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The Heathkit Legacy

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Monitoring Times

Vol. 32 No. 7 July 2013

The Heathkit Legacy 8

By Rich Post KB8TAD

This month's cover story is a look at the long history of the most successful high-end amateur radio kit company that spanned the greater part of the 20th Century. Longtime Heathkit collector and regular contributor to *Monitoring Times*, Rich Post KB8TAD, has been building and collecting Heathkit products since he was a teenager in the late 1950s.

Begun originally in the early 1920s as a kit-plane business, the Heath Company has enjoyed a varied life infused with a sense of quality that made Heathkit radio products extremely popular in the tube-era of the 1950s and 60s and which products are still heard on the air today in amazing quantities.

With the company motto, "We will not let you fail," ringing in their ears, many thousands of hams all over the world built Heathkit products that were always well designed with thorough construction documentation. The company kept pace with the technology of home electronics right into the era of the personal computer and included stereos, TV sets and even electronic organs among kits on offer.

Rich covers the rise and eventual fall of the company that set the standard for amateur radio products for at least one entire generation of hams.

On Our Cover

Heathkit's five generations of four-band, entry level, superhet sets plus one regenerative set as follows: Bottom left to right GR-91, GR-64, SW-717. Top left to right AR-3 and AR-2; extreme right on top is the GR-81, Heath's four-band regenerative set. (Photo courtesy: Rich Post KB8TAD)

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Designed for the monitoring or technical service professional, there are no interruptions in the AR6000's tuning range. With exceptional tuning accuracy and sensitivity throughout its tuning range, the AR6000 begins at the floor of the radio spectrum and continues up through microwave frequencies so it can be used for land-based or satellite communications. It works as a measuring receiver for those seeking a reliable frequency and signal strength standard. To support its broad spectrum, the AR6000 has two antenna ports, with the added capability of an optional remote antenna selector from the front panel of the receiver.

With its popular analog signal strength meter and large easy-to-read digital spectrum display, the AR6000 is destined to become the new choice of federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, lab technicians, news-gathering operations and security professionals.

Continuously amazing, the AR6000 professional grade receiver features:

- 40 kHz ~ 6 GHz coverage with no interruptions
- Multimode AM, FM, WFM, FM Stereo, USB, LSB and CW
- Tuning steps of 1 Hz up to 3.15 GHz; 2 Hz from 3.15 ~ 6 GHz
- Receiver is programmable and manageable through a USB computer interface
- Up to 2,000 alphanumeric memory channels
- Analog S-meter, large tuning dial, front panel power, volume & squelch controls
- Direct frequency input
- Fast Fourier Transform algorithms
- An SD memory card port can be used to store recorded audio
- Two selectable antenna input ports plus optional remote antenna selector

Add to the capabilities of the AR6000 with:

- Optional APCO-25 decoder
- Optional interface unit enables remote control via the internet
- Optional I/Q output port allows capture of up to 1 MHz onto a computer hard drive or external storage device

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Address:	7540 Highway 64 West, Brasstown, NC 28902-8079
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Subscription Questions?
belinda@grove-ent.com

Owners
Bob and Judy Grove
judy@grove-ent.com

Publisher
Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Managing Editor
Ken Reitz, KS4ZR
editor@monitoringtimes.com

Assistant and Reviews Editor
Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com

Editor Emeritus
Rachel Baughn, KE4OPD

Art Director
Bill Grove

Advertising Services
Larry Van Horn, N5FPW
(828) 837-9200
advertising@monitoringtimes.com

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You may contact any *MT* staff writer by email by combining their ***first and last name @ monitoringtimes.com.*** By postal mail, you may write them in care of *MT* Headquarters in Brasstown. Please enclose a self-adressed, stamped envelope if you wish the columnist to reply.

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to the editors

editor@monitoringtimes.com

This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!

Ken Reitz, Editor

Narrowbanding in Real-Life

MT "Below 500 kHz" columnist, Kevin O'Hern Carey WB2QMY writes:

"In the May *Communications* column, *MT* Publisher Bob Grove wrote a helpful piece on narrowbanding, including what it really means and who it affects. This kind of summary was much needed. I appreciated that someone finally clarified that only VHF-Hi and UHF services are affected. We still use VHF-Lo in my area for some fire communications, and some of these users have gotten nervous that they'll need to soon replace equipment for this part of the spectrum. Not true!

"I did have one question. At the end of your piece you state that narrowing the bandwidth results in a 3 dB reduction in signal strength which could affect long-range dependability. As radio people, we've become accustomed to hearing that narrow bandwidths actually promote *longer* communication ranges and more usable signals. In fact, in the same issue of *MT* on Page 12 ("The Original Digital Mode: Learning and Using Morse Code Today"), Kirk Kleinschmidt NT0Z makes this very point in his fifth paragraph where he compares SSB to CW. This has always been the conventional thinking on bandwidth *vs.* signal intelligibility.

"Locally, what I've noticed with monitoring narrowband signals on VHF-Hi, is that there is a reduction in *recovered audio*, but not in carrier strength. This makes sense with FM, as the audio level is directly coupled to the amount of spectrum being modulated. I wonder if what was actually meant was that there will be a reduction in the *audio* strength when listening to a narrowband signal on a receiver intended for wider bandwidths. This has been my experience, and it simply means turning the volume up slightly on my scanner. So far, I have not noticed any reduction in communication range for these stations."

Bob Grove W4JHD responds:

"I'm glad you liked the piece; there's so much misinformation out there and very little reception is being disturbed by the narrowbanding effort.

"I agree with your puzzlement about reduced receivability and that it is probably true that it's in the audio rather than RF. I haven't seen a clarification of this. And, like you, I know that narrower signal bandwidth allows narrower filters resulting in less background noise for audio recovery."

Protecting Local and Distant AM Signals

Kriss Larson KR6ISS writes:

"It seems the FCC is no longer interested in protecting out-of-town clear channel 50 kW stations from local nighttime interference anymore. Down here in Southern California, local Christian station KBRT, 740 kHz, with a transmitter out on Catalina Island, has always had to go off the air after sunset to clear out for 50 kW KCBS up in San Francisco. Because KCBS has to directionalize their signal at night to protect a Canadian station, they are particularly strong down here at night – since they are an all-news station, they're always a good source of what's happening in the Bay Area at night.

"Now recently, the FCC has given KBRT a low power license at night, which has the practical effect of creating a mish-mash of both stations on top of each other with lousy reception of either. If you have a good loop antenna, you may be able to null one or the other out, but in a car, it's just a mess.

"There is no way any local station down here can transmit on 740 kHz at night without KCBS taking them out. KCBS is so strong to the south at night, I was able to easily pull them in on Easter Island, laying in bed at my hotel with a portable radio, 4800 miles from San Francisco. (Easter Island is a great place to do AM band DXing, by the way; no local AM station)

"So, who in the FCC do I complain to about this? What was the FCC thinking?"

Doug Smith, *MT's* Broadcast Bandscan columnist, replies:

KBRT-740's Catalina Island license carried permission for nighttime operation at fairly low power (115 watts if I recall properly) for quite some time. I'm not entirely sure they used that low power. Given KCBS's monster signal, KBRT's night signal probably didn't reach the mainland! KBRT is a Class D station; as such, it's not "required" to operate at night.

Recently, KBRT moved onto the mainland. They did get an increase in night power to about 190 watts. I suspect the closer transmitter site is the more important reason for the stronger night signal at your location (again, I'm not entirely sure they were operating at night at all from Catalina Island).

There are four classes of AM station, in terms of nighttime interference protection. (All AM stations are protected from interference during the day)

Class A - The daytime "groundwave" coverage area is also protected at night. So is part of the "skywave" coverage area.

Class B - The daytime "groundwave" coverage area is also protected at night.

Class C - Class C stations operate on six specific frequencies which only host other Class C stations, all of which are licensed for the same power (1,000 watts). Class C stations use the same power and antenna day and night; it's assumed that, since they don't interfere with each other during the day, they also won't interfere with each other at night (this is not a valid assumption!).

Class D - Nighttime coverage is not protected at all.

KCBS is a Class B station. This means the area it covers during the day is also protected from interference at night. Of course, KCBS doesn't have any "daytime" coverage in Southern California. So, as long as KBRT's interference is confined to Southern California, the FCC doesn't care.

As for KCBS clobbering KBRT…KBRT is a Class D station, its nighttime signal is not protected at all, from KCBS or anything else.

None of that is much solace, but hopefully it at least explains what's going on.

Multi-mode Reception on Apple Portable Devices

Walter White asks:

"Are there any multimode-decoders, free or otherwise, that will run on Apple software or Apple hardware such as an iPad?"

Each year more programs are added to the fairly slim list of multi-mode decoders for the increasingly popular iPad. Currently there are apps for decoding CW, Packet, ACARS, HF Weather FAX, NAVTEX, PSK31, and SSTV. They are all made available here: ***http://www.blackcatsystems.com/ham_radio_iPhone_iPad_iPod_Apps.html***

When you click on any of the apps you'll be re-directed to Apple's iTunes store where each is available separately for $2.99. Most are for receive-only though that will probably change in the future. Right now only the SSTV app lets you transmit as well as receive.

Some similar apps are also available for Android devices though they are more expensive: DroidRTTY ($5.50), DroidSSTV ($7), DroidPSK ($5.50), Morse Decoder ($5) and CW Trainer ($3). One such Droid app creator is found here: ***https://play.google.com/store/apps/details?id=com.wolphi.sstv&feature=also_installed#?t=W251bGwsMSwxLDEwNCwiY29tLndvbHBoaS5zc3R2Il0.*** *A seemingly endless list of Android radio-related products is found here: https://play.google.com/store/search?q=amateur+radio&c=apps*

Readers may look forward to an article addressing the use of multi-mode decoders for portable devices in an upcoming issue of Monitoring Times. – Editor

Missing Shortwave Resources?

Richard Quintal writes:

Re: MTxtra Resource Guide, page 41 only provides web addresses for I-Z. Where's A-Z?

Because of the size, the MTXTRA Shortwave Broadcast Resource Guide is split into two pages. A-G appeared in the April issue, I-Z appeared in the May issue. A-G appeared again in the June issue, etc. The home pages for these stations don't change from month to month so by splitting them up we can have the full list six times per year without a lot of page-wasting duplication. – Editor

COMMUNICATIONS

by Ken Reitz KS4ZR

Communications is compiled and edited by Ken Reitz KS4ZR (kenreitz@monitoring-times.com) based on clippings and links provided by our readers. Many thanks to this month's fine reporters: Anonymous, Bob Grove, Norm Hill, Lynn Kelly, Steve Karnes, and Larry Van Horn.

Spire Set on WTC Replacement

MT contributor Kevin Parrish was at the ceremonial spire-topping May 10 at the new World Trade Center, known as "Freedom Tower." Here is his report:

"This was one of those extra special remote-broadcasts with memories that will last a lifetime for the entire *NBC News* crew involved in this historic assignment!

"Since the Freedom Tower is still under construction, I was given the task, as the *NBC News* engineer-in-charge, of providing all of the wireless (RF) infrastructure needed for Matt Lauer to broadcast from atop a construction tower crane on the building's north side. The entire live remote-broadcast was wireless!

"The producers of the *TODAY Show* requested multiple cameras on the roof of the Freedom Tower, from a building rooftop down below us in lower Manhattan and across the river at Liberty State Park in New Jersey. In addition, we also had a helicopter in the mix providing some spectacular aerials as the final spire of the Freedom Tower was raised and bolted in place, all wireless, all live, on *NBCs' TODAY Show*.

"For this *NBC* RF engineer it was no small task yet one of those once-in-a-lifetime assignments. After we finished and packed up all the equipment the entire crew was completely exhausted (I had had only 3 and a half hours sleep in two days). Here's a link if you would like to see the broadcast: **www.today.com/video/today/51839758#51839758**."

Boston Terror Media Fallout

The Boston Marathon bombings gave Americans a glimpse of the social monster created by the likes of Twitter and Facebook as official and unofficial investigators tried to get to the bottom of the terrorist incident.

In a rush to scoop each other, self-anointed cyber-deputies combed social media for fragments of news relating to the incident, true or false, that might boost their web presence. That drove conventional media to take shortcuts in order not to be scooped by the amateur sleuths. The result was a horrifying display of the breakdown of journalistic common sense.

With legitimate police agencies tweeting advice to the public and various individuals tweeting and re-tweeting what they thought they heard on their scanners, it wasn't long before truth became a casualty of the info-war.

According to *CNN*, Broadcastify, which streams some 3,500 scanner channels, had 180,000 listeners tuned in at once during the peak of the manhunt for the alleged Boston bombing perpetrators. Concerned police officials asked that such services not compromise the investigation, so, Broadcastify pulled the plug on Boston police scanning. But, no sooner had the plug been pulled then individuals put up their own on-line streams using their own scanners.

As events unfold police agencies around the country, when asked, trotted out the "officer safety" excuse for the inevitability of switching police transmissions to encrypted channels. This threat comes despite the fact that Broadcastify, for example, time-delays scanner transmissions by 30-90 seconds, prohibits transmission of tactical, SWAT, narcotics and fire investigation feeds, and the fact that there has never been a report of criminals actually using such streams to successfully avoid capture or actually endangering law enforcement officers.

New FCC Head: Former Industry Lobbyist

The White House announced May 1 the appointment of Tom Wheeler as the new chairman of the Federal Communications Commission, subject to Senate confirmation. Missing from the official announcement was the fact that Wheeler served as the president of the National Cable Television Association (NCTA), CEO of the Cellular Telecommunications and Internet Association (CTIA), both of which are the largest lobbying groups in their respective industries. He is currently an executive with the D.C.-based Core Capital Partners, a venture capital firm managing $350 million in private equity relating to wireless applications in industry.

During the 2011-12 election cycle the communications industry, which includes cable-TV, satellite TV and the mobile wireless industry, contributed more than $200 million to the campaigns of the Democratic and Republican parties. Overall the communications/electronics sector gave President Obama $20.7 million while Mitt Romney received $7.5 million, according to the Center for Responsive Politics.

Time magazine, citing the Center for Responsive Politics noted that Wheeler had also been a fund-raiser for President Obama in the last two presidential elections, bringing together more than $700,000 in the two campaigns combined. The *Time* article also noted that outgoing FCC Chairman Julius Genachowski had also been a major campaign fund bundler for the president.

Cable and OTA Fight

In early May, Arizona Senator John McCain introduced the "Television Consumer Freedom Act," in the U.S. Senate aimed at unbundling cable-TV channels and allowing customers to select channels they want to pay for on an "a la carte" basis. The measure has traditionally been opposed by cable interests who insist that the old tier-system offers "better value than per-channel options." DISH Network founder and billionaire Charlie Ergen, who claims to be in favor of a la carte pricing, told one news outlet that there were a number of "big groups" that would have enough influence to see that such legislation goes nowhere. A la carte pricing schemes, normally supported by consumer advocacy groups, have been floated for decades but never seem to get traction.

A lesser known part of McCain's bill would strip operating licenses from Over-the-Air (OTA) stations that would offer their programming locally only to cable-TV subscribers. The provision came on the heels of threats made by the Fox-TV network to make such a move in order to combat on-line streaming newcomer Aereo from rolling out its on-line OTA subscription service to new cities.

Aereo, which began in New York City and later became available in Boston, debuted in Atlanta at the end of June. The company announced at the January Consumer Electronics Show in Las Vegas that it would expand the service to include 22 U.S. cities this year alone including Boston, Miami, Austin, Chicago, Dallas, Houston, Washington, D.C., Baltimore, Detroit, Denver, Minneapolis, Philadelphia, Pittsburgh, Tampa, Cleveland, Kansas City, Raleigh-Durham, Salt Lake City, Birmingham, Providence, and Madison, Wisconsin.

As stated in their January press release, "Aereo's innovative technology enables consumers to access live broadcast television on compatible Internet connected devices, at home or on the go. Aereo's innovative remote antenna/DVR technology makes watching television simple. Using Aereo's technology, consumers can pause, rewind and fast forward any program that they are watching live, or save a program for future viewing, just as you can with a home DVR." Service plans begin at $1/day, $8/month or $80/year, according to the company.

As soon as the service debuted in New York City, broadcast interests cried foul and sued to nip the "innovative technology" in the bud, but lost their case in federal court. On April 1 (no joke) the Second Circuit Court of Appeals again sided with Aereo, ruling against the consortium of 17 network broadcasters for a preliminary injunction against Aereo and its service. According to the company, Aereo works on 'smart' devices from tablets to phones to laptop computers and is currently supported on iPad, iPhone, iPod Touch, Chrome, Internet Explorer 9, Firefox, Safari, Opera, AppleTV (via airplay) and Roku devices.

The Heathkit Legacy

By Rich Post KB8TAD
(All photos courtesy of the author)

The on-line auction of bank-seized assets of the Heathkit Educational Services Company brought a note of sadness to me during August of last year. With waning sales of its educational materials, Heathkit had tried to restart just a bit of the kit business that the company had been known for, but failed when funds ran out.

Like so many experimenters and builders of Heathkit products over the years, I fondly remember my first Heathkit. For me, it was an AR-3 Communications Receiver. In 1959 I was in the eighth grade and saving my hard-earned paper-route money to buy an electric train. But, after seeing an AR-3 in a Heathkit ad in *Popular Electronics*, I changed my mind. I wanted to build a shortwave radio. I looked at the offerings of Allied Radio with their somewhat cheaper regenerative kits but that AR-3 was a superhet that covered broadcast and three shortwave bands. It sported bandspread and a real BFO (Beat Frequency Oscillator). So, with a money order for $29.95, I ordered the kit.

I already had most of the needed tools; a wire stripper, screwdrivers, a 75 watt Lenk soldering iron and a roll of rosin-core solder. The package from Heath arrived about 10 days later. I carefully sorted all screws, resistors and capacitors, and an assortment of small parts in several egg cartons and the side of a corrugated box, checking the parts list carefully to make sure I had everything.

My parents, who knew very little about radios or electronics, saw the myriad parts and told themselves that their kid would never be able to complete the radio. As wise parents, they did not tell me that until much later.

I posted the large Heathkit chassis diagrams on the wall of my room and started the assembly process. Heath's manual was a marvel of simplicity. I dutifully checked off each step as it was completed and gradually the set began to take shape. I took my time with the kit, spending over two weeks worth of evenings on the construction and, at last, the chassis was complete.

With a combination of excitement and apprehension, I plugged the set into the power outlet and waited for the tubes to warm up. The two pilot lights lit up nicely and the tubes glowed but no sound came from the speaker. What I had not realized when ordering the set was that a superhet needed alignment. The manual made that very clear and I assumed that the lack of alignment was the reason it did not work right away.

I had my parents drive me to a nearby town to the hams at Wilson's Electric Service. I asked if one of the hams could align the set for me. I would be happy to pay them. Several weeks went by before they finally called and said to pick up the set. Not only had the hams aligned the set, but they found the location near the volume control where I had squeezed the spiral shield a bit too much, shorting out the audio signal. They refused my offer of payment. I learned that such willingness to help a budding radio enthusiast was typical for hams. They were also very familiar with Heathkits.

For Christmas that year, my parents gave me the $4.95 for the matching cabinet. They were not only surprised that their kid was able to complete the set but were amazed that the radio could pick up the BBC, Radio Netherlands, France and other overseas stations. I overheard them brag to their friends about what their kid had built.

I became a shortwave listener with that radio. I also read and re-read Heathkit's excellent explanation of how the radio worked. Reading that manual was almost like taking a course in radio. It helped me to understand the workings of a superheterodyne circuit. I learned to read schematics, to trace signals, and to do voltage measurements to the point where, with the help of an RCA tube manual, I was soon able to recognize which tube was associated with what function and could repair radios. That first Heathkit quickly led to building the matching QF-1 Q-multiplier followed by an SG-8 signal generator, both of which worked perfectly when completed. Each kit added to my radio knowledge.

Heathkit's manuals were second to none in kit building. The thoroughness of the instructions and detail of the illustrations and explanations were part of Heath's uniqueness that underscored their motto: "We will not let you fail."

Benton Harbor "lunchbox" transceiver series for 2, 6, and 10 meters.

It Started with an Airplane

It all began with Edward Heath who bought a small company in 1912 that sold airplane parts. After World War I, as the Heath Airplane Company, he sold surplus aircraft and parts and offered flying instruction. He was a successful light-plane racing pilot, having won at the National Air Races in his "Baby Bullet" airplane.(1)

By 1926, Heath sold an airplane kit; everything from just blueprints to all the parts and pieces to build his "Parasol"(2), a single-seater monoplane so-named because the center of the airplane wing was located above the pilot. Heath's small company had an excellent reputation, but he died in an airplane crash during a test flight for a new design on February 1, 1931. The business was carried on by another pilot who changed the name but went bankrupt several years later.

Howard Anthony bought the company in 1935 at bankruptcy sale, reportedly with $300; his wife's life savings. Anthony had built and flown his own airplane at the age of 12. In 1932-35, he had operated a radio sales, service and custom design shop.(3) But 1935 was the height of the Great Depression and Anthony and his wife struggled to make ends meet at their airplane business for the first few years. However, the company soon built a following in private aviation circles for light plane parts such as a steerable tail wheel, Plexiglas windshields, snow skis, and an inspection port. (4)

Anthony had changed the name back to the Heath Company because of the reputation the company enjoyed, offering excellent products at reasonable prices. He kept that reputation.

The first electronic device he sold was not a kit but a low-cost aircraft radio receiver designed at his direction by Meissner. Costing less than one-third of the comparable RCA product, it was battery operated and did not require a specific aircraft electrical system. He followed that up with a low-cost, directional antenna. Anthony's genius was not only knowing the needs of his customers but designing systems that did the job at a lower cost. For example, directional loop antennas of the time used a relatively expensive slip-ring contact. Anthony simply used a very flexible lead to avoid that cost.

During World War II Anthony secured several government contracts such as skids for military cargo gliders and spotter plane windshields of molded Plexiglas. In the Spring of 1946 with the end of those war contracts, Anthony's work force dropped from 125 to 8. He had to make a change. At first he bought quantities of government surplus electronic parts and assemblies, selling those directly. His first two ads in "Radio News" in August 1947 still show airplanes as part of the Heath Company logo. The ads include a Navy ARB receiver and a Collins Autotune transmitter as well as oil condensers and other parts. Other ads include ARC-5 "Command" receivers and transmitters for which Heath offered power supply kits.

As a do-it-yourselfer, Anthony had built personal test equipment earlier in his career because commercial models were too expensive for him. The oscilloscope and its principles of operation fascinated him. An article appeared in the October 1946 *Radio News* by Lyman E. Greenlee titled "Build This 5 inch Cathode Ray Oscilloscope." Greenlee noted that with government surplus parts, the scope could be built for about $35. However, the parts had to be located, the chassis needed to be laid out and drilled, and a front panel needed to be made, all of which complicated making a homebrew scope.

Anthony saw an opportunity. With a large purchase of surplus 5BP1 cathode-ray oscilloscope tubes and a quantity of surplus scope transformers, he decided to offer a complete oscilloscope kit. His first run was for 100 kits which he advertised along with his regular surplus items in an ad in the November 1947 *Radio News*. Price of the kit was $39.50. It was a close copy of the Greenlee schematic, but the Heath scope was a complete kit with a machined bezel, a silk screened panel and none of the homebrew look. The ad noted, "This makes an excellent training course."

The scope proved to be successful well beyond Anthony's expectations, launching Heath in the electronic kit business. Other test equipment kits quickly followed. A vacuum tube voltmeter (VTVM) was introduced in the December ad at $24.50, the G-1 RF signal generator in the January 1948 ad at $19.50, and in the March ad, the C-1 resistor/ capacitor tester and T-1 signal tracer, also at $19.50.

In each case, Anthony found ways to make equipment cheaper and accompanied them with instructions that allowed the builder to easily calibrate the devices without specialized equipment. As an example, all of my Heathkit VTVMs have a small red dot to the right of the 1.5 volt base scale. That dot is the calibration mark for voltage when measuring a new carbon-zinc "C" cell used for the VTVM ohms function. The voltage was normally expected to be 1.55 volts. Using such a simple calibration scheme, the VTVM would be close enough to its typical 3% precision. Builders with access to meters of greater precision could recalibrate as needed. Even for the last series of Heathkit's resistor/ capacitor tester kits, the IT-11 and the IT-28, calibration was simplified by using a couple of extra resistors supplied with the kit. Instructions were also provided for those with access to more elaborate equipment and standards.

All five generations of entry level, four-band, communications receivers.

Heathkit test equipment construction appealed not only to the typical radio/TV repair shops that blossomed along with television after WWII but also to hobbyists from all walks of life. What quickly set Heath apart was the detail and step-by-step instructions in the construction manuals. The "We will not let you fail!" motto started early as an attitude that forged the company's success and can be traced right back to Anthony, a man known for his integrity.

Bjorn Heyning, (4) whose career covered much of the heyday of Heath as an electronics kit manufacturer, provided a set of first-hand stories that encompassed a great deal of the early history. He noted that "any inquiry or letter got a prompt reply." He quoted one early letter from a physician who had purchased the scope kit, "Saw your Scope ad, sent the order and in 3 days I got the kit. Fine! Checked the parts against the parts list and they were all there! Mounted the parts and they all fit! Wired it up and tried it out. It does all you said it should! Marvelous! What do I do with it now? ... Please send me your next kit." It was the start of Heathkit developing a loyal, almost evangelistic following of kit builders. Heathkit offered an audio amplifier, a radio kit, and a ham transmitter in 1948 but the test equipment line proved the most successful in the early years.

The 1954 Heathkit catalog lists 48 kits. A two-chassis Williamson hi-fi amp kit was offered with either an Altec-Lansing or Acrosound output transformer, both still prized today. Heathkit was developing the O-10 oscilloscope that could be used with the color burst frequency of 3.58 MHz. A less capable oscilloscope, the OM-1, was still priced at $39.50. Nearly 100,000 oscilloscope kits had been sold.

Heath was so successful that Anthony was in the market for a new twin-engine pressurized company airplane, a DeHavilland Dove. On July 23, 1954, on a demonstration flight to Florida with a professional pilot and Anthony and four others as passengers, they encountered severe weather over Tennessee. The plane crashed

G-1, C-1 and T-2 make up the Heath 1948-49 test bench.

with no survivors. Speculation for the cause of the crash was possible severe air turbulence.

Corporate Ownership Begins

The death of Howard Anthony left his very capable wife Helen, who had handled the finances for Heathkit, devastated but determined to sell Heathkit to a company that would keep the current employees and the Benton Harbor location. This again reflected the integrity of the Anthonys. The purchaser was Daystrom, a manufacturer diversifying into military electronics and technology.

On February 1, 1955, ironically the 24th anniversary of the day that took the life of Edward Heath, Helen Anthony and Thomas Roy Jones, the President of Daystrom each wrote letters to Heathkit customers announcing that Heathkit was now a subsidiary of Daystrom. Jones wrote,

"Yesterday was indeed an important day for Daystrom as well as Heath. Since I have been using Heathkits in my own basement workshop at home for years, you can well imagine how enthusiastic I am about this acquisition. You have, I am sure, appreciated the high standards set by Howard Anthony, not only for the products which he distributed but for the service and personalized attention which every order and letter received.... We shall join our material and engineering resources with those of Heath to develop still finer kits, and thus still better instruments for universities, engineering schools, industrial laboratories, radio and TV service men and hobbyists. The amateur radio kits which will make their appearance soon should rate cheers from you Hams. Along with you hi-fi fans, I am looking forward to even better amplifiers, tuners, and other phonographic gear."

Daystrom reportedly recovered their investment in just a matter of months. In 1958, a larger plant was built in nearby St. Joseph. Daystrom was in turn acquired by Schlumberger Limited, an oil field services company in 1961. Schlumberger had pioneered oil field quality measurements using electrical resistive techniques. The kit business thrived under both parent corporations. The years from 1955 to 1979 were some of the most successful for Heathkit with millions of kits produced.

Heathkit MR18 Mariner, introduced in 1970 at $125.

In addition to test equipment and hi-fi offerings that paralleled the growth in electronics, ham radio kits became a major product line. Kits became increasingly more complex, again in parallel with ham radio equipment generally. The early Heathkit AT-1 transmitter quickly gave way to the DX series including the DX-20, 35, 40, and 100. Then came the green tribal name series of big box single sideband and VHF offerings as separate receivers and transmitters.

Heath's most popular ham product line was an inexpensive transceiver quickly dubbed the "Benton Harbor lunchbox." The cabinet was the same size as my SG-8 signal generator. Versions were produced for the 2, 6, and 10 meter ham bands as well the Citizen's Band, the CB-1. Each was an inexpensive and relatively simple crystal-controlled transmitter and super-regenerative receiver. The Heathkit "Cantenna" also sold well. It was a simple but ingenious design of a resistive dummy-load in an oil-filled gallon paint can.

Several single band transceivers were produced for both HF and VHF. After Collins introduced its excellent, but expensive, KWM-2 transceiver for the 80 to 10 meter HF bands, Heath introduced the SB-100. The SB series of sets were quickly dubbed by hams as "the poor man's Collins."

Low cost radio receiver kits were also sold. The AR-1, Heath's first shortwave superhet had three bands but no BFO or bandspread. Heath then developed the four-band AR-2 with BFO and bandspread. It appealed to shortwave listeners and Novice amateurs. This was followed by the AR-3, GR-91, GR-64, and finally the SW-717 to make five successive generations of Heathkit four band receivers. For a complete compendium of Heath's ham radio kits, see Chuck Penson's "Heathkit, A Guide to Amateur Radio Products."(5)

The 1967 catalog back page lists 43 "Famous Heathkit Firsts" such as "First electronic guitar kits," "First electronic kit manufacturer to own patents on new circuits, (e.g. scope sweep circuit)," and, "First and only impedance bridge and Q-meter test instrument kits."

During the corporate ownership years, Heath continued to introduce diverse kits for the consumer market, from direction finders to depth finders to fish finders, an analog computer, color TV sets, including "The World's First (and only) Programmable Color TV," the Hero robots; a small off-road motorcycle called the "booney bike," Heathkit/Thomas electronic organs, metal locators, the "most accurate clock," radio control (R/C) model planes and systems, engine timing lights, auto ignition analyzers, garage door openers, programmable thermostats, audio components such as the "Pro-Series" audio system; 4-channel audio scopes; synthesized hi-fi receivers; an electronic air cleaner; the "SmartHome" computer-based X-10 controller, several weather stations, and a projection TV "home theatre."

Heath manuals and catalogs

Heathkits were popular as a low-cost equipment option for schools and colleges. Heath introduced several series of purpose-built education kits. Malmstadt and Enke's book, "Electronics for Scientists,"(6) details a number of the EUW series which are also shown in the 1967 catalog. Heath also supplied its color TV and other kits under the name of correspondence schools such as NRI (National Radio Institute). Heath also published an electronics reference library and began offering direct, self-instructional courses in electronics, computers and related areas for continuing education credits (CEUs).

The 1955 catalog lists 53 kits. The 1967 catalog has 181 and the Summer 1977 has 288. Heath also opened Heathkit Electronic Centers. The Summer 1977 catalog lists 47 stores coast-to-coast, noting that they are "units of Schlumberger Products Corporation." The Winter 1979 catalog lists 54 stores. The stores allowed customers to see the Heathkit products directly although the prices were slightly higher than mail-order. The Christmas 1977 catalog opens with: "Presenting Heathkit Personal Computers; the new value standard in personal computing systems featuring two powerful computers with exclusive Heath-designed software plus full documentation and service support."

Those two computers were the H-8 and H-11. The pages also show the H-9, a

Heathkit Mohican from 1961-68 costing $110 ($194 assembled).

video terminal and the H-10, a paper tape reader/ punch.

The Fall 1979 catalog introduced the H-88 and 89 "All-in-One" computer comparing its price and features to the Pet, Apple, and the Radio Shack TRS-80. More peripherals and interface cards and software were introduced. It was the success of the Heathkit Data Systems computers that caught the eye of the Zenith Radio Company which purchased Heath from Schlumberger in 1979. Zenith renamed the computer division as Zenith Data Systems. During this era, Zenith also changed its name to Zenith Electronics Corporation.

The 1980 catalog lists the 54 Heathkit Electronic Centers as "units of Veritechnology Corporation," another name change. Zenith was mainly interested in Heathkit's computer division and gave short shrift to the kit business. Heath's kit sales steadily declined after 1981. In the 40th anniversary 1987 catalog, I counted 221 kits with some of those being modules for other kits. That catalog also includes a larger proportion of assembled products not available as kits, a trend that would continue in the next several years.

Apparently Zenith's television and computer sales declined as well. Because of major reverses in its finances and changes in the personal computer business, Zenith sold Heath, Zenith Data Systems and Veritechnology with its 56 Heath/Zenith Business Centers, to Groupe Bull, a French state-owned computer maker in 1989.(7)

The 1990 Holiday catalog lists 79 kits including instructional trainers. Some of the newer kits were small low-cost units such as a piezo-electric Magical Film Speaker, "Amaze your family and friends with a Mylar balloon, a mirror or a picture on the wall that talks and plays music." A pull-out section for assembled home automation devices was included in the catalog. The two oscilloscopes in the catalog were not kits. The end of kits was clearly in sight.

The end of Heath in the kit business came in 1992.(8) The company continued in business as Heathkit Educational Systems (HES) selling its excellent self-instructional courses to schools and corporations. Some educational trainer kits were included as part of the course offerings. Eventually even the educational market dried up. In 2011, HES introduced a couple of new kits to capitalize on the growing nostalgia interest in Heathkits, the GPA-100 Garage parking Assistant and a Wireless Swimming Pool Monitor. Unfortunately the offerings were too little and too late with HES closing its doors in bankruptcy by August, 2012.

So, What Ended the Kit Market for Heath?

Despite the timing, which coincides with the ownership of Heathkit by Zenith, the trend was already clear. Heathkit market studies indicated that its loyal following of kit builders was growing older and less interested in the kits of their youth. Interest was shifting to computers. The kits themselves became more expensive compared to similar finished products built with robotic manufacturing techniques. The advent of large-scale integrated circuits and miniaturization of components, surface-mount soldering, and the expense of increasingly complex manuals with fewer options for simple testing and calibration procedures, added to kit-building difficulty and expense. Whole assemblies had to be factory built, aligned and tested as part of the kits.

Complete Heathkit SB101 station. Left to right bottom: SB-101 transceiver, SB-600 speaker (with HP-23B power supply inside) and SB-610 Signal Monitor. On top from left HM-102 RF power meter and HM-15 SWR meter. The official name of the HM-15 as printed on the front panel is "reflected power meter" but most hams simply call it an SWR meter. Foreground HDP-21A mike.

Some of the last Heath color TV kits were variations of Zenith System 3 TV sets using pre-assembled standard plug-in circuit modules. Only one circuit module needed to be built. The kit version included a built-in, cross-hatch generator. In comparing a Heathkit version with a comparable Zenith, I noticed an added isolation transformer in the kit version for safety. However, the kit cost more than the comparable manufactured TV. There was no savings and some of the hands-on satisfaction of kit building was lost.

14 year-old Rich Post with his Heathkit AR-3

The Continuing Appeal

Very few ham radio operators have the skills or the tools to repair today's sophisticated transceivers. Even though excellent kits are still offered by smaller companies such as Elecraft, TenTec and Ramsey, Heathkits of the past remain popular because they can be readily repaired and the learning about electronics theory and circuitry that drew so many of us to those kits is still a major draw. Re-kitting by taking apart a poorly built Heathkit and/ or testing and replacing parts as needed is an increasingly popular option.

The last Heathkit I built was an IM-4100 frequency counter. I still use it as well as that unique Heathkit plastic nut starter that came with many of the kits. And I'm still proud of that little AR-3 receiver that began it all for me. Every time I see a piece of Heathkit gear, I want to study how it works, to restore it if needed and to use it. Building new Heathkits is no longer possible, but the satisfaction of repairing and knowing that the functions and circuits can be understood is the continuing appeal of Heathkits.

The late Steve Jobs, in an April 1995 interview with *Computerworld* magazine (9), related that as a child, a ham neighbor had introduced him to Heathkits. Jobs is quoted, "looking at a television set you would think that 'I haven't built one of those but I could. There's one of those in the Heathkit catalog and I've built two other Heathkits so I could build that.' ... It gave a tremendous level of self-confidence, that through exploration and learning one could understand seemingly very complex things in one's environment."

And that's the Heathkit legacy. It gave those who built the kits the self-confidence that with small cumulative steps, they could build a plane, they could build an electronics product, they could learn a subject that had seemed impossible, they could succeed. Heathkit wouldn't let us fail. Steve continued, "My childhood was very fortunate in that way." Mine too, Steve. Thank you, helpful hams and Heathkit. Long live the legacy.

Rich Post's previous feature article, "60 Years of Lafayette Radio," was the cover story for the December 2012 issue. "The Lafayette Surprise: Political Intrigue and Radio," a follow-up article, appeared in the April 2013 issue. His web site is: ***www.ohio.edu/people/postr/bapix****.*

Notes:

(1) Heath and his "Baby Bullet" racing plane are pictured at **www.air-racing-history.com/aircraft/Heath%20Baby%20Bullet.htm**

(2) For more on Edward Heath with pictures of the Parasol, see the "Heath Story" at **www.jimforeman.com/Stories/heath.htm**

(3) Reported in "Mr. Heathkit,", a two-page tribute to Anthony in the Heathkit 1955 catalog.

(4) Heyning's original stories as well as some he collected from colleagues and other sources are online at Bill Wilkinson's excellent Heath Company webpage at **http://ww_heco.home.mindspring.com**

(5) "Heathkit: A Guide to the Amateur Radio Products," 2nd edition, by Chuck Penson WA7ZZE, CQ Publications

(6) "Electronics for Scientists: Principles and Experiments," H. V. Malmstadt and C. G. Enke, W. A. Benjamin, Inc., New York, 1962.

(7)(8) New York Times business section 1/16/1991 and 3/30/1992

(9) More of the Steve Jobs interview can be found at: **www.computerworld.com/s/article/9220609/Steve_Jobs_interview_One_on_one_in_1995**

The Fleet Is In: Angling for Radio Buoys

By Mario Filippi N2HUN

If this were 30 years ago when the United States AM broadcasting band ended at 1600 kHz, and you happened to be tuning your shortwave radio between 1600 and 1799 kHz, an array of interesting transmissions could be heard such as analog cordless phones, Decca Hi Fixradio navigation, Cubic Argo, the Caribbean Beacon from Anguilla, and TIS (Traveler's Information Stations). In later years the AM band was expanded to 1700 kHz, leaving a segment of the spectrum spanning 1700 – 1799 kHz where for the most part little was known.

Decca Hi-Fix, Cubic Argo, the Caribbean Beacon from Anguilla and cordless phones are long gone from these frequencies, but it's in this region and beyond where you'll find radio buoys, those low powered (three to eight watts) floating transmitters that commercial fisherman use to locate their nets and increase the efficiency of their catches. They are also referred to as "fishnet beacons" or "driftnet beacons" that are powered by a 24 volt dry cell battery and are complete, self-contained, transmitting stations that bob and float in the briny waters of the world's oceans.

I first discovered these beacons on shortwave on a winter's night two years ago after hearing one of them identifying in Morse code but having no clue as to what they were. They are low powered transmitters with unique call signs, sent in Morse code, that can be heard sporadically and require a quick wrist and lots of patience to find.

The purpose of this article is to introduce the shortwave listener to these interesting QRP beacons whose one way messages by nature are not designed to be heard by a large audience but have the simple purpose of allowing fisherman to home in on their nets. Due to their low power and potential long range propagation, they are an interesting addition to the shortwave utility listener's agenda.

Characteristics of Radio Buoy Transmissions

Radio buoys transmit their call signs in flawless CW, usually three times in a row, but some send their call as many as five times. My estimate of the code speed is about seven to thirteen words per minute. Most will send a dash of varying lengths after their call sign, followed by a silent period of four to six minutes. So, if you hear one on a particular frequency, just sit tight and wait; you'll hear it repeat. You may even hear two or more beacons on the same frequency.

KTUS Sel-Call buoy. (Courtesy: Blue Ocean Tackle)

Start by listening on 1700 kHz and move up and down the band until one is heard. Now, interestingly, these beacons have been heard even on the 160 meter amateur band, some sending out their CW signals right next to SSB QSOs by ham operators!

Table One is a list of radio buoys heard at my location (about 40 miles from the New Jersey shore) over the past two years. Note that all were logged late at night during the cold months as band conditions were optimal at those times. Lack of atmospheric noise during the cold months makes reception much easier. A set of good headphones to block out ambient noise is recommended as the signal strength of these pea-whistle transmitters is minimal and signal fade (QSB) does occur.

The beacons in the log to the right were received using a modest station consisting of a Ten Tec RX-320D receiver ($383) fed by a S9v43 ground-mounted vertical antenna ($200) from LDG Electronics with 53 radials buried below ground, some as long as 90 feet. The Ten Tec RX-320D is a computer controlled receiver with a great memory option, allowing me to store any frequencies on which radio buoys were heard.

Making Sense of Call Signs and Locations

Unlike amateur radio licensing, little is known about call sign assignment for individual beacon stations. Perhaps they are selected and programmed by the manufacturer or the end user. Lacking that information, one cannot determine the locations of these beacons or whether the reception is via ground or sky wave. Since these have not been heard by the author during daylight hours, it is assumed that we are looking at sky wave propagation, akin to the AM broadcast band and the 160 meter ham band, which tends to open up at night with ranges of a few hundred miles to even thousands of miles.

N2HUN RADIO BUOYS LOG

Call sign	Freq (KHz)	Date	Time	Comments
4KHD	1726	11/30/11	0200	
4QEL	1721	11/30/11	0203	
KW212	1728	11/30/11	0205	
4XWO	1770	12/31/11	0255	
94W224	1728	2/7/12	0118	
FO74	1714	2/7/12	0120	
4ONH	1726	10/03/12	0354	
KW212	1726	10/03/12	0352	
4OXI	1791	10/03/12	0358	
PO3	1801	10/03/12	0359	
4PDU	1752	10/03/12	0401	
VA1	1785	10/03/12	0405	
4PPJ	1785	10/03/12	0405	
4KPU	1723	10/03/12	0408	
ZC0	1723	10/03/12	0410	
4POF	1709	10/03/12	0416	
CE9	1779	10/03/12	0418	Chirpy CW
4ORE	1779	10/03/12	0418	
4ORU	1779	10/03/12	0423	
4QSY	1797	10/04/12	0304	
4QSS	1787	10/04/12	0313	
4KLU	1787	10/04/12	0317	
4OSD	1801	10/14/12	0327	
5AIP	1975	3/30/13	0300	ID (identifies) every four minutes
QM56	1994	3/31/13	0215	ID every four minutes
CW89	1993	3/31/13	0216	
AKL5	1964	3/31/13	0217	ID every four minutes
4OMO	1982	3/31/13	0217	ID every five minutes. Chirpy, raspy CW.
AX6	1990	3/31/13	0218	
EP51	1959	3/31/13	0223	
AGI4	1981	3/31/13	0227	
4G22	1924	3/31/13	0238	
4MVZ	1882	3/31/13	0231	
4LHT	1909	3/31/13	0234	
4LDA	1878	3/31/13	0235	
DN8	1924	4/17/13	0308	ID every four minutes
4PEL	1953	4/17/13	0327	ID every four minutes
GJ0	1950	4/17/13	0335	ID every five minutes
FD1	1969	4/17/13	0337	ID every four minutes
VJS4	1952	4/17/13	0345	ID every five minutes
CF4	1964	4/17/13	0348	ID every four minutes
JV3	1930	4/17/13	0359	ID every six minutes
CU8	1939	4/17/13	0408	ID every four minutes
OG0E	1885	4/18/13	0151	ID every five minutes
4QEC	1859	4/22/13	0237	ID every four minutes
JV1	2001	4/22/13	0253	ID continuously, followed by three second dash
94W125	1758	4/29/13	0219	ID every four minutes
AFJ0	1970	4/29/13	0230	ID every four minutes
ALU2	1977	4/29/13	0231	ID every four minutes
4HAE	1977	4/29/13	0231	ID every five minutes
GC6	1970	4/29/13	0234	ID every four minutes
ES4G	1970	4/29/13	0242	ID every three minutes
AGA4	1965	4/29/13	0250	
4FCP	1939	4/29/13	0251	
APT4	1937	4/29/13	0252	
ALT9	1937	4/29/13	0253	
4OIU	1932	4/29/13	0256	
4DQX	1997	4/29/13	0259	

Resources for Radio Buoys

There are excellent resources for data mining on this interesting subject which range from Yahoo groups to beacon manufacturers and websites devoted to the subject. Some include actual loggings, similar to the table above. An excellent site to begin with can be found at **www.genesisradio.com.au/VK2DX/fishnet.html** by VK2DX. Other sites to check are **www.hfunderground.com/wiki/Fishnet_beacon** along with **www.w8ji.com/ndb%20beacon%20fish%20buoy%20net%20beacons.**htm.

Interestingly, one manufacturer states the working range of their buoy is 260 miles, while others quote a range of 30 – 90 miles, quite a feat with such low output and short antenna, but as we hams know, CW will always get through!

2013 Winter SWL Fest

By Thomas Witherspoon K4SWL

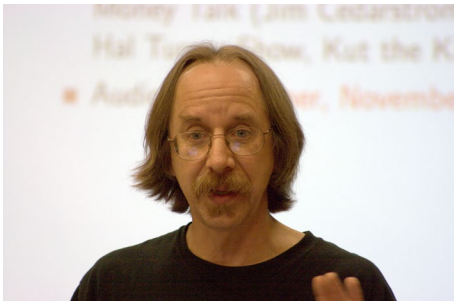
Every year I look forward to the only event I know that brings together both my avid interest in radio *and* my loyal radio-listening friends: the Winter SWL Fest, sometimes just called Winterfest. This is the one place where, among the 100-plus attendees, you can talk freely about all aspects of the shortwave hobby without any need of explanation as to why you find radio so fascinating. As a result, over the course of the five years I've attended the 'Fest, it has begun to feel less like a technical hobbyists convention and more like a (most enjoyable) family reunion.

