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MT's 2011 Amateur Radio Special

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In this issue:

AR5001D Wide Coverage Professional Grade Communications Receiver

The Legend Lives On!

The AR5001D delivers amazing performance in terms of accuracy, sensitivity and speed.

Available in both professional and consumer versions, the AR5001D features wide frequency coverage from 40 KHz to 3.15 GHz, with no interruptions. Developed to meet the monitoring needs of security professionals and government agencies, the AR5001D can be controlled through a PC running Windows XP or higher. Up to three channels can be monitored simultaneously. Fast Fourier Transform algorithms provide a very fast and high level of signal processing, allowing the receiver to scan through large frequency segments quickly and accurately. AR5001D standard features include storage of up to 2000 frequencies, 45 MHz IF digital signal processing, direct digital sampling, a high performance analog RF front-end, a DDS local oscillator and advanced signal detection capabilities which can detect hidden transmitters. With its popular analog signal meter and large easy-to-read digital spectrum display, the AR5001D is destined to become the choice of federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.*

Discover the next generation in AOR's legendary line of professional grade desktop communications receivers.

- Multimode receives AM, wide and narrow FM, upper and lower sideband and CW
- Up to 2000 alphanumeric memories (50 channels X 40 banks) can be stored
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- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all of the receiver's functions
- An SD memory card port can be used to store recorded audio
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- CTCSS and DCS squelch operation
- Two selectable Type N antenna input ports
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- Triple-conversion receiver exhibits excellent sensitivity
- Powered by 12 volts DC (AC Adapter included), it can be operated as a base or mobile unit
- Professional (government) version is equipped with a standard voice-inversion monitoring feature

Add to the capabilities of the AR5001D with options:

- Optional APCO-25 decoder
- Optional LAN interface unit enables 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
- Optional AR-I/Q Windows software facilitates the easy storage and playback of transmissions captured within the selected spectrum in conventional modes, or, signals can be subjected to further analysis
- Optional GPS board can be used for an accurate time base and for time stamping digital I/Q data

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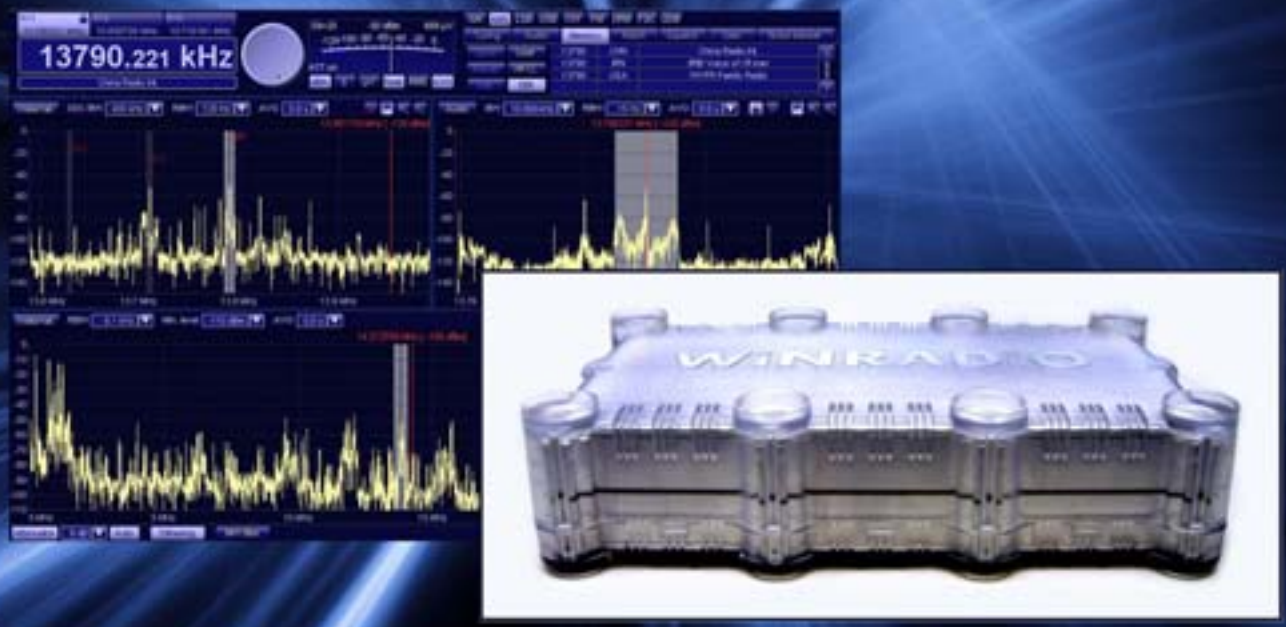
It's a Winner!

"In performance terms the Excalibur sets new standards in several areas. It is the most sensitive SDR we have yet measured."

"Conclusion: All in all, Excalibur is already the best SDR we have used - and knowing WiNRADiO we imagine that future software releases will only serve to make it even better."

Overall rating: 5 stars
WRTH category award winner: Best SDR 2011



And many other independent reviewers agree:

"The Excalibur receiver is a top rate performer supported by excellent software and the spectrum displays are a superb bonus. The 16-bit analogue to digital converter results in unsurpassed strong signal performance and once again my league table of close-in dynamic range receiver performance has a new No. 1." --- *Peter Hart, RadCom*

"In my professional lifetime in communications electronics, I've never seen anything with such shortwave receiving and processing power at such a low price. In the time it took me to write this review, I have changed from a digital skeptic to a true believer. This is one amazing radio!" --- *Bob Grove, Monitoring Times*

Shouldn't you have a look, too?
www.winradio.com

Monitoring Times

Vol. 30 No. 5 May 2011

MT's 2011 Amateur Radio Special

The feature articles in this year's amateur radio issue examine just a few of the many facets of amateur radio today: How digital technology has made operating SSTV more interesting than ever; why hams living in apartments and condos don't have to give up their radio hobby; how female operators have thrived in a male-dominated field, and how one ham eschews retirement to pursue a lifelong passion for antennas.

But wait, there's more! Our regular columnists bring their own dishes to the table. *On the Ham Bands* takes an in-depth look at horizontal loops; the *Beginner's Corner* extols the joys of the 10 meter band; the *QSL Report* looks at QSLing special event stations; *Antenna Topics* shows you how to get on HF; *Sky Surfing* explains how to work the International Space Station, and *First Look* examines the FLEX-1500, a remarkable software defined QRP transceiver.

Our Cover

Slow Scan TV (SSTV) images (Courtesy: Dave Granoff K3AS); Cheryl N0WBV operates from Christmas Island as T32WW (Courtesy: Cheryl Muhr N0WBV); QSL card from T32WW; Charlie Gyenes W6HIQ in his shack with a small Soviet-era tube radio from his native Hungary circa 1957 (Courtesy: Charlie Gyenes W6HIQ)

C O N T E N T S

R E V I E W S

Universal Radio — Quality equipment since 1942.

YAESU FT-450D

The **Yaesu FT-450D** amateur transceiver operates 160 to 6 meters with 100 watts on all bands. The superb receiver covers 30 kHz to 54 MHz. Operating modes include USB, LSB, CW, AM and FM. A built-in TCXO provides outstanding stability. The Yaesu FT-450D expands on the success of the previous FT-450, providing features such as: built-in antenna tuning system, classically designed knobs, dedicated data jack for FSK-RTTY, CTCSS, user configurable functions, digital voice announcement of frequency, mode and S-meter, 500 regular memories and two voice memories, CW beacon function, 10 kHz roofing filter, key Illumination, foot stand plus 500 and 300 Hz CW filters. If you are in the market for a good shortwave receiver, with the idea of going into amateur radio in the future, this may be your ticket.
The FT-450D comes with: MH-31A8J hand mic, mic clip and DC power cord. This radio requires 13.8 VDC at 22 amps.

YAESU FTM-350AR

The **Yaesu FTM-350AR** dual band mobile transceiver provides 50 watts on 2 meters and 440 even QRP 220 MHz (1 watt). It has two separate receivers with dual speakers on the rear of the control head. On the left receiver enjoy the AM, and stereo FM with extended receive: 0.5-1.7, 76-108, 108-250, 300-1000 MHz (less cellular). The right receiver covers 108-250, 300-1000 MHz (less cellular). Enjoy 500 alpha memories for each band plus 9 DTMF memories and six types of scanning. There are also stereo line inputs available. This radio has a built-in TNC for APRS® applications and is WiRES compatible. Cross-band repeat is supported and CTCSS Encode/Decode is standard. This new "**A**" version adds GPS Standard format NMEA ready, way point data out, and APRS® refinements. With: MH-48A6JA DTMF hand mic, front panel vacuum cup-mounting bracket, DC cable, control panel cable and speaker cable. Please call Universal or visit our website for price.

YAESU VX-8DR/GR

The **Yaesu VX-8DR** HT provides 5 watts FM on 50/144/430 MHz plus 1.5 watts on 222 MHz. It supports Blue Tooth hands-free operation with the optional BU-1 and BH-1A or BH-2A accessories. There is also an optional GPS unit and antenna with loads of features. This radio supports APRS® 1200/9600 bps data communication (B band only) and is WiRES compatible. In fact, this latest "D" version adds these APRS enhancements:

- ✔ Smart Beaconing™ Function,
- ✔ Station List memories raised from 40 to 50.
- ✔ APRS® Msg mems raised from 20 to 30.
- ✔ New DIGI-PATH route indication function.
- ✔ Heads up compass display.
- ✔ Msg LED flashing rate is selectable.
- ✔ DIGI-PATH route settings raised to 7.

The VX-8DR is submersible to IPX57 specs. A 7.4 V 1100 mAh Li-Ion battery is included. It supports simultaneous independent 2-signal dual receive function with both V+V or U+U. It has weather alert and a barometric sensor is included. The dot matrix LCD provides memory tags (to 16 characters). You even get a high-resolution spectrum analyzer with ±60 channels indication with wave monitoring of received/modulated signal! DCS and CTCSS encode/decode are standard. 2.36 x 3.74 x 0.92".

The **Yaesu VX-8GR** HT provides 5 watts FM on 144/430 MHz. Receive is 108-999 MHz in NFM/FM modes. Unlike the VX-8DR, this radio is not BlueTooth capable, does not have the SU-1 built in and is not submersible. It is however APRS capable (B band only) and even has a GPS built-in. Details at **www.RFfun.com**

YAESU

FT-857D

FREE Yaesu orange mug with FT-857D/897D.

The **Yaesu FT-857D** is the world's smallest HF/VHF/UHF multimode amateur transceiver covering 160 m to 70 cm with 100 watts on HF. Now with 60 meters and DSP2 built-in.

FT-897D

The **Yaesu FT-897D** is a multi-mode high-power base/mobile transceiver covering 160 m to 70 cm including 60 meters. Now with TCXO.

FREE Yaesu canvas urban case with FT-817ND.

FT-817ND

The **Yaesu FT-817ND** is an improved, deluxe version of the hugely popular FT-817. It includes 60 meter coverage plus the new high capacity FNB-85 battery. This radio has an excellent shortwave receiver built-in and is a fully self-contained, battery-powered, low power amateur MF/HF/VHF/UHF QRP transceiver.

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COMMUNICATIONS

by Ken Reitz

SHORTWAVE

Radio Nord Revival

The fiftieth anniversary of Radio Nord, an offshore Swedish pirate radio station, was celebrated with on-air ceremonies carried on Radio Nord Revival, a land-based station operating on 1512 medium wave and 6060 shortwave thanks to a license issued by the Swedish Post and Telecom Agency. According to the station's blog (**http://radionordrevival.blogspot.com**), the initial shortwave broadcast, using a 10 kW transmitter which is fed into a 37 meter vertical antenna, had been widely heard.

The station will QSL reports sent either by email (*ronny@ronnybgoode.se*) or via their postal address: Ronny Forslund Radio Nord Revival Vita Huset SE-17995 Svartsjö Sweden.

AM/FM/TV BROADCASTI

Last Chance to Log Canadian Analog OTA TV

The Canadian Radio-television and Telecommunications Commission has set the date for Canada's switch to digital TV: August 31, 2011. Some stations will be exempt from the switch for the time being. Those mandated to change are national, provincial and territorial capital cities; areas with populations over 300,000, and other areas where there is more than one local TV station broadcasting Over-the-Air (OTA) signals.

PUBLIC SERVICE

NYPD Radio Still Not Tunnel-ready

We know that, nationwide, public service radio systems are over budget, overdue, and underperforming. But, at least in New York City they've got it right. Right?

Wrong. According to an article in *AM New York*, even after $144 million in transit funds have been spent, only a network for New York's fire department has been established. Police agencies are still unable to use their radios in the city's subway tunnels, the article states. And, as might be expected, the buck is freely passed from the mayor's office to the police department to the Metro Transit Authority.

Technical issues and interference are among the reasons given for problems experienced. But, the company working on the project, E. A. Technologies, says the system, installed just four years ago, needs an upgrade. It's not known who will pick up the tab for the estimated $28 million dollar fix, but the company says it could take another year to do the work – that is, once it's approved.

TIS May Get New Life

For the first time since the inception of the Travelers' Information Stations (TIS) service in 1977, the FCC is planning to revise rules governing TIS. The service consists of low power, government operated stations typically transmitting traffic-related information in the AM broadcast band. According to an article in *Radio World* online, there are some 1,300 TIS stations nationwide, with the National Park Service noted as one of the largest users of TIS.

Among the changes the FCC's Notice of Proposed Rulemaking (NPRM) might consider would be a renaming of the service to more accurately reflect the official local government status of the service; allowing TIS stations to be located in areas other than near roadways; to broaden the scope of information transmitted, and to allow setting up networks of TIS stations to increase local coverage.

There is opposition to such sweeping changes. According to comments filed with the FCC regarding the NPRM, the National Association of Broadcasters (NAB) wrote: "NAB reiterates its support for a targeted expansion of the TIS rules. We believe that the record does not support a broader expansion, let alone a complete transformation of the TIS service."

While recognizing the value of the TIS service, National Public Radio (NPR) wrote: "The Commission should not proceed to recast the TIS service as a general purpose, low power radio service without geographic limitation absent a compelling case for such a fundamental change in the TIS service."

In favor of major changes in the NPRM is the American Association of Information Radio Operators which, in its comments, argued for the TIS to allow rebroadcast of NOAA Weather Radio transmissions, currently prohibited by FCC rules.

National EAS Test

This month could see the first of a new nationwide test of the Emergency Alert System (EAS), an FCC mandated program to tie all radio, TV and other telecommunications systems to a single national broadcast in the event of a nationwide emergency. Participants will submit their own test results to the FCC's Bureau of Public Safety and the Department of Homeland Security, according to a report in Government Security News among many other media outlets.

SATELLITES

Russia Space Shambles

According to a report on the Russian news service RIA Novosti, the Russian defense ministry announced that a military satellite launched in February was in an orbit that rendered its mission useless. The GEO-IK-2 was to draw a 3D map of the Earth and comes on the heels of the loss of three GPS satellites in a launch mishap two months earlier that resulted in the sacking of two top Russian space officials and a warning from Russian President Dmitry Medvedev to tighten discipline at Russia's Federal Space Agency.

U.S. Space Shambles

Numerous media sources reported that NASA's $424 million Glory satellite, designed to investigate global warming plunged into the Pacific Ocean in March after failing to make orbit. The four stage Taurus rocket headed for the depths of the Pacific when the fairing, the clamshell covering that protects the payload as the rocket heads into space, didn't deploy away from the rocket as planned.

What's more puzzling is that a similarly expensive satellite, the Orbiting Carbon Observatory, designed by the same company, Orbital Sciences Corporation, suffered the same fate two years earlier. The company and NASA were convinced they had worked out the problems with the fairing. Investigations by both will continue throughout the next several months.

Also lost in the Glory/Taurus fiasco was a Cal Poly project that contained three CubeSats, the hard work of students from universities in Colorado, Kentucky and Montana.

Georgia Readies Sat-Tax

When times get tough, municipalities start thinking about taxing someone, and it's not long before their hungry gaze falls on satellite TV viewers. Cable-TV interests have always paid a franchise fee to localities for the privilege of hooking up the local populace to their cable system, but it's always rankled those interests that satellite TV providers pay no such tax.

For decades the friendly legal brains of cable-TV have urged localities to hit satellite TV providers with a tax to sort of level the retail play-

ing field. In most cases the proposed bills fail to be adopted, but in some cases they're passed, only to be challenged in court.

Up until last year, satellite-TV interests won far more than they lost. But, a loss in the Ohio State Supreme Court has given the cable industry new heart. The latest such threat comes from Georgia where Atlanta CBS affiliate, WGCL-TV, reported a Georgia house bill will hit satellite TV subscribers, both commercial and residential, with a 7% tax.

FCC ENFORCEMENT

Miami FM Pirate Fined $20K

In March of 2010 FCC field agents, working the day watch out of the Miami office, responded to a complaint about an unlicensed FM operator squatting on the 99.5 FM slot in Ft. Lauderdale. Using direction finding techniques, the agents located the signal as coming from a commercial property. It didn't take long for the agents to determine that the signal exceeded Part 15 device rules (250 milliwatts at 200 feet).

The station owner admitted the transmitter was his and that he didn't have license, turned off the transmitter and signed for receipt of a Notice of Unlicensed Operations (NOUO). Agents returned in August 2010 and found the station back up and running and left a second NOUO. A week later they returned and found the same station broadcasting on the same frequency from the same location.

It was a classic case of willful and repeated, so the FCC doubled the fine: $20,000.

QRO and Wrong Antenna - $13K

According to FCC documents, a Florida FM translator operator was operating a licensed translator in excess of its assigned power output and using more than one antenna. During an investigation, prompted by interference complaints, agents found that, instead of a power output of 61 watts, the transmitter had been jacked up to 172 watts.

During the inspection, the president of the company turned the power down to the legal output, but, following additional complaints seven months later, agents returned twice to find the output had somehow crept up to 140 watts. That's when they observed an additional antenna helping the signal get out even better and that's when the FCC trotted out its calculator.

Exceeding power limits: $4,000. Use of unauthorized equipment: $5,000. Willful and repeated: $13,000 total.

CB Op Thumbs Nose at FCC

It's tough enough these days for first responders to get their equipment operating properly without the help of a nearby CB operator getting his bodacious signal into their equipment. So, when FCC agents were called in to investigate interference to the Merced (California) County Fire Department, they observed, according to FCC documents, " …that transmissions on CB radio station frequency 27.165 MHz [CB channel 17] appeared to match the audio distortion received on frequency 154.4 MHz within the Merced County Fire Department's audio receiver and speaker system in what appeared to be audio rectification interference."

Using direction finding techniques and monitoring CB 17, it wasn't long before they found the source of the signal creating the interference: A CBer operating from his home in that city. The CBer admitted to operating the CB station but denied causing interference to the fire department. The operator further denied the agents' request to inspect the station. Before leaving the house they left him with a Notice of Unlicensed Operation (NOUO) and warned him of the consequences of exceeding the legal limit, causing interference and refusing a request to inspect. The operator refused to accept the NOUO.

After leaving the premises the agents continued to monitor CB 17 and heard the CBer describing the agents' attempted inspection on the air. Later that afternoon they noted the interference stopped and the fire department also reported that the interference had ceased.

But, five months later another complaint came in from the fire department. Interference had resumed over the prior two weeks and appeared to be coming from the same source, lasting anywhere from 10 to 45 minutes at a time. The same CB operator could clearly be heard.

Agents again monitored CB 17 and direction finding equipment confirmed the source to be the same CB operator. This time the agents showed up with two Merced police officers. He still refused the request to inspect. The agents eventually left after issuing a second NOUO.

A few days later the Merced County Fire Department stated that CB interference had again resumed. That's when the FCC issued the Notice of Apparent Liability for Forfeiture in the amount of $7,000.

Communications is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from news clippings and links supplied by our readers. Many thanks to this month's fine reporters: Anonymous, Rachel Baughn, Bob Grove, Norm Hill, Bob Fraser, Steve Karnes, Gayle Van Horn, and Larry Van Horn.

SSTV in the Digital Age

By Dave Granoff K3AS

Recent improvements in computers, software, and sound card technologies have made it easier than ever for the amateur radio operator and Short Wave Listener to enjoy the analog and digital image modes found on the HF bands. Still images and data can be exchanged reliably around the world with amazing color and clarity.

Not many years ago image communications required a substantial amount of technical know-how to set up and execute, and often the "video" station required unconventional equipment. This is no longer the case, and anyone with basic computer knowledge and radio skills can configure the (mostly) plug and play hardware and software. The original cathode ray oscilloscope used for viewing facsimile images gave way to more "modern" Cathode Ray Tube (CRT) screens and as computer technology and LCD's evolved, analog Slow Scan Television (SSTV), Digital (DRM) SSTV, and KG-STV moved into the mainstream alongside the other popular amateur modes.

A PC or laptop must be connected to an HF radio and antenna capable of operating Upper Sideband (USB) to take advantage of the digital and imaging modes. By adding interface cables, a stable sound card, and imaging software, the station is complete and ready to operate. ATV (digital) and "live video" NTSC (analog) TV modes are also available to amateurs, but these modes are currently restricted to the VHF frequencies due to their wide bandwidth requirements.

What the Digital Image Modes Offer

Many amateurs have shied away from trying analog or DRM SSTV because they felt the whole process was much too technical to master or that the equipment was not within their budget. Some have thought it was a mode that belonged to an elite group of experimenters within the radio community, but this is simply no longer the case. Any operator who is comfortable using the digital modes such as PSK, or who wants to learn about them, should also consider the imaging modes as well.

If your station is already configured for the digital modes, you are ahead of the game, because most of the connections and sound card settings needed to run the imaging modes are similar. You have the ideal opportunity to create your own amateur "TV" station!

Communication by image transmissions using analog SSTV, DRM SSTV and KG-STV adds another dimension – visual pictures – to the realm of amateur radio and shortwave listening. It opens up an entirely new way of "watching" operators express themselves in a QSO. It brings new meaning to the old cliché that, "A picture is worth a thousand words." Most operators never forget the magic of seeing their first SSTV contact on their computer's screen, and often archive many favorite received images for later recall and enjoyment.

The operator personally selects and customizes his/her favorite picture images to send, often offering information about their person, station, or QTH. A theme may become established between the communicating stations to engage in an exchange of similar pictures. Nautical, celestial, nature, and comic themes are common. At other times, varied images of interest are sent. Frequently, images are sent for pure admiration or to bring attention to an event. One thing is certain – no two images are ever alike! In a very real sense, it is like receiving a new QSL card from the sending station on every exchange.

Pictures can carry embedded text containing the receiving and sending station call signs, signal reports, name, QTH, and other pertinent info. The text is easily added by the image software's editing program and created templates can be stored for instant recall. An entire QSO exchange often results in three or four images being sent back and forth between stations on a busy frequency. During quiet band times or on a side frequency there is no limit to the number of image exchanges that can occur.

Between image transmissions, stations often communicate using standard USB voice mode as well and each digital and analog SSTV transmission ends with a required CW trailer containing the sender's call sign.

The fun does not stop there. Participation in the digital image modes also involves delving into related interests of photography (digital or old-fashioned print), photo composition and modification, geography, computing, remote station control, propagation and more. Any of these areas could become a subject of discussion by itself. A chronology of received digital images is often likened to a mini walk through a *National Geographic* magazine.

There is an aura of anticipation while watching the pictures materialize on your screen. It has been likened to the excitement of waiting for a Polaroid picture to develop, listening for the delayed weak signal return from moon bounce, or hearing the affirmative reply from a rare DX station in a pile up.

How the Image Modes Work

Analog SSTV became the main analog imaging mode after its popularity with amateurs took hold in the mid 1950s, and it still remains the most popular imaging mode worldwide. It can be used to communicate over long distances, using medium to moderate power of 50-1000+ watts. It's also susceptible to the same ionospheric propagation variations and band interference that can challenge SSB and other digital modes.

SSTV is, however, the most durable of the popular sound card imaging signals. I have made many SSTV QSOs using low power settings of 50 watts or less over thousands of miles during times of favorable band conditions.

Transmission of JPEG, BMP and GIF images relies on a variation of frequency shift keying (FSK) modulation sent over a bandwidth of approximately 3 kHz on designated HF

frequencies. Colorful SSTV analog images are transmitted in still picture format and can take up to a minute or two to receive, one line at a time.

Image qualities range from perfectly clear and sharp to snowy or slightly distorted depending on external interference and conditions. Today, the two most common analog SSTV transmission formats typically employ 240 or 256 lines of resolution and are known as "Scottie" in the U.S. and "Martin" in Europe. In Japan, the AVT mode has 400 lines of resolution and "Robot" transmits in black and white only. Vertical Interval Signaling (VIS) codes are embedded in the transmission and provide automatic selection of proper decoding parameters and sender ID to the receiving software.

Within the SSTV software, an image is divided into horizontal lines of resolution. These lines are scanned from left to right, and then top to bottom. The pixilated RGB (red, green, blue) colors are converted into specific sound tones, sent in sequence to the transmitter's audio input through a sound card and transmitted at a constant amplitude (sustained transmitting power). Upon reception, software reverses the process and the sounds are decoded back into images.

DRM SSTV is less robust and more prone to decoding errors under weak signal and interference conditions, but successfully received images demonstrate fantastic clarity and stunning beauty. The decoded images appear as *exact reproductions* of the picture that was sent. DRM SSTV uses *digital* parameters to process images and is only termed "SSTV" because of its likeness in sending pictures. DRM in this application stands for Digital Radio Mondiale which, in the shortwave industry, is noted for Forward Error Correction (FEC). That's a means of duplicating encoded data that can be used to reconstruct any lost digital information during reception.

Amateur DRM software can receive and transmit almost any type of visual data, including pictures or print. Unlike analog SSTV software, which encodes data line by line, DRM software arranges and encodes electronic data into blocks. If weak signals cause the blocks to fall below the receiving software's decoding threshold, an image will not materialize. To correct this, a BSR (Bad Segment Request) is created and sent back. A fix file is re-transmitted to complete the image. Many operators like to avoid the need for these back and forth fixes and wait patiently for daily band conditions to improve before exchanging images.

KG-STV is the newest of the imaging modes and is the creation of Myoko-shi Niigata JJ0OBZ from Japan. This mode appears to combine the resiliency of analog SSTV transmission format with digital file encoding technology. KG-STV pictures deliver the digital image quality characteristic of DRM and it's able to punch through QRM like analog SSTV. KG-STV uses the familiar FSK modulation method for sending sound data, but only sends 15 compressed scan lines with each line containing 20 *digital* blocks of 16 x 16 pixels.

What is unique to KG-STV is that the high resolution blocks are published *individually* if received correctly. When any blocks fail to copy, the software creates a BSR that can be sent for a fix to replace the missing files. This new mode insures that a QSO can proceed even under challenging band conditions to display at least some parts of the high resolution digital image.

It should be noted that all of the modes described herein require their own unique software programs to operate.

The Hardware and Software Solutions

Setting up your station

For some individuals hardware set-up is a fun part, but for others it is a daunting technical challenge. There is good news for both parties – set-up is often straightforward and may take only a few minutes once you have most of the necessary information and parts at hand. Assuming that you already own a radio that can tune in USB and have a computer or laptop running Windows, Mac, or Linux, you're almost there! There is even an "app" for the Apple iPad (made by Black Cat Systems and available in Apple's iTunes store), that lets you connect to the radio's audio output and start receiving analog SSTV images directly on the iPad!

There are many different ways to configure radio receivers and transmitters to receive and operate the HF image modes, but they all rely upon a sound card. The sound card becomes the *heart* of your digital modes station and functions as a modem that transfers data between the software and the radio. More often than not, problems with transmission or reception of digital modes can be traced to a sound card problem. For this reason, it is suggested that a sound card used for HF radio fulfil three basic requirements: stability, RF isolation, and sound channel dedication. To best achieve these objectives, I suggest that an external sound card device is often the best choice.

If the native computer sound card is to be used with your radio, you must remember to turn off standard Windows or other computer sounds before proceeding, or ad lib computer sounds may distort the incoming audio data and inadvertently transmit sounds over the airwaves, an FCC no-no. On many occasions I have tuned to the digital mode frequencies and heard a classic voice in the background exclaim, "You've got mail!" If you're using a Windows computer, turning off Windows sounds is easy. Go to *control panel*, and select *sounds*. There you will find another sound tab. Click on the *no sounds* category and close the window.

Computer stability involves the ability of a sound card to adhere to a timed reference, and it's crucial. When unstable, a sound card can suffer from "clocking errors." Older or inexpensive sound cards are most prone to these errors and must be calibrated through a lengthy process using a known time standard, such as WWV. A wandering sound card clock can produce both reception and transmission distortions and contribute to a condition in the image modes known as "slant." The sound card must be in sync with other station's sound cards to exchange information properly. Instructions for correction can be found within the SSTV software programs themselves, and an excellent tutorial is found on Paul Young, G0HWC's SSTV site, at **www.G0HWC.com**.

Radio frequency shielding should be provided whenever computer cables or external devices are connected to a station to protect the susceptible electronic circuits. Stray RF feedback loops can produce distortion, hum, sound card and software data perversion as well as crashes.

Ideally, all equipment should be connected to a metal grounding strip that goes directly to earth. The sound card should be encased (when possible) in a metal enclosure and situated at the station as far away as possible from transmitting and power lines. Standard shielded audio cables are usually recommended for computer and radio connections.

In certain cases, when RF hum or loop circuits persist, additional ferrite beads and coils over the cables may be needed. At my own station, I was forced to add a tunable MFJ artificial ground unit (MFJ-931), which successfully dissipated stray RF from my station wiring. It turned out that my station had been serving as an accessory ground counterpoise to my 40 meter vertical!

Modern, stable sound card designs can be made from inexpensive kits or spare parts and commercial units are easy to obtain locally. Most are plug and play devices, either by USB or serial port connections, and should be connected with RF isolated cables. Instructional articles about external sound card construction and configuration can be found in abundance by searching under "sound card interface" on the Internet.

If the computer does not have serial (RS-232) ports, which has become a common finding on modern laptops, a serial-to-USB converter from Radio Shack or another local distributor can be purchased for about $20. Some ham radio manufacturers, including Ten Tec, also offer proprietary versions of plug and play sound cards that are designed to be used with their own radios.

The current gold standard of sound card modems is the sound card interface. These nifty devices control a number of functions and allow the user to match up nearly every radio design and computer on the market. They come with

a number of features that make connections, adjustments and calibrations simple. Many amateurs regard the sound card interface as a must-have addition to the modern digital station.

An interface provides effective RF isolation, plug and play functionality, custom configuration of PTT (push to talk), independent on-the-fly setting of sound card levels, and sometimes quick switching between one or more radios. Popular brands include Tigertronics, West Mountain Radio, MFJ Enterprises, Kantronics, Timewave, micro-Ham, Rig-Expert, and others. Each interface comes with detailed setup instructions and cables.

Choosing software

Now it's onto the "brains" behind the digital imaging modes. Today's imaging modes would not be possible without the excellent software that has been developed by talented individuals in collaboration with the amateur community worldwide. Analog, DRM and KG-STV SSTV are all separate and distinct operating modes that require separate software installations.

Popular analog SSTV software programs include Makoto Mori JE3HHT's MMSSTV version 1.13a; Simon Brown's DM-780 (now a stand-alone program from Ham Radio Deluxe); Jim Barber N7CXI's Chromapix version 1.6.17, and Nick Fedoseev UT2UZ's MixW. Every one of these programs works very well. MMSSTV and DM-780 are a free download and Chromapix and MixW require a purchase fee for long term use.

My main operating preference is MMSSTV v. 1.13a, which has released several recent software updates and is easy to use. The picture display window and embedded photo editors in MMSSTV contain many easy to use image modification settings and the main screen has a large image pane where you can store up to 300 thumbnail pictures and 1200 transmit templates for quick retrieval. MMSSTV provides an easy soundcard assignment menu and a tunable notch filter in the waterfall that attenuates interference with a single right click of the mouse.

Erik Sundstrup VK4AES' EasyPal Program is currently the main software used for Digital (DRM) SSTV and is a free download. EasyPal has undergone several recent upgrades that have made it more stable and easier to use. As mentioned earlier, images received by EasyPal are nothing less than spectacular. The program contains nearly a full page for the viewing pane, and images are received in a 16:9 full screen format. The full capabilities of a computer monitor are put to good use when carefully mastered shots appear.

The handy waterfall serves to receive station IDs, text, and even black and white "wav" images. Images can be sent to and retrieved from IrfanView, a free and a powerful picture editing program that can be set to run in the background. The software even has a QSL button that allows you to create a custom QSL from your image!

The new KG-STV program continues to evolve thanks to interest from the world amateur radio community. The software allows you to drag and drop images into the TX (transmit) window, automatically resizes them to the required 320 x 240 pixel size, and sends. A convenient text window also allows transmission of digital blocks containing text up to 510 characters at a time. SSB tuning is accomplished with centering guides on the waterfall and digital reception can be manually fine-tuned by a tuning "eye" graph to assure best decoding. Images are transmitted over a 1-3 minute interval and are exact digital reproductions with image quality equal DRM SSTV. The software is straightforward and easy to use.

You Can Do This!

If you want to use your computer's internal sound card to receive images only, you can try connecting your radio's *headphone* (sound output) jack to the computer's *mic* (sound input) jack. If audio voltage is insufficient to drive the sound card, you may need to connect the radio's *speaker terminals* to the *mic* jack. If you have an external sound card or interface sound card, connect the radio to the unit's *input* jack. This simple way works well for many people and is cost effective.

For amateurs who want to receive *and* transmit through a simple external sound card or built-in computer card, *shielded audio cables* are needed for all connections. Connect the radio's audio out to computer's mic input as described above and for the transmitting connection run a *shielded audio cable* from the computer's *headphone* jack to the radio mic's audio pin *input*. Different radios have different microphone pin configurations, so check your radio manual to find the proper pin.

The use of a sound card interface unit makes these somewhat confusing connections unnecessary. Units are supplied with intuitive instructions, necessary cables, and any internal jumpers specific for the operator's radio. Simple connections usually require an open USB (or Serial) port on the computer and an open data port on the radio. In any case, once the cables are connected, and the computer is rebooted, you are ready for the final step – the radio and software configurations.

