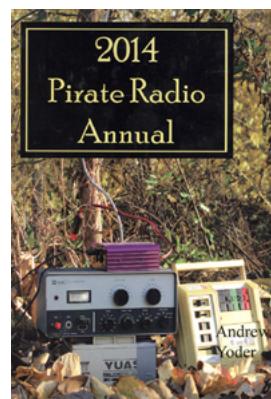
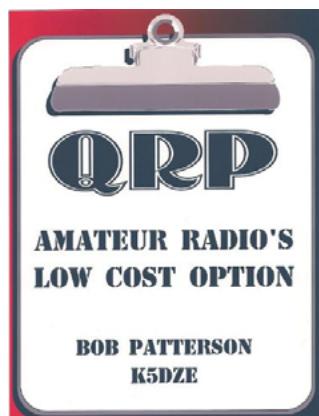
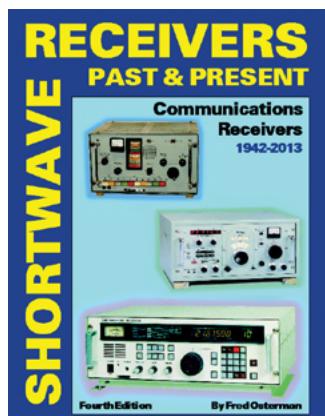
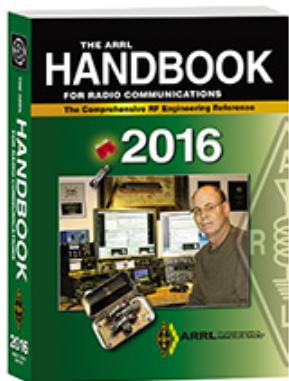
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ABOUT US

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*. 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.rogdabbit.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