This year, and for the third year in a row, the Winterfest was held at the DoubleTree Inn and Suites in Plymouth Meeting, Pennsylvania, just outside Philadelphia. The venue is spacious and comfortable, and all presentations are held within its generous environs.

Moreover, we enjoyed presentations on a number of interesting topics that were by no means limited just to shortwave radio. A few topics catered to individuals who simply enjoy DXing in any form. Here's a sampling:

Ed Mauger started the forums off on a light note with a fun discussion on how to increase the size of your radio collection through online auctions and flea markets. His forum drew a large crowd and many questions.

Larry Wills, of WBCQ's *Area 51* fame, held the second forum, which was a look back through the WBCQ video and audio archives. During the course of his presentation, Larry covered many of the nuances of WBCQ's history, including some of the people and circumstances surrounding the birth of this remarkable free speech radio station. Trust me when I say that it was not difficult to keep the audience engaged on this topic: WBCQ listeners are well aware of the variety of shows, not to mention the on-air personalities, that station features. Larry's presentation put these in context. By the conclusion, I felt I had visited the WBCQ transmitter site in Monticello, Maine, myself.



Larry Will of WBCQ/Area 51, presenting a history and virtual tour of WBCQ shortwave.

Mario Filippi's forum, *DXing with a Dish*, explained the hobby of TV DXing; Free-To-Air (FTA) satellite television and radio. His presentation was comprehensive, covering everything from the components of a home system to the free content currently available.

And, speaking of satellites, Dave Marthouse's forum, *Sounds from Space: Monitoring and Tracking Satellites Using HF,* taught us how to monitor various orbiting satellites that can be heard throughout the spectrum. He also demystified the process, showing us how easy and inexpensive hunting space sounds can be.

Skip Arey presented a topic many ham radio operators can appreciate, namely, *QRP: How Low Can You Go?* Skip's presentation made for an interesting juxtaposition to the kilowatt shortwave broadcasting world when he revealed how to communicate across the planet on 5 watts or less!

Jef Eichner once again presented on the topic of loop antennas. As more and more of us are bombarded with radio frequency interference (RFI) from consumer electronics, loop antennas provide an affordable antenna that can help you cope with noise. Though this topic can get pretty technical, Jef kept the discussion at a level most anyone could understand. He even brought his own homemade loop for demonstration.

Dr. Kim Andrew Elliott and yours truly presented a forum on *Digital Text via Shortwave Broadcast*. We demonstrated how incredibly effective and simple it is to broadcast digital text modes used by radio amateurs, PSK31 for example, on analog amplitude-modulated shortwave broadcasts. These modes can be decoded by anyone with a basic shortwave radio and personal computer or smartphone. We proved that even when the human voice is difficult to comprehend because of poor shortwave reception conditions, digital text can be received with nearly 100% accuracy. The applications for this technology are numerous, but the service can be invaluable when the Internet is disrupted by disasters (or by dictators).

Of course, there are a few mainstays in the Winterfest forum line-up, forums we've come to anticipate:

The annual "Scanner Scum" forum, which this year focused on scanner antennas that are effective and affordable. The presenters also explained the differences in the numerous types of rechargeable batteries on the market; as a result, many of us now have a better understanding of discharge curves and their effect on radios.

The annual Pirate Forum always attracts a large crowd. This year, George Zeller and a panel of pirate broadcast enthusiasts took the stage to introduce newcomers to the pirate radio listening hobby and review the pirate radio year. This year, Free Radio Weekly editor Chris Lobdell and the pirate station Captain Morgan were inducted into the Pirate Radio Hall of Fame.

David Goren (the resident Shortwaveologist) held his 10th Annual Shortwave Shindig, an evening celebrating the unique sonic properties of our favorite international medium. David showcased a number of his own shortwave audio productions and numerous intriguing recordings.

Saul Brady played radio-themed folk music, and the talented Martin Peck quizzed the audience with his woodwind renditions of dozens of interval signals past and present. Martin even took requests from the audience and played interval signals on demand...Where else could you hear this stuff, but at the Shortwave Shindig of the Winter SWL Fest?

Saul Brady leading a sing-along of "Turn the Radio On" at the "Shortwave Shindig"

Of course, there are also opportunities to buy and trade equipment at the Friday night swap meet. And, if you were lucky, you might have won a treasure in the silent auction (where all proceeds go to charity) or in the dinner banquet raffle. Indeed, since I've been going to the 'Fest, I've been most impressed with the number and quality of items in the raffle. The odds are good, and this year yours truly even won a few items. This year's grand prize? The newly introduced CommRadio CR-1 tabletop SDR.

As interesting and varied as the forums are, and as rewarding as the silent auction and dinner/raffle can be, I believe many of the 'Festers would agree that one of the strongest attractions is the yearly opportunity to socialize and connect with all of radio's kindred. At times radio listening can feel like a very solitary hobby, as voices drift in and out of the ether. Perhaps the beauty of the Winter SWL Fest is that it brings everyone together face-to-face to socialize and to theorize on the ever-widening scope of radio communications and broadcasting.

In short, the SWLing Winterfest is always a unique and dynamic event, but don't take my word for it; next year you might just want to check it out for yourself! The 26th North American Shortwave Association (NASWA) Winter SWL Fest will be held on February 28 and March 1, 2014. For details, check out their web site: **www.swlfest.com**.

The Day the KNX Tower Collapsed

By Gordon Schlesinger W6LBV
(All photographs by the author)

The unexpected destruction of a broadcast transmitter facility is always a sad and expensive matter. Such losses are often due to collapse of the facility's largest and most exposed element, its tower. Tower failures may be caused by strong weather, earthquakes, fires, or structural flaws. However, this is the story of one such collapse that wasn't due to these typical causes, but rather to sabotage!

KNX: an L.A. Broadcast Powerhouse

A major AM broadcast voice in Los Angeles for almost nine decades has been the CBS-owned-and-operated station KNX (1070 kHz). From its humble beginning in 1920 as a five watt independent radio station in a Hollywood back bedroom, it grew steadily in size and scope, changing frequencies several times and increasing its authorized transmitting power in steps to its present 50,000 watts.

In 1936 the CBS Radio Network purchased the station for its southern California regional outlet. By 1938 the network had finished building its flagship west coast network radio production center, Columbia Square, an Art Deco-style complex located on Sunset Boulevard in Hollywood.

Their motivation for establishing a west coast production center presumably was that it would be much easier to persuade big-name entertainment talent to drive the five miles from their homes in Beverly Hills over to Hollywood to star in a network radio broadcast than it would be to convince them to take a train to New York to appear. Many very popular radio "Golden Age" network programs originated from Columbia Square, which also simultaneously served as the home of the KNX studios until 2005.

Fast-forward now to the mid-1960s. KNX was by that time a mature radio voice over southern California and it was in transition from its previous general news and entertainment format to that of an all-news station. The U.S. was then at war in Viet Nam, but there were no foreign threats to the mainland and the economy remained healthy. It was a relatively peaceful, placid, and most importantly, innocent time. In that era the possibility of sabotage of facilities was one of the farthest things from anyone's mind.

The KNX Transmitter Plant

While the KNX studio facilities were located within the Columbia Square complex in Hollywood, its remotely-operated transmitter facility was about 20 miles south in the city of Torrance, part of the "South Bay" section of the region. The transmitter site in the mid-1960s consisted of a fenced 12 acre field in a relatively-unpopulated community. The site contained a transmitter building at its center and a single guyed steel lattice tower next to the building. KNX broadcast both then and now with 50,000 watts throughout the full 24-hour day; there was no required power decrease at night.

The use of a single tower signified that KNX was authorized to transmit a non-directional signal. As with almost all AM stations, the tower itself was the transmitting antenna. Thus there was nothing attached to it except the necessary obstruction marker lighting and the guy wires that stabilized it. With the tower's uniform triangular cross section of about four feet on a side along its entire 500 foot height, this very visible tower was electrically about a half wavelength at the operating frequency.

The Day of the Disaster

Figure 1. An overall view of the KNX transmitter site today, showing the transmitter building, main tower (right, rising out of the building), auxiliary tower (left), and security fencing around all installations. The site's layout in 1965 was substantially the same as today. A public park now surrounds the facility; both it and the auxiliary tower did not exist in 1965.

During a late summer evening in 1965 the KNX signal over southern California abruptly ceased. I was not aware of its absence until early the following morning when I began my drive to work; the familiar spot on the car radio dial contained only background radio noise! I immediately thought that this was odd, since a major regional broadcaster surely would have "hot-standby" transmitters at its facility and the station should never go off-air because of equipment failure. But by tuning to another station for local news, I learned the details. The KNX tower had collapsed during the previous night.

A sad truth quickly became apparent: KNX did not have an auxiliary transmit antenna for emergency back-up service. Recall that these were simpler days and other than complying with site safety requirements, no station management thought to plan in advance for possibility of sabotage. After the tower collapse, KNX remained off-air for almost 24 hours and then returned with a weaker signal that initially also contained some hum and buzz. Their former, dominating AM signal would not return to its full strength for months.

During the day-long outage KNX simulcast its programming on its sister FM station, which had its own transmitter facility located on 6,000 foot high Mount Wilson, near Pasadena. In the mid 1960s, however, FM broadcasting had not yet reached its present day level of listener saturation, especially by comparison to the numbers of mobile and portable FM receivers that are deployed today. The AM voice was really missed!

A Visit to the Disaster

Since I was curious about this major broadcast failure, since my place of employment at that time was located about four miles from the Torrance transmitter site, and since I had a full hour lunch break every day, some time after the incident I drove over to the site during the noon hour. What I found there laid open the situation for me.

As I drove toward the site I saw a large, fenced open field of dirt and weeds with the transmitter building near the center. The badly deformed remains of the tower lay in front of the building, pointing away from the front door. Adjacent to the building were two new and exceptionally tall wooden utility poles with cross-arms at the top. The arms supported a temporary horizontal wire antenna stretched between them with a center-fed transmission line running down into the building. On that day there were no other transmitting antennas on the property, nor

wire-based or auxiliary towers.

The gate in the perimeter fence was open, and I continued through it and down a dirt road toward the transmitter building. There were no other fences or gates inside, and most critically no barriers existed around the tower's three large concrete ground anchors that terminated its multiple levels of guy wires. I noted that the front door of the building was also open, so I parked next to the only other car on the property and went inside.

I found a fellow working inside who identified himself as a "CBS Network engineer from New York City." I explained my curiosity and interest to him, and he seemed glad both to have a visitor and to talk about the work. He gave me a brief tour of the building including the main transmitter and, in the building's rear, open courtyard, the remains of the tower base. I can recall that the 50 kilowatt main transmitter that was in use at the time was a General Electric. I probably would have toppled over if it had been an RCA broadcast product, since RCA was the owner of arch-rival NBC! At the time of my visit, the station had returned to stable full power operation using the temporary wire antenna, and program audio was playing in the background from a large bookshelf speaker in one of the interior rooms.

Figure 3. The base of the present auxiliary tower and its antenna tuner building, located inside double security fencing. A soccer net for park users is stored outside the fence. This facility would have been invaluable had it existed in 1965.

The Details of the Sabotage

The engineer and I discussed the situation. The tower collapse was caused by the severing of one of the north set of guy wires, and there was no doubt about this. A portion of that guy wire assembly appeared to have been deliberately cut, and that sabotage was made possible because there had been no access barriers or alarms to prevent an intruder from reaching the ground anchor points.

The size and ruggedness of the guy wire hardware argued against the possibility that it could have been cut by some teenagers equipped with a cheap hack saw, out for an evening's lark. This was very likely a deliberate act planned by one or more well-equipped vandals. And it was also a dangerous one: a broken guy contains a large amount of kinetic energy, and its direction of travel is unpredictable!

Figure 2. The main tower's north guy earth anchor today. One of the guy wires at this anchor was severed by saboteurs in 1965. Note the double level of fencing now surrounding the anchor point. No access barriers or alarms existed in 1965.

Furthermore, the engineer expressed a theory about the intent of the vandalism. The base of the tower had rested on a massive porcelain insulator that was located on the concrete floor of the open courtyard on the north side of the transmitter building. Perhaps the perpetrator's thinking was that severing the north guy system would cause the tower to drop toward the south. And inside the building, south of the base of the tower, sat the transmitter racks. So, the intent may have been to completely demolish the facility by dropping the tower onto the building.

Fortunately, the tower itself had other "instructions." At the moment of severance, tension was instantly relieved on the north guy system, but 10,000 pounds of tension remained, unbalanced, in the south-east and south-west guys. The two remaining guys pulled the tower toward the south as expected. But as it began to move, the tower also "lifted" and it rose! The bottom of the rising tower cleared the top of the building before falling toward the south. The entire tower leapfrogged in an arc completely over the building and dropped into the open field on the opposite side. The building was saved!

Return to Broadcasting, but Mystery Remains

The restoration work began immediately. On the morning after the collapse, the local power company installed the two tall wooden utility poles and KNX/CBS engineers strung the temporary wire antenna and the transmission line. A 'home-brew" antenna tuner was constructed to feed the antenna system, and then it was modified by trial and error. The broadcast signal came back on-air almost exactly twenty-four hours after its abrupt exit. The transmission was at less than full authorized power, but over the course of the next several days power was gradually increased.

Once the situation stabilized, in the weeks and months that followed, KNX first purchased a smaller, unused broadcast tower from another Los Angeles AM station, constructed it at the site and transferred broadcast operations over to it. Today this tower remains as the auxiliary antenna, a function now required by FCC Rules. Finally, KNX ordered and constructed a near-duplicate of its original tower and almost one year after the sabotage, the station resumed operation at its full broadcast authorization.

A few years after the collapse KNX/CBS donated most of the private land at the site to the City of Torrance to increase the size of the new, city-owned Columbia Park. The station retained access and land-use rights to its facility which, today, occupies the south-west corner of this 52 acre public park.

It Happens Again!

This would not be the only major tower collapse that Los Angeles would suffer. Almost 40 years later, in 2004 a similar tall guyed tower in southern Los Angeles County belonging to 50,000 watt KFI (640 kHz) collapsed after being struck just below its top by a small private aircraft flying during daylight hours. Two years after the destruction the partially-rebuilt replacement tower again collapsed during construction, because of internal flaws. In 2008 the replacement tower was finally finished and it did go into service.

Today at the KNX site in Columbia Park the transmitter building, the bases of the main and the auxiliary towers, and all six guy earth anchors are each protected from intruders by their own dual high barriers. Clearly KNX/CBS does not want to suffer a repeat of this tragedy. And, in time other broadcast sites followed the example with their own increased security. Weather may still claim a few towers from time to time, but saboteurs and vandals now have a much more difficult task.

This much publicized crime at KNX was well investigated by various law enforcement agencies at every governmental level. They followed up on all the prevalent "theories" about the identity of the perpetrator(s), but no arrests were ever made. Today, almost 50 years after the sabotage, the mystery at KNX still remains unsolved and there is a good chance that the perpetrators are no longer alive. But the broadcast industry now takes transmitter site security extremely seriously. This was a very expensive lesson!

A news photo of the 1965 event along with a 2009 recap of the story is found here: **http://blogs.dailybreeze.com/history/2009/10/28/knx-radio-towers/**

About the Author

Gordon Schlesinger is a retired scientist/engineer/project manager with fifteen years of professional experience in the Private Land Mobile Radio industry and more than fifty years as a licensed radio amateur (W6LBV). He has done personal writing and blogging in the "wireless" area, and has a long record of written participation in Federal Communications Commission rule making docket proceedings, in both the amateur and commercial Land Mobile Radio areas and, occasionally, in the broadcast service itself. He may be reached at ***lbv@att.net****.*

Dan Veeneman
danveeneman@monitoringtimes.com
www.signalharbor.com

Choosing Your First or Next Scanner

I am looking to get started in the scanning hobby. Can you recommend a good hand-held and desktop unit? I live in Hawthorn Woods, Illinois and plan to listen to police and emergency activity as well as aviation-related activity.

- Andy in Illinois

Selecting a "good" scanner is a subjective choice and depends on a number of factors, including your location and the type of activity you'd like to monitor. With this information you can determine the specific features your scanner will need to have. Although there are many scanners on the market, the list of necessary features is relatively short. Here are two questions about the target radio system that will help you to decide what scanner features you will need:

Does the radio system carry voice in analog form or some kind of digital format?

Every scanner is capable of monitoring analog transmissions, so those are no problem. The "digital-capable" scanner models can monitor digital voice traffic if the system follows the APCO Project 25 (P25) Common Air Interface (CAI). However, if the system uses some other type of digital voice format, such as Harris OpenSky or ProVoice, you will not be able to monitor it with any consumer scanner.

Does the radio system operate conventionally or does it use trunking?

Conventional systems permanently assign a frequency for a specific purpose, so whenever your scanner is tuned to that frequency you have a good idea who is using it and what kind of conversations you'll hear. This is the simplest way to run a radio system and every scanner can monitor such activity. Trunked systems, in contrast, assign frequencies to a group of users on an as-needed basis, so one moment a particular frequency might be carrying part of a police conversation and the next moment it may have a fire department message. A group of users is called a *talkgroup* and a unique number identifies each one on the system.

There are several different types of trunking systems. The three most common are referred to as Motorola, EDACS, and LTR. Motorola, as you might expect, is a trunking protocol designed and sold by Motorola, Inc. (now called Motorola Solutions). EDACS (Enhanced Digital Access Communication System) is another 1980s-era trunking protocol now owned by Harris, Inc. LTR (Logic Trunked Radio) is an even older protocol developed by E.F. Johnson in the 1970s. There is also a newer trunking protocol specified in the APCO Project 25 standards that works exclusively with P25 digital voice systems. If your target radio system uses one of these trunking protocols, your scanner will need to be capable of tracking it.

I maintain a comprehensive list of modern scanners and their trunking capabilities at **www.signalharbor.com/trunking.html.**

Hawthorn Woods, Illinois

Hawthorn Woods is a suburb of Chicago, located in the southwestern corner of Lake County about 40 miles northwest of downtown. The town has almost 8,000 residents.

The Hawthorn Woods Police Department has 10 full-time sworn officers and handled nearly 22,000 incidents in 2012. The nearby Lake Zurich Public Safety Answering Point (PSAP) dispatches calls for Hawthorn Woods as well as the towns of Island Lake and Kildeer. There are a number of conventional (non-trunked) analog transmissions in and around Hawthorn Woods.

Frequency	Description
45.56	County Emergency Services Disaster Agency
150.7900	County Fireground ("Green"), Helicopter Operations
151.1975	South Lake County Regional Community Emergency Response Team
151.2350	South Lake County Regional Community Emergency Response Team
153.2150	Long Grove Fire Protection District
153.8900	County Fire (Southwest Dispatch)
154.2650	Interagency Fire Emergency Radio Network (IFERN)
154.3250	County Fire (Northeast Dispatch)
154.3700	County Fireground
154.4000	County Fire (Northwest Dispatch)
154.4300	County Fire (Southeast Dispatch)
154.7925	South Lake County Regional Community Emergency Response Team
154.9500	Metropolitan Enforcement Group 1
155.0025	Hazardous Materials and Bomb Disposal Operations
155.3400	Ambulance-to-Hospital
155.4000	Medical Emergency Radio Communications for Illinois
155.8200	Hawthorn Woods Public Works
155.8350	Lake Zurich Fire and Rescue (Dispatch)
156.0000	Metropolitan Enforcement Group 2
156.2100	County Fire and Rescue (Dispatch)
159.3375	South Lake County Regional Community Emergency Response Team
159.3900	South Lake County Regional Community Emergency Response Team
160.6050	Northeast Illinois Regional Commuter Railroad Corporation
165.2875	Metropolitan Enforcement Group 3
451.9125	Hawthorn Mall (Security)
452.4500	Hawthorn Mall (Security)
452.5000	Hawthorn Mall (Macy's)
453.0625	Lake County Forest Preserve District
453.1875	Lake County Forest Preserve District
453.4500	Countywide Mutual Aid
453.8500	County Highway Department
458.4875	Bomb Disposal Robot
461.4125	Hawthorn Mall (Macy's)
461.5875	Hawthorn Woods Golf Course
462.2875	Hawthorn Woods Golf Course
462.3625	Hawthorn Woods Golf Course
463.2125	Hawthorn Woods Golf Course
464.4750	Courthouse Maintenance and Security (Waukegan)
464.8750	Hawthorn Mall (Maintenance)
466.9625	Hawthorn Mall (J.C. Penney)
467.3625	Hawthorn Woods Golf Course
470.7375	Hawthorn Woods Police (Dispatch, via Lake Zurich)
476.7375	Hawthorn Woods Police (Alternate)
477.3875	Hawthorn Woods Police (Tactical)

Lake County operates a largely analog voice EDACS (Enhanced Digital Access Communication System) trunked radio network from six repeater sites located in Highwood, Lake Villa, Lake Zurich, Libertyville, Warren Township and Waukegan. It uses eight frequencies and carries much of the public safety radio traffic in the county.

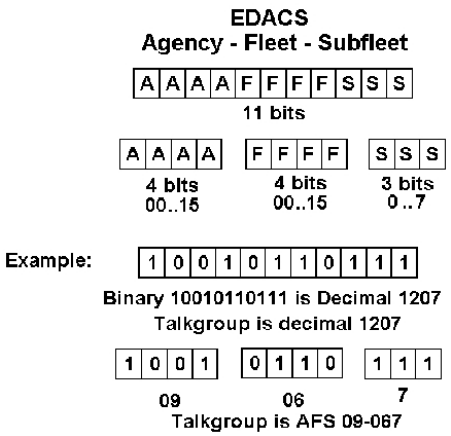
LCN	Frequency
1	851.2500
2	851.3000
3	851.6375
4	851.6875
5	852.1250
6	852.7250
7	852.8125
8	853.5625

Because it is an EDACS network, the frequencies are listed along with their associated Logical Channel Number (LCN). EDACS equipment uses LCNs to identify the actual frequency on which a talkgroup is active. Scanners must have these frequencies programmed in the proper LCN order to correctly track conversations. The user manual for the particular trunk-tracking scanner you choose will have specific instructions on how to perform this LCN programming.

❖ Agency-Fleet-Subfleet

EDACS talkgroups also have a unique method of identification. Each talkgroup identifier is made up of three numbers: an "Agency" number followed by a dash, then a "Fleet" number and finally a "Sub-fleet" number. This is known as AFS format and it allows the system operator to logically separate talkgroups according to the structure of the agency or organization that uses them. Within each agency, users are divided into groups (called "fleets") and smaller operational units (called "sub-groups").

For instance, a police department might be assigned the Agency number "01," with patrol cars set as fleet 01 and detectives set as fleet 04. Patrol cars for the northern part of a city could



be subfleet 1 and southern patrol cars could be subfleet 2. So, the talkgroup list might look like:

AFS	Usage
01-011	Police Patrol Cars (North)
01-012	Police Patrol Cars (South)
01-041	Police Detectives (Burglary)
01-042	Police Detectives (Homicide)
01-043	Police Detectives (Vice)

On the same system, a fire department could use agency number "02" with fire-fighting equipment assigned as fleet 01 and ambulances as fleet 02. The talkgroup list could then look like this:

AFS	Usage
02-011	Fire Department (East Side)
02-012	Fire Department (West Side)
02-021	Ambulances

There is no set standard for how AFS numbers are assigned, so each EDACS network will be different.

❖ AFS Conversion

EDACS talkgroup identifiers also have a decimal equivalent. Although the scanner will perform the conversion for you, here is the equivalence between AFS and a single number. A talkgroup identifier uses a total of 11 binary digits ("bits") divided up among each component. The most common arrangement is 4 bits for the Agency, 4 bits for the Fleet and 3 bits for the Subfleet. Note that the number of bits provides an upper limit on the range that each component can take; 4 bits can represent a value between 0 and 15 while 3 bits have a range of 0 to 7. This means that an Agency number or a Fleet number cannot be greater than 15 and a Subfleet cannot be greater than 7.

Bit Pattern	Decimal	Hexadecimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

An AFS of 09-067 would have the following binary representation for each component:

Component	Decimal	Binary
Agency	09	1001
Fleet	06	0110
Subfleet	7	111

String the binary components together to come up with the 11-bit binary sequence 10010110111. A bit of math or a scientific calculator will quickly reveal that the sequence has a decimal equivalent of 1207 and a hexadecimal equivalent of 4B7.

❖ Talkgroups

The following is a list of reported talkgroups on the Lake County EDACS network. There are almost certainly more talkgroups programmed into the system than are listed here and are just the ones that have been monitored by local listeners. You may hear new or seldom-used groups; if so, send me an email with your discoveries!

Dec	AFS	Description
1	00-001	Illinois State Police Emergency Radio Network
2	00-002	Illinois State Police Emergency Radio Network
17	00-021	Sheriff Patrol 1
18	00-022	Sheriff Patrol 2
19	00-023	Sheriff Car-to-Car
20	00-024	Sheriff Local Government
21	00-025	Prisoner Transport
22	00-026	Reserve Deputies
23	00-027	County Jail
24	00-030	Court Security
25	00-031	Warrant Service
26	00-032	Process Servers
27	00-033	Marine Unit
28	00-034	Forest Preserve Rangers (Dispatch)
29	00-035	Sheriff Criminal Investigation
37	00-045	Sheriff Gang Unit
38	00-046	Sheriff Gang Task Force
40	00-050	Sheriff Tactical 1
41	00-051	Sheriff Tactical 2
42	00-052	Sheriff Tactical 3
43	00-053	Sheriff Tactical 4
44	00-054	Sheriff Tactical 5
45	00-055	Sheriff Tactical 6
46	00-056	Sheriff Tactical 7
47	00-057	State's Attorney (Investigators)
49	00-061	Emergency Management Agency
50	00-062	Sheriff Emergency Telephone Systems Board (911)
51	00-063	County Emergency 1
52	00-064	County Emergency 2
53	00-065	County Emergency 3
54	00-066	County Emergency 4
55	00-067	County Emergency 5
56	00-070	County Emergency 6
57	00-071	County Emergency 7
58	00-072	County Emergency 8
59	00-073	County Emergency 9
60	00-074	County Emergency 10
61	00-075	County Emergency 11
62	00-076	County Emergency 12
63	00-077	County Emergency 13
65	00-081	FIRECOM
66	00-082	County Disaster 1
67	00-083	County Disaster 2
68	00-084	County Disaster 3
69	00-085	County Disaster 4
70	00-086	County Disaster 5
71	00-087	County Disaster 6
72	00-090	County Disaster 7
73	00-091	County Disaster 8
74	00-092	County Disaster 9
75	00-093	County Disaster 10
76	00-094	County Disaster 11
77	00-095	County Disaster 12
78	00-096	County Disaster 13

79	00-097	County Disaster 14
101	00-125	Island Lake, Port Barrington, Tower Lakes Police (Dispatch)
102	00-126	Island Lake area (Car-to-Car)
103	00-127	Island Lake area (Car-to-Car)
273	02-021	County Department of Public Works (Administration)
275	02-023	County Jail (Administration)
276	02-024	County Jail (Supervisors)
277	02-025	County Department of Public Works
278	02-026	County Highway Maintenance
280	02-030	County Building and Zoning
281	02-031	County Public Works (Maintenance)
301	02-055	County Health Department
305	02-061	County Animal Control Public Works
306	02-062	County Animal Control
308	02-064	County Animal Control (Dispatch)
309	02-065	State's Attorney (Administrative)
313	02-071	Coroner
314	02-072	Coroner 2
315	02-073	Coroner 3
337	02-101	Special Events 1
338	02-102	Special Events 2
339	02-103	Special Events 3
340	02-104	Special Events 4
341	02-105	Special Details 1
342	02-106	Special Details 2
343	02-107	Special Details 3
344	02-110	Special Details 4
345	02-111	County Building Cleaning Crews
346	02-112	County Jail (Maintenance)
354	02-122	Forest Preserve (Dispatch)
355	02-123	Forest Preserve (Maintenance)
356	02-124	Forest Preserve (Ranger 1)
358	02-126	Forest Preserve (Detail 1)

❖ STARCOM21

Illinois has a statewide digital public safety radio network that is owned and operated by Motorola. It is an all-digital system that uses the APCO Project 25 trunking standard.

There are more than 180 repeater sites across the state. Lake County has seven locations (Deerfield, Fox Lake, Gurnee, Highland Park, Libertyville, Sylvan Lake and Zion) that all transmit simultaneously (called *simulcast*) on the following frequencies: 851.4625, 852.4625, 852.9375, 853.9875, 854.9125 and 855.2375 MHz. The system serves the Illinois State Police, Illinois State Toll Highway Authority, as well as a number of county and local agencies.

In order to scan STARCOM21 you will need a digital-capable scanner with the ability to track conversations on a "pure" P25 system, meaning it must be capable of tracking the P25 trunking standard. This is in contrast to systems that carry voice in the P25 digital standard but use the older Motorola trunking standard. Such a mix allows the system operator to save money by continuing to operate older analog-only radios and slowly add in newer digital radios over time.

❖ Aviation

Waukegan Regional Airport (UGN) is a 500-acre facility with a manned tower two asphalt runways, the longest of which is 6,000 feet. It serves more than 50,000 aircraft operations each year.

120.050	Tower
120.550	Chicago Approach and Departure
121.650	Ground Control
122.950	Unicom
131.850	Landmark Aviation (Fixed Base Operator)
132.400	Automated Terminal Information Service (ATIS)

Campbell Airport (C81) is a small untowered airport near Grayslake. It uses a Unicom frequency of 122.700 MHz.

❖ Scanners

So, if you want to be able to monitor all of the radio traffic in southwestern Lake County, you will want a relatively recent scanner that is capable of monitoring both EDACS and APCO Project 25 systems. Any of the following models meet those criteria.

Model	Type	Introduction
Uniden BC296D	Handheld	2003
Uniden BC796D	Base/Mobile	2003
Uniden BCD396T	Handheld	2005
Uniden BCD396XT	Handheld	2009
Uniden BCD996T	Base/Mobile	2006
Uniden BCD996XT	Base/Mobile	2009
Uniden HomePatrol-1	Base/Mobile	2010
GRE PSR-500	Handheld	2007
GRE PSR-600	Base/Mobile	2007
GRE PSR-800	Handheld	2011
Radio Shack Pro-106	Handheld	2007
Radio Shack Pro-18	Handheld	2011
Radio Shack Pro-197	Base/Mobile	2007

The HomePatrol-1 and the GRE PSR-800 are probably the easiest to use since they both offer a feature known as "location-based" scanning. The user simply enters a zip code to choose the frequencies and systems to monitor. Frequencies and talkgroup information are stored on a micro SD card and can be updated without much difficulty.

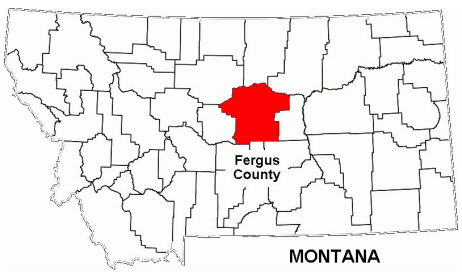
❖ Lewistown, Montana

Dan,

I will be in Lewistown, Montana (Fergus County). I can't find police or any other interesting frequencies. Can you help?

- Johannes in North Dakota

Lewistown is the county seat of Fergus County and is home to nearly 6,000 residents. Fergus County covers about 4,300 square miles in central Wyoming and has a population of just over 11,000 people, so I can understand why finding frequencies might be more difficult than for more populated areas. The good news is that much of the public safety and state agency radio traffic can be found on VHF (Very High Frequency) and UHF (Ultra High Frequency) bands in conventional analog format, so nearly any scanner will be able to monitor local activity.



Frequency	Description
39.82	Statewide Intersystem Mutual Aid
39.88	Sheriff (Alternate Dispatch)
151.1300	State Department of Transportation (Car-to-Car)
151.2200	Department of Natural Resources and Conservation (DNRC)
153.7550	County Office of Disaster and Emergency Services (DES)
153.8000	Statewide Law Enforcement Tactical ("Black")
153.8300	Statewide Fire Repeater ("Ruby")
153.9050	Statewide Common Mutual Aid ("Gold")
154.0700	State Fire Mutual Aid ("Red")
154.1600	Lewistown Rural Fire District
154.1750	Lewistown Fire
154.2350	Lewistown Fire
154.2650	State Fireground 1 ("Coral")
154.2725	Statewide Fire Tactical ("Copper")
154.2800	Statewide Fire Mutual Aid Command and Control ("Maroon")
154.2875	Statewide Fire Tactical ("Burgundy")
154.2950	State Fireground 2 ("Scarlet")
154.3025	Statewide Fire Tactical ("Crimson")
154.4450	Lewistown Rural Fire District
155.0550	Central Montana Fairgrounds Operations/Security
155.1000	County Highway Department
155.1600	National Search and Rescue Common ("Violet")
155.2200	State Search and Rescue Common ("Purple")
155.2800	Emergency Medical Services Ambulance-to-Hospital ("White")
155.3250	Central Region Dispatch and Paging ("Gray")
155.3400	Statewide Air-to-Ground Incident Scene Coordination ("Tan")
155.3850	Western/Eastern Region Dispatch and Paging ("Pink")
155.4750	National Law Enforcement Emergency ("Blue")
155.7900	State Law Enforcement Mutual Aid ("Silver")
155.8200	State Office of Disaster and Emergency Services ("Brown")
157.4250	Statewide Mutual Aid Simplex ("Neon")
158.7900	Lewistown Police (Dispatch)
159.0300	Lewistown Police (Car-to-Car)
159.0900	Sheriff (Dispatch)
159.3450	State Fire Control ("Garnet")
171.4750	US Forest Service Common ("Green")
172.2250	Statewide General Use Mobile Repeater ("Alpha")
172.3750	Statewide General Use Mobile Repeater ("Bravo")
453.350	State Hospital (Security)
460.050	State Department of Transportation (Lewistown)

Note that encryption may be used on "White" and "Black" channels.

Montana, like many other states, has assigned colors to specific frequencies. They explain the choice this way:

"Mutual aid and common frequencies have been assigned color names to eliminate confusion that could occur when referring to long technical names and numbers. Color names were chosen because the names are short, commonly recognized, and have been linked with associative memory. Clarity and simplicity of communications are essential in public safety radio use."

I could not agree more.

Please send your questions, comments and reception reports to me via email at **danveeneman@monitoringtimes.com** and check my web site at **www.signalharbor.com** for more scanner-related information.

ASK BOB
GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *Is there a simple way I can hook up my Sangean multiband portable to an external antenna? Can I just hook up a wire with an alligator clip to the little whip? There is a 1/8-inch antenna jack on the side of the radio. (Danny Barnes, email)*

A. Keep in mind that any indoor antenna will pick up electrical appliance noise and AC house wiring noise. Assuming you will be using an outdoor antenna with coax, definitely use the antenna jack on the side of the radio so that the coax shield is also connected as well as the center wire. If you are confined to an indoor antenna, then you might as well attach it to the whip and endure the stronger noise along with the signals.

Q. *I recently read that conventional fluorescent lamps are on their way out. Is this true? (M.H., email)*

A. Yes. In a 2009 rulemaking, the four-foot dual-pin T12, two-foot dual-pin U-shaped, and eight-foot dual and single-pin fluorescent bulbs are being phased out by the Department of Energy because of their low efficiency. Ballast transformers for replacement purposes will remain available until 2014.

It is expected that eventually LED lamps will become the standard. The net result will be higher efficiency, more compact size, better durability, longer life, and no mercury contamination from disposable fluorescents. For a complete look at banned and accepted bulbs, see **http://applications.nam.lighting.philips.com/cmolegislation/index.php#2**

Q. *I am listening now on 15.0161 MHz to what sounds like military communications in Upper Sideband (USB). They start off by saying "Attention all stations," and then go into what seems to be a numbers-and-alfa cadence. (Bill Fisher, Buena Park, CA)*

A. It's military all right. You have tuned into the USAF High Frequency Global Communications System (HF-GCS) on which they transmit scheduled Emergency Action Messages (EAMs). Another active frequency is 11175 kHz.

Q. *I've read numerous times that it's best to use coax from your radio to your antenna to avoid extra noise. It's also a good idea to ground your radio. I have a Sangean ATS909 portable with a 1/8-inch antenna connection and no ground connection. Should I still use a coax and, if so, how would you suggest I make the coax connection and the ground connection?*

A. The use of coax for a transmission line from your antenna to your radio is mandatory with the number of interference-radiating entities in a modern household or office. The coax center conductor attaches to the tip of the plug and the shield to the barrel. It is probably easier to use a standard coax connector on the receiver end of the coax and an adapter to reduce it to the 1/8-inch plug.

To see if an earth ground helps, touch the ground wire temporarily to the metal on the casing (shield) of the coax plug. The earphone jack shell should work for the test to see if the noise is reduced. You could even attach the ground wire to the negative post of the battery holder.

Q. *I saw on YouTube how to make a magnetiser/demagnetiser using the core of a fan salvaged from an old microwave oven. Can I steady the thing in a vise when I use it? (Mark Burns, Terre haute, IN)*

A. The closer the steel of the vise comes to the steel of the fan core, the more it will distort the magnetic field. It would be best to clamp it in the vise using wood separators between the fan and the jaws of the vise. Keep in mind, however, that it will probably magnetize the vise when the power is switched off unless you remove the fan while it is still plugged in.

Q. *Back in the 90s I came across a scanner frequency in the 152.500 MHz range that that sounded like people either leaving or retrieving voicemail. I have always been curious to know what I may have heard. (Ossian, email)*

A. Those were the days of analog paging, when easily overheard voice messages were openly transmitted to belt-worn pagers. One of the most frequently heard was 152.480 MHz. Gradually, unreadable digital formats crept in with POCSAG being the most common.

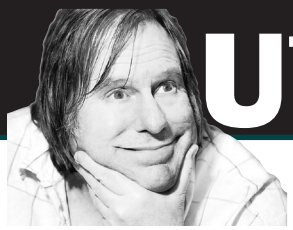
Q. *When I tune in my local Boston Center air traffic control frequency (134.0 MHz) I hear the controller but sometimes not the planes using my attic antenna. What could cause this? (Todd, email)*

A. If they are military planes, they could be replying on the UHF frequency paired with 134.0 VHF. Another possibility is that your indoor antenna is suffering from reflection and/or blocking from certain directions. And finally, the responding aircraft could simply be far enough away that the signal is too weak to be heard at your location, but being heard just fine with the FAA tower.

Q. *I have my PAR end-fed antenna mounted horizontally across my roof at a height of 30 feet with 6 feet down at a slope. How would the antenna work if I loosely wind the wire just a few turns around a two-inch diameter pipe? Would it perform better than its current installation hanging horizontally (where it acts as a directional antenna), or if it was hanging vertically (in which case, would it be omnidirectional)? (Bill Von Wida, email)*

A. I think it would probably work just fine, especially if there are very few turns around the pole. If, instead, the turns were many and close together, you would restrict its bandwidth because the inductive and capacitive reactances would become resonant at some frequency. Yes, if hung vertically it would be omnidirectional rather than the bi-directional pattern it has now as a horizontal wire.

Questions or tips sent to Ask Bob, c/o MT are printed in this column as space permits. Mail your questions along with a self-addressed stamped envelope in care of MT, or e-mail to bobgrove@monitoringtimes.com. (Please include your name and address.)



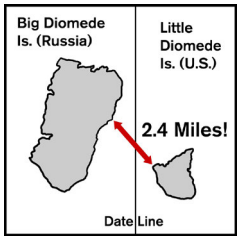
Hugh Stegman, NV6H
mtutilityworld@gmail.com
www.ominous-valve.com/uteworld.html
http://mt-utility.blogspot.com

Monitoring Russia: The Complete Beginner's Guide

The Russian Federation is still a major factor in global politics. Given the enormous reach of this gigantic country, which borders on Europe, China, and the Middle East, it's safe to expect Russia's influence to keep growing.

Some people are surprised to see just how extensive Russia really is. For example, it is 2.4 miles from the United States. The two countries meet in the Bering Strait, with the International Date Line in the middle, and the small Diomede Islands on either side. And so, there really is one place in Alaska from which one can see Russia. It's just a very remote one.

Another interesting Russian appendage goes southward to the Caucasian Mountains. It's a contentious area, with oil resources at stake. Its religious and territorial issues have figured in several terrorist attacks. Furthermore, its proximity to the Middle East guarantees that Russia will always be a major player in Iran and Syria.



And so, here comes the whirlwind tour of Russian utility radio. Hang on!

USB Aeronautical

While a bewildering number of largely custom modes can be heard, listeners will be pleased to find out that a lot of the "good" stuff is still in plain old Upper Sideband (USB) voice. This is especially true in military and civil aeronautics.

The Air Force and Naval Aviation use a number of Russian-language voice identifiers. Here's a partial list, with common English spellings:

Balans and Katolik: New, unknown;
Klarnetist: Air Force, Tver;
Davlenie: Air Force, Taganrog;
Korsar: Air Force Pskov;
Kraket: Kaliningrad;
Monolog: Air Transport eastern sector, Vladivostok;
Nabor: Unknown;
Norka: Naval Aviation, Crimea;
Novator: Naval Aviation, Murmansk or Severomorsk;
Polis: Air Force, Orenberg;
Priboj: Air Transport central sector, Moscow; and
Proselok: Air Force, Bryansk.

Air to ground comms using these identifiers can be heard pretty much daily on 6685, 6885, 8816, 11254, 11354, and 11360 kilohertz (kHz), USB. 8090 kHz USB appears to be an air-to-air frequency, where "Bear" bombers have recently been heard.

Voice traffic is in Russian, but it uses well-documented procedural signals. "Priyom" is a colloquialism for "receiving" or "accepting," and it means about the same as "over." "Govorit," which means "speaking," is a station identifier.

Four internal, civilian Volmet nets provide another source of Russian-language voice. Volmet, vaguely from French for "Flying Weather," is a regularly scheduled recitation of very highly formatted aviation weather information. The same airports are announced at the same times hourly. Therefore, much of the content is identifiable to non-speakers.

Frequencies for Net One are 2869, 6693, 8888, and 11318 kHz USB. Net Two is 2941, 6617, 8939, and 11297. Net Three is 3116, 5691, 8861, and 13267. Finally, Net Four is 3407, 6730, 8819, and 11279. Tashkent, a frequently reported station, comes up on Net Four at 20 and 50 minutes after the hour.

Finally, there's RosAeronavigatsia (Russian Air Navigation). This is the official government agency in charge of civil air traffic control in Russian airspace. Voice air-to-ground traffic is heard nightly on 4045 kHz USB.

Military Morse

Russian military and intelligence agencies still use an amazing amount of Morse code. This isn't just because the equipment is old. There also seems to be a policy of sticking to the tried and true.

Code transmissions are usually in straight CW ("continuous wave"), with on-off keying. However, there is also a lot of what's generally called FSK Morse. This uses the same frequency-shift keying as radio teletype (RTTY or RATT), but the Morse is sent in one of the shifted tones. The challenge is to find the right one.

Often, the FSK Morse will be operator chatter (opchat) before subsequent communication in a digital mode. The straight CW can be opchat or traffic.

The Navy's various fleets have group and headquarters call signs. A very short list of the more common ones includes:

RCV, Black Sea Fleet, Sevastopol, Ukraine;
RIT, Northern Fleet, Severomorsk;
RIW, many sites (former Moscow headquarters);
RJS, Pacific Fleet, Vladivostok;
RKN, Caspian Flotilla, Astrakhan; and
RMP, Baltic Fleet, Kaliningrad.

RMP is frequently reported on 3192, 3264, 4886, and 11418 kHz CW. RCV is often heard on 5083, 6043, 8345, 10543, 12464, and 19201. RIT is heard on 4465, 5343, 6449, and 11155. RIW is on 5083, 9145, 11000, and 13086. Naval Air Transport can be heard daily on 8816 kHz CW.

Most plain text is in Russian, using the special Cyrillic Morse characters. This is rarely a problem, due to the very heavy use of international "Q" signals. Unlike most operators, Russians learn the obscure ones, and they use them a lot.

Opchat and message procedures use all the simple ones that hams learn, such as QRU (I have nothing for you), QSA (signal quality: 1-5), QSX (I am listening on - frequency), QTC (I have messages), QTH (my position is…), and QSL (I am acknowledging receipt).

After these, we go quickly into the head-scratchers. A few common ones are QSW (I am sending on - frequency), QRD (I am enroute to…), QRE (my estimated time of arrival is…), QTO (I have departed at - time), QTM (my magnetic heading is…), and QTR (the time is -hours).

Ground-to-air comms also make use of the old, otherwise mostly abandoned, QAA through QNZ block. At one time, international agreements specified these for aeronautical use. Common are QAH (I am at - altitude), QBD (my fuel endurance is…), and QBG (I am at - altitude above clouds). Oddly, they don't seem to make much use of QNH (altimeter).

Finally, the Russian military has a few signals of its own. Frequency selection may use QDW (go to…), or QWH (I will be on…). Mode selection can use the obscure QRR, QYR, QYS, and QYT, each followed by a number. These aren't well understood.

Naval Air Transport can be found on 8816.

Finally, there is all the tactical CW traffic. Stations use special, four-character call signs. At any given time, several frequencies will be active with calling and message handling. This is usually in duplex mode, using two frequencies. It can be challenging to find the other one.

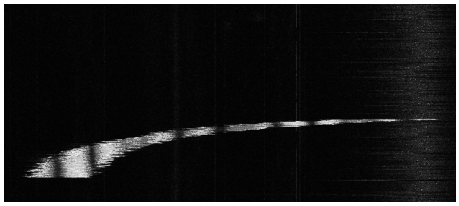
These messages are encrypted using five-figure groups. Fortunately, there's usually plenty of opchat, using Q signals and common, international Morse abbreviations.