Quick steps to SSTV success:

- Go to the computer control panel first and locate the sound cards dashboard. Once there, match the computer with its own sound card.
- Open the "software settings," and select the proper sound card that will carry the radio's audio.
- Double check that you have assigned that card's proper pathways to "sound in" and "sound out."
- Check for sound card activity in the open software program. Movement and tracings in the indicators suggest proper soundcard pathways have been selected.
- Place the radio in USB mode
- Set the Radio's SSB bandwidth filter to 3 kHz.
- Double check that the radio's bandwidth is 3 kHz by observing the receive waterfalls. A colorful and bright noise tracing should fill the entire width of the allowable waterfall screen. A black or narrow tracing suggest improper sound card selection, insufficient sound levels, or narrow bandwidth settings.
- Turn OFF all receiver filters: notch, roofing filters, ALC, and speech processors.
- Assign PTT settings through either CAT control and com ports and/or SSTV software and soundcard interface controls (this is easier than it sounds!).
- Check that the rig is tuned to the EXACT frequencies for the designated modes; a little bit off frequency may yield no copy.
- When transmitting, remember to 'throttle back' the power level below the full duty threshold recommended for your radio, to avoid damage to your finals!

With a little luck after your hard work, you will begin to copy images. Don't forget to read the detailed software tutorials that are contained in the menus. Familiarize yourself with the controls and functions that the software can perform before you begin to operate. Practice locating, editing, and adding images into the browser and create new templates from the basic ones that are included in the program.

Where and When to Tune

Look for the greatest signal activity during daylight hours on the higher bands and into the early evening hours on 40 and 80 Meters. Minor sound card gain adjustments may be necessary to optimize your set-up. Antenna permitting, look to 20 meters where a good deal of activity occurs daily on 14.230 MHz USB for SSTV and 14.233 MHz USB for DRM SSTV and KG-STV. If the waterfalls in your software are well lit and receiving background noise and tracings, be patient, because the wait is sure to be worth it!

In the meantime, if you have an internet connection, you can visit interesting websites at **www.g0hwc** and **www.worldsstv.com** and watch live still image receptions occurring 24/7 from around the world. These images are uploaded live every 90 seconds from stations who participate as monitors on several frequencies by automatically uploading received images at their stations using John Benedict KE5RS's excellent FTP Widget software application.

I've covered a lot in this article and I hope you have found the information instructive and helpful. I spend a good part of my airtime working the analog and digital image modes, and have met many interesting individuals there. Analog SSTV remains my favorite imaging mode for overall everyday use and for long range DX exchanges, but when band conditions are good, I tune in the digital image modes as well. I never grow tired of enjoying the beautiful masterpieces that DRM SSTV and KG-STV can deliver to my desk top!

For more information and resources about SSTV and the imaging modes, please begin your search at: "The Amateur Radio Resource Guide," **www.DXzone.com/catalog/Operating_Modes/SSTV**. My own site, **www.k3as.com,** also contains many useful links.

Life as an apartment-dwelling ham is full of challenges, technical, legal and interpersonal, but with ingenuity, stealthiness and a little luck, you can enjoy ham radio no matter where you live.

Stealth Operating:

How to Overcome Property Limitations

By Kirk A. Kleinschmidt NT0Z

It's more than a little ironic that, in an era when there are more hams than ever before, amateur radio itself is besieged by restrictive zoning regulations, overzealous homeowner and neighborhood associations, deed Covenants, Conditions and Restrictions (CC&Rs), "crafted" from crazy boilerplate, and "anti-expression" crusaders of every stripe. Reverence for property value seems to have replaced common sense and basic civility as the arbiter of social norms, at least in this country.

Perception is reality nowadays, and a ham's home is no longer his or her castle! The situation is bad enough for property owners, and it's worse for most renters. A quick glance at the various online ham radio discussion forums will show dozens of often heated debates about who's right and who's wrong when it comes to moving into "radio restricted" housing. In some areas unencumbered property is pretty easy to find. In many areas, however, deed restrictions and the like are a near certainty.

In most small towns here in Minnesota, for example, restrictions are rare. In Rochester, a big city in this neck of the woods, restrictions seem to encumber about 60% of available properties (and almost all newer properties). Whatever the mix is like near your QTH, chances are good that you're going to have to enjoy ham radio on the sly.

For years organizations such as the ARRL have been promoting various forms of legislative relief. The biggest success to date came in 1985 when the FCC enacted PRB-1 (**www.arrl.org/prb-1**), which preempted state and local ordinances that unduly restrict effective, reliable amateur radio communications. Local authorities can still regulate amateur installations on safety and health grounds, but they can't easily get away with blanket, arbitrary restrictions, special fees or outright prohibitions as they had in the past. Unfortunately, the relief offered by PRB-1 doesn't extend to properties already affected by deed restrictions, CC&Rs, or association agreements. The ARRL provides its members with extensive help on PRB-1 which is another reason to consider joining the League.

Other legislative initiatives aimed at extending PRB-1-type protections to all properties are presently in the works. The Amateur Radio Emergency Communications Enhancement Act of 2011, for example, is currently working its way through the House and Senate, but passage is anything but assured, especially in these turbulent financial and political times. Enactment, if and when approved, could take years.

Recent successes in the area of a "citizen's right to receive" include the FCC's 1998 "over the air rule," (**www.fcc.gov/mb/facts/otard.html**) which forces landlords and property associations to allow certain external TV and satellite antennas to be installed in a manner that preempts existing restrictions. This rule was enacted because TV is big business and money talks.

Getting a similar deal for ham operators involves getting the government to agree that ham radio's public safety value is significant enough to warrant the political "push back" that will accompany federal preemption. That's exactly the approach taken in the pending legislation (but don't hold your breath).

The Decision to Be Sneaky

Legislation aside, the decision to get on the air from your apartment, condo or townhouse is essentially yours. One man's scofflaw is another man's freedom fighter. If you see yourself more as the latter, the trick is to balance your interest in pursuing your radio hobby with the needs of others in your immediate vicinity. Even though you are choosing to operate under the radar, I encourage you to tread lightly and be respectful of others. Practice the Golden Rule.

It's certainly possible to install a 20-meter dipole in your townhouse attic and feed it 1500 W of RF. But in addition to exceeding the FCC's RF exposure guidelines, you'll undoubtedly make life needlessly difficult for your neighbors and your family, if not yourself. Some stealthy installations can handle high power (if the antenna is hidden in a grove of trees 200 feet into a swamp behind a cluster of townhouses), but most are best restricted to 5 to 50 W for very practical reasons. It's just the right thing to do for everyone involved. Remember, even 50 W of RF indoors may couple into the ac power mains and dim everyone's lights in time to your modulation, not to mention messing with TV sets, stereo equipment and computers. A complete list of resources and information about complying with the FCC's RF exposure rules is available at **www.arrl.org/rf-exposure**.

Deciding whether to tell your landlord, or certain neighbors, about your radio-related plans can be tricky. If they react badly, going ahead with your plans could expose you to eviction, lawsuits or just about anything in these litigious times! If they commiserate and cooperate, however, your ham radio success could be greatly enhanced. I have successfully made both decisions over the years.

When I moved to Connecticut in the late '80s, I rented a third-story apartment from a ham landlord (the best kind) after operating for three months with an invisible wire antenna that ran from my motel room window to the top of a big willow tree in the back lot!

In my present condo, after determining that my next-door, "on the other side of the common wall," neighbor was as annoyed with the townhouse association as I was, I asked him if I could extend my attic antenna into his attic space. After I assured him that I would quickly handle any RFI issues (there were none), he agreed, which allowed me to install a killer 40-meter horizontal loop into "my" attic space.

When I rented an apartment in an older downtown brick building, I traded a tiny amount of janitorial work (a big help to the out-of-state landlord) for unrestricted access to the huge flat roof of the entire building! I attached a 6-meter beam and a rotator to an abandoned TV mast and used another existing wooden pole to support a 102-foot dipole and an auto-coupler. At 40 feet above the street, these "apartment antennas" were awesome, although not stealthy by strict definition.

In situations where my gut told me that I was unlikely to get official permission, I carefully installed stealth antennas on my own. When I lived in the below-ground level of a "professionally managed" brick 8-plex, I ran an insulated wire out my ground-level bedroom window and worked the southwest downspout against a single counterpoise with an MFJ antenna tuner. A perky sunspot cycle helped my QRP CW signals work the world.

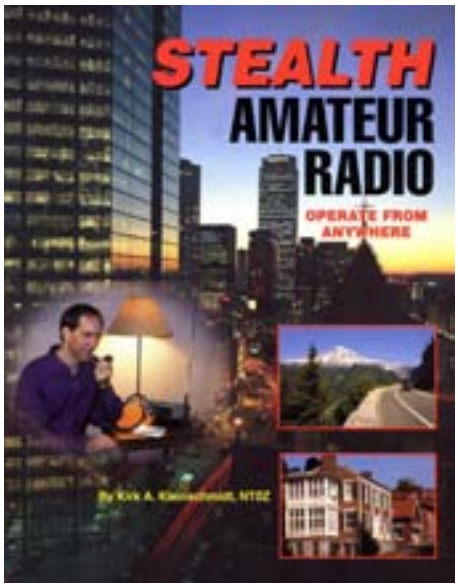
When I lived in a fourth-floor brick dormitory in downtown Fargo, I attached a lead fishing sinker to the end of a 24-gauge enamel-covered wire and dangled it out the window, working the "upside down vertical" against a 1/4-wave counterpoise that ran around the baseboards of my room. I closed the window on a 1-foot-long wooden ruler to space the dangling wire away

MFJ's Model 1786 magnetic loop and remote control box, shown at ground level for photo purposes only, offers continuous coverage of 30 through 10 meters (ham and SWL) with a single, compact antenna.

from the brick wall on the alley-side of the building. It, too, worked great with only 1 to 5 W.

Apartments, condos and townhouses come in a near-infinite variety of shapes and sizes: basements, walk-ups, high-rise, with attics and without, townhouses, farm houses, you name it. Landlords may be laid back or "by the book"; they may also live on site, nearby, or six states away. Each property and landlord requires a tailored approach. For your sake, when deciding whether to disclose your intentions, may your instincts be true!

When it comes to actual, factual, legal issues, as a renter, you don't have a strong position with any authorities. A landlord can't simply walk into your apartment at any time of the day or night to watch the game on your big plasma TV, but landlords do have the right to enter your property in emergencies, at the request of the police, etc. (laws vary by jurisdiction). If your radio activities garner too much attention, cause too much interference, and can be traced back to you, you can expect your landlord to take steps, sometimes draconian steps, to eliminate the problem (in this case, you!).



My book, Stealth Amateur Radio, which covers the topics presented here (and more) in much greater detail, is now available for the Amazon Kindle and as a PDF at www.stealthamateur.com. The site also has additional links, resources and articles about successfully hamming under the radar.

From a practical standpoint it doesn't matter who's right, who's wrong, or who has an FCC license. It's just not enough in the real world to be technically correct. Depending on your location and the individuals involved, getting into a tangle under these circumstances can get you harassed, shunned, ostracized, attacked, bankrupt, evicted or all of the above.

In 30-odd years of mostly stealth hamming I have never had more than a minor, easily resolved issue or two. That's why, even though I have always chosen in favor of getting on the air no matter what the circumstances, I recommend a balanced, safe, reasoned approach to stealth radio that includes good manners and low-power operating.

Common Stealth Issues

There isn't enough space to adequately address every detail of successful stealth operation, so let's get right to the biggies. Morse code and the various digital modes such as PSK31 and Olivia are your best bets. They have way better signal-to-noise performance than SSB and other voice modes, and they can't easily be traced to you, the stealthy operator. If you're practicing the Golden Rule, keeping your power down, making sure your station is technically sound, etc, you may still be interfering with a neighbor's stereo, TV, or other electronic device. And, if you're running SSB, AM or FM it may be possible for others to understand your distorted speech, pointing the "fickle finger of interference" straight at you! If your neighbors hear hissy, clicky, distorted dots and dashes or a weirdly droning digital carrier coming from the speaker of a cheap clock radio, unless they know Morse code, you're in the clear. "Premeditated digital operating" might seem a bit unsettling, but it's absolutely practical.

Because of a typical stealth antenna's physical size relative to its ideal size, low-frequency operation is much more difficult than high-frequency operation, especially with indoor antennas. If you can somehow construct an invisible, full-size 80-meter vertical antenna, more power to you! It will work a lot better than loading up a 20-meter dipole in your attic! For most stealth antennas, working 20 meters and up is easier than working 160 through 40 meters.

Within reason, the bigger an antenna is, the better it performs. A 20-foot vertical whip works better than a 10-footer, which works better than a five-footer. Similarly, the higher an antenna is, the better it performs. And, with a few exceptions, outdoor stealth antennas generally outperform indoor antennas (although a 15-meter dipole inside the penthouse suite of a skyscraper may work better than a similar outdoor dipole 10 feet off the ground).

As hams, stealthy or otherwise, we need to be primarily concerned with two types of grounds: electrical (safety) and RF. Electrical safety grounds are designed to protect you (and your house) from electrical shock and related fire hazards. In an apartment, your electrical safety ground is almost certainly a terrible RF ground, as are water pipes, gas lines, etc. If you connect

In 2010, during a year of casual operating and rather poor overall propagation, Bill Mabry N4QA, of Radford, Virginia, made 560 contacts on 160 through 6 meters, 558 of which were at 5 W or less, using this downspout as his antenna! Fed with an ICOM AH-4 auto-coupler for lightning-fast band changes, Bill calls the antenna GADS, short for Gutter and Down Spout. In addition to working QRP DX on four continents, Bill worked all states except Hawaii and most Canadian provinces. If Cycle 24 perks up in 2011, look for Bill to be busting pileups in every direction! (Photos courtesy: N4QA)

RF from your antenna system to these, you may cause or aggravate potential interference and noise problems. In most cases, your station is already connected to this safety ground through a properly wired 117-V ac receptacle.

RF grounds are complicated and can't be adequately addressed here. For our very limited purposes, you should know that the radio-related functions of an RF ground are distinct and separate from the safety related functions of an electrical safety ground. Every station needs an electrical safety ground, but many stations work better and cause less interference by eliminating conventional RF grounds.

In the simplest terms, balanced antennas such as dipoles and loops don't require RF grounds to work well. Because of their electrical characteristics, they have "built-in RF grounds." End-fed wires, random wires and typical vertical antennas require good RF grounds to function well and to minimize RFI. These designs need

radials or counterpoise wires to function well and can be difficult to implement, especially for beginners.

Antennas are the Key

As Howard Cosell often said: "the antenna...always, the antenna!" There's no escaping it: whether stealthy or completely out in the open, your antenna will largely define your success as a ham. Focus your attention on your antenna(s) before worrying about the rest of your stealthy station setup. Stealthy antennas may be outdoors, yet invisible (or nearly so), hidden indoors or inside "innocent-looking objects," or disguised as something else, such as a flagpole, downspout or the guy wires of a rooftop TV antenna mast (which may be allowed under the new rules).

The designs are mostly conventional. Dipoles, loops, end-fed wires and verticals are common. These antennas may be made from small-gauge wire and hard-to-see insulators, but they're still traditional in every other sense. Antennas specifically designed for restricted installations, such as magnetic loops or base-loaded whips that clamp onto balcony railings, aren't breaking any laws of physics, they're just not as common as the rest. Because each stealth installation is unique, take the time to explore your antenna options thoroughly before making a decision.

As mentioned, outdoor antennas tend to work best, so if you can safely hide or disguise your feed line, antenna wire, insulators and support ropes, an outdoor antenna may be your best bet. The antenna books suggest that you build wire antennas from 12-gauge Copperweld® antenna wire, heavy-duty ceramic insulators and weather-resistant Dacron rope. This makes for great antennas, but they're far from stealthy!

Instead, try 26- to 30-gauge hard-drawn brass or stainless-steel wire. Stainless-steel doesn't solder as well as brass, but it's super strong. Small-diameter braided steel wire used to make fishing leaders can also work well. It's a bit "springy" and pricey, but it's very durable and impossible to see unless you're right on top of it. Purists will cry foul about using steel wire for antennas, but don't worry about it. Steel isn't as good as copper, but it's a heck of a lot better than no antenna at all, and the practical performance differences are negligible, as many stealth ops have discovered.

Instead of big-ol' "dog bone" insulators, tiny, invisible end insulators can be made from tiny pieces of 1/4-inch-thick Plexiglas, or you can use a clear or pearl-colored 4-hole button (from an old shirt). If Dacron rope is too high profile (and it is), try my stealthy support rope secret weapon: clear or sky blue weed trimmer line or heavy-duty monofilament fishing line.

I've used weed trimmer line to hold up large non-stealthy loops and dipoles for years. It's almost invisible once it's up in the air, it's obscenely strong and durable and it snakes through trees and bushes without complaint. It's also inexpensive and widely available. Super-stealthy installations should probably use heavy-duty fishing monofilament which is even harder to see. If they're accessible, people will also walk into tiny wires, so be careful with placement and be sure to check on your outdoor stealth antennas regularly, fixing them as necessary.

Most indoor antennas can be made from standard-size components unless you need to appease housemates and spouses on aesthetic grounds. As with outdoor designs, the bigger, the higher, the better. If you have access to a walk-up or crawl-up attic space, that's a good place to start.

Try to keep your indoor antennas or antenna wires away from metal objects such as wall studs, pipes, flashing, ductwork, existing runs of house wiring, attic-mounted furnace or air-conditioning hardware, etc. Wooden studs and plywood roofs with asphalt shingles are best; steel siding and steel roofing are the worst (really try for an outdoor solution).

Even in a small apartment with no attic it's usually possible to find the space to put up a dipole for 10, 15 or 20 meters. Perhaps the best way to install an indoor dipole is to run the insulated wire elements along the wall/ceiling juncture and run the coax up the wall in a corner. This keeps the room looking nice and tidy. I often use old-school, screw-in, stand-off insulators to space the antenna wires a few inches away from the wall, but if your insulated wires are mounted on the surface of the wall, feel free to paint them when you paint the wall for extreme camouflage (works on exterior wood walls, too).

Horizontal loops are recommended over dipoles and are usually better performers (see this month's and last month's *On the Ham Bands*). As with a dipole, run the coax up the wall in a corner and run a closed loop of wire around the perimeter of the wall/ceiling juncture. A standard antenna tuner, an auto-coupler or a specialized small-loop tuner will probably be required for both antennas. That's okay. With indoor installations, having a naturally resonant antenna isn't necessary (or even possible).

To cure "odd RF behavior" that may manifest, add a counterpoise wire (a form of RF ground) to the antenna tuner's ground terminal if necessary (mostly needed for unbalanced antennas such as random wires). The simplest counterpoise is a single wire cut to a quarter wavelength at the antenna's lowest operating band. A deluxe counterpoise consists of quarter-wave wires cut for each desired band of operation (the wires can be taped together and run as a single wire). Counterpoise wires are typically run around the perimeter of the room at floor level. Because of practical size restrictions, routing a counterpoise sized for the higher bands is easier. Make sure the far end of each counterpoise wire is insulated (wrapped with electrical tape). If necessary, use one of the "artificial grounds," essentially an antenna tuner for your counterpoise, made by MFJ or Ten-Tec. Use low power and experiment as necessary.

Ready-made indoor antennas are available from several sources, and some work better than others, depending on your exact circumstances. MFJ makes several magnetic loops, antenna tuners designed specifically for tuning small indoor loops, and base-loaded vertical whips designed for space-restricted and indoor operation. The units generally cover 40 through 10 (or 6) meters and have been used effectively by many stealth-mode hams. See all of MFJ's stealth accessories

Designed to tune wire or copper tubing loops without radials or grounds, MFJ's Model 935B high-efficiency loop tuner is an interesting addition to the company's lineup of stealth radio accessories. (Courtesy: MFJ Enterprises)

www.mfjenterprises.com.

At $400, MFJ's Model 1786 magnetic loop is a bit pricey and can be tedious to use for "band hoppers," but it covers 10-30 MHz continuously, puts out a good signal and offers other receive-only benefits for stealth ops. It's a one-meter plastic and metal loop that can often be unobtrusively mounted outside, on balconies, etc. It looks more like a bird perch/feeder, a piece of modern art or a UFO detector than an antenna, so it can sometimes hide in plain sight.

Some operators mount mobile whip antennas to their balcony railings, working them against a set of counterpoise wires instead of a car body (the counterpoise wires probably work better anyway!). Flagpoles that are actually vertical antennas are popular with those who can get away with planting one in their yards. Several radials are required for reasonable performance, but a 20-meter vertical flagpole is only 16 feet tall. With an auto-coupler hidden at the base, this antenna can be used effectively from 40 through 10 meters. ZeroFive Antennas, Steppir and other companies make multiband flagpole antennas if you don't want to make your own.

For many space-restricted hams, VHF/UHF bands are prime territory. At these frequencies antennas are physically small. Putting up a small beam antenna isn't out of the question. When I was getting acquainted with 440-MHz FM, I simply aimed a small beam out my third-floor window. I hit several area repeaters with no trouble and had many simplex QSOs, too. In many metro areas, the rubber-ducky antenna that comes with VHF/UHF hand-helds will be more than enough to access several local machines. Here, indoor antennas may be no sacrifice at all!

There's a lot more information to uncover about stealthy operating and I encourage you to explore the Internet, which is awash in information about stealth amateur radio and examples from hams at all experience levels who have taken to operating "under the radar" or "in the shadows."

Even if you're apartment-bound or stuck in condo hell, you can still enjoy ham radio if you get creative and don't give up. Ingenuity, inspiration, and experimentation may be required, but that's what ham radio is all about. See you in the shadows!

MT

Young Ladies' Radio League QRV since 1939

By Cheryl Muhr N0WBV
(All photos and graphics courtesy the author and YLRL)

There are many subsets to the hobby of amateur radio. Many hams are interested in one subset in particular, while others are interested and participate in them all. Some like to talk to operators in other countries. Others like to participate in contests where they try to contact as many other hams as they can in a certain amount of time following certain criteria.

Some operators like to go on DXpeditions to distant or rare places where they set up their radio gear and work as many other hams as possible while they are there. Still others like to collect the QSL cards that operators send each other to confirm they talked on a specific band at a specific time on the air. Many prefer providing emergency communications in times of disasters.

There is one other subset of ham radio: the YL or Young Lady. In amateur radio parlance a female is a "Young Lady" no matter what her age. Every male is an "Old Man," abbreviated as OM, regardless of his age.

The largest organization for YL ham operators in the world is the Young Ladies' Radio League (YLRL), which exists to encourage and assist YLs throughout the world to become licensed amateur radio operators. It also sponsors and otherwise carries out programs to promote YL interest, appreciation, and understanding of radio communications and electronics, and encourages them to advance and improve their skills as amateur radio operators.

The Young Ladies' Radio League, Inc., began when one YL wanted to see if there were any others out there. Thus, twelve women banded together in a male dominated activity, growing an organization that reaches around the world.

It all started with an ad and a letter

In May, 1939, an ad with an elaborately-curlicue border appeared in the magazine *QST* that began, "Dear YL's – The nearest thing to a pair of lace gimmicks that our printer has – and we had to catch your eye in *some* way!"

That lace-bordered ad for the book *Two Hundred Meters and Down*, written by a gentleman, caught the eye of Ethel Smith, then W7FWB, later K4LMB. It led her to wonder about other YLs in a hobby that "simply *reeks* of MAN-Power!" according to the ad about the book.

She wrote back to the editor: "That lace-bordered ad of 'Two Hundred Meters and Down' brought up a point that has my curiosity aroused for some time: How many 'YL key twitchers' are there?" She wondered, "Nobody seems to know, but I think we [YL operators] would tell. I should like to have you [*QST*] publish this letter or some kind of a request to have the YLs make themselves known."

Ethel Smith W7FSW, later K4LMB, at the radio, reprinted from CQ-YL

Her full letter was published in the July 1939 *QST*, asking the other YLs out there to please "send all the dope to me. Perhaps we should band ourselves together in a YLRL or something to that effect and make these woman-ignoring authors sit up and take notice." Twelve YLs answered that letter. The names and addresses were compiled and a tentative constitution was drawn up.

These twelve women became what are known as the founding mothers of the Young Ladies' Radio League. The constitution and by-laws were dated September 1939.

The Early Years

To promote YLRL all over the country, a District Chairwoman was appointed in each of the call areas. In November 1939, the first issue of the organization's publication was born. Titled *YL News*, it contained a single mimeographed sheet with a plea for new members, published by Enid (Carter) Aldwell, then W9NBX, later W6UXF.

It also asked for suggestions for a more dignified name for the publication and in December, it bore the name *YL-Harmonics*, a name chosen from approximately 20 entries.

By February 1940, YL clubs were being organized around the United States. In that issue, Enid warned the members "Beware the OM who passes himself off as a YL. W1IOR has been taken off our membership list since it was discovered that the only feminine thing about him was his desire to be a member of the YLRL!"

The first anniversary, November 1940, boasted an issue of *YL-Harmonics* with 15 pages. It also named the winner of the YLRL slogan contest, Anita Bein W8TAY, who submitted the slogan "QRV-I am ready."

The group had also previously been officially recognized in the Amateur Radio Relay League (ARRL) publication *QST* in an article titled "YL's Unite!" YLRL nets had begun, and now YLs could talk to each other at specific times on specific frequencies.

Defining a YL

There have been many controversies over the definitions of YL versus XYL. The term YL was first defined in a Traffic Report signed "The American Radio Relay League" by E. C. Adams on May 13, 1920 to Miss M. Adaire Garmhausen 3BCK. He was replying to her submission of an article submitted to *QST* on "How to Build a Wireless Station."

In it he called her "My Dear YL–" and stated, "We have had to coin a new phrase for your benefit as you will readily see that OM will not fit and OL [Old Lady] would certainly be most inapplicable." Although Miss Garmhausen wasn't the first YL ham radio operator, this is when the term was first applied specifically to label all women as Young Ladies no matter what their age.

The article was published in the July 1920 issue of *QST* and a second article of hers followed in May 1921, but it wasn't until October 1922, in the column "Who's Who in Amateur Wireless," that M. Adaire's picture was printed as she was honored along with another YL, Miss Winifred Dow 7CP, from Tacoma, Washington.

Many OMs have used XYL (meaning Ex-Young Lady) to describe a wife versus a single lady, but some women, though not all, take offence at this term, feeling that getting married does not mean a female is no longer a Young Lady.

In May 1940, the YLRL set forth the policy for *YL-Harmonics* and YLRL that the term "YL" was to be used of all licensed amateur operators of the feminine sex. This meant they were all young ladies no matter what their marital status was. A licensed female is a YL.

Pam Williams operating out of Belize as V31PW

Call to Action in a Time of War

Even before America's involvement in World War II, YLs had become involved with defense work. They taught code and theory along with their Red Cross work and worked in defense plants. YLs were living up to their YLRL slogan of QRV–I am ready. They were ready to participate in serving the War Department. Dot Knapp W2MIY, was the only female Radio Aide for AARS (Auxiliary Amateur Radio System, the precursor to the Military Amateur Radio System), while Viola Grossman W2JZX served with the Signal Corps. Other areas in which YLRL members served included the Army where they received AARS instruction in cryptography.

After reading an article by Anita Bein W8TAY titled "*YLRL QRV*," First Lady Eleanor Roosevelt wrote, "I have read with interest the story of the work carried on by the Young Ladies Radio League, and I applaud your sincerity and enthusiasm.

"At a time when all of us must be alert to defend the institutions we cherish, the work of the League is an inspiration, and I am sure will prove of inestimable value should the need for active defense arise."

After the attack on Pearl Harbor, the United States Congress issued the same order to cease all amateur radio operations that it had issued in World War I. Civilian transmitters remained silenced until after the war.

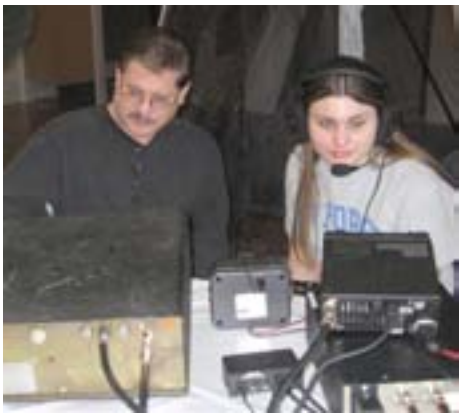
YLs volunteered their service and their experience as ham radio operators qualified them for specialized training. While many women learned factory work to become "Rosie the Riveter," YLRL members often became WIRES–Women in Radio and Electric Service.

YLs instructed all branches of the service in radio work, teaching classes that had doubled and tripled in size since before the war. Women amateurs were sought after for many positions because of their radio experience. They received Signal Corps training as radio operators and technicians as well as instrument repairmen.

After the War

The Young Ladies Radio League stayed banded together through World War II, and by 1950, they added a new contest in which both YLs and OMs could participate. The YL-OM Contest has the YLs call the OMs and the OMs, the YLs.

The contest was one way for many OMs to find YLs on the air in order to work towards



Mike N3TDV and Charlene KB3OMI at Field Day

earning the YLRL version of Worked All States certificate, YL-Worked all States. Other certificates included working one YL on each continent (YL-WAC) and YL Century Club (YLCC) for working 100 different YLs (the same YL with a different callsign doesn't count!).

In 1958, Louisa Sando W5RZJ wrote the book *CQ-YL*, chronicling the start of YLRL and many of the YL firsts in Amateur Radio. It has been revised twice since then and the current YLRL officers and members plan to revise it again to bring it up to date.

YLRL Conventions

Since the YLRL is an organization with members all over the world, it isn't easy to catch up over a Saturday morning breakfast. So, after much planning, the YLs descended on the Miramar Hotel in Santa Monica, California, for the first International YLRL Convention June 24-26, 1955.

The convention committee was comprised of members of the Los Angeles Young Ladies Radio Club, which also hosted the event. Members from all over the continental United States, Hawaii, Alaska and the Canal Zone were in attendance. OMs were invited as well and tours were provided

Rebekah WG4Y 2008

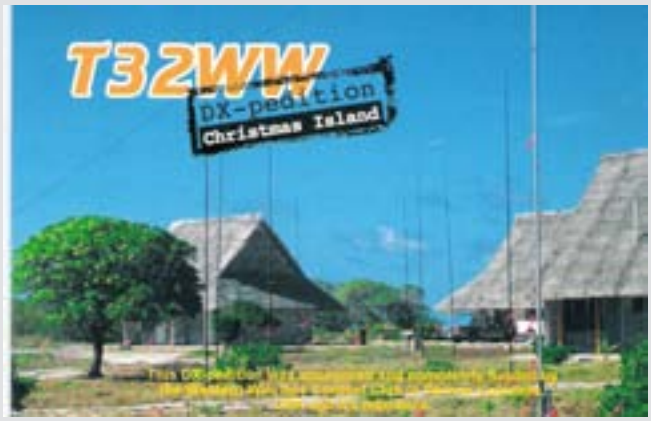
for them while the ladies got down to business.

The second YLRL convention was held in conjunction with the 9th National ARRL convention and drew the largest licensed YL attendance ever recorded at the time–nearly 100 female hams from 24 states, representing all the different call districts and one DX YL from Mexico. President Dwight D. Eisenhower included the YLs in a congratulatory message to the convention.

"Please give my congratulations to the members of the American Radio Relay League and to the International Young Ladies' Radio League jointly on the occasion of their 9th [YLRL's second] national amateur radio convention," he wrote.

Conventions since then have been held every three or four years so that they would always be held during an anniversary year. The location varies depending on who and which club has volunteered to take up the task. Conventions have been held all over the United States, coast to coast, including Albany, New York; Denver, Colorado; Honolulu, Hawaii; and on the Queen Mary in Long Beach, California.

The next convention is this year–July 21-14, 2011 in Quincy, Massachusetts, near Boston. The Women Radio Operators of New England (WRONE) are the hosting club and make up the current convention committee with Anne Manna WB1ARU, as convention chairwoman.



A YL ON CHRISTMAS ISLAND

In November 2003, eight Coloradoans (seven OMs and one YL) traveled to Christmas Island in Eastern Kiribati (T32) via Hawaii, with a brief layover to allow for airline delays and to make sure all the radio gear made it through – weight was the main issue.

Customs on Christmas Island went smoothly and we were quickly transported to the Captain Cook Hotel. We stayed in bungalows separate from the main hotel, so our radio activities wouldn't disturb the other guests.

Despite occasional brief rainstorms, the weather was perfect for the radio operations as well as for fishing and scuba diving. Radio equipment and antennas for every possible band and mode were unpacked before anything else. Assembling antennas took most of the day. Designs included customized poles based on pictures in the Microlight DXpeditions book. We had antennas set up for 10 through 160 including the WARC bands and used every one.

The stations consisted of an ICOM 756PRO and two 756PROIIs; Alpha 76 and 78 amplifiers; ICE band pass filters; Heil headsets with microphones; laptop computers, and a paddle for each. RTTY was used on two of the stations with a KAM TNC and MMTTY.

The CQWW CW contest was one of the main reasons for going and everyone in the group got a chance at operating during the contest as T32WW. It was incredible to finish the contest with a contact rate almost as strong as at the start! Our contest score was just over 7800 contacts. As a group we made over 31,000 contacts in a two-week period talking to 161 countries.

Front and back of QSL from 2003 DXpedition to T32WW Christmas Island, East Kiribati. Group photo on back shows author Cheryl N0WBV and her husband John KT0F (dark shirt next to Cheryl) with other members of the Western Wireless Contest Club, Denver, Colorado.

YLRL Membership

The Young Ladies' Radio League is still going strong today. The membership ebbs and flows with the economy, health, and new ham statistics; boasting a high of approximately 1500 members. The membership numbers vary every year, as do the ages of the members. As of today, the age range of members has been as young as seven and as old as 104.

OMs Can Participate Too!

OMs can also be involved with the YLs and YLRL. While OMs do not have voting rights, they may become a subscriber to *YL-Harmonics*, if they do not have a licensed YL in the family. OMs can earn many of the certificates given by the YLRL, including the YL-Worked All States, YL-DXCC, YL Century Club (YLCC), and YL-WAC.

The OMs are encouraged to participate in the YL-OM contest each February; in fact they are the very reason for this contest! It is held around the Valentine's Day weekend and YL-to-YL and OM-to-OM contacts don't count. Clubs and individual operators may use CW, SSB, or digital modes.

Merri AB0MV works as part of the W1AW/0 team for IARU

YL-Only Certificates & Contests

In addition to the certificates the OMs can earn, YLs can also earn certificates and awards that the OMs are not eligible for, including the Continuous Membership certificate and YL-DX certificate. (A YL works 25 different YLs outside of her own country.)