Any time conditions permit, there is bound to be some Russian CW going somewhere. Happy hunting!

Squiggle Solved?

"The squiggle" is one of the older short wave mysteries. It is usually encountered as a squiggly, back-and-forth noise which moves downward in frequency before stopping abruptly. It comes and goes with the propagation, and it's heard worldwide.

Squiggles are common between about 25 and 32 megahertz (MHz). Whenever the 10-me-



ter amateur band is open, it's Squiggle Central. Some of these are fairly contained, while others sweep 150-200 kHz.

Utility listeners are among the world's most curious people. Theories for this funny noise have abounded for years. Recently, this editor concluded that the squiggle is most likely caused by the normal operation of equipment used for radio-frequency (RF) heating, sealing, or welding. Typically, a worker places the material to be heated, sealed, or welded into some type of metal carrier, and then manually hits a start button when everything looks safe.

The machine, with a power anywhere from 1500 to 150,000 watts, pulls in the work, lowers a large metal head onto it, and starts up the RF. As with most RF systems, this is a tuned circuit. As the material heats, its dielectric constant changes, and so does the tuning.

Older equipment handles this by allowing the frequency to drop. It swishes around, seeking a match. The center frequency decreases rapidly, and then settles down.

The signal thus produced is a perfect squiggle. Better yet, videos of these machines in use tend to show a cycle of operation that exactly matches the timing of these radio noises.

Newer machines are similar, except that they are usually designed to stay inside the narrow ISM (Industrial, Scientific, and Medical) band centered on 27.12 MHz. They also meet tight specs for RF emission.

But that's the new stuff. It's clear that plenty of older gear is still around. Some operators even remove any retrofitted shielding.

Unless someone knows a better explanation, the squiggle has been nailed.

ABBREVIATIONS USED IN THIS COLUMN

AFB.....Air Force Base
ALE.....Automatic Link Establishment
AM.....Amplitude Modulation
AWACS.....Airborne Warning And Control System
BOM.....Australian Bureau of Meteorology
Camslant.....Communications Area Master Station, Atlantic
Camspac.....Communications Area Master Station, Pacific
COTHEN.....Customs Over-The-Horizon Enforcement Network
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DHFCS.....Defence High Frequency Communications Service
DSC.....Digital Selective Calling
E06.....Russian "English Man," callup and numbers
E11.....'Stritch" English numbers with "/" in callup
E11c.....'Stritch" English null-message variant
EAM.....Emergency Action Message
FAX.....Radiofacsimile
FEMA.....U.S. Federal Emergency Management Agency
FM.....Frequency Modulation
HFDL.....High Frequency Data Link
HFGCS.....High Frequency Global Communications System
ID.....Station identification
LDOC.....Long-Distance Operational Control
MARS.....U.S. Military Auxiliary Radio System
MFA.....Ministry of Foreign Affairs
NAT.....North Atlantic oceanic air control, families A-F
NATO.....North Atlantic Treaty Organization
Navtex.....Navigational Telex
NDB.....Non-Directional Beacon (AM aero).
NOAA.....U.S. National Oceanic and Atmospheric Administration
RTTY.....Radio Teletype
S28.....Russian voice messages on "UVB-76"
Selcal.....Selective Calling
Sitor.....Simplex Telex Over Radio, modes A & B
UK.....United Kingdom
Unid.....Unidentified
U.S.....United States
USAF.....U.S. Air Force
USCG.....U.S. Coast Guard
Volmet.....Scheduled, formatted, aviation weather broadcasts

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations have their ENIGMA (European Numbers Information Gathering and Monitoring Association) designators in ().

37.5 Unid-Probably U.S. Navy NRK, Iceland, encrypted data stream at 0327 (PPA-Netherlands).

416.0 POZ-NDB, Pozarevac, Serbia, Morse ID at 2211 (Ary Boender-Netherlands).

428.0 TGM-NDB, Targu Mures, Romania, Morse ID at 2217 (Boender-Netherlands).

477.0 RP-NDB, Malacky-Kuchyna Air Base, Slovakia, Morse ID at 2222 (Boender-Netherlands).

1640.0 Unid-Pennsylvania Turnpike Authority, AM information station, loop with two short data bursts and female voice giving contact info, at 1240 (Mario Filippi-NJ).

1700.0 WPSH468-Manville, NJ Office of Emergency Management, AM information station with female giving contact information, then NOAA weather, at 1245 (Filippi-NJ).

1878.0 4LDA-Unknown fish net beacon with CW ID; others on 1882, 1909, 1924, 1959, 1964, 1975, 1981, 1982, 1990, 1993, and 1994; at 0235 (Filippi-NJ).

2216.0 XSS-UK DHFCS control, Forest Moor, ALE sounding; also on 2451.5, 3086, 5295, 8107, 8182, 8336, 9019, 9022, 10150, 11128, 11283, 14485, and 15040; at 2242 (MPJ-UK).

2579.0 IPB-Bari Radio, Italy, female giving weather in Italian, at 0416 (Filippi-NJ).

2680.0 IDC-Cagliari Radio, Italy, female with marine information in English and Italian, at 2019 (MPJ-UK).

2860.0 4XZ-Israeli Navy, Haifa, CW ID and messages; also on 4331, 4595, 6379, and 6607; at 1848 (Boender-Netherlands).

3261.0 TNKL-Russian military, 4-element tactical call, CW checks with G1HM, FUSJ, and others, at 2040 (MPJ-UK).

3330.0 CHU-Canadian National Research Council, time signals in USB with carrier, at 0017 (Filippi-NJ).

3361.0 SNJV-Russian military net control, duplex CW traffic for 3VXX, LPDR, and many others; similar activity on 5104, 5514, 6696, 7041, 7768, 7964, and 13953; at 2058 (MPJ-UK).

3924.0 Plymouth Air Safety-UK Royal Air Force, passing altimeter setting to aircraft using trigraph call, at 2124 (MDMonitor-Netherlands Remote).

4207.5 H8UT-Puerto Rican flag bulker *Placid Sea*, DSC call at 1700 (Patrice Privat-Hong Kong Remote).

4209.5 TAH-Istanbul Radio, Turkey, CW ID in Sitor-A marker, also on 4216 and 8431, at 2115 (Boender-Netherlands).

4212.0 UGC-St Petersburg Radio, Russia, CW ID in Sitor-A marker, at 1916. XSQ-Guangzhou Radio, China, CW ID in Sitor-A marker, also at 1916 (Boender-Netherlands).

4215.0 XSG-Shanghai Radio, China, CW ID in Sitor-A marker, at 1922 (Boender-Netherlands).

4426.0 NMN-USCG Camslant Chesapeake, male "Iron Mike" voice with marine weather, at 0342 (Filippi-NJ).

4447.0 "6-G-R"-NATO player in Joint Warrior exercise, working "1-I-B," at 2003 (MDMonitor-Netherlands).

4625.0 Unid-Russian military, seven strategic voice messages (S28) on The Buzzer, group callup "MDZhB," starting at 0829 (Boender-Netherlands).

4886.0 RMP-Russian Navy Baltic Fleet headquarters, Kaliningrad, coded CW message for RJL99, also on 5086, at 2011 (MPJ-UK).

5066.5 REDHWK-Unknown U.S. military, calling helicopter R26131, also on 7718 and 9081.5, ALE at 2354 (Jack Metcalfe-KY).

5083.0 RIR98-Russian Navy Black Sea Fleet, working RCV, headquarters in Sevastopol, Ukraine, CW at 2022 (PPA-Netherlands).

5167.0 CA0-French military Joint Warrior player, working CB0 and F2B0, also on 5794, at 1752 (PPA-Netherlands).

5189.0 891-Russian Intelligence numbers (E06), callup "891 116 15," then message in 5-figure groups, came from 5186, at 2030 (MPJ-UK).

5194.0 956-"Stritch" family numbers in English (E11), callup "956 Oblique 30," then 5-figure-group message, at 1710. 958-E11, callup 958/38 and numbers, also at 1710 (MPJ-UK).

5680.0 Kinloss Rescue-UK Rescue Coordination Centre, Scotland, working Sea King helo Rescue 193, at 1930 (MDMonitor-Netherlands). Rescue 165-UK rescue helo, working Kinloss at 2015 (Michel Lacroix-France).

5687.0 DHM 91-German Air Force, Münster, working GAF 121, at 1529 (MDMonitor-Netherlands).

5732.0 GML-Possibly USCG buoy tender *Alder* (NGML), COTHEN ALE sounding at 0420 (PPA-Netherlands).

6314.0 NMF-USCG Comm Station Boston, MA, Sitor B broadcast in Navtex format (identifier "F"), at 0205 (Filippi-NJ).

6532.0 7T-VJW-Air Algerie A330, flight AH4021, HFDL log-on and position for Shannon, at 2307 (MPJ-UK).

6535.0 "06"-HFDL ground station, Hat Yai, Thailand, uplink to VQ-BBG, Aeroflot A330 flight SU0232, at 2053 (PPA-Netherlands).

6596.0 "14"-Krasnoyarsk HFDL, Russia, working 9M-MND, a Malaysia Airlines A380, at 1738 (PPA-Netherlands).

6617.0 Rostov-Russian Volmet net two in Russian, also on 11297, at 2329 (MDMonitor-Netherlands).

6622.0 Gander-NAT-F, working Speedbird 23T, a British Airways B777 reg G-VIIG, at 0539 (PPA-Netherlands).

6640.0 New York LDOC, position from Amerijet 441, a B767, at 0618 (Allan Stern-FL).

6661.0 "04"-Riverhead HFDL, NY, working VP-BPY, an Orenair B737, at 0550 (PPA-Netherlands).

6676.0 Mumbai Volmet, India, aviation weather for Karachi, at 1758 (PPA-Netherlands).

6685.0 Korsar-Russian Air Force, Pskov; radio checks with Klarnetist (Tver), Polis (Orenburg), and Davlenie (Taganrog); at 1800 (MDMonitor-Netherlands).

6739.0 Andrews-USAF HFGCS control point, Andrews AFB, MD, 30-character EAM "4VLKGJ," showing multi-transmitter echoes, at 0156 (Filippi-NJ).

6802.0 GQ10-British Joint Warrior player, radio check with GQ0, at 1927 (PPA-Netherlands).

6825.0 FAV22-French Morse code practice, also on 8016, CW at 1303 (Lacroix-France).

6885.0 Korsar-Russian Air Force, Pskov, working Il-76 transport aircraft 78845, at 2252 (MDMonitor-Netherlands).

6985.0 "1-T-O"-NATO Joint Warrior player, working "9-K-P," at 1154 (MDMonitor-Netherlands). R22976-U.S. National Guard helicopter, Montana, calling KHLN, Helena Regional Airport, ALE at 2128 (Metcalfe-KY).

7325.0 NW1-U.S. military Nightwatch command post aircraft, calling ALNFEM (FEMA) and TTD (unknown); also on 8045.6, 9019, and 11238; ALE at 2021 (Metcalfe-KY).

7661.3 CORDOI-U.S. Department of the Interior, Fish and Wildlife Service, Corbin, VA, ALE sounding; also DENDOI, Denver, CO; also on 9394.6, 11597.6, and 18502.6; at 2021 (Metcalfe-KY).

7791.5 206102-Turkish Emergency Net, ALE sounding; also on 7810, 7868, 7870, 7993.5, 8092, 8150, 8412.5, 8950, and 12209; at 0357 (PPA-Netherlands).

7863.0 758-E11c, null-message callup 758/0000/00, at 1925. 757-E11c, null-message callup at 2000 USB (MPJ-UK).

8173.0 147-E06, callup "147 1 16551" and message, at 2000 (MPJ-UK).

8320.0 Unid-Probably the Argentina southern FAX service, weather chart in Spanish, called the Falklands "Las Islas Malvinas," at 0233 (Filippi-NJ).

8414.5 9HA2352-Maltese flag tanker *Nena K*, DSC call to 9HA2319, sister ship *Nosi K*, setting up voice on 12990, at 2123 (MPJ-UK).

8472.0 WLO-ShipCom, Mobile, AL, RTTY and Sitor-B "RYRY" test slips, followed by NOAA Gulf of Mexico weather, at 1228 (Filippi-NJ).

8600.0 XSV-Tianjin Radio, China, coded Chinese characters in CW, at 2024 (PPA-Netherlands).

8764.0 NMN-USCG Camslant, "Iron Mike" voice with gale warning, at 0334 (PPA-Netherlands).

8885.0 "15"-Al Muharraq HFDL, Bahrain, position from Kenya Airways flight KQ542, at 1919 (PPA-Netherlands).

8886.0 RP-C8388-AirPhil Express A320 flight 2P0993, HFDL log-on with Krasnoyarsk, Russia, at 2035 (MPJ-UK).

8888.0 Syktyvkar Volmet, aviation weather for Torbat in Russian, at 1903 (PPA-Netherlands). Luanda-Angola regional air route control, working Springbok 207, a South African Airways A340, at 1915 (MDMonitor-Netherlands).

8894.0 "11"-Albrook HFDL, Panama, uplink to N567AV, an Avianca A320 flight AV9449, at 0431 (PPA-Netherlands).

8903.0 Kinshasa-African air route control, Congo Republic, working South African Air Force LMG737, at 1805 (PPA-Netherlands).

8906.0 Santa Maria-NAT-A, Azores, position from USAF Air Mobility Command transport Reach 716, at 1939 (MDMonitor-Netherlands).

8912.0 D47-US Customs and Border Protection P-3, reg N147CS, COTHEN ALE sounding at 0429 (PPA-Netherlands).

8939.0 St. Petersburg Volmet, aviation weather in Russian, at 1908 (MDMonitor-Netherlands).

8957.0 "13"-Santa Cruz HFDL, Bolivia, position from COPA 277, a B737 reg HP-1727CMP, at 0538 (PPA-Netherlands).

8977.0 5K0108-HiFly A340 reg CS-TFX, HFDL log-on with Reykjavik, at 2125 (MPJ-UK).

8983.0 Camslant Chesapeake-USCG, VA, ops-normal and position from Coast Guard 2112, a USCG HU-25C Falcon Jet, at 1455 (Stern-FL).

8992.0 Unid-US military, short EAM with no repeat, then right into Skyking broadcast, at 1153 (Gary Cohen-NY). Circus Vert-French Air Force, Villacoublay, working unknown aircraft, at 1910 (MDMonitor-Netherlands).

9016.0 Offutt-USAF HFGCS, NE, working Reach 7041, at 1522 (Stern-FL).

9031.0 Tascomm-UK Terrestrial Air-Sea Communications, weather for Ascot 6852, a Royal Air Force transport, at 1627 (MDMonitor-MD).

9067.7 Unid-Egyptian MFA, Cairo, long Arabic Sitor-A message to Pyongyang, North Korea, at 2048 (PPA-Netherlands).

10018.0 Mumbai-African/Indian Ocean air route control, India, working Thai Airways International flight 518, an A330 reg HS-TEN, at 1853 (PPA-Netherlands).

10075.0 UK-32014-Uzbekistan Airways A320, flight HY0762, HFDL log-on with Al Muharraq, at 2142 (MPJ-UK).

10093.0 "09"-Barrow HFDL, AK, uplink to PK-GFP, a Garuda Indonesia B737 flight 852, at 1818 (PPA-Netherlands).

10543.0 RCV-Russian Navy, working vessel RHL80, CW at 1951 (PPA-Netherlands).

10555.0 VMW-Australian BOM, Wiluna, FAX wave chart at 2306 (Filippi-NJ).

10987.0 ZUWT-Probable Russian military, calling OOH9 in CW, at 0041 (Filippi-NJ).

11000.0 RIW-Russian Navy, CW and data with RGV82, at 0901 (PPA-Netherlands).

11030.0 VMC-Australian BOM, Charleville, FAX weather chart at 1247 (Filippi-NJ).

11090.0 KVM70-NOAA, HI, FAX satellite image at 1257 (Filippi-NJ).

11175.0 Reach 333-USAF Air Mobility Command, radio check with Andrews (Andrews AFB, MD), channel also busy with many 30-character EAMs, at 0538 (Tony Agnelli-FL). Lima Lima 301-U.S. Navy P-3C, patch via Andrews HFGCS to Fiddle (USN Tactical Support Center, FL), at 1430 (Stern-FL).

11184.0 VT-JCK-Jet Airways (India) ATR-72, HFDL position for Reykjavik, at 2049 (MPJ-UK).

11193.0 Moscow LDOC, radio check in Russian with 78847, an Il-76, at 1209 (MDMonitor-Netherlands).

11205.0 Tascomm-UK military, selcal JK-ES to ASCOT 6692, a UK Royal Air Force C-17A number ZZ171, at 1021 (Lacroix-France). Tascomm, unsuccessfully sending weather info to Magic 83, back end of a NATO E-3 AWACS; went to 13257 for better propagation, at 1233 (MDMonitor-Netherlands). Echo Whiskey-U.S. Navy, target tracking net with November, at 2004 (Metcalfe-KY).

11217.0 Afriqiyah-Afriqiyah Airways company LDOC, Libya, weather for Afriqiyah 461 in English and Arabic, at 1235 (MDMonitor-Netherlands).

11220.0 Offutt-USAF HFGCS, Offutt AFB, NE, secure voice check with Reach 7041, then went to 9016, at 1510 (Stern-FL).

11254.0 Priboj-Russian air transport central sector, Moscow, working aircraft 46548, then passing its status to Novator (possibly Murmansk), at 1153 (MDMonitor-Netherlands).

11256.0 Holloway-Ethiopian Airways company LDOC, working Ethiopian 3910, at 1746 (MDMonitor-Netherlands).

11300.0 Tripoli Radio-African air route control, Libya, working Kenya 102 (Kenya Airways), at 0130 (Stern-FL). Speedbird 65-British Airways flight working Tripoli air route control, Libya, at 1426 (Lacroix-France).

11306.0 "16"-Agana HFDL, Guam, uplink to A7-ADV, a Qatar Airways A321 flight 304, at 1811 (PPA-Netherlands).

11345.0 Stockholm LDOC, Sweden, weather for VDA 9052, a Volga-Dnepr Airlines An-124 freighter, at 1515 (MDMonitor-Netherlands).

11354.0 Priboj-Russian Air Force, Moscow, working 04104, a Russian Navy transport, at 1422 (MDMonitor-Netherlands).

11360.0 Korsar-Russian Air Force; radio checks in Russian with Davlenie (Taganrog), Polis (Orenburg), and Proselok (Bryansk); at 1305 (MDMonitor-Netherlands).

11387.0 Australian Volmet, Ningi, Queensland, aviation weather at 1902 (PPA-Netherlands).

11396.0 Jakarta-Southeast Asian air route control, Indonesia, working Singapore 478, a Singapore Airlines B777 reg 9V-SVE, at 1912 (PPA-Netherlands).

11418.0 RMP-Russian Navy, calling RKO81, CW at 1852 (PPA-Netherlands).

12365.0 VMC-Australian BOM, Charleville, weather forecast and gale warnings, at 0734 (PPA-Netherlands).

12577.0 005743030-Ho Chi Minh Ville Radio, Viet Nam, DSC call to 371825000, Panamanian flag vessel *Peace Traffic* (3FFR6), at 1804 (PPA-Netherlands).

12579.0 NMF-USCG, Boston, Sitor-B ice reports at 1709 (PPA-Netherlands).

13089.0 NMC-USCG Camspac Point Reyes, CA, East Pacific forecast from the National Hurricane Center, Miami, at 2253 (Robbie Spain-WY).

13110.0 WLO-ShipCom, AL, female machine voice with weather, at 2304 (Spain-WY).

13215.0 160017-USAF C-5B #86-0017, ALE sounding at 1423 (MDMonitor-Netherlands).

13257.0 Tascomm, came from 11205 for Magic 83, frequency was no better, so went to 6733, at 1238 (MDMonitor-Netherlands).

13264.0 Shannon Volmet, Ireland, female machine voice with European aviation weather, at 1235 (Filippi-NJ).

13270.0 "06"-Hat Yai HFDL, uplink to 9V-SKP, a Singapore Airlines A380 flight SQ0322, at 1826 (PPA-Netherlands).

13282.0 Hong Kong Volmet, aviation weather for China, at 1848 (PPA-Netherlands).

13306.0 New York-NAT-A, selcal EL-CQ to Speedbird 253, a B767 reg G-BNWV, at 1921 (PPA-Netherlands).

13312.0 "02"-Molokai HFDL, HI, uplinks to B-6519, a Hainan Airlines A330, and B-6175, a Sichuan Airlines A319, at 0623 (PPA-Netherlands).

13315.0 PR-ONL-Avianca Brasil A320, domestic flight O66313, HFDL position for Santa Cruz, at 2100 (MPJ-UK).

13330.0 Unid-Kenya Airways company LDOC, Nairobi, selcal HS-AQ to a B767 reg 5Y-KYX, at 1925 (PPA-Netherlands).

13342.0 Stockholm LDOC, Sweden, selcal EK-HQ to Speedbird 638, a British Airways B737 reg G-BNWN, at 1600 (Lacroix-France).

13564.0 "GNK"-KC9GNK legal HiFER beacon, WI, CW ID at 2302 (Filippi-NJ).

13900.0 BMF-Taipei weather FAX, Taiwan, two forecast charts at 1725 (PPA-Netherlands).

13927.0 AFA9AY-USAF MARS, CA, morale patch from Reaper 13, a B-2A, to a commercial number, at 2250 (Stern-FL).

13988.5 JMH4-Japan Meteorological Agency, FAX upper level chart at 1709 (PPA-Netherlands).

15016.0 Offutt-USAF HFGCS, EAM at 1401 (PPA-Netherlands).

15658.0 049CDCT30-U.S. Department of Public Health and Human Services, MT, voice call WNG 958, calling 001CDCNHQ, U.S. Centers for Disease Control, GA, ALE text message, at 1419 (Metcalfe-KY).

16804.5 003669991-USCG, Boston, DSC call to 209063000, Cyprus flag bulker *Norfolk* (P3HC9), at 1336 (PPA-Netherlands).

16892.0 XSG-Shanghai Radio, China, CW ID after Sitor-A selcal marker, also on 16898.5, at 2325 (Filippi-NJ).

17231.0 JFC-Misaki Fishery Radio, Japan, short CW messages in probable Japanese Wabun code, at 0835 (Eddy Waters-Australia).

20992.5 AFA3CU-USAF MARS, VA, patching Dragon 21, a U-2, to Beale AFB Operations, at 1940 (Stern-FL).

22526.0 NMC-USCG Camspac, CA, FAX schedule part two, at 2336 (Filippi-NJ).

22611.5 HLF-Seoul Radio, Korea, CW marker at 0034 (Filippi-NJ).

30620.0 "Base"-Probably WPSD819, Millennium Taxi Service, Chattanooga, TN; female dispatcher with Southern accent, used a 210.7 hertz guard tone, FM at 2000 (Hugh Stegman-CA).

Mike Chace
mikechace@monitoringtimes.com
www.chace-ortiz.org/umc

North Korean Diplomatic HF Operations

As this column goes to press, tensions between the Democratic People's Republic of Korea (DPRK), its neighbor to the South and the U.S. continue on a daily basis, with threats of action being made by all sides. As one might expect under these circumstances, diplomatic networks will be carrying increased traffic. However, this doesn't appear to be the case for the MFA Pyongyang and its diplomatic HF operations overseas which continue at the same pace as before.

Some inaccurate frequency guides still list the organization's old 50 bd/1000 Baudot RTTY channels but these have been silent for more than a decade. These days, the only way of following MFA Pyongyang is by its proprietary ARQ (Automatic Repeat Request) system. This system is unfortunately not decodable by any available software, but it is at least distinctive enough to be readily identifiable by ear with its raspy, burst cadence (see Resources below).

This proprietary FSK ARQ system operates at two different speeds, 600 baud and 1200 baud and occupies 600 Hz or 1200 Hz of bandwidth respectively. The higher speed mode has a "smoother" sound to its rasp than the slower variety. At least one monitor has reported a 400 baud mode too, but I have yet to hear this kind. The system appears to have a 600 baud calling mode, noticeable by its short, repetitive nature heard before the receiving station answers and traffic begins. The ACF (Auto-Correlation Function, or measure of periodicity in the signal) shows 306 or 307 bits, which you can see in Figure 1.

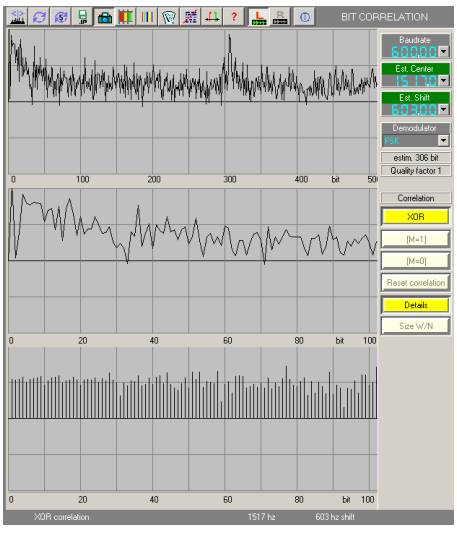


Figure 1: MFA Pyongyang 600bd/600 FSK ARQ Autocorrelation Function

Like many ARQ-based systems, MFA Pyongyang and its embassies use duplex operation where the sender (usually logged as the ISS or Information Sending Station) and receiver (the IRS or Information Receiving Station) occupy different frequencies that are usually separated by one or two megahertz according to needs and propagation conditions. So, if you hear one of these stations, it's useful to scan +/- 1 or 2 MHz to find the other half of the link. If you have two receivers or a single radio with dual, independent VFOs, you can set one receiver or VFO to the ISS and the other to the IRS frequency and verify that you've found the other half by noting that when the ISS sends its bursts, the IRS replies on the other frequency during the gaps in between. In the case of the North Korean system, the ISS burst takes approximately 310 ms and the repeat request burst from the IRS takes around 200 ms. You can see this timing clearly in Figure 2.

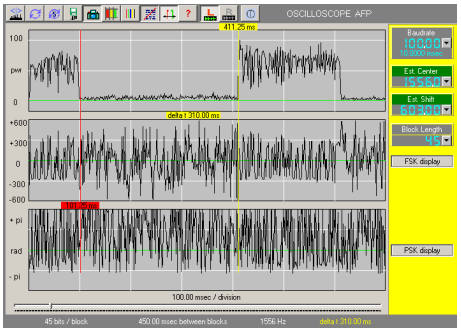


Figure 2: MFA Pyongyang FSK ARQ Signal Timing

Also in common with some other duplex diplomatic operations, the MFA often applies constant carrier power to one "leg" of the FSK signal. This is thought to allow the embassies to use AGC (Automatic Gain Control) on the higher power signals available from the MFA outlet. At least one monitor has reported that the signals are carried on the Lower Sideband (LSB) because of operator chatter heard following the data transmission, but I have yet to verify this. Until then, I will quote the center of data on the USB frequency (dial or carrier USB frequency being 1500 Hz below those quoted). Here are some recently active channels to check for activity, which is usually highest in late evening and early morning U.S. time:

6748.5, 10405.5, 10418.5, 10553.5, 10618.5, 10623.5, 10848.5, 11198.5, 11433.5
11438.5, 12205.5, 13098.5, 13128.5, 13371.5, 13448.5, 13848.5, 13871.5, 14373.5
14442.5, 14528.5, 14530.5, 14778.5, 14808.5, 14848.5, 14888.5, 15961.5, 16001.5
16006.5, 16018.5, 16118.5, 16128.5, 16131.5, 16246.5, 16310.5, 16316.5, 16348.5
16418.5, 16548.5, 16618.5, 17198.5, 17413.5, 17418.5, 18031.5, 18318.5, 18348.5
19118.5, 19318.5, 19448.5, 19638.5, 19848.5, 19994.5, 20098.5, 20118.5, 20248.5
20928.5, 21448.5 & 21668.5 kHz

The Mysterious OL1A

I've heard this mysterious station and its partners OL1B and S2A a number of times over the past months. The registered owner of the call sign is a Czech amateur radio contesting station and therefore unlikely to be operating outside the allocated ham bands, suggesting that this is a bogus call sign. Data is often sent in plain text using PacTOR-II or III and often features casual reports of activity in Czech which might suggest something other than a military, intelligence or aid operation. However, voice encryption using a TCC DSP9000 unit or compatible equipment has also been reported in use by the station, suggesting otherwise. Operation has continued since at least 2005, having been heard on a wide variety of channels as follows:

3318, 5469, 6821, 6946, 8134, 9384L, 10706L, 14892, 16180, & 20350 kHz USB (L=LSB)

Here's an example of Czech text copied back in 2009 by UDXF monitor Bruno Casula in Italy:

> Ideální rodina z pohledu TV reklam Ideální rodina zije v novém domku, s velkou zahradou a bazénem, zatíženém hypotékou. V garázi mají rodinný vùzpoøízený na leasing, stejnì jako mají na splátky vybavenou celou domácnost. Èlenové rodiny jsou ètyøi, otec, matka, a dvì dìti.

Data can also be seen using binary transfers of (usually) PKZIP compressed files, as can be seen in this example of two different messages below:

```
F>
Standby for the following file/s from OL1A
np.dat 6242 bytes
#BIN#np.z~~ 6389 np.dat 6242
PK]MyBi˘©˘ábnp.dat
{binary main body of PKZIP compressed data deleted for clarity}
]MyBi˘©˘áb$Ânp.datPK
F>
Standby for the following file/s from OL1A
stop.txt 22 bytes
#BIN#stop.txt 22 stop.txt 22
DasGLNbnGF1TNHowN9Ls
F>
```

In this case, the first transmission is a zip file containing a source file called "np.dat" and the second, a short 22 character string. Transmissions generally end with the character string "##CRCOK##".

I've received some great comments from readers on columns over the past months, so please use the email address in the heading above or via "snail mail" and feel free to drop me a line with any questions or requests for features you'd like to see in future editions of Digital Digest.

Resources:

MFA Pyongyang Clip **dl.dropboxusercontent.com/u/301213/DPRK600bdFSK.wav**

Kirk A. Kleinschmidt, NT0Z
kirk@monitoringtimes.com

Globalization, Lab Equipment and Your Pocketbook

In Mumbai, India, a wealthy industrialist can lounge beside an olympic-size swimming pool atop his 27-story single-family home. Six floors of the "world's largest home" are parking levels, one for each of the house's five residents, plus a "spare" for guests. One of the interior "rooms" can create "artificial weather," and another, in the parking levels, hosts a BMW-staffed service station. I didn't see any ham radio towers in a photo of the place, but what ham wouldn't want a billionaire-grade antenna with a 400-foot height above average terrain and a pileup-producing VU call sign?

Ironically, the house, valued by some at almost a billion dollars, towers over one of the worst slums on planet Earth, where millions of people live in unbelievable poverty and a typical 12-hour work day nets $3 in wages. This tightly packed 500 acres of "hell on earth," with one working bathroom for each 1400 residents, is an open sewer of toxic and human waste that exists to process the garbage of the whole of Mumbai's 20-million residents. For the moment, anyway, nowhere else on the planet better illustrates the extreme differences between the haves and the have-nots.

But that may soon be changing. Riots in Greece, Spain and Italy protest the inequitable distribution of wealth, resources and jobs, and an increasingly schizophrenic political and social discourse about the same issues is taking place in the this country. What's now so starkly evident in Mumbai may soon be reality in parts of Europe, the U.S., or your backyard.

Thanks in large part to globalization and technology, the world's economic and political systems are changing rapidly. And, if you're able to take advantage of this transitional moment in world history (by having the good fortune to have a sustainable income and a place to live and house your radio shack, as most *MT* readers do), you can enjoy unparalleled value and performance when it comes to all electronic devices, from computers to coffee makers to amateur radios to test equipment (OK, scratch coffee makers from the list. Those probably *were* better values back in the day).

This brief introduction to the modern value proposition of electronic radio goodies is admittedly (and purposefully) a bit over the top. But in these days of $300 laptop PCs and $700 DC-to-daylight ham rigs, it's important that we at least remember that there is often a darker side to change and progress. Although the Roman Empire lasted an awfully long time, it did eventually end. I suspect, however, that even during the several hundred years that marked the "decline" of the Empire, life was still pretty good for typical Romans.

In the summer of 2013, on the eve of what's to come – whether continued decline or the next great leap forward for humanity – as hams and electronics hobbyists we now enjoy the best "bang for the buck" in the entire history of the hobby (which is decidedly short compared to the Roman Empire!).

The Golden (Expensive) Age of Radio

If you've never done it, or if you think your present-day hobby is too expensive, you owe it to yourself to check out the equipment ads in old ham radio and electronics magazines from the 1930s through the 1960s. Whether components (made by National, Millen or Miller) or classic receivers and transmitters (made by Collins, National, Drake, Johnson, Hammarlund, etc.), they all had one thing in common: stellar price tags. In those days, a high-end receiver could set you back $1,000 or more (add another thousand for a transmitter). Even as late as the 1960s you could buy a new car (fully loaded) for less than the cost of a Collins transmitter and receiver!

It's crazy but true: In 1968, a new Chevy Camaro SS cost $2,588. A 1966 Ford pickup was a reasonable $1,795. In the same year, a Collins 51S-1 shortwave receiver cost more than $2,000! Drake's R4, a solid performer but more of a "ham bands only" box, still cost $600! At the very upper echelons, National's HRO-500 all-solid-state shortwave receiver cost a cool $3,000 in 1974. Yikes!

According to the inflation calculator at the U.S. Bureau of Labor Statistics (**www.bls.gov/data/inflation_calculator.htm**), a radio that cost $500 in 1968 would cost a whopping $3,334 in 2013 dollars! That Collins 51S-1 would cost $13,377 today, and the 1974 HRO-500 a whopping $14,164! I'm sure you could spend $16,000 2013 dollars on an exotic, CIA-grade shortwave receiver if you really wanted to, but there's no performance-based reason to do so (just as there's really no practical reason to build a billion-dollar, 27-story house).

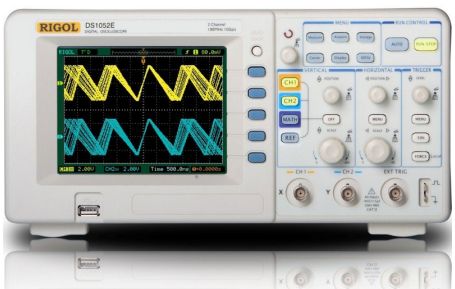


Fig *1* ***Rigol's DS1052E 50-MHz, dual-trace, digital-storage oscilloscope, tops the chart in terms of price, performance and value. This much measurement goodness for $320? The good old days were never this good! For more information see www.rigolna.com.***

Looking at "reverse inflation" is even more interesting. Consider, for example, Icom's venerable IC-718 entry-level HF transceiver. At about $700, it's arguably the least expensive 100-W transceiver on the market, and it has a solid feature set and repair history. In 1968 dollars, the IC-718 would have sold for a mere $104! That's a pretty amazing benchmark of value, technological progress and today's globalized economy, even if you don't consider that the '718 can do things a 1968 radio couldn't yet imagine.

Most hams and SWLs have at least some awareness about prices and technological progress when it comes to radios, computers and TVs, but test equipment and lab gear have followed the same path. While you weren't looking, its price/performance evolution has kept pace with, or even surpassed, that of the ham radio gear we know and love. Experimenters and home-brewers rejoice! You've never had access to so much hardware for such little money. Learning how to effectively use the stuff is probably as challenging as ever, but that's another story! Let's take a look at a few formerly big-ticket lab goodies.

Oscilloscopes

Last week I saw an oscilloscope for sale at a local garage sale, and it wasn't the usual basket case! It was a 20-MHz, dual-trace model from the 1980s, and it sported a recognizable brand name (that wasn't Tektronix). The $500 price tag was a bit shocking, so I struck up a conversation with the seller, a friendly, recently widowed lady in her late 70s. Her husband, who had recently passed away, told her that his scope (a longtime companion) was worth $500, and she had remembered the great care he had taken when packing and moving the instrument.

With her permission I turned the scope on and used a paperclip to connect one BNC input to the scope's built-in calibration terminal (she had inadvertently "donated" the probes to the local electronics recycler). A trace came up with no arcing and sparking, and the focus and intensity controls functioned smoothly. The test voltage (square wave) displayed OK, but it was clear that the scope or the calibrator was a bit out of spec. The horizontal trace was tilted quite a bit, too, as if a jolt or bump had rotated or shifted the coils on the back of the CRT, but there were no cracks, dents or missing knobs, etc. It's possible that an internal "screen rotation" control exists, which might correct that issue, but no external control of that type was visible.

I told her that 20 years ago, the scope *was* worth $500, and that 30 years ago, it was

probably worth $1,000, but that now, her old-school scope (sans probes and with a possible bump to the head), was worth $40 to $100. Because she was a veteran computer user, she understood the precipitous drop in actual value, and the price premium of sentimental value we all tend to attach to our favorite possessions, electronic or otherwise. She immediately dropped the price to $50 and made a new sign with a big, black marker! I told her that I might have been tempted to buy it, but that I already had two analog scopes at home that were *seeing no use whatsoever* since they were pushed aside by a Rigol DS-1052E (pronounced like "regal," as in Buick, **www.rigolna.com/products/digital-oscilloscopes/ds1000e/ds1052e**).

The '1052E is perhaps the best example of how far oscilloscopes have come, and how far prices have fallen (paralleling mainstream ham gear). It's a 50-MHz, dual-trace, digital-storage scope that's super-easy to use and typically retails for $320 (its big brother, the DS-1102E, is the same rig, but with a 100-MHz bandwidth that retails for $399). These scopes have LCD displays (no CRTs and their associated high-voltage supplies), weigh only a few pounds and are smaller than a loaf of bread. Unlike older analog scopes that take plenty of button-pushing and knob twirling to "freeze" a waveform, with the Rigol scopes you touch the test probe to the signal source and push one button. The scope "auto-freezes" the waveform and displays frequency and voltage information, to boot. An image of the waveform can easily be saved to a flash drive, or the scope can be computer-controlled via USB. This probably isn't the best tool to use to actually *learn about* what oscilloscopes do and how they do it, but the functionality, convenience and low cost make an irrefutable argument!

There are other makes and models out there with similar specs, and some have a feature or two that the little Rigols don't, but DS-series scopes have a huge user base, proven designs, known longevity and accessible U.S.-based customer service. Few competing brands in this price range can say the same. There are plenty of good, used, high-end scopes from yesteryear that have trickled down to the present, but there are a lot of nightmare junkers out there, too. So, unless you prefer vintage electronics (nothing wrong with that) or have a specific use scenario, it's hard for me to recommend a 30-year old Tektronix or HP scope over the Rigol, even if the former may have cost $10,000 back in the day.

❖ Spectrum Analyzers

In my days at ARRL HQ, using the lab's HP spectrum analyzer (then a 141-T chassis with 8500-series plug-ins as I recall) was off-the-chart exciting. The gear lived in a large, submarine-like Faraday cage (screen room) and was the very stuff used to test radios and other items for *QST* Product Reviews. Testing the spectral output of a $5 home-brew QRP transmitter seemed like overkill, but with the lab tech's assistance, I tested it nonetheless!

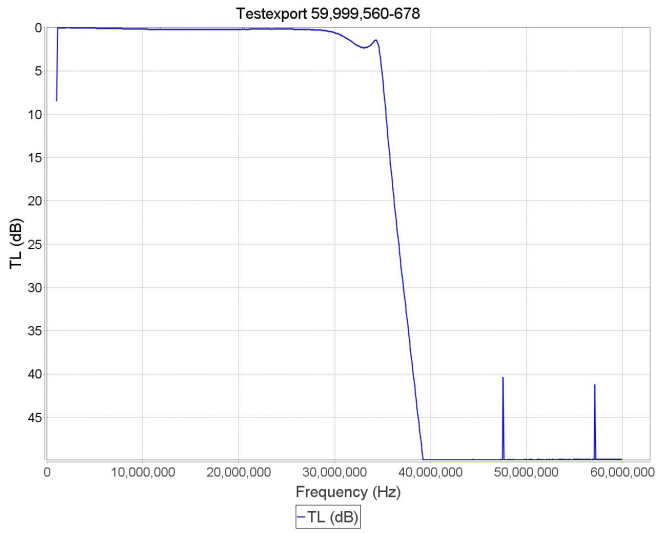


Fig 2 ***This miniVNA scan of my Drake HF low-pass filter looks very "spectrum analyzer" like. The sweep shows almost no attenuation up to 30 MHz, and after that, a sharp fall off until the filter loss maxes out at 40 MHz. A spectrum analyzer would likely show detail at attenuation levels greater than 50 dB—the approximate dynamic range of the minivan. But, in lieu of an instrument costing three to 10 times as much, it's still very useful, and it's a top-notch antenna analyzer, to boot. See www.w4rt.com. (Scan by NT0Z.)***

Because it was made in the 60s and 70s, that high-end HP lab gear cost many tens of thousands of dollars when new, and was rarely, if ever found in an individual's shack. Now, many years later, you can buy it on eBay or from a variety of test equipment brokers. A display chassis with analyzer and tracking generator modules (DC-to-1.5 GHz) can be had for $500 to $5,000 depending on source, condition and your ability to fix and maintain it.

When calibrated and in good condition, the older HP stuff still works wonders and can run rings around some of its newer, much-less-expensive counterparts (resolution bandwidth and dynamic range, to name two). But it's physically huge by modern standards and uses some internal parts that were exotic in the day and may be all but impossible to find now. And, with 20-40 years on the clock, even instrument-grade electronics need ongoing service, maintenance and calibration.

The alternatives, while not as comparatively inexpensive as today's oscilloscopes, are varied, and in several years will probably sport similar bargain-basement prices. Most modern spectrum analyzers have SDR innards, which could produce potentially bizarre low prices in a few short years.

You could build your own spectrum analyzer. The W7ZOI design (**http://homepages.wmich.edu/~cotton/SA1.html**) has been replicated by experienced builders, but it's not something I'd recommend to beginners! The same goes for Hans Summers' design (**www.hanssummers.com/spectrumanalyser.html**). I've found that every DIY design out there comes up just shy of actual "buildability" unless you're an engineer!

You could use a miniVNA or a miniVNA Pro (**www.w4rt.com/Misc/miniVNA.htm**), or one of its counterparts, as "half an analyzer." (A full-grown spectrum analyzer has two main modes. One mode is a wide-range receiver with a graphical display that's used to measure the spectral output of transmitters and other circuits that produce their own RF signals. The second mode uses an RF tracking generator to "sweep" a filter or other device under test and show the results on the analyzer's graphical display.) W4RT's miniVNA, short for mini-Vector Network Analyzer, has its own tracking generator, so for tests that require a tracking generator, it *is* a spectrum analyzer (one that uses your PC to display results). Its dynamic range is less than that of a full-size spectrum analyzer, but at $399 to $550, so is its price. Plus, it's also an ace antenna analyzer (it's main function). Back in the day, VNAs were obscenely expensive. Now, they're almost casual.

Software-defined radios (SDRs), from Softrocks (**http://fivedash.com**), to FlexRadios (**www.flex-radio.com**), to Universal Software Radios (USRPs, **www.ettus.com/home**), and almost everything in-between, can function as spectrum analyzers subject to their bandwidth limitations. Among other things, *Gnu Radio* software (**www.gnuradio.org**) lets you design your own spectrum analyzer type device and works especially well with USRPs). Most ham/SWL SDRs don't come with tracking generators (although they easily could... hint, hint), but it's still possible to sweep filters and circuits by using an inexpensive wideband noise generator such as Elecraft's N-gen (**www.elecraft.com**) as a signal source.

You can also just cut to the chase and simply buy a spectrum analyzer. They're still not inexpensive, but they cost a tiny fraction of what they used to cost. Leading the pack of recommended devices is Rigol's DSA-815-TG (TG is the model with a built-in tracking generator), a $1500, 9-pound box of RF goodness that will cover you to 1.5 GHz with decent specs, bandwidth and resolution bandwidth (**www.rigolna.com/products/spectrum-analyzers/dsa800**). This unit is well-reviewed by those who are "in the know." And Santa, if you're listening, this is the one!

As with mainstream ham gear, there are many other ham lab devices that now have *crazy low* prices, from digital multimeters to LCR meters to antenna analyzers (which didn't even exist back in the day), and I will cover them in more detail in a future column (along with some things that may have increased in relative price such as rotators and towers). Until civilization implodes, there has never been a better time to stock your DIY ham radio laboratory!

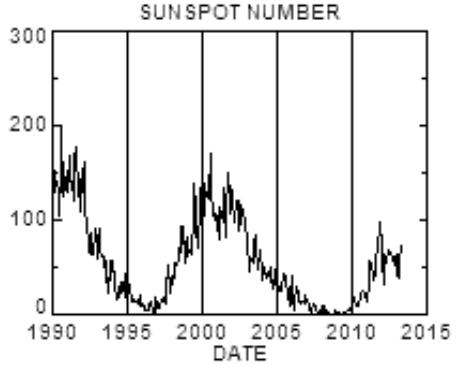
Ken Reitz, KS4ZR
kenreitz@monitoringtimes.com

Solar Cycle Issues, Tiny OTA-TV Antennas, Pirate Radio and More!