Each year there is also a YL-only Friendship Award to earn. This year's award is for working 15 different YLs and collecting a favorite color from each one. The catch? You can't use the same color more than once; however, light blue, blue, dark blue and navy are all considered different colors.

Though you may hear YLs on the air in many of the contests throughout the year and in the YL-OM contest, there is one contest that is specifically for YLs to contact each other. It was formerly two contests now combined into one. Held in October, the DX-YL to NA-YL Anniversary Party merges both the DX-YL to North American YL contest and the YL Anniversary Party. It is a YL-only contest where YLs in North America try to contact all foreign YLs and vice versa. It is held in October, but represents the Anniversary of the start of YLRL.

YL Nets

YLs can find each other on the air during YL nets. OMs are not allowed to participate during a YL-only net, but YLs are often happy to stick around afterward and talk to them. It is a great way to find YLs for the YL certificates.

YL-only nets include, but are not limited to: The Tangle Net on Thursdays at 1800 UTC on14.297 MHz; the DX-YL net on Mondays 1500 UTC on 14.280 to .290 MHz; and the Unofficial YLRL net held Thursday evenings. The YLRL net tries to get as many women on as possible by operating in the general portions of the ham bands, and it starts 02:00 UTC (1 hour earlier in summer-DST) on the 20 meter band and moves to the 40 meter band at 02:30 UTC depending on conditions. Frequencies for the YLRL net are +/- so as not to interfere with active conversations, but the net can be found near 14.288 MHz and 7.194 MHz.

YLRL Scholarship

The Young Ladies' Radio League also provides two scholarships of just $1,500 each year. These scholarships are offered in memory of two of the founding mothers – Ethel Smith K4LMB and Mary Lou Brown NM7M. The Mary Lou Brown scholarship was created posthumously to honor her immense contribution to the organization. She was not only a past President, but was extremely active with the scholarship fund. After her death it seemed fitting to honor her with a scholarship in her name.

The scholarships are granted to, "Worthy Young Ladies for continuing their education, with preference given to those in the academic study of communications and electronics or related arts and sciences," according to the YLRL by-laws. A ham license is currently mandatory for all scholarships being administered by the Foundation for Amateur Radio as these two scholarships are.

YLRL at Ham Radio Events

Members of the YLRL can be found at Hamfests all over the world. YLRL members have tables with YLRL themed merchandise, past issues of *YL Harmonics*, certificate information and brochures.

Mio JR3MVF at BY4AA station

Board of Directors on the Queen Mary for YLRL Convention 1999

You may also find YLRL members at these events presenting a YL forum as well. Themes can be anything from the YLRL and its history to local YL clubs and what YLs are currently doing in amateur radio.

Every year at the Dayton Hamvention® in Dayton, Ohio, the YLRL and the Buckeye Belles (a local Ohio YL club) share a table to greet YLs in attendance. The YLRL also moderates a YL forum at the event, which this year will be held from 1:00 pm to 2:15 pm on Friday, May 20th.

Belonging to YLRL

The original dues for membership in the YLRL in 1939 were 25 cents and inflation has risen a bit since then. Today dues are $15 a year which covers 6 issues of *YL-Harmonics*, one of which is a members-only Directory edition.

All dues go to printing *YL-Harmonics*, mailing costs for ballots and renewal forms, and any other mailings and supplies, as the YLRL is a non-profit organization. Under the constitution and by-laws, no dues money goes towards the scholarship fund.

The YLRL can be found on Yahoo groups under YLRL and on the Web at **www.ylrl.org**, where the website is currently undergoing construction and updates. Membership forms and officer contact information are all on the website.

YLRL Today

Nearly 75 years after that fateful question, "Are there any YLs out there?" the answer is a resounding yes – the YLs are out there and active! Ethel Smith started an organization that has outlasted its founding mothers, but is still going strong with members all over the world. Though none of the original twelve founding mothers are with us any longer, there is at least one member who has earned 64 years of continuous membership and another with 63 years. A handful of members have 50-55 years of continuous membership as well.

Members are from all walks of life, all ages and all levels of ham radio interest. Whether they got into the hobby to talk to their spouse locally or go around the world to the strangest of places, one of the many radio interests they have in common is other YLs. The YLs are still QRV and still on the air.

About the Author:

Cheryl Muhr N0WBV was first licensed in April of 1993 and joined the YLRL when she found it at the Dayton Hamvention® a year later. She earned her Extra Class license in early 2000. She was the YLRL 10th District Chairwoman for 10 years before serving as President from 2004-2005. Currently she is Vice-President and Publicity Chairwoman as well as editor for YL-Harmonics, a position she had held for the last 7 years.

She is a member of many YL organizations including those in Japan, Canada, New Zealand and England. She is a member Scandinavian Young Ladies' Radio Association (SYLRA) and traveled to the SYLRA meeting in Norway in 2009 where they finished by operating out of Svalbard (JW) in the Arctic Circle. She is also a member the Australian Ladies' Amateur Radio Association (ALARA) and went to Tasmania (VK7) for their 33rd anniversary ALARAmeet in 2008.

She holds amateur radio licenses and has operated from Midway Island (KH4), Turks and Caicos (VP5), Grenada (J3), Svalbard (JW), Christmas Island/Eastern Kiribati (T32) and is believed to be the first civilian YL operator to operate from Midway Island. She loves going on DXpeditions and being DX as well as operating from her home state of Colorado. Though she passed her 20WPM code, she finds that a female voice tends to get through better in a pile-up. She may be contacted at n0wbv@earthlink.net MT

The Uncommon Life of Charlie Gyenes W6HIQ

(All photos and graphics courtesy Charlie Gyenes W6HIQ)
By Ken Reitz KS4ZR

NASA ground-penetrating-radar antenna

If you hope to keep pace with Charlie Gyenes W6HIQ, you'd better get an early start, because on a typical workday morning, by 4:30 he's already in pursuit of his next antenna project. The 73 year-old native of Hungary and owner of Hi-Q Antennas likes to say he's a one man business working out of his garage. While that's technically true, he does so in a league of his own. Few garages sport the sort of sophisticated metal working machines, electronic analyzers or the non-stop brain power of the man who just likes to be called Charlie.

What Makes Charlie Run?

As a 13 year-old in Soviet-dominated Hungary, Charlie was desperate to learn to fly, but he was too young to get a pilot's license and even a glider pilot needed to be 14 years old. "A little monkeying around with some paper work, and now I could learn to fly gliders," Charlie chuckles. Sixty years later he's still flying.

By 1956 he was an apprentice in electronics and manufacturing engineering at Iskolai Taneszkozok Gyar, laying a foundation for another lifelong interest in electronics and manufacturing.

"When I was 18 years old it was illegal to own any kind of radio that had any capability to receive shortwave, and it was quite obvious that, you know, when something is illegal when you are young, you definitely want to make it legal yourself!"

It was also illegal, under the Communist system to learn any foreign language other than Russian. The only way to learn English was to build a radio that could receive Radio Free Europe, BBC and the Voice of America. "I got together with other guys that were also doing this illegal thing, building things, and we actually came out with a little one-tube radio that we were able to listen to broadcasts from England, France and some from Germany."

Charlie (now) and Soviet-era radio (then).

But, for the time being, amateur radio would be out of young Charlie's grasp. "In Hungary in those times, there were radio clubs, but because of the Communist regime, in order to participate you had to be a member of the Youth Communist Party which I had no great interest in." It would be another five years before Charlie would get his first ham ticket.

After he and his family fled Hungary in 1958 they stayed briefly in France and soon emigrated to Canada where they settled in Vancouver, British Columbia. "I very quickly got involved with coworkers who were hams and I began to study for my ham ticket with great aches and pains and super difficulty, because I wasn't really speaking English." Because he had to translate Morse code in his head into Hungarian and then English it took him three years to master both. In 1962 he finally got his license and the call VE7BOC. After that he got involved with many hams across the border living in the Seattle-Bellingham, Washington area.

It was during transmitter fox hunts that his previously earned electronics, engineering and manufacturing abilities came into play. "I got interested in antennas, especially VHF and UHF and improvement of communications antennas. My mentor was D.K. "Don" Reynolds, a professor at the University of Washington and a ham. Many, many times when I came up with a new design for an antenna he would be testing it at the university antenna test site, which they had inherited from the U.S. Navy after the war."

That's when Charlie started earning an income from manufacturing antennas. He made 2 meter, 220 and 440 MHz gain antennas and sold them to other hams and local police and fire departments in the Vancouver area. But, the economy in Canada in 1965 was not good to Charlie. The greener pastures of the United State beckoned, so he moved south to Anaheim, California. He took a job with National Cash Register (now NCR), at the time an up-and-coming computer company with century-old ties in the business world.

A Full Career in Aviation

"When I came to the United States, things picked up and I began to make good money and was able to buy gliders and then I started my own aviation business called Glider Aero, Inc. Then I bought a company involved in the importation of sail planes from Europe and then set up the distribution network in the western world for these planes."

In those days, Charlie says, Polish and Hungarian gliders were excellent, but they were from a Communist system, so it wasn't easy for them to have dealerships in Australia, Japan, and New Zealand where there was a demand for such items. To accommodate the demand he started another company, Aero Sport, Inc. at Lake Elsinore, California airport. "We built a 20,000 square foot hangar and facilities and we imported 2,200 gliders, motor planes and aerobatic airplanes." The business was so prosperous that he left NCR in 1970 and for the next ten years ran Aero Sport.

Charlie's Aero test-bed.

Then, there came an offer he couldn't refuse. "I was operating out of the Long Beach, California airport and planes from my company would come into the airport, get assembled and get flown out of that airport. The director of foreign trade for McDonnell-Douglas saw what was going on and before you know it, he offered me a job. At the time they were selling a lot of Douglas and Boeing planes to Europe, and even parts of the 'Evil Empire,' but we had to buy back their products 'counter-trade and barter,' it was called."

Thanks to his Eastern European background, his language skills and amazing salesmanship, Charlie was soon responsible for all of Eastern Europe and Scandinavia for McDonnell-Douglas. The barter aspect proved interesting, too, "Once we sold 28 airplanes to Yugoslavia and bought back hams and candy and jewelry and tools."

Shortly after that, Charlie was working for

Gulfstream Aerospace. "I was vice-president of marketing, selling those beautiful $50 million business jets. But, by this time Boeing had discovered that if we want to do business with Eastern Europe then we need somebody who knows those areas, and before you know it, I became president of Boeing Aerospace and opened up an office in Budapest in 1996." In forty years, Charlie Gyenes had come full circle.

He stayed with Boeing until he retired in 2001 and that could have been the end of his story. But, Charlie isn't the type to retreat to the golf course or just enjoy flying his plane or visiting his children and grandchildren. Instead, Charlie started a new career, picking up where he left off many years before, by launching Hi-Q antennas (**www.hiqantennas.com**).

No Sign of Retirement

When he retired from Boeing, he decided that his ham radio hobby needed to be turned into something that kept him busy. Charlie isn't content to waste away the rest of his life ragchewing on 80 meters with the rest of the retirees, swapping stories about medical aliments.

When he launched Hi-Q Antennas in 2001 he specialized in high-quality, high-ticket, VHF/UHF and HF mobile antennas and, to hear him tell it, they've been extremely well received. A check with **www.eham.net** proved him right. Of the 17 Hi-Q Antenna products reviewed by ordinary hams, the lowest rating was a 4.7 out of five. The other 16 Hi-Q products rated 5 out of 5 across the board. Every review would make dream ad copy for any antenna company.

It happened that as he started his business, the U.S. military was ramping up operations in Iraq and Afghanistan and that many of his original mobile antennas were being used by hams in the military. As he looked into what the military was using for mobile antennas Charlie was appalled, "What they were using were antenna systems that dated back to the Korean War!"

So, Charlie formed a separate division for military sales called Hi-Q Military (**http://www.hi-q-militaryantennas.com**) which makes antennas for Homeland Security and emergency services as well. He makes all manner of mobile communications antennas such as the Hi-Q-6/2-30 MC4, a remotely tunable antenna specifically designed for the U.S. Marine Corp for on-the-move HF communications. Charlie has worked with virtually every U.S. military branch, crafting specialty antennas on nearly a moment's notice. And, thanks to his high security clearance from his earlier career, he works on many interesting, and secret, antenna systems.

He tells the story of a young Marine captain who was told, "'Look up this guy Charlie. Beg, borrow or steal an antenna from him, and in Camp Pendleton install a couple of these on some Humvees and MRAPs [Mine Resistant Ambush Protected vehicles], go out to China Lake, the Navy base and I want you guys to try to communicate with us on the other side of the mountain.'

"And, they invited everybody, Satcom people, VHF-UHF, any kind of communications you can muster, because in Afghanistan, which is much more mountainous terrain, they're having

Charlie and his Swedish submarine antenna.

a heck of a time to communicate. The bottom line is: they went out on a Thursday and, I'll never forget this because, Friday 6:00 AM I get a phone call from this guy who's arranging all this and he says, 'I'm calling you early because I cannot contain myself to let you know that, with all of the systems we have there, the only way we could communicate with the Humvees was with Hi-Q antennas.' And, that happened because they were using my NVIS [Near Vertical Incident Skywave] antennas."

Among other things, Charlie is working on a special project with the Naval Air Systems Command; he's the sole supplier to Sweden's submarine fleet for HF antennas, and has provided antennas to the U.S. State Department.

He's excited about a recent project with NASA that, as he relates the story, he found intriguing. They wanted a special antenna to use for ground penetrating radar on a mission to an asteroid 1.2 million kilometers away from Earth. The trajectory of this asteroid places it uncomfortably close to Earth in 2040.

"The idea in this project is that two antennas will be built with one landing on the asteroid and the other circling it and taking ground penetrating radar readings and relaying it back to Earth. They want to know what's going on, because we've had some near misses in recent years. Between NASA and the European Space Agency (ESA) 114 applications to build this antenna were received and Hi-Q Antennas was awarded the contract."

He was given two years to develop the antenna and in less than a month he had the engineering prototype ready and sent them a picture. "They actually sent someone out to look at it to make sure that I was telling the truth!"

The secret to Hi-Q antennas, according to Charlie, "comes down to these components: choosing the proper design and choosing the right components and materials. The material I use to cover the loading coils, for instance, is made by Beyer, the German chemical company. It was chosen because it has the absolute minimal RF absorption so it can radiate instead of dissipating the signal as heat." The other key is manufacturing to the highest durability possible.

As for his own station, he uses an Icom 756 Pro and has Yaesu and Kenwood radios in addition to many military radios. He has a 100 foot Rohn tower on which he has a 40 meter beam among other antennas. And, of course, he has Hi-Q Antennas for his car. He notes, "I am the one and only civilian west of the Mississippi licensed to test on military frequencies."

To say that Charlie Gyenes' new business is an old-fashioned American success story would be a gross understatement. He tells it so much better: "I tell you, this thing turned out to be a pleasure! Looking at the year 2010, I finished the year and actually surpassed a million dollars in sales of antennas. It became a hell of a business! I'm still a one-man operation. All of my antennas are designed and prototyped by me, sent to my machine shop and then the production quantity comes out from there, but each and every product still goes through my hands for assembly and testing and it really does have my name on it."

And, to talk with him personally, as so many of his customers have done, or write him an email (he gets several hundred a day), you'll hear the same combination of humility and pride: "So, this little garage operation, this little guy certainly come a long way and I'm very proud. It couldn't have happened in any other country than this one. I am proud to be an American." MT

Charlie's "garage" test lab

SCANNING REPORT

THE WORLD ABOVE 30MHZ

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

Finding Elusive Public Safety Frequencies

With new public safety systems coming online, it's not uncommon to lose track of where agencies are operating. Old, well-known frequencies go silent and it can be a challenge to find out where they relocated.

❖ Idaho

Dear Dan,

After a year without a scanner, I find my local police and an adjoining city (Caldwell and Nampa, Idaho) can no longer be heard on their published frequencies. Along with this I found that listening to the Idaho Cooperative Radio System (ICAWIN) does not reveal that the two cities are relocated there. Short of actually calling the two police departments, I cannot find a way to find where they have moved to, unless I just sit in my car at the stations and use my new scanner to stalk the frequencies. Any suggestions as to how I can easily find and confirm any new used frequencies for the police?

Rodney Stephens

Caldwell is a town of about 26,000 in the southwest part of Idaho. It is also the county seat of Canyon County. Nampa is the largest city in Canyon County with just over 80,000 residents and is located about 10 miles southeast of Caldwell.

Until recently, Canyon County operated two separate public safety radio systems. Five law enforcement agencies operated in the UHF band, while nine fire and emergency medical services departments used radios in the VHF band. Both of these radio systems were more than two decades old and, according to the county, were at the end of their useful life. Interoperability was also a problem, given the age and technical differences of the respective systems.

Known VHF and UHF frequencies for these old analog systems are as follows:

Canyon County Old Analog Systems

Frequency	Description
150.7975	Nampa Fireground
151.010	County Highway Department
151.115	County Emergency Medical Services
153.890	County Fire (South Dispatch)
154.010	County Fire (Dispatch)
154.055	County Rodent and Noxious Weed Control
154.115	County Fire
154.190	Nampa Fire (Dispatch)
154.310	Caldwell Fire (Tactical)
154.430	Caldwell Fire (Dispatch)
154.445	Nampa Fireground
154.7625	Nampa Fireground
154.8525	County Public Safety
154.965	County Fireground
155.205	County Emergency Medical Services (Dispatch)
155.280	Fire Mutual Aid (Statewide)
155.340	Emergency Medical Services (Statewide)
155.925	Nampa Fire
156.180	Nampa Highway Department
158.760	Caldwell City Departments (Common)
158.805	Nampa City Departments (Common)
158.940	Nampa City Departments (Common)
160.150	Nampa Fire (Vehicle-mounted Repeaters)
453.0375	Caldwell City Services
453.400	Sheriff (Tactical)
453.525	Nampa Police (Tactical)
453.925	County Public Safety
458.0375	Caldwell City Services
458.400	Sheriff (Tactical)
458.5875	Nampa Police (Tactical)
458.650	Caldwell Police (Car-to-Car)
460.0125	Sheriff (Juvenile Detention Center)
460.050	Nampa Police (Dispatch)
460.175	Caldwell Police (Dispatch)
460.250	Sheriff (Jail)
460.325	Sheriff (Dispatch)
460.425	Nampa Police - Countywide Tactical
462.500	County Fire (Patch to 154.010 MHz)
460.575	Nampa Police
460.600	Sheriff
462.8125	Nampa Parks and Recreation
462.950	Mercy Medical Center
463.7375	Nampa Parks and Recreation
465.275	Nampa Police (Car to Car)
494.000	Nampa Fire (Mobile Data Terminals)

Like nearby counties Ada and Bannock, Canyon County chose to build a 700 MHz radio system for all first responder agencies and to provide coverage across the entire county. In 2009, five repeater sites were constructed, three in the county proper and two in adjacent counties. Funding sources included a $3.1 million Community Oriented Policing Services (COPS) grant and $1.1 million from the Public Safety Interoperable Communications (PSIC) fund.

Idaho Statewide Network

In 2005 the Governor of the State of Idaho created the Statewide Interoperability Executive Council (SIEC), which developed goals and policies to establish an interagency radio system called the Idaho Cooperative Agencies' Wireless Interoperable Network (ICAWIN).

One of the primary goals of the new network is to provide interoperability between federal, state and local first responders and agencies, allowing immediate exchange of voice and data. The Department of Homeland Security (DHS) Wireless Public Safety Interoperable Communications Program (SAFECOM) defines five levels of technological interoperability.

Level	Description
1	Use spare or swapped radios designed for the host system
2	Use gateways and dispatch consoles to rebroadcast transmissions
3	Share common frequencies, typically in analog voice format
4	Share a proprietary system provided by a single manufacturer
5	Share a non-proprietary standard, like APCO Project 25

The SIEC set a goal of December 31, 2012 for statewide Level 5 interoperability.

ICAWIN uses "pure" APCO Project 25, which means that the voice traffic will be carried in the P25 Common Air Interface (CAI) and the trunking control channels will follow the P25 standard.

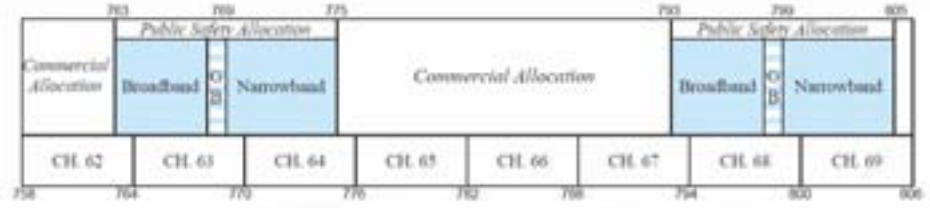
The ICAWIN backbone operates on frequencies in the 700 MHz range and the SIEC strongly encourages all agencies to do the same, although they recognize that some local agencies may wish to stay on VHF or UHF frequencies.

❖ 700 MHz Public Safety

In 2007 the Federal Communications Commission (FCC) established a set of rules for using frequencies in the 700 MHz band. As part of the transition to digital television, former analog UHF television channels 52 to 69, covering frequencies from 698 MHz to 806 MHz, were reallocated to commercial and public safety wireless services. Public safety was granted four blocks of spectrum totaling 24 MHz, equally divided between broadband and narrowband. An additional 2 MHz of spectrum was assigned as "guard bands" to prevent interference between the blocks.

700 MHz Band Plan

Frequencies	Size	Type	Usage
763 to 768	6 MHz	Broadband	Base transmit
768 to 769	1 MHz	Guard band	Prevent interference
769 to 775	6 MHz	Narrowband	Base transmit
793 to 798	6 MHz	Broadband	Mobile transmit
798 to 799	1 MHz	Guard band	Prevent interference
799 to 805	6 MHz	Narrowband	Mobile transmit



The broadband blocks are intended, according to the FCC, "to facilitate the establishment of a nationwide, interoperable broadband communications network for the benefit of state and local users." This network would have sufficient bandwidth to carry high speed data and video imagery.

The narrowband blocks are designed to serve the more familiar voice and low speed data needs and are divided into 1,920 channels, each of which is 6.25 kHz wide. Although channels of 12.5 and 25 kHz are far more common today, advances in technology allow more efficient use of the spectrum and narrow 6.25 kHz channels will become common in the future.

Narrowband channels 1 through 960 correspond to frequencies between 769 MHz and 775 MHz, while channels 961 through 1920 run from 799 MHz to 805 MHz. Channels are usually paired, with one frequency between 769 and 775 MHz paired with another frequency between 799 and 805 MHz, separated by exactly 30 MHz.

For radios that require channels wider than 6.25 kHz, channels may be combined; two adjacent channels give a 12.5 kHz segment and four consecutive channels provide 25 kHz of bandwidth.

Channel	6.25 kHz Center	12.5 kHz Center	25 kHz Center
1	769.003125	769.00625	769.0125
2	769.009375		
3	769.015625	769.01875	
4	769.021875		
...	...		
957	774.978125	774.98125	774.9875
958	774.984375		
959	774.990625	774.99375	
960	774.996875		
961	799.003125	799.00625	799.0125
962	799.009375		
963	799.015625	799.01875	
964	799.021875		
...	...		
1917	804.978125	804.98125	804.9875
1918	804.984375		
1919	804.990625	804.99375	
1920	804.996875		

The FCC specifies that certain 700 MHz channels are reserved for specific uses, including nationwide interoperability, data transmissions only, calling and trunking. Some channels are also set aside for use by states rather than individual agencies.

❖ Regional Planning Committee

Rather than dealing with each and every agency in the country individually, the FCC created a licensing structure that allows Regional Planning Committees (RPCs) to develop and submit frequency assignment plans on behalf of all of the public safety users within a geographic area. RPCs are expected to take into account local needs and restrictions for radio frequencies and work out any conflicts prior to submitting a plan to the FCC for approval.

❖ Canyon County, Idaho

The FCC identifies Idaho as Region 12, and the RPC there assigned the following frequencies for Canyon County.

Type	Bandwidth	Channel	Base	Mobile
General Use	12.5 kHz	19-20	769.11875	799.11875
General Use	12.5 kHz	49-50	769.30625	799.30625
General Use	12.5 kHz	97-98	769.60625	799.60625
General Use	12.5 kHz	139-140	769.86875	799.86875
General Use	12.5 kHz	179-180	770.11875	800.11875
General Use	12.5 kHz	209-210	770.30625	800.30625
General Use	12.5 kHz	247-248	770.54375	800.54375
General Use	12.5 kHz	299-300	770.86875	800.86875
General Use	12.5 kHz	329-330	771.05625	801.05625
General Use	12.5 kHz	353-354	771.20625	801.20625
General Use	12.5 kHz	377-378	771.35625	801.35625
General Use	12.5 kHz	405-406	771.53125	801.53125
General Use	12.5 kHz	429-430	771.68125	801.68125
General Use	12.5 kHz	453-454	771.83125	801.83125
General Use	12.5 kHz	477-478	771.98125	801.98125
General Use	12.5 kHz	505-506	772.15625	802.15625
General Use	12.5 kHz	529-530	772.30625	802.30625
General Use	12.5 kHz	553-554	772.45625	802.45625
General Use	12.5 kHz	577-578	772.60625	802.60625
General Use	12.5 kHz	601-602	772.75625	802.75625
General Use	12.5 kHz	625-626	772.90625	802.90625
General Use	12.5 kHz	667-668	773.16875	803.16875
General Use	12.5 kHz	707-708	773.41875	803.41875
General Use	12.5 kHz	745-746	773.65625	803.65625
General Use	12.5 kHz	789-790	773.93125	803.93125
General Use	12.5 kHz	829-830	774.18125	804.18125
General Use	12.5 kHz	869-870	774.43125	804.43125
General Use	12.5 kHz	905-906	774.65625	804.65625
General Use	12.5 kHz	945-946	774.90625	804.90625
State License	25 kHz	145-148	769.91250	799.91250
State License	25 kHz	193-196	770.21250	800.21250
State License	25 kHz	273-276	770.71250	800.71250
State License	25 kHz	653-656	773.08750	803.08750
State License	25 kHz	693-696	773.33750	803.33750
State License	25 kHz	853-856	774.33750	804.33750
State License	25 kHz	933-936	774.83750	804.83750

❖ FCC Database

The source for frequency assignments is the Universal Licensing System (ULS) maintained by the FCC. Go to **http://wireless.fcc.gov** and select "Databases" from the left-hand side. Choose "Universal Licensing System (ULS) License Search" under the Search section. Select

"Advanced License Search" on the left-hand side. This will bring you to a search form. You can also reach this form directly at the web address

http://wireless2.fcc.gov/UlsApp/UlsSearch/searchAdvanced.jsp

Within the form, under the "Licensee" section, select "Idaho" as the state. Under the "Frequencies" section click the "Exact" button and enter "769.11875" in the associated box. Click on the "Search" button at the bottom right-hand side of the form.

Three results appear. The first entry, callsign WQKJ610, is shown as "Expired" in the "Status" column. The second entry, callsign WQKU686, is assigned to Kootenai County. The third entry, callsign WQKX619, is "Active" and is assigned to Canyon County. Clicking on the callsign brings us to the related license information.

Clicking on the "Location" tab shows that there are three repeater sites in Canyon County, located in Caldwell, Nampa and Parma. Two additional towers, one in Boise County and one in Owyhee County also provide coverage into Canyon County.

Clicking on the "Frequencies" tab reveals frequency assignments for each of the repeater sites. In the table below I've separated the control channel from the voice channel based on local user reports – the FCC database does not provide this level of usage information.

WQKX619, Canyon County, Idaho

Site	County	Control	Voice Frequencies
Caldwell	Canyon	774.18125	769.60625, 770.54375, 771.53125, 771.98125, 772.60625, 73.16875, 773.65625
Nampa	Canyon	774.43125	769.30625, 770.11875, 770.86875, 771.35625, 771.83125, 772.45625, 772.90625
Parma	Canyon	773.93125	769.86875, 771.20625, 771.68125, 773.30625, 773.41875
Shafer Butte	Boise	73.74375	770.36875, 771.00625, 771.45625, 772.16875, 773.21875, 774.66875
Marsing	Owyhee	774.90625	769.11875, 769.83125, 770.30625, 771.05625, 772.01875, 772.75625, 774.45625

❖ Scanning 700 MHz

Once you have the possible frequencies from your Internet research, it's time to begin scanning. In order to follow activity on ICAWIN, you will need a scanner that is capable of following P25 trunked transmissions in the 700 MHz band. Scanner models that can do so are:

Manufacturer	Model
GRE	PSR-500, PSR-600, PSR-800
Radio Shack	Pro-18, Pro-106, Pro-197
Uniden	BCD396T, BCD396XT, BCD996T, BCD996XT, HomePatrol

Because ICAWIN is a "pure" P25 system, meaning the control channel follows the Project 25 standard, you can use "control channel only" scanning to follow activity on the system. The P25 control channel contains all of the information necessary for your digital scanner to tune to the proper voice channel when a talkgroup is active, so all you really need to program are the five control channels listed above.

The next step is to begin gathering talkgroup information. When you're first starting out, you want to run the scanner in "open" mode, accepting all talkgroups that came your way. Later, as you associate talkgroup identifiers with agencies and departments, you can move to a "closed" mode, where you listen only to the talkgroups you specify. On scanners that are programmed using object-oriented concepts, for instance the Radio Shack Pro-106, you would program a TSYS object with a Wildcard for the talkgroup ID (as described on pages 33 and following in the Pro-106 *User's Guide*).

By the way, if the manual that came with your scanner is confusing or light on the details, you might want to check **www.marksscanners.com** where you can find easier-to-read instructions for many newer analog and digital scanners.

You can also check various web sites for further Idaho scanning information. One popular site is **www.radioreference.com**, which has forums dedicated to various geographic locations, including southwestern Idaho. The user-submitted frequency and talkgroup databases on Radio Reference are used in the newest scanners, such as the GRE PSR-800, Radio Shack Pro-18, and Uniden HomePatrol, as an easy and quick way to load programming data.

You can also check **http://groups.yahoo.com** and join an electronic mailing list for your geographic area. There is a group called "IdaScan" with more than 100 members that is advertised as being "dedicated to radio scanning in the state of Idaho." You might also look for groups that are dedicated to your particular scanner. Users on these lists often share programming files that contain frequencies and talkgroups for your area that you can load directly into your scanner.

It is in these groups that you can share information with other listeners and help to verify talkgroup activity. For instance, one Idaho scanner listener reported that the Nampa Police Department is on ICAWIN but encrypts all of their transmissions; you can help confirm that this is the case.

Whatever you end up doing and discovering, keep in touch with *Monitoring Times* and send me a reception report!

❖ Dayton Hamvention

In the world of radio, May means a trek to the Dayton Hamvention, the world's largest gathering of amateur radio and technology enthusiasts. This year the convention is scheduled for the weekend of Friday, May 20 through Sunday, May 22 at the Hara Arena in Dayton, Ohio. Last year more than 18,000 people made the pilgrimage to Dayton, seeing the sights and sounds of this annual event.

The arena offers more than 500 indoor exhibitor spaces, populated with hundreds of radio, technology and electronics vendors offering their latest wares. Major equipment manufacturers including Icom, AOR, Yaesu, GRE, Kenwood and others will have radios and accessories on display, along with sales staff to answer your questions.

Out in the parking lot surrounding the arena there are more than 2,000 flea market spaces, where you can find almost anything related to electronics, including old and new radios, scientific and laboratory equipment, cell phones, manuals and books, electronic parts, test equipment, tools, video games, flashlights and other sources of illumination, GPS receivers, and yes, even scanners. As the saying goes, "If you can't find it at Dayton, you can't find it!"

As in past years, a number of forums will be held during the three-day weekend, covering a wide variety of radio topics. Sessions are scheduled for Automatic Position Reporting System (APRS) equipment and software, fox hunting (finding hidden transmitters), Balloon-Sat and Amateur Satellite (AMSAT) operation, low power (QRP) transmission and reception, radio signal propagation (including effects driven by the Sun), kit building, radioteletype contests, and presentations for collectors interested in specific equipment manufacturers (like Drake and Collins). Also on the schedule is a Teacher Workshop to help educators use electronics and technology in the classroom, a guided tour of the American Radio Relay League (ARRL) Laboratory, a demonstration of various pieces of useful test equipment, and a youth forum for younger radio enthusiasts. You will also be able to hear how amateur radio is used in space from astronaut Doug Wheelock.

More information is available on the Internet at **www.hamvention.org**.

That's all for this month. I welcome your e-mail to *danveeneman@monitoringtimes.com*, and I have more radio and scanner-related information on my web site at **www.signalharbor.com**. If I don't see you at the Hamvention, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
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Several antenna system questions have come in, and I've taken the liberty of assembling them in one column:

Q. *If the only way you can know for sure how much power actually reaches your antenna to be radiated is to place a wattmeter at the antenna feedpoint, does that mean that there is nothing I can put down at my rig to give me an accurate reading for the final radiated power?*

A. That's exactly what that means, and that's exactly why so many hams, and all professional installers, use commercially-made antennas with known efficient/matching characteristics, and why a standard (50 ohms) impedance is used as a baseline.

Q. *If I am using a 20 meter antenna for 15 meter transmitting, is most of my power lost in heating the coax feed line, or is most of the power present at the feed point and being radiated?*

A. If your antenna is a conventional dipole, this will represent a bad impedance match with a great deal of reflected power on the feedline as indicated by a high VSWR. In that case, most of the power is wasted heating the transmission line if you're using coax. That's why old-timers and experienced, multi-band field day operators use open-wire feeders – no dielectric losses and eventually all the power gets radiated.

If the VSWR gets too high, modern transceivers shut down their power to keep the high voltages from burning out a transceiver's final amplifier components. But keep in mind that even if the radiated power is knocked down to only 25%, that's still only one S-unit (6 dB).

Q. *I notice that tuning at lower power levels and then increasing the power sometimes causes the SWR to be higher. Is this because of the higher power (and higher voltage) forcing higher current through the insulation (dielectric)?*

A. That's a good question and I've often wondered about that myself. After all, the coax and antenna are the same regardless how much power is being fed to them.

Readers? Any ideas on this one? Is it just a quirk of modern transceiver design?

Q. *I have a low-end antenna analyzer. Unless I use it right at the antenna, are the readings very useful?*

A. The only way an antenna analyzer can work effectively is if it's attached to the antenna; that's why it's called an *antenna* analyzer! Attached at the transceiver end of the cable, it can only tell you what it sees in the line plus the antenna; it won't tell you a thing about radiation efficiency.

As an extreme example, a perfectly-tuned antenna and a 50 ohm resistor will show the same VSWR on an analyzer, but you're much better off using the antenna!

Q. *I have a 30 foot tower topped by a 17 foot mast. On top is a dual-band 144/440 MHz vertical. Below that is a 144 MHz beam. Side by side and 7 feet apart are a 220 MHz and 440 MHz beam. The SWR on both are zero. Does this configuration sound OK? (Conrad, WB1GXM)*

A. Sounds like it's built by the book; I wouldn't expect any problems. I trust you're using low-loss coax. The beams are way more than 1/2 wavelength apart, so there shouldn't be any interaction, and with the low VSWR readings, I'd say you're good to go!

Q. *I would like to replace the short whip that comes with the Uniden HomePatrol-1 scanner with a better one. What do you suggest? (Martin Zardeskas, Saugus, MA)*

A. The best scanner antenna is always an outdoor elevated one. If it must be indoors, it's best as high as practical, like in an attic crawl space, perhaps dangling from a roof truss. If that's impractical, then you can have a good outdoor antenna mounted inconspicuously (if possible!) downstairs, like against an outside wall (assuming you don't have aluminum siding which shields signals) or, even better, a window.

You can replace the short stubby rubber ducky that came with the scanner with a better one like the Condor (**www.grove-ent.com/ANT14.html**) or the Diamond RH77CA (**www.grove-ent.com/rh77ca.html**). I consider these the best multiband flex antennas on the market.

For the HomePatrol you will also need a right-angle adapter (**www.grove-ent.com/ADP13.html**) and an SMA to BNC adapter (**www.grove-ent.com/ADP33.html**).

Q. *I've moved out into the country and my discone antenna just doesn't seem to bring in stations very well on my scanner; is there a better choice in antennas?*

A. The discone works fine for hearing in all directions over a limited distance, but you need gain, probably in the direction of the nearby city if that's where you want to recover your signal strength. I'd suggest you get the Grove ANT-03 Scanner Beam; nothing beats it in the price class for outperforming a discone. Point the antenna in the direction of primary interest; it will also pick up around it in other directions as well, but not as well as in the forward direction.

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.)

UTILITY WORLD

HF COMMUNICATIONS

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2011: Sunspots, Trouble Spots, and Radio

Winter and spring of 2011 will be remembered for turbulence. On the Sun, Solar Cycle 24 finally got going in earnest, with the predicted rapid rise in activity coming to pass. On the Earth, North Africa and the Middle East experienced historic political unrest.

Starting on the Sun, we finally began to see large groups of sunspots, with attendant flares and coronal mass ejections. Some minor radio "blackouts" occurred. The rest of the time, signal strength increased on frequencies above 15 megahertz (MHz), allowing reception of stations not heard in years.

Back on Earth, the eighteen or so trouble spots produced plenty of high-frequency (HF) utility activity. Let's look at two of these, as examples of how one can still hear history happening on short wave.

❖ Libya

At press time, this geographically expansive country still has a very violent and evolving situation. It will probably stay this way for quite some time.

Any time a country gets into this much trouble, it's a good idea to check the appropriate aeronautical mobile frequencies. They can get pretty dramatic.

The best Libya frequency to monitor is 11300 kilohertz (kHz), upper sideband (USB). This is used by Tripoli air traffic control on the Africa/ Indian Ocean route net called AFI-3. Right now, thousands of foreign oil workers are being evacuated by military and civilian aircraft belonging to a surprising number of countries. Procedures for these unscheduled flights are often being improvised as situations develop.

Other AFI-3 frequencies are 3467, 5517 (night primary), 6754, 13288, and 17961 kHz, all USB.

Tripoli has also been heard on 8894 kHz USB. This is the AFI-2 net that includes western Libya and most of Algeria. Other AFI-2 frequencies are 3419, 5652, 13273, and 17961 kHz USB.

Those wanting to add Libya to their countries list can also look for the far-flung radio system operated by the Great Man-Made River Authority (GMMRA). The Great Man-Made River is actually an enormous irrigation and drinking water project fed by thousands of wells. Surprisingly, these are beneath the Sahara Desert, in an ancient geological formation trapping huge amounts of water.

This system went crazy with Automatic Link Establishment (ALE) contacts when violence first broke out. Base stations have 3-character addresses (identifiers) like "HQ1." Mobiles identify "MOBILE" plus two numbers. Here are the frequencies: 3000, 3900, 4050, 4200, 5037, 5300, 5368, 5768, 6800, 6884, 7000, 7805, 7900, 8200, 8800, 9218, 9375, 10125, 10215, 10250, 10375, 10404, and 11100 kHz, all USB ALE.

❖ Egypt

Slightly before the conflict in Libya, the country to its immediate east had its own government change. Mass bloodshed was avoided due to a vastly different military situation. The situation is still unstable, however, especially right along the border with Libya.

In the early days of this uprising, communications were blocked by the government. As a result, ham radios on 40 meters were pressed into use. These were heard using CW (continuous-wave Morse telegraphy) for several days.

On the aircraft side, Cairo was and is heard on the same AFI-2 frequencies as Tripoli. Listeners have also reported planes working the Stockholm, Sweden commercial Long-Distance Operational Control (LDOC) station. It's listed on many frequencies, but the important ones are 5541 kHz USB, its night primary, and 13342, for day time.

Egypt also has one of the few ministries of foreign affairs (MFAs) that still heavily uses HF. Its large net runs hours of encrypted traffic and plain text operator chatter with embassies worldwide. Stations are often unidentified, though the MFA in Cairo sometimes uses the call of "SSE." The net often uses selective calling (SELCAL), allowing identification of stations if the codes are known.

Several digital modes have been heard, though most traffic is in Simplex Telex Over Radio, Mode A (SITOR-A). This is more or less the same mode as the old ship Telex, except that most of the time Egypt is using an Arabic teleprinting alphabet called ATU-80. This decodes just fine on hobby-level equipment. Readable portions, like numbers, can be copied, but they are read right to left.

When the Egyptian uprising began, this net lit up like a match, all over the bands. The circuit from Cairo to Washington, DC was especially busy.

Recently logged frequencies include the following: 5121.7, 6785, 7778.7, 7794.7, 8022, 8131.7, 8333, 9106.7, 9036.7, 9045.7, 9046.7, 9067.7, 9078.7, 9089.7, 10223.7, 10334.7, 13445.7, 13881.7, 14336.7, 14443.7, 14981.7, 16046.7, 16061.7, 16067.7, 16216.7, 16224.7, 16241.7, 16319.7, 16341.7, 18222.7, and 19021.7. The many .7 decimals are due to the 1.7 kHz signal offset, which gives some ambiguity in how these frequencies are logged. Obviously, it's best to tune around.

❖ CW Is Alive #1

Better solar conditions bring answers to such questions as, "Does ANYBODY really use CW Morse telegraphy anymore?" The answer is, "Yes."

Example number one came from an anonymous listener in New Jersey. This guy is good, but for a while it had us both stumped.

What he had was a mysterious CW message, broadcast daily for an hour around 0000 Coordinated Universal Time (UTC). It was, and still is, in Spanish, on approximately 3487.4 kHz CW. This is a very strange frequency, right between a couple of important aero mobile voice channels.

Investigation was complicated by the really rough copy in the eastern US, where it got stomped by the New York VOLMET (aviation weather) on 3485.0 USB. Here in the west, 80 meters hadn't opened for that kind of distance yet. Finally, one brief recording in e-mail had recognizable Morse. It was processed, equalized, filtered, gated, and finally (in desperation) examined in a huge zoom where the individual dits and dahs could be counted and turned into characters.

Even so, fast fades made much of it uncopyable. First thing that emerged from various e-mail exchanges was that the daily transmission was a weather report ("boletin meteorologico"). There were place names in the Yucatan area. It started to look like an old Mexican weather schedule that was on a long time ago, but which no one had reported in years.

Finally, a whole sign-on was extracted and verified. A station with the call sign XBC wished us a very good evening ("muy buenos noches"), and identified itself as the radio station of the Gulf of Mexico Forecasting Center ("Centro de Previsión del Golfo de México").

The XBC call comes back to a transmitter in Boca de Rio, Veracruz. It is indeed operated by the forecasting center. This is part of the

Mexican National Weather Service ("Servicio Meteorológico Nacional"). The Mexican NWS is part of the National Water Commission (Comision Nacional del Agua, or CONAGUA).

A small, blurry photo on the Internet shows an observatory-like complex. Two antenna towers are visible, though not well enough to see what's on them. It'll be fun to investigate this interesting station.

❖ CW Is Alive #2

This second one comes from the same listener, but it's a lot easier to hear in the US. It was discovered on 8602.0 kHz CW, though it has a tendency to occasionally drift down to more like 8601.3 kHz.

This one is also on-air around 0000 UTC, with a pronounced tendency to start late. The big problem trying to get copy on this frequency is that tiny pieces of the signal simply drop out, turning dahs into two dits and other such mischief. This drives software decoders absolutely batty, creating strings of E's and T's at any speed. As always, "wetware" (your brain) works far better, but it's still pretty hopeless.

A call sign that sounded like "CIMA" was eventually reliably copied as "CWA." This is Cerrito Radio, near Montevideo, Uruguay. It runs a daily schedule of weather and navigation warnings nominally at 0000, 1400, and 1900 UTC. It's been the subject of some Internet chatter, and was added to the UK Admiralty Signals List in 2009. Its position is listed as 34 degrees 51 minutes south, and 56 degrees 10 minutes west.

The lists on the Internet also turned up more frequencies. It's parallel on 4346.0, 8602.0, 12750.0, and 17230.0 kHz, all straight CW. All these frequencies have been verified here. It is also listed on medium wave 421.5 kHz, straight and modulated CW. One mailing list post noted the station's rubbery times and frequencies, and advised tuning with a wide filter to find the signal before zeroing in.

Following some intense solar activity, the 17230 frequency came blasting into California on the 0000 sked. It was quickly identified as coming from the Uruguay Naval Service of Oceanography, Hydrography, and Meteorology ("Servicio de Oceanografia, Hidrografia, y Meteorologia de la Armada"). Google turned up a photo of their building, showing a sign to this effect in front.

The transmission starts with a hello-all-stations callup ("CQ CQ DE CWA CWA"). This is followed by a maritime weather report in Spanish, then the procedural signal "NW SVH BT." "NW" might be the CW abbreviation for "now." "SVH" appears to mean that traffic is pertinent to safety of life at sea. Like most of these old signals (including MAYDAY), it comes loosely from the French, in this case "Securite de la Vie Humaine." BT, of course, is the short break signal, sent all together (dahdidididah).

There is then a pause, and it launches into a series of numbered, Spanish, navigational warnings in the standard format. These deal with buoys, lighthouses, hazardous activities, and the like. "Rio de la Plata" is frequently mentioned. This is a huge estuary on the southern border of Uruguay. Montevideo is on the north side, and Buenos Aires, Argentina is on the south. "Atlantico" is, of course, the Atlantic Ocean.

Happy ditting, and see you next month.

ABBREVIATIONS USED IN THIS COLUMN

AFB ..... Air Force Base
ALE ..... Automatic Link Establishment
AM ..... Amplitude Modulation
AWACS ..... Airborne Warning And Control System
CAMSLANT ..... USCG Communications Area Master Station, Atlantic
CAMSPAC ..... USCG Communications Area Master Station, Pacific
CW ..... On-off keyed "Continuous Wave" Morse telegraphy
DSC ..... Digital Selective Calling
EAM ..... Emergency Action Message
FAX ..... Radiofacsimile
HFDL ..... High-Frequency Data Link
HF-GCS ..... High-Frequency Global Communication System
LDOC ..... Long-Distance Operational Control
M08 ..... Cuban CW numbers, cut to ANDUWRIGMT
M89 ..... Chinese CW "V ffff de ffff" coded markers
MCW ..... Modulated CW, by tone or in AM
MX ..... Generic for Russian single-letter beacons/markers
MARS ..... US Military Auxiliary Radio System
Meteo ..... Meteorological; weather office
MFA ..... Ministry of Foreign Affairs
NASA ..... US National Aeronautics and Space Administration
NAVTEX ..... Navigational Telex
PACTOR ..... Packet Teleprinting Over Radio, modes I-III
RTTY ..... Radio Teletype
S28 ..... Russian UVB76, "Buzzer" and short voice messages
S30 ..... Russian "Pip" marker and short voice messages
S32 ..... Russian "Squeaky Wheel," well-named marker
Selcal ..... Selective Calling
SESEF ..... Shipboard Electronics Systems Evaluation Facility
SHARES ..... Shared Resources; US federal frequency pool
SIPRNET ..... USAF Secure Internet Protocol Router Network
SITOR ..... Simplex Telex Over Radio, modes A & B
STS ..... Space Transportation System ("Space Shuttle").
UK ..... United Kingdom
Unid ..... Unidentified
US ..... United States
USAF ..... US Air Force
USCG ..... US Coast Guard
V02a ..... Cuban "Atencion;" callup and 5-figure groups
Volmet ..... 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 ( ).

518.0 "R"-Icelandic Coast Guard, Saudanes, SITOR-B NAVTEX at 0654 (Michel Lacroix-France).
1677.0 EJM-Malinhead Coast Guard, Ireland, navigational warnings at 0435 (PPA-Netherlands).
2187.5 002320001-UK Coast Guard, Shetland Islands, DSC call to 311875000, Bahamas registry cargo vessel Sevan Hummingbird (C6SG2), at 0427 (PPA-Netherlands).
2252.0 Golf Foxtrot-US Navy, net with Delta, Kilo, and Sierra, at 0046. Golf Charlie, calling November at 0312 (Jack Metcalfe-KY).
2663.0 IPC-Crotone Radio, Italy, English navigation warnings, then South Adriatic weather in Italian, at 1708 (Patrice Privat-France).
2872.0 KLM 643-KLM Royal Dutch Airlines B777, registration PH-BQC, answered selcal HR-AS from Shanwick, at 1854 (Lacroix-France).
3103.5 FAV22-French Morse training net, 5-letter groups in CW, also on 5685, at 0805 (Lacroix-France).
3250.0 PT40-Algerian National Guard, calling CY51, ALE at 2022 (Lacroix-France).
3287.0 CKN-Canadian Forces, Vancouver, BC, RTTY channel marker, also on 8463, at 0653 (PPA-Netherlands).
3297.0 Q7NW-Chinese Military (M89), CW calling marker to GKVZ, at 1250 (Ary Boender-Hong Kong Remote).
3327.0 WOXN-M89, calling QPZM, CW at 1244 (Boender-Hong Kong).
3594.7 "D"-Russian Navy CW cluster beacon (MX), Sevastopol, Ukraine, also on 4557.7, 5153.7, 8494.7, 13527.7, 16331.7, and 20047.7; at 2106 (Boender-Netherlands).
3658.0 "V"-Russian CW channel marker (MX), Khiva, Uzbekistan, also on 4961, at 2056 (Boender-Netherlands).
3756.0 Unid-The Pip (S30), Russian CW/MCW marker, at 2115 (Boender-Netherlands).
3802.5 08T646-Spanish Civil Defense, Barcelona, chatter with 20T365 and 05T144, at 2130 (ALF-Germany).
3810.0 SV1TEST-Greek beacon, possibly unlicensed, CW identifier at 0127 (ALF-Germany).
3828.9 Unid-The Squeaky Wheel (S32), weird marker at 2114 (Boender-Netherlands).
4033.0 IHBC-Italian Navy replenishment ship Vesuvio, calling IDR, Rome, at 2139 (ALF-Germany).
4225.0 QV5B-M89, calling 7NPE, CW at 1242 (Boender-Hong Kong).
4325.9 "R"-Russian CW channel marker (MX), Izhevsk, at 2102 (Boender-Netherlands).
4532.0 UN2T-M89, calling JA3L, CW at 1247 (Boender-Hong Kong).
4558.0 "C"-Russian CW cluster beacon (MX), Moscow, also on 5154, 7039, 10872, 13528, 16332, and 20048; at 2054 (Boender-Netherlands).
4616.0 BMF-Taipei Meteo, Taiwan, FAX weather chart at 1932 (Lacroix-France).
4625.0 The Buzzer-Probable Russian military command control (S28), AM voice message with new callsigns KZJT and LNR4, at 1448 (Boender-Netherlands).
4645.0 EETN-Tallinn Volmet, Estonia, aviation weather at 1854 (Lacroix-France).
5000.0 BPM-Chinese National Time Service Center, CW identifier and time pips, at 1929 (PPA-Netherlands).
5195.0 DRA5-German amateur propagation beacon, CW forecast at 1907 (MPJ-UK).
5238.5 Calorie-French Air Force, CW marker with days and months in French, also on 6843 and 7690, at 0143 (ALF-Germany).
5318.0 "A-9-K"Trigraph tactical call of net control in joint Ionian Sea exercise Proud Manta 2011, radio checks with "8-U-P" (Belgian), others, at 0518 (PPA-Netherlands).
5379.0 MALI-Albanian Police, calling DRINI, also on 5400, ALE at 0511 (PPA-Netherlands).
5387.5 "44-80"-French military, time of day for 44-04, 44-82, 44-05, and 44-81, at 1100 (ALF-Germany).
5403.5 CT1EEB-Portuguese 60-meter experimental station, Estarreja, all-stations (CQ) call at 0030 (ALF-Germany).

5450.0 UK Royal Air Force Volmet, aviation weather at 1342 (Boender-Netherlands).
5505.0 Shannon Volmet, Ireland, European aviation weather at 1344 (Boender-Netherlands).
5517.0 Virgin 671M-Virgin Atlantic flight, reported position in the blind to Tripoli, Libya, was told by Cairo that Tripoli copied, at 0030 (ALF-Germany).
5541.0 SU-MWF-Midwest Airlines (Egypt) B737, on the ground in Tripoli, Libya, patch to Operations via Stockholm LDOC, at 2207 (ALF-Germany).
5568.0 Sphora-Rostov Airport, Russia, working Stavok, Vladikavkaz Airport, at 0513 (PPA-Netherlands).
5616.0 N162JC-Private Gulfstream V registered to actor Jim Carrey, position for Gander, at 0355 (ALF-Germany).
5649.0 Martinair 058-Martinair Holland MD-11 freighter, registration PH-MCP, working Shanwick at 0750 (Lacroix-France).
5652.0 "04"-HFDL ground station, Riverhead, uplink to Virgin Atlantic A340 G-VWKD (Miss Behavin'), at 0415 (PPA-Netherlands).
5680.0 Rescue 137-UK Coast Guard Sea King helicopter, working Kinloss Rescue at 1327 (Lacroix-France).
5696.0 NMN-USCG CAMSLANT, VA, calling HU-25 Coast Guard 2104, at 2244 (Lacroix-France).
5732.0 RTF-USCG Cutter Active, (NRTF/ WMEC-618), COTHEN link check with K64 (HH-65C #6564), then into secure voice, at 0151 (ALF-Germany).
5747.0 203EF-French Air Force E-3F, calling MOBE3F, ALE and data, also 6745, at 1226 (Lacroix-France).
5883.0 Unid-Cuban Spanish female voice in AM (V02a), in progress at 0736 (Lacroix-France).
5898.0 V02a in progress, very strong AM at 0824 (Lacroix-France).
5945.0 Unknown-Department of Environment and Natural resources, Adelaide, Australia, calling 9701, 4730, and 4720, ALE at 1110 (Waters-Australia).
6435.5 DAO36-KielRadio, Germany, old-school Hayes modem codes in SITOR-B, at 0822 (Lacroix-France).
6450.0 TARANTO-Italian Financial Police, calling ANGELINI, ALE at 1205 (Privat-France).
6655.0 AWM-Chennai Air, India, selcal HR-AB to Malaysian Airlines flight 193, B737 registration 9M-MLF, at 2017 (PPA-Netherlands).
6676.0 Bangkok Volmet, aviation weather at 1842 (Lacroix-France). Mumbai Volmet, India, aviation weather at 2027 (PPA-Netherlands).
6712.0 Circus Vert-French Air Force, Villacoublay, formatted aviation weather at 0924 (Lacroix-France).
6715.0 JDGSPR-USAF SIPRNET entry, Diego Garcia, calling JTYSPR, Japan, ALE at 2010 (PPA-Netherlands).
6834.0 Alpha Whiskey-US Navy, net with Golf Charlie and Uniform, at 2052. Golf Charlie, tracking aircraft with November, Sierra, and Whiskey, at 2204 (Metcalfe-KY).
6854.0 Cuban CW "Cut Number" station (M08), 5-letter-group message suddenly cut off, at 2223 (ALF-Germany).
6907.0 1101-Uzbek military, ALE link checks with 1709, 1711, 1712, 1703, and 1704; at 0230 (ALF-Germany).
6998.0 HWK7-Italian Crazy Pirate, CW marker and rants about political situation, at 1450 (ALF-Germany).
7039.4 "M"-Russian cluster beacon (MX), Magadan, also on 8495.4 and 13528.4, CW at 1238 (Boender-Hong Kong).
7535.0 Silver Surfer-US Navy vessel, voice testing with Norfolk SESEF, also RTTY on 10711, at 2014 (Metcalfe-KY).
7566.0 RCV-Russian Navy, Sevastopol, Ukraine, CW navigation warnings for vessel RGX94, at 0454 (PPA-Netherlands).
7795.0 JMH2-Japan Meteorological Agency, FAX surface chart at 0545 (PPA-Japan Remote).
8022.0 SSE-Egyptian MFA, Cairo, SITOR-A selcal to TVVC (Baghdad embassy), then Arabic SITOR-B sending station to 8333, at 1615 (ALF-Germany).
8143.0 Unknown-Pakistan Navy, calling NRS, TARIQ, COMSCHOOL, and KHAIBAR, ALE at 1211 (Waters-Australia).
8183.5 KKL-Swisscom, Vashon, WA, CW identifier in PACTOR-I bursts, at 1731 (PPA-WA Remote).
8190.0 PARTIPILO-Italian Financial Police, working SANNA, ALE at 1022 (Privat-France).
8200.0 MOBILE25-Probably Libyan Great Man-Made River Authority, working MOBILE16, also on 10404, ALE at 1011 (MPJ-UK).
8220.0 Unid-Unknown shipping company, probably India, discussing cargo and Mumbai, at 2016 (PPA-Netherlands).
8333.0 SSE-Egyptian MFA, Cairo, came from 8022 for SITOR-A selcal TVVC to Baghdad, at 1622 (ALF-Germany).
8337.6 Shark 27-USCG cutter, working Shark 10 (Cutter Thetis, WMEC-910), at 2130. Coast Guard Rescue 2113-USCG Dassault HU-25D, reporting position to unknown vessel at 0028 (MDMonitor-MD).
8386.0 72-Singapore Navy frigate Stalwart, working CN3 (Changi), ALE at 1750 (PPA-Netherlands).
8414.5 UBFF4-Russian cargo vessel Kardelen, DSC with Istanbul at 0848 (Lacroix-France). 006010001-Capetown Radio, South Africa, calling 564646000, Singapore flag liquid natural gas tanker Gallina (9VGC4), DSC at 1958 (PPA-Netherlands).
8416.5 NMC-USCG CAMSPAC Point Reyes, CA, SITOR-B navigation warnings at 1740 (PPA-OR Remote).
8436.0 XSG-Shanghai Radio, China, taking SITOR-A autotelex commands from unknown vessel, at 0323 (PPA-Japan Remote).
8458.9 NOJ-USCG Kodiak, AK, FAX text schedule at 1737 (PPA-WA).
8461.9 9MR-Malaysian Navy, Johor Baharu, RTTY test loop at 1756 (Lacroix-France).
8467.5 Unid-Kyodo News, Japan or Singapore, Japanese Seamen's Union news in Japanese, FAX (60/576), at 2044 (PPA-Netherlands).
8665.0 XSG-Shanghai Radio, China, CW weather in English, at 0305 (PPA-Japan).
8776.0 Cognizant-US military, EAM at 2312 (Metcalfe-KY).
8782.0 XSQ-Guangzhou Radio, China, phone patch in Chinese, at 0259 (PPA-Japan).
8912.0 CAMSLANT Chesapeake-USCG, VA, taking position of Coast Guard 1708 (an HC-130H), at 2001 (MDMonitor-MD).
8957.0 Shannon Volmet, aviation weather at 1753 (MDMonitor-MD).
8971.0 Fiddle-US Navy, FL, taking Spare Group report from "712," a P-3C, at 1649 (MDMonitor-MD).
8977.0 SU0172-Aeroflot A321 registration VQ-BEG, HFDL with Reykjavik, Iceland, at 1231 (Lacroix-France).
8983.0 CAMSLANT-USCG, working Coast Guard 2129, an HU-25C on a training mission, at 2135 (MDMonitor-MD).
8992.0 Andrews-USAF HF-GCS, EAMs at 1904 and 2118. Offutt-USAF HF-GCS, sending transport Reach 854 to 11220 for a patch, at 2113 (MDMonitor-MD).
9019.0 UKE306-UK Royal Air Force E-3D, ALE link check and text message to UKE302, another E-3, at 1450 (ALF-Germany).
9025.0 Raymond 24-USAF, Tinker AFB, OK, taking formatted report from unknown aircraft (probable AWACS), at 1908 (MDMonitor-MD).
9132.0 BRD-NASA Booster Recovery Director, Cape Canaveral Air Force Station, FL, working Booster Recovery Ships Freedom Star and Liberty Star, for STS-133 launch at 1955 (Allan Stern-FL).
10000.0 PPE-Brazilian Observatorio Nacional, Rio de Janeiro, time pips and announcements at 0753 (PPA-Netherlands).
10084.0 "05"-HFDL ground station, Auckland, New Zealand, uplink to UP0038, United Parcel Service MD-11 freighter, registration N254UP, at 0829 (PPA-Netherlands).
10162.0 060PCRCAP-US Civil Air Patrol, new Pacific Region net, ALE sounding at 1827 (PPA-OR Remote).
10871.9 "S"-Russian cluster beacon (MX), Sevoromorsk, also on 16331.9, CW at 1231 (Boender-Netherlands).
11112.5 MXU89-Unknown military, RTTY net with MXUD89, MXQD89, and SUDU, at 1930 (Metcalfe-KY).
11175.0 McClellan-USAF HF-GCS, radio check with Canoe 04, an E-8C JSTARS (Joint Surveillance and Target Attack Radar System), at 2103. Andrews, with EAM at 2151 (MDMonitor-MD). Reach 0457-USAF Air Mobility Command, radio checks with Puerto Rico HF-GCS, at 2200 (Stern-FL).
11220.0 Offutt-USAF HF-GCS, came from 11175 for the patch to a commercial number from Reach 854, at 2115 (MDMonitor-MD).
11232.0 Trenton Military-Canadian Forces, Ontario, working Canforce 3183, at 1921 (PPA-Netherlands). Trenton Military, patch with Sentry 61 (E-3B AWACS), at 1935. Trenton Military, patching CC-130H Atlas 223 to RCC (Rescue Coordination Centre), at 1938.(MDMonitor-MD).
11282.0 San Francisco-Pacific air control, CA, working American 31 at 1842 (PPA-OR).
11300.0 Tripoli-North African air route control, Libya, working Kabo Air flight QNK9007, a B747, at 1134 (PPA-Netherlands). KKK210-Atlasjet (Turkey) A330 registration TC-ETP, position for Tripoli, Libya, at 1453 (ALF-Germany). Qatari 593-Qatar Airways A330 registration A7-AFL, working Khartoum, Sudan, at 1705 (Privat-France).
11474.0 AAR9LX-US-Army MARS, weekly SHARES (SHAred RESources) net with AAT7WE, at 1748 (PPA-WA).
12365.0 VMC-Charleville Meteo, Australia, gale warning at 1611 (PPA-Netherlands).
12372.0 Unid-Asian duplex telephone calls in unknown language, similar on 12392, at 1609 (PPA-Japan).
12577.0 URRT-Ukrainian dry cargo vessel Nikolay Kuznetsov, DSC safety request call to Aarhus/Bremen rescue center, at 1450 (MPJ-UK).
12856.0 XSG-Shanghai Radio China, CW weather in English, at 0904 (PPA-Netherlands).
13267.0 Irkutsk-Russian Volmet, followed by Kirensk, aviation weather in Russian, at 0858 (Lacroix-France).
13270.0 "06"-HFDL ground station, Hat Yai, Thailand, uplink to VT-IGT, IndiGo A320, at 163 (PPA-Netherlands).
13445.7 Unid-Egyptian MFA, Cairo, SITOR-A message in Arabic to unknown embassy, at 1303 (Waters-Australia).
14396.5 NNN0VUV-US Navy/ Marine Corps Mars, CA, control of weekly SHARES Control Net with AFA7HY, KS, checking in stations at 1548 (MDMonitor-MD).
14981.7 Unid-Egyptian MFA, Cairo, SITOR-A selcal to OOVK (Jakarta, Indonesia) , at 1253 (PPA-Netherlands).
15034.0 Trenton Volmet-Canadian Forces, aviation weather at 1340 (Boender-Netherlands).
15043.0 ICZ-USAF, Sigonella, Italy, ALE sounding at 1143 (MPJ-UK).
15635.0 TUD-Tunisian military/ government net control, working TU1, ALE at 1219 (MPJ-UK).
15940.0 AAA-Israeli Air Force, ALE sounding at 0722 (Waters-Australia).
16540.0 Unid-Unknown Philippine vessel, working Paricoy in Tagalog, at 1545 (MDMonitor-MD).
16555.0 MORTON25-Polish Army, working ASKAR64, ALE at 1211 (MPJ-UK).
18765.0 2002-Moroccan Civil Defense, working 2204 and 2404, ALE at 1113 (MPJ-UK).
22382.0 NRV-USCG, Guam, CW identifier in SITOR-A sync marker, at 2310 (Hugh Stegman-CA).
27870.0 HAWSPR-USAF SIPRNET entry, Wideawake Air Field, Ascension Island, ALE sounding at 1801 (Stegman-CA).

DIGITAL DIGEST

DIGITAL MODES ON HF

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Bits and Pieces

❖ RTTY "in the clear"?

One of the often asked questions from beginners in digital utility listening is "What RTTY can I hear in the clear?" It's a good question, because these days much of what appears to be radioteletype is actually encrypted and little remains that can be seen in plain text. But there are a few that can still be heard. So, for reference, here they are:

The **German Weather Service** from Pinneberg can be heard widely, throughout the day and night. The station sends a frequent and lengthy test tape that mentions the frequencies in use and callsigns on each. The rhythmic repetition of the "RYRYRYR..." start to the test tape is easy for the beginner to spot by ear. Much of the regular traffic is comprised of weather reports using synoptic codes. Many decoders have the ability to turn these strings of numbers into meaningful reports. Live weather at your fingertips!

Frequencies used are 7646, 11039, 14467.3 and 15988 kHz using 50bd and a shift of 425 Hz.

The **Dutch Navy** from Den Helder (callsign PBB) and Goeree Island (callsign PBC) occupies several channels with the standard NATO CARB (Channel Availability Broadcast) format which communicates the status of its ship-to-shore frequencies. In both cases, 75bd RTTY with 850Hz shift is used.

Frequencies used are 2474, 2845, 3765, 4280, 6368.5, 8337.5, 8439, 10840.5 and 12840.5 kHz.

The **NATO** station at Monsanto near Lisbon, Portugal also transmits a constant CARB signal. Once more, 75bd and 850Hz shift are used with callsign CTP.

Frequencies used are 3782, 6389, 8551.5, 12823.5 and 16986 kHz.

The **Canadian Forces** station, callsign CFH, provides an opportunity to hear another NATO message format, the NAWS (Notice to Allied Warships). 75bd and 850Hz shift are used. NAWS messages look like this:

naws de cfh zkr f1 2822 3394 4158 6242 8324 12311 16522 ar

Frequencies are 5097, 6496.5, 10945, and 15920 kHz

❖ French Forces ARQ-E3 Transmissions

Like many other legacy digital modes, the once plentiful ARQ-E and ARQ-E3 transmissions from various French Forces stations around the world are now a rarity on the HF bands. However, with a bit of careful tuning and patience, there remain a few frequencies that can be heard using these modes.

20536.2kHz	UNID
20001.7kHz	Djibouti
18449.2kHz	N'djamena
16261.7kHz	Libreville
16149.2kHz	Paris
16077.7kHz	Paris
13979.2kHz	Paris
13886.7kHz	Paris
13543.7kHz	Libreville
13442.2kHz	Djibouti
11521.7kHz	Mayotte Island
11421.7kHz	Crozet Island

Most of these transmissions use 192bd and 400Hz shift ARQ-E3. Messages are infrequent and links can be idle for days on end.

❖ Dominican Navy

A few months ago I stumbled upon a PacTOR network on 8324.3 kHz. At the time, all that was heard was a station repeatedly sending selcals to attempt a connection to the callsign PISCIS (Spanish for the Pisces star or astrological sign). Despite monitoring over a few days, nothing further was heard to help identify the origin of the signal.

Last week, I happened on the same activity again, this time on 8296.7 kHz. Unfortunately, after seeing the same selcal go out, the stations switched to PacTOR-III for which I don't have a decoder. Once more, I parked the receiver on frequency, left the PacTOR-I and II decoders set just in case the link throttled back to the slower versions and went to cook dinner instead. When I returned to the shack later in the evening, I was rewarded with a message in Spanish forming in the PacTOR-II decoder window.

Once complete, the sender switched to USB voice on 8295.4 kHz and started calling for "Piscis" with his callsign being "Acuario" (Acquarius). The two chatted for a while, acknowledging the message transfers and called it quits.

The message was sent from "JUF" for the attention of "COMBICLAYA" and copied to "Jefe Crucero." A quick search of the web brought me to several mentions of Crucero on Dominican Navy websites. Also, checking the Dominican fleet on Haze Grey and Wikipedia showed that the majority of their vessels are named after stars, constellations or astrological signs. While I couldn't find vessels named Picsis or Acuario, it's a good bet that these are bases or perhaps newer ships. I'll be continuing to monitor the frequency in the hope of gathering more evidence.

❖ Bulgarian Diplomatic Service

We mentioned the activities of MFA Sofia in a number of recent columns. While most activity continues to use their proprietary 240bd 8FSK modem, which sounds very much like a speeded up version of MIL-188-141A ALE, some channels appear to be testing RFSM8000.