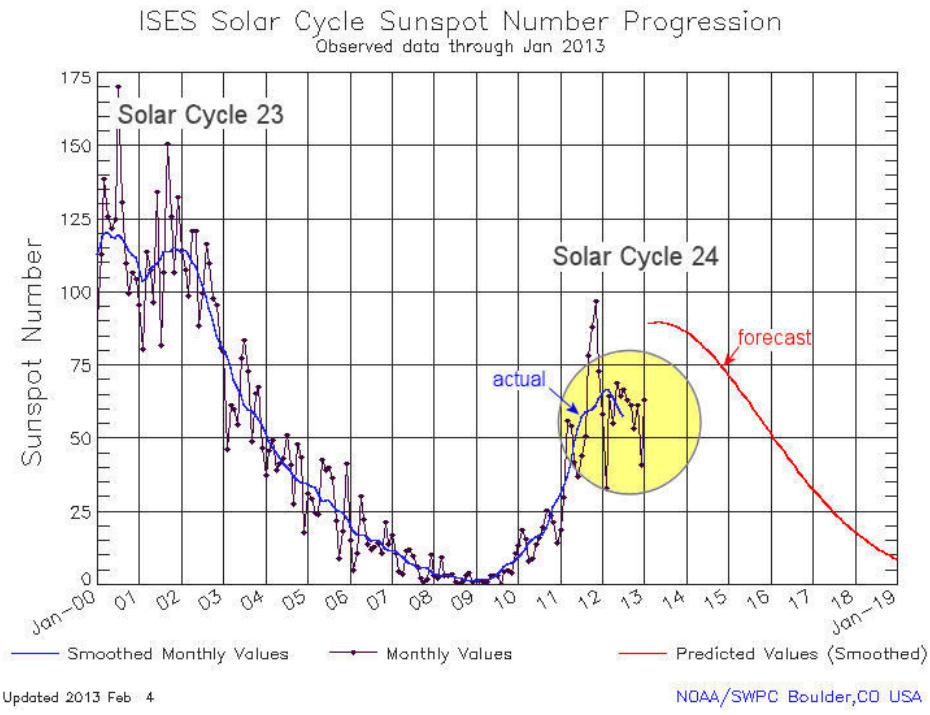
Referring to a comment I made in this column regarding Solar Cycle 24, Mike Colburn KV6Q writes: "Perhaps what was intended on 'Getting Started' for May 2013, was that another set of peak conditions won't likely be seen for another 11 years, as opposed to 'it gets worse for the next 11 years.' In reality, we can probably expect generally less favorable conditions for about the next five to six years, followed by a gradual increase to the next peak, in about 2014. I recall day and night-long openings on ten meters, providing ample opportunity to plaster the walls with new QSL's. Not sure that has been seen this time."

Ordinarily, I would agree that after next year propagation will trend downward for the next five to six years and then trend back up. But, the trend within the trend indicates that, since Solar Cycle 22, Cycles 23 and 24 were increasingly poor performers (peaks during each not coming close to previous peaks) suggesting to some a further trend towards a Maunder Minimum (the 70 year period between 1645 and 1715 when there was very little solar activity observed, though solar observations were common by then).

Maybe I'm just the gloomy type, but I don't think the average ham (now aged 61 and rising) will live to see the kind of solar cycle we celebrated as recently as during Cycle 22, specifically between 1988 and 1993 when sunspot numbers daily hit 150 to 200. The chart captioned, "Trends in the last three solar cycles," from NASA's Marshall Solar Physics web page illustrates the point. You might say that right now we're going "up the down escalator" in that, while we may see a relative increase in solar activity, the peaks are considerably less in amplitude and shorter in duration, more closely resembling the peak of Cycle 14 (1900-1912, at the dawn of the radio age) which saw a cycle amplitude of 84.2 daily sunspots. At any rate, what I was hoping to relate is that, regardless of how bad the coming solar propagation may be, hams today have several new transmission modes available that will let us cope with the possibility of "worse times yet to come."



Trends in the last three solar cycles updated as of May 1. (Courtesy: NASA)



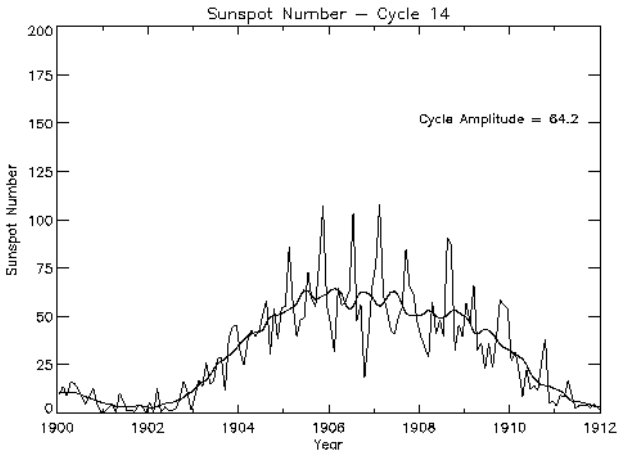
Possible "double peak" on Solar Cycle 24 may correspond to Cycle 14. (Courtesy: NASA)

Morgan Little provided a link to a website touting a thin, inexpensive Over-the-Air (OTA) TV antenna and wrote: "What about the HD-Blade antenna? Is it for real? What's the difference in frequency between HDTV and HD-Radio®"

Morgan wrote before the June issue came out which featured a review in this column of the Mohu SKY-HDTV antenna, available here: ***https://store.gomohu.com/sky-hdtv-outdoor-antenna.html****. The company also makes a product similar to the one you mentioned called the Leaf, a small flexible, flat-plate TV antenna. The advantage of the SKY antenna is that it is designed for outdoor use (though it can be attic-mounted), picks up VHF as well as UHF-TV channels and is bi-directional.*

Some of these smaller antennas have pre-amps built-in and others don't. Most have less coax lead-in. You can usually tell which are amplified by the extra cost. Adding the amplifier usually doubles the price. Since they advertise them as "indoor" antennas my guess is that they're intended for use in suburban or urban locations. As stated in my review, the SKY worked amazingly well, pulling in VHF and UHF-TV stations from 40 miles away and 25 miles away in the opposite direction.

The SKY-HDTV is very small and comes with 30 feet of coax and a power-inserter that powers the amplifier. It's expensive ($170 with their discount, though shipping is free).



Solar cycle 14 from just over 100 years ago as radio was in its infancy. Imagine what might have happened if radio had been invented during a surge of solar activity! (Courtesy: NASA)

It performs better than the Winegard SS-2000 which had been my favorite small antenna until now. For me the big advantage is bi-directional reception.

As to HDTV and HD-Radio frequencies, nothing has changed in the TV bands so far; they use the same VHF and UHF frequencies they've occupied since the 1950s. What's changed is that most TV stations are on the UHF band though certain channels may remain VHF. But, in the future the FCC will sell off most of the UHF frequencies to wireless developers and who knows what will be left of either band. HD-Radio is still limited to the traditional AM and FM bands, though there are very few AM HD stations.

Mohu Leaf amplifiled indoor VHF-UHF-TV antenna ($90). (Courtesy: Mohu)

Johannes Vikerns writes: "I live 25 miles from the Canadian border. If I have an HDTV set and I hook it up to an antenna will I pick up Canadian broadcasting? I have tried OTA-TV, and my kids don't like it but I refuse to pay for commercials. We are on dialup AOL which will end in September, so we will lose Internet and streaming will be out too."

Initially, I would say yes, you should be able to receive Canadian broadcasting. But it really depends on how far away you are from the nearest Canadian city, the type of antenna, the height of the antenna, the terrain between your antenna and the target area, power output of the stations you are trying to receive and other factors including whether or not you have a mast-mounted preamp and rotator. I've also found that it depends on the TV itself, some TV sets are better receivers than others.

The first thing to do is go here: ***www.tvfool.com****. At this web site you'll enter your address or even just your Zip code and the calculator will display a map showing the TV signals that it might be possible for you to receive. With the cursor you can click on each station and the call sign, channel designation, network affiliation, power output and distance from your location will be listed.*

Digital TV signals are considerably less robust than the old analog signals. We used to be able to put up with a certain amount of "snow" on the screen from weaker signals, but digital broadcasts require more signal to keep from dropping out. It's helpful to use a rotator because not all transmissions will be coming from the same direction and it will be handy to be able to move the antenna. I've found that, in my location, reliable signals (that is, not just occasional signals) will be possible within a 50 mile radius (I have a large UHF antenna mounted at 25 feet with a preamp and rotator).

As for losing your dial-up Internet service, you might be interested in this: ***www.exede.com****. It's a satellite-delivered Internet connection that the FCC says delivers considerably more than advertised (12 Mbps). Plans start at $50/month for 10 GB/month, plus $10/month equipment lease. There are other similar services such as HughesNet Gen4 (****http://internet.hughesnet.com****) which they tout as being capable of up to 15 Mbps. The services aren't cheap, but in rural areas there's usually no alternative.*

Today, plans for all such services are based on bandwidth and all offer a "data allowance." You pay more for more allowance and, if you go over your allowance, you'll know in a hurry because you'll be "throttled," that is, only a small amount of bandwidth will be available unless you buy extra bandwidth for the month or upgrade to a greater bandwidth plan.

Like their satellite-TV companions, all such plans offer low, short-term, introductory rates, free or reduced rate installation and other inducements. Best advice on these services is to read the reviews ordinary consumers write about their experiences.

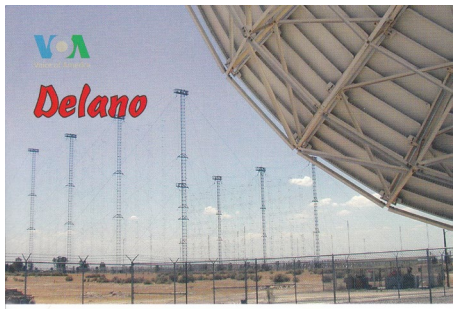
Daniel Amoroso W3DI from Media, Pennsylvania writes:"I have been enjoying some shortwave broadcasts recently and received some nice QSL cards and wanted to share the cards and some station information. These are recent cards from

Deutsche Welle – copied broadcast on 15275 kHz on Jan 20, 2013 at 1930 Z

China Radio International – copied broadcast on 9580 & 6020 kHz on Dec 29 & 31, 2012 at 0130 Z

VOA – copied Africa service of VOA. They sent not only a QSL but a beautiful 2013 calendar.

"Shortwave listening was my first step to becoming an amateur. My first receiver was a Lafayette HE-10 with a Q-multiplier I built. Now I'm using a WiNRADiO 313 – things have really changed. When I first started, I was WPE3DNC, remember those SWL calls ?"



VOA QSL card. (Courtesy: Daniel Amoroso W3DI)

Deutsche Welle QSL card. (Courtesy: Daniel Amoroso W3DI)

Thanks, Daniel, for proof that QSLing is still alive and well. And, yes, I do remember the Popular Electronics SWL calls (I was WPE4IYY). SWL was also my intro to amateur radio having started with a Knight-Kit Star Roamer I built while a junior in high school in 1966, it would be 22 years later that I would get my ham ticket (along with my then 12 year-old daughter). That's a great receiver you have and it's quite a difference from the Lafayette! Thanks for passing along the QSLs and I hope you'll continue to do so. All other MT readers are welcome to share their QSLs as well. Just send them as jpegs to editor@monitoringtimes.com.

❖ Pirate Shortwave Update

As usual the late spring and early summer proved to be great for monitoring the HF pirates. As summer progresses, the longer days and increased atmospherics make monitoring 6925 and 6930 (the two favorite frequencies) more difficult. On one weekend of casual listening in late May I heard All Aboard Radio, Radio Free Whatever, Left Lane Radio, XLR8 (none of which were listed in the 2012 Pirate Radio Annual) and Red Mercury Laboratories.

QSLing pirate HF stations is quite easy. Most stations broadcast an email address (often a Gmail account) and will send e-QSLs sometimes within hours of the broadcast. Others ask that reception reports be sent to a mail drop which is also announced. In those cases you'll receive old-school, paper QSLs. QSL while you can, because you never know when a particular station's broadcast will be their last. Typically broadcasts are half an hour to an hour but sometimes their transmissions are quite short; All Aboard Radio's transmission lasted all of six minutes.

Long-time pirate radio web site, Free Radio Network, has not been up for some time. There are other pirate radio web sources that provide excellent coverage of HF operations including: **www.hfunderground.com/board/index.php** and **http://shortwavepirate.info/?page_id=1687**. A Google group called Free Radio North America is found here: **https://groups.google.com/forum/#!forum/free-radio-north-america**

And, Free Radio Café is found here: **http://freeradiocafe.com/forum/.**

WBCQ-shortwave airs "Pirates Week with Ragnar Daneskjold" on 5110 kHz Sundays at 11:00 pm Eastern Time (0200-0300 UTC). Daneskjold hosts the Shortwave Pirate Info page above.

And, finally, this email I recently received from Commander Bunny, "I'm on vacation, spending the millions of 'campaign funds' monkeys sent to me during the Presidential campaign. Leave a message if you like, but I won't be back for many, many months!"

Is this the end of the Rodent Revolution? Are we now free to move about the planet? And, anyway, does nature really abhor a vacuum? Stay tuned.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

Fred Waterer
fredwaterer@monitoringtimes.com
www.doghousecharlie.com/radio

Summer Celebration via Shortwave

Summer is finally here! This month, we shine the Programming Spotlight on some interesting history from Canada and New Zealand, and some really great Sunday night programming from Russia.

Like our American friends to the south, Canada celebrates its birthday in early July. Canada Day is on July 1 and most Canadian radio stations will duly note the celebration. **CFRX** 6070 kHz, relaying **CFRB** 1010, **CKZU** 6160 kHz in Vancouver relaying CBC's **CBU**, and **CKZN** also on 6160 kHz (but all the way across the country relaying the CBC station in Happy Valley- Goose Bay, Newfoundland) will all salute the 146th anniversary of Confederation.

The programming on the latter station might be interesting to try for on this special day. July 1 is a day of mixed emotions in the province of Newfoundland, once an independent Dominion within the British Empire (and still technically a "radio country"). Prior to Newfoundland joining Canada in 1949, July 1 was a day tinged with sadness. It was Memorial Day in Newfoundland, honouring the fallen of the First World War. In 1914 and 1915, the flower of Newfoundland youth had volunteered to serve the King in what would become the awful carnage of that awful war. On July 1, 1916 the Newfoundland troops were flung into one of those hopeless assaults on the German lines which were a feature of the conflict, in a place called Beaumont Hamel. At 9:15 am, 25 officers and 770 other ranks went "over the top." In half an hour it was over and only 86 men answered the roll call that evening. It was a disaster for a colony of 300,000 people.

Vasily Strelnikov, host of "From Moscow with Love." (Courtesy: Voice of Russia)

As a result, while celebrating the birthday of the country, the province's radio stations will also note the tragedy of Beaumont Hamel and the service of all veterans from Newfoundland. **CKZN** has been known in the past to play "Ode to Newfoundland," the hauntingly beautiful former national anthem of the then self-governing Dominion. "As loved our fathers, so we love, Where once they stood, we stand; Their prayer we raise to Heaven above, God guard thee, Newfoundland" (Wikipedia)

New Zealand is a nation with a rich and varied history. It is only natural therefore that **Radio New Zealand** should feature a program showcasing its rich heritage. The long running program *Sounds Historical* is just that program, hosted for many years by Jim Sullivan. It is a wonderful look at the history of New Zealand and the South Pacific from many angles. You will learn a bit about the people and history of the region, from both the perspective of the indigenous people and the European colonizers. Jim has hosted this program for years and he brings a conversational style and encyclopaedic knowledge to the subject.

Topics discussed on the program are as varied as the people of this fascinating country. In early May a typical episode of the two-hour program featured historic recordings from the **RNZ** archives talking about notable people in the nation's history and other vintage recordings about politicians and media personalities who had recently passed away.

Jim also gives a "homework assignment." In May, listeners were invited to write in to the program with their selection of turning points in New Zealand history. One listener suggested that New Zealand's decision to stay non-nuclear was one such turning point. Another interesting aspect of the show is the *As I Remember* segments. Jim reads first person accounts of different events in New Zealand history. On this particular occasion, he read one woman's account of ANZAC Day ceremonies on Norfolk Island in 1986, and the memories of a man who worked for the civil service 100 years ago. The program concludes with a feature called *Book of the Week* which examines a recently released book on a historical event or topic. This particular program looked at a book about the arrival of a ship in New Zealand carrying news of the Scott expedition to Antarctica.

If you have an interest in history, or just enjoy listening to a good story, tune in to *Sounds Historical* on UTC Sundays at 0808 on 9700 kHz. You can also listen to the program live online and archived at **www.radionz.co.nz/national/programmes/soundshistorical**.

Sunday mornings in North America, one can hear the very insightful program *Sunday Nights* on **Radio Australia** at 1200 UTC on 9580 kHz. The program looks at issues of religion, spirituality, ethics and values. I happened to tune into the first hour or so of the program recently and was drawn to the very interesting discussion. The first part of the program featured a panel of eminent thinkers discussing the case for, and against, the concept of a "believable God." They explored the paradox of a decline in formal observance and a simultaneous increase in public interest in matters of faith. They also discussed who or what is God, and what sort of belief is reasonable in the 21st century. It was a fascinating discussion, showcasing a number of viewpoints on this very engaging subject.

radio
THE VOICE OF RUSSIA

Sunday night (Monday UTC) is my favorite time to listen to **Voice of Russia**. Tune in on 9665 kHz after 0000 UTC for a solid line-up of quality programming.

Agree or Disagree is a great show heard on **Voice of Russia** at 0200 UTC. The program is hosted by Marina Dzhashi, one of a growing new generation of presenters at the station. She is very well prepared and professional. Her program covers very diverse subjects. In early May she did a program analyzing the state of higher education in Russia. Studio guests discussed efforts by Russian universities to climb in the world rankings of institutions of higher learning. In April, an episode examined the legacy of the late Baroness Margaret Thatcher, noting it was a Soviet source that dubbed her "The Iron Lady."

Following *Agree or Disagree*, one can hear **VOR**'s *Treasure Store* at 0230 UTC. During April, each episode looked at a literary work by iconic Russian writers Maxim Gorky or Nikolai Gogol. Having read both extensively, I found the program very enlightening.

Next up after *Treasure Store* comes the delightful *From Moscow With Love*, hosted by Vasily Strelnikov and Natalia Stefanova. These two have a great rapport on air. I would equate this program to **Radio Netherlands Happy Station** of the past. It's a fun, relaxing show to finish up the weekend. Vasily and Natalia chat about all sorts of subjects, mostly less than serious, and if you recall Vasily's contributions to Radio Moscow in the 1980s, you know he is very funny with a quirky sense of humour. In a recent program he lampooned the travel habits of the Russian prime minister by pretending that his helicopter kept buzzing the studio (with appropriate sound effects). *From Moscow With Love* is well worth 30 minutes of your time on a Sunday night. Listen at 0300 UTC.

Finally, at 0330 UTC, one can hear *Jazz Show*. For many years it was a fan favorite, hosted by Carl Yegorov/Watts. Sadly, he passed away a few years ago but the program continues in the capable hands of Svetlana Yekimenko. If you like jazz, this program is a real treat. What a great way to wind up a Sunday night before bed. The program brings you the best of Russian jazz and the musicians who play it. Today's **Voice of Russia** bears little resemblance to the old Soviet-era Radio Moscow. Be sure and give it a listen. Your ears will thank you!

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com
http://mt-shortwave.blogspot.com
Twitter @QSLRptMT

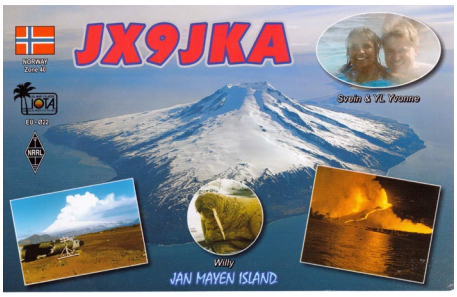
Firecracker Special 2013

It's sizzling July again, a month *MT* forgoes tips and updates, and brings you the latest QSLs from across the globe.

AMATEUR RADIO

Belgium-ON4KBJ, 20 MHz/PSK 31. Full data castle scenery card of Province of Hainaut. Received in 14 months via ARRL. (Larry Van Horn, NC)

Jan Mayen Island-JX9JKA, 24 MHz SSB. Full data color scenery/map and logo card. Received in three months for $3.00US and nested Euro envelope. QSL address: Svein Rabbevaag, Brendlia 12, 6013 Aalesund, Norway. (Van Horn) **www.jan-mayen.no/**



NA5DV, Museum Ship, USS Texas 14242 kHz USB. Full data USS Texas card, signed by Michael N5TGL. Received in 98 days for SWL report, SASE and $ 1.00US (used). Verification for 2012 Armed Forces Day. QSL address: 23635 River Place Dr., Katy, TX 77494 (Bill Wilkins, Springfield, MO)

NA0PW, Pueblo Colorado Aircraft Museum,14245.5 kHz USB. Partial data B-29 card, signed by Ted, K0LDS. Received in 59 days for SWL report, SASE, $1.00US (used). Verification for 2012 Armed Forces Day. QSL address: 676 S. Dante Dr., Pueblo West, CO 81007 (Wilkins).

CANADA

Radio Canada International, 13760 kHz. Full data sheet signed by Bill Westenhaver, Audience Relations, plus two decals. Received in 11 days for an English report of last RCI shortwave broadcast and two IRCs. Station address: Boc 6000, Montreal PQ H3A8 Canada (Wilkins). Streaming audio: **www.rcinet.ca/en/**

CLANDESTINE

Ascension Island-Cotton Tree News 11875 kHz. Full data QSL card. Received in 30 days for report and Swiss mint stamp. QSL address: Fondation Hirondelle, Avenue du Temple 19c, CH-1012 Lausanne, Switzerland. (Gigi Naj, Asti, Italy/playdx)

Radio Free Sarawak, 15430 kHz. Full data E-QSL. Received in 14 days for posting e-report online at **www.radiofreesarawak.org/contact**. (Frank Hillton , Charleston, SC) On-demand audio at **www.radiofreesarawak.org**

GUAM

KTWR-TWR Asia 11840 kHz. Full data QSL signed by Rebecca Philyaw, plus letter. Received in 34 weeks for e-report to *ktwrfcd@guam.twr.org*. Station address: P.O. Box 8780, Agat, Guam 96928 (Artur F. Llorella, Catalonia, Spain/HCDX) Streaming/on demand audio **http://nea.ktwr.net**

MEDIUM WAVE

KCJJ 1630 kHz AM. *The Mighty 1630*. Full data prepared QSL returned as verified by Tom Suter, General Manager. Received in 15 days for an AM report, prepared QSL card and two mint stamps. Station address: 845 Quarry Rd., Ste 120, Coralville, IA 52241 (or) P.O. Box 2118, Iowa City, IA 52244. Veri-signer email: *suterman7@aol.com* (Hillton) Streaming audio at: **www.1630kcjj.com**

KCMN 1530 kHz AM. *Good Times-I 25 Radio*. Verification statement written on back of business card from Tron Simpson, Account Executive. Received in 17 days for a CD report. QSL address: 5050 Edison Ave., Ste. 218, Colorado Springs, CO 80915. Received second QSL signed by M.R. Murray, plus KWRP (690) and KIQN (106.9) bumper stickers. Station address: Pueblo Radio Group, 3715 Thatcer Ave., Pueblo, CO 81005. (Patrick Martin, Seaside, OR). Streaming audio at **www.tunein link** at **www.tunein.com/radio**

WLRO 1210 kHz AM. *Hallelujah 1210*. Partial verification statement written on bottom of reception report, signed by Bob Murphy, Regional VP/Programming, plus business card. Received in 108 days for an AM report, $1.00US (returned) and address label (used). Station address: 5555 Hilton Ave., Ste 500, Baton Rouge, LA 70808 (Wilkins).

WPLA 1670 kHz AM. *Fox Sports Radio 1670*. Frequency only on E-QSL from James Gay, Director of Engineering at *jamesgay@clearchannel.com*. Received in 15 days after followup. Total response 138 days for English report, audio CD, and $1.00US. Station address: 7080 Industrial Hwy., Macon, GA 31216. (Al Munick, Whitehall, PA/HCDX). Streaming audio via iHeart Radio link at **www.foxsports1670.com**

MONACO

Radio Monaco, 8728/13146 kHz. Verification letter, unsigned. Received in five months for e-report to *info@naya.mc* (or) *contact@radio-monaco.com* (Llorella). Station address: 7 rue du Gabian, Gildo Pastor Center, 98000 Monaco. Relays newscast, for ships via Monaco Radio/Naya Radio utility station. Website: **www.radio-monaco.com.**

POLAND

Polish Radio/External Service, 12095 kHz. Full data scenery card, unsigned. Received in four months for an English email report to:*english@polskie.pl* Station address: P.O. Box 46, 00-977 Warszawa, Poland. (Tom Banks, Dallas, TX) Streaming/on-demand audio at **www.polskieradio.pl**

SRI LANKA

Voice of America relay, 12075 kHz. Full data scenery card, unsigned. Received in 85 days for an English report. Station address: IBB Transmitting Station, P.O. Box 14, Negombo, Sri Lanka. Return address on envelope as: U.S. Embassy, 210, Galle Road, Colombo 3, Sri Lanka. (Sam Wright, Biloxi, MS)

UTILITY

Canada-CFB Gander/Volmet, 10.0051 MHz. Full data E-QSL from John Michael Fleming, Operations Specialist. Received in two days for e-report to *service@navcanada.ca* (Hillton) Station address: 77 Metcalf Street, Ottawa, Ontario, Canada K1P5L77.

Hungary-MR1 Kossuth Rádió, 1251 kHz. Full data verification. Received in seven weeks via registered mail. Station address: MTVA, Kunigunda útja 64, H-1037 Budapest, Hungary. (Llorella).

International Waters-EBWM-OPDR Cadiz (Container Vessel) 8414.5 kHz. Full data prepared QSL card stamped and signed. Received in 53 days for a utility report. QSL address: Oldenburg-Portugiesische Dampfschiffs Rhederei GmbH & Co KG, Kojen 10, 20459 Hamburg, Germany (Patrick Robic, Austria/UDXF).

OUNO2-Esvagt Don (Offshore Tug Supply Vessel) 2187.5 kHz. Full data prepared QSL card stamped and signed by Lars Thorkilsen, Second Officer, plus photos. Received in 45 days for a utility report. QSL address: Esvagt A/S, Adgangvejen 1, 6700 Esbjerg, Denmark (Robic).

ZDJJ(-Magny Cours Express (RO-RO/Passenger Ship) 8414.5 kHz. Full data prepared QSL card stamped and signed, returned as verified. Received in 69 days for a utility report. QSL address: Vroon B.V., Postbus 28, 4510 AA Breskens, Netherlands (Robic).

Russia-Novosibirsk Aero, 4712 kHz. Partial data verification letter, stamped and signed by V.A. Bondarev. Received in 98 days for a prepared QSL card (not used). QSL address: GKOVD, Novobirsk RDZ, Airport Tolmachevo, Ob-4, Novosibitskaya oblast 633104, Russia. (Robic)

Uruguay-CWA Cerrito (Marine Coastal station) 12750 kHz. Full data English verification letter, signed by Jose Luis Rodriguez. Received in 21 days for a Spanish utility report and $2.00US. Station address: Villaderbo 1500, Piso 1, Montevideo, Uruguay. (Munick).

USA-KPH, Point Reyes, 12808.5 kHz CW. Partial data Marine Radiotelegram, unsigned. Return address indicated as Paul Shinn. QSL for 2012 Night of Nights. Received in 103 days for a utility report and $1.00US (used). Station address: P.O. Box 392, Pt. Reyes, CA 94956 (Wilkins).

How to Use the Shortwave Guide

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af

① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Daylight Saving Time) 4, 5, 6 or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

Note that all ***dates***, as well as times, are in UTC; for example, a show which might air at 0030 UTC ***Sunday*** will be heard on ***Saturday*** evening in America (in other words, 7:30 pm Eastern, 6:30 pm Central, etc.).

Not all countries observe Daylight Saving Time, not all countries shift at the same time, and not all program scheduling is shifted. So if you do not hear your desired station or program, try searching the hour ahead or behind its listed start time.

FIND THE STATION YOU WANT TO HEAR

Look at the page which corresponds to the time you will be listening. English broadcasts are listed by UTC time on ① , then alphabetically by country ③, followed by the station name ④. (If the station name is the same as the country, we don't repeat it, e.g., "Vanuatu, Radio" [Vanuatu].)

If a broadcast is not ***daily***, the days of broadcast⑤ will appear in the column following the time of broadcast, using the following codes:

Codes	
s/Sun	Sunday
m/Mon	Monday
t	Tuesday
w	Wednesday
h	Thursday
f	Friday
a/Sat	Saturday
occ:	occasional
DRM:	Digital Radio Mondiale
irreg	Irregular broadcasts
vl	Various languages
USB:	Upper Sideband

CHOOSE PROMISING FREQUENCIES

Choose the most promising frequencies for the time, location and conditions.

The frequencies ⑥ follow to the right of the station listing; all frequencies are listed in kilohertz (kHz). Not all listed stations will be heard from your location and virtually none of them will be heard all the time on all frequencies.

Shortwave broadcast stations change some of their frequencies at least twice a year, in April and October, to adapt to seasonal conditions. But they can also change in response to short-term conditions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and *MT* readers to make the Shortwave Guide up-to-date as of one week before print deadline.

To help you find the most promising signal for your location, immediately following each frequency we've included information on the target area ⑦ of the broadcast. Signals beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible.

Target Areas

af:	Africa
al:	alternate frequency (occasional use only)
am:	The Americas
as:	Asia
ca:	Central America
do:	domestic broadcast
eu:	Europe
me:	Middle East
na:	North America
pa:	Pacific
sa:	South America
va:	various

Mode used by all stations in this guide is AM unless otherwise indicated.

MT MONITORING TEAM

Gayle Van Horn
Frequency Manager
gaylevanhorn@monitoringtimes.com

Larry Van Horn, MT Asst. Editor
larryvanhorn@monitoringtimes.com

Additional Contributors to This Month's Shortwave Guide:

Thank You to …

BCL News; Cumbre DX; DSWCI/ DX Window; Hard-Core DX; DX Mix News 779-781; WWDX Club/Top News. Alokesh Gupta, New Delhi, India; Derek Kickbush/Australia HCJB Global Voice; Dario Monferini, Italy; Drita Cico/R Tirana; Michael Bethge, Germany; Eike Bierwirth, Germany; Jose Jacob, India; Brenda Constantino/WYFR; Nigel Holmes/R Australia; Georgi Bancov/ Balkan DX; Ivo Ivanov, Bulgaria; Sean Gilbert UK/WRTH; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

kHz	Meters
2300-2495	120 meters (Note 1)
3200-3400	90 meters (Note 1)
3900-3950	75 meters (Regional band, used for broadcasting in Asia only)
3950-4000	75 meters (Regional band, used for broadcasting in Asia and Europe)
4750-4995	60 meters (Note 1)
5005-5060	60 meters (Note 1)
5730-5900	49 meter NIB (Note 2)
5900-5950	49 meter WARC-92 band (Note 3)
5950-6200	49 meters
6200-6295	49 meter NIB (Note 2)
6890-6990	41 meter NIB (Note 2)
7100-7300	41 meters (Regional band, not allocated for broadcasting in the western hemisphere) (Note 4)
7300-7350	41 meter WARC-92 band (Note 3)
7350-7600	41 meter NIB (Note 2)
9250-9400	31 meter NIB (Note 2)
9400-9500	31 meter WARC-92 band (Note 3)
9500-9900	31 meters
11500-11600	25 meter NIB (Note 2)
11600-11650	25 meter WARC-92 band (Note 3)
11650-12050	25 meters
12050-12100	25 meter WARC-92 band (Note 3)
12100-12600	25 meter NIB (Note 2)
13570-13600	22 meter WARC-92 band (Note 3)
13600-13800	22 meters
13800-13870	22 meter WARC-92 band (Note 3)
15030-15100	19 meter NIB (Note 2)
15100-15600	19 meters
15600-15800	19 meter WARC-92 band (Note 3)
17480-17550	17 meter WARC-92 band (Note 3)
17550-17900	17 meters
18900-19020	15 meter WARC-92 band (Note 3)
21450-21850	13 meters
25670-26100	11 meters

Notes

Note 1	Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.
Note 2	Broadcasters can use this frequency range on a (NIB) non-interference basis only.
Note 3	WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007
Note 4	WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

0000 UTC - 8PM EDT / 7PM CDT / 5PM PDT

0000 0030	Egypt, R Cairo	9965na		
0000 0045	India, AIR/External Svc	9690as	9705as	11710as 13605as
0000 0045 DRM	India, AIR/External Svc	11645as		
0000 0056	Romania, R Romania Intl	9700na	11955na	
0000 0100	Anguilla, Caribbean Beacon/Univ Net	6090ca		
0000 0100	Australia, ABC/R Australia	9660va	12080pa	15240va 15415va 17795pa 19000va 21740va
0000 0100	Australia, NT VL8A Alice Springs	4835do		
0000 0100	Australia, NT VL8K Katherine	5025do		
0000 0100	Australia, NT VL8T Tennant Creek	4910do		
0000 0100	Canada, CFRX Toronto ON	6070do		
0000 0100	Canada, CFVP Calgary AB	6030do		
0000 0100	Canada, CKZN St Johns NF	6160do		
0000 0100	Canada, CKZU Vancouver BC	6160do		
0000 0100	China, China R International	6020as		6075as 6180as 7350as 7415as 9570na 11790as 11885as 13750as 15125as
0000 0100	Germany, HCJB Germany	3995eu	7365eu	
0000 0100 Sun	Germany, Mighty KBC Radio	7375eu		
0000 0100	Germany, R 6150	6070eu		
0000 0100	Malaysia, RTM/Traxx FM	7295do		
0000 0100	Micronesia, V6MP/Cross R/Pohnpei	4755as		
0000 0100	New Zealand, R New Zealand Intl	15720pa		
0000 0100 DRM	New Zealand, R New Zealand Intl	17675pa		
0000 0100	Russia, VO Russia	9665ca		
0000 0100	Spain, R Exterior de Espana	6055na		
0000 0100	Thailand, R Thailand World Svc	15275na		
0000 0100	UK, BBC World Service	5970as	6195as	9410as 9740as 11750as 12095as 15335as 15755as 17685as
0000 0100	USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0000 0100	USA, Overcomer Ministry	3185na		
0000 0100	USA, WBCQ Monticello ME	7490na		9330na
0000 0100 fas	USA, WBCQ Monticello ME	5110na		
0000 0100	USA, WEWN/Irondale AL	11520af		
0000 0100 twhfas	USA, WHRI Cypress Crk SC	5920va		
0000 0100	USA, WINB Red Lion PA	9265am		
0000 0100	USA, WTWW Lebanon TN	5085sa	5830na	
0000 0100	USA, WWCR Nashville TN	4840eu	5935af	6875eu 7520ca
0000 0100 irreg	USA, WWRB Manchester TN	3185na		3215na
0000 0100 Sun/irreg	USA, WWRB Manchester TN	5050na		
0000 0100	USA, WYFR/Family R	6115am		
0030 0100	Australia, ABC/R Australia	17750va		
0030 0100 twhfa	Serbia, International R Serbia	9685na		
0030 0100	USA, WHRI Cypress Crk SC	7315ca		

0100 UTC - 9PM EDT / 8PM CDT / 6PM PDT

0100 0115 mtwha	Australia, HCJB Global Australia	15400as		
0100 0115 Sat/Sun	Canada, Bible VO Broadcasting	9490as		
0100 0130 Sun	Serbia, International R Serbia	9685na		
0100 0130	Vietnam, VO Vietnam/Overseas Svc	12005na		
0100 0200	Anguilla, Caribbean Beacon/Univ Net	6090ca		
0100 0200	Australia, ABC/R Australia	9660va	12080pa	15160pa 15240va 15415va 17750va 17795pa 19000va
0100 0200	Australia, NT VL8A Alice Springs	4835do		
0100 0200	Australia, NT VL8K Katherine	5025do		
0100 0200	Australia, NT VL8T Tennant Creek	4910do		
0100 0200	Canada, CFRX Toronto ON	6070do		
0100 0200	Canada, CFVP Calgary AB	6030do		
0100 0200	Canada, CKZN St Johns NF	6160do		
0100 0200	Canada, CKZU Vancouver BC	6160do		
0100 0200	China, China R International	6020as		6175eu 6180as 9410eu 9470eu 9535as 9570na 9580na 9675eu 11870as 15125as 15785as
0100 0200	Cuba, R Havana Cuba	5040ca	6000na	6165na
0100 0200	Germany, HCJB Germany	3995eu	7365eu	
0100 0200 Sun	Germany, Mighty KBC Radio	7375eu		
0100 0200	Germany, R 6150	6070eu		
0100 0200	Malaysia, RTM/Traxx FM	7295do		
0100 0200	Micronesia, V6MP/Cross R/Pohnpei	4755as		
0100 0200	New Zealand, R New Zealand Intl	15720pa		
0100 0200 DRM	New Zealand, R New Zealand Intl	17675pa		
0100 0200	Russia, VO Russia	9665ca		
0100 0200	Taiwan, R Taiwan Intl	11875as		
0100 0200	UK, BBC World Service	12095as	15310as	
0100 0200	USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0100 0200	USA, Overcomer Ministry	3185na		
0100 0200	USA, VO America	7430va	9780va	15205as
0100 0200	USA, WBCQ Monticello ME	7490na		9330na
0100 0200 fas	USA, WBCQ Monticello ME	5110na		
0100 0200	USA, WEWN/Irondale AL	11520af		
0100 0200 twhfa	USA, WHRI Cypress Crk SC	5920va		
0100 0200	USA, WHRI Cypress Crk SC	9860na		
0100 0200	USA, WINB Red Lion PA	9265am		
0100 0200 irreg	USA, WRNO New Orleans LA	7506na		
0100 0200	USA, WTWW Lebanon TN	5085sa	5830na	9479na
0100 0200	USA, WWCR Nashville TN	3215eu	4840na	5935af 7520ca
0100 0200 irreg	USA, WWRB Manchester TN	3185na		3215na
0100 0200 Sun/irreg	USA, WWRB Manchester TN	5050na		
0100 0200	USA, WYFR/Family R	6115am		
0120 0200	Myanmar, Thazin R	6030do		
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0130 0200 twhfas	Albania, R Tirana	9850va		
0130 0200 mtwhf	USA, WRMI/R Slovakia Intl relay	9955am		
0140 0200	Vatican City State, Vatican R	11730as		15470as

0200 UTC - 10PM EDT / 9PM CDT / 7PM PDT

0200 0230	Thailand, R Thailand World Svc	15275na		
0200 0230	USA, WRMI/R Prague relay	9955am		
0200 0300	Anguilla, Caribbean Beacon/Univ Net	6090ca		
0200 0300 twhfa	Argentina, RAE	11710am		
0200 0300	Australia, ABC/R Australia	9660va	12080pa	15160pa 15240va 15415va 17750va 17795pa 19000va
0200 0300	Australia, NT VL8A Alice Springs	4835do		
0200 0300	Australia, NT VL8K Katherine	5025do		
0200 0300	Australia, NT VL8T Tennant Creek	4910do		
0200 0300	Canada, CFRX Toronto ON	6070do		
0200 0300	Canada, CFVP Calgary AB	6030do		
0200 0300	Canada, CKZN St Johns NF	6160do		
0200 0300	Canada, CKZU Vancouver BC	6160do		
0200 0300	China, China R International	11770as		13640as
0200 0300	Cuba, R Havana Cuba	6000na	6165na	
0200 0300	Egypt, R Cairo	9720na		
0200 0300	Germany, HCJB Germany	3995eu	7365eu	
0200 0300	Germany, R 6150	6070eu		
0200 0300	Malaysia, RTM/Traxx FM	7295do		
0200 0300	Micronesia, V6MP/Cross R/Pohnpei	4755as		
0200 0300	New Zealand, R New Zealand Intl	15720pa		
0200 0300 DRM	New Zealand, R New Zealand Intl	17675pa		
0200 0300	Russia, VO Russia	9665ca		
0200 0300	South Korea, KBS World R	9580sa		9690as
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0200 0300	UK, BBC World Service	15310as	17790as	
0200 0300	USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0200 0300	USA, Overcomer Ministry	3185na	5890va	
0200 0300	USA, WBCQ Monticello ME	7490na		

	9330na	
0200 0300 fas	USA, WBCQ Monticello ME	5110na
0200 0300	USA, WEWN/Irondale AL	11520af
0200 0300	USA, WHRI Cypress Crk SC 7315ca 9860na	5920va
0200 0300	USA, WINB Red Lion PA	9265am
0200 0300 irreg	USA, WRNO New Orleans LA	7506na
0200 0300	USA, WTWW Lebanon TN	5085sa 5830na
0200 0300	USA, WWCR Nashville TN 5890ca 5935af	3215eu 4840na
0200 0300 irreg	USA, WWRB Manchester TN 3195na	3185na
0200 0300 Sun/irreg	USA, WWRB Manchester TN	5050na
0200 0300	USA, WYFR/Family R	6115am
0215 0230	Nepal, R Nepal	5005do
0215 0300	Myanmar, Myanma R	9731do
0230 0300	Myanmar, Myanma R	5985do
0230 0300	Vietnam, VO Vietnam/Overseas Svc	12005na
0255 0300 Sun	Swaziland, TWR Africa	3200af

0300 UTC - 11PM EDT / 10PM CDT / 8PM PDT

0300 0320	Vatican City State, Vatican R	15460as
0300 0325 Sun	Swaziland, TWR Africa	3200af
0300 0330	Egypt, R Cairo	9720na
0300 0330	Myanmar, Myanma R	5985do
0300 0330 Sat	Sri Lanka, SLBC	6005as 9770as 15745as
0300 0330	Vatican City State, Vatican R 9660af	7360af
0300 0356	Romania, R Romania Intl 17830as	7350na 9645na
0300 0356 DRM	Romania, R Romania Intl	15340as
0300 0400	Anguilla, Caribbean Beacon/Univ Net 6090ca	
0300 0400	Australia, ABC/R Australia 15415va 17750va	9660va 15160pa 21725va
0300 0400	Australia, NT VL8A Alice Springs	4835do
0300 0400	Australia, NT VL8K Katherine	5025do
0300 0400	Australia, NT VL8T Tennant Creek	4910do
0300 0400	Canada, CFRX Toronto ON	6070do
0300 0400	Canada, CFVP Calgary AB	6030do
0300 0400	Canada, CKZN St Johns NF	6160do
0300 0400	Canada, CKZU Vancouver BC	6160do
0300 0400	China, China R International 9790na 11770as 13750as 15120as 15785as	9690am 15110as
0300 0400	Cuba, R Havana Cuba	6000na 6165na
0300 0400	Germany, R 6150	6070eu
0300 0400	Malaysia, RTM/Traxx FM	7295do
0300 0400	Micronesia, V6MP/Cross R/Pohnpei as	4755
0300 0400	New Zealand, R New Zealand Intl	15720pa
0300 0400 DRM	New Zealand, R New Zealand Intl	17675pa
0300 0400	Oman, R Sultanate of Oman	13600af
0300 0400	Russia, VO Russia	9665ca
0300 0400 mtwhf	South Africa, Channel Africa 5980af	3345af
0300 0400 Sun	Sri Lanka, SLBC	6005as 9770as 15745as
0300 0400	Taiwan, R Taiwan Intl	6115as 15320as
0300 0400	Turkey, VO Turkey	6165as 9515va
0300 0400	UK, BBC World Service	12095as 15365as
0300 0400	USA, AFN/AFRTS 12759usb 13362usb	4319usb 5765usb
0300 0400	USA, Overcomer Ministry	3185na 5890va
0300 0400	USA, VO America 9885af	4930af 6080af
0300 0400	USA, WBCQ Monticello ME 9330na	7490na
0300 0400	USA, WEWN/Irondale AL	11520af
0300 0400	USA, WHRI Cypress Crk SC 9825eu	7385na
0300 0400 irreg	USA, WRNO New Orleans LA	7506na
0300 0400	USA, WTWW Lebanon TN	5085sa 5830na
0300 0400	USA, WWCR Nashville TN 5890ca 5935af	3215eu 4840na
0300 0400 irreg	USA, WWRB Manchester TN 3195na	3185na
0300 0400 Sun/irreg	USA, WWRB Manchester TN	5050na
0330 0400	Iran, VOIRI/VO Justice	13650eu 15470eu
0330 0400	Vietnam, VO Vietnam/Overseas Svc	6175na

0400 UTC - 12AM EDT / 11PM CDT / 9PM PDT

0400 0427	Iran, VOIRI/VO Justice	13650eu 15470eu
0400 0430	USA, WHRI Cypress Crk SC	7385na
0400 0457	Germany, Deutsche Welle	9470af 12045af
0400 0457	North Korea, VO Korea 9730as 11735ca	7220as 9445as 13760sa 15180sa
0400 0458	New Zealand, R New Zealand Intl	15720pa
0400 0458 DRM	New Zealand, R New Zealand Intl	17675pa
0400 0500	Anguilla, Caribbean Beacon/Univ Net 6090ca	
0400 0500	Australia, ABC/R Australia 15160pa 15240va	9660va 12080pa 15415va 21725va
0400 0500	Australia, NT VL8A Alice Springs	4835do
0400 0500	Australia, NT VL8K Katherine	5025do
0400 0500	Australia, NT VL8T Tennant Creek	4910do
0400 0500	Canada, CFRX Toronto ON	6070do
0400 0500	Canada, CKZN St Johns NF	6160do
0400 0500	Canada, CKZU Vancouver BC	6160do
0400 0500	China, China R International 15120as 15785as 17730va	13750as 17855va
0400 0500	Cuba, R Havana Cuba	6000na 6165na
0400 0500	Germany, Deutsche Welle	5905af
0400 0500	Germany, R 6150	6070eu
0400 0500	Malaysia, RTM/Traxx FM	7295do
0400 0500	Micronesia, V6MP/Cross R/Pohnpei as	4755
0400 0500 mtwhf	South Africa, Channel Africa	3345af
0400 0500 Sun	Sri Lanka, SLBC	6005as 9770as 15745as
0400 0500	UK, BBC World Service 12095as 15365as	3955va 11945af 15420af
0400 0500	USA, AFN/AFRTS 12759usb 13362usb	4319usb 5765usb
0400 0500	USA, Overcomer Ministry	3185na 5890va
0400 0500	USA, VO America 6080af 9885af	4930af 4960af 12025af
0400 0500	USA, WBCQ Monticello ME	9330na
0400 0500	USA, WEWN/Irondale AL	11520af
0400 0500	USA, WHRI Cypress Crk SC	9825me
0400 0500	USA, WTWW Lebanon TN	5830na
0400 0500	USA, WWCR Nashville TN 5935ca 15285af	4840eu 5890na
0400 0500 irreg	USA, WWRB Manchester TN	3185na
0430 0500	Myanmar, Thazin R	9460do
0430 0500 mtwhf	Swaziland, TWR Africa	3200af
0430 0500	USA, VO America 6080af 12025af	4930af 4960af
0455 0500 irreg	Nigeria, VO Nigeria	15120eu
0459 0500	New Zealand, R New Zealand Intl	11725pa
0459 0500 DRM	New Zealand, R New Zealand Intl	11675pa

0500 UTC - 1AM EDT / 12AM CDT / 10PM PDT

0500 0527	Germany, Deutsche Welle	5905af 9470af
0500 0530	Germany, Deutsche Welle	9800af 12045af
0500 0530	Japan, R Japan/NHK World 11970af	5975as
0500 0530	Vatican City State, Vatican R 13765af	11625af
0500 0557	North Korea, VO Korea	13650as 15105as
0500 0600	Anguilla, Caribbean Beacon/Univ Net 6090ca	
0500 0600	Australia, ABC/R Australia 13630pa 15415va	9660va 12080pa 21725va
0500 0600	Australia, NT VL8A Alice Springs	4835do
0500 0600	Australia, NT VL8K Katherine	5025do
0500 0600	Australia, NT VL8T Tennant Creek	4910do
0500 0600	Bhutan, Bhutan BC Svc	6035do
0500 0600	Canada, CFRX Toronto ON	6070do
0500 0600	Canada, CKZN St Johns NF	6160do
0500 0600	Canada, CKZU Vancouver BC	6160do
0500 0600	China, China R International 11895as 15465as 15350as 17730va 17855va	11710af 17505va
0500 0600	Cuba, R Havana Cuba	6010na 6060na

	6125am 6165na	
0500 0600	Germany, R 6150	6070eu
0500 0600	Malaysia, RTM/Traxx FM	7295do
0500 0600	Micronesia, V6MP/Cross R/Pohnpei as	4755
0500 0600	Myanmar, Thazin R	9460do
0500 0600	New Zealand, R New Zealand Intl	11725pa
0500 0600 DRM	New Zealand, R New Zealand Intl	11675pa
0500 0600 irreg	Nigeria, VO Nigeria	15120af
0500 0600 mtwhf	South Africa, Channel Africa	7230af
0500 0600 mtwhf	Swaziland, TWR Africa	4775af
0500 0600 Sat/Sun	Swaziland, TWR Africa	3200af 4775af
0500 0600	Swaziland, TWR Africa	9500af
0500 0600	UK, BBC World Service	3255af 3955va 5875af 6005af 6190af 7355af 11945af 15420af
0500 0600	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0500 0600	USA, Overcomer Ministry	3185na 5890va
0500 0600	USA, VO America	4930af 6080af 12025af 15580af
0500 0600	USA, WBCQ Monticello ME	9330na
0500 0600	USA, WEWN/Irondale AL	11520af
0500 0600	USA, WHRI Cypress Crk SC	9825me
0500 0600	USA, WTWW Lebanon TN	5830na
0500 0600	USA, WWCR Nashville TN	3215eu 4840na 5890ca 5935af
0500 0600 irreg	USA, WWRB Manchester TN	3185na
0515 0530	Rwanda, R Rep Rwandaise	6055do
0530 0556	Romania, R Romania Intl	9700eu 17760pa 21500pa
0530 0556 DRM	Romania, R Romania Intl	11875eu
0530 0557	Germany, Deutsche Welle	9800af
0530 0600	Australia, ABC/R Australia	17750va
0530 0600	Germany, Deutsche Welle	12045af
0530 0600	Thailand, R Thailand World Svc	17770eu

0600 UTC - 2AM EDT / 1AM CDT / 11PM PDT

0600 0627	Germany, Deutsche Welle	15275af
0600 0630	China, Xizang PBS	6025do 6130do 9580do
0600 0630	Germany, Deutsche Welle	12045af 17800af
0600 0630	Myanmar, Thazin R	9460do
0600 0657	North Korea, VO Korea	7220as 9445as 9730as
0600 0700	Anguilla, Caribbean Beacon/Univ Net	6090ca
0600 0700	Australia, ABC/R Australia	9660va 11945va 13630pa 15240va 15415va 17750va 21725va
0600 0700	Australia, NT VL8A Alice Springs	4835do
0600 0700	Australia, NT VL8K Katherine	5025do
0600 0700	Australia, NT VL8T Tennant Creek	4910do
0600 0700	Canada, CFRX Toronto ON	6070do
0600 0700	Canada, CFVP Calgary AB	6030do
0600 0700	Canada, CKZN St Johns NF	6160do
0600 0700	Canada, CKZU Vancouver BC	6160do
0600 0700	China, China R International	11710af 11870me 15140me 15350as 17505va 17710as
0600 0700	China, VO the South China Sea	13660as
0600 0700	Cuba, R Havana Cuba	6010na 6060na 6125am 6165na
0600 0700 wa/irreg	Germany, Hamburger Lokalradio	7265eu
0600 0700	Germany, R 6150	6070eu
0600 0700	Malaysia, RTM/Traxx FM	7295do
0600 0700	Micronesia, V6MP/Cross R/Pohnpei as	4755
0600 0700 DRM	New Zealand, R New Zealand Intl	9890pa
0600 0700	New Zealand, R New Zealand Intl	11725pa
0600 0700 irreg	Nigeria, VO Nigeria	15120af
0600 0700	Russia, VO Russia	21800pa 21820pa
0600 0700 DRM	Russia, VO Russia	11830eu
0600 0700 mtwhf	South Africa, Channel Africa	7230af 15255af
0600 0700	Sudan, VO Africa/Sudan R	9505af
0600 0700	Swaziland, TWR Africa	4775af 6120af
0600 0700	UK, BBC World Service	5875eu 6005af 6190af 7325eu 7355af 9860af 12095af 15105af 15420af 17640af
0600 0700	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0600 0700	USA, Overcomer Ministry	3185na 5890va
0600 0700	USA, VO America	6080af 12025af 15580af
0600 0700	USA, WBCQ Monticello ME	9330na
0600 0700	USA, WEWN/Irondale AL	11520af
0600 0700	USA, WHRI Cypress Crk SC	9825me
0600 0700	USA, WTWW Lebanon TN	5830na
0600 0700	USA, WWCR Nashville TN	3215eu 4840na 5890ca 5935af
0600 0700 irreg	USA, WWRB Manchester TN	3185na
0615 0700 Sat	USA, WHRI Cypress Crk SC	9825me
0630 0645 mtwhfa	Vatican City State, Vatican R	15595me
0630 0700	Germany, Deutsche Welle	15440af 17800af
0630 0700	Vatican City State, Vatican R	13765af 15570af
0657 0700	Germany, TWR Europe	6105eu

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700 0730	Myanmar, Myanma R	5985do
0700 0745 Sat/Sun	Canada, Bible VO Broadcasting	5945eu
0700 0750	Austria, TWR Europe	7400eu
0700 0750	Germany, TWR Europe	6105eu
0700 0758	New Zealand, R New Zealand Intl	11725pa
0700 0758 DRM	New Zealand, R New Zealand Intl	9890pa
0700 0800	Anguilla, Caribbean Beacon/Univ Net	6090ca
0700 0800	Australia, ABC/R Australia	7410va 9475as 9660va 9710va 11945va 12080pa 13630pa 15240va
0700 0800	Australia, NT VL8A Alice Springs	4835do
0700 0800	Australia, NT VL8K Katherine	5025do
0700 0800	Australia, NT VL8T Tennant Creek	4910do
0700 0800	Canada, CFRX Toronto ON	6070do
0700 0800	Canada, CFVP Calgary AB	6030do
0700 0800	Canada, CKZN St Johns NF	6160do
0700 0800	Canada, CKZU Vancouver BC	6160do
0700 0800	China, China R International	11895as 13660as 13710eu 15350as 15465as 17480va 17490eu 17540as 17710as
0700 0800 wa/irreg	Germany, Hamburger Lokalradio	7265eu
0700 0800	Germany, R 6150	6070eu
0700 0800	Malaysia, RTM/Traxx FM	7295do
0700 0800	Micronesia, V6MP/Cross R/Pohnpei as	4755
0700 0800	Russia, VO Russia	13785as 17500as 21800pa 21820pa
0700 0800 DRM	Russia, VO Russia	11830eu
0700 0800 mtwhf	South Africa, Channel Africa	9625af
0700 0800	Swaziland, TWR Africa	4775af 6120af 9500af
0700 0800	UK, BBC World Service	5875eu 6190af 7325va 11770af 12095af 13660af 15400af 15420af 17640af 17830af
0700 0800	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0700 0800	USA, Overcomer Ministry	3185na 5890va
0700 0800	USA, WBCQ Monticello ME	9330na
0700 0800	USA, WEWN/Irondale AL	11520af
0700 0800	USA, WTWW Lebanon TN	5830na
0700 0800	USA, WWCR Nashville TN	3215eu 4840na 5890ca 5935af
0700 0800 irreg	USA, WWRB Manchester TN	3185na
0730 0800	Australia, HCJB Global Australia	15490as
0759 0800	New Zealand, R New Zealand Intl	9700pa
0759 0800 DRM	New Zealand, R New Zealand Intl	9890pa

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800 0830	Australia, HCJB Global Australia	15490as
0800 0830	Australia, NT VL8A Alice Springs	4835do
0800 0830	Australia, NT VL8K Katherine	5025do

0800 0830	Australia, NT VL8T Tennant Creek	4910do
0800 0900	Anguilla, Caribbean Beacon/Univ Net	6090ca
0800 0900	Australia, ABC/R Australia	5995as 7410va 9475as 9580pa 9710va 11945va 12080pa 15240va
0800 0900	Bhutan, Bhutan BC Svc	6035do
0800 0900	Canada, CFRX Toronto ON	6070do
0800 0900	Canada, CFVP Calgary AB	6030do
0800 0900	Canada, CKZN St Johns NF	6160do
0800 0900	Canada, CKZU Vancouver BC	6160do
0800 0900	China, China R International	11620as 11895as 13710as 15350as 15465as 17480va 17490eu 17540as
0800 0900 Sat/Sun	Germany, Mighty KBC Radio	6095eu
0800 0900	Germany, R 6150	6070eu
0800 0900 Sat	Italy, IRRS Shortwave	9510va
0800 0900	Malaysia, RTM/Traxx FM	7295do
0800 0900	Micronesia, V6MP/Cross R/Pohnpei	4755as
0800 0900	New Zealand, R New Zealand Intl	9700pa
0800 0900 DRM	New Zealand, R New Zealand Intl	9890pa
0800 0900 irreg	Nigeria, VO Nigeria	15120af
0800 0900 mtwhfs	Palau, T8WH/World Harvest R	9930as
0800 0900	Russia, VO Russia	13785as 17500as 21800va 21820pa
0800 0900 DRM	Russia, VO Russia	9850eu 11830eu
0800 0900 Sun	South Africa, Amateur R Today	7205af 17660af
0800 0900 mtwhf	South Africa, Channel Africa	9625af
0800 0900	South Korea, KBS World R	9570as
0800 0900	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0800 0900	USA, Overcomer Ministry	3185na 5890va
0800 0900	USA, WBCQ Monticello ME	9330na
0800 0900	USA, WEWN/Irondale AL	11520af
0800 0900 mtwhfs	USA, WHRI Cypress Crk SC	11565pa
0800 0900	USA, WTWW Lebanon TN	5830na
0800 0900	USA, WWCR Nashville TN	3215eu 4840na 5890ca 5935af
0800 0900 irreg	USA, WWRB Manchester TN	3185na
0815 0830	Nepal, R Nepal	5005do
0830 0900	Australia, NT VL8A Alice Springs	2310do
0830 0900	Australia, NT VL8K Katherine	2485do
0830 0900	Australia, NT VL8T Tennant Creek	2325do
0850 0900 smtwhf	Singapore, TWR Asia	15200as

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900 0910	Pakistan, R Pakistan	11570eu 15265eu
0900 0930	Mongolia, VO Mongolia	12085as
0900 0930 smtwhf	Singapore, TWR Asia	15200as
0900 1000	Anguilla, Caribbean Beacon/Univ Net	6090ca
0900 1000	Australia, ABC/R Australia	9580pa 11945va
0900 1000	Australia, NT VL8A Alice Springs	2310do
0900 1000	Australia, NT VL8K Katherine	2485do
0900 1000	Australia, NT VL8T Tennant Creek	2325do
0900 1000	Canada, CFRX Toronto ON	6070do
0900 1000	Canada, CFVP Calgary AB	6030do
0900 1000	Canada, CKZN St Johns NF	6160do
0900 1000	Canada, CKZU Vancouver BC	6160do
0900 1000	China, China R International	11620as 13790as 15270eu 15350as 17490eu 17570eu 17650pa 17750as
0900 1000 Sat/Sun	Germany, Mighty KBC Radio	6095eu
0900 1000	Germany, R 6150	6070eu
0900 1000	Malaysia, RTM/Traxx FM	7295do
0900 1000	Micronesia, V6MP/Cross R/Pohnpei	4755as
0900 1000 3rd Sun	Netherlands, XVRB Radio	6045eu
0900 1000 DRM	New Zealand, R New Zealand Intl	9890pa
0900 1000	New Zealand, R New Zealand Intl	9700pa
0900 1000 irreg	Nigeria, VO Nigeria	9690af
0900 1000	Palau, T8WH/World Harvest R	9930as
0900 1000	Russia, VO Russia	21800va 21820va
0900 1000 DRM	Russia, VO Russia	9850eu 11830eu
0900 1000 mtwhf	South Africa, Channel Africa	9625af
0900 1000	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0900 1000	USA, Overcomer Ministry	3185na 5890va
0900 1000	USA, WBCQ Monticello ME	9330na
0900 1000	USA, WEWN/Irondale AL	11520af
0900 1000 Sun	USA, WHRI Cypress Crk SC	11565pa
0900 1000	USA, WTWW Lebanon TN	5830na
0900 1000	USA, WWCR Nashville TN	4840na 5890ca 5935af 15285eu
0900 1000 irreg	USA, WWRB Manchester TN	3185na
0930 1000 fs	China, VO the Strait	6115do
0930 1000 Sun	Italy, IRRS Shortwave	9510va
0930 1000	Saudi Arabia, BSKSA/External Svc	15250af

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000 1000	USA, KNLS Anchor Point AK	9655as
1000 1020 mtwhf	Singapore, TWR Asia	11840pa
1000 1030	Japan, R Japan/NHK World	9625as 9695as
1000 1030 Sat	Singapore, TWR Asia	11840pa
1000 1030	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as
1000 1057	North Korea, VO Korea	11710ca 11735as 13650as 15180sa
1000 1058	New Zealand, R New Zealand Intl	9700pa
1000 1058 DRM	New Zealand, R New Zealand Intl	9890pa
1000 1100	Anguilla, Caribbean Beacon/Univ Net	11775ca
1000 1100	Australia, ABC/R Australia	9580pa 12065pa
1000 1100 Sat/Sun	Australia, ABC/R Australia	5995as 6080as 6150as 9475va 9710va 12080pa
1000 1100	Australia, NT VL8A Alice Springs	2310do
1000 1100	Australia, NT VL8K Katherine	2485do
1000 1100	Australia, NT VL8T Tennant Creek	2325do
1000 1100	Canada, CFRX Toronto ON	6070do
1000 1100	Canada, CFVP Calgary AB	6030do
1000 1100	Canada, CKZN St Johns NF	6160do
1000 1100	Canada, CKZU Vancouver BC	6160do
1000 1100	China, China R International	11610as 11620as 11635as 13590as 13620as 13720as 13790pa 15190as 15210pa 15350as 17490eu
1000 1100 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1000 1100	Germany, R 6150	6070eu
1000 1100	India, AIR/External Svc	7270as 13605as 13695pa 15030as 15410as 17510pa 17895pa
1000 1100 irreg	Indonesia, VO Indonesia	9526pa
1000 1100 Sun	Italy, IRRS Shortwave	9510va
1000 1100	Malaysia, RTM/Traxx FM	7295do
1000 1100	Micronesia, V6MP/Cross R/Pohnpei	4755as
1000 1100 irreg	Nigeria, VO Nigeria	9690af
1000 1100	Russia, VO Russia	11530as 12030as
1000 1100 DRM	Russia, VO Russia	9850eu
1000 1100	Saudi Arabia, BSKSA/External Svc	15250af
1000 1100 mtwhf	South Africa, Channel Africa	9625af
1000 1100	UK, BBC World Service	6195as 9740as 15285as 17760as 21660as
1000 1100	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1000 1100	USA, Overcomer Ministry	3185na 5890va
1000 1100 Sat	USA, Overcomer Ministry	15420am
1000 1100	USA, WBCQ Monticello ME	9330na
1000 1100	USA, WEWN/Irondale AL	11520af
1000 1100 Sun	USA, WHRI Cypress Crk SC	11565pa
1000 1100 Sun	USA, WINB Red Lion PA	9265am
1000 1100	USA, WTWW Lebanon TN	5830na
1000 1100	USA, WWCR Nashville TN	4840na 5890ca 5935af 15285eu
1000 1100 irreg	USA, WWRB Manchester TN	3185na
1030 1100	Iran, VOIRI	21505va 21640va
1059 1100	New Zealand, R New Zealand Intl	9700pa
1059 1100 DRM	New Zealand, R New Zealand Intl	9890pa

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100 1105	Pakistan, R Pakistan	11570eu 15265eu
1100 1115 mwh	Australia, HCJB Global Australia	15490as
1100 1127	Iran, VOIRI	21505va 21640va
1100 1130 Sun	Canada, Bible VO Broadcasting	21480as
1100 1130 f/DRM	Japan, R Japan/NHK World	9760eu
1100 1130 Sat/DRM	South Korea, KBS World R	9760eu
1100 1130	Vietnam, VO Vietnam/Overseas Svc	7285as
1100 1156	Romania, R Romania Intl	15210eu 15430eu 17510eu 17670af
1100 1200	Anguilla, Caribbean Beacon/Univ Net	11775ca
1100 1200	Australia, ABC/R Australia	5995as 6080as 6140as 6150va 9475as 9580pa 11945va 12065pa
1100 1200 DRM	Australia, ABC/R Australia	12080pa
1100 1200	Australia, NT VL8A Alice Springs	2310do
1100 1200	Australia, NT VL8K Katherine	2485do
1100 1200	Australia, NT VL8T Tennant Creek	2325do
1100 1200 Sat	Canada, Bible VO Broadcasting	21480as
1100 1200	Canada, CFRX Toronto ON	6070do
1100 1200	Canada, CFVP Calgary AB	6030do
1100 1200	Canada, CKZN St Johns NF	6160do
1100 1200	Canada, CKZU Vancouver BC	6160do
1100 1200	China, China R International	5955as 11660as 11795as 13650as 17490eu
1100 1200 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1100 1200	Germany, R 6150	6070eu
1100 1200 Sun	Italy, IRRS Shortwave	9510va
1100 1200	Malaysia, RTM/Traxx FM	7295do
1100 1200	Micronesia, V6MP/Cross R/Pohnpei	4755as
1100 1200	New Zealand, R New Zealand Intl	9700pa
1100 1200 DRM	New Zealand, R New Zealand Intl	9890pa
1100 1200 irreg	Nigeria, VO Nigeria	9690af
1100 1200	Russia, VO Russia	11530as 12030as 15670as
1100 1200 DRM	Russia, VO Russia	9850eu
1100 1200	Saudi Arabia, BSKSA/External Svc	15250af
1100 1200 mtwhf	South Africa, Channel Africa	9625af
1100 1200	Taiwan, R Taiwan Intl	7445as 9465as
1100 1200	UK, BBC World Service	6195as 9740as 15285as 17760as
1100 1200	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1100 1200	USA, Overcomer Ministry	3185na 5890va
1100 1200 Sat	USA, Overcomer Ministry	15420am
1100 1200	USA, WBCQ Monticello ME	9330na
1100 1200	USA, WEWN/Irondale AL	11520af
1100 1200 Sun	USA, WHRI Cypress Crk SC	7315ca
1100 1200 Sun	USA, WINB Red Lion PA	9265am
1100 1200	USA, WTWW Lebanon TN	5830na
1100 1200	USA, WWCR Nashville TN	4840na 5890ca 5935af 15285eu
1100 1200 irreg	USA, WWRB Manchester TN	3185na
1115 1145 f	Canada, Bible VO Broadcasting	21480as
1130 1145 smtha	Australia, HCJB Global Australia	15490as
1130 1145 f	USA, Eternal Good News	15525as
1130 1200 f	Vatican City State, Vatican R	17590me 21560me
1130 1200	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200 1225	Saudi Arabia, BSKSA/External Svc	15250af
1200 1230	Japan, R Japan/NHK World	9695af 11740as
1200 1259	New Zealand, R New Zealand Intl	9700pa
1200 1300	Anguilla, Caribbean Beacon/Univ Net	11775ca
1200 1300	Australia, ABC/R Australia	6080as 6140as 6150va 9475as 9580pa 11945va
1200 1300 DRM	Australia, ABC/R Australia	5995as
1200 1300	Australia, NT VL8A Alice Springs	2310do
1200 1300	Australia, NT VL8K Katherine	2485do
1200 1300	Australia, NT VL8T Tennant Creek	2325do
1200 1300	Canada, CFRX Toronto ON	6070do
1200 1300	Canada, CFVP Calgary AB	6030do
1200 1300	Canada, CKZN St Johns NF	6160do
1200 1300	Canada, CKZU Vancouver BC	6160do
1200 1300	China, China R International	6010as 9460as 9600as 9645as 9730as 11650as 11660as 11690va 11980as 13645as 13650eu 17490eu 17630eu
1200 1300	Ethiopia, R Ethiopia/Natl Svc	9705do
1200 1300 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1200 1300	Germany, R 6150	6070eu
1200 1300	Malaysia, RTM/Traxx FM	7295do
1200 1300 irreg	Nigeria, VO Nigeria	9690af
1200 1300 Sat/Sun	Palau, T8WH/World Harvest R	9930as
1200 1300	Papua New Guinea, R Fly	3915do 5960do
1200 1300	Russia, VO Russia	11530as 15670as
1200 1300	UK, BBC World Service	5875as 6195as 9740as 11750as
1200 1300	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1200 1300	USA, KNLS Anchor Point AK	7355as
1200 1300	USA, Overcomer Ministry	9370na 9980va
1200 1300	USA, VO America	7575va 9510va 12075va 12150va
1200 1300	USA, WBCQ Monticello ME	9330na
1200 1300	USA, WEWN/Irondale AL	15610eu
1200 1300	USA, WHRI Cypress Crk SC	9795am
1200 1300	USA, WTWW Lebanon TN	5830na
1200 1300	USA, WWCR Nashville TN	7490af 9980ca 13845na 15285eu
1200 1300 irreg	USA, WWRB Manchester TN	3185na
1215 1300	Egypt, R Cairo	17870as
1230 1245 smtwhf	Australia, HCJB Global Australia	15340pa
1230 1300	Bangladesh, Bangla Betar	15105as
1230 1300	South Korea, KBS World R	6095as
1230 1300	Thailand, R Thailand World Svc	9390as
1230 1300	Turkey, VO Turkey	15450va
1230 1300	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300 1330	Egypt, R Cairo	17870as
1300 1330	Japan, R Japan/NHK World	15735as
1300 1330	Turkey, VO Turkey	15450eu
1300 1357	North Korea, VO Korea	9435na 11710na 13760eu 15245eu
1300 1400	Anguilla, Caribbean Beacon/Univ Net	11775ca
1300 1400	Australia, ABC/R Australia	5940as 6150va 9580pa 12065pa
1300 1400 DRM	Australia, ABC/R Australia	5995as
1300 1400	Australia, NT VL8A Alice Springs	2310do
1300 1400	Australia, NT VL8K Katherine	2485do
1300 1400	Canada, CFRX Toronto ON	6070do
1300 1400	Canada, CFVP Calgary AB	6030do
1300 1400	Canada, CKZN St Johns NF	6160do
1300 1400	Canada, CKZU Vancouver BC	6160do
1300 1400	China, China R International	5955as 9570na 9730as 9760pa 9765va 9870as 11660as 11760pa 11980as 13610eu 13755as 17630eu
1300 1400 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1300 1400	Germany, R 6150	6070eu
1300 1400 irreg	Indonesia, VO Indonesia	9526as
1300 1400	Malaysia, RTM/Traxx FM	7295do
1300 1400	New Zealand, R New Zealand Intl	6170pa
1300 1400 irreg	Nigeria, VO Nigeria	9690af
1300 1400	Papua New Guinea, R Fly	3915do 5960do
1300 1400	Russia, VO Russia	12030as 15670as
1300 1400 DRM	Russia, VO Russia	9850eu
1300 1400	South Korea, KBS World R	9570as 15575na
1300 1400	Tajikistan, VO Tajik	7245va
1300 1400	UK, BBC World Service	5875as 6195as 9740as 15310as 17790as
1300 1400	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1300 1400	USA, KJES Vado NM	11715na

1300 1400	USA, Overcomer Ministry	9370na 9980va
1300 1400 Sat/Sun	USA, VO America	7575va 9510va 12075va 12150va
1300 1400	USA, WBCQ Monticello ME	9330na
1300 1400	USA, WEWN/Irondale AL	15610eu
1300 1400 Sat/Sun	USA, WHRI Cypress Crk SC	9795am 9840na
1300 1400	USA, WTWW Lebanon TN	9479na
1300 1400	USA, WWCR Nashville TN	7490af 9980ca 13845na 15285eu
1300 1400 irreg	USA, WWRB Manchester TN	9370na
1330 1400 f	Clandestine, JSR Shiokaze	6020as
1330 1400	India, AIR/External Svc	9690as 11620as 13710as
1330 1400	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400 1425 mtf	Singapore, TWR Asia	15190as
1400 1430 f	Clandestine, JSR Shiokaze	6020as
1400 1430	Japan, R Japan/NHK World	11705af 15735as
1400 1430	Laos, Lao National R	6130as
1400 1430 h	Singapore, TWR Asia	15190as
1400 1430	Thailand, R Thailand World Svc	9950as
1400 1435 sw	Singapore, TWR Asia	15190as
1400 1445 Sun	USA, Pan Am Broadcasting	15205as
1400 1500	Anguilla, Caribbean Beacon/Univ Net	11775ca
1400 1500	Australia, ABC/R Australia	5940as 5995va 9580pa 12065pa
1400 1500	Australia, NT VL8A Alice Springs	2310do
1400 1500	Australia, NT VL8K Katherine	2485do
1400 1500	Australia, NT VL8T Tennant Creek	2325do
1400 1500 Sun	Canada, Bible VO Broadcasting	17495as
1400 1500	Canada, CFRX Toronto ON	6070do
1400 1500	Canada, CFVP Calgary AB	6030do
1400 1500	Canada, CKZN St Johns NF	6160do
1400 1500	Canada, CKZU Vancouver BC	6160do
1400 1500	China, China R International	5955as 9765va 9870as 11665me 11675as 11765as 13710eu 13740na 17630eu
1400 1500 wa/irreg	Germany, Hamburger Lokalradio	7265eu
1400 1500 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1400 1500	Germany, R 6150	6070eu
1400 1500	India, AIR/External Svc	9690as 11620as 13710as
1400 1500	Malaysia, RTM/Traxx FM	7295do
1400 1500	New Zealand, R New Zealand Intl	6170pa
1400 1500 irreg	Nigeria, VO Nigeria	9690af
1400 1500	Oman, R Sultanate of Oman	15560af
1400 1500	Russia, VO Russia	4960va 9900me 11530as 12030as 15670as
1400 1500	South Korea, KBS World R	9640as
1400 1500	UK, BBC World Service	5845as 11890as 15310as
1400 1500	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1400 1500	USA, KJES Vado NM	11715na
1400 1500	USA, Overcomer Ministry	9370na 9980va 13810va
1400 1500 mtwhf	USA, Overcomer Ministry	9655eu
1400 1500 fas	USA, Overcomer Ministry	9655eu
1400 1500 mtwhf	USA, VO America	7575va 12120as 12150va
1400 1500	USA, VO America	4930af 6080af 15580af
1400 1500	USA, WBCQ Monticello ME	9330na
1400 1500 Sat	USA, WBCQ Monticello ME	15420na
1400 1500	USA, WEWN/Irondale AL	15610eu
1400 1500 Sun	USA, WHRI Cypress Crk SC	9795am 9840na 21600af
1400 1500	USA, WINB Red Lion PA	13570am
1400 1500	USA, WJHR Intl Milton FL	15550usb
1400 1500	USA, WTWW Lebanon TN	9479na
1400 1500	USA, WWCR Nashville TN	7490af 9980ca 13845na 15285eu
1400 1500 irreg	USA, WWRB Manchester TN	9370na
1415 1430	Nepal, R Nepal	5005do
1415 1430 mtwhfa	USA, Pan Am Broadcasting	15205as
1420 1455	Swaziland, TWR Africa	6025af
1430 1500	Australia, ABC/R Australia	9475va 11665va
1430 1500 Sat	Canada, Bible VO Broadcasting	17495as
1430 1500	China, China Business R	6190do 7220do
1430 1500	China, China Natl R/CNR11	4905do 4920do 6130do
1430 1500 Sun	Palau, T8WH/World Harvest R	15550as

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500 1530	Australia, ABC/R Australia	11665va 12065pa
1500 1530	Australia, HCJB Global Australia	15340pa
1500 1530 Sun	Italy, IRRS Shortwave	15190va
1500 1530	Vietnam, VO Vietnam/Overseas Svc	7285as 9840as 12020as
1500 1550	New Zealand, R New Zealand Intl	6170pa
1500 1557	North Korea, VO Korea	9435na 11710na 13760eu 15245eu
1500 1600	Anguilla, Caribbean Beacon/Univ Net	11775ca
1500 1600	Australia, ABC/R Australia	5940as 5995va 7240pa 9475va
1500 1600	Australia, NT VL8A Alice Springs	2310do
1500 1600	Australia, NT VL8K Katherine	2485do
1500 1600	Bhutan, Bhutan BC Svc	6035do
1500 1600	Canada, CFRX Toronto ON	6070do
1500 1600	Canada, CFVP Calgary AB	6030do
1500 1600	Canada, CKZN St Johns NF	6160do
1500 1600	Canada, CKZU Vancouver BC	6160do
1500 1600	China, China R International	5955as 6095me 7325as 7395as 9720me 9800as 9870as 13640eu 13740na 15245eu
1500 1600	Germany, R 6150	6070eu
1500 1600	Malaysia, RTM/Traxx FM	7295do
1500 1600 irreg	Nigeria, VO Nigeria	15120af
1500 1600	Russia, VO Russia	4960va 6185as 9900me
1500 1600 mtwhf	South Africa, Channel Africa	9625af
1500 1600	UK, BBC World Service	5845as 7565as 9410as 11675as 11890as 12095af 15420af
1500 1600	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1500 1600	USA, KNLS Anchor Point AK	9920as
1500 1600	USA, Overcomer Ministry	9370na 9980va 13810va
1500 1600 mtwhf	USA, Overcomer Ministry	9655eu
1500 1600 fas	USA, Overcomer Ministry	9655eu
1500 1600	USA, VO America	4930af 6080af 7540va 7575va 12120va 12150va 15580va 17895va
1500 1600	USA, WBCQ Monticello ME	9330na
1500 1600 Sat	USA, WBCQ Monticello ME	15420na
1500 1600	USA, WEWN/Irondale AL	15610eu
1500 1600	USA, WHRI Cypress Crk SC	17510eu
1500 1600	USA, WINB Red Lion PA	13570am
1500 1600	USA, WJHR Intl Milton FL	15550usb
1500 1600	USA, WTWW Lebanon TN	9479na
1500 1600	USA, WWCR Nashville TN	9980ca 12160af 13845na 15285eu
1500 1600 irreg	USA, WWRB Manchester TN	9370na
1525 1555 Sat/Sun	Swaziland, TWR Africa	6025af
1530 1545	India, AIR/External Svc	9910as
1530 1550 smtwhf	Vatican City State, Vatican R	11850af 15110as
1530 1550 smtwhf/DRM	Vatican City State, Vatican R	17550as
1530 1600	Australia, ABC/R Australia	11660as 11880va
1530 1600 DRM	Belgium, The Disco Palace	15775as
1530 1600 Sat	Canada, Bible VO Broadcasting	17600as
1530 1600 smtwa	Germany, AWR Europe	15335as
1530 1600	Iran, VOIRI	13780va 15515va
1530 1600	Mongolia, VO Mongolia	12015as
1530 1600	Myanmar, Myanma R	5985do
1530 1600 Sat	Vatican City State, Vatican R	11850as 15110as 17550as

1551 1600 New Zealand, R New Zealand Intl 6170pa
1551 1600 DRM New Zealand, R New Zealand Intl 5975pa

1600 UTC - 12PM EDT / 11AM CDT / 9AM PDT

1600 1627 Iran, VOIRI 13780va 15515va
1600 1630 Australia, ABC/R Australia 9540as
1600 1630 DRM Belgium, The Disco Palace 15775as
1600 1630 Indonesia, AWR Asia/Pacific 15360as
1600 1630 Myanmar, Myanma R 5985do
1600 1630 Sun Palau, T8WH/World Harvest R 15505as
1600 1630 Vietnam, VO Vietnam/Overseas Svc 7220me 7280eu 9550me 9730eu
1600 1650 DRM New Zealand, R New Zealand Intl 5975pa
1600 1650 New Zealand, R New Zealand Intl 6170pa
1600 1657 North Korea, VO Korea 9890va 11645va
1600 1700 Anguilla, Caribbean Beacon/Univ Net 11775ca
1600 1700 Australia, ABC/R Australia 5940as 5995va 7240pa 9475va 11660as 11880va
1600 1700 Australia, NT VL8A Alice Springs 2310do
1600 1700 Australia, NT VL8K Katherine 2485do
1600 1700 Bhutan, Bhutan BC Svc 6035do
1600 1700 Canada, CFRX Toronto ON 6070do
1600 1700 Canada, CFVP Calgary AB 6030do
1600 1700 Canada, CKZN St Johns NF 6160do
1600 1700 Canada, CKZU Vancouver BC 6160do
1600 1700 China, China R International 6060as 7235as 9570af 11900af 11940eu 11965eu 13760eu 15250va
1600 1700 Egypt, R Cairo 15345af
1600 1700 irreg Ethiopia, R Ethiopia/Intl Svc 7235va 9560va
1600 1700 Germany, R 6150 6070eu
1600 1700 Malaysia, RTM/Traxx FM 7295do
1600 1700 Russia, VO Russia 4960va 6035as 6185as 9490as
1600 1700 South Korea, KBS World R 9515eu 9640as
1600 1700 Taiwan, R Taiwan Intl 9440as 15485as
1600 1700 UK, BBC World Service 3255af 5845as 6190as 7565as 9410as 11675as 11890as 12095af 15420af 17640af 17830af
1600 1700 USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb
1600 1700 USA, Overcomer Ministry 9370na 9980va
1600 1700 USA, VO America 4930af 6080af 15580af
1600 1700 USA, WBCQ Monticello ME 9330na
1600 1700 Sat USA, WBCQ Monticello ME 15420na
1600 1700 USA, WEWN/Irondale AL 15610eu
1600 1700 USA, WHRI Cypress Crk SC 21630af
1600 1700 USA, WINB Red Lion PA 13570am
1600 1700 USA, WJHR Intl Milton FL 15550usb
1600 1700 USA, WTWW Lebanon TN 9479na
1600 1700 USA, WWCR Nashville TN 9980ca 12160af 13845na 15285eu
1600 1700 irreg USA, WWRB Manchester TN 9370na
1615 1630 Vatican City State, Vatican R 15595me
1630 1700 mwf Indonesia, AWR Asia/Pacific 15360as
1630 1700 m South Africa, Amateur R Today 3230af
1630 1700 Turkey, VO Turkey 15520as
1630 1700 mtwhf USA, VO America/S Sudan in Focus 9490af 11655af 13870af
1651 1700 New Zealand, R New Zealand Intl 9700pa
1651 1700 DRM New Zealand, R New Zealand Intl 5975pa

1700 UTC - 1PM EDT / 12PM CDT / 10AM PDT

1700 1710 Pakistan, R Pakistan 11570eu 15265eu
1700 1715 tf Canada, Bible VO Broadcasting 15215me
1700 1730 Australia, ABC/R Australia 11660as
1700 1730 h Canada, Bible VO Broadcasting 15215me
1700 1730 m South Africa, Amateur R Today 3230af
1700 1730 Turkey, VO Turkey 15520as
1700 1730 Vietnam, VO Vietnam/Overseas Svc 9625eu
1700 1750 DRM New Zealand, R New Zealand Intl 5975pa
1700 1750 New Zealand, R New Zealand Intl 9700pa
1700 1756 DRM Romania, R Romania Intl 9535eu
1700 1756 Romania, R Romania Intl 11740eu
1700 1800 Anguilla, Caribbean Beacon/Univ Net 11775ca
1700 1800 Australia, ABC/R Australia 5995va 9475as 9500va 9580pa 11880va
1700 1800 Australia, NT VL8A Alice Springs 2310do
1700 1800 Australia, NT VL8K Katherine 2485do
1700 1800 Sat/Sun Canada, Bible VO Broadcasting 15215me
1700 1800 Canada, CFRX Toronto ON 6070do
1700 1800 Canada, CFVP Calgary AB 6030do
1700 1800 Canada, CKZN St Johns NF 6160do
1700 1800 Canada, CKZU Vancouver BC 6160do
1700 1800 China, China R International 6090as 6140as 6165me 7235as 7265af 7410as 7420as 9570as 9695eu 11900af 13570eu 13760eu
1700 1800 Egypt, R Cairo 15345af
1700 1800 Germany, R 6150 6070eu
1700 1800 Malaysia, RTM/Traxx FM 7295do
1700 1800 Russia, VO Russia 4960va 6035as 6185as 9420as
1700 1800 DRM Russia, VO Russia 9820as
1700 1800 mtwhf South Africa, Channel Africa 15235af
1700 1800 Sudan, VO Africa/Sudan R 9505af
1700 1800 Sat/Sun Swaziland, TWR Africa 3200af
1700 1800 Taiwan, R Taiwan Intl 15690af
1700 1800 UK, BBC World Service 3255af 5845as 6190af 6195as 9410as 12095af 15400af 15420af 17795af 17830af
1700 1800 USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb
1700 1800 USA, Overcomer Ministry 9370na 9980va
1700 1800 USA, VO America 6080af 11795af 15580af 17895af
1700 1800 USA, WBCQ Monticello ME 9330na 15420na
1700 1800 USA, WEWN/Irondale AL 15610eu
1700 1800 USA, WHRI Cypress Crk SC 21630af
1700 1800 USA, WINB Red Lion PA 13570am
1700 1800 USA, WJHR Intl Milton FL 15550usb
1700 1800 USA, WTWW Lebanon TN 9479na 9930sa
1700 1800 USA, WWCR Nashville TN 9980ca 12160af 13845na 15285eu
1700 1800 irreg USA, WWRB Manchester TN 9370na
1720 1740 Sat/Sun USA, VOA/Studio 7 4930af 5940af 15455af
1730 1800 Australia, ABC/R Australia 6080as
1730 1800 mtwh USA, VOA/Studio 7 4930af 5940af 15455af
1730 1800 Vatican City State, Vatican R 11625af 13765af 15570af
1745 1800 Bangladesh, Bangla Betar 7250eu
1745 1800 India, AIR/External Svc 7550eu 9445va 9950eu 11580af 11670eu 11935af 13695af 17670af
1745 1800 mtwhf Swaziland, TWR Africa 3200af
1751 1800 New Zealand, R New Zealand Intl 9700as
1751 1800 DRM New Zealand, R New Zealand Intl 7285as

1800 UTC - 2PM EDT / 1PM CDT / 11AM PDT

1800 1815 Sat Canada, Bible VO Broadcasting 11855as
1800 1815 Sat Canada, Bible VO Broadcasting 9430me
1800 1830 Japan, R Japan/NHK World 9590af 11885af
1800 1830 USA, VO America 6080af 15580af 17895af
1800 1830 Sat/Sun USA, VO America 4930af
1800 1850 New Zealand, R New Zealand Intl 9700pa
1800 1850 DRM New Zealand, R New Zealand Intl 7285pa
1800 1857 North Korea, VO Korea 13760eu 15245eu
1800 1900 Anguilla, Caribbean Beacon/Univ Net 11775ca
1800 1900 mtwhf Argentina, RAE 15345eu
1800 1900 Australia, ABC/R Australia 6080as 9475as 9500va 9580pa 9710va 11880va
1800 1900 Australia, NT VL8A Alice Springs 2310do

1800 1900	Australia, NT VL8K Katherine	2485do
1800 1900	Bangladesh, Bangla Betar	7250eu
1800 1900 Sat/Sun	Canada, Bible VO Broadcasting	15215me
1800 1900 Sun	Canada, Bible VO Broadcasting	6130eu
1800 1900	Canada, CFRX Toronto ON	6070do
1800 1900	Canada, CFVP Calgary AB	6030do
1800 1900	Canada, CKZN St Johns NF	6160do
1800 1900	Canada, CKZU Vancouver BC	6160do
1800 1900	China, China R International	6175eu
	9600eu 13760eu	
1800 1900	Germany, R 6150	6070eu
1800 1900	India, AIR/External Svc	7550eu 9445va
	9950eu 11580af	11670eu 11935af
	13695af 17670af	
1800 1900 fas	Italy, IRRS Shortwave	7290va
1800 1900	Kuwait, R Kuwait	15540va
1800 1900	Malaysia, RTM/Traxx FM	7295do
1800 1900 irreg	Nigeria, VO Nigeria	7255af
1800 1900	Russia, VO Russia	4960va 9900va
1800 1900	South Korea, KBS World R	7275eu
1800 1900 Sat/Sun	Swaziland, TWR Africa	3200af
1800 1900	Swaziland, TWR Africa	9500af
1800 1900	Taiwan, R Taiwan Intl	6155eu
1800 1900	UK, BBC World Service	3255af 6190af
	7375as 11810af	12095af 15400af
	15420af 17795af	
1800 1900	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
1800 1900	USA, Overcomer Ministry	9370na 9980va
1800 1900	USA, WBCQ Monticello ME	9330na
	15420na	
1800 1900	USA, WEWN/Irondale AL	15610eu
1800 1900	USA, WHRI Cypress Crk SC	9840na
	21630af	
1800 1900	USA, WINB Red Lion PA	13570am
1800 1900	USA, WJHR Intl Milton FL	15550usb
1800 1900	USA, WTWW Lebanon TN	9479na 9930sa
1800 1900	USA, WWCR Nashville TN	9980ca 12160af
	13845na 15285eu	
1800 1900 irreg	USA, WWRB Manchester TN	9370na
1815 1845 Sun	Canada, Bible VO Broadcasting	9430me
1830 1845 Sat	Canada, Bible VO Broadcasting	6130eu
1830 1845	Rwanda, R Rep Rwandaise	6055do
1830 1900 Sun	Canada, Bible VO Broadcasting	9635as
1830 1900 irreg/DRM	Nigeria, VO Nigeria	15120af
1830 1900	Serbia, International R Serbia	6100eu
1830 1900	South Africa, AWR Africa	11840af
1830 1900	Turkey, VO Turkey	9785eu
1830 1900	USA, VO America	4930af 15580af
1845 1900 irreg	Guinea, RTV Guinee	7125do
1851 1900	New Zealand, R New Zealand Intl	11725pa
1851 1900 DRM	New Zealand, R New Zealand Intl	15720pa

1900 UTC - 3PM EDT / 2PM CDT / 12PM PDT

1900 1915 Sun	Canada, Bible VO Broadcasting	9635as
1900 1930	Germany, Deutsche Welle	11800af 11865af
	15275af	
1900 1930	Turkey, VO Turkey	9785eu
1900 1930	USA, VO America	4930af 9850af
	15580va	
1900 1930	Vietnam, VO Vietnam/Overseas Svc	7280eu
	9730eu	
1900 1945	India, AIR/External Svc	7550eu 9445eu
	9950eu 11580af	11670eu 11935af
	13695af 17670af	
1900 1957	North Korea, VO Korea	7210af 9875va
	11635va 11910af	
1900 2000	Anguilla, Caribbean Beacon/Univ Net	
	11775ca	
1900 2000	Australia, ABC/R Australia	6080as 9500va
	9710va 11660va	
1900 2000	Australia, NT VL8A Alice Springs	2310do
1900 2000	Australia, NT VL8K Katherine	2485do
1900 2000	Canada, CFRX Toronto ON	6070do
1900 2000	Canada, CFVP Calgary AB	6030do
1900 2000	Canada, CKZN St Johns NF	6160do
1900 2000	Canada, CKZU Vancouver BC	6160do
1900 2000	China, China R International	7295va
	9435af 9440af	
1900 2000	Egypt, R Cairo	15290af
1900 2000	Germany, R 6150	6070eu
1900 2000 irreg	Indonesia, VO Indonesia	9526eu
1900 2000	Kuwait, R Kuwait	15540va
1900 2000	Malaysia, RTM/Traxx FM	7295do
1900 2000	Micronesia, V6MP/Cross R/Pohnpei	4755as
1900 2000	New Zealand, R New Zealand Intl	11725pa
1900 2000 DRM	New Zealand, R New Zealand Intl	15720pa
1900 2000 irreg	Nigeria, VO Nigeria	7255af
1900 2000 mtwhf	Spain, R Exterior de Espana	9665eu
	11615af	
1900 2000	Swaziland, TWR Africa	3200af
1900 2000	Thailand, R Thailand World Svc	9390eu
1900 2000	UK, BBC World Service	3255af 6190af
	11810af 12095af	15400af 15420af
	17795af	
1900 2000	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
1900 2000	USA, Overcomer Ministry	9370na 9980va
1900 2000	USA, WBCQ Monticello ME	15420na
1900 2000 at	USA, WBCQ Monticello ME	7490na
1900 2000	USA, WEWN/Irondale AL	15610eu
1900 2000	USA, WHRI Cypress Crk SC	9840na
	21630af	
1900 2000	USA, WINB Red Lion PA	13570am
1900 2000	USA, WJHR Intl Milton FL	15550usb
1900 2000	USA, WTWW Lebanon TN	9479na 9930sa
1900 2000	USA, WWCR Nashville TN	9980ca 12160af
	13845na 15285eu	
1900 2000 irreg	USA, WWRB Manchester TN	9370na
1905 1920 Sat	Mali, ORTM/R Mali	9635do
1930 1957	Germany, Deutsche Welle	11865af 15275af
1930 2000	Iran, VOIRI 9400eu	9715eu 11750af
	11885af	
1930 2000 Sun	USA, Pan Am Broadcasting	9515af
1930 2000	USA, VO America	4930af 15580as