Readers may remember that RFSM (see **rfsm2400.radioscanner.ru**) is a radio amateur version of the 2400bd MIL-188-110A HF serial tone high speed modem developed by a Russian team but with various improvements and additions made. The modem sends a brief carrier burst at +1800Hz above the USB point before the data is sent. 13380 kHz has seen a lot of action with this modem. I'll be downloading a copy of RFSM in the hope of finding out more.

❖ Sudanese Diplomatic Service

It's been a long time since I've heard activity from some stations rumored to be the Sudanese diplomatic service. They have been active since at least 1995, though sporadic in operation. For a long time, 300bd AX.25 Packet Radio was used to send compressed, encrypted messages using the 7Plus coding scheme, now PacTOR is used. Callsigns used are 101, 261, 701, 711, 721, 761, 801, 851, 901 and 981.

In this latest case, I heard not just PacTOR-I on 14847.2, but Arabic male voices on 14845USB after the message transfer was complete. Unfortunately, the voice signals were too weak for further identification.

Frequencies used are 10293.7, 12577.2, 13566.7, 13576.7, 14576.7, 14577.2, 14847.2, 14907.2, 15946.7, 18506.7, 19517.2 and 19907.2 kHz.

❖ Possible French Diplomatic Net

There continues to be interesting activity on 18308.5 kHz using PacTOR-III and, more bizarrely, 1200bd AX.25 Packet Radio that is usually reserved for VHF use. A number of callsigns have been heard including 5TATR, F1OLS, F1PPN and F6PRS.

Interestingly, the French-style callsigns appear in the register of French amateur radio operators as "reserved." 5T would be a callsign of Mauritania where the French still have an embassy in the capital, Nouakchott. PacTOR-III traffic was decoded off-line from my recording by a friend and resulted in fragments of a Zipfile. This one continues to be a mystery!

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

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Horizontal Loops - The Sequel

In last month's column I confessed the full extent of my Loopiness – my long-time addiction to horizontal loop antennas – and made an impassioned case. As you may remember, I called the horizontal loop the best single-wire antenna for multiband HF operation, asserting that it outperforms conventional dipoles, vees and verticals, especially when mounted at less than ideal heights.

Since last month, nothing's happened to change my mind (surprise!), but there are a few advanced aspects that warrant further discussion, and a few construction and siting details to clarify as well.

If you don't have last month's issue in front of you, the most basic horizontal loop is a full wavelength at the lowest operating frequency, usually triangular or square in shape (requiring three or four skyhooks, respectively), installed as high as practically possible (25 to 60 feet is typical) and fed with coax and a shack-mounted antenna tuner.

However, don't try to use it below its resonant frequency while feeding it with coax and a shack-mounted antenna tuner. If your basic loop is resonant at 80 meters, for example, it will put out a great signal from 80 through 10 meters, but if you load it up on 160 meters, which is way below its resonant point, its performance will likely be quite poor (if it even tunes up at all).

To successfully operate the loop below its resonant point, use an autocoupler mounted at the antenna's feed point or an open-wire feed line. With an outdoor autocoupler placed at the feed point, the coax between the loop and the shack is nicely matched and suffers only minimal losses because of SWR (unlike the previous example). Autocouplers, which are usually designed to provide a wide matching range, can successfully load physically small antennas without much trouble. There are some losses in the tuner's matching network, (true with every tuner), but the SWR losses that plague short antennas fed with coax and shack-mounted tuners can be truly staggering. I wish I'd known that as a beginning ham!

If you want your antenna tuner in your shack and need to operate the loop below its resonant frequency, open-wire feed lines (including 450-ohm ladder line and even 300-ohm twin lead) will keep feed line SWR losses to a minimum. Balanced feeders are usually more difficult to install and route in and out of buildings, etc, and best performance requires a tuner designed for balanced feed lines (as opposed to a standard model with a tuner-output balun). Because I'm a crazed band-hopper, I prefer autocouplers...

❖ Insulators and Support Ropes

The hardware for the horizontal loop is entirely pedestrian – no fancy stuff required. The center insulator is the same as that of a dipole. You can use just about anything – just don't use a center insulator with a built-in 1:1 or 4:1 balun. For this antenna design a balun doesn't do anything useful, may make things worse, and will definitely add unnecessary expense!

If you're using open wire feeders, make sure your center insulator is designed to distribute the strain and fatigue from wind movement and flexing, or your feed line will quickly break. I use a T-shaped piece of plexiglass or white polyolefin (cutting board material) to relieve the strain. As shown in Figure 1, Ten-Tec and others make center insulators designed for 450-ohm ladder line.

Figure 1 – Ten-Tec's Model 3003 Acro-Bat antenna hanger is made from UV resistant, high-stability polycarbonate with stainless-steel hardware.

A square loop requires four corner insulators and a feed point "center insulator." You can feed the loop at any corner, using one of the corner insulators as a feed point, but it's usually easier to keep the feed point insulator separate. At least one corner insulator (especially the one nearest the feed point) should be fixed to the antenna wire; the rest can remain floating. This keeps the feed point in one place and lets the antenna wire float through the other insulators, which makes erection and adjustment easier, especially for irregularly shaped loops. See Figure 2.

When it comes to support ropes, feel free to use whatever material you're comfortable with except conductive wire or rope that contains wire strands. That stuff will mess up your antenna, loop or otherwise! Dacron, nylon and poly ropes are all usable (depending on your climate, inventory, etc), but I've found that heavy-duty weed whacker line, available in large, inexpensive spools at department and farm stores, works the best. I use clear or sky blue. It's practically invisible once in the air, it doesn't rot in the sunlight, it has a bit of flex for strain relief, and it's easy to pull up and over treetops and bushes. I have used the stuff to loft big horizontal loops here in Minnesota for decades at a time without a single failure. This

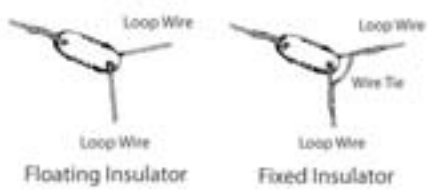

Figure 2 – Use a combination of floating and fixed insulators to keep your loop in shape. See text for more information.

giant monofilament line is also a great insulator.

The only shortcoming of weed whacker line is that it's difficult to knot gracefully. Not a knot guy of any merit, after running the stuff through an insulator, I simply tie a bunch of inelegant square knots and tape the pigtail to the main line with a few wraps of black tape: ugly, but effective.

If your loop is supported by treetops that move back and forth in the breeze, some form of strain relief will probably be necessary to keep the antenna up for the long haul. Purists may choose to use pulleys and weighted support cords, while minimalists such as myself go with the whacker line, which has a fair amount of stretch. Unless your loop is under extreme tension, you can add high-quality bungee cords to one or more corner insulators.

❖ Reality Check

Horizontal loops have been studied and modeled frequently in recent years, but the antennas seem to work better than the raw performance numbers suggest they should. Mathematics aside, feel free to put up the basic antenna, make tons of DX and stateside QSOs with ease, and marvel at the mystery of it all before worrying about how or why it works so well and how to make it work even better!

❖ Feed Point Location

For typical installations there's no need to worry about whether to place the feed point at the loop's corner, in the middle of a "side," or anywhere else along its circumference. At frequencies at or near the antenna's fundamental frequency, the

loop's radiation pattern is mostly omnidirectional, with four or more somewhat sharper lobes appearing at certain higher frequencies. If you can precisely place the loop's skyhooks (three or four poles or towers) and there are no foreign objects in the vicinity, you can "steer" or "place" the upper-frequency lobes with some accuracy by placing the feed point in a particular orientation. With trees and houses in close proximity, precisely placing these lobes is impractical (and not in keeping with the design's main strengths).

❖ Static Build-up

A closed loop of wire several hundred feet long and 50 feet in the air can produce a lot of static electricity – even without the presence of nearby thunderstorms. Make sure your tuner and feed lines are properly grounded to bleed this static, or keep them disconnected to prevent electricity from bleeding to ground through the front end of your transceiver (blowing transistors and diodes in the process).

When testing my pre-condo loop with open-wire feeders one summer, I distinctly recall hearing plenty of snaps, crackles and pops in the shack – and I wasn't eating Rice Crispies at the time! With electrical storms 10 to 100 miles away, the ends of the open-wire feed lines would arc periodically as the big loop "received" electric charges. When thunderstorms were actually overhead, the feed line ends – disconnected from my balanced line tuner and stored inside a glass mayonnaise jar for insulation – crackled like a Jacob's ladder. No kidding – it was scary stuff! Before I figured out what was happening during that storm-plagued summer, static electricity killed the front-end amplifier transistor in my radio. Twice...

❖ Operation as a Top-Loaded Vertical

For certain installations, configuring the horizontal loop as a top-loaded vertical may improve DX performance on 160 and 80 meters. If you can run your loop's feed line straight down to the ground, you can short the two conductors together (coax or open-wire line) and work the resulting "vertical antenna" against a set of conventional ground radials. The loop acts as a super-size capacitance hat and the feed line acts as a vertical radiator.

Perhaps the best way to make this work is to use a ground-mounted autocoupler to feed the overhead loop through a vertical length of open-wire line. The coupler, fed with coax, is mounted on a short post, with open-wire line running straight up to the loop's feed point. The chassis of the coupler can be connected to a set of radials (which will also be connected to the shield of the coax that runs from the shack to the coupler).

For operation as a loop, the two open-wire feeders are connected "normally" (one to the coupler's chassis ground and one to the coupler's output terminal). For operation as a vertical, the two feeders are shorted together and connected to the coupler's output terminal (and worked against the field of radials).

A relay, switchable from the shack, could toggle between the two modes. The autocoupler would quickly match either configuration, so you could quickly switch between them to maximize any particular signal. The radials could remain connected all the time and would not interfere with using the loop in either configuration.

❖ Operation as a Diamond Dipole

Under certain circumstances it may be advantageous to operate the antenna as a "diamond dipole" instead of as a closed loop. To make this work, install a square loop and place the feed point at one corner. At the corner opposite the feed point, leave the loop electrically open, which makes the antenna a diamond-shaped dipole or sorts.

If a jumper is placed across the gap, the two halves are again connected, forming the usual closed loop. If, for example, your loop is a full wavelength at 40 meters, electrically opening the insulator that's across from the feed point makes the antenna an 80-meter diamond dipole. A shack-controlled relay would make the switch-over more convenient.

Unlike operating the loop as a top-loaded vertical, which could potentially provide superior DX performance on multiple bands, the diamond dipole trick is probably only useful to enable operation on a lower-frequency band when feeding the loop with coax via a shack-mounted antenna tuner.

Using the example above, feeding a 40-meter full-wave loop with coax and a shack-mounted tuner works great. Feeding a 40-meter loop on 80 meters – without swapping the coax for open-wire line – will probably work quite poorly, as the SWR losses on the coax will be very high. Electrically opening the far insulator, however, makes the 40-meter loop into an 80-meter dipole, which will not suffer high SWR losses when fed with coax and a shack-mounted tuner.

❖ Adjustments for Weird SWR

My pre-condo loop tuned up easily on all HF bands except for the upper part of 80 meters, where my autocoupler and my balanced line tuner just couldn't find a low-SWR solution. Adding 15 feet to the length of my feed line changed the impedance presented to my tuners and they were able to match things with no problem. If you find "hard to tune" band segments with your loop, lengthening or shortening the feed line (or the antenna itself) can make things right.

When operating at or above the loop's fundamental frequency this will probably never be an issue. My pre-condo loop was resonant at 5 MHz, and the hard to tune spot was at 3.8 MHz, which is below the loop's fundamental frequency which, in conjunction with my particular feed line length, was presenting an "out of range" impedance to my tuners.

Using an antenna impedance analyzer or a vector network analyzer can make short work out of this particular issue by eliminating iterative trial and error.

❖ Height

For horizontal wire antennas, there's no substitute for height above ground when it comes to ultimate performance, and the horizontal loop is no exception. But compared to dipoles and vees, when mounted at less than a half-wavelength above ground, the take-off angle produced by horizontal loops that are at least two wavelengths long is much lower, making for much better DX performance. That's a key factor that contributes to a horizontal loop's performance edge when installed 25 to 60 feet above ground.

❖ Frequency Scaling

Careful readers will notice that I said "at least two wavelengths long" in the previous paragraph. Although the horizontal loop is a good performer on all bands at or above its fundamental frequency, for best DX performance (lower take-off angles), a loop should be at least two wavelengths long at its operating frequency.

For example, if your loop is a full wavelength at 80 meters, when used on that band, most of its energy will be radiated at high angles, providing big signals stateside, but weaker signals when DXing. An 80-meter loop is two wavelengths long on 40 meters, however, and because of that, most of its energy is radiated at lower angles, providing strong stateside and strong DX signals.

On 20 meters an 80-meter loop is four wavelengths long. Gain is increasing and take-off angles are decreasing, making the antenna a fabulous DX performer. On 10 meters an 80-meter loop is eight wavelengths long. Gain is still quite high (although it has peaked and is starting to drop a bit) and take-off angles low, providing great DX performance. At 6 meters the antenna is still useful, but gain lobes are becoming super narrow, limiting useful potential.

On the most practical level, this means that a 40-meter loop will work well from 40 through 6 meters, with best DX performance starting at 20 meters (two wavelengths). An 80-meter loop will work well from 80 through 10 meters, with best DX performance starting at 40 meters. A 160-meter loop will work well from 160 through 15 meters, with best DX performance starting at 80 meters. And so on. The horizontal loop has a huge operating range overall, but its "DX zone" starts at two wavelengths and ends somewhere between six to eight wavelengths.

An 80- or 40-meter horizontal loop at 50 feet can outperform three-element Yagis on 20 through 10 meters all day long, but getting peak DX performance on 160 meters, for example, would take a 320-meter full-wave loop mounted 100 to 150 feet above ground. At 300+ feet on a side that's just too big to be reasonable, and that's why most DX antennas for 160 meters are verticals. (If you had a football field sized clearing ringed by giant sequoias you could really put yourself on the RF map, especially on 80 and 40 meters!)

If you're looking for a superior multiband wire antenna, just put up a horizontal loop by hook or by crook. These extra tidbits are definitely for deluxe installations. For more info, check out "A Closer Look at Horizontal Loop Antennas," by Doug DeMaw, W1FB, in May 1990 *QST*; "The Horizontal Loop – An Effective Multipurpose Antenna," by Scott Harwood, K4VWK, in November 2006 *QST*; or any of a number of in-depth horizontal loop articles by L. B. Cebik, W4RNL, at **www.cebik.com** (free site registration required).

GETTING STARTED

THE BEGINNER'S CORNER

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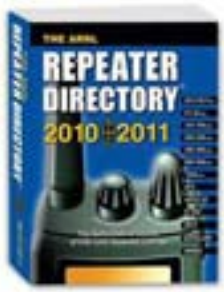
The Joys of Ten

According to the Oxford English dictionary, the word *amateur* comes from French by way of the Italian word *amatore* which descends from the Latin *amator* or "lover." Well, that just about sums up the phrase we know today as *amateur radio* and describes the crazed state most of us are in when it comes to the subject of radio. We love it unconditionally, wildly and with the zeal of the converted. The word applies to shortwave listeners as well; there's no stipulation that you have to be licensed to be a real *amateur*, as the French say.

If you take an unscientific poll, as I claim to have done, you'll find that the band hams love most is 10 meters. Why is that? Well, what's not to love? 10 is the widest of all HF bands available (1.7 MHz, plenty of room to spread out); it's reserved exclusively worldwide for amateur use; it's the only ***HF*** band on which anything goes (CW, SSB, AM, FM, SSTV, RTTY, PSK31, etc.); it has frequencies for space communications; and it allows repeater operation (imagine being stuck in commuter traffic and working South American DX through a 10 meter repeater in the Caribbean! Try *that* on 2 meters.)

But, best of all, 10 meters is the great equalizer band. When sunspots flare and the ionosphere is juiced, you don't need to be a Big Gun to work the world. A nice, modest 100 watt rig and a good old fashioned vertical antenna will take you anywhere the propagation blows. And, if you really want to blast your signal into rare DX pileups, antenna books are crammed with easy to build wire and aluminum tubing beams that are far smaller than conventional tri-band beams.



ARRL Repeater Directory ($11) tells you where the ten meter repeaters are all over the U.S. (Courtesy: ARRL)

Still, that hardly scratches the surface of this band. Old-school AM operators love 10 meters (29.000-29.200 MHz) and you'll hear many with CB rigs modified to work 10 meters and pumping out that glorious 4 watt AM sound into cut-down CB antennas. Remember, it works this way and not the other way around. You can't put your Kenwood, Icom or Yaesu on the CB channels and ratchet-jaw with your former good buddies. They'll have to earn their tickets to join you, and once they do, they'll wonder why they ever settled for 40 channels!

Who's on Ten?

Ten meters has it all over the other bands because of a built in 100 kHz-wide beacon band that makes it only too clear where the propagation is open. Hundreds of coordinated beacons from around the world transmit 24/7, typically with under 10 watts, from 28.200-28.300 MHz. If you can hear any of those beacons, you know that your 100 watts will be heard quite well in their direction.

But, what if a signal falls on 10 meters and nobody's around to hear it? Does it exist? The answer is, yes!, thanks to PropNET, an automated system of radios tuned to the 10 meter PSK31 frequency (28.120 MHz USB). Using PSK31 software, you can call CQ and wait. If nobody picks up your signal, you can find out if your signal is in fact getting out. Go to **http://propnet.org** and click on "real time plots." Now, click on "self reports." Enter the information on the left of the map and click where it says, "here." You'll soon have a graphic picture of where your signal was heard and who heard it on 10 meters.

CushCraft Ten3 ($269) is an inexpensive three element monobander for 10 meters. (Courtesy: Universal Radio)

Want to work Slow Scan TV (SSTV)? Go to 28.680 MHz. Looking for amateur satellite downlinks? You'll find them between 29.300-29.510 MHz. Want to go FM simplex? There's a calling frequency on 29.600 MHz. Once you make your contact, move the QSO down the band and let others call. When your QSO is finished, go back to the calling frequency and make another contact. It's easy to see why hams get so excited about an upswing in the solar cycle. Ten meters is the place to go.

There are some peculiarities about 10 that you'll soon become aware of: QSB (fading) is a fact of life on 10. Sometimes a great path will open up to Europe and you'll work one after another with little effort, then the band will just drop out. To avoid losing your contact, keep your side of the conversation fairly short. Unlike 80 or 40 meters, there's no place for long-winded, old-buzzard style comments.

Another thing that's weird about 10 is that you won't be able to work any stations within a several hundred mile "skip zone" of your QTH. That's what makes it so hard for many to get their Worked All States on 10 award. While stations from 1,500 and 5,000 miles will roll in nicely, you won't be able to work any nearby states. Except, that is, when the band changes radically during the summer months and it suddenly becomes possible to work those states nearest to you and anything outside the country is rare. You will be able to work some stations within a 20-40 mile radius via groundwave propagation nearly all the time.

Propagation favors areas of the Earth that are illuminated by the Sun and, because the Earth is round and tilted, interesting things happen along the *terminator*, the line that separates the light from the dark areas of the planet. Long distance contacts are easily made during this period of the day which lasts anywhere from a few minutes to a few hours, depending on how much the ionosphere is energized.

As this is written (early March) we are having an unusually high sunspot number and 10 meters is hotter than it's been in years. I had been working a number of stations from Europe, Africa, North and South America all day and by sunset I started listening for the South Pacific. It wasn't long before I came upon Graeme ZL50GH calling CQ from New Zealand running 400 watts into a 4 element beam pointed at North America.

Listening for a couple of minutes proved

ANYTHING GOES ON TEN

Total band width: 28.000-29.700 MHz

28.000-28.070	CW (QRP CW calling frequency: 28.060)
28.070-28.120	RTTY/Data (28.120 PSK31)
28.120-28.189	Automatically controlled data stations
28.190-28.225	Beacons (IBP/NCDXF beacons: 28.200)
28.300-29.300	Phone (28.365 QRP SSB calling frequency; 28.680 SSTV)
29.000-29.200	AM
29.300-29.510	Satellite downlinks
29.520-29.580	FM repeater inputs
29.600	FM Simplex
29.620-29.680	FM repeater outputs

that competition was stiff with folks all over North and South American eager to catch the ZL. There was a little fading as his signal dropped to an S1 (just barely bouncing the needle on the S-meter on an otherwise totally quiet band), but by 2319 his signal was easily 55. After a couple of attempts I made the contact and a half-hour later his signal was gone. It was a delicious taste of the good things to come on 10.

❖ More Loop Madness

Last July Bob Patterson K5DZE wrote a feature article in *MT* called "An Easy to Build All-Band Loop Antenna" (pages 16 and 17). Later this past fall a series of storms and the ravages of time brought down my trusty Grove All-Band dipole, which has been up for the better part of 22 years. It seemed like a perfect time to try something new, so why not build a loop?

I found several hundred feet of aluminum fence wire that I had been using for several years as a Beverage antenna for longwave reception and I pulled it out of the woods. In the junk box I found four ceramic insulators and, using the design in Bob's article, I put up a 480 foot horizontal loop, feeding it with the 50 ohm coax that had previously fed the old dipole.

However, it wasn't until the past few weeks that the Sun woke up and started giving us some old fashioned sunspot numbers (after more than 200 days without sunspots in 2010!) so there hadn't been any point to testing the antenna. But now, with an active Sun and the new loop I've been able to give it a serious workout. The results have been most gratifying from 80 through 10 meters and next month I'll go into a little more detail on the loop's performance.

❖ The Considerate Operator

Long time *MT* reader Judy May W1ORO writes: "In the November issue of *Getting Started*, you printed a list of special frequencies in the HF bands that hams should be aware of when choosing where to call CQ. It is just what I needed, and the timing was perfect. Just weeks before, I got my first all-band HF rig! I obtained my General Class license years ago, but my operation was on a 10-meter-only radio. My goal for this year is to make my first CW contact, and then to try CW in a contest!

"In your listing of allocated frequencies, I was surprised that you did not notate 28.400 MHz; I thought I had learned that this was the general calling frequency for 10 meter SSB.

"Also, I just heard something in a 2 meter conversation yesterday. It was mentioned that there was a general agreement that 17 meters is off-limits to contest operation. Is that true? This stuff seems pretty important for an HF beginner like me. Thanks for publishing the list."

Great questions as usual, Judy! The best source for where to operate (and where *not* to operate) is the ARRL's "Considerate Operator's Frequency Guide" which is found here: **www.arrl.org/files/file/conop.pdf**. Print it out and post it in your shack. It covers the entire amateur radio HF spectrum (160-10 meters) and lists band segments where the various modes are

Uniden 2510 and its twin, the Radio Shack HTX-10, were great 10 meter rigs: 25 watts output, all-mode, compact, solidly built and still selling for about $100 used. I paid $150 for mine new more than 20 years ago and worked the world from the front seat of the car. (Courtesy: Author)

allowed. As you'll see from the guide, 28.400 MHz isn't listed as a general SSB calling frequency, but 28.385 is listed as a QRP (low power) SSB calling frequency. So, it's good to avoid that frequency (unless of course you're a QRP operator!).

Also not listed but good to avoid at 1800 UTC is the Ten-Ten International net frequency (28.380). Ten-Ten International is a formal non-profit organization that was formed in 1962 to encourage amateur use of the 10 meter band. Members collect "10-10 numbers" (certificate numbers issued to each new member) and qualify for an unending series of 10-10 awards which keeps the band in use. When Ten-Ten was founded it was feared that unless hams made active use of the band, it would be auctioned off to commercial interests, split into CB-style band segments, or simply taken over by non-licensed pirate stations (there are plenty of them on 10 meters as it is). Ten-Ten has done a great job over the decades providing an active voice on the band and have issued more than 75,000 10-10 numbers. Details on Ten-Ten International can be found at **www.ten-ten.org**.

Of course, nothing in FCC rules gives any group, club or individual rights to any particular frequency, but the "considerate operator" tries to stick as close to the accepted band plans as possible.

As to contesting: Yes, it's considered that, since their inception, the so-called WARC bands (12, 17 and 30 meters) were "off limits" to contest operation (and that includes Field Day!). One reason is that, unlike the major HF amateur bands (160, 80, 40, 20 15 and 10 meters); they are all fairly small bands with little enough room without an invasion of contesters. And, the agreement provides a nice oasis where hams who are not interested in contesting can retreat.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Radio in Times of Crisis

As the deadline for this column approached, a terrible earthquake, measuring 9.0 on the Richter scale, struck off the coast of Japan. As of this writing hundreds are dead, thousands are missing and Japan faces the daunting task of rescue, recovery and rebuilding amidst the triple tragedies of earthquake, tsunami and potentially serious nuclear accidents.

Once again, one has to be impressed with the professionalism and in some cases bravery of journalists covering this multi-faceted tragedy. Some truly remarkable video, shot by citizens and journalists has already turned up on the internet and on television screens. No doubt other videos will have appeared since this was written. It never ceases to amaze me that people in harm's way will stop to record tragic events such as these.

NHK Radio and TV have been most impressive as this story develops. It was noted early on, that this might well be the most documented earthquake disaster in history. Japan is a very earthquake-prone region and the country has civil defense plans to react to such events (perhaps saving thousands of lives in this case). In addition, it was reported that after the Kobe earthquake of January 1995, cameras and sensors were set up all over the country as an early warning/damage assessment tool. Hence the reason many of the amazing scenes are flashing around the world via television and the internet.

While the television reports have been riveting, and often more up-to-date, radio once again demonstrates its importance in this disaster. Listening to **NHK Radio** English-language broadcasts whenever possible has provided a depth of analysis and detail not available via the television.

English-language news broadcasts were expanded early on, doubling in length from 15 to 29 minutes. In this all too brief time an astounding amount of detail was conveyed. Often reports and events from **NHK** domestic broadcasts were simply translated from the original Japanese. While television can convey the images of devastation, the **NHK** radio reports brought many facts to light that simply haven't been covered on television.

For instance, one interview with a medical first responder was particularly poignant, reminding the listener just how many victims of the disaster are crowded into shelters that are often cold (temperatures hover around 0 Celsius or 32 Fahrenheit). The crowded facilities have the potential to enable the spread of illness and disease, while food and water (not to mention medical supplies) are in short supply, as the entire supply chain in Japan has been disrupted. Complicating things is the ongoing drama at a number of nuclear

power plants damaged by the quake and tsunami leading to fears of radiation leaks or worse.

I've been listening to the **Radio Japan** live news stream online quite a bit. Although I barely understand a word being said (it's been all Japanese), it is strangely compelling listening. I know what they have to be discussing. At one point an official was heard repeating the words kilometer...I assume he was discussing the evacuations around the nuclear plants. His tone was measured but there was urgency in his voice.

You, dear reader, will have a better idea of how this all has turned out. In the coming days and weeks as Japan attempts to recover from its nightmare, I'll be glued to **NHK radio** broadcasts and those of other countries for in depth analysis and coverage.

❖ Radio Prague

"Same to You, Only Different"

When I was a kid and someone attempted to insult me, I'd quite often come back with "Same to you, only different!" I thought of this phrase as I checked out the **Radio Prague** website. As you may know, **Radio Prague** gave up shortwave broadcasts as a cost cutting measure at the end of January. One can still hear **Radio Prague** on shortwave via WRMI, Radio Miami International (Cuban jammers permitting). The current schedule features daily broadcasts at 0700 UTC, Monday to Friday at 1000 UTC, and Saturday and Sunday at 1930 UTC.

Perhaps the easiest way to listen is via the internet. The **Radio Prague** website has changed a bit from a few years ago, with slightly fewer bells and whistles than in the past. Nonetheless, one can listen to **Radio Prague** programs "live" (that is, via a live stream) according to a regular schedule, hear daily programs on demand, or select individual program features on demand.

If one scrolls to the bottom of the **Radio Prague** main page in English at **www.radio.cz/en,** one can see all of the most recent program

features as broadcast by **Radio Prague,** with a brief synopsis and a link to listen to that particular program.

Looking at these options in reverse order, some highlights include:

Sunday Music Show – A weekly music feature heard, as the name suggests, on Sundays. Recent programs have featured music hits from the Communist era in Czechoslovakia, and the music of James Harries, a Briton who has lived in Prague for 13 years. The program is something a little different musically, an opportunity to hear some great music that one can hear nowhere else... at least not on the radio.

From the Archives – This weekly program features historic recordings from the Radio Prague archives, interspersed with background information on the significance of the recordings. Many of these programs were previously aired over the past few years; nevertheless it is a fascinating opportunity to hear **Radio Prague** archive programming from the 1930s to the present. If you like "old time radio," this is the program for you. ***From the Archives*** can be heard on UTC Saturdays, at the end of the broadcast.

SoundCzech is the innovative program which teaches Czech words and phrases through song lyrics. The last episode, which was aired January 29 two days before shortwave broadcasting was shut down, covered the phrase *vypdanout z týhle díry* – to get out of this hole...perhaps a bit of irony. **Radio Prague** has certainly been innovative in its teaching of the Czech language over the years! ***SoundCzech*** can be heard at the conclusion of each UTC weekday broadcast.

One on One – This is the weekly interview program from **Radio Prague** heard on UTC Mondays. Each week someone famous (or not so famous) is interviewed. Recent guests have included everyone from a Brazilian-born journalist, to a magazine editor, to a government official, to an 18-year-old student. The section archive at **www.radio.cz/en/section-archive/one-on-one** contains 46 pages (!) of past interviews going back years – close to 500 programs at your fingertips.

That is the really great thing about the **Radio**

Prague website. There may be as much as ten years worth of past programming available to hear on demand!

If you want to listen to any thirty-minute program from the past week, including news and features, you can go to **www.radio.cz/en/static/about-radio-prague/listen-on-demand** and download them or listen.

And finally, there is a continuous stream in which English is scheduled at 2200, 0100, 0400, 0700, 1000, 1300, 1600 and 1900 UTC. You can hear this by clicking on the "Live Broadcast" link at **www.radio.cz/en/static/about-radio-prague/live-broadcast**

Even though **Radio Prague**, like many broadcasters, may be all but gone from shortwave, one can still hear most of the quality programming that has been offered for many years by this popular broadcast entity. It's largely the same programming to you...only different!

Radio Prague is not the only international broadcaster who has made the transition to internet broadcasting. Others include **Radio Slovakia International, Swedish Radio International** and **HCJB.**

❖ Radio Slovakia International

Like their former compatriots in the Czech Republic, **Radio Slovakia** is heard via the internet these days. A few casual "tunings" suggest that the **Radio Slovakia** programming is much like it once was on shortwave. You can access about a month's worth of programs for listening at your computer or downloading for future listening at your leisure, at **www.rozhlas.sk/radio-international-en/web-archiv?rel=980**

❖ Swedish Radio International

Radio Sweden is another broadcaster that may have abandoned shortwave, but remains available via the internet. Even before they left shortwave, I used to download the daily podcast of the 30-minute broadcast via iTunes. While there is certainly a romance to hearing the programs via the radio, it is rather nice to hear them in higher quality over the internet.

Radio Sweden has always done a quality job despite budgetary limitations. There is quite an extensive archive of past programs; you can listen to **Radio Sweden** broadcasts going well back into 2010!

These **Radio Sweden** English programs are the last opportunity to hear English from Scandinavia. One by one, in my listening experience, Denmark, Norway and Finland have left the airwaves in English. Finally Sweden joined them last fall, but at least they kept some English online. You can access the huge archive of past shows, and subscribe to the daily podcast via the Radio Sweden website at: **http://sverigesradio.se/sida/laddaner.aspx?programid=2054**

❖ HCJB

In the 1970s and 1980s, **HCJB, "Heralding Christ Jesus' Blessings,"** was a regular stop in my listening. Their powerful transmitters in Quito, Ecuador made for always-reliable reception here in my part of the world. In fact it was the very first station I ever QSLed.

The programming was extremely varied. In many ways **HCJB** served as an external service for Ecuador itself, featuring travel and cultural programs from that country, as well as news and information.

As its name suggests, it was a Christian missionary station, founded on December 25, 1931. There was a lot of quality programming available, including such longtime favorites as ***Morning in the Mountains, Musical Mailbag, Muisca del Ecuador*** and of course, ***DX Party Line***. Another program carried by **HCJB** among others was ***Unshackled***, a throwback to the radio dramas of yesteryear, but often set in the present day.

HCJB ended English broadcasts from Quito a few years ago. The **HCJB** website has a highly useful page at **www.hcjb.org/listen** Here, you will find links to a number of broadcasters around the world, including missionary stations and websites featuring broadcasts in English and other languages from such diverse nations as Haiti (**4VEH**), South Africa, Romania, Lesotho and Ghana. There are also links to podcasts for such programs as ***DX Partyline***, which still continues, as well as just about every aspect of the **HCJB** mission as it transitions into the 21st Century. There's a lot to be seen and heard via the website: check it out!

❖ Recommended Listening

German by Radio – Deutsche Welle

Germany's **Deutsche Welle** has always offered the Cadillac of language instruction (or maybe that should be Porsche). For many years, DW has offered a German course in one form or another. In the 1980s, it was ***Auf Deutsch Gesagt***. Later, the course was entitled ***Deutsch, Warum Nicht?*** (*German, Why Not?*). More recently they have introduced ***Radio D***, a new course that introduces the listener to two young radio producers who travel throughout Germany researching mysterious cases. Kind of like an American cartoon minus much of the cast and the Scooby snacks.

Radio D, like its predecessors, consists of two series of 26 episodes. Audio of the lessons is available for download, as are pdf files of the manuscripts and the exercises for each episode. There is a workbook with two CDs available for purchase, but it's not clear if these duplicate what is available on the DW site.

All episodes of the earlier course, ***Deutsch, Warum Nicht?*** are still available for download via the DW site as well. Simply go to the **Deutsche Welle** website, and follow the links under "Learning German" on the left side of the page. Happy learning!

❖ What's New?

From Russia With Love – Voice of Russia

There have been a lot of additions to the **Voice of Russia** lineup. ***From Russia With Love*** is another (relatively) new program from this radio station. This one is a treat if you recall **Radio Moscow** of the mid to late 1980s. **Natalia Stefanova** and **Vasily Strelnikov** host ***From Russia with Love***. Debuting in December 2010, it marks the return of two **Radio Moscow** veterans after almost 20 years. This is a delightful program, featuring a lively discussion about the Russian capital. Vasily and Natalia discuss the highs and lows, the good and the bad about Moscow.

In the 1980s, Vasily hosted the very original ***Listener's Request Club, Vasily's Weekend*** and (anyone remember this one?) ***Warmonger's Monthly*** (!). Vasily was a breath of fresh air at **Radio Moscow** even before the days of Gorbachev and perestroika.