2000 UTC - 4PM EDT / 3PM CDT / 1PM PDT

2000 2020 tf	Belarus, R Belarus	7255eu 11730eu
2000 2027	Iran, VOIRI 9400eu	9715eu 11750af
	11885af	
2000 2030 mtwhfa	Albania, R Tirana	7465va
2000 2030	Australia, ABC/R Australia	6080as 9500va
2000 2030	Egypt, R Cairo	15290af
2000 2030 Sat/Sun	Swaziland, TWR Africa	3200af
2000 2030	USA, VO America	4930af 15580af
2000 2030	Vatican City State, Vatican R	11625af
	13765af	
2000 2057	Germany, Deutsche Welle	11865af
2000 2100	Anguilla, Caribbean Beacon/Univ Net	
	11775ca	
2000 2100	Australia, ABC/R Australia	9580pa 11650va
	11660va 12080pa	15515va
2000 2100	Australia, NT VL8A Alice Springs	2310do
2000 2100	Australia, NT VL8K Katherine	2485do
2000 2100	Australia, NT VL8T Tennant Creek	2325do
2000 2100	Canada, CFRX Toronto ON	6070do
2000 2100	Canada, CFVP Calgary AB	6030do
2000 2100	Canada, CKZN St Johns NF	6160do
2000 2100	Canada, CKZU Vancouver BC	6160do
2000 2100	China, China R International	5960eu
	5985af 7285eu	7295va 9440af
2000 2100 f	Clandestine, JSR Shiokaze	6075as
2000 2100	Cuba, R Havana Cuba	11760am
2000 2100	Germany, Deutsche Welle	11800af 12070af
2000 2100	Germany, R 6150	6070eu
2000 2100	Kuwait, R Kuwait	15540va
2000 2100	Malaysia, RTM/Traxx FM	7295do
2000 2100	Micronesia, V6MP/Cross R/Pohnpei	4755as
2000 2100 DRM	New Zealand, R New Zealand Intl	15720pa
2000 2100	New Zealand, R New Zealand Intl	11725pa
2000 2100 Sat/Sun	Spain, R Exterior de Espana	9570af
2000 2100	UK, BBC World Service	11810af 12095af
	15400af	
2000 2100	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	

2000 2100	USA, Overcomer Ministry	7490am	9370na	9980va
2000 2100	USA, WBCQ Monticello ME	15420na		
2000 2100 mtwhf	USA, WBCQ Monticello ME	7490na		
2000 2100	USA, WEWN/Irondale AL	15610eu		
2000 2100 Sun	USA, WHRI Cypress Crk SC	17510va		
2000 2100	USA, WINB Red Lion PA	13570am		
2000 2100	USA, WJHR Intl Milton FL	15550usb		
2000 2100	USA, WTWW Lebanon TN	9479na	9930sa	
2000 2100	USA, WWCR Nashville TN	9980ca	12160af	13845na 15285eu
2000 2100 irreg	USA, WWRB Manchester TN	9370na		
2020 2100	Belarus, R Belarus	7255eu	11730eu	
2030 2045	Thailand, R Thailand World Svc	9390eu		
2030 2056 DRM	Romania, R Romania Intl	9800eu		
2030 2056	Romania, R Romania Intl	11745na	11975eu	13800na
2030 2100	Australia, ABC/R Australia	9500va	11695va	
2030 2100	Turkey, VO Turkey	7205va		
2030 2100	USA, VO America	4930af	6080af	15580af
2030 2100 Sat/Sun	USA, VO America	4940af		
2030 2100	Vietnam, VO Vietnam/Overseas Svc	7220me	7280eu	9550eu 9730eu
2045 2100	India, AIR/External Svc	7550eu	9445eu	9910pa 11620pa 11670eu 11740pa
2045 2100 DRM	India, AIR/External Svc	9950eu		

2100 UTC - 5PM EDT / 4PM CDT / 2PM PDT

2100 2130	Australia, NT VL8A Alice Springs	2310do		
2100 2130	Australia, NT VL8K Katherine	2485do		
2100 2130	Australia, NT VL8T Tennant Creek	2325do		
2100 2130	Austria, AWR Europe	11955af		
2100 2130	Serbia, International R Serbia	6100eu		
2100 2130	South Korea, KBS World R	3955eu		
2100 2130	Turkey, VO Turkey	7205va		
2100 2150	New Zealand, R New Zealand Intl	11725pa		
2100 2150 DRM	New Zealand, R New Zealand Intl	15720pa		
2100 2157	North Korea, VO Korea	13760eu	15245eu	
2100 2200 irreg	Angola, Angolan Natl R	7217af		
2100 2200	Anguilla, Caribbean Beacon/Univ Net	11775ca		
2100 2200	Australia, ABC/R Australia	9500va	9660va	11650va 11695va 13630pa 15515va
2100 2200	Belarus, R Belarus	7255eu	11730eu	
2100 2200	Canada, CFRX Toronto ON	6070do		
2100 2200	Canada, CFVP Calgary AB	6030do		
2100 2200	Canada, CKZN St Johns NF	6160do		
2100 2200	Canada, CKZU Vancouver BC	6160do		
2100 2200	China, China R International	5960eu	7205af	7285eu 7325af 7415eu 9600eu
2100 2200	Egypt, R Cairo	11890eu		
2100 2200	Germany, Deutsche Welle	11800af	11865af	12070af
2100 2200	Germany, R 6150	6070eu		
2100 2200	India, AIR/External Svc	7550eu	9445eu	9910pa 11620pa 11670eu 11740pa
2100 2200 DRM	India, AIR/External Svc	9950eu		
2100 2200	Malaysia, RTM/Traxx FM	7295do		
2100 2200	Micronesia, V6MP/Cross R/Pohnpei	4755as		
2100 2200 Sat/Sun	Spain, R Exterior de Espana	9570af	9665eu	
2100 2200 mtwhf	UK, BBC World Service	9915af	11810af	12095af
2100 2200	USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
2100 2200	USA, Overcomer Ministry	7490am	9370na	9980va
2100 2200	USA, VO America	6080af	15580af	
2100 2200 Sun	USA, WBCQ Monticello ME	7490na		
2100 2200	USA, WEWN/Irondale AL	15610eu		
2100 2200 Sun	USA, WHRI Cypress Crk SC	17510va		
2100 2200 m	USA, WINB Red Lion PA	9265am		
2100 2200	USA, WJHR Intl Milton FL	15550usb		
2100 2200	USA, WTWW Lebanon TN	9479na	9930sa	
2100 2200	USA, WWCR Nashville TN	6875eu	9350af	9980ca 13845na
2100 2200 irreg	USA, WWRB Manchester TN	3215na		9370na
2130 2200	Australia, NT VL8A Alice Springs	4835do		
2130 2200	Australia, NT VL8K Katherine	5025do		
2130 2200	Australia, NT VL8T Tennant Creek	4910do		
2151 2200	New Zealand, R New Zealand Intl	15720pa		
2151 2200 DRM	New Zealand, R New Zealand Intl	17675pa		

2200 UTC - 6PM EDT / 5PM CDT / 3PM PDT

2200 2230	India, AIR/External Svc	9910pa	11620pa	11670eu 11740pa
2200 2230 DRM	India, AIR/External Svc	9950eu		
2200 2245	Egypt, R Cairo	11890eu		
2200 2256	Romania, R Romania Intl	7430eu	9540eu	9790as 11940as
2200 2300	Anguilla, Caribbean Beacon/Univ Net	6090ca		
2200 2300	Australia, ABC/R Australia	9660va	9855as	12080pa 13630pa 15240va 15415va 15515va
2200 2300	Australia, NT VL8A Alice Springs	4835do		
2200 2300	Australia, NT VL8K Katherine	5025do		
2200 2300	Australia, NT VL8T Tennant Creek	4910do		
2200 2300	Canada, CFRX Toronto ON	6070do		
2200 2300	Canada, CFVP Calgary AB	6030do		
2200 2300	Canada, CKZN St Johns NF	6160do		
2200 2300	Canada, CKZU Vancouver BC	6160do		
2200 2300	China, China R International	9590as		
2200 2300	Germany, R 6150	6070eu		
2200 2300	Malaysia, RTM/Traxx FM	7295do		
2200 2300	Micronesia, V6MP/Cross R/Pohnpei	4755as		
2200 2300	New Zealand, R New Zealand Intl	15720pa		
2200 2300 DRM	New Zealand, R New Zealand Intl	17675pa		
2200 2300	Russia, VO Russia	9465ca		
2200 2300	South Korea, KBS World R	11810eu		
2200 2300	Taiwan, R Taiwan Intl	15440na		
2200 2300	Turkey, VO Turkey	9830va		
2200 2300	USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
2200 2300	USA, Overcomer Ministry	7490am	9370na	9980va
2200 2300 smtwh	USA, VO America	5915va	7480va	7575va 12150va
2200 2300	USA, WBCQ Monticello ME	7490na		
2200 2300	USA, WEWN/Irondale AL	15610eu		
2200 2300 Sat/Sun	USA, WHRI Cypress Crk SC	11775eu		
2200 2300	USA, WTWW Lebanon TN	9479na	9930sa	
2200 2300	USA, WWCR Nashville TN	6875eu	9350af	9980ca 13845na
2200 2300 irreg	USA, WWRB Manchester TN	3215na		9370na
2230 2300	China, Xizang PBS	4905do		
2230 2300	Indonesia, AWR Asia/Pacific	15320as		
2230 2300	USA, WYFR/Family R	6115am		
2245 2300	India, AIR/External Svc	9690as	9705as	11710as 13605as
2245 2300 DRM	India, AIR/External Svc	11645as		

2300 UTC - 7PM EDT / 6PM CDT / 4PM PDT

2300 0000	Anguilla, Caribbean Beacon/Univ Net	6090ca		
2300 0000	Australia, ABC/R Australia	9660va	9855as	12080pa 15240va 15415va 17795pa 19000va 21740va
2300 0000	Australia, NT VL8A Alice Springs	4835do		
2300 0000	Australia, NT VL8K Katherine	5025do		
2300 0000	Australia, NT VL8T Tennant Creek	4910do		
2300 0000	Canada, CFRX Toronto ON	6070do		
2300 0000	Canada, CFVP Calgary AB	6030do		
2300 0000	Canada, CKZN St Johns NF	6160do		
2300 0000	Canada, CKZU Vancouver BC	6160do		

2300 0000	China, China R International				5915as
	5990ca	7350eu	7410as	11690as	
	11790as	11955as			
2300 0000	Cuba, R Havana Cuba		11880af		
2300 0000	Egypt, R Cairo	9965na			
2300 0000	Germany, R 6150		6070eu		
2300 0000	India, AIR/External Svc		6055as	9690as	
	9705as	11710as	13605as		
2300 0000 DRM	India, AIR/External Svc		11645as		
2300 0000 c	Malaysia, RTM/Traxx FM		7295do		
2300 0000	Micronesia, V6MP/Cross R/Pohnpei				4755
	as				
2300 0000	New Zealand, R New Zealand Intl				15720pa
2300 0000 DRM	New Zealand, R New Zealand Intl				17675pa
2300 0000	Russia, VO Russia		9465ca		
2300 0000	UK, BBC World Service		3915as	6195as	
	7490as	9740as	9890as	11850as	
	12010as				
2300 0000	USA, AFN/AFRTS		4319usb	5765usb	
	12759usb	13362usb			
2300 0000	USA, Overcomer Ministry		9370na	9980va	
2300 0000	USA, VO America		5895va	7480va	
	7575va	12150va			
2300 0000	USA, WBCQ Monticello ME				7490na
2300 0000 Sat/Sun	USA, WBCQ Monticello ME				5110na
2300 0000	USA, WEWN/Irondale AL		15610eu		
2300 0000 Sat/Sun	USA, WHRI Cypress Crk SC				11775eu
2300 0000 mtwhfs	USA, WHRI Cypress Crk SC				7315ca
2300 0000 m	USA, WINB Red Lion PA		9265am		
2300 0000	USA, WTWW Lebanon TN		9479na	9930sa	
2300 0000	USA, WWCR Nashville TN		6875eu	9350af	
	9980ca	13845na			
2300 0000 irreg	USA, WWRB Manchester TN				3215na
	9370na				
2300 0000	USA, WYFR/Family R		6115am		
2300 2315 smtwh	Moldova, R PMR/Transistria				9665eu
2330 0000	Australia, ABC/R Australia		17750va		
2330 0000 Sat/Sun	Indonesia, AWR Asia/Pacific				17650as
2330 0000	Vietnam, VO Vietnam/Overseas Svc				9840as
	12020as				

India, AIR/Aizawl....www.allindiaradio.org/
India, AIR/Bhopal....www.allindiaradio.org/
India, AIR/Chennai....www.allindiaradio.org/
India, AIR/Chennai/FM Gold....www.allindiaradio.org/
India, AIR/Delhi....www.allindiaradio.org/
India, AIR/External Svc....www.allindiaradio.org/
India, AIR/External Svc/Haj Season....www.allindiaradio.org/
India, AIR/Gangkok....www.allindiaradio.org/
India, AIR/Guwahati....www.allindiaradio.org/
India, AIR/Hyderabad....www.allindiaradio.org/
India, AIR/Imphal....www.allindiaradio.org/
India, AIR/Itanagar....www.allindiaradio.org/
India, AIR/Jaipur....www.allindiaradio.org/
India, AIR/Jeypore....www.allindiaradio.org/
India, AIR/Kohima....www.allindiaradio.org/
India, AIR/Kolkata....www.allindiaradio.org/
India, AIR/Kuresong....www.allindiaradio.org/
India, AIR/Leh....www.allindiaradio.org/
India, AIR/Lucknow....www.allindiaradio.org/
India, AIR/Mumbai....www.allindiaradio.org/
India, AIR/Natl Channel....www.allindiaradio.org/
India, AIR/Port Blair....www.allindiaradio.org/
India, AIR/Shillong....www.allindiaradio.org/
India, AIR/Shimla....www.allindiaradio.org/
India, AIR/Srinagar....www.allindiaradio.org/
India, AIR/Thiruvananthapuram....www.allindiaradio.org/
India, AIR/Uttaranchal Prg....www.allindiaradio.org/
India, AIR/Vivdh Bharati....www.allindiaradio.org/
India, Athmeeya Yatra R/GFA....www.ayasia.org
India, TWR India....www.radio882.com
Indonesia, RRI Makassar....www.rrimakassar.com/
Indonesia, VO Indonesia....www.voi.co.id
Iran, VO Islamic Palestinian Revol....www.irib.ir
Iran, VO Islamic Rep of Iran....www.irib.ir
Iran, VO Islamic Rep of Iran/Al Quds TV....www.irib.ir
Iran, VO Islamic Rep of Iran/Mashad Prg....www.irib.ir
Iran, VO Islamic Rep of Iran/VO Justice....www.irib.ir
Israel, Galei Tzahal....www.glz.msn.co.il
Israel, Kol Israel....www.intkolisrael.com
Italy, IRRS SW....www.nexus.org
Japan, R Japan/NHK World....www.nhk.or.jp/english/
Japan, R Nikkei/Pgm 1....www.radionikkei.jp
Japan, R Nikkei/Pgm 2....www.radionikkei.jp
Jordan, R Jordan....www.jrtv.jo/rj
Kuwait, R Kuwait....www.media.gov.kw/
Kuwait, R Kuwait/General Svc....www.media.gov.kw/
Kuwait, R Kuwait/Holy Qur'an Svc....www.media.gov.kw/
Kyrgyzstan, Kyrgyz Radiosu....www.ktr.kg
Laos, LNR Natl Svc/Vientane....www.lnr.org.la/
Laos, LNR Prov Svc/Houa Phan/Sam Neua....www.lnr.org.la/
Madagascar, AWR Africa....www.awr2.org/
Mali, ORTM/R Mali....www.ortm.ml
Mauritania, R Mauritanie....www.mauritania.mr
Mexico, R Educacion....www.radioeducacion.edu.mx/
Mexico, R Mil Onda Corta....www.radiomil.com.mx
Mexico, R Universidad....www.uaslp.mx
Micronesia, V6MP/Cross R/Pohnpei....www.pmapacific.org/
Moldova, R PMR/Pridnestrovye....www.radiopmr.org
Mongolia, Mongolian R/Pgm 2....www.mnb.mn
Mongolia, Voice of Mongolia....www.vom.mn/
Morocco, R Marocaine....www.snrt.ma
Morocco, R Mediterranee Intl/Medi 1....www.medi1.com
Nepal, R Nepal....www.radionepal.org/
New Zealand, R New Zealand Intl....www.rnzi.com
Nigeria, VO Nigeria....www.voiceofnigeria.org
North Korea, VO Korea....www.vok.rep.kp
Oman, R Sultanate of Oman....www.oman-tv.gov.om
Pakistan, R Pakistan External Svc....www.radio.gov.pk
Pakistan, R Pakistan/Dom SW Svc....www.radio.gov.pk
Palau, T8WH/World Harvest R....www.whr.org/
Papua New Guinea, Wantok R Light....www.wantokradio.org
Peru, La Voz de la Selva....www.radiolavozdelaselva.org/
Peru, R Altura....www.radioalturatv.com
Peru, R Ancash....www.ancash.org
Peru, R Bethel....www.bethelradio.fm/
Peru, R del Pacifico....www.grupopacifico.org/radio.html
Peru, R JPJ del Peru....www.radiojpj.com
Peru, R Libertad de Junin....www.rlibertadjunin.com/
Peru, R Logos....www.ethnicradio.org
Peru, R Maranon....www.radiomaranon.org.pe
Peru, R Melodia....www.radiomelodia.com.pe
Peru, R Quillabamba....http://quillabambanoticias.org
Peru, R Santa Rosa....www.radiosantarosa.com.pe/
Peru, R Sicuani....www.radiosicuani.org.pe
Peru, R Victoria....www.ipda.com.pe/
Peru, R Vision....www.visionradioperu.com
Peru, R Voz Cristiana....www.radiovozcristianaperu.com
Philippines, FEBC Philippines....www.febc.ph
Philippines, R Pilipinas Overseas Svc....www.pbs.gov.ph/
Philippines, R Veritas Asia....www.rveritas-asia.org
Poland, Polish R/External Svc....www.polskieradio.pl
Romania, R Romania Intl....www.rri.ro/
Russia, GTRK/Adygeya....www.rri.ro/
Russia, R Rossii....www.radiorus.ru
Russia, VO Russia....http://english.ruvr.ru/
Rwanda, R Rep Rwandaise....www.orinfor.gov.rw/
Rwanda, TWR Africa....www.twrafrica.org/
Saudi Arabia, BSKSA/Call of Islam....www.saudiradio.net/
Saudi Arabia, BSKSA/External Svc....www.saudiradio.net/
Saudi Arabia, BSKSA/First General Pgm....www.saudiradio.net/
Saudi Arabia, BSKSA/Quran Pgm....www.saudiradio.net/
Saudi Arabia, BSKSA/Second General Pgm....www.saudiradio.net/
Serbia, International R Serbia....http://voiceofserbia.org
Solomon Islands, SIBC....www.sibconline.com.sb
South Africa, AWR Africa....www.awr2.org/
South Africa, Channel Africa....www.channelafrica.org
South Africa, CVC 1 Africa R....www.1africa.tv
South Africa, R Sonder Grense....www.rsg.co.za
South Africa, RTE R Worldwide....www.rte.ie/radio1/
South Africa, TWR Africa....www.twrafrica.org/
South Korea, KBS World R....www.worldkbs.co.kr
Spain, R Exterior de Espana....www.rtve.es/
Sri Lanka, AWR Asia....www.awr2.org/
Sri Lanka, SLBC....www.slbc.lk
Sudan, Sudan RTV/Sudan R....www.sudanradio.info/
Swaziland, TWR Africa....www.twrafrica.org/
Sweden, IBRA Radio....www.ibra.org/
Switzerland, Stimme Des Trostes....www.missionswerk-arche.ch
Syria, R Damascus....www.radio-damascus.net/
Taiwan, AWR Asia....www.awr2.org/
Taiwan, R Taiwan Intl....www.rti.org.tw
Taiwan, R Taiwan Intl....http://english.rti.org.tw/
Thailand, R Thailand World Svc....www.hsk9.org/
Tunisia, RTV/R Tunisia....www.radiotunisienne.tn/
Turkey, VO Turkey....www.trt-world.com/
Uganda, Dunamis SW....www.biblevoice.org/
Uganda, UBC Radio....www.ubconline.co.ug
UK, BBC World Service....www.bbc.co.uk/worldservice/
UK, FEBA Radio....www.febaradio.net
USA, AFN/AFRTS....http://myafn.dodmedia.osd.mil/
USA, BBG/R Free Asia....www.rfa.org/english/
USA, BBG/R Free Europe/R Liberty....www.rferl.org/
USA, BBG/R Marti....www.martinoticias.com
USA, BBG/RFE/RL/R Farda....www.radiofarda.com
USA, BBG/RFE/RL/R Free Afghanistan....www.azadiradio.org/
USA, BBG/VOA....www.voanews.com
USA, BBG/VOA/Aap Ki Dunyaa....www.voanews.com/urdu/news
USA, BBG/VOA/Afia Darfur R....www.afiadarfur.com
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USA, BBG/VOA/R Ashna....www.voanews.com/dari
USA, BBG/VOA/R Mashaal....www.mashaal.org
USA, BBG/VOA/Studio 7....www.voanews.com
USA, BBG/VOA/Sudan in Focus....www.voanews.com
USA, KNLS Anchor Point AK....www.knls.org/
USA, Overcomer Ministry....www.overcomerministry.org
USA, WBCQ Monticello ME....www.wbcq.com/
USA, WEWN/EWTN Irondale AL....www.ewtn.com/
USA, WHRI Cypress Creek SC....www.whr.org/
USA, WINB Red Lion PA....www.winb.com
USA, WRMI Miami FL....www.wrmi.net/
USA, WRMI/R Prague relay....www.wrmi.net/
USA, WRMI/R Slovakia Intl relay....www.wrmi.net/
USA, WRNO New Orleans LA....www.wrnoradio.com
USA, WTWW Lebanon TN....www.wtww.us/
USA, WWCR Nashville TN....www.wwcr.com
USA, WWRB Manchester TN....www.wwrb.org/
USA, WYFR/Family R Worldwide....www.familyradio.com/
Uzbekistan, CVC/The Voice Asia....www.christianvision.com/
Vatican City State, Vatican R....www.vaticanradio.org/
Vietnam, VO Vietnam 1/Buon Ma Thuot....www.vov.org.vn
Vietnam, VO Vietnam 1/Hanoi....www.vov.org.vn
Vietnam, VO Vietnam 1/Son Tay....www.vov.org.vn
Vietnam, VO Vietnam 1/Xuan Mai....www.vov.org.vn
Vietnam, VO Vietnam 2/Xuan Mai....www.vov.org.vn
Vietnam, VO Vietnam 4/Buon Ma Thuot....www.vov.org.vn
Vietnam, VO Vietnam 4/Xuan Mai....www.vov.org.vn
Vietnam, VO Vietnam/Overseas Svc....www.vov.org.vn
Yemen, Rep of Yemen R/R Sana'a....www.adenradio.net
Zambia, Christian Voice....www.voiceafrica.net
Zambia, CVC Intl/1 Africa....www.1africa.tv
Zambia, Zambia Natl BC....www.znbc.co.zm
Zimbabwe, VO Zimbabwe/Ext Svc....www.zbc.co.zw
Zimbabwe, Zimbabwe BC....www.zbc.co.zw

Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com
Blog: http://mt-milcom.blogspot.com
Twitter: MilcomMP

Air Force Reserve Military Call Sign

If you are a Mode-S radar box user, you probably have seen the call sign Cody ## associated with various military aircraft and units. I have been tracking this call sign for some time and noticed that Air Force Reserve C-130/KC-135 aircraft appeared to be using this call sign.

With this information in hand I turned to the Internet and the Air Force Publications website to solve this call sign mystery. It did not take long to find my answer in the Adobe PDF files located on that website.

According to the instruction I consulted, the call sign is associated with the "Reserve Airlift Support (RAS) Program." The RAS program is the process by which the Air Force Reserve schedules aircraft and crews to support AFRC priority or short-notice organic airlift requirements. C-130 and KC-135 flying units are normally scheduled to provide RAS support. The RAS call sign is "Cody 01." Additional RAS aircraft operating concurrently will be assigned "Cody 02" etc., as necessary.

These Cody aircraft work through the Headquarters, Air Force Reserve Command Center at Robins AFB, Georgia. If you are in the southeast United States their primary UHF frequency is 372.175 MHz and 311.0 MHz secondary with the ground station call sign of "Gunrunner."

Watch future editions of this column for more official military call sign lists.

USAF Reserve 302 Air Wing C-130 aircraft taxi for takeoff from Peterson AFB,

❖ 3 MHz 'OR' Aeronautical Sub-Band Scan

In this *MT Milcom* column we will continue with our exclusive profiles of the various aeronautical 'OR' sub-bands. This month has a detail breakout of the 3026 to 3152 kHz frequency range in Table One. The information presented in our exclusive frequency list is based on many hours of monitoring and analyzing field monitor reports from around the world. You can learn more about monitoring these frequencies in the October 2012 *MT Milcom* column.

❖ ARTCC Update

This month we will continue our FAA Air Route Traffic Control Center tour with a look at the frequencies used by the Boston ARTCC (Table Two). I want to remind regular readers of this column to please be patient and we will get around to the ARTCC covering your area as soon as space and current events allow. Note: All frequencies listed in table 2 are in MHz and mode is AM.

And that does it for this month, until next time, 73 and good hunting.

USAF Reserve 434 Air Refueling Wing KC-135 aircraft on the ramp at Grissom Air Reserve Base, Indiana.

Table One: 3 MHz 'OR' Aeronautical Sub-Band Scan

*Note: All frequencies are in kHz and the mode is Upper Sideband (USB) unless otherwise indicated. An * indicates a frequency this is not part of the 'OR' band plan.*

3026.0	USAF Assignment: Air Mobility Command (AMC) High Frequency Global Command System (HFGCS) global discrete
3029.0	USAF Assignment: AMC HFGCS global discrete; U.S. Air Force (USAF) Mystic Star network
3029.7*	HWK Swedish Navy – Karlskrona, USB/MIL STD 188-110 Serial Tone/1200 Bps/Long Interval Messages every half+full Hour.
3032.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; U.S. Army (USA) National Guard – National Net 1 (ALE/USB); FUI French Navy – Ajaccio, Corsica, Air Reporting and Control Net (ARCN); Royal New Zealand Air Force (RNZAF) Air Operations Communication Center Auckland (AOCCAK) Network
3035.0	USN Assignment: U.S. Navy (USN) Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets; Algerian Military HF ALE Net (ALE/USB); LBJ Norwegian Navy – Harstad, Air Reporting and Control Net (ARCN)
3038.0	USN/CANFORCE Assignment: USN Atlantic fleet ship/air operations, including HF Composite Warfare Commander (CWC) voice coordination nets; USN Stratcom Wing One command post – Tinker AFB, Oklahoma;. FWV French Navy – Nimes (Garon), Air Reporting and Control Net (ARCN); JWT Norwegian Navy – Stavanger, Air Reporting and Control Net (ARCN)
3041.0	USAF Assignment: AMC HFGCS global discrete; USAF Eastern Test Range launch support network; USAF Special Operations Command (AFSOC) Moody AFB Wing Common; USAF Nellis AFB Search and Rescue (SAR) Net
3043.5*	Swiss Air Defense network unidentified digital mode 200/100 paired with 3044.5 kHz [tentative]
3044.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; Austrian Military VFT 2x100/170 encrypted text; FUI French Navy – Ajaccio, Corsica, Air Reporting and Control Net (ARCN); Swiss unknown network FSK (2xF1B/100Bd/170Hz/1kHz spaced, encrypted "FEC-like")
3044.5*	Unknown Russian military FSK 150/100 (CIS-100); Swiss Air Defense network unidentified digital mode 200/100 paired with 3043.5 kHz [tentative]
3047.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets; Canadian Forces (CANFORCE) Military Aeronautical Communications System (MACS} discrete Trenton Military (also Edmonton remote to Trenton)
3050.0	USN/CANFORCE Assignment: USN Atlantic fleet ship/air operations, including HF CWC voice coordination nets
3052.0*	NATO/U.S. Department of Defense (DoD) Link-11 (TADIL-A) data signal, Mil-Std-188-203-1A
3053.0	USCG/CANFORCE Assignment: U.S. Coast Guard (USCG) Primary air/surface – local AIRSTA and remote operations
3056.0	USCG/CANFORCE Assignment: USCG Primary air/surface – local AIRSTA and remote operations
3058.0*	Japanese Navy XSL Slot machine (MPSK)
3059.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; Algerian Navy (ALE/USB)
3062.0	USAF Assignment: AMC HFGCS global discrete
3064.2*	Italian Maritime Force (ITMARFOR) (Stanag 4285)

3065.0	USAF Assignment: AMC HFGCS global discrete; USAF/NORAD Air defense network; USAF AWACS/JStars discrete; NATO/DoD Link-11 (TADIL-A) data signal, Mil-Std-188-203-1A; Mexican Navy Mil-Std-188-110A serial tone standard (encrypted)
3068.0	USAF/CANFORCE Assignment: AMC/DoD/Joint Chiefs of Staff (JCS) HFGCS Global Black - NIPRNet (Unclassified but Sensitive Internet Protocol Router Network) (formerly called the Non-Classified Internet Protocol Router Network)
3071.0	USAF Assignment: AMC HFGCS global discrete; FPI French Navy – St. Assise Air Reporting and Control Net (ARCN); MKL United Kingdom (UK) Royal Air Force (RAF) – Northwood/Inskip discrete
3074.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete
3077.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete
3080.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; USN Pacific fleet ship/air operations
3083.0	USN Assignment: USN Atlantic/Pacific fleet ship/air operations; NAS Whidbey Island, Washington, Tactical Support Center (TSC) flight following - Pacific (Habitat call sign); UK Defense High Frequency Communications Service (DHFCS) Terrestrial Air Sea Communications (TASCOMM) ALE Net (ALE/USB)
3086.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations; UK DHFCS TASCOMM ALE Net (ALE/USB)
3088.0*	NATO/DoD Link-11 (TADIL-A) data signal, Mil-Std-188-203-1A
3089.0	USN Assignment: USN Atlantic/Pacific fleet ship/air operations; NASA Mission Support Air/Ground/Air (A/G/A); UK RAF – Kinloss Search and Rescue RCC Night (Secondary)
3092.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations; USN Fleet Air/Area Control & Surveillance Facility (FACSFAC) Pensacola, Florida, discrete; CANFORCE MACS discrete Trenton Military (also Edmonton remote to Trenton)
3095.0	USN/CANFORCE Assignment: USN Atlantic fleet ship/air operations; USN FACSFAC Pensacola, Florida, discrete; Malaysian Air Force – Butterworth, SAR RCC
3098.0	USN Assignment: NAS Whidbey Island, Washington, TSC flight following - Pacific (Habitat call sign); USN Stratcom Wing One command post – Tinker AFB, Oklahoma
3101.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets
3104.0	USN Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets; USN NAS Corpus Christi, Texas Command Post; USN FACSFAC Virginia Capes discrete
3107.0	USN Assignment: USN Atlantic/Pacific fleet ship/air operations; French Navy – Brest (Kerlouan) Centre De Coordination et De Contrôle Marine De L'Atlantique (Armour Voice call sign)
3109.0*	Italian Air Force – Pisa-San Giusto, 46 Aerial Brigade (ALE/USB)
3110.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete
3113.0	USAF/CANFORCE Assignment: AMC HFGCS Global Red - SIPRNet (Secure Internet Protocol Router Network)
3116.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; DHM42/DHJ59 German Navy – Glücksburg/Wilhelmshaven, MARTELO Air Reporting and Control Net (ARCN); ARINC HFDL Reykjavik, Iceland, Slot 3
3118.0*	Unknown military, Tadiran encrypted speech
3119.0	USCG Assignment: USCG Primary air/surface – local AIRSTA and remote operations
3120.0*	USN Link-11 (TADIL-A) data signal, Mil-Std-188-203-1A
2120.5*	Unknown military, Tadiran encrypted speech
3122.0	USCG /CANFORCE Assignment: USCG Primary air/surface – local AIRSTA and remote operations; DHM42/DHJ59 German Navy – Glücksburg/Wilhelmshaven, Ship-to-Shore voice/digital channel
3125.0	USN Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets; USN Eastern Test Range launch support network
3127.0*	USN NAA – NCTS Cutler, Maine, NATO-75 (RTTY) 850/75 KG-84 encryption (Stanag 4481)
3128.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets
3131.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets
3133.0*	Swiss unknown network, FSK (2xF1B/100Bd/170Hz/1kHz spaced, encrypted "FEC-like")
3134.0	USAF Assignment: AMC HFGCS global discrete
3137.0	USAF/CANFORCE Assignment: AMC HFGCS Scope Command ALE HF network
3140.0	USAF Assignment: AMC HFGCS global discrete
3143.0	USAF/CANFORCE Assignment: AMC HFGCS global discrete; DHM 91 German Air Force – Munster, German Air Force Air Transport Command Headquarters
3146.0	USAF Assignment: AMC HFGCS global discrete; IDR Italian Navy – Rome, Air Reporting and Control Net (ARCN); UK DHFCS TASCOMM discrete
3149.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets
3150.0*	French Air Force Voice Network
3151.0*	Japanese Self Defense Force (SDF), Coast Guard Search and Rescue for SDF
3152.0	USN/CANFORCE Assignment: USN Atlantic/Pacific fleet ship/air operations, including HF CWC voice coordination nets; CANFORCE – Vancouver/Halifax, MACS SAR discrete

Table Two: Indianapolis ARTCC RCAG Frequency List

RCAG Freq V/U Pair MHz	RCAG Location (ICAO Identifier)	Sector #/Name: Notes
118.425/277.400	Woodstock, Connecticut (BDL)	Sector 46/Boston Hi
118.550/285.400	Waterboro, Maine (QEL) Alternate Workload (Ex-South Acton ME)	Sector 16/Paso Lo
118.825/251.075	St. Albans, Vermont (BTV) Backup 342.250	Sector 53/Plattsburgh Hi
120.250/346.400	Houlton, Maine (HUL) Simulkey BGR	Sector 15/Surry Lo
	St. Albans, Maine (BGR) Simulkey HUL	Sector 15/Surry Lo
120.350/342.250	Turin, New York (RME) Simulkey QHB	Sector 53/Montpelier Hi
	St. Albans, Vermont (QHB) Simulkey RME/Backup 118.825	Sector 53/Montpelier Hi
121.350/257.850	Lake George, New York (GFL)	Sector 22/Albany Lo
123.750/338.200	Gardner, Massachusetts (GDM)	Sector 36/Gardner Lo
123.875/323.000	Turin, New York (RME)	Sector 9/Utica Hi
124.125/273.550	Remsen, New York (QXU)	Sector 10/Rockdale Hi
124.250/290.500	St. Albans, Maine (BGR)	Sector 15/Surry Lo
124.525/254.375	Calverton, New York (CCC)	Sector 31/Hampton Hi
124.750/239.050	Caribou, Maine (QYD)	Sector 15/Surry Lo
124.850/269.200	Woodstock, Connecticut (BDL)	Sector 34/Providence Lo
125.575/290.350	Shelton, Connecticut (BDR)	Sector 20/Kingston Hi
126.225/370.900	Mt. Tom, Massachusetts (QE6)	Sector 46/Boston Hi
127.375/353.925	Rockdale, New York (RKA) Ex-126.475	Sector 24/Delancey Hi
127.650/257.925	Woodstock, Connecticut (BDL)	Sector 7/Chester Lo
128.050/319.100	Houlton, Maine (HUL) Simulkey MLT/BGR	Sector 1/Millnocket Hi
	Millinocket, Maine (MLT) Simulkey HUL/BGR	Sector 1/Millnocket Hi
	St. Albans, Maine (BGR) Simulkey HUL/MLT	Sector 1/Millnocket Hi
128.100/351.700	Shelton, Connecticut (BDR) Change to 353.675	Sector 6/Pawling Lo
128.200/263.050	Waterboro, Maine (QEL) Ex-South Acton ME/322.400	Sector 16/Parso Lo
128.325/348.700	Concord, New Hampshire (CON) Simulkey GFL	Sector 39/Cambridge Hi
	Lake George, New York (GFL) Simulkey CON	Sector 39/Cambridge Hi
128.750/290.300	Barnstable, Massachusetts (EWBB)	Sector 18/Cape Lo
132.300/346.300	Calverton, New York (CCC)	Sector 33/Erick Lo
132.650/379.100	Cummington, Massachusetts (QHA)	Sector 21/Canan Lo
132.900/307.300	Barnstable, Massachusetts (EWBB) Alternate Workload	Sector 18/Cape Lo
133.250/279.500	Rockdale, New York (RKA) Simulkey RME	Sector 23/Hancock Lo
	Turin, New York (RME) RKA	Sector 23/Hancock Lo Simulkey
133.325/353.700	Melrose, Massachusetts (MEL) Alternate Workload	Sector 36/Gardner Lo
133.425/307.900	Woodstock, Connecticut (BDL)	Sector 47/Bosox Hi/Lo
133.450/269.300	Hyannis, Massachusetts (HYA) Simulkey QYA	Sector 17/Nantucket Hi/Lo
	Bucks Harbor, Maine (QYA) Simulkey HYA	Sector 17/Nantucket Hi/Lo
133.625/354.100	Lake George, New York (GFL) Control	Sector 52/Special Use AWACS

Also the following sites associated with this frequency pair: Turin, New York (RME), Watertown/Rome, New York (ART), Gardner, Massachusetts (GDM),Montpelier, Vermont (MPV), and Burlington, Vermont

134.000/317.700	Shelton, Connecticut (BDR) Ex-288.250 (Change to 322.325)	Sector 19/Danbury Lo
134.300/256.900	Kingston, New York (IGN)	Sector 05/Stewart Lo
134.625/291.750	Bucks Harbor, Maine (QYA)	Sector 17/Nantucket Hi/Lo
134.700/269.475	Gardner, Massachusetts (GDM) Simulkey LEB (ex-381.400)	Sector 37/Concord Lo
	Lebanon, New Hampshire (LEB) Simulkey GDM (ex-381.400)	Sector 37/Concord Lo
134.950/307.000	Augusta, Maine (AUG)	Sector 2/Augusta Hi
135.075/306.300	Shelton, Connecticut (BDR) Alternate Workload	Sector 6/Pawling Lo
135.250/377.100	Turin, New York (RME)	Sector 8/Watertown Lo
135.325/360.600	Woodstock, Connecticut (BDL) Simulkey GFL	Sector 38/Athens Hi
	Lake George, New York (GFL) Simulkey BDL	Sector 38/Athens Hi
135.550/341.700	Melrose, Massachusetts (MEL) Alternate Workload	Sector 47/Bosox Hi/Lo
135.700/282.200	Berlin, New Hampshire (BML) Simulkey MPV	Sector 52/Montpelier Hi/Lo
	Montpelier, Vermont (MPV) Simulkey BML	Sector 52/Montpelier Hi/Lo
135.800/292.150	Calverton, New York (CCC)	Sector 32/Sardi Lo
---------/321.300	Rome, New York (RME)	Sector 8/TSU AWACS
---------/377.150	Augusta, Maine (AUG)	Sector 2/TSU AWACS
---------/380.150	Nantucket, Massachusetts	Sector 17/TSU AWACS

Chris Parris
chrisparris@monitoringtimes.com
www.mt-fedfiles.blogspot.com

Monitoring at a Presidential Library Dedication

In the May edition of the Fed Files, I covered several public events that featured plenty of federal radio communications activity. This time around, we have a couple more big events to talk about, one planned and one very much unplanned.

❖ Bush Presidential Library Dedication

Photo of the George W. Bush Presidential Library, Courtesy bushcenter.org

On April 24th, 2013, the George W. Bush Presidential Library was dedicated in Dallas, Texas, on the campus of Southern Methodist University. The $250 million facility includes the library and museum, which will be administered by the National Archives and Records Administration. You can see more about the Bush Presidential Library at their web site: **www.bushcenter.org,**

The National Archives and Records Administration operates the Presidential Library System that preserves and catalogues documents and other historical material associated with past presidents, beginning with Herbert Hoover. Other libraries for presidents prior to Hoover exist, but are not officially part of the NARA system. You can find out more about specifics of the NARA by checking out these web links: **www.archives.gov en.wikipedia.org/wiki/National_Archives_and_Records_Administration**

While the NARA is an independent federal agency, most Presidential Libraries appear to utilize commercial or business type radio systems for their day-to-day operations. I have no recent records of federal frequency assignments for the National Archives and Records Administration, outside of Washington, D.C. In the D.C. area, the National Archives is a user of a federal UHF trunked system, the details of which you can see here:

www.radioreference.com/apps/db/?sid=3152

As has been tradition in other Presidential Library dedications, all living U.S. presidents were on hand for the dedication. Also, this was the first time in American history that a former president could attend the dedication of his son's presidential library. In addition to the former presidents, many foreign leaders and international dignitaries were on hand as well, thus adding to the intensity of the protective details. This presented a tremendous opportunity to keep an ear on local law enforcement as well as Department of State and Secret Service radio traffic. In addition to all the public safety and federal protective activity surrounding the dedication, there was a combat air patrol (CAP), apparently provided by the Texas Air National Guard.

All Five Living U.S. Presidents, Photo courtesy of whitehouse.gov

Local listeners in the Dallas area eagerly searched the bands for interesting activity for days prior to the scheduled dedication. Here is a listing of what was reported as being active at the Bush Presidential Library dedication. Just a reminder about all of the frequency lists featured in this column: All frequencies listed are in Megahertz (MHz), **PL** indicates a CTCSS squelch tone, **D** is a digital coded squelch (DCS) and **N** indicates an APCO P-25 digital network access code (NAC).

140.2000	AM	Combat Air Patrol
163.6500		Unknown
164.4000	N001	Secret Service PAPA
164.6500	N001	Secret Service TANGO
164.8875	N001	Secret Service OSCAR
165.2125	N001	Secret Service MIKE – Bush (43) Detail
165.3750	N001	Secret Service CHARLIE
165.7875	N001	Secret Service BAKER
166.4000	N001	Secret Service GOLF
166.5125	N001	White House Communications Agency ALPHA
167.0125	N001	Secret Service Executive Protection Details
167.0375	N001	Secret Service Executive Protection Details
167.9000	N001	Secret Service Dallas Field Office
170.6625	N167	FBI – Possible E.O.D. team at SMU
271.0000	AM	Combat Air Patrol
282.6000	AM	Combat Air Patrol
352.6000	AM	Combat Air Patrol
409.5250	N293	Department of State Diplomatic Security Service

I often see reports from listeners complaining about not hearing anything on their scanners during a visit to their area by the President or Vice President and there is often speculation that the Secret Service has moved to some super-secret radio system. But this event shows that they are still utilizing the same VHF channels that they have for many years.

❖ Boston Terror Bombing

The attacks on the 117th running of the Boston Marathon signaled the start of a strange and terrifying episode in the Boston area that lingers to this day. On April 15th, 2013 at approximately 2:50 PM, two improvised explosive devices went off at the finish line of the Boston Marathon. Boston public safety agencies instantly responded to the explosions with police, fire and medical assistance. Shortly after, various federal agencies responded along side local and state police agencies to investigate who was involved and what had happened. Within hours of the explosions, they determined these explosions were the result of home made devices and not accidental. The search was on for those involved.

Local listeners were glued to their scanners, and people from all over the country were listening in via Internet-based live audio feeds of Boston police and fire channels. Needless to say, the quest for information on what was happening drove some scanner audio feeds to crash with overloaded traffic requests. And, as quickly as one shut down, another would spring up to replace it. Some of the computers providing the audio feeds were overwhelmed and shut down, while others shut down voluntarily after being asked to stop feeding the police communications while they were still searching for the bombing suspects.

While the search by police went on for the suspects in the Watertown area, communications were being supervised through the Unified Command Center (UCC) in Boston. Listeners report that things seemed to be coordinated well and dispatchers were well trained and cool under pressure. There were initially many false reports of additional bombs, unconfirmed suspects, and suspicious objects that all had to be checked out, so things were very busy.

In previous columns I have covered the topic of federal interoperability with local and state first responders and law enforcement. In this case,

there seemed to be very little direct patching or interconnection between local and federal radio communications systems. It appears that the federal law enforcement agencies had personnel present in the Unified Command Center, and relayed important information from this command post to their various federal agencies.

Also, there appeared to be very little intercommunications between federal agencies on the federal interoperability frequencies set side for just this occasion. Some testing was heard on at least one of the nationwide federal interoperability channels, but not much else was heard on that. Most federal agencies simply stuck to their normal operating channels.

FBI Mobile Command Post, Photo courtesy of fbi.gov

As expected in terror-related incidents, the lead federal agency is the Federal Bureau of Investigation (FBI). Local listeners noted that known, local radio channels came alive, but a slew of new channels appeared while other agency frequencies became active as well. as well. Several sources sent along what they had heard during the week after April 15. Some of these frequencies may not have been directly related to the bombing response and investigation, but they were active around that time:

136.2750	AM	Federal air operations
162.1250	N293	Coast Guard NET 109
162.3250	N293	Coast Guard NET 111
163.1500		
163.6750	N295	Immigration & Customs Enforcement (ICE)
163.7000	N289	ICE
163.7500	N289	ICE, Boston 1
164.4000	N001	Secret Service PAPA
164.6500	N001	Secret Service TANGO
164.7875	N169	ICE Nationwide TAC 4
164.9000	N293	Coast Guard NET 118
164.9125	N293	Coast Guard NET 119
165.2375	N301	Customs & Border Protection (CBP), DNET 1
165.2875	N650	Bureau of Alcohol, Tobacco, Firearms & Explosives (BATFE), NET 1
165.3750	N001	Secret Service CHARLIE
165.7375	N291	ICE, Boston 2
165.7875	N001	Secret Service BAKER
166.4625		Federal Common
167.1625	N650	BATFE TAC 1
167.4375	N167	Federal Interoperability, link to BAPERN, 470.4875 MHz
167.4625	N070	
167.4875	N167	FBI
167.5625	N167	FBI Bureau Common
167.7625		
167.7875	N167	FBI
168.1125	$68F	Federal Interoperability LE-4
168.8500	N070	FBI and US Marshals
168.8500	N167	FBI
169.4500	N301	Customs & Border Protection (CBP), DNET 2
169.5750	N070	
169.6250	N167	FBI
169.6625		
170.4250	N167	FBI
170.8375	N167	FBI
170.8875	N167	FBI
170.9250	N167	FBI
170.9625	N167	
171.2375	N293	Coast Guard NET 127
171.3500	N293	
171.4375	N167	FBI
171.5000	N293	Coast Guard
171.5500	N167	FBI
172.0750	N167	FBI
172.1875	N167	FBI
172.2875	N167	FBI
172.7750	N294	ICE
173.9625	N167	FBI
408.2000	N201	Federal Protective Service
409.5250	N293	Department of State
409.9375	N482	Postal Inspection Service

Even as I am writing this column, investigative work by the FBI and other agencies continues in Boston and other areas of the world. They do tend to keep their communications secure, so actually hearing what is going on will probably not be an option. And, as the investigation continues, the news media has started reporting on some aspects of the investigation that remain a mystery to local residents:
http://theaviationist.com/2013/05/12/fbi-planes-boston/

As I mentioned earlier, listeners reported little usage of the federal interoperability resources in the Boston area during the days after the bomb blasts. Boston originally had several "Federal I/O" channels available, but things have changed over the years. When the Justice Department started their project to promote federal interoperability resources, they assigned three different frequencies for interagency communications:

"BOS FIO"	165.3250 MHz
"BAPERN FIO"	167.4375 MHz, 167.9 PL – patch to BAPERN 470.7875 MHz
"BPD FIO"	158.9100 MHz (154.8600 input)

The "BOS FIO" frequency of 165.3250 MHz was a former Coast Guard channel associated with operations at a liquid natural gas terminal. However, they appeared to have abandoned that frequency with the increased usage of the standard Coast Guard P-25 land mobile radio channels. Current Department of Justice documentation shows only 158.9100 MHz as "BOS FIO", but the patch between the Boston Area Police Emergency Network (BAPERN) and 167.4375 MHz still exists and is active.

FBI Evidence Response Van, Photo courtesy of fbi.gov

❖ FBI and the "D" Zone

In a major event like the one in Boston, the Federal Bureau of Investigation will send in agents from all over the country to assist. When that happens, the agents coming in to an unfamiliar area will still need to be able to communicate amongst themselves and other FBI agents. But re-programming the visiting agents radios or handing out local radios and training visiting agents as to what channels are used to what would be too time consuming. This is why the FBI has a common, nationwide zone of channels in all of their radios that can be utilized anywhere they go. This zone is referred to as the "D" Zone. If you look over the federal frequencies logged in Boston after the bombing, you will note some of the frequencies are part of this D zone.

As the FBI started to move from DES encrypted, analog radios to P-25 digital radios, they have provided these common channels in both analog (wideband) and digital (narrowband). These digital channels in the D zone of the radio are often referred to as "NB" or narrow-band channels. It appears that they have both analog and digital D zones available, as some users occasionally still show up in analog. Also, with the new digital radios, the number of channels in the D zone has expanded, so some frequencies in this zone remain a mystery. Here is the best guess at the current frequencies in the D zone of the FBI radios, however it is far from complete:

164.5500	N167	D01 OCDETF, repeater (168.8625 in)
164.5500	N167	D02 OCDETF, simplex
166.4625		D03 Federal Common
167.5625	N167	D04 FBI Bureau Common
167.5375	N167	D05 FBI Special Operations, repeater (163.8635 in)
167.5375	N167	D06 FBI Special Operations, simplex
163.1000	N167	D07 Federal Common
170.9250	N167	D08
Unknown		D09
Unknown		D10
Unknown		D11
Unknown		D12
Unknown		D13
Unknown		D14
170.8875	N167	D15
155.4750		D16 National Law Enforcement

The frequencies of 165.9500, 169.9750, 170.2750, 170.8250, 170.9000 and 171.6250 have all been nominated by federal listeners as possibilities for inclusion in the list of D zone FBI channels. It is also possible that the new channels include some other agency common channels, but so far this is mostly speculation. If you have any information or even a good guess at what might be in the narrowband D zone of the FBI radios, please send them along to me at the Fed Files and *Monitoring Times*. You can always send questions, comments or frequencies to me via email, **chrisparris@monitoringtimes.com**.

Ron Walsh VE3GO
ronwalsh@monitoringtimes.com

Your Maritime Monitoring Questions Answered, and More!

(All photos courtesy of the author)

I always ask for mail from readers of the column and the April column led to many replies. The fact that people read and enjoy my column makes my efforts to find useful material worthwhile. Hopefully, I may cross paths with these readers and meet some of them in person. The information provided by readers is substantial and I always learn something myself. I encourage all readers to keep the replies coming. I particularly want to know the frequencies, times and stations you listen to.

Jim Falls K6FWT sent me a note about his monitoring. He particularly mentioned station HWL2 on 12.930 MHz. I have done some research but cannot find this station. The frequency is used by the Spanish navy. He also mentioned a station on 12.590 MHz. There is a listing for the Russian navy using CW here. At 12.595, KLB, near Seattle, has a listing for CW/ARQ. They do some Morse idling on this frequency. Jim collects old radios and has a great page on QRZ.com. I hope to hear more from him in the future.

Jim's request led me to research these stations and I ran into the Utility Dxers Forum web site, **http://udxf.nl**. They have quite the list of useful tools and information. You can also join the Utility DX forum group. I also found a great frequency site called Shortwave Watch. You can access this site at **www.shortwavewatch.com**. They have columns for 5-10, 10-15 and 15-30 MHz. Their home column lists stations from 18 kHz to 5 MHz. I found this to be an interesting site and have begun to check out some of their listings. They do seem to be up to date.

My April listings did have some errors and I received several replies about them. Although the web site said it had been corrected to December 2012, some of the listings for the U.S. were quite out of date. I suspected this as I had heard nothing from the stations, but the only way to check these is with reader support. Dick Holbert K2HZ from Rochester, New York, brought me up to date on the U.S. listings as I asked. All HF except for WOO, WOM, and KMI were gone by the early 80s. He sent a map of the old stations and it brought back memories. Oh, how I remember listening to WLC Rogers City, WMI Lorraine and WBL Buffalo on the lakes. WCM Pittsburgh also came in well here. The private Canadian stations for Upper Lakes Shipping, Hall Corporation, etc., are also all gone.

Ray Throop, Commanding Officer CCGC Cape Hearne, doing a radio check with VBR Prescott Radio.

There is still HF in Alaska and the U.S. Territories along with some Coastal Limited stations like Crawley Marine. You can get U.S. HF information at **www.navcen.uscg.gov/?pageName=cgcommsCall**. The HF in Canada, Bermuda and the U.S. Coast Guard is still there but more for safety and weather broadcasts as I have listed in other columns.

Canada uses 2598 and 2749 kHz on the East Coast while 2054 is used on the West Coast. 2670 is used by the USCG and 2582 is used by ZBR Bermuda. Also, watch 4125 kHz for information. He doubted there was much 500 kHz CW except the historical station such as those run by the Marine Radio Historical Society. However, I still see many listings for low frequency CW in Asia on various sites. I would appreciate someone updating me on this.

Dick also said he knew the Seaway was open when he heard the *Birchglen and Algoeast* report to Seaway Sodus and Seaway Newcastle on VHF. Like all areas with VHF marine coverage, channels 11, 12 13 and 14 are used for traffic control. The AIS frequencies are alive again with many ships showing. With the summer recreational boating and increased commercial traffic the VHF bands will be active here. The DSC channel 70 has had some traffic as well. I know spring has arrived when I hear the SAR cutter CCGC *Cape Hearne* arriving in Kingston for the season.

Bob Fraser of Belfast Maine wrote to me via the editor. He listened to WOU until the early 80s VAR St. John on 2598. VAR is now using 2749 kHz. Your letter was answered in the June letters column, Bob, but I hope you continue to send me any information on what you listen to.

Another regular correspondent is Jim Hastings W2RFM. Jim also has a Marconi marine radio similar to mine and he wants a manual as well. A friend of his found a listing for a similar radio in the UK and sent him the address. Jim kindly sent me the link and a copy of the manual. I can now tune this old crystal rig for the best reception. The IF frequency is 455 kHz and thus the receive crystal must be 455 kHz above the frequency you wish to listen to. I want to get CHU on 3330 kHz for this set. It was the first commercial radio I ever used, back in 1968. He also asked for the Myrtle Beach frequencies for a friend K2SA, Steve, who also spends time there during the winter. I have sent what I have by email.

Self-unloading bulk carrier Algoma Transport downbound for Quebec City.

John Schmeizer from St. Louis sent me a copy of an ODXA article about the MFJ Noise canceller. I appreciate the article and I am going to try and use the one I bought again. Unfortunately, I feel the noise just overloads the capability of the unit. However, I may be the problem so, I will try again. He also mentioned some one meter-wide shielded loops for low frequency reception. I feel this might also be something to try. I have some antenna work to do including a new matchbox on my R-8 vertical. All this should be done when this column is read and I hope to try a loop along with a friend who is also a long time SWL. He said he hopes my neighbour gets a different television. I would have even replaced it myself but it is so large that is too expensive. Thanks, John, for your letter and the attached articles. If I get results I will be sure to mention them in further columns.

I received the usual interesting letter from John Musgrave from Oona River, British Columbia. John travels to the West Coast and has been a radio enthusiast for many years. He said he enjoyed the quality of my photographs. He has forwarded some to an ill friend who likes ship photos. I asked him for the address so I can do the same. I use a Pentax K10 D SLR camera and have been very happy with it. I actually use the telephoto lens from my old Pentax film camera. He is building a bigger radio shack and has to build this on a float of large logs. He said he has corralled enough of these for the project. He said he monitors the radio to hear about the junk from the Japanese tsunami which is now washing up all along the

Ocean vessel Federal Maas up-bound at Iroquois with steel for Hamilton, Ontario.

coast. John said he found a 500 watt, 110 volt red light bulb used on fishing boats and surprisingly it still works. He also said he is getting older and it is not as easy to climb trees to put up antennas. His radio monitoring allowed him to avoid the humpback whales with his sailing boat and hear the usual Gale Warnings. I can't wait to hear about John's radio monitoring and travels after this summer.

❖ Waterway Net

I met KI4JDE Jeff Wingfield, Rear Commodore of the Waterway Radio and Cruising Club, while working the radio station NI4BK aboard the Battleship USS *North Carolina*. He told me that this year is the 50th anniversary of the radio net. Congratulations are certainly in order for an organization to keep things going that long. The WRCC has approximately 800 dues paying members. However, membership is not required to join the net.

The net meets daily at 0745 Eastern Time on 7.268 MHz LSB. The purpose is to encourage amateur radio communications to and from boats. There is an emphasis on safety and weather information. Position reports and float plans are regularly exchanged. The net is a controlled net and is run in a very efficient manner. There is also a CW net at 0700 eastern on 7.047 MHz.

The RWCC will hold their annual picnic on Sunday December 9, at Wickham Park in Melbourne, Florida. They also hold an Amateur Radio Flea Market. This event is held in conjunction with the seven Seas Cruising Association and this year will be used to celebrate the WRCC's 50th anniversary. I am sure Ned W4KS will do a great job managing the picnic. Check the WRCC website at **www.waterwayradio.net** for details and a great deal of information relating to marine radio items. I have joined the net on several occasions and met many interesting people.

❖ NI4BK

While aboard the USS *North Carolina* I had the chance to listen on a 1941 model RCA CRV46148 receiver. This was connected to a vertical antenna near the smoke stack of the USS *North Carolina*. The 22 tube receiver works very well and the analog dials are very accurate. I explored several frequencies and heard CHU Ottawa on 3.330, 7.850 and 14.670 MHZ while there. I did listen to the Maritime Mobile net on 14.300 MHz and heard VE1YL on 7.055 MHz. I want to go back next year and try some marine frequencies while there. I have been invited back to work the North Carolina QSO party next year. I hope to contact many readers while aboard. I also want to work the station on the aircraft carrier, Yorktown at Patriots Point near Charleston, South Carolina. They also have a destroyer and a submarine which I believe they activate as well. I have contacted the Charleston Club and hope to set up a date for next year.

❖ Suggested Frequencies

I looked at the UDXF Marine Safety File and found some frequencies that might be on interest. (Times are UTC, Frequency in kHz)

0003 Punta Carretas, Uruguay 2768.5, 4357.4, 6518.8, 8291.2, 13128.7, 17620.8, 22636.3 Weather in English/Spanish
0003 Port Moresby, Papua New Guinea 4405, 6510 weather
0120 Ammassilik, Denmark 2250, 3250, 4381 navigation info in English/Danish
0157 Darwin, Australia 8175 navigation info.
0335 Mexican Stations 8514 navigation info and weather
0400 Barrow, Alaska (KCB53) 4125 Weather (APR. 1 to Sept. 15)
0430 Yakutat, Alaska 4125 Weather
0445 Mahina, Tahiti 8803 Weather in French
0530 Cold Bay, Alaska 4125 Weather

These are just examples of the information available on the UDXF site. The stations broadcast several times a day. I am sure you will find several that might be of interest to you and provide informative listening. I plan to try to log some of them.

When this column is out, I will have worked Field Day here with the Frontenac County Emergency Communications Group and have activated several islands/ lighthouses in this area. We were asked to stand by when we had flood emergencies in neighboring counties this spring. I also acted as net control during several possible severe storms this spring. We did not get the worst of them but Gale Warnings and even Storm Warnings were issued for Lake Ontario. Many ships on the lakes went to a lee to avoid the weather. There was a lot of damage near here due to falling trees and downed power lines. We did have a confirmed F1 tornado to the Northeast.

The VHF marine bands have been busy and I have already monitored them to take advantage of photographic opportunities. We have had several notices about shoals and low water levels in the system.

All the photos with this column were taken at the Seaway lock near Iroquois, Ontario. I use the Seaway traffic website to get a good day and the VHF traffic control stations to get ETA for the vessels. I will probably make a trip to the Welland Canal for the same reason.

Again, let me know what you listen to, what frequencies you monitor and at what times of the day. I am sure many readers will want to know and perhaps join in listening. And, If you have photos you have taken, relating to marine radio sites, send them along. If possible, we can use them in the column.

Kevin O'Hern Carey, WB2QMY
kevincarey@monitoringtimes.com

Mailbag Catch-Up

Longtime reader and contributor Perry Crabil W3HQX (VA) wrote with an explanation of the old Radio Compass Stations that used to be heard frequently on longwave:

"At one time the U.S. Navy operated a series of radio compass stations along the Atlantic, Gulf, and Pacific coasts of the U.S. These stations provided bearing and position information to ships at sea on request to call-ups on the watch wavelength of 800 meters (375 kilocycles), using precision loop antennas.

"There were two types of compass stations. Independent stations supplied bearing information only. Harbor entrance stations were a group of three stations around a harbor. One of the three was the control station for the group and received the bearings from the other two via landline. By plotting all three bearings on a nautical chart, the control station determined the latitude and longitude of the ship and transmitted it on 800 meters. The ship station used Morse code and the Q signal QTE? (What is my bearing?) or QTF? (What is my position?) on 800 meters to initiate its request. When given the signal K (invitation to transmit), the ship station sent the Morse letters MO repeatedly for 60 seconds, then stood by for receiving the position report on 800 meters.

"While monitoring longwave marine frequencies from my QTH in Washington, D.C., prior to WWII, I occasionally heard such exchanges. Although I have no logs from that period, these stations were part of groups situated along the East Coast. A Google search for Radio Compass Stations will turn up several sites with information about them as far back as 1922. I thought *MT* readers might find this bit of history interesting."

New Catches from NJ

Mario Filippi N2HUN (NJ) continues to have good results with his Ten Tec RX-320D receiver and 43-foot vertical antenna. He writes:

"This time there are some repeats, but also many new ones in the mix. New catches include ZMR, R1, YEL, ADG, PT, YQA, LE, DF, YXL, SYW, CKI, AVN, BV, YSH. SYW in Texas is my best U.S. DX so far. I cannot find a listing for CXM, I might have miscopied the ID, I'm not sure. Note that ZV on 273 kHz was randomly mis-keying, and sometimes sounded like 'ZIT' or 'ZU.' Mis-keying does not happen often, but it is exciting when it occurs."

Thanks for writing Mario, and for another excellent list of loggings (see table). I was unable to find a listing for CXM on or near 386 kHz, although there is one listed at 205 kHz in Brazil. At first, I wondered if this station had changed frequency, but such a wide move is unusual, and hearing a beacon from Brazil in the Northeast U.S. would be rare (but not impossible). It seems more likely that it is a miscopy, a keying error, or a new station that has sprung up (also quite rare these days). At any rate, keep listening for this station and feel free to send along any updates.

Selected logs from NJ

kHz	ID	ST/PR/ITU*	CITY
272	YQA	ON	Montreal
272	ZMR	QC	Montreal
273	ZV	QC	Sept Isles
275	R1	QC	Thetford Mine
276	YEL	ON	Yellow Lake
278	ADG	MI	Adrian
278	NM	QC	Natagami
283	PT	ON	Pelee Island
326	FC	NB	Fredericton
329	CH	SC	Charleston
332	YFM	QC	LaGrande-4
334	YSH	ON	Smith Falls
335	YLD	ON	Chapleau
336	BV	QC	Quebec
344	AVN	NY	Rochester
346	YXL	ON	Sioux Lookout
350	DF	NL	Deer Lake
350	LE	NC	Raleigh
353	CGE	MD	Cambridge
353	QG	ON	Windsor
368	ZYZ	ON	Toronto
373	2Q	QC	Mont-Laurier
375	7B	ON	St. Thomas
378	RJ	QC	Roberval
378	YRR	ON	Ottawa
385	EMR	GA	Augusta
386	CXM	??	UNID
398	HFY	IN	Indianapolis
404	CKI	SC	Kingstree
407	ZHU	QC	Montreal
408	SN	ON	St. Catharines
409	YTA	ON	Pembroke
410	JU	NC	Jefferson
414	3U	QC	Ottawa
414	OGY	NY	New York
415	CBC	CYM	Cayman Brac
417	HHG	IN	Huntington
420	CFY	SC	Lake City
423	SIF	NC	Reidsville
426	IZS	GA	Montezuma
428	SYW	TX	Greenville
429	RYS	MI	Detroit
432	IZN	NC	Lincolnton

Finding Ferrite Loops

Joe Majewski WA1WRH (NH) has been looking for an air-coupled ferrite antenna to improve reception with his portable sets, including a Tecsun PL-660, but not having much luck finding one that works on LW. He asks:

"I wonder if you can guide me in the right direction. I'd like to narrow my search for a simple inductively coupled LW antenna for my portable radios. I have an AM band loop that I purchased, but naturally it doesn't do anything for LW reception. C.Crane Co. has a ferrite stick antenna, but again it is for the AM band, not LW reception.

"I find many designs and components, and one company has a large selection of ferrite rods, and variable capacitors, but all I seem to find in various articles are comments on how to wind coils, add capacitors, and 'experiment' for best performance. Is there a source that might be more specific? I can use a soldering iron without difficulty, and can build circuits, but I'm trying to find a simple, passive, portable antenna. Any assistance will be appreciated. If I am overlooking something right under my nose, don't hesitate to tell me!"

Hi Joe, you are not alone in your search for an inductively-coupled loop for LW. Because LW is not used for broadcast here in the U.S., such antennas can be rather difficult to come by. One commercial unit that comes to mind is the Q-Stick by Radio Plus+, which you can read about online at **www.dxtools.com/QStick.htm**. I use one of these with my Sony 2010, as well as other portables, and have had good results. It even allows air coupling of other antenna types to your receiver, such as random wires. Whether you build or buy, good luck in your search, and keep us posted on your progress!

LORAC (and that's not a typo!)

Dick Dillman, Chief Operator at coastal marine station KSM (see **www.radiomarine.org**) in CA, wrote with an update to our coverage a few issues back on "extinct" navigation systems, plus yet another Navaid system that has been long forgotten. He reports:

"Regarding the *Gone But Not Forgotten* coverage of navigation systems, I think the San Francisco CONSOLAN station was located not at Point Reyes but instead near the KCBS-AM transmitter in Novato, CA. I remember seeing it listed on aviation sectional charts.

"Another navigation system that's often forgotten is LORAC (not LORAN) for LOng Range Accuracy. These were typically deployed around harbor entrances. I stumbled on the one at the Golden Gate when I saw signals I did not recognize in the 2 MC marine range on a

spectrum analyzer. I traced them down to two towers, one on the south side of the gate at The Presidio and the other on the headlands north of the Golden Gate. I was able to confirm that I had the right towers by listening to the signals on a portable set while monitoring the signal in the tower radials with a vintage General Radio Corp. Wavemeter. There is some scant information about the system online at **http://archive.org/details/evaluationupdati00durk**."

Many thanks for this update, Dick. The *Gone but not Forgotten* column generated far more interest than I ever expected, and also prompted many folks to send in further information. Some of these systems have been off-air for decades, so it is always surprising to see how much historical information is out there for them. Today, we pretty much take GPS for granted, but in earlier times these ground-based systems were key to safe and accurate navigation.

❖ New to Longwave

Carl Schmidt WA8ZTZ (MI) writes:

"Hi Kevin, Your monthly *MT* article inspired me to give longwave a try. This finally became possible upon my obtaining an old aircraft ADF which had been removed from service long ago. It is a King Radio KR-80, a mid-to-late 1960s vintage receiver that is designed to mount in a standard 3-1/8 inch aircraft panel instrument hole. It covers the low band from 190 to 560 kHz and also the AM broadcast band. Inside, it is an electro-mechanical work of art, permeability tuned with transistors installed by point-to-point wiring. I have heard many beacons from my Michigan location, mostly Canadian (Ontario, Quebec, Newfoundland, PEI). My best DX so far has been Greenland. My antenna is just a 50 foot sloper up 10-25 feet. Thanks for motivating me to try something new."

Great to hear from you Carl, and welcome to radio's basement band! Your King Radio KR-80 sounds very interesting. I have seen older tube-type receivers of this type made by Bendix and Carlson. Yours sounds a bit newer than those models. I'm glad to hear the 50 foot sloper is working out for you. In time, you may wish to try an LF active antenna or a loop, but it's hard to argue with the success of hearing Greenland! Keep up the great work, and feel free to send loggings into Below 500 kHz anytime.

❖ LF Converter: Field Report

Jim Pederson (CA) writes:

"A while back you asked for feedback on the Jackson Harbor Press LF Converter (**http://wb9kzy.com/lfconv.htm**). I built this kit several months ago. My only disappointment is that the support documentation needs to be simplified. The up-converter works very well, but with a few birdies (internally generated signals). I have an IC-735 receiver. This receiver does not have a pre-amp that works below 500 kHz, so up-converting to 4 MHz or 10 MHz sounded like a way to put the receive signal at a frequency that did use the built-in pre-amp. I was pleased to discover that the Jackson Harbor Press LF Up-converter has enough output drive that in many cases I didn't need to use the pre-amp anyway. Overall the converter has my vote; Just keep track of your birdies and enjoy."

❖ We Have a Winner!

The winner of the essay contest and recipient of *The Low and Medium Frequency Radio Scrapbook* is James Hagan (FL). He wrote with an interesting story on how he got started in the longwave hobby many years ago. Congratulations on your book, Jim, and thanks for sharing your story…

Jim Hagan (FL) won this out-of-print LF Scrapbook for his essay on getting started in longwave.

"I had wanted to build a crystal set for BC reception when I was 9 years old. As I had no mentors, it was two years later before this dream was realized. This got me started on a lifelong interest in radio. By the time I was 14, I was familiar with the extension of the radio spectrum above the high end of the broadcast band, commonly known as shortwave. Later, I began to wonder about that mysterious region below the AM radio dial. At the time (early 1950s), LW receivers were quite rare. I managed to pad my crystal set down into the marine band and heard WSC at about 450 kHz. I wanted more.

"I accidentally discovered that an oscillator tuned above 1600 kHz and antenna, both connected to the antenna terminals on a BC radio tuned just above 1600kHz, allowed me to hear a few of the stronger aero beacons in my area and NSS on 21.4 kHz. I was hooked! Over the next few months I built a tube converter that tuned from 60 kHz up to about the center of the BCB. With that, I copied some of the last transatlantic telephone signals from Rocky Point, Long Island. Transmissions were SSB and difficult to tune in properly with my gear. It was now 1954 and the station was decommissioned never to be heard again.

"LORAN C (100 kHz) started up later in 1954 as I was entering college. Its purpose and source were a mystery to me. At the time I thought it was something connected with the college physics department as I had not yet heard it at home. Many years later in 1967, I was one of the first to operate a beacon transmitter on the 1750 meter band. I have been interested in LW ever since. In the following years I built several very successful LW converters and owned a variety of receivers. My job in satellite communications gave me the opportunity to listen to LW while working in Europe, Africa, Asia, South America and our own West Coast."

Marc Ellis, N9EWJ
marcellis@monitoringtimes.com

The Radiola III Squawks Again!

(All graphics courtesy of the author)

In the last issue we introduced a new project radio, the RCA Radiola III. This is a two-tube battery set of 1924 vintage. Its cost was low as radios of the era went and it used a newly developed tube, the WD-11, whose filaments could be powered from inexpensive disposable dry cells instead of the automotive style lead-acid storage batteries then in general use. This freed up the user from the necessity of regularly manhandling a heavy battery down to the local garage for recharging and dealing with possible damage to household furnishings from the battery's corrosive electrolyte. Over one hundred thousand of these popular little radios were manufactured.

In last month's column, we discussed the Radiola III's two-tube circuit, which included a regenerative detector and one stage of audio amplification. Removing the radio from its cabinet, we looked at the construction, which was somewhat unconventional for a consumer set even by 1924 standards. For one thing, tuning and regeneration were controlled by variometers (variable inductors) instead of the more usual variable capacitors. For another, construction was "battleship" style, with oversized, very well anchored, parts throughout. To me, it looked more like a military set of the era than anything intended for a consumer's living room.

We also reviewed the Radiola III's unusual antenna input circuit, in which both the tuning range and the selectivity of the set depended on which of the four input binding posts were used for the antenna and which (if any) were connected with the shorting bar provided. Finally, we checked the tubes and reviewed the battery needs of the radio.

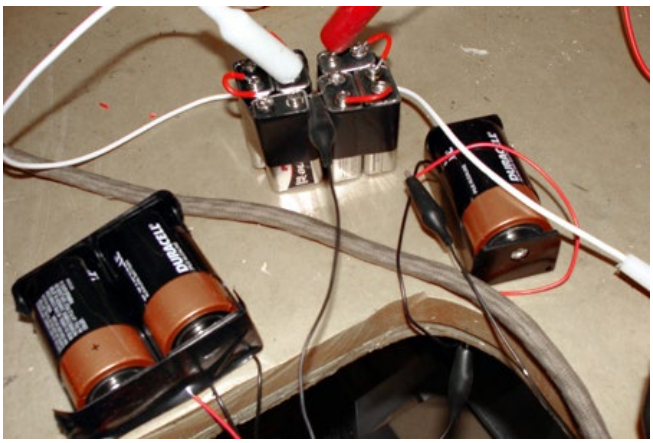
I wasn't able to fully test the tubes because my military TV-7 lacked both the settings and the special sockets that would be required for the rare WD-11s. I had to be satisfied with just a filament continuity test which, luckily, both tubes passed.

When available, used WD-11s sell in the $80.00 range. Type 864 tubes, made for military use, are electrically identical but have the standard 4-pin base rather than the unusual WD-11 style (which has one fat pin and three skinny ones instead of the usual two and two). A recent Google search revealed several suggestions for re-basing the 864 to fit a WD-11 socket. The 864s are also somewhat rare, but are a lot easier to find and afford.

The type 99, a somewhat later dry cell tube developed by General Electric as a more robust successor to the RCA WD-11, is much more common than the WD-11 and can be rebased to substitute for it. However some circuit changes are necessary because the 99 filament requires 3.0 - 3.3 volts at 60 - 63 mA as opposed to the WD-11's 1.1 volts at 250 mA. Certain tubes developed for 1940s battery portables, such as the 1Q5 and the 1A5, can also be adapted to substitute for the WD-11.

❖ Battery Substitutions

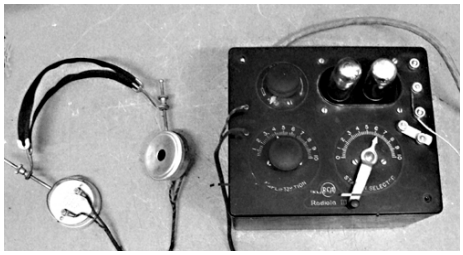
The Radiola III required five batteries: two 1.5-volt dry cells, connected in parallel, served as "A" batteries to light the filaments and two 22 ½-volt "B" batteries supplied plate voltage for the two WD-11s. A third 1.5-volt dry cell served as a "C" battery, providing bias for the audio amplifier stage. Neither the No. 6 dry cells specified for the "A" and "C" batteries nor the 22 ½-volt radio "B" batteries are readily available today, so it was necessary to put together substitutes.



Battery packs replace difficult to obtain original batteries. From left: "A" battery, "B" batteries and "C" battery.

The most obvious choice as a substitute for the No. 6 dry cell is the common alkaline "D" cell. While the energy available from this smaller cell would have to be much more limited in comparison to the hefty No. 6 dry cell, it is inexpensive and readily obtainable. One chart that I've come across says that an alkaline "D" cell can provide an unbelievable 17000 mA hours of energy.

I use two of them in parallel for my "A" battery. They're mounted in two individual single-cell holders from Radio Shack. These are taped together to make a more compact package. Since the two WD-11 tube filaments draw a total of 500 mA, the combined 34,000 mA hours from my dual "D" cell "A" battery should technically operate the set for 68 hours. I'm not sure I believe that, and there are no doubt factors I'm not aware of that would reduce this figure. But it does seem that my improvised "A" battery should operate the radio for a comfortable amount of time.



Radiola III set up on the bench for listening test.

A third "D" cell in an individual holder serves as the "C" battery. The "AA" or even "AAA" size would have been fine for this very low drain application, but my "D" cells came in a package of three and that looked like a good use for the extra one.

The closest readily available substitute for the two 22 ½-volt radio "B" batteries would be two sets of three common 9-volt batteries in series – one set for the detector plate, the other for the amplifier. According to my research, an alkaline 9-volt cell should provide 590 mA-hours of energy—which would be the same rating for three in series. The two tubes don't draw more than a couple of mA each by actual measurement with a signal present and so, technically, these batteries should last for a couple of hundred hours. I do think that the battery life numbers I've come up with are definitely surprising and I invite review by readers who are more knowledgeable in this area.

In putting together the 9-volt battery sets, I did run into a situation that's probably worth mentioning. Since snap-on terminals for 9-volt batteries were priced at more than a couple of dollars each, and since this was going to be just a temporary power supply, I decided to economize and make my connections by soldering directly to the battery terminals. This was no problem with some Walgreen's alkaline energizer batteries that I had on hand. But testing a second set that I put together later with Alkaline Enercells from Radio Shack, I ended up with an output of zero from the group as a whole or from any individual battery.

Testing another Enercell right out of the package, I found that it delivered the full nine volts. . .until a wire was soldered to a terminal, however carefully. . .at which point it became permanently dead.

❖ Lighting the Filaments

With the substitute batteries all put together, it was time to think about powering up the radio. The Radiola III receives its power through a five-conductor battery cable. The leads are

identified both by color codes and small metal tags stamped with the identification shown in the instruction manual. As it happens, the color code on most of the leads had faded beyond definite recognition. The passage of time had also somehow affected the stamped IDs, some of which had faded to the point where they were very difficult to read.

So I began the work by positively identifying each of the leads, using whatever color code and tag identification was legible. "Mystery" leads were traced back into the radio and their attachment points compared with the schematic diagram in the owner's manual. A temporary masking tape tag was then attached to each lead, properly identifying it. The last thing I wanted to do was to misconnect a "B" battery across the filament circuit and blow out two hundred dollars worth of tubes!

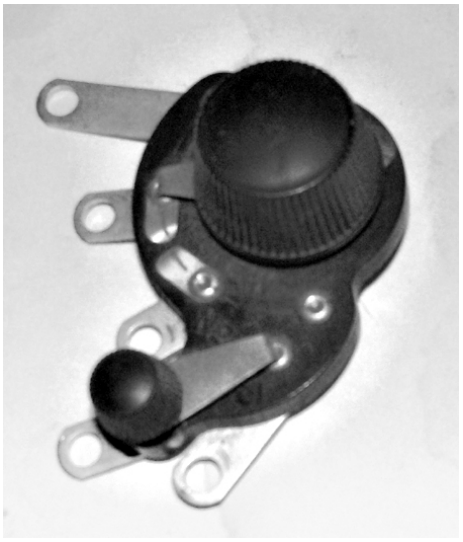
The next item requiring attention was the condition of the bare ends of the cable leads. They were black with the patina of the ages and were tangled and twisted from, one presumes, the many battery changes that had been made during the service life of this radio. These ends were cut off and, getting out my wire stripper, I skinned back about a half inch of insulation from each lead. The exposed metal strands weren't much cleaner than the ends I had cut off. but at least all of the wire strands were parallel to each other, making it easy for me to clean them up with steel wool.

Now I was ready to power the filament circuit. Plugging one of the tubes back into its socket, I connected my "A" battery, through a VOM set for 500 mA, across the filament leads on the battery cable and turned the filament rheostat to the "full on" position. I was expecting to read the tube's full rated current of 250 mA on the meter, but was surprised to see only 30 or 40 mA. Yet removing the tube and checking it with an ohmmeter, I found good continuity across the filament pins.

The second tube also had good continuity and, after spraying the tube pins and the socket contacts with contact cleaner, I plugged it into the socket where the first tube had been. The result was the same: 30 or 40 mA where about 250 mA should have been flowing! Though the interior of the radio was quite clean, I was no beginning to wonder if there was a loose or corroded filament connection inside the box.

But before investigating that, I set the radio aside and clip-leaded the battery and milliammeter directly across the filament pins of the tube that I had unplugged. Again, I was reading 30 or 40 mA where I should be seeing 250! Removing the plugged-in tube, I connected it up and got the same results. Now I couldn't blame connections inside the radio. Instead I began to wonder about the condition of the meter or, perhaps, my sanity.

Then occurred one of those unexplainable happenings that one sometimes runs into in radio repair. Moving the meter and battery hookup to the other tube I tried one more time and read – you guessed it – almost 250 mA. Going back to the first tube I got the same encouraging results. Perhaps I was dealing with a poor connection in one of the clip leads that I was using to make the hookups. At any rate,



Accessory input switcher slips over antenna binding posts, allows rapid switch selection of any of the six possible antenna configurations.

emboldened and encouraged, I plugged both tubes back into the radio and hooked up my battery and milliammeter. Turning the filament rheostat all the way up and checking the meter, I was rewarded with the hoped-for reading of almost 500 mA.

❖ Connecting the "B" and "C" Batteries

Turning the filament rheostat to the "Off" position and grabbing a small handful of clip leads, I now proceeded to make the several connections from the "B" and "C" batteries to the battery cable as shown in the diagram in the owner's manual. To make sure that the cable wouldn't fall over and disturb the clip leads, I supported it in my workbench vise with the connections upright. My short basement antenna was connected to the input binding posts in the configuration specified "For Very Small Antennas." In this configuration, the radio's tuning range is 520-1070 kHz (See last month's column for pictures and descriptions of all six possible configurations).

Now I was almost ready to try the radio except for one thing: I needed a headset with tip jacks and most of the ones in my collection had quarter-inch phone plugs. This resulted in several moments of annoyance and frustration until I remembered a box where I had put away a set of Brandes phones with the required termination. I quickly plugged them in, turned up the filament rheostat and slowly began to advance the "Amplification" control (otherwise known as the regeneration control).

At first I heard nothing and, considering all the trouble I had getting the filaments to light, nothing was what I expected. I hadn't expected this radio to give up without more of a fight. But I was wrong! Suddenly there was a raucous cackle in the phones as the radio broke its silence of probably 75 years. In the background was the voice of a male announcer. Backing off the regeneration control and tweaking the "Station Selector," or tuning dial, a bit I was able to bring in the announcer with decent volume and clarity.

Moving the "Station Selector" through its range, I was able to pick up signals throughout the band. This was quite impressive, considering that I was working with a two tube set on a short basement antenna, even though some of the signals were weak heterodynes that couldn't be resolved as intelligible speech.

This concludes our work with the Radiola III. Watch for a new topic or a new project in next month's column.

Stan Nelson KB5VL
stannelson@monitoringtimes.com

Using the FUNCube Dongle as a Radio Telescope

(All photos by the author except as noted)

In this column, I like to highlight relatively inexpensive projects to encourage you to become exposed to radio astronomy. I once mentioned that it is a unique monitoring hobby in that we mostly listen or record noise generated by various objects such as the Sun, Jupiter, stars, and other galactic sources.

With that in mind, I must admit I never quite got a dish erected. In my December, 2012 column, I mentioned a surplus 5.8 foot (1.5 meter) dish and its mount that I had acquired for the price of removing it from the roof. In November, 2012 I erected the mount and dish in my backyard.

The dish mounting hardware was designed for a fixed elevation and needs modifications. I plan to modify the mount to allow it to move in elevation only. In this mode, the dish will scan the sky with the earth's drift or rotation. I purchased a new cylindrical feed-horn from Radio Astronomy Supplies that is designed to operate on 1420 MHz.

The LNA (Low Noise Amplifier) is attached close to the feed. Its output feeds a low-loss cable into the shack and attaches to a FUNCube SDR (Software Defined Radio) tuned to 1420 MHz. Other plans are to drive an ICOM R-8500 receiver and use the RF-Space SDR-14 receiver tied to the 10.7 MHz I.F. (Intermediate Frequency) output where a larger chunk of bandwidth can be monitored for detecting 1420 MHz noise.

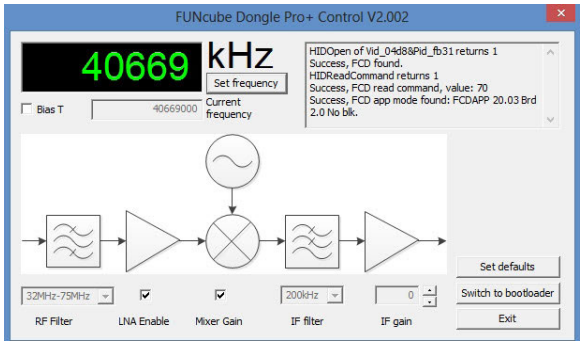
There are a lot of old 10-foot satellite-TV dishes still out there and I would bet the owners would be happy to give the dish to you if you ask.

Meteor Activity

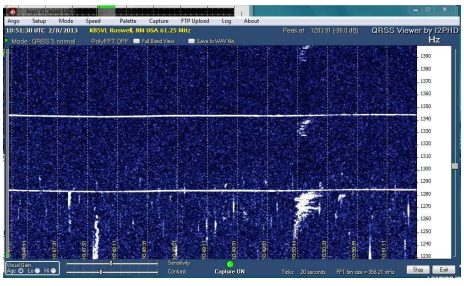
Based on K0LGI's experience with SCAN-SNOTEL, I recently gave meteor scanning a try. During numerous previous attempts I couldn't detect them. Until K0LGI noted they had changed the frequency to 40.67 MHz. The original base station frequencywas 40.53 MHz.

To listen to the SCAN/SNOTEL frequency, I use the FCD (FUNcube Dongle Pro+). This tiny dongle-size SDR has a frequency capability from 155 kHz to 1.8 GHz. The frequency stability is 0.5 ppm (parts/million). The program to set the FCD's frequency of operation is available as a zipped file named FCHid2.002.zip which can be downloaded from **www.funcubedongle.com**.

The program shows the frequency entered in kHz. No decimal points are used. SCAN/SNOTEL's frequency is stated as 40.670 MHz but I used 40.669 MHz when using the USB (Upper Side Band) mode.



I use another FUNcube Pro+ for meteor burst monitoring on the old TV Channel 3 carrier frequency of 61.25 MHz. Presently, I do not know where the signals are from, however, Mexico still uses analog TV and that may be the source. And, there are possibly analog TV translators out there where they are allowed to continue to operate because of the service area. The Argo screen capture, below, shows some recent meteor activity on 61.25 MHz.



If you're new to the FUNcube concept, the receiver provides upto 96 KHz of bandwidth to one of several programs such as SpectraVue. It can demodulate the signals and the audio can then be fed to a variety of programs such as the ARGO chart shown above.

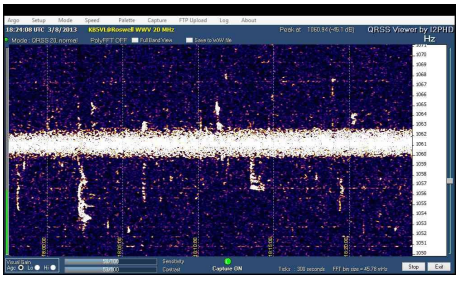
Above is my simple antenna used to detect TV channel 3's video carrier.

The simple two-element beam using PVC pipes points up and is mostly non-directional. The antenna is based on a design shown on a NASA site some years ago which monitored TV Channel 4's video carrier on 62.250 MHz. A discussion of the technique and the antenna details they used can still be found at: **www.nasa.gov/offices/meo/outreach/forward_scatter_detail_prt.htm**

I suspect NASA no longer uses the system since TV went digital. I have since built a similar beam for 40.670 MHz for the SCAN-SNOTEL detection. With it, and the FUNcube Dongle receiver, I catch about 10 to 20 pings an hour. Using Spectrum Lab's software, you record and count the meteor activity. I use a 'conditional actions' file available from: **www.cmhas.wikispaces.com/SLMeteor**. The file will need some modification to suit your setup. Details are provided in the web page.

Another frequency worth checking out is the 20 MHz time signal from WWV in Fort Collins, Colorado. My first attempts to capture meteor activity appeared to be minimal. I finally attempted to zoom in on the carrier using the FUNCube Pro+ tuned to 19999 kHz using SpectraVue software for USB (Upper Side Band) operation. ARGO's software displays the carrier with it zoomed in very close.

The image below shows significant meteor activity. The broad line is the carrier. Note the narrow bandwidth. Using lower frequencies reduces the Doppler shift for a given echo due to its relative motion to your station. One interesting thing I noticed is the carrier more or less



disappears after sun down with the 'pings' still active due to the day/night propagation differences. I live about 600 miles south of Ft. Collins, Colorado.

To see my current ARGO charts and related activity, checkout **www.RoswellMeteor.com**.

❖ SARA Southwest Conference and VLA Tour

I attended my first Society of Amateur Radio Astronomers (SARA) conference in Socorro, New Mexico this past February. It was a great experience and the presentations on the first day were excellent. Two presentations that caught my interest were Whitham Reeve's details on the e-Callisto receiver designed to monitor the sun. Frank Schinzel (University of New Mexico), presented details of the LWA1 (Long Wavelength Array Site 1). This site is on the west side of the present VLA (Very Large Array), located 50 miles west of Socorro, New Mexico. We visited the VLA and LWA arrays later the next day. Below is a picture of the dual-polarization LWA dipoles.

The antennas look like drooping bow-ties. The sloping antenna elements are about 60 inches long. Each pair feeds a pre-amplifier and impedance matching balun which is located in the white box on top of the pole. This particular antenna is numbered one-hundred. The entire array of the antennas consists of 256 individual elements.

Note that the antenna elements are somewhat aligned with an east-west and north-south orientation. The antennas are not in perfect lines due to phasing of the pattern requirements. There is a coax cable run from each antenna into a small building. Each cable is lightning protected.

The most striking fact about this array is that it is designed to cover 10 to 85 MHz with less than 1 mJy (milli-Jansky) sensitivity. The array is also designed to form up to four beams simultaneously. All of this magic is done with digital processing after the signals have been converted with A/D (analog to digital) processors that produces about 512 Mb (MegaBytes) of data per second! It was noted that students carry about 150 Tb (TerraBytes) of data into Albuquerque every 3 days.