In the course of the 25-minute program, Vasily and Natalia will discuss any number of topics, often sounding unrehearsed. These often include a discussion of places or districts in the capital such as The Arbat, reminiscences of their younger days in Moscow after living abroad, and the contrast with life in Moscow today.

They also reminisce about their earlier days at **Radio Moscow**, which provide fascinating insight into what it was like to work there in the waning days of the Cold War. Particularly touching was the program they did after the death of **Carl Watts**, in which they discussed his very interesting life and personality both on and away from the mic.

In late February and early March, episodes were dedicated to life in Moscow in the 1970s, the 1980s and the "unforgettable"1990s. The second program about the 1980s was particularly interesting. Reportedly the staff were all very friendly and hung around together in their off hours. It was interesting to hear their take on the Reagan era and the arrival of Gorbachev on the scene during this turbulent time in Soviet-American relations.

In light of the events in Japan, the discussion of the Chernobyl disaster was quite chilling. In spite of this, it's a very light-hearted and interesting program, which is well worth hearing every week. Vasily always sounded like he belonged at a Top 40 radio station in a major American market rather than a state broadcaster, let alone one in Russia. He's a little bit older now, but he hasn't changed that much in the intervening years. It's a delight to have him back, and his rapport with his co-host Natalia makes this program a must-hear for this listener.

You can contact the program at *moscowwithlove@gmail.com* In each edition, Vasily and Natalia often answer two or three emails from listeners, often leading to a spirited discussion.

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
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Twitter @QSLRptMT

Special Event QSLing in Amateur Radio

One of the interesting aspects of amateur radio is the diversity of activity operators can use to communicate. Whether in a car, a listening-post, hiking in the mountains or boating, hams are involved in all sorts of fun and challenging activities.

While many think amateur radio is merely a hobby, it actually has saved countless lives with the help of skillful and trained volunteer operators, providing communications during disasters, when all other communications have failed.

Known as *hams*, station operators can participate in a wide variety of activities such as sending and receiving Morse code, HF digital modes, FM transmissions on VHF/UHF local repeaters, handling message traffic and operating their own slow or fast scan television stations. Other popular operating activities include using the moon as a reflector of radio waves (an activity known as moonbounce) and using a hand-held receiver (HT) to access orbiting satellites called OSCARs (Orbiting Satellite Carrying Amateur Radio). Operators also routinely make contacts with the International Space Station, as many of the astronauts and cosmonauts are licensed amateur radio operators.

Many amateurs also enjoy setting up special event stations for fellow hams and shortwave listeners. Set up to commemorate special occurrences, they often issue distinctive QSL cards or certificates. Some stations use unusual prefixes, such as the OO prefix used by Belgian amateurs in 2005 to commemorate their nation's 175th anniversary. Some events are held annually to celebrate a special event such as Jamboree on the Air, Memorial Day or the 4th of July.

Many operators decorate their radio listening posts with these special cards and certificates. To obtain a certificate from any of the special event stations offering them, send your contact information along with a 9x12 inch self-address stamped envelope to the address announced during the event. To receive a special event QSL card (when offered) be sure to include a self-addressed, stamped business envelope along with your QSL card and contact information.

The following represent a portion of special events being offered to amateur radio and shortwave listeners in May. Contact these stations to commemorate the historical occasion or special event.

May 5

50th Anniversary of Alan Shepard's First Manned Space Flight, 1400-2100 UTC. KA1SKY, Concord, NH, Contoocook Valley Radio Club. Operating on 28.400, 21.300, 14.250, 144.20 kHz SSB. Certificate. Wayne Santos, 163 Hartshorn Road, Barnstead, NH 02318. Operating at the McAuliff-Shepard Discovery Center. Station is a collaborative project of CVRC, NEAR-Fest and the Discovery Center. **www.klbke.org/plantarium/ka1sky.htm**

May 7

Palo Alto Battlefield Anniversary. 1600-2200 UTC. K5VC, Brownsville, Texas. Charro Radio Club/South Texas ARES District 15. Operating on 28.310, 21.280, 14.230 kHz SSB and 14.070 PSK-31. Rio Grande Valley Rep. Certificate and QSL. Clifford Wareham, 32086 Share 28 Road, Los Fresnos, TX 78566. Anniversary of the Mexican-American war at Palo Alto Battlefield site, May 8, 1845. *cliffordwareham@hotmail.com*

May 7

Titan Missile Museum 25th Anniversary. 1500-2300 UTC. WE7GV, Green Valley, Arizona. Green Valley Amateur Radio Club. Operating on 14.245, 14.242 kHz SSB. Certificate and QSL. Green Valley Amateur Radio Club, 601 North La Canada Dr., (SAV) Green Valley, AZ 85614. Titan Missile site in Sahuarita, Arizona.

May 13-29

100th Indy 500 Anniversary, 1500-2200 UTC, W9IMS, Indianapolis, Indiana. Indianapolis Motor Speedway Amateur Radio Club.

Operating on 21.340, 14.240, 7.240, 3.840 kHz SSB. Certificate and QSL. W9IMS, P.O. Box 18495, Indianapolis, IN 46218. SASE for QSL, $ 4.00 for certificate. Must work all three Indy races in one year to qualify for certificate. **www.qrz.com/db/w9ims**

May 14

Armed Forces Day, National Maritime Day, Navy Nurse Corps. Established 1908. MARS Amateur Radio Crossband Operations Event, 1700-2359 UTC. NI6IW, San Diego, California. USS Midway (CV-41) Museum Radio Operations Room. Operating on 14.320, 7.250 kHz SSB and 14.070 PSK-31. QSL card. USS Midway Museum Radio Room, 910 North Harbor Dr., San Diego, CA 92101.*kk6fz@arrl.net*

May 18-22

Mt. St. Helen QSO Party, 2100-2300 UTC. Vancouver, Washington, Clark County Amateur Radio Club. Operating on 14.245, 72.40, 3.840 kHz SSB. Certificate and QSL. W7AIA Special Events, P.O. Box 1424, Vancouver, WA 98668. *SpecialEvents@w7aia.org*

May 21-22

The American Air Power Museum, 1220-1220 UTC. W2GSB, Farmingdale, New York. The Great South Bay Amateur Radio Club. Operating on 14.255, 7.175, 3.850 kHz SSB and 14.070 PSK-31. Certificate and QSL. W2GSB/Air Power, P.O. Box 1356, West Babylon, NY 11704. Honoring our service men and women of the armed forces who have given so much for our country. Operating from the historic hanger at Republic Air Field, home of many of the airplanes that help our country fight for rights and freedoms. **www.gsbarc.org**

May 22

Coastal Defense Day, 1600-2000 UTC. Sandy Hook, New Jersey. Roseland Amateur Radio Club. Operating on 14.270 and 7.270 kHz SSB. QSL. Operating from the Sandy Hook, New Jersey Lighthouse, USA.

May 29-31

Annual activation of NW0AA. The northern most amateur radio club in the 48 contiguous states. Operating 1400-2100 UTC on 14.240, 14.040, 7.240, and 3.940 kHz SSB. Certificate and QSL. Dan Whipple, WA0FJJ, 11726 Norway St. NW, Minneapolis, MN 55448.

May 30

Memorial Day, 1500-2245 UTC. W5KID, Baton Rouge, Louisiana and *USS Kidd* Amateur Radio Clubs. General Class bands CW, using reduced power in the 20 and 40 meter bands. W5KID, 305 S. River Dr., Baton Rouge, LA 70802.

ADDITIONAL ACTIVITY REMINDERS

Jon Lervik, LA8HGA, will be operating from Svalbard, **May 19-23**. Operations will be on HF and CW only. Location will be Longyearbyen, Spitsbergen (EU-026). QSL via Jon Morten Lervik, Landskronaveien 205, NO-2013 Skjetten, Noway or via ARRL.

EU-044, Operators Bert, DL2RNS and Ric, DL2VFR, are planning to be active at LA home call from Mageroya Island from **May 28-31.** Activity will coincide with the CQ WPX CW Contest on May 28-29. They plan to concentrate their operations on the first two days on 30, 17 and 12 meters CW. After the contest, they will work all bands CW, SSB and special attention to the JA stations.

Don't forget the annual Dayton Hamvention 2011, May 20-22. Exhibits, forums, flea markets and more. Don't miss this megafest. Details at **www.hamvention.org**

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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 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, 8:30 pm Eastern, 7:30 pm Central, etc.).

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 broadcast ⑤ 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

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Additional Contributors to This Month's Shortwave Guide:

Thank You to ...

BCL News; British DX Club; Cumbre DX; DSWCI-DX Window, Hard-Core DX; Radio Bulgaria DX Mix News; Media Broadcast, Play DX; WWDXC-BC DX-Top News; World DX Club/Contact, World Radio TV Handbook. Klingenfuss 2011 SW Frequency Guide.

Alokesh Gupta, New Delhi, India; Alan Roe, UK; Babcock, UK; Claudius Dedio/AWR; Derek Kickbush/HCJB Australia; Dario Monferni, Italy; Drita Cico, Albania/R Tirana; Evelyn Marcy/WYFR; Hans Johnson/WINB; Ivo Ivanov/Radio Bulgaria; JaisakthivelThangavel, India/ADXC; Sean Gilbert, UK/WRTH; Wolfgang Büeschel, Stuttgart, Germany; Rachel Baughn/MT; Rich D' Angelo/NASWA-Flash Sheet.

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

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WiNRADiO AX-71C Discone	ANT01	$89.95
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WiNRADiO AX-37AM Wide-band Log Periodic	ANT29	$499.95
WiNRADiO AX-07B flexible VHF/UHF	ANT47	$24.95
WiNRADiO AX-91M magnetic antenna base	ANT48	$24.95
Icom AH-8000 Wide-coverage Discone	ANT54	$249.95
Grove Flex-tenna HVU	ANT45	$14.95
Grove Flex-tenna VU	ANT46	$9.95
Professional Wideband Discone	ANT 9	$99.95
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Super-M Ultra Base Station	ANT61MBS	$189.95
Super-M Ultra Mobile antenna w/NMO mount	ANT61NMO	$109.95
Super-M Ultra Mobile mag mount	ANT61	$124.95
Super-M Multiband base antenna	ANT10MBS	$99.95
Super-M Mobile antennna w/ NMO mount	ANT10NMO	$79.95
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AOR MA500 Wide Range	ANT 12	$99.00
AOR SA7000 super-wide receiving	ANT 39	$229.95
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WiNRADiO AX-24B discone antenna	ANT 63	$349.95
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Scancat Gold for Windows SE Upgrade	SFT 2SE	$59.95
Scancat-Lite Plus	SFT 19	$29.95
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FM Trap Filter 88-108MHz	FTR-FMDS	$69.95
PAR NOAA Weather Filter 162 MHz	FTR 162DS	$69.95
GRE Superamplifier	PRE 1	$59.95
Noise Cancelling Mobile Speaker	SPK 7	$8.95

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

0000	0030		Egypt, Radio Cairo	11590am		
0000	0030		USA, Voice of America	7555as		
0000	0030		USA, Voice of America/Radio Ashna			7560as
0000	0045		India, All India Radio/External Service			6055as
			7305as	9950as	11645as	13605as
			9705al			
0000	0056		Romania, Radio Romania International			7385na
			9580na			
0000	0057		Canada, Radio Canada International			11700as
0000	0057		China, China Radio International			6005eu
			6020eu	6180eu	7350as	7425eu
			9425as	9570as	11650as	11790eu
			11885eu			
0000	0058		Germany, Deutsche Welle	9885as		13780as
0000	0100		Anguilla, Worldwide Univ Network			6090am
0000	0100		Australia, ABC NT Alice Springs			4835do
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Creek			4910do
0000	0100		Australia, Radio Australia	9660pa		12080pa
			13690pa	15240as	15415as	17715pa
			17750as	17795pa		
0000	0100		Bahrain, Radio Bahrain	6010me		
0000	0100		Bulgaria, Radio Bulgaria	5900na		7400na
0000	0100		Canada, CFRX Toronto ON	6070na		
0000	0100		Canada, CFVP Calgary AB	6030na		
0000	0100		Canada, CKZN St Johns NF	6160na		
0000	0100		Canada, CKZU Vancouver BC	6160na		
0000	0100		Malaysia, RTM/Traxx FM	7295do		
0000	0100		Micronesia, The Cross Radio/Pohnpei			4755 as
0000	0100		New Zealand, Radio NZ International			15720pa
0000	0100	DRM	New Zealand, Radio NZ International			13730pa
0000	0100		Russia, Voice of Russia	7250na		7290na
0000	0100		Spain, Radio Exterior de Espana			5970na
0000	0100		Thailand, Radio Thailand World Service			13745na
0000	0100		UK, BBC World Service	5970as		6195as
			7360as	9410as	9740as	
0000	0100		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0000	0100		USA, EWTN/WEWN Irondale, AL			11520af
0000	0100		USA, FBN/WTJC Newport NC	9370na		
0000	0100		USA, WBCQ Monticello ME	5110na		7415am
			9330am			
0000	0100		USA, WHRI Cypress Creek SC			5875 ma
			7315na			
0000	0100	Sat	USA, WHRI Cypress Creek SC			5920na
0000	0100		USA, WINB Red Lion PA	9265am		
0000	0100		USA, WRNO New Orleans LA	7505am		15590al
0000	0100		USA, WTWW Lebanon TN	5080va		5755va
0000	0100		USA, WWCR Nashville TN	3195na		5935na
			9980na			
0000	0100		USA, WWRB Manchester TN	2390na		5050va
0000	0100		USA, WYFR/Family Radio Worldwide			5950na
			6985na	7520sa	9505na	15440ca
0000	0100		Zambia, CVC Radio Christian Voice			4965af
0030	0045	twhfas	Albania, Radio Tirana	9860na		
0030	0100	fas	Canada, Bible Voice Broadcasting Network			
			5950as			
0030	0100		USA, Voice of America/Special English			7430va
			9715va	9780va	11725va	12005va
			15205va	15290va	17820va	
0030	0100		USA, WHRI Cypress Creek SC			15680na
0035	0040		India, All India Radio, Delhi-Kingsway			7370do

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

0100	0130		Vietnam, Voice of Vietnam	6175am		
0100	0157		China, China Radio International			6005eu
			6020eu	6075eu	6175eu	7350eu
			9410as	9420as	9570as	9580as
			11650eu	11885eu		
0100	0157	DRM	China, China Radio International			6080na
0100	0157		North Korea, Voice of Korea	7220as		9345as
			11735am	13760sa	15180sa	
0100	0200		Anguilla, Worldwide Univ Network			6090am
0100	0200		Australia, ABC NT Alice Springs			4835do
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Creek			4910do
0100	0200		Australia, Radio Australia	9660pa		12080pa
			13690pa	15240as	15415as	17715pa
			17750as	17795pa		
0100	0200		Bahrain, Radio Bahrain	6010me		
0100	0200		Canada, CFRX Toronto ON	6070na		
0100	0200		Canada, CFVP Calgary AB	6030na		
0100	0200		Canada, CKZN St Johns NF	6160na		
0100	0200		Canada, CKZU Vancouver BC	6160na		
0100	0200		Cuba, Radio Havana Cuba	6000na		6050na
0100	0200		Malaysia, RTM/Traxx FM	7295do		
0100	0200		Micronesia, The Cross Radio/Pohnpei			4755 as
0100	0200		New Zealand, Radio NZ International			15720pa
0100	0200	DRM	New Zealand, Radio NZ International			13730pa
0100	0200		Russia, Voice of Russia	7250na		7290na
0100	0200		Taiwan, Radio Taiwan International			11875as
0100	0200		UK, BBC World Service	5940as		5970as
			9740as	11750as		
0100	0200		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0100	0200		USA, EWTN/WEWN Irondale, AL			11520af
0100	0200		USA, FBN/WTJC Newport NC	9370na		
0100	0200		USA, Voice of America	7430va		9780va
			11705va			
0100	0200		USA, WBCQ Monticello ME	5110na		7415am
			9330am			
0100	0200		USA, WHRI Cypress Creek SC			5875na
			7315na	15680na		
0100	0200	Sat	USA, WHRI Cypress Creek SC			5920na
0100	0200		USA, WINB Red Lion PA	9265am		
0100	0200		USA, WRNO New Orleans LA	7505am		
0100	0200		USA, WTWW Lebanon TN	5080va		5755va
0100	0200		USA, WWCR Nashville TN	3215na		4840na
			5935na	9980na		
0100	0200		USA, WWRB Manchester TN	3185va		3215na
			6890va			
0100	0200		USA, WYFR/Family Radio Worldwide			6985na
			9505na	15440ca		
0100	0200		Zambia, CVC Radio Christian Voice			4965af
0130	0200		Iran, VOIRI/IRIB	9605na	11920na	
0130	0200		Sri Lanka, SLBC	6005as	9770as	15745as
0130	0200	twhfa	USA, Voice of America/Special English			7465va
			9820va			
0130	0200	twhfa	USA, WRMI/Radio Slovakia Intl			9955ca
0140	0200		Vatican City State, Vatican Radio			5895va
			7335va			
0145	0200	twhfas	Albania, Radio Tirana	7425na		

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

0200	0227		Iran, VOIRI/IRIB	9605na	11920na	
0200	0230		Thailand, Radio Thailand World Service			15275na
0200	0230		USA, WINB Red Lion PA	9265am		
0200	0245		USA, WYFR/Family Radio Worldwide			5985ca
			11835ca			
0200	0257		China, China Radio International			11785as
			13640as			
0200	0257		North Korea, Voice of Korea	13650as		15100as
0200	0300		Anguilla, Worldwide Univ Network			6090am
0200	0300		Argentina, RAE	11710na		
0200	0300		Australia, ABC NT Alice Springs			4835do
0200	0300		Australia, ABC NT Katherine	5025do		
0200	0300		Australia, ABC NT Tennant Creek			4910do
0200	0300		Australia, Radio Australia	9660pa		12080pa
			13690pa	15240as	15415as	15515as
			17750as	21725va		
0200	0300		Bahrain, Radio Bahrain	6010me		
0200	0300		Canada, CFRX Toronto ON	6070na		
0200	0300		Canada, CFVP Calgary AB	6030na		
0200	0300		Canada, CKZN St Johns NF	6160na		
0200	0300		Canada, CKZU Vancouver BC	6160na		
0200	0300		Cuba, Radio Havana Cuba	6000na		6050na
0200	0300		Egypt, Radio Cairo	6270na		
0200	0300		Indonesia, Voice of Indonesia/Jawa Barat			
			9525va	15150va		
0200	0300		Malaysia, RTM/Traxx FM	7295do		
0200	0300		Micronesia, The Cross Radio/Pohnpei			4755 as
0200	0300		New Zealand, Radio NZ International			15720pa
0200	0300	DRM	New Zealand, Radio NZ International			13730pa
0200	0300		Philippines, PBS/ Radyo Pilipinas			11880me
			15285me	17710me		
0200	0300		Russia, Voice of Russia	7250na		7290na
0200	0300		South Korea, KBS World Radio			9580sa
0200	0300		Sri Lanka, SLBC	6005as	9770as	15745as
0200	0300		Taiwan, Radio Taiwan International			5950na
			9680ca			
0200	0300		UK, BBC World Service	5875me		5940as
			7445af			
0200	0300		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0200	0300		USA, EWTN/WEWN Irondale, AL			11520af
0200	0300		USA, FBN/WTJC Newport NC	9370na		

0200	0300		USA, KJES Vado NM	7555na		
0200	0300		USA, WBCQ Monticello ME	5110na	7415am	9330am
0200	0300		USA, WHRI Cypress Creek SC			5875na
			5920na	7315na	7385na	15680na
0200	0300		USA, WRNO New Orleans LA	7505am		
0200	0300		USA, WTWW Lebanon TN	5080va	5755va	
0200	0300		USA, WWCR Nashville TN	3215na	4840na	
			5890na	5935na		
0200	0300		USA, WWRB Manchester TN	3145va	3185va	5050va
0200	0300		USA, WYFR/Family Radio Worldwide			6985na
			9385ca	9505na		
0200	0300		Zambia, CVC Radio Christian Voice			4965af
0215	0227		Nepal, Radio Nepal	5005as		
0230	0255		China, Voice of the Strait (News Channel) Fuzhou			9505do
0230	0300	twhfas	Albania, Radio Tirana	7425na		
0230	0300		USA, WINB Red Lion PA	13570am		
0230	0300		Vietnam, Voice of Vietnam	6175am		
0245	0300		Australia, HCJB Global Australia			15400as
0245	0300		India, All India Radio, Delhi-Kingsway			6030do
			7235do	11830do	15135do	
0245	0300		India, All India Radio/Gorakhpur			3945do
0250	0300		Vatican City State, Vatican Radio			6040am
			7305am			
0250	0300		Zambia, Zambia Broadcasting Corp			6165do
0255	0300	Sun	Swaziland, TWR Swaziland	3200af		

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

0300	0310		Pakistan, Azad Kashmir Radio/Islamabad			7265do
0300	0310		Pakistan, Azad Kashmir Radio/Rawalpindi			4790do
0300	0315		Croatia, HRT Voice of Croatia			3985eu
			7375am			
0300	0320		Vatican City State, Vatican Radio			7305as
0300	0325	Sun	Swaziland, TWR Swaziland	3200af		
0300	0330		Philippines, PBS/ Radyo Pilipinas			11880me
			15285me	17710me		
0300	0330		Sri Lanka, SLBC	6005as	9770as	15745as
0300	0330		USA, KJES Vado NM	7555na		
0300	0330		Vatican City State, Vatican Radio			7360af
			9660af			
0300	0330	DRM	Vatican City State, Vatican Radio			9660af
0300	0356		Romania, Radio Romania International			7335na
			9645na	11895as	15340as	
0300	0357		China, China Radio International			6190na
			9460na	9690as	9790as	11785eu
			13620as	15110as	15120as	
0300	0357		North Korea, Voice of Korea	7220as		9345as
			9730as			
0300	0358		Germany, Deutsche Welle	12005as		15595as
0300	0400		Anguilla, Worldwide Univ Network			6090am
0300	0400		Australia, ABC NT Alice Springs			4835do
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek			4910do
0300	0400		Australia, Radio Australia	9660pa		12080pa
			13690pa	15240as	15415as	15515as
			17750as	21725va		
0300	0400		Bahrain, Radio Bahrain	6010me		
0300	0400		Bulgaria, Radio Bulgaria	5900na		7400na
0300	0400	twhfas	Canada, CBC Northern Quebec Service			9625na
0300	0400		Canada, CFRX Toronto ON	6070na		
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St Johns NF	6160na		
0300	0400		Canada, CKZU Vancouver BC	6160na		
0300	0400		Cuba, Radio Havana Cuba	6000na		6050na
0300	0400		Germany, Deutsche Welle	15595as		
0300	0400		Italy, IRRS-Shortwave/NEXUS	9670af		
0300	0400		Malaysia, RTM/Traxx FM	7295do		
0300	0400		Micronesia, The Cross Radio/Pohnpei			4755 as
0300	0400		New Zealand, Radio NZ International			15720pa
0300	0400	DRM	New Zealand, Radio NZ International			13730pa
0300	0400		Oman, Radio Sultanate of Oman			15355af
0300	0400		Russia, Voice of Russia	7250na	7290na	
			7440na	12030na	12040na	13735na
0300	0400		South Africa, Channel Africa	3345af	6120af	
0300	0400		Taiwan, Radio Taiwan International			5950na
			15320as			
0300	0400		Turkey, Voice of Turkey	6165as	9515va	
0300	0400		UK, BBC World Service	3255af	5940va	
			6100af	6145af	6190af	7255af
			7445af	9410as	9460af	
0300	0400		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0300	0400		USA, EWTN/WEWN Irondale, AL			11520af
0300	0400		USA, FBN/WTJC Newport NC	9370na		
0300	0400		USA, Voice of America	4930af		6080af
			9885af	15580af		
0300	0400		USA, WBCQ Monticello ME	5110na	7415am	9330am
0300	0400		USA, WHRI Cypress Creek SC			5920na
			7315na	7385na	7590na	15680na
0300	0400		USA, WINB Red Lion PA	13570am		
0300	0400		USA, WRNO New Orleans LA	7505am		
0300	0400		USA, WTWW Lebanon TN	5080va	5755va	
0300	0400		USA, WWCR Nashville TN	3215na	4840na	
			5890na	5935na		
0300	0400		USA, WWRB Manchester TN	3145va	3185va	5050va
0300	0400		USA, WYFR/Family Radio Worldwide			11740ca
			15255sa			
0300	0400		Zambia, CVC Radio Christian Voice			4965af
0300	0400		Zambia, Zambia Broadcasting Corp			6165do
0330	0400	twhfas	Albania, Radio Tirana	7425na		
0330	0400	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0330	0400		UK, BBC World Service	11860af		
0330	0400		Vietnam, Voice of Vietnam	6175am		
0335	0340		India, All India Radio, Delhi-Kingsway			7235do
			11830do	15135do		

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

0400	0430	mtwhf	France, Radio France Internationale			9805af
			11995af			
0400	0430		USA, Voice of America	4930af		4960af
			6080af	9855af	11670af	15580af
0400	0445		USA, WYFR/Family Radio Worldwide			6985na
			9505na			
0400	0457		China, China Radio International			6190na
			9460na	13620as	15120eu	17725as
			17855af			
0400	0457		Germany, Deutsche Welle	7240af		
0400	0458		New Zealand, Radio NZ International			15720pa
0400	0458	DRM	New Zealand, Radio NZ International			13730pa
0400	0459		Germany, Deutsche Welle	13840af		
0400	0500		Anguilla, Worldwide Univ Network			6090am
0400	0500		Australia, ABC NT Alice Springs			4835do
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek			4910do
0400	0500		Australia, Radio Australia	9590pa		12080pa
			13690pa	15240as	15515as	21725va
0400	0500		Bahrain, Radio Bahrain	6010me		
0400	0500	twhfas	Canada, CBC Northern Quebec Service			9625na
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St Johns NF	6160na		
0400	0500		Canada, CKZU Vancouver BC	6160na		
0400	0500		Germany, Deutsche Welle	6180af		15400af
0400	0500		Italy, IRRS-Shortwave/NEXUS	9670af		
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500		Micronesia, The Cross Radio/Pohnpei			4755 as
0400	0500		Russia, Voice of Russia	7290na		12030na
			12040na	13735na	15250as	15520as
0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		South Africa, Channel Africa	7230af		
0400	0500		South Africa, CVC 1 Africa Christian Radio			9430af
0400	0500	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		UK, BBC World Service	3255af	6055af	
			6190af	7255af	9410as	9460af
			11860af			
0400	0500		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0400	0500		USA, EWTN/WEWN Irondale, AL			11520af
0400	0500		USA, FBN/WTJC Newport NC	9370na		
0400	0500		USA, WBCQ Monticello ME	5110na	7415am	9330am
0400	0500		USA, WHRI Cypress Creek SC			5920na
			7315na	7385na		
0400	0500	smtwhf	USA, WHRI Cypress Creek SC			7465na
0400	0500	Sat	USA, WHRI Cypress Creek SC			9640na
0400	0500		USA, WINB Red Lion PA	13570am		
0400	0500		USA, WRNO New Orleans LA	7505am		
0400	0500		USA, WTWW Lebanon TN	5080va	5755va	
0400	0500		USA, WWCR Nashville TN	3215na	4840na	
			5890na	5935na		
0400	0500		USA, WWRB Manchester TN	3145va	3185va	5050va
0400	0500		USA, WYFR/Family Radio Worldwide			5985na
			9680na	9715ca		
0400	0500		Zambia, CVC Radio Christian Voice			4965af

SHORTWAVE GUIDE

0400	0500		Zambia, Zambia Broadcasting Corp			6165do
			4828al			
0430	0500		Australia, Radio Australia	15415as		
0430	0500	mtwhf	Swaziland, TWR Swaziland	3200af		4775af
0430	0500		USA, Voice of America	4930af		4960af
			6080af	11670af	15580af	
0430	0500		USA, WHRI Cypress Creek SC			15680na
0455	0500		Nigeria, Voice of Nigeria/Ikorodu			15120va
0459	0500		New Zealand, Radio NZ International			11725pa
0459	0500	DRM	New Zealand, Radio NZ International			11675pa

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

0500	0507	twhfas	Canada, CBC Northern Quebec Service			9625na
0500	0530		Eritrea, Radio Bana	5060do		
0500	0530	mtwhf	France, Radio France Internationale			13680af
			15160af			
0500	0530		Germany, Deutsche Welle	6180af		7430af
			9480af			
0500	0530		Japan, Radio Japan NHK World			5975eu
			6110na	9770af	15205as	17810as
0500	0530		Vatican City State, Vatican Radio			7360af
			9660af	11625af		
0500	0557		China, China Radio International			7220na
			11880na	15350me	15465as	17505as
			17540as	17725af	17855as	
0500	0600		Anguilla, Worldwide Univ Network			6090am
0500	0600		Australia, ABC NT Alice Springs			4835do
0500	0600		Australia, ABC NT Katherine	5025do		
0500	0600		Australia, ABC NT Tennant Creek			4910do
0500	0600		Australia, Radio Australia	9590pa		12080pa
			13630as	15160pa	15240pa	17750as
0500	0600		Bahrain, Radio Bahrain	6010me		
0500	0600		Bhutan, Bhutan Broadcasting Service			6035do
0500	0600		Canada, CFRX Toronto ON	6070na		
0500	0600		Canada, CKZN St Johns NF	6160na		
0500	0600		Canada, CKZU Vancouver BC	6160na		
0500	0600		Cuba, Radio Havana Cuba	6000na		6010na
			6050na	6060na	6150sa	
0500	0600		Italy, IRRS-Shortwave/NEXUS	9670af		
0500	0600		Liberia, Star Radio	3960do		
0500	0600		Malaysia, RTM/Traxx FM	7295do		
0500	0600		Micronesia, The Cross Radio/Pohnpei			4755 as
0500	0600		New Zealand, Radio NZ International			11725pa
0500	0600	DRM	New Zealand, Radio NZ International			11675pa
0500	0600		Nigeria, Voice of Nigeria/Ikorodu			15120va
0500	0600		Russia, Voice of Russia	12030na		15250as
			15520as			
0500	0600	DRM	Russia, Voice of Russia	15735as		
0500	0600		South Africa, Channel Africa	7230af		
0500	0600		South Africa, CVC 1 Africa Christian Radio			
			9430af			
0500	0600		Swaziland, TWR Swaziland	4775af		9500af
0500	0600		Taiwan, Radio Taiwan International			6875na
0500	0600		UK, BBC World Service	3255af		5875eu
			6005eu	6190af	7255af	9410as
			11770as	11860af		
0500	0600	DRM	UK, BBC World Service	3955af		
0500	0600		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0500	0600		USA, EWTN/WEWN Irondale, AL			11520af
0500	0600		USA, FBN/WTJC Newport NC	9370na		
0500	0600		USA, Voice of America	4930af		6080af
			15580af			
0500	0600		USA, WHRI Cypress Creek SC			7315va
			7465va	11565va		
0500	0600		USA, WINB Red Lion PA	13570am		
0500	0600		USA, WRNO New Orleans LA	7505am		
0500	0600		USA, WTWW Lebanon TN	5080va		5755va
0500	0600		USA, WWCR Nashville TN	3215na		4840na
			5890na	5935na		
0500	0600		USA, WWRB Manchester TN	3185va		
0500	0600		USA, WYFR/Family Radio Worldwide			5985na
			9680na			
0500	0600		Zambia, CVC Radio Christian Voice			6065af
0500	0600		Zambia, Zambia Broadcasting Corp			6165do
0502	0600		Swaziland, TWR Swaziland	6120af		
0505	0600		Russia, Voice of Russia	9855na		
0530	0556	DRM	Romania, Radio Romania International			7305eu
0530	0556		Romania, Radio Romania International			9655eu
			17760eu	21500eu		
0530	0600		Clandestine, Sudan Radio Service/SRS			13720af
0530	0600		Palau, T8WH/World Harvest Radio International			
			15680as			
0530	0600		Thailand, Radio Thailand World Service			11730va
0530	0600		USA, WHRI Cypress Creek SC			15680va

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

0600	0620	mtwhfa	Vatican City State, Vatican Radio			4005eu
			7250eu			
0600	0630	Sat/Sun	Australia, Radio Australia	15290pa		15415as
0600	0630	mtwhf	France, Radio France Internationale			11615va
			15160af	17605af	17800af	
0600	0630		Germany, Deutsche Welle	9545af		15275af
0600	0630		Laos, Lao National Radio	7145as		
0600	0630	mtwhfa	Vatican City State, Vatican Radio			5965eu
0600	0657		China, China Radio International			11750af
			11770af	11880as	13645as	15145af
			15350as	15465as	17505af	17540as
			17710as			
0600	0658		New Zealand, Radio NZ International			11725pa
0600	0658	DRM	New Zealand, Radio NZ International			11675pa
0600	0700		Anguilla, Worldwide Univ Network			6090am
0600	0700		Australia, ABC NT Alice Springs			4835do
0600	0700		Australia, ABC NT Katherine	5025do		
0600	0700		Australia, ABC NT Tennant Creek			4910do
0600	0700		Australia, Radio Australia	9590pa		12080pa
			13630as	13690pa	15160pa	15240pa
			17750as			
0600	0700		Bahrain, Radio Bahrain	6010me		
0600	0700		Canada, CFRX Toronto ON	6070na		
0600	0700		Canada, CFVP Calgary AB	6030na		
0600	0700		Canada, CKZN St Johns NF	6160na		
0600	0700		Canada, CKZU Vancouver BC	6160na		
0600	0700		Cuba, Radio Havana Cuba	6000na		6010na
			6050na	6060na	6150sa	
0600	0700		Greece, Voice of Greece	11645eu		
0600	0700		Liberia, Star Radio	3960do		
0600	0700		Malaysia, RTM/Traxx FM	7295do		
0600	0700		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
0600	0700		Micronesia, The Cross Radio/Pohnpei			4755 as
0600	0700		Nigeria, Voice of Nigeria/Ikorodu			15120va
0600	0700		Palau, T8WH/World Harvest Radio International			
			15680as			
0600	0700		Papua New Guinea, Radio Fly	3915do		5960do
0600	0700		Russia, Voice of Russia	9855na		12030na
0600	0700		South Africa, Channel Africa	7230af		15255af
0600	0700		South Africa, CVC 1 Africa Christian Radio			
			13590af			
0600	0700		Swaziland, TWR Swaziland	4775af		6120af
			9500af			
0600	0700		UK, BBC World Service	3995eu		5875eu
			6005af	6190af	9410af	9860af
			11760as	11770af		
0600	0700		UK, BBC World Service	3955eu		
0600	0700		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0600	0700		USA, EWTN/WEWN Irondale, AL			11520af
0600	0700		USA, FBN/WTJC Newport NC	9370na		
0600	0700		USA, Voice of America	6080af		11670af
			15580af			
0600	0700		USA, WHRI Cypress Creek SC			7385va
			9615va	15680va		
0600	0700		USA, WINB Red Lion PA	13570am		
0600	0700		USA, WRNO New Orleans LA	7505am		
0600	0700		USA, WTWW Lebanon TN	5080va		5755va
0600	0700		USA, WWCR Nashville TN	3215na		4840na
			5890na	5935na		
0600	0700		USA, WWRB Manchester TN	3185va		
0600	0700		USA, WYFR/Family Radio Worldwide			5850ca
			7520eu	9680na	11530af	11580eu
0600	0700		Zambia, CVC Radio Christian Voice			6065af
0600	0700		Zambia, Zambia Broadcasting Corp			6165do
0630	0700		Australia, Radio Australia	15415as		
0630	0700		Congo Dem. Republic, Radio Kahuzi			6209do
0630	0700		Vatican City State, Vatican Radio			7360af
			9660af	11625af		
0659	0700		New Zealand, Radio NZ International			9765pa
0659	0700	DRM	New Zealand, Radio NZ International			11675pa

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

0700	0705	mtwhf	Croatia, HRT Voice of Croatia			6165eu
			17860pa			
0700	0730		China, Xizang People's Broadcasting Sta/Lhasa			
			4905do	4920do	5240do	6110do
			6130do	9490do	9580do	
0700	0730	mtwhf	France, Radio France Internationale			15605af
			15615af	17605af		

0700	0730		USA, WRMI/Radio Prague	9955na		
0700	0745		USA, WYFR/Family Radio Worldwide	7570eu		
0700	0757		China, China Radio International	11785as		
			13645as	15125me	15350as	15465as
			17490as	17540as	17710af	
0700	0758		New Zealand, Radio NZ International	9765pa		
0700	0758	DRM	New Zealand, Radio NZ International	11675pa		
0700	0800		Anguilla, Worldwide Univ Network	6090am		
0700	0800		Australia, ABC NT Alice Springs	4835do		
0700	0800		Australia, ABC NT Katherine	5025do		
0700	0800		Australia, ABC NT Tennant Creek	4910do		
0700	0800		Australia, Radio Australia	9475pa	9590pa	
			9710pa	11945pa	12080pa	15160pa
			15240as			
0700	0800		Bahrain, Radio Bahrain	6010me		
0700	0800	m/DRM	Belgium, TDP Radio	6015eu		
0700	0800		Canada, CFRX Toronto ON	6070na		
0700	0800		Canada, CFVP Calgary AB	6030na		
0700	0800		Canada, CKZN St Johns NF	6160na		
0700	0800		Canada, CKZU Vancouver BC	6160na		
0700	0800		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
0700	0800		Liberia, Star Radio	3960do		
0700	0800		Malaysia, RTM/Traxx FM	7295do		
0700	0800		Malaysia, RTM/Voice of Malaysia	6175as		
			9750as	15295as		
0700	0800		Micronesia, The Cross Radio/Pohnpei	4755 as		
0700	0800		Palau, T8WH/World Harvest Radio International			
			9930as	15680as		
0700	0800		Papua New Guinea, Radio Fly	3915do	5960do	
0700	0800		Russia, Voice of Russia	15700as	17665pa	
			17805pa			
0700	0800	DRM	Russia, Voice of Russia	11635eu		
0700	0800		South Africa, CVC 1 Africa Christian Radio			
			13590af			
0700	0800		Swaziland, TWR Swaziland	4775af	6120af	
			9500af			
0700	0800		UK, BBC World Service	6190af	9860af	
			11760me	11770af		
0700	0800	DRM	UK, BBC World Service	3955eu	5875eu	
0700	0800		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0700	0800		USA, EWTN/WEWN Irondale, AL	11520af		
0700	0800		USA, FBN/WTJC Newport NC	9370na		
0700	0800		USA, WHRI Cypress Creek SC	9615va		
			15680va			
0700	0800		USA, WINB Red Lion PA	13570am		
0700	0800		USA, WRNO New Orleans LA	7505am		
0700	0800		USA, WTWW Lebanon TN	5080va	5755va	
0700	0800		USA, WWCR Nashville TN	3215na	4840na	
			5890na	5935na		
0700	0800		USA, WWRB Manchester TN	3185va		
0700	0800		USA, WYFR/Family Radio Worldwide	5950ca		
			5985na	6875na	9385af	9505ca
0700	0800		Zambia, CVC Radio Christian Voice	6065af		
0700	0800		Zambia, Zambia Broadcasting Corp	6165do		
0709	0712	mtwhf	Austria, Radio Austria International	6155eu		
0730	0735		India, All India Radio, Delhi-Kingsway	15185do		
			15260do			
0730	0745	mtwhf	Vatican City State, Vatican Radio	5965eu		
			7250eu	9645eu		
0730	0745	mtwhfa	Vatican City State, Vatican Radio	4005eu		
			11740eu	15595eu		
0730	0800		Australia, HCJB Global Australia	11750pa		
0730	0800		Bulgaria, Radio Bulgaria	5900eu	7400eu	
0730	0800	Sun	USA, WHRI Cypress Creek SC	11565va		
0745	0800	Sun	Germany, TWR Europe	6105eu		
0745	0800	Sun	Monaco, TWR Europe	9800eu		
0759	0800	DRM	New Zealand, Radio NZ International	9870pa		

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

0800	0820		Indonesia, RRI Cimanggis/Jawa Barat	9680do		
0800	0830		Australia, ABC NT Alice Springs	4835do		
0800	0830		Australia, ABC NT Katherine	5025do		
0800	0830		Australia, ABC NT Tennant Creek	4910do		
0800	0830		Australia, HCJB Global Australia	11750pa		
0800	0830	Sun	Canada, Bible Voice Broadcasting Network			
			7220eu			
0800	0845	Sat	Canada, Bible Voice Broadcasting Network			
			7220eu			
0800	0845		USA, WYFR/Family Radio Worldwide	5950ca		
			9385af			
0800	0850	mtwhf	Germany, TWR Europe	6105eu		
0800	0850	mtwhf	Monaco, TWR Europe	9800eu		
0800	0857		China, China Radio International	9415as		
			11785as	11880as	15350as	15465as
			15625as	17490as	17540as	
0800	0900		Anguilla, Worldwide Univ Network	6090am		
0800	0900		Australia, Radio Australia	5995as	9475pa	
			9485pa	9580va	9590pa	11945pa
			12080pa	13630pa		
0800	0900		Bahrain, Radio Bahrain	6010me		
0800	0900	t/DRM	Belgium, TDP Radio	6015eu		
0800	0900		Canada, CFRX Toronto ON	6070na		
0800	0900		Canada, CFVP Calgary AB	6030na		
0800	0900		Canada, CKZN St Johns NF	6160na		
0800	0900		Canada, CKZU Vancouver BC	6160na		
0800	0900		Equatorial Guinea, Radio African 2/Malabo			
			15190af			
0800	0900		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
0800	0900		Greece, Voice of Greece	11645eu		
0800	0900		Liberia, Star Radio	3960do		
0800	0900		Malaysia, RTM/Traxx FM	7295do		
0800	0900		Malaysia, RTM/Voice of Malaysia	6175as		
			9750as	15295as		
0800	0900		Micronesia, The Cross Radio/Pohnpei	4755 as		
0800	0900		New Zealand, Radio NZ International	9765pa		
0800	0900	DRM	New Zealand, Radio NZ International	9870pa		
0800	0900		Palau, T8WH/World Harvest Radio International			
			9930as	15680as		
0800	0900		Papua New Guinea, Radio Fly	3915do	5960do	
0800	0900		Russia, Voice of Russia	15700as	17650pa	
			17665pa	17805pa		
0800	0900	DRM	Russia, Voice of Russia	11635eu		
0800	0900		South Africa, CVC 1 Africa Christian Radio			
			13590af			
0800	0900	Sun	South Africa, SA Radio League	7205af		
			17860af			
0800	0900		South Korea, KBS World Radio	9570as		
0800	0900		UK, BBC World Service	6190af	9860af	
			11760me			
0800	0900	DRM	UK, BBC World Service	5875eu		
0800	0900		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0800	0900		USA, EWTN/WEWN Irondale, AL	11520af		
0800	0900		USA, FBN/WTJC Newport NC	9370na		
0800	0900		USA, KNLS Anchor Point AK	11870as		
0800	0900		USA, WHRI Cypress Creek SC	11565va		
			15680va			
0800	0900		USA, WINB Red Lion PA	13570am		
0800	0900		USA, WRNO New Orleans LA	7505am		
0800	0900		USA, WTWW Lebanon TN	5080va	5755va	
0800	0900		USA, WWCR Nashville TN	3215na	4840na	
			5890na	5935na		
0800	0900		USA, WWRB Manchester TN	3185va		
0800	0900		USA, WYFR/Family Radio Worldwide	5985na		
			6875na			
0800	0900		Zambia, CVC Radio Christian Voice	6065af		
0800	0900		Zambia, Zambia Broadcasting Corp	6165do		
0815	0827		Nepal, Radio Nepal	5005as		
0815	0850	Sat	Monaco, TWR Europe	9800eu		
0820	0900	mtwhfs	Guam, TWR Asia/KTWR	15170pa		
0830	0840		India, All India Radio, Delhi-Kingsway	15185do		
			15260do			
0830	0900		Australia, ABC NT Alice Springs	2310do		
0830	0900		Australia, ABC NT Katherine	2485do		
0830	0900		Australia, ABC NT Tennant Creek	2325do		
0830	0900	mtwhfa	Guam, TWR Asia/KTWR	11840pa		
0840	0855		Mongolia, Mongolian Radio 2/Murun	4895do		
0840	0855		Mongolia, Mongolian Radio 2/Ulaanbaatar			
			7260do			
0850	0900	Sun	Germany, TWR Europe	6105eu		

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

0900	0910	mtwhfa	Guam, TWR Asia/KTWR	11840pa		
0900	0910		Papua New Guinea, Wantok Radio Light	7325do		
0900	0920	Sun	Germany, TWR Europe	6105eu		
0900	0957		China, China Radio International	9415as		
			15210as	15270as	15350as	17490eu
			17570eu	17690eu	17750as	
0900	0959		Germany, Deutsche Welle	15640as	17820as	
0900	1000		Anguilla, Worldwide Univ Network	6090am		
0900	1000		Australia, ABC NT Alice Springs	2310do		
0900	1000		Australia, ABC NT Katherine	2485do		
0900	1000		Australia, ABC NT Tennant Creek	2325do		
0900	1000		Australia, Radio Australia	9475pa	9485pa	
			9580va	9590pa	11945pa	12080pa
			13630pa			
0900	1000		Bahrain, Radio Bahrain	6010me		

0900	1000	w/DRM	Belgium, TDP Radio	6015eu		
0900	1000		Canada, CFRX Toronto ON	6070na		
0900	1000		Canada, CFVP Calgary AB	6030na		
0900	1000		Canada, CKZN St Johns NF	6160na		
0900	1000		Canada, CKZU Vancouver BC	6160na		
0900	1000		Equatorial Guinea, Radio African 2/Malabo 15190af			
0900	1000		Equatorial Guinea, Radio East Africa/Malabo 15190af			
0900	1000	3rd Sat	Germany, Radio City	9510eu		
0900	1000	1st Sat	Germany, Radio Joystick	9510eu		
0900	1000	3rd Sat	Italy, IRRS-Shortwave/NEXUS	9510va		
0900	1000		Malaysia, RTM/Traxx FM	7295do		
0900	1000		Malaysia, RTM/Voice of Malaysia 9750as	15295as		6175as
0900	1000		Micronesia, The Cross Radio/Pohnpei			4755 as
0900	1000		New Zealand, Radio NZ International			9765pa
0900	1000	DRM	New Zealand, Radio NZ International			9870pa
0900	1000		Nigeria, Voice of Nigeria/Ikorodu			9690af
0900	1000		Palau, T8WH/World Harvest Radio International 9930as	15680as		
0900	1000		Papua New Guinea, Radio Fly	3915do		5960do
0900	1000		Russia, Voice of Russia 17665pa	15700as	17805pa	17650pa
0900	1000		South Africa, CVC 1 Africa Christian Radio 13590af			
0900	1000		Tajikistan, Voice of Tajik	7245va		
0900	1000		UK, BBC World Service 9860af	6195as	11760me	9740as 11895as
0900	1000		USA, American Forces Network 5446usb 12759usb	5765usb 13362usb	7812usb	4319usb 12133usb
0900	1000		USA, EWTN/WEWN Irondale, AL			11520af
0900	1000		USA, FBN/WTJC Newport NC	9370na		
0900	1000		USA, WHRI Cypress Creek SC 11565va	15680va		9840va
0900	1000		USA, WINB Red Lion PA	13570am		
0900	1000		USA, WRNO New Orleans LA	7505am		
0900	1000		USA, WTWW Lebanon TN	5080va		5755va
0900	1000		USA, WWCR Nashville TN 5935na	9985na	4840af	5890na
0900	1000		USA, WWRB Manchester TN	3185va		
0900	1000		USA, WYFR/Family Radio Worldwide 9755ca			9465as
0900	1000		Zambia, CVC Radio Christian Voice			6065af
0900	1000		Zambia, Zambia Broadcasting Corp			6165do
0930	0945		Papua New Guinea, Radio Fly	3915do		5960do
0930	1000		China, Voice of the Strait/Fuzhou			6115do
0959	1000		Netherlands, R Netherlands Worldwide 15110as			12065as

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

1000	1025		China, Voice of the Strait (News Channel) Fuzhou 9505do			
1000	1030	Sat/Sun/DRM	Bulgaria, Radio Bulgaria/Euranet 11900eu			
1000	1030		Japan, Radio Japan NHK World 9625pa	9840pa	11780as	9605as
1000	1030		USA, WINB Red Lion PA	13570am		
1000	1030	mtwhf	USA, WRMI/Radio Prague	9955na		
1000	1030		Vietnam, Voice of Vietnam	9840as		12020as
1000	1040		Micronesia, The Cross Radio/Pohnpei			4755as
1000	1057		China, China Radio International 7215eu 13720as 17490as	7255eu 15190pa 17690as	11640as 15210pa	5955as 13590as 15350as
1000	1057		Netherlands, R Netherlands Worldwide 15110as			12065as
1000	1057		North Korea, Voice of Korea 9335sa	9850as		6185as 6285sa
1000	1058		New Zealand, Radio NZ International			9765pa
1000	1058	DRM	New Zealand, Radio NZ International			9870pa
1000	1100		Anguilla, Worldwide Univ Network			11775am
1000	1100		Australia, ABC NT Alice Springs			2310do
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek			2325do
1000	1100		Australia, Radio Australia 9485va 12080pa	9580pa	9590pa	6140as 9475pa 11945pa
1000	1100		Bahrain, Radio Bahrain	6010me		
1000	1100	h/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St Johns NF	6160na		
1000	1100		Canada, CKZU Vancouver BC	6160na		
1000	1100		Equatorial Guinea, Radio African 2/Malabo 15190af			
1000	1100		Equatorial Guinea, Radio East Africa/Malabo 15190af			
1000	1100	3rd Sun	Germany, European Music Radio			6140eu
1000	1100	4th Sun	Germany, Radio Gloria International			6140eu
1000	1100		India, All India Radio/External Service 13710pa 17800as	15235as 17895pa	15260as 13695al	7270as 17510pa 15020al
1000	1100		Indonesia, Voice of Indonesia/Jawa Barat 9525va	11785va		
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100		Nigeria, Voice of Nigeria/Ikorodu			9690af
1000	1100		Palau, T8WH/World Harvest Radio International 9930as			
1000	1100		Russia, Voice of Russia 17650pa	7205as 17665pa	17805pa	15700as
1000	1100		Saudi Arabia, BSKSA/Saudi Radio			15250af
1000	1100		South Africa, CVC 1 Africa Christian Radio 13590af			
1000	1100		UK, BBC World Service 9740as	6195as 9860af	11760me	9605as 11895as
1000	1100		USA, American Forces Network 5446usb 12759usb	5765usb 13362usb	7812usb	4319usb 12133usb
1000	1100		USA, EWTN/WEWN Irondale, AL			9390as
1000	1100		USA, FBN/WTJC Newport NC	9370na		
1000	1100		USA, KNLS Anchor Point AK	11870as		
1000	1100		USA, WHRI Cypress Creek SC			11565va
1000	1100		USA, WRNO New Orleans LA	7505am		
1000	1100		USA, WTWW Lebanon TN	5080va		5755va
1000	1100		USA, WWCR Nashville TN 5935na	9985na	4840af	5890na
1000	1100		USA, WWRB Manchester TN	3185va		
1000	1100		USA, WYFR/Family Radio Worldwide 5985na	6875na	9465as	5950na
1000	1100		Zambia, CVC Radio Christian Voice			6065af
1000	1100		Zambia, Zambia Broadcasting Corp			6165do
1030	1100		Iran, VOIRI/IRIB 21630as	25820as		
1030	1100	Sun	Italy, IRRS-Shortwave/NEXUS	9510va		
1030	1100		Mongolia, Voice of Mongolia	12085as		
1030	1100	Sun	USA, WHRI Cypress Creek SC			7385va
1030	1100		USA, WINB Red Lion PA	9265am		
1059	1100		New Zealand, Radio NZ International			13660pa
1059	1100	DRM	New Zealand, Radio NZ International			9870pa

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

1100	1104		Pakistan, PBC/Radio Pakistan	15725eu		17720eu
1100	1105		Pakistan, Azad Kashmir Radio/Islamabad	7265do		
1100	1127		Iran, VOIRI/IRIB 21630as	25820as		
1100	1130	Sat/DRM	South Korea, KBS World Radio			9760eu
1100	1130	Sun	Vatican City State, Vatican Radio			7250eu
1100	1130		Vietnam, Voice of Vietnam	7280as		
1100	1145		USA, WYFR/Family Radio Worldwide 9550sa	9755ca		6875na
1100	1156		Romania, Radio Romania International 15430eu	17510af	17670af	15210eu
1100	1157		China, China Radio International 5960na 13590as 17490eu	9570as 13645as	11650as 13665as	5955as 11795na 13720as
1100	1158	DRM	New Zealand, Radio NZ International			9870pa
1100	1200		Anguilla, Worldwide Univ Network			11775am
1100	1200		Australia, ABC NT Alice Springs			2310do
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek			2325do
1100	1200		Australia, Radio Australia 6140as 9580va	9475pa 9590pa	9485pa 11945pa	5995as 6020pa 9560va
1100	1200	DRM	Australia, Radio Australia	12080as		
1100	1200		Bahrain, Radio Bahrain	6010me		
1100	1200	f/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC Northern Quebec Service			9625na
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St Johns NF	6160na		
1100	1200		Canada, CKZU Vancouver BC	6160na		
1100	1200		Equatorial Guinea, Radio African 2/Malabo 15190af			
1100	1200		Equatorial Guinea, Radio East Africa/Malabo 15190af			
1100	1200	Sun	Italy, IRRS-Shortwave/NEXUS	9510va		
1100	1200		Malaysia, RTM/Traxx FM	7295do		
1100	1200		New Zealand, Radio NZ International			13660pa
1100	1200		Nigeria, Voice of Nigeria/Ikorodu			9690af
1100	1200		Russia, Voice of Russia	7205as		
1100	1200		Saudi Arabia, BSKSA/Saudi Radio			15250af
1100	1200		South Africa, CVC 1 Africa Christian Radio			

			13590af			
1100	1200		Taiwan, Radio Taiwan International			7445as
			11715as			
1100	1200		UK, BBC World Service	6195as		9605as
			9740as	9860af	11760me	11895as
1100	1200		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1100	1200		USA, EWTN/WEWN Irondale, AL			9390as
1100	1200		USA, FBN/WTJC Newport NC			9370na
1100	1200		USA, WHRI Cypress Creek SC			9840va
			9985va			
1100	1200	Sat/Sun	USA, WHRI Cypress Creek SC			17540va
1100	1200		USA, WINB Red Lion PA	9265am		
1100	1200		USA, WRNO New Orleans LA	7505am		
1100	1200		USA, WTWW Lebanon TN	5080va		5755va
1100	1200		USA, WWCR Nashville TN	4840af		5890na
			5935na	15825na		
1100	1200		USA, WWRB Manchester TN	3185va		
1100	1200		USA, WYFR/Family Radio Worldwide			5950na
			7730sa	9625sa		
1100	1200		Zambia, CVC Radio Christian Voice			6065af
1100	1200		Zambia, Zambia Broadcasting Corp			6165do
1130	1140	f	Vatican City State, Vatican Radio			15595as
			17765as			
1130	1200		Vietnam, Voice of Vietnam	9840as		12020as
1135	1140		India, All India Radio, Delhi-Kingsway			9595do
			11710do	15185do		
1135	1140		India, All India Radio/Dehli-Khampur			11620do
1135	1140		India, All India Radio/Gorakhpur			7250do

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

1200	1215		Vatican City State, Vatican Radio			9865am
1200	1225		Saudi Arabia, BSKSA/Saudi Radio			15250af
1200	1230		France, Radio France Internationale			21620af
1200	1230		Germany, AWR Europe	17535as		
1200	1230		Japan, Radio Japan NHK World			6120na
			9625pa	9790eu		
1200	1245		USA, WYFR/Family Radio Worldwide			5950na
			5985na			
1200	1257		China, China Radio International			5955as
			7250eu	9460as	9600as	9645as
			9730as	11760as	11780me	11980as
			12015as	13665eu	13790eu	17490eu
1200	1258		New Zealand, Radio NZ International			13660pa
1200	1259		Poland, Polskie Radio Warsaw			11675eu
			11980eu			
1200	1300		Anguilla, Worldwide Univ Network			11775am
1200	1300		Australia, ABC NT Alice Springs			2310do
1200	1300		Australia, ABC NT Katherine	2485do		
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300		Australia, Radio Australia	6020pa		6140as
			9475pa	9485pa	9560va	9580va
			9590pa	11945pa		
1200	1300	DRM	Australia, Radio Australia	5995pa		
1200	1300		Bahrain, Radio Bahrain	6010me		
1200	1300	Sat/ SRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC Northern Quebec Service			9625na
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St Johns NF	6160na		
1200	1300		Canada, CKZU Vancouver BC	6160na		
1200	1300		Equatorial Guinea, Radio African 2/Malabo			
			15190af			
1200	1300		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
1200	1300	Sun	Italy, IRRS-Shortwave/NEXUS	9510va		
1200	1300		Japan, Radio Japan NHK World			9695as
1200	1300		Malaysia, RTM/Traxx FM	7295do		
1200	1300		Nigeria, Voice of Nigeria/Ikorodu			9690af
1200	1300	DRM	Russia, Voice of Russia	7340as		
1200	1300		Russia, Voice of Russia	7350as		9695as
			11660as			
1200	1300		South Africa, CVC 1 Africa Christian Radio			
			13590af			
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		UK, BBC World Service	5875as		6190af
			6195as	9605as	9740as	9860af
			11760me			
1200	1300		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1200	1300		USA, EWTN/WEWN Irondale, AL			13580as
1200	1300		USA, FBN/WTJC Newport NC			9370na
1200	1300		USA, KNLS Anchor Point AK	11870as		
1200	1300		USA, Overcomer Ministries	15320af		
1200	1300		USA, Voice of America	7575va		9510va
			12075va	12150va		
1200	1300		USA, WHRI Cypress Creek SC			9965va
1200	1300	Sat/Sun	USA, WHRI Cypress Creek SC			17540va
1200	1300		USA, WINB Red Lion PA	13570am		
1200	1300		USA, WRNO New Orleans LA	7505am		
1200	1300		USA, WTWW Lebanon TN	9480va		9990va
1200	1300		USA, WWCR Nashville TN	7490na		9980na
			13845na	15825na		
1200	1300		USA, WWRB Manchester TN	3185va		
1200	1300		USA, WYFR/Family Radio Worldwide			17555sa
			17795ca			
1200	1300		Zambia, CVC Radio Christian Voice			6065af
1200	1300		Zambia, Zambia Broadcasting Corp			6165do
1215	1300		Egypt, Radio Cairo	17870as		
1215	1300	mtwhf	UK, BBC World Service	9410ca		11860sa
1230	1235		India, All India Radio, Delhi-Kingsway			4860do
			6085do	17860do		
1230	1300		Australia, HCJB Global Australia			15400as
1230	1300		Bangladesh, Bangladesh Betar			7250as
1230	1300		Thailand, Radio Thailand World Service			9720as
1230	1300		Turkey, Voice of Turkey	15450va		
1230	1300	Sun	USA, WHRI Cypress Creek SC			7385va
1230	1300		Vietnam, Voice of Vietnam	9840as		12020as
1259	1300		New Zealand, Radio NZ International			5950pa

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

1300	1330		Egypt, Radio Cairo	17870as		
1300	1330		Japan, Radio Japan NHK World			9875as
1300	1330		Turkey, Voice of Turkey	15450va		
1300	1357		China, China Radio International			5995as
			7300na	9570na	9655as	9730as
			9765as	9870as	11760me	11885as
			11900eu	11980as	13670as	13790as
			15230as			
1300	1357		North Korea, Voice of Korea	7570eu		9335na
			11710na	12015eu		
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, Radio Australia	6020pa		9485pa
			9560va	9580va	9590pa	
1300	1400	DRM	Australia, Radio Australia	5995pa		
1300	1400		Bahrain, Radio Bahrain	6010me		
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na		
1300	1400	Sat/Sun	Canada, CBC Northern Quebec Service			9625na
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St Johns NF	6160na		
1300	1400		Canada, CKZU Vancouver BC	6160na		
1300	1400		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
1300	1400		Germany, Overcomer Ministries			15495af
1300	1400		Indonesia, Voice of Indonesia/Jawa Barat			
			9525as	11785as		
1300	1400		Malaysia, RTM/Traxx FM	7295do		
1300	1400		New Zealand, Radio NZ International			5950pa
1300	1400		Nigeria, Voice of Nigeria/Ikorodu			9690af
1300	1400		Palau, T8WH/World Harvest Radio International			
			9930as			
1300	1400		Russia, Voice of Russia	7205as		
1300	1400		South Africa, CVC 1 Africa Christian Radio			
			13590af			
1300	1400		South Korea, KBS World Radio			9570as
1300	1400		UK, BBC World Service	5875as		6190af
			6195as	9410as	9740as	9860af
			11760me	11805as		
1300	1400		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1300	1400		USA, EWTN/WEWN Irondale, AL			13580as
1300	1400		USA, FBN/WTJC Newport NC			9370na
1300	1400		USA, Overcomer Ministries	11680af		17765af
1300	1400	Sat/Sun	USA, Voice of America	9510va		9760va
			12150va			
1300	1400		USA, WHRI Cypress Creek SC			9540va
			9840va	17540va		
1300	1400		USA, WINB Red Lion PA	13570am		
1300	1400		USA, WRNO New Orleans LA	7505am		
1300	1400		USA, WTWW Lebanon TN	9480va		9990va
1300	1400		USA, WWCR Nashville TN	7490na		9980na
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN	3185va		
1300	1400		USA, WYFR/Family Radio Worldwide			11830na
			11865na	11910na	17795ca	11520as
			11560as			
1300	1400		Zambia, CVC Radio Christian Voice			6065af

SHORTWAVE GUIDE

1300	1400		Zambia, Zambia Broadcasting Corp			6165do
1330	1400	stw	Guam, AWR/KSDA	11860as		
1330	1400		India, All India Radio/External Service			9690as
			11620as	13710as		
1330	1400		Laos, Lao National Radio	7145as		
1330	1400		Vietnam, Voice of Vietnam	9840as		12020as
1359	1400		Netherlands, R Netherlands Worldwide			11835as

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

1400	1415	Sun	Germany, Pan American Broadcasting			13645as
1400	1425	mh	Guam, TWR Asia/KTWR	9975as		
1400	1430	`	Japan, Radio Japan NHK World			5955as
			9875as	21560af		
1400	1430		Serbia, International Radio Serbia			9505eu
1400	1430		Thailand, Radio Thailand World Service			9725as
1400	1430	Sun	UK, FEBA Radio	12025as		
1400	1435	twfas	Guam, TWR Asia/KTWR	9975as		
1400	1457		China, China Radio International			5955as
			7300na	9460na	9700as	9765as
			9795eu	9870as	11665na	13675eu
			13685af	13740as	15230as	17630af
1400	1457		Netherlands, R Netherlands Worldwide			9800as
			11835as			
1400	1500		Anguilla, Worldwide Univ Network			11775am
1400	1500		Australia, ABC NT Alice Springs			2310do
1400	1500		Australia, ABC NT Katherine	2485do		
1400	1500		Australia, ABC NT Tennant Creek			2325do
1400	1500		Australia, Radio Australia	5995pa		6080pa
			7240pa	9590pa		
1400	1500		Bahrain, Radio Bahrain	6010me		
1400	1500	DRM	Belgium, TDP Radio/Disco Palace			6015eu
1400	1500	Sat/Sun	Canada, CBC Northern Quebec Service			9625na
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St Johns NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
1400	1500		Ethiopia, Radio Ethiopia/Home Service			5989do
			7110do	9705do		
1400	1500		Germany, Overcomer Ministries			15495af
1400	1500		India, All India Radio/External Service			9690as
			11620as	13710as		
1400	1500		Italy, IRRS-Shortwave/NEXUS	15710va		
1400	1500		Libya, LJBC Voice of Africa	17725af		21675af
			21695af			
1400	1500		Malaysia, RTM/Traxx FM	7295do		
1400	1500		New Zealand, Radio NZ International			5950pa
1400	1500		Nigeria, Voice of Nigeria/Ikorodu			9690af
1400	1500		Oman, Radio Sultanate of Oman			15140va
1400	1500		Palau, T8WH/World Harvest Radio International			
			9930as			
1400	1500		Russia, Voice of Russia	7205as		11660as
1400	1500	DRM	Russia, Voice of Russia	7340as		
1400	1500		South Africa, CVC 1 Africa Christian Radio			
			13590af			
1400	1500		UK, BBC World Service	5875as		6190af
			6195as	9410as	9740as	9860as
			9915af	11760as		
1400	1500	DRM	UK, BBC World Service	5845as		13590as
1400	1500		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1400	1500		USA, EWTN/WEWN Irondale, AL			15610me
1400	1500		USA, FBN/WTJC Newport NC	9370na		
1400	1500		USA, KJES Vado NM	11715na		
1400	1500		USA, KNLS Anchor Point AK	11765as		
1400	1500		USA, Overcomer Ministries	9460eu		13810me
			17580af			
1400	1500		USA, Voice of America	6080af		12080af
			15580af	17545af		
1400	1500	mtwhf	USA, Voice of America	7540va		7575va
			12150va			
1400	1500		USA, WBCQ Monticello ME	9330am		
1400	1500		USA, WHRI Cypress Creek SC			9840va
			15180va	17540va		
1400	1500		USA, WINB Red Lion PA	13570am		
1400	1500		USA, WJHR International Milton FL			15550usb
1400	1500		USA, WRNO New Orleans LA	7505am		15590al
1400	1500		USA, WTWW Lebanon TN	9480na		9990va
1400	1500		USA, WWCR Nashville TN	7490na		9980na
			13845na	15825na		
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family Radio Worldwide			11910na
			13695na	17795ca	11560na	
1400	1500		Zambia, CVC Radio Christian Voice			6065af
1400	1500		Zambia, Zambia Broadcasting Corp			6165do
1405	1430	Sat/Sun	Canada, Bible Voice Broadcasting Network			
			6225as			
1415	1427		Nepal, Radio Nepal	5005as		
1415	1430	Sun	Canada, Bible Voice Broadcasting Network			
			13635as			
1415	1430		Germany, Pan American Broadcasting			13645as
1425	1455		Swaziland, TWR Swaziland	6025af		
1430	1435		India, All India Radio, Delhi-Kingsway			9835do
1430	1440		India, All India Radio, Delhi-Kingsway			6085do
			9575do			
1430	1445		Bangladesh, Bangladesh Betar/Home Service			
			4750do			
1430	1445	Sun	Germany, Pan American Broadcasting			13645as
1430	1500	mtwhfa	Albania, Radio Tirana	13625na		
1430	1500		Australia, Radio Australia	9475pa		11825as
1430	1500	Sat	Canada, Bible Voice Broadcasting Network			
			13365as			
1445	1500	smtwhf	Australia, HCJB Global Australia			15340as

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

1500	1510	mtwhfa	Turkmenistan, Turkmen Radio Service 1			5015do
1500	1515	Sun	Canada, Bible Voice Broadcasting Network			
			12035as			
1500	1530		Guam, AWR/KSDA	11720as		
1500	1530		UK, BBC World Service	9410af		11860af
1500	1530		Vietnam, Voice of Vietnam	7280as		9840as
			12020as			
1500	1545		USA, WYFR/Family Radio Worldwide			15770sa
1500	1550		New Zealand, Radio NZ International			5950pa
1500	1555	Sat/Sun	Swaziland, TWR Swaziland	6025af		
1500	1557		Canada, Radio Canada International			11675as
			15125as			
1500	1557		China, China Radio International			5955as
			6095me	7325as	7405as	9435as
			9525as	9720as	9785eu	9870eu
			13685af	13740as	17630af	
1500	1557		Libya, LJBC Voice of Africa	17725af		21675af
			21695af			
1500	1557		North Korea, Voice of Korea	7570eu		9335na
			11710na	12015eu		
1500	1600		Anguilla, Worldwide Univ Network			11775am
1500	1600		Australia, ABC NT Alice Springs			2310do
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, Radio Australia	5995pa		6080pa
			7240pa	9475pa	9590pa	11825as
1500	1600		Bahrain, Radio Bahrain	6010me		
1500	1600		Bhutan, Bhutan Broadcasting Service			6035do
1500	1600	Sat/Sun	Canada, CBC Northern Quebec Service			9625na
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St Johns NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600		Equatorial Guinea, Radio East Africa/Malabo			
			15190af			
1500	1600		Germany, Overcomer Ministries			17580af
1500	1600		Italy, IRRS-Shortwave/NEXUS	15710va		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Nigeria, Voice of Nigeria/Ikorodu			15120va
1500	1600		Russia, Voice of Russia	4975va		7260as
			9660as			
1500	1600	DRM	Russia, Voice of Russia	5905eu		9675eu
1500	1600		South Africa, CVC 1 Africa Christian Radio			
			13590af			
1500	1600		Uganda, Dunamis Shortwave	4750af		
1500	1600		UK, BBC World Service	5875as		5975as
			6190af	6195as	7395as	9485as
			9740as	9860as		
1500	1600	DRM	UK, BBC World Service	5845as		13590as
1500	1600		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1500	1600		USA, EWTN/WEWN Irondale, AL			15610me
1500	1600		USA, FBN/WTJC Newport NC	9370na		
1500	1600		USA, KJES Vado NM	11715ca		
1500	1600		USA, Overcomer Ministries	9460eu		13810me
			17580af			
1500	1600		USA, Voice of America	4930af		6080af
			7540as	12080af	12150va	13750va
			15530va	15580af	17895af	
1500	1600		USA, Voice of America/Special English			6140af
			7465va	9485va	9760va	
1500	1600		USA, WBCQ Monticello ME	9330am		
1500	1600	Sat	USA, WBCQ Monticello ME	15420am		
1500	1600		USA, WHRI Cypress Creek SC			9840af
			21630af			