The present array has detected 16 known pulsars so far during array testing. The pulsars were in the 38 and 74 MHz range.This is the first of many planned sites. More arrays tied together can produce much higher resolution.

❖ Additional SARA Activities

A couple of programs SARA supports are Space Weather Monitoring and Teacher and Student Grants. Check out **www.radio-astronomy.org** for more details. There is also a SARA Google Group you can check into for current activities at: **www.groups.google.com/forum/?fromgroups#!forum/sara-list**

❖ E-Callisto Solar Monitoring

E-Callisto is an International Network of Solar Spectrometers. Project details were presented at the SARA conference**.** The receiver is designed to step through frequencies from 45 to 870 MHz. The goal of the receiver is to create a FITS (Flexible Image Transport System) file that displays the spectrum of energy from the sun. The FITS files are regularly uploaded to a server in Switzerland. The E-callisto web site is **www.e-callisto.org**.

I decided to order one from Whit Reeves in Alaska at **www.reeve.com**. He sells the Callisto receivers as a kit or pre-built. I chose to order mine pre-built. The unit requires 12 volts at 500 mA. The desired antenna needs to be broadband. Grove sells a Creative Products CLP5130-1 log-periodic which covers 50 to 1300 MHz which I also ordered. It is also recommended that a LNA (Low Noise Amplifier) be mounted close to the antenna to improve the system sensitivity.

If you decide to give it a try, here are a few comments about my experiences with hooking the Callisto receiver up. Once you have the receiver, antenna, LNA (if used) installed, the next step is setting up a PC and a network connection. The software is provided with the receiver. Also included is a 9-pin serial cable that connects the serial port on the receiver and a serial port on the PC. Today, few PCs have them so be prepared to get a USB-to-serial adaptor.

The serial protocol used by the Callisto receiver is 115,200 kb, 8 data bits, 1 start bit, no parity. The serial port is how all of the data is transferred to the PC and the receiver is controlled; and, it works very well. Only 3 wires are need for the serial cable connecting pins 2, 3, and 5. It's nice not having to worry about audio levels. I highlight the serial details since it is slowly becoming a lost art with USB connections replacing the serial ports. You will have to verify the COM port your PC chooses to use. Mine defaulted to COM5. Check the settings in the computer's device manager settings and note the COM port assigned. You will enter that in the callisto.cfg text file.

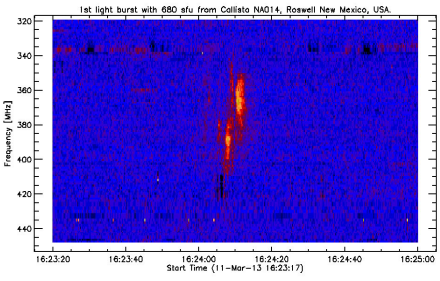
The PC should have good performance and it's highly recommended that it be dedicated to the Callisto program and running at least during sunlit hours. You need the network connection for transferring the FITS files to Switzerland. The software setup manual has a check list of all of the setups and software adjustments to Windows that makes the system work well with the supplied software. I used my daughter's hand-me-down Sony Vaio with a 3 Gigabit processor, Windows XP, and 1.5 Gigabytes of RAM. A Belkin USB to Serial adaptor F5U109 worked fine for the serial port.

The supplied documentation walks you

through the setup of the Callisto software and it's quite detailed. You will spend a few hours getting familiar with each module's part in the system. The software modules generally require you to modify the configuration files using Notepad, etc.

The required changes are explained in the Software Users Guide. Most importantly, be sure the configuration files default paths match how you installed the software. I missed one in the scheduler configuration file and it was being placed where it said. But I needed it in another directory; easy to fix, but necessary if you expect the system to work properly. Below is a picture of my Callisto receiver, serial number NA014.

Below is a picture of my first solar event detected. The chart shows a Type III Solar Burst. Pixcourtesy of Christian Monstein, Switzerland.



❖ Radio Astronomy in the Movies

I found a YouTube movie called "How to Make a Radio Telescope." Three guys dressed in lab coats running around a field erectingwhat appeared to be a 'Radio Jove' project antenna, a two element wire 20.1 MHz beam.The home-made movie shows them having goofy fun. **www.youtube.com/watch?v=nvBWiZi99Dk&feature=related**

Keep listening up!

Brian Wood, W0DZ
www.dzkit.com

Decoding HD-Radio®

There's been software available to decode Digital Radio Mondiale (DRM), used primarily in Europe for some time now, but there hasn't been anything comparable for the U.S. standard, In-Band-On-Channel (IBOC), known by its trademark HD-Radio. This is due to a licensing arrangement with the owner of the IBOC standard, IbiquityDigital Corp., itself a consortium of radio industry companies. Ibiquity does, however, license various manufacturers to make proprietary chips to decode IBOC. Thus, we are forced to buy hardware to listen to HD Radio stations. According to the Ibiquity website (**http://ibiquity.com/hd_radio**):

"Today, there are more than 2,100 stations serving local markets across the country with HD-Radio Broadcast Technology. In addition to the upgrades to the original primary channel – the HD1, HD Radio Technology enables broadcasters to create extra FM channels on the radio dial. We call these HD2/HD3 channels and today more than 1,400 HD2/HD3 channels are available in radio markets across the country, thereby providing consumers more diverse listening options than ever.

"HD2/HD3 channels are found adjacent to a radio station's traditional location on the dial. These channels provide a wide range of new, diverse content and often provide expanded coverage of the content played on the primary HD1 channel. For example, if a consumer traditionally enjoys listening to classic rock on 101.1 FM (the HD1), with HD Radio Technology there can be a second rock channel – perhaps deep cuts from a great album – on the HD2 channel and additional creative programming on the HD3."

❖ IBOC

From Wikipedia:"The AM version of HD Radio technology uses the 20 kHz channel (+/- 10 kHz), and overlaps 5 kHz into the opposite sideband of the adjacent channel on both sides. When operating in pure digital mode, the AM HD Radio signal fits inside a standard 20 kHz channel (20-40 kbit/s) or an extended 30 kHz channel (40-60 kbit/s), at the discretion of the station manager. As AM radio stations are spaced at 9 kHz (Europe) or 10 kHz (Americas) intervals, much of the digital information overlaps adjacent channels when in hybrid mode."

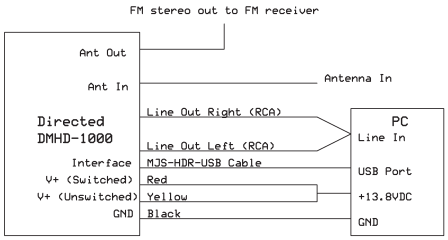
The IBOC standard produces spectrum as shown below. This is a shot from an RFSpace SDR-IQ panadapter. The carrier is in the center with its normal AM sidebands extending out about 10 kHz on each side and the digital sidebands contained at the +/-15 kHz points. As you can see, the typical IF filter in a communications receiver would not pass this 30 kHz wide signal. An SDR's front end, though, could be widened enough to "hear" the whole thing and pass the baseband audio into a PC sound card for processing. If software was available to process the data, we could easily listen to IBOC stations with our PCs without any fancy hardware. But Ibiquity has chosen to protect its intellectual property instead, which is of course its right. As a result, we must use licensed hardware to decode the HD signals.

❖ The Directed Electronics "Car Connect"

While I found many home and car stereo boxes available to allow you to listen to HD Radio, I spent a fair amount of time hunting for an HD radio solution that could be interfaced to a PC. After all, this column *is* about computers and radio! There are many stand-alone boxes that can be used to listen to HD-Radio, but not very many that can be interfaced to a PC. I did find one that can be connected to iPads and iPhones, but that didn't appeal to me, particularly because I have an Android-based phone.

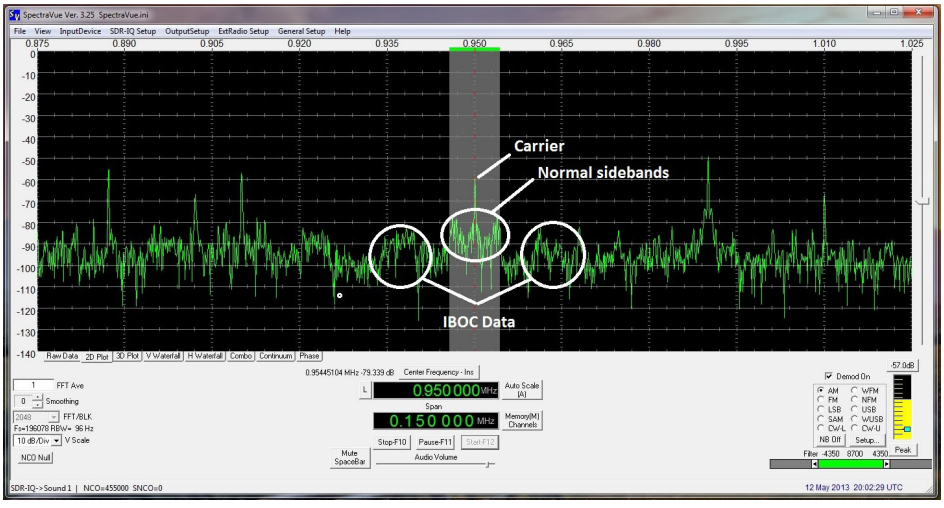
I finally stumbled on a solution by Directed Electronics. Although now discontinued by the manufacturer, it is still available from some distributors. I bought one from by "Mobile Computing Solutions" (**www.mo-co-so.com/Directed-DMHD-1000-HD-Radio-Receiver-p/mcs-dir-hdr.htm?CartID=1**) which focuses on computer applications for cars. Mo-Co-So tells me that they "have thousands in stock."

The above photo shows the Directed Electronics solution. It's simple enough: 12V power (switched and unswitched), PC/front panel interface, stereo line out jacks, antenna in and antenna out RF jacks. Since the interface jack is meant to be attached to the included front panel, a separate cable, available from Mo-Co-So (MCS-MJS-HDR), is needed to connect the box to a USB port. The cable also works with the Visteon HDZ-300. Below shows how to connect this device to a PC.

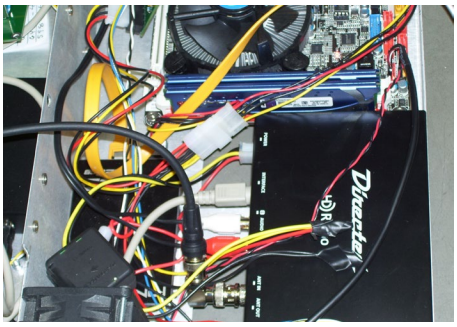


The antenna output is not a pass-through antenna to be used when the unit is off. There's actually an FM modulator inside so that the decoded stereo can be fed into a car's FM radio antenna input. When used with a PC in the application being discussed here, you must use the line out audio jacks.

It just so happens that my own company, DZKit, just announced the "Sedona," a companion box to the Sienna HF transceiver, that provides a metal box that can hold a mini-ITX motherboard (see *MT*'s Computers and Radio, January 2013) and any other small accessories. The MCS-DIR-HDR fits nicely inside and can be connected internally to a spare internal USB port using the adapter cable mentioned above (although it's a type-A USB connector, so adapters are needed to connect to the internal USB port on a mini-ITX motherboard).



The line out audio can also be connected to the PC's HD sound card. Although motherboard noise typically reduces the realizable dynamic range, it is probably good enough for this application. A purist may want to route the audio to the Xonar Essence STX high performance sound card that also fits inside a Sedona. The photo below shows the MCS box connected inside a Sedona enclosure.



❖ Software, Drivers and Results

As with most USB devices and Windows, one never really knows whether to install the software first with the device disconnected, or to plug the device in and let Windows ask you to install drivers, and that was the case here. I had to uninstall the software and disconnect the USB cable until I got the order right. There's precious little paperwork with the hardware, but there is an installation manual on the small CD-ROM that's provided with the interface cable. After installing the drivers, it's necessary to install the free software application "HD Radio PCR." Once that was done, it connected and started playing just fine. The photo below shows the HD Radio PCR program locked onto KRWZ from Denver.

I found a few reviews online about the poor sound quality from the line out jacks. And although I did detect some distortion, it was not really objectionable. The "fix," from the manufacturer, is supposedly to ground the chassis in addition to using the ground wire to the power supply. I suspect that in a small case with wires that are not very long, the grounding is not a huge problem. I also noticed a rather large ferrite bead clamped onto the supply leads, which may have been added as a fix for this kind of thing. You can see some of this "rat's nest" in the close up of the Sedona compartment where the radio was placed.

The receive sensitivity is not fantastic, but certainly should be adequate in strong signal areas. It's specified at 25uV for 20dB SNR for the AM tuner, 2uV, SNR=35dB for FM. I typically use my amateur vertical antenna, a Hustler 5BTV (five band trap vertical) on the AM broadcast band. Although its lowest frequency is supposed to be 3.5 MHz, just having a tall piece of metal outside, oriented vertically, seems to be good enough to bring in good signals. At least it works better than my 20 meter monoband beam! I was able to pick up Denver oldies HD radio station, KRWZ (950 AM, Denver), from my Loveland QTH 50 miles away and not in their main lobe. The difference between a non-HD radio tuned to that station and HD is huge. The high notes in particular really come through.

Digital radio is the wave of the future, although some would say "unfortunately" because of the lost charm of analog radio, not to mention the need for a stronger signal to be able to get anything at all through the digital decoders. But take heart! Because of the need to resort to simple technology in emergencies (such as after an EMP event), analog radio is never likely to disappear completely. So, don't throw away your grandfather's Zenith Transoceanic tube-type radio! But in the meantime, progress marches on, relentlessly dragging us into the digital age.

West Mountain Radio RIGblaster Advantage

By Larry Van Horn N5FPW

As an active ham for many years now, I have observed that one segment of our radio hobby is growing faster than any other – digital modes operation. Interest in amateur radio digital communications has been a rapid rise since the first sound card digital mode software was released back in 2000.

Today, thanks to digital modes, even hams who live in homes that have restrictions on outdoor antennas can use low power and compromised antennas to get on the air.

If you want to get in on the action and add digital capability in your ham shack you will need five items to get on the air – antenna, transceiver, computer, digital mode software and a sound card hardware interface.

If you are like most hams, you already own most of the items mentioned above. The two that usually aren't in an active ham shack is software and a sound card interface. Since this is a review of a hardware interface I won't discuss the dozens of software packages available for the various digital modes. You can learn more about many of the various software packages in current use on the West Mountain Radio website at **http://www.westmountainradio.com/content.php?page=links**.

That leaves the hardware interface. It is the one item that brings all the other station components together to get you on the air using sound card digital modes.

At a minimum, a hardware interface has only one job to do – let the computer toggle the radio between transmit and receive. Many amateurs build their own simple interfaces that provide the aforementioned switching capability and add in audio isolation. This is fine for some, but there are a lot more features available to the amateur from commercially produced sound card interfaces.

The leader in this field is West Mountain Radio. West Mountain Radio has been making their famous RIGblaster interfaces almost since the day hams began using sound cards to create new digital modes. But it's only been in the last couple of years that they introduced an interface with a built-in sound device – the RIGblaster Advantage.

❖ What's in the Box?

In addition to the interface box, the RIGblaster Advantage kit includes all the items you need to get up and running including: one 6-foot, 1/8-inch audio cable; one 3-foot, 8-pin screw-on custom microphone cable; four instant setup connectors (ISC); USB cable; DVD with drivers and sound card software, printed owner's manual; and an accessory kit that consists of eight white jumpers and five blue shunt jumpers.

❖ RIGblaster Advantage Capabilities

The RIGblaster Advantage features a simplified PC interface and expanded rig control radio compatibility, accomplished without compromising the functionality and flexibility that the RIGblaster products are known for. This new addition to the West Mountain Radio product line incorporates several user requested enhancements not seen in previous interface units.

- Internal sound card generates audio completely independently from PC's sound card
- Single plug-and-play USB cable connection to PC for audio, rig control and power – no separate audio/rig control cables or power supply needed
- Automatically mutes microphone audio while transmitting digital modes
- Rig control interface for CAT/CI-V as well as RS232 through a DB9 port
- Front panel mounted transmit power level, receive audio level and VOX delay adjustment knobs
- Includes Instant Setup Connectors and cables for microphone configuration
- High speed (50 wpm) CW keying output for keyboard CW and RTTY software

The Advantage is capable of running the following software modes/operations: PSK31, WinMOR HF-Email (WL2K), MFSK16, ALE, MT63, Hellschreiber , SSTV, digital SSTV, RTTY AFSK, RTTY FSK, PACKET 300 and 1200 baud AX25, APRS with packet sound card software, MCW/CW transmit and receive, contest voice keying, WSJT FSK441 high speed FSK meteor scatter, WSJT JT65 extreme weak signal tropo and EME, FM repeater announcements, automatic and unattended, EchoLink® Internet radio linking with the EchoLink system, simplex or duplex repeater control with EchoStation, digital voice over SSB bandwidth on HF, transmit speech processing: EQ and compression, computer RIG control, and DX beacon monitoring.

One of the big reasons the Advantage was an important addition in my shack was the built-in sound card. This feature eliminates the need to reconfigure your computer's sound card audio levels for digital mode operation. When using the Microsoft Windows® operating system you manually change the volume to the levels that are comfortable for you when watching videos, playing music, etc. If you are using the same computer for ham operations you will have to flip these audio levels back to the proper settings for the various digital modes and bands you want to use. This can be very frustrating and all this reconfiguring can cause errors and accidental emissions over the air. You surely do not want "You have mail!" being broadcast in the digital bands every time new email arrives on your computer.

With the Advantage sound card interface you set it and forget it! It frees the computer's existing sound card to generate system sounds, music etc. without danger of unintentional transmission. The front panel controls for transmit level and receive level are much better solutions than hunting for the computer's sound card sliders in the Windows audio mixer interface. With the volume levels located on the front of the interface I can quickly change the microphone gain or headphone volume without calling up the Windows mixer control.

Phone and digital operations with this interface are a snap. With the RIGblaster Advantage, you simply plug your microphone into the interface and connect the interface to the radio microphone jack. The interface switches between the microphone and the internal sound device automatically.

❖ Computer Interface

Interfacing that unit with the computer and the rig was a snap using the supplied plug-and-play USB cable which provides positive PTT, CW/FSK keying, CAT/CI-V rig control and sound card. Gone are the days of a bunch of cables behind the rigs to connect everything up. The Advantage uses Microsoft certified USB drivers and they are automatically installed from the Windows update function. Another benefit of this type of installation is that the unit is powered through USB cable, no wall supply needed

❖ Compatible with All Manufacturers' Radios

The Advantage uses pre-wired microphone jumper blocks known as Instant Setup Connectors (ISC) that enable users to match microphone connector wiring schemes without having to refer to wiring diagrams. Six ISCs are provided (three "Round Metal") and three "RJ45 Modular") to cover the most popular radios – Icom, Yaesu, Kenwood, JRC, SGC and Elecraft.

The supplied cables and ISCs allow me to use the unit on any of my rigs. It's a matter of moving one cable and plugging in a different ISC, if needed.

If you own an older ham transceiver, jumpers are provided so that they can be used as well. This interface works with any radio that has an eight pin, round, screw-on microphone connector or RJ45 modular connector. If you have a radio with an RJ25, six-wire microphone connector you'll need an optional FT100 style six-wire modular microphone cable. The unit will also interface with any radio with a four-pin round microphone connector with the optional four-pin microphone cable.

❖ Built-in Rig Control

If you want to control your rig through your digital mode software (i.e. Fldigit, Ham Radio Deluxe, etc.), the Advantage has CAT/CI-V and DB9 rig control interface functions built in. West Mountain has custom CAT/CI-V cables available as accessories if the cable package included with the interface doesn't do the trick.

❖ True Keyed CW/FSK

If you are interested in true CW/FSK keying, the Advantage can do this too using relay switching via a dedicated jack on the back of the Advantage. There is a caveat in this regard that not all transceivers are capable of FSK RTTY. An undocumented feature, that ought to be in the manual, allows full break-in (QSK) CW from the keyboard as effectively as from the paddles.

❖ Advantage Microphone / Keying/Audio Flexibility

Some more interesting features that the Advantage has include:

- RTS, Footswitch or VOX PTT keying circuit
- Front panel mounted transmit and receive audio level knobs make it easy to adjust transmit/receive levels on the fly without having to make changes in software sound levels.
- No extra manual switches needed, includes DPDT relay for true automatic operation unlike other sound card interfaces.
- Simpler operation than the other brands, you never have to remember to push un-needed switches to make your station work.
- Rear panel RCA PTT-switch/foot-switch jack enables the PTT override and interrupt.
- Properly matched and RF suppressed audio for your radio.
- Fully isolated transmit audio and PTT keying, unlike other interfaces that have little or no isolation.
- Positive and fully automatic PTT control supports for almost 100 ham software programs.

❖ Bottom Line

I have been a long time West Mountain Radio RIGblaster user. My first digital interface was the original RIGblaster released back in 2000. Recently when I decided I wanted an interface for my Icom IC-728 secondary rig I purchased the Advantage.

I found the Advantage easy to set up, install and operate. This is my fourth RIGblaster and seventh digital interface and the setup installation of this unit was the easiest of any I have ever used. When I put the Advantage on the air, I was operating on JT-65 using the JT65-HF software package within minutes of un-boxing the unit.

I didn't even have to put the installation DVD in the computer during this installation. West Mountain paid Microsoft for the registered drivers the unit requires which are available via the Windows update. The longest part of the install was the wait for the driver download via the Internet. This unit represents plug and play at its best.

I have no extraneous RF in shack and all my digital mode contacts have noticed no quality issues. The audio in and out is impeccable and cleaner than the audio coming from my computer sound card.

The manual is excellent and well written, emphasizing a straight-forward set up and install. The manual is very detailed and does a very good job explaining setup for several of the more popular digital software packages that that available for ham radio use. A PDF version of the manual is also available for download from the company website.

The Advantage is superbly constructed, has silky smooth transmit/receive/VOX controls on the front of the unit and a small footprint. It is easy to swap around with other rigs (i.e. such you might do during Field Day operations).

The best part of owning a West Mountain Radio product is the superior customer service you receive from the company's technical staff if you hit a brick wall. I had a couple of minor questions regarding this unit and within a couple of minutes of contacting tech support, Sholto Fisher K7TMG, I was able to receive service that was nothing short of excellent. Their support staff is as good as any I have ever dealt with.

Bottom line, if you want to get in on the ham radio digital revolution and want a quality product to interface your computer to the rig, there is nothing better in today's marketplace than the RIGblaster Advantage.

Manufacturer: West Mountain Radio, 1020 Spring City Drive, Waukesha, Wisconsin 53186. Telephone: 262-522-6503, Website for more information and to order: **www.westmountainradio.com/mtadv**. RIGblaster Advantage retails for $200 and when you contact West Mountain be sure to tell them *MT* sent you.

** Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.*

RIGblaster Advantage Specifications

Overall Dimensions (maximum without cables): 1 1/4-inch high by 6 1/4-inches wide by 4-inches deep
Weight: 24 oz.
DC Power Requirements: USB Powered
PTT Max Contact Rating: 2 Amps at 24 Volts or 1 Amp at 48 Volts
CW/FSK Direct Keying Ratings: Transistor logic only, tube rigs not supported. Positive pull-down 20 mA maximum.
Serial Interface Port: USB
TTL Rig Control Interface Port: Dual circuit mini jack connector
Standard TTL: 5V logic, selectable bi-directional or unidirectional
Warranty: One year from date of purchase.

Loyd Van Horn, W4LVH
globalnetmt@gmail.com
Twitter: @GlobalnetMT

Living in a Digital World

When I really stopped to look around and notice just how far the Internet had encroached into our lives, I was amazed.

In the spectrum of this column, we talk about niches such as Internet radio, streaming video and television, VoIP telephone and chat services, online streaming software-defined-radio just to name a few. But, what about listening to streaming radio on your refrigerator, or getting an alert from your washing machine when the load is finished?

Streaming technology is popping up in all sorts of places that you wouldn't normally expect to find it. As this happens, the use of apps has become a more integrated part of our daily lives.

Take for example, Samsung's new refrigerator that includes a LCD screen that is stocked with apps – including Pandora. The retail for this modern marvel is around $3500, but as with any new advances in technology, expect the price on these to eventually come down.

Not sold?

We have already seen in the past five years striking advances in app-based entertainment in automobiles. When I first started writing this column, in-auto app usage was in its infancy. Now, it has become nearly standard equipment on all new models to have a touch-screen system loaded with apps.

Still not convinced? A few years back, if you wanted to watch Netflix streaming video on your television, you had to have a third-party device such as Apple TV or Roku. Then we started seeing smart devices such as Blu-ray players pop-up on the market that included a slew of apps. Now, apps are appearing directly in our televisions, allowing instant access to streaming video and audio without the need for any extra equipment. We are a long way from the 'rabbit ears' antennas I grew up with.

The fact that we are starting to see apps integrate with home appliances is just a further extension of what has been happening in the industry over the past few years. While today it is refrigerators and washing machines, the possibilities of what could be on the horizon are endless.

Imagine a mirror with a touch-screen interface for your bathroom. From this one interface, you could check your e-mail, the local weather forecast, watch news videos or listen to your favorite Internet radio service, all while never leaving your bathroom while getting ready to start your day. This isn't just something from a science fiction movie – the technology is real.

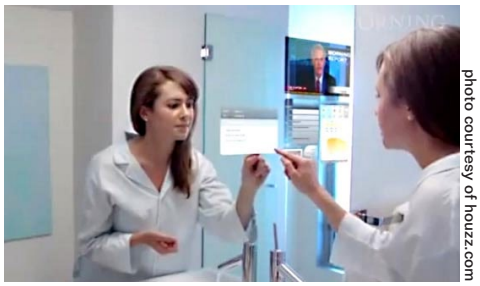


photo courtesy of houzz.com

Or how about a riding lawn mower with a built-in docking station for your mobile device. This way you can listen to your favorite streaming service while finishing up your yard duties. It can even communicate to an app on your device when the gas is running low or even when it is time to change the air filter.

There are already apps that allow you to control your home heating and air conditioning and lights even when you aren't at home. How about an app that will start brewing your morning coffee as you are getting out of bed? Or one that will help you pick your outfit for the day, based on what is currently in your closet?

With the explosion of tablet and smartphone usage, and with new devices such as Windows' Surface tablet/laptop hybrid entering the market, we are poised to see even further penetration of apps into our daily lives. And, I haven't even mentioned the anticipated launch of Google Glass glasses, that will allow users to have constant access to the Internet and their favorite apps – all within their normal point of view.

Starting to feel like the machines are taking over? It's not an entirely crazy concept. However, as I have said many times in this column, fear not. For all of the advancements and new technologies that are available, our traditional methods of getting information aren't going anywhere.

You can still hear signals coming through when you turn on your radio. The nightly news is still right where you left it on your television. You can still get ink on your hands as you read your daily paper in the morning.

It is easy to feel like we are living in a digital world. But every now and then, you still have to take some time to stop and smell the analog that is all around us.

GlobalNet mailbag

Loyd - I just read your Globalnet article in the May 2013 edition of Monitoring Times. You mentioned that you can control your CC-WiFi radio with your smartphone. Which app are you using and is it an iOS or Android? BTW I love my CC-WiFi radio. Regards, Tom Greenli

Tom – It is an amazing little box, isn't it? While composing my response to your email, I am listening to the sounds of RTB Radio (Radio Burkina) in Burkina Faso. The app I was referring to is the Reciva app, available for iOS devices. No Android app is on the market yet, but there is also a PalmOS app available.

Once you set up the app to communicate with your C. Crane WiFI radio (an easy process), you have full control over volume and changing stations. I will say, even as intuitive as the C. Crane's interface is for changing stations, the touch screen interface of the Reciva app makes pulling up stations an effortless process. You can find stations just as you do on the radio – by location, genre or by searching for a station.

My favorite part is how easy it is to manage your preset stations by using this app. All you have to do is find a station you want to save in a preset spot, tap on 'presets' on the bottom of the screen (look for the star). Then click the blue arrow to add the current station into the desired preset spot. It will confirm you want to make the change and that's it! Much easier even than using the included remote that came with the C. Crane.

If you have additional Reciva powered radios in your home, you can also use this app to control them. Not all radios are supported, so be sure to check the literature available online about the syncing process.

Hope that helps! Have something you would like to submit to the Globalnet mailbag? Send me an email at **globalnetmt@gmail.com**

GlobalNet links

Samsung 'Smart Fridge' **www.bestbuy.com/site/Samsung+-+28.0+Cu.+Ft.+French+Door+Refrigerator+with+LCD+Touch+Screen+and+Apps+-+Stainless-Steel/2305079.p?id=1218320074851&skuId=2305079&utm_campaign=bazaarvoice&utm_medium=SearchVoice&utm_source=AskAndAnswer&utm_content=Default**

Apps for your appliances are the next opportunity **http://news.cnet.com/8301-1035_3-57359435-94/how-apps-for-your-appliances-represent-the-next-opportunity/**

Google Glass **www.google.com/glass/start/**

Reciva iOS app **https://itunes.apple.com/us/app/reciva-iradio/id354665944?mt=8**

Reciva PalmOS app **https://developer.palm.com/appredirect/?packageid=com.reciva.radio.full**

What's NEW

Tell them you saw it in Monitoring Times

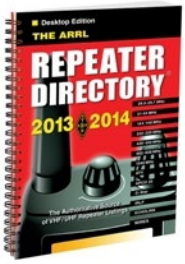
Larry Van Horn, New Products Editor

The ARRL Repeater Directory® – 2013/2014 Edition

Summer is vacation time and many ham radio operators turn their vehicles into rolling ham shacks. As you travel around the country, it really is a lot of fun to work area hams in various VHF/UHF repeaters. But to really take advantage of mobile repeater operations you need a comprehensive and up-to-date guide.

The best directory of VHF/UHF repeater frequencies is the annual *ARRL Repeater Directory* and they have just released the 42nd edition of this popular publication.

This publication includes D-Star and APCO-25 references for operating practices, emergency message handling, tips for handling interference and more. It also includes guidelines for severe weather reporting to SKYWARN nets and the National Weather Service.



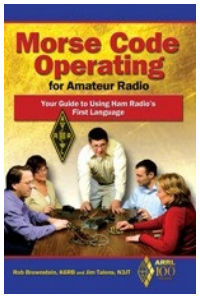
There are two different print editions including a 790 page pocket-sized edition, perfect for mobile operations (3.75 by 5.25 inches), and a 645 page desktop edition (6 by 9 inches and spiral bound). Both editions have 21800 plus listings for VHF/UHF repeaters across the U.S. and Canada and have the following features:

- Repeater operating practices, repeater lingo and hints for newly licensed hams.
- Frequency coordinator contact information.
- VHF/UHF Band plans and two meter channel-spacing map
- Amateur Television (ATV), D-Star and APCO 25 repeaters
- CTCSS tones and Digital Coded Squelch (DCS)
- IRLP, WIRES-II, and EchoLink® (Internet linked) nodes
- Repeater listings for 29.5-29.7, 51-54, 144-148, 222-225, 420-450, 902-928 and 1240 MHz and above.
- Emergency message handling procedures (ARRL Radiogram, Numbered Radiograms, and ICS0213 General Message Form)
- Tips for handling interference
- Transceiver memory log
- Handy indexing tabs on the cover to aid finding the listings you're looking for.
- Easy-to-read listings
- Key to repeater notes located right up front.
- Icons make it easy to identify "open" or limited access repeater systems.

The pocket-sized book (ARRL #2575) cost $11, and the Desktop edition (ARRL #2605) sells for $16 plus shipping.

Morse Code Operating for Amateur Radio

Tune in to the low end of any HF band, and you'll find it populated with ham radio operators using Morse code for casual conversations, chasing DX or engaged in fast-paced contests. They enjoy practicing a skill that they worked hard to obtain, a skill not everyone has. You can learn that skill too. If you are new to amateur radio or high frequency (HF) operation, or even if you've been operating HF phone and RTTY but were reluctant to try learning and using Morse code, this book is especially for you.



Morse Code Operating for Amateur Radio is your introduction into the fascinating world of radio communication by Morse code, usually referred to as "CW." It discusses how to get started in the hobby, the advantages to learning and using Morse code, how to set up your station for CW and how to adjust your Morse code key. Learn the protocols and techniques unique to CW operating and gain the confidence to try out your new skills on the air. Topics included in the paper cover book include: Why CW? Learning Basic Morse, How to Operate CW, How to Set Up a CW Station, More Fun with CW, Morse and Radio: A Long History, and CW Today.

This 80 page ARRL publication (#0004) sells for $16 plus shipping and handling.

To order from ARRL call their Publication Team toll-free in the US 1-888-277-5289, Monday through Friday from 8 AM to 5 PM Eastern time [Outside US telephone (860) 594-0355]. You can also contact the ARRL, the national association for Amateur Radio® via snail mail 225 Main Street, Newington, CT 06111-1494 USA, or visit their website at **www.arrl.org**.

DXtreme Station Log — Multimedia Edition, Version 10.0

DXtreme Software™ produces powerful and easy-to-use logging applications for radio enthusiasts such as amateur radio operators, shortwave DXers, broadcast band DXers, VLF DXers, VHF, UHF, and TV DXers.

Amateur radio operators will be interested in a new version of their popular logging program: DXtreme Station Log — Multimedia Edition™, Version 10.0.

DXtreme Station Log lets hams log their contacts and import ADIF files from other programs. It offers the following multimedia and advanced functions:

- DX Spot Checker™ – Receives DX spots from Telnet-based servers, and determines whether QSOs are needed for new or verified DXCC® entities, band-entities, mode-entities, or VUCC grids.
- DX Atlas Integration – Performs optional DX Atlas azimuth plots from the user's location to that of a spotted or logged station. Also creates maps for a variety of reports. A software license for Afreet DX Atlas is required to use this software package.
- Band Master Integration – Afreet Band Master can be invoked with needed lists based on the user's Station Log database. A software license for Afreet Band Master is required to use this software package.
- Rig Control – Tunes/retrieves frequencies and modes from supported rigs through integration with Afreet Omni-Rig, available from Afreet Software.
- QSL Processing – Creates QSL and address labels for physical QSLs, ADIF files for LoTW® signing in TQSL, and ADIF files for eQSL.cc verifications. Also retrieves LoTW QSL records, and includes a QSL Imaging™ facility for scanning, capturing, and displaying physical and electronic QSLs, including LoTW QSLs.
- Audio Facility – Records and plays QSOs
- Reports – Provides a wide range of performance and station reports to let users see how well they're doing. All reports can be filtered and sorted and includes a window-based DXCC® Analytics™ tool for analyzing and enhancing DXCC standing.

New features in that have been incorporated into version 10.0 include:

- DX Spot Checker Enhanced – The DX Spot Checker can now display bearings to spotted stations and DXCC entities. It also provides DX and user-defined command buttons for sending commands to the server quickly.
- Last Log Entries Grid Updated – The grid, which provides the look and feel of a paper logbook, can now be positioned at the top and the bottom of the Station Log window. A Properties dialog box lets users change the order of columns, and records can now be sorted in additional ways. Double-clicking records displays their detailed data on the Station Log window.
- HamQTH.com Support – HamQTH.com is now supported for call sign lookups, joining Buckmaster™ HamCall™ and QRZ XML Logbook Data as supported services.
- Support for TQSL Version 1.14 – Supports TQSL V1.14 for optionally uploading .TQ8 files to the LoTW server automatically, saving users the step of performing this task manually on the LoTW web site. Also invokes the Ask command of TQSL to warn users when they're about to upload duplicate records to the server. Users can either cancel the operation or continue with the upload.
- Enhanced Multiple-Database Management – Offers an improved workflow for managing multiple databases, including several system-specific and database-specific preferences and functions.

DXtreme Station Log runs in 32- and 64-bit versions of Microsoft® Windows® 8, Windows 7, Windows Vista®, and Windows XP. DXtreme Station Log retails for $90 USD in North America and $94 USD elsewhere for electronic delivery. Special pricing is available for upgrading users,

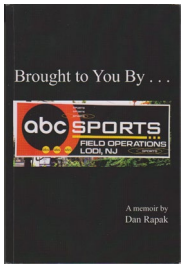
and CD shipment is available for a nominal surcharge. All prices include lifetime product support by Internet e-mail.

For more information about DXtreme Station Log – Multimedia Edition V10.0, visit **www.dxtreme.com** or contact Bob Raymond NE1I at bobraymond@dxtreme.com.

Brought to You By... by Dan Rapak

Like us, Dan Rapak WA3ATV, is a long-time radio hobbyist and an avid reader of *Monitoring Times*. Unlike us, Dan was a key member of the technical crew of ABC's remote operations for some three decades, has been in TV production for nearly four decades, and has won three Emmy Awards.

Brought to You By… is more than a look back at a division of a network's day-to-day operations, it is a sensitive and revealing behind-the-scenes history of ABC-TV as experienced by the author, from the earliest days of his employment by small town broadcasters and through his growth and involvement with major productions such as the Super Bowl and the Olympics. He has been on the scenes at earthquakes and NASA launches. His recollections are sharp and provide remarkable insight into the workings of major broadcasting.



For those readers who accept TV broadcasting with the assumption that all is professional and technically elegant, Dan informs us that it is not. In one instance he reveals how something went wrong with the audio feed just moments before the network news broadcast. He rapidly traced various circuitry until he could find the audio on a pair of terminals. Then, with a pair of test leads, he connected the make-do wiring and sat on the floor holding them securely in place until the end of the broadcast.

While the appearance of network cooperation at major events is smooth, the author reveals the time that a competitive network engineer kept sneaking into Dan's control booth to give precedence to the competitor's own network's audio. Dan caught him at it, grabbed him by the shirt collar and belt, and physically threw him outside.

Dan was also critically involved in setting up microwave links to cover the near-disaster of the nuclear facility at Three Mile Island. The techs working on that emergency link weren't trained in nuclear chemistry, so they didn't know how dangerous the assignment was until attending a showing of *The China Syndrome* which was released at the time of the incident. The movie accurately depicted a nuclear meltdown in a power plant. As the author observed, "…seeing this film was absolutely spooky!"

Long-time employees of network broadcasting know that their profession is rife with pranksterism. A special chapter entitled *Shenanigans* details some of the most outrageous ploys Dan experienced in his days with ABC-TV.

For those of us who have had careers in broadcasting, Dan's accounts of equipment failures, massive setups at sports tournaments, interactions with friendly and unfriendly staff, and the sheer fun that much of broadcasting offers, will sound familiar.

For those who religiously followed the manned space program, the author's detailed accounts of rocket launches from Cape Kennedy will bring back memories. The book is filled with humor and good will, but there is sadness as well when stunning news events report tragedy. Dan Rapak's memoir is a good read. It is available from Amazon, Barnes & Noble, and some independent book stores in hard and soft cover as well as e-book. Order from the publisher at **http://bookstore.authorhouse.com/AdvancedSearch/Default.aspx?SearchTerm=brought+to+you+by.** – Review by Bob Grove W8JHD

K1JT Releases a New JT9 Software Package

Joe Taylor K1JT has released a new version of his WSJT-x software package and digital mode fans will love it. This new package has been modernized with the look and feel of Joe Large W6CQZ's popular JT65-HF package.

This new version offers a new mode called JT9, designed for use on the LF, MF, and HF bands. JT9 shares many characteristics with the modes JT65 and JT4 made popular in the WSJT software releases. All three modes are designed for making minimal QSOs under extreme weak-signal conditions. They use nearly identical message structure and source encoding. JT65 was designed for EME on the VHF/UHF bands and has also proved very effective for worldwide QRP communications at HF; JT4 is used mainly on the microwave bands. In contrast, JT9 is optimized for HF and lower frequencies.

JT9 is about 2 dB more sensitive than JT65A while using less than 10% of the bandwidth. Several dozen JT9 signals fit easily into a 1-kHz slice of spectrum. World-wide QSOs are possible with power levels around one watt and compromise antennas.

All WSJT modes use timed sequences of alternating transmission and reception. JT9 offers five choices for the sequence durations: Submodes JT9-1, JT9-2, JT9-5, JT9-10, and JT9-30 use 1-, 2-, 5-, 10- and 30-minutes, respectively. A minimal QSO with JT9-1 usually takes four to six minutes: two or three transmissions by each station, one transmitting in odd minutes and the other even. The remaining JT9 sub-modes take proportionally longer, so JT9-1 is the preferred sub-mode under most circumstances.

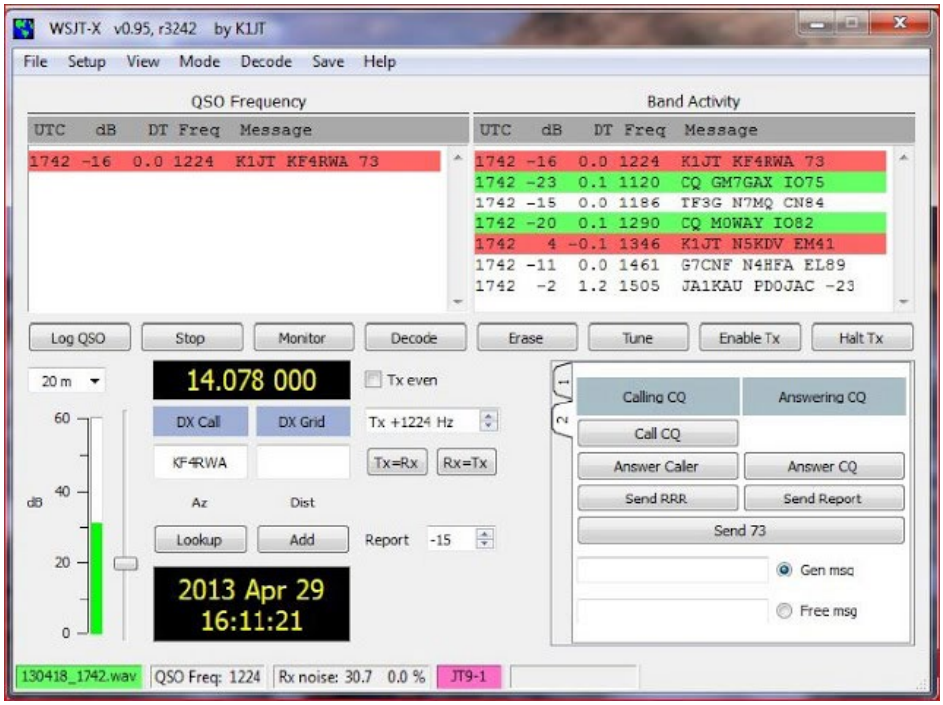
The sub-modes with longer transmissions trade reduced throughput for smaller bandwidth and increased sensitivity. The slowest sub-mode, JT9-30, has total bandwidth 0.4 Hz and operates at signal-to-noise ratios as low as –40 dB measured in the standard 2.5 kHz reference bandwidth. It requires very stable oscillators in both transmitter and receiver. JT9-1 is always the recommended sub-mode unless you really need the additional sensitivity of a slower mode.

Julian G4ILO recently posted on his Internet blog, "Due to the health issues of the developer Joe Large, it has been some time since there was a new version of his popular JT65-HF application." The good news is that Joe Taylor's plans for future program development call for WSJT-X and WSJT to merge together: WSJT-X will gradually acquire the modes JT65, JT4, FSK441, and ISCAT that are now supported in WSJT.

You can download your current copy of the WSJT-x software package at **http://physics.princeton.edu/pulsar/K1JT/wsjt.html**. Oh, and the price is just right for this new software package – Free!

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.



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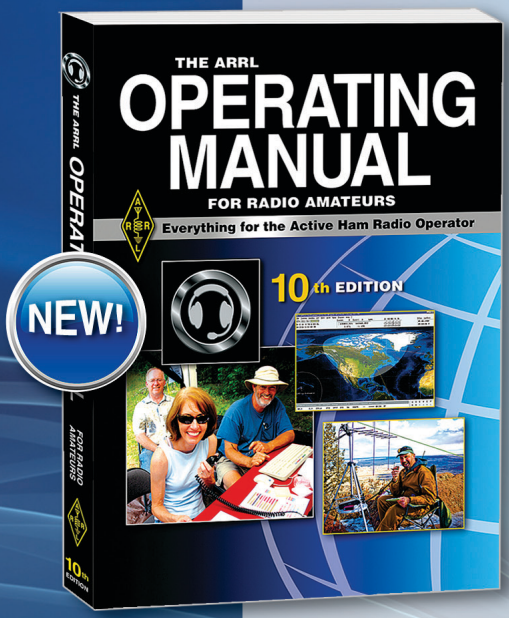

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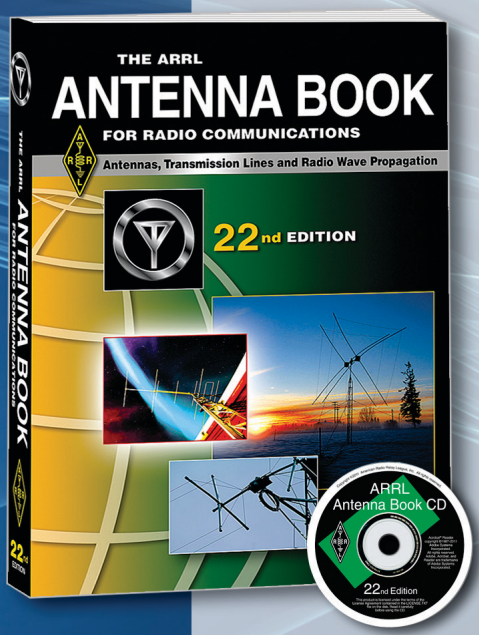

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*System Requirements: Windows® 7, Windows Vista®, or Windows® XP, as well as Macintosh® systems, using Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at www.adobe.com. PDF files are Linux readable. The ARRL Antenna Book utility programs are Windows® compatible, only. Some utilities have additional limitations and may not be compatible with 64-bit operating systems.

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