1500	1600	Sun	USA, WHRI Cypress Creek SC			15680va
1500	1600	Sat/Sun	USA, WHRI Cypress Creek SC			15180va
1500	1600		USA, WINB Red Lion PA	13570am		
1500	1600		USA, WJHR International Milton FL			15550usb
1500	1600		USA, WRNO New Orleans LA	7505am		15590al
1500	1600		USA, WTWW Lebanon TN	9480na		9990va
1500	1600		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN	9385na		
1500	1600		USA, WYFR/Family Radio Worldwide			6280as
			11830na	11910na	17795ca	
1500	1600		Zambia, CVC Radio Christian Voice			6065af
1500	1600		Zambia, Zambia Broadcasting Corp			6165do
1515	1530		Australia, HCJB Global Australia			15340as
1515	1545	Sat	Canada, Bible Voice Broadcasting Network			
			13670as			
1530	1545		India, All India Radio, Delhi-Kingsway			6085do
			9575do	9835do		
1530	1545		India, All India Radio/Aligarh	7255do		9910do
1530	1545		India, All India Radio/External Service			9910as
			7255al	9820al		
1530	1545		India, All India Radio/Panaji, Goa			9820do
1530	1550	smtwhf	Vatican City State, Vatican Radio			11850as
			13765as			
1530	1550	Sat	Vatican City State, Vatican Radio			7585as
1530	1558	Sat	Vatican City State, Vatican Radio			7585am
			11850as	13765as		
1530	1600	h	Canada, Bible Voice Broadcasting Network			
			13670as			
1530	1600		Germany, AWR Europe	15255as		
1530	1600		Iran, VOIRI/IRIB	9600as	11945as	
1530	1600	mwf	Mongolia, Voice of Mongolia	9665as		
1530	1600	Sat	UK, BBC World Service	9410af		11860af
1551	1600		New Zealand, Radio NZ International			7440pa
1551	1600	DRM	New Zealand, Radio NZ International			5950pa

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

1600	1615		Pakistan, PBC/Radio Pakistan	11585va		15285va
1600	1627		Iran, VOIRI/IRIB	9600as	11945as	
1600	1630		Eritrea, Radio Bana	5060	d0	
1600	1630		Guam, AWR/KSDA	11805as		12035as
1600	1630		Vietnam, Voice of Vietnam	7220me		7280eu
			9550me	9730eu		
1600	1645		USA, WYFR/Family Radio Worldwide			11830na
			11865na			
1600	1650	DRM	New Zealand, Radio NZ International			5950pa
1600	1650		New Zealand, Radio NZ International			7440pa
1600	1657		China, China Radio International			6060as
			6100as	7235af	7255eu	7420eu
			7435eu	9435eu	9525eu	9570eu
			9600af	11650af		
1600	1657		North Korea, Voice of Korea	9990va		11545va
1600	1658		Germany, Deutsche Welle	6170as		
1600	1659		Germany, Deutsche Welle	15410as		
1600	1700		Anguilla, Worldwide Univ Network			11775am
1600	1700		Australia, ABC NT Alice Springs			2310do
1600	1700		Australia, ABC NT Katherine	2485do		
1600	1700		Australia, Radio Australia	5995pa		6080pa
			7240pa	9475pa	9590pa	9710pa
			11825as			
1600	1700		Bahrain, Radio Bahrain	6010me		
1600	1700	Sat	Canada, CBC Northern Quebec Service			9625na
1600	1700		Canada, CFRX Toronto ON	6070na		
1600	1700		Canada, CFVP Calgary AB	6030na		
1600	1700		Canada, CKZN St Johns NF	6160na		
1600	1700		Canada, CKZU Vancouver BC	6160na		
1600	1700		Egypt, Radio Cairo	12170af		
1600	1700		Ethiopia, Radio Ethiopia	7235af		9559af
1600	1700		France, Radio France Internationale			15605af
			17605af			
1600	1700		Italy, IRRS-Shortwave/NEXUS	15710va		
1600	1700		Malaysia, RTM/Traxx FM	7295do		
1600	1700		Palau, T8WH/World Harvest Radio International			
			9930as			
1600	1700		Russia, Voice of Russia	4975me		6130as
			7305as	9470va		
1600	1700	DRM	Russia, Voice of Russia	7340as		
1600	1700		South Africa, CVC 1 Africa Christian Radio			
			13590af			
1600	1700		South Korea, KBS World Radio			9640as
			9515eu			
1600	1700		Taiwan, Radio Taiwan International			9435as
			15485as			
1600	1700		Uganda, Dunamis Shortwave	4750af		
1600	1700		UK, BBC World Service	3255af		5975as
			6190af	7355as	9740as	
1600	1700	Sat	UK, BBC World Service	9410af		11860af
1600	1700		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1600	1700		USA, EWTN/WEWN Irondale, AL			15610me
1600	1700		USA, FBN/WTJC Newport NC	9370na		
1600	1700		USA, Voice of America	4930af		6080af
			15580af			
1600	1700		USA, Voice of America/Special English			11890va
			12080va	13750va		
1600	1700		USA, WBCQ Monticello ME	9330am		
1600	1700	Sat	USA, WBCQ Monticello ME	15420am		
1600	1700		USA, WHRI Cypress Creek SC			9840af
			15180af	21630af		
1600	1700		USA, WINB Red Lion PA	13570am		
1600	1700		USA, WJHR International Milton FL			15550usb
1600	1700		USA, WRNO New Orleans LA	7505am		15590al
1600	1700		USA, WTWW Lebanon TN	9480na		9990va
1600	1700		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1600	1700		USA, WWRB Manchester TN	9385na		
1600	1700		USA, WYFR/Family Radio Worldwide			6085ca
			13695na	17555eu	17795ca	18980eu
			21525af			
1600	1700		Zambia, CVC Radio Christian Voice			6065af
1600	1700		Zambia, Zambia Broadcasting Corp			6165do
1615	1700	Sun	UK, BBC World Service	9410af		11860af
1630	1700	Sun	Canada, Bible Voice Broadcasting Network			
			9460me			
1630	1700		China, Xizang People's Broadcasting Sta/Lhasa			
			4905do	4920do	5240do	6110do
			6130do	7255do	7385do	
1630	1700		Guam, AWR/KSDA	11740as		
1630	1700		Turkey, Voice of Turkey	15520as		
1630	1700	mtwhf	UK, BBC World Service	9410af		
1640	1650		Turkmenistan, Turkmen Radio Service 2			4930do
1645	1700	mf	Canada, Bible Voice Broadcasting Network			
			9460me			
1645	1700	twhfa	Canada, Bible Voice Broadcasting Network			
			9460me			
1651	1700		New Zealand, Radio NZ International			9765pa
1651	1700	DRM	New Zealand, Radio NZ International			9890pa

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

1700	1705	Sat/Sun	Croatia, HRT Voice of Croatia			6165eu
1700	1715	f	Canada, Bible Voice Broadcasting Network			
			9460me			
1700	1715	mtwhfa	Croatia, HRT Voice of Croatia			6165eu
1700	1720	t	Canada, Bible Voice Broadcasting Network			
			9460me			
1700	1730	DRM	Romania, Radio Romania International			7350eu
1700	1730		Turkey, Voice of Turkey	15520as		
1700	1745	h	Canada, Bible Voice Broadcasting Network			
			9460me			
1700	1746		UK, BBC World Service	9410af		11860af
1700	1750		New Zealand, Radio NZ International			9765pa
1700	1750	DRM	New Zealand, Radio NZ International			9890pa
1700	1756	DRM	Romania, Radio Romania International			9535eu
1700	1756		Romania, Radio Romania International			11735eu
1700	1757		China, China Radio International			6090as
			6100as	6140eu	7205eu	7255af
			7335af	7410af	7420as	7425as
			7435eu	9570af		
1700	1759	DRM	Poland, Polskie Radio Warsaw			7265eu
1700	1759		Poland, Polskie Radio Warsaw			9770eu
1700	1800		Anguilla, Worldwide Univ Network			11775am
1700	1800		Australia, ABC NT Alice Springs			2310do
1700	1800		Australia, ABC NT Katherine	2485do		
1700	1800		Australia, Radio Australia	5995pa		6080pa
			9475pa	9580pa	9710pa	11880pa
1700	1800		Bahrain, Radio Bahrain	6010me		
1700	1800	Sun	Canada, Bible Voice Broadcasting Network			
			9460me			
1700	1800	Sat	Canada, Bible Voice Broadcasting Network			
			9460me			
1700	1800	Sat	Canada, CBC Northern Quebec Service			9625na
1700	1800		Canada, CFRX Toronto ON	6070na		
1700	1800		Canada, CFVP Calgary AB	6030na		
1700	1800		Canada, CKZN St Johns NF	6160na		
1700	1800		Canada, CKZU Vancouver BC	6160na		
1700	1800		Egypt, Radio Cairo	12170af		
1700	1800		Equatorial Guinea, Radio Africa/Malabo			15190af
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		Palau, T8WH/World Harvest Radio International			
			9930as			
1700	1800		Russia, Voice of Russia	4975va		7240as

SHORTWAVE GUIDE

			7330as	9470va	9880as	
1700	1800		South Africa, Channel Africa	15235af		
1700	1800		South Africa, CVC 1 Africa Christian Radio			
			4965af	13590af		
1700	1800		Swaziland, TWR Swaziland	3200af		
1700	1800		Taiwan, Radio Taiwan International			15690af
1700	1800		Tajikistan, Voice of Tajik	7245va		
1700	1800		UK, BBC World Service	3255af		5975as
			6190af	9740as		
1700	1800		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1700	1800		USA, EWTN/WEWN Irondale, AL			15610me
1700	1800		USA, FBN/WTJC Newport NC	9370na		
1700	1800		USA, Voice of America	6080af		12015af
			15580af	17895af		
1700	1800		USA, WBCQ Monticello ME	9330am		
1700	1800	Sat	USA, WBCQ Monticello ME	15420am		
1700	1800		USA, WHRI Cypress Creek SC			15180af
			21630af			
1700	1800		USA, WHRI Cypress Creek SC			9840af
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800		USA, WJHR International Milton FL			15550usb
1700	1800		USA, WRNO New Orleans LA	7505am		15590al
1700	1800		USA, WTWW Lebanon TN	9480na		9990va
1700	1800		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1700	1800		USA, WWRB Manchester TN	9385na		
1700	1800		USA, WYFR/Family Radio Worldwide			13690na
			17555eu	17795eu		
1700	1800		Zambia, CVC Radio Christian Voice			4965af
1700	1800		Zambia, Zambia Broadcasting Corp			6165do
1714	1800		Congo Dem. Republic, Radio Kahuzi			6209do
1715	1730		Vatican City State, Vatican Radio			4005eu
			5885eu	7250eu	7290eu	9645eu
1720	1740	Sat/Sun	USA, Voice of America/Studio 7			4930af
			15775af			
1730	1735		India, All India Radio, Delhi-Kingsway			6085do
			7370do	9575do	9835do	
1730	1800		Clandestine, Sudan Radio Service/SRS			9840af
1730	1800	mtwh	USA, Voice of America/Studio 7			4930af
			12080af	15775af		
1730	1800		Vatican City State, Vatican Radio			9755af
			11625af	13765af		
1745	1800		Bangladesh, Bangladesh Betar			7250as
1745	1800	DRM	India, All India Radio/External Service			9950eu
1745	1800		India, All India Radio/External Service			6280eu
			7400af	7410af	7550eu	9415af
			9445af	11935af	6120al	
1751	1800		New Zealand, Radio NZ International			11725pa
1751	1800	DRM	New Zealand, Radio NZ International			11675pa
1759	1800		Netherlands, R Netherlands Worldwide			6020af
			15495af			

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

1800	1810		Tanzania, Radio Tanzania/Zanzibar			11735af
1800	1815		Canada, Bible Voice Broadcasting Network			
			9460me			
1800	1830	Sat	Canada, Bible Voice Broadcasting Network			
			9460me			
1800	1830		Congo Dem. Republic, Radio Kahuzi			6209do
1800	1830		South Africa, AWR Africa	3215af		3345af
1800	1830	w	South Africa, AWR Africa	9755af		
1800	1830		UK, BBC World Service	7260as		7355as
1800	1830		USA, Voice of America	6080af		9850af
			12015af	15580af		
1800	1830	Sat/Sun	USA, Voice of America	4930af		
1800	1830		Vietnam, Voice of Vietnam	5955eu		
1800	1850		New Zealand, Radio NZ International			11725pa
1800	1850	DRM	New Zealand, Radio NZ International			11675pa
1800	1857		China, China Radio International			6100eu
			7405eu			
1800	1857		Netherlands, R Netherlands Worldwide			6020af
			15495af			
1800	1857		North Korea, Voice of Korea	7570eu		12015eu
1800	1859		Canada, Radio Canada International			9530af
			11765af	17810af		
1800	1859		Canada, Radio Canada International			9740va
			11845af	15365af	17790af	
1800	1900		Anguilla, Worldwide Univ Network			11775am
1800	1900		Argentina, RAE	9690eu	15345eu	
1800	1900		Australia, ABC NT Alice Springs			2310do
1800	1900		Australia, ABC NT Katherine	2485do		
1800	1900		Australia, Radio Australia	6080pa		7240pa
			9475pa	9580pa	9710pa	11880pa
1800	1900		Bahrain, Radio Bahrain	6010me		
1800	1900		Bangladesh, Bangladesh Betar			7250as
1800	1900	Sat	Canada, Bible Voice Broadcasting Network			
			6110me			
1800	1900	Sun	Canada, Bible Voice Broadcasting Network			
			6110me	9460me		
1800	1900		Canada, CFRX Toronto ON	6070na		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St Johns NF	6160na		
1800	1900		Canada, CKZU Vancouver BC	6160na		
1800	1900		Equatorial Guinea, Radio Africa/Malabo			15190af
1800	1900	DRM	India, All India Radio/External Service			9950eu
1800	1900		India, All India Radio/External Service			6280eu
			7400af	7410af	9415af	9445af
			11935af	6120al		
1800	1900		Kuwait, Radio Kuwait	15540va		
1800	1900		Liberia, Star Radio	3960do		
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900		Nigeria, Voice of Nigeria/Ikorodu			15120va
1800	1900		Palau, T8WH/World Harvest Radio International			
			9955as			
1800	1900		Russia, Voice of Russia	4975va	7240as	
			7305va	7330as	9880af	12060af
1800	1900		South Africa, CVC 1 Africa Christian Radio			
			4965af	13590af		
1800	1900		South Korea, KBS World Radio			7275eu
1800	1900		Swaziland, TWR Swaziland	3200af		
1800	1900		Taiwan, Radio Taiwan International			6155eu
1800	1900		UK, BBC World Service	3255af		5875eu
			5945as	5955as	6005af	6190af
			7225eu	9615af	11810af	
1800	1900		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1800	1900		USA, EWTN/WEWN Irondale, AL			15610me
1800	1900		USA, FBN/WTJC Newport NC	9370na		
1800	1900		USA, WBCQ Monticello ME	9330am		15420am
1800	1900		USA, WHRI Cypress Creek SC			9840af
			21630af			
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900		USA, WJHR International Milton FL			15550usb
1800	1900		USA, WRNO New Orleans LA	7505am		15590al
1800	1900		USA, WTWW Lebanon TN	9480na		9990va
1800	1900		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1800	1900		USA, WWRB Manchester TN	9385na		
1800	1900		USA, WYFR/Family Radio Worldwide			13615na
			13690na	17795ca	17845af	18980eu
1800	1900		Yemen, Yemen RTV Corp/Radio Sana			6005me
			9780me			
1800	1900		Zambia, CVC Radio Christian Voice			4965af
1800	1900		Zambia, Zambia Broadcasting Corp			6165do
1830	1900		Bulgaria, Radio Bulgaria	6200eu		7400eu
1830	1900	DRM	Bulgaria, Radio Bulgaria	9700eu		
1830	1900	mtwhf	Moldova, (Transnistria) Radio PMR			6240na
1830	1900		South Africa, AWR Africa	9610af		
1830	1900		Turkey, Voice of Turkey	9785eu		
1830	1900		UK, BBC World Service	9410af		
1830	1900		USA, Voice of America	4930af		6080af
			9850af	12015af	15580af	
1830	1900	Sat	USA, WHRI Cypress Creek SC			15180af
1845	1850		Guinea, RTV Guineenne	7125do		
1845	1900	mtwhfa	Albania, Radio Tirana	7520eu		13640na
1851	1900		New Zealand, Radio NZ International			11725pa
1851	1900	DRM	New Zealand, Radio NZ International			15720pa
1859	1900		Netherlands, R Netherlands Worldwide			7425af
			11610af			

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

1900	1915	Sun	Canada, Bible Voice Broadcasting Network			
			9460me			
1900	1930		Germany, Deutsche Welle	6150af		9735af
			11795af	17610af		
1900	1930		Turkey, Voice of Turkey	9785eu		
1900	1930		USA, Voice of America	4930af		4940af
			6080af	9850af	15580af	17895af
1900	1930		Vietnam, Voice of Vietnam	7280eu		9730eu
1900	1945	Sun	Canada, Bible Voice Broadcasting Network			
			9470me			
1900	1945	DRM	India, All India Radio/External Service			9950eu
1900	1945		India, All India Radio/External Service			6280eu
			7400af	7410af	9415af	9445af
			11935af	6120al		
1900	1945		USA, WYFR/Family Radio Worldwide			6085ca
1900	1950	DRM	New Zealand, Radio NZ International			15720pa
1900	1950		New Zealand, Radio NZ International			11725pa
1900	1957		China, China Radio International			7285af
			7295af	9440af		

1900	1957		Netherlands, R Netherlands Worldwide	7425af	15495af		
1900	1957		North Korea, Voice of Korea	7210af	9975af	11535va	11910af
1900	2000		Anguilla, Worldwide Univ Network	11775am			
1900	2000		Australia, ABC NT Alice Springs	2310do			
1900	2000		Australia, ABC NT Katherine	2485do			
1900	2000		Australia, Radio Australia	6080pa	7240pa	9475pa	9500as
			9580pa	9710pa	11880pa		
1900	2000		Bahrain, Radio Bahrain	6010me			
1900	2000	Sat	Canada, Bible Voice Broadcasting Network	9470me			
1900	2000	Sun	Canada, Bible Voice Broadcasting Network	6030eu			
1900	2000		Canada, CFRX Toronto ON	6070na			
1900	2000		Canada, CFVP Calgary AB	6030na			
1900	2000		Canada, CKZN St Johns NF	6160na			
1900	2000		Canada, CKZU Vancouver BC	6160na			
1900	2000		Cuba, Radio Havana Cuba	11760sa			
1900	2000		Egypt, Radio Cairo	11510af			
1900	2000		Equatorial Guinea, Radio Africa/Malabo	15190af			
1900	2000		Indonesia, Voice of Indonesia/Jawa Barat	9525eu	11785eu		
1900	2000	fas	Italy, IRRS-Shortwave/NEXUS	6090va			
1900	2000		Kuwait, Radio Kuwait	15540va			
1900	2000		Liberia, Star Radio	3960do			
1900	2000		Malaysia, RTM/Traxx FM	7295do			
1900	2000		Nigeria, Voice of Nigeria/Ikorodu	7255af			
1900	2000		Palau, T8WH/World Harvest Radio International	9930as			
1900	2000		Russia, Voice of Russia	4975va	7330eu	12060af	
1900	2000		South Africa, CVC 1 Africa Christian Radio	4965af	13590af		
1900	2000	mtwhf	Spain, Radio Exterior de Espana	9605af	9665eu		
1900	2000		Swaziland, TWR Swaziland	3200af			
1900	2000		Thailand, Radio Thailand World Service	7570eu			
1900	2000		UK, BBC World Service	3255af	5875eu	5945as	5955as
			6005af	6190af	7225eu	9410af	9615af
			11810af				
1900	2000		USA, American Forces Network	4319usb	5446usb	5765usb	7812usb
			12133usb	12759usb	13362usb		
1900	2000		USA, EWTN/WEWN Irondale, AL	15610me			
1900	2000		USA, FBN/WTJC Newport NC	9370na			
1900	2000		USA, KJES Vado NM	15385ca			
1900	2000		USA, Voice of America/Special English	7485va	9630va		
1900	2000		USA, WBCQ Monticello ME	9330am	15420am		
1900	2000	mtwhfa	USA, WBCQ Monticello ME	7415am			
1900	2000		USA, WHRI Cypress Creek SC	9840af	15180af	17520na	
1900	2000		USA, WINB Red Lion PA	13570am			
1900	2000		USA, WJHR International Milton FL	15550usb			
1900	2000		USA, WRNO New Orleans LA	7505am	15590al		
1900	2000		USA, WTWW Lebanon TN	9480na	9990va		
1900	2000		USA, WWCR Nashville TN	9980na	12160af	13845na	15825na
1900	2000		USA, WWRB Manchester TN	9385na			
1900	2000		USA, WYFR/Family Radio Worldwide	13615na	13690na	17795ca	17845af
			18930eu	18980eu			
1900	2000		Zambia, CVC Radio Christian Voice	4965af			
1900	2000		Zambia, Zambia Broadcasting Corp	6165do			
1905	1910	mtwhfa	Croatia, HRT Voice of Croatia	6165eu			
1905	1920	Sat	Mali, RTV Malienne	5995do			
1905	2000	m	South Africa, SA Radio League	3215af			
1915	1945	Sat	Canada, Bible Voice Broadcasting Network	6030eu			
1930	2000	Sat/Sun	Germany, Pan American Broadcasting	6020af			
1930	2000		Iran, VOIRI/IRIB	5940eu	6205eu	9780eu	9800af
1930	2000		South Africa, RTE Radio Worldwide	6225af			
1930	2000		USA, Voice of America	4930af	4940af	6080af	15580af
1930	2000	Sat/Sun	USA, WRMI/Radio Prague	9955na			
1951	2000		New Zealand, Radio NZ International	11725pa			
1951	2000	DRM	New Zealand, Radio NZ International	17675pa			

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

2000	2005	m	South Africa, SA Radio League	3215af			
2000	2015	Sun	Germany, Pan American Broadcasting	6020af			
2000	2027		Iran, VOIRI/IRIB	5940eu	6205eu	9780eu	9800af
2000	2030	mtwhfa	Albania, Radio Tirana	7465eu	13640na		
2000	2030		Egypt, Radio Cairo	11510af			
2000	2030	Sat	Germany, Pan American Broadcasting	6020af			
2000	2030		Niger, ORTN/La Voix du Sahel	9705do			
2000	2030		South Africa, RTE Radio Worldwide	6225af			
2000	2030	Sat	Swaziland, TWR Swaziland	3200af			
2000	2030		USA, Voice of America	4930af	4940af	6080af	15580af
2000	2030		Vatican City State, Vatican Radio	7365af	9755af	11625af	
2000	2045		Rwanda, Radiodiffusion Rwandaise	6055do			
2000	2045		USA, WYFR/Family Radio Worldwide	17750eu			
2000	2050		New Zealand, Radio NZ International	11725pa			
2000	2050	DRM	New Zealand, Radio NZ International	17675pa			
2000	2057		China, China Radio International	5960eu	5985af	7285eu	7295af
			9440af	9600eu	11640eu	13630af	
2000	2057		Germany, Deutsche Welle	6150af			
2000	2057		Netherlands, R Netherlands Worldwide	7425af	11610af		
2000	2100		Anguilla, Worldwide Univ Network	11775am			
2000	2100		Australia, ABC NT Alice Springs	2310do			
2000	2100		Australia, ABC NT Katherine	2485do			
2000	2100		Australia, ABC NT Tennant Creek	2325do			
2000	2100		Australia, Radio Australia	9500as	9700as	11650as	
2000	2100	Sat/Sun	Australia, Radio Australia	6080va	7240pa	12080pa	
2000	2100		Bahrain, Radio Bahrain	6010me			
2000	2100	DRM	Belgium, TDP Radio/Disco Palace	17555am			
2000	2100		Canada, CFRX Toronto ON	6070na			
2000	2100		Canada, CFVP Calgary AB	6030na			
2000	2100		Canada, CKZN St Johns NF	6160na			
2000	2100		Canada, CKZU Vancouver BC	6160na			
2000	2100		Canada, Radio Canada International	13650af	15235af	17735af	
2000	2100		Equatorial Guinea, Radio Africa/Malabo	15190af			
2000	2100		Kuwait, Radio Kuwait	15540va			
2000	2100		Liberia, Star Radio	3960do			
2000	2100		Malaysia, RTM/Traxx FM	7295do			
2000	2100		Nigeria, Voice of Nigeria/Ikorodu	7255af			
2000	2100		Palau, T8WH/World Harvest Radio International	9930as			
2000	2100		Russia, Voice of Russia	7330eu			
2000	2100		South Africa, CVC 1 Africa Christian Radio	4965af	9505af		
2000	2100		Syria, Radio Damascus	9330eu	12085va		
2000	2100		UK, BBC World Service	3255af	6005af	6190af	9410af
			9615af	11810af			
2000	2100		USA, American Forces Network	4319usb	5446usb	5765usb	7812usb
			12133usb	12759usb	13362usb		
2000	2100		USA, EWTN/WEWN Irondale, AL	15610as			
2000	2100		USA, FBN/WTJC Newport NC	9370na			
2000	2100	mtwhf	USA, Voice of America	5930va	9480va		
2000	2100		USA, WBCQ Monticello ME	7415am	15420am		
2000	2100		USA, WBCQ Monticello ME	5110am			
2000	2100		USA, WINB Red Lion PA	13570am			
2000	2100		USA, WJHR International Milton FL	15550usb			
2000	2100		USA, WRNO New Orleans LA	7505am	15590al		
2000	2100		USA, WTWW Lebanon TN	9480na	9990va		
2000	2100		USA, WWCR Nashville TN	7465na	9350na	9980na	13845na
2000	2100		USA, WWRB Manchester TN	9385na			
2000	2100		USA, WYFR/Family Radio Worldwide	17725sa	17795ca	17845af	18980eu
2000	2100		Zambia, CVC Radio Christian Voice	4965af			
2000	2100		Zambia, Zambia Broadcasting Corp	6165do			
2000	21000		USA, WHRI Cypress Creek SC	7540na	15180na	15665na	
2030	2045		Thailand, Radio Thailand World Service	9535eu			
2030	2056	DRM	Romania, Radio Romania International	9765eu			
2030	2056		Romania, Radio Romania International	11880na	11940na		
2030	2100	mtwhf	Moldova, (Transnistria) Radio PMR	6240eu			
2030	2100		Turkey, Voice of Turkey	7205va			
2030	2100		USA, Voice of America	4930af	6080af	7555as	15580af
2030	2100	Sat/Sun	USA, Voice of America	4940af			
2030	2100		USA, Voice of America/Radio Ashna	7560as			
2030	2100		Vietnam, Voice of Vietnam	7220me	7280eu	9550me	9730eu
2045	2100		India, All India Radio/External Service	6280eu	7550eu	9445eu	11620pa
			11715pa	9910al	9940al		
2045	2100	DRM	India, All India Radio/External Service	9950eu			
2045	2100	DRM	Vatican City State, Vatican Radio	9800am			
2050	2100		Vatican City State, Vatican Radio	4005eu	5885eu	7250eu	

2051	2100		New Zealand, Radio NZ International	11725pa
2051	2100	DRM	New Zealand, Radio NZ International	15720pa

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

2100	2110		Papua New Guinea, Wantok Radio Light	7325do
2100	2120		Vatican City State, Vatican Radio	4005eu
			5885eu 7250eu	
2100	2130		Australia, ABC NT Alice Springs	2310do
2100	2130		Australia, ABC NT Katherine 2485do	
2100	2130		Australia, ABC NT Tennant Creek	2325do
2100	2130		Austria, AWR Europe 11955af	
2100	2130	Sat	Canada, CBC Northern Quebec Service	9625na
2100	2130		Turkey, Voice of Turkey 7205va	
2100	2130	DRM	Vatican City State, Vatican Radio	9800am
2100	2145		USA, WYFR/Family Radio Worldwide	13615na
			13690na 17795ca 18980eu	
2100	2150		New Zealand, Radio NZ International	11725pa
2100	2150	DRM	New Zealand, Radio NZ International	15720pa
2100	2157		China, China Radio International	7250af
			11640af 13630af	
2100	2157		China, China Radio International	5960as
			6135as 7205eu 7225as 7250as	
			7285as 7405eu 7415eu 9600af	
			11640af 13630af	
2100	2157		North Korea, Voice of Korea 7570eu	12015eu
2100	2200		Anguilla, Worldwide Univ Network	11775am
2100	2200		Australia, Radio Australia 9500as	9660pa
			11650as 11695va 12080pa	13630pa
			15515va	
2100	2200		Bahrain, Radio Bahrain 6010me	
2100	2200		Belarus, Radio Station Belarus 6155eu	7360eu
			7390eu	
2100	2200	DRM	Belgium, TDP Radio 17555eu	
2100	2200		Canada, CFRX Toronto ON 6070na	
2100	2200		Canada, CFVP Calgary AB 6030na	
2100	2200		Canada, CKZN St Johns NF 6160na	
2100	2200		Canada, CKZU Vancouver BC 6160na	
2100	2200	DRM	Canada, Radio Canada International	9800na
2100	2200		Equatorial Guinea, Radio Africa/Malabo	15190af
2100	2200		India, All India Radio/External Service	6280eu
			7550eu 9445eu 11620pa	11715pa
			9910al 9940al	
2100	2200	DRM	India, All India Radio/External Service	9950eu
2100	2200		Malaysia, RTM/Traxx FM 7295do	
2100	2200		Micronesia, The Cross Radio/Pohnpei	4755 as
2100	2200		Palau, T8WH/World Harvest Radio International	
			9930as	
2100	2200		Russia, Voice of Russia 7290eu	7330eu
2100	2200		South Africa, CVC 1 Africa Christian Radio	
			4965af 9505af	
2100	2200		Syria, Radio Damascus 9330va	12085va
2100	2200		UK, BBC World Service 3255af	3915as
			5875as 5910af 5965as	6190af
			6195as 9410af 9915af	
2100	2200		USA, American Forces Network	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
2100	2200		USA, EWTN/WEWN Irondale, AL	15610as
2100	2200		USA, FBN/WTJC Newport NC 9370na	
2100	2200		USA, Voice of America 6080af	7555as
			15580af	
2100	2200		USA, Voice of America/Radio Ashna	7560as
2100	2200		USA, WBCQ Monticello ME 7415am	9330am
			15420am	
2100	2200	Sat	USA, WBCQ Monticello ME 5110am	
2100	2200		USA, WHRI Cypress Creek SC	7555na
			15180na 15665na	
2100	2200		USA, WINB Red Lion PA 9265am	
2100	2200		USA, WJHR International Milton FL	15550usb
2100	2200		USA, WRNO New Orleans LA 7505am	15590al
2100	2200		USA, WTWW Lebanon TN 9480na	9990va
2100	2200		USA, WWCR Nashville TN 7465na	9350na
			9980na 13845na	
2100	2200		USA, WWRB Manchester TN 9385na	
2100	2200		USA, WYFR/Family Radio Worldwide	17845af
2100	2200		Zambia, CVC Radio Christian Voice	4965af
2100	2200		Zambia, Zambia Broadcasting Corp	6165do
2115	2200		Egypt, Radio Cairo 6270eu	
2130	2200		Australia, ABC NT Alice Springs	4835do
2130	2200		Australia, ABC NT Katherine 5025do	
2130	2200	mtwhfa	Canada, CBC Northern Quebec Service	9625na
2151	2200		New Zealand, Radio NZ International	15720pa
2151	2200	DRM	New Zealand, Radio NZ International	17675pa

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

2200	2205		Zambia, Zambia Broadcasting Corp	6165do
2200	2210		Guinea, Radio Familia FM 4900do	
2200	2230		India, All India Radio/External Service	6280eu
			7550eu 9445eu 11620pa	11715pa
			9910al 9940al	
2200	2230	DRM	India, All India Radio/External Service	9950eu
2200	2230		South Korea, KBS World Radio	3955eu
2200	2245		Egypt, Radio Cairo 6270eu	
2200	2245		USA, WYFR/Family Radio Worldwide	15770af
2200	2256		Romania, Radio Romania International	5960eu
			7435eu 9790eu 11940eu	
2200	2257		China, China Radio International	5915as
2200	2300		Anguilla, Worldwide Univ Network	6090am
2200	2300		Australia, ABC NT Alice Springs	4835do
2200	2300		Australia, ABC NT Katherine 5025do	
2200	2300		Australia, Radio Australia 11695pa	12080pa
			13590as 13630pa 15230as	15240pa
			15360pa 15415as 15515va	15560pa
2200	2300		Bahrain, Radio Bahrain 6010me	
2200	2300		Belarus, Radio Station Belarus 6155eu	7360eu
			7390eu	
2200	2300		Bulgaria, Radio Bulgaria 6200eu	7400eu
2200	2300	smtwhf	Canada, CBC Northern Quebec Service	9625na
2200	2300		Canada, CFRX Toronto ON 6070na	
2200	2300		Canada, CFVP Calgary AB 6030na	
2200	2300		Canada, CKZN St Johns NF 6160na	
2200	2300		Canada, CKZU Vancouver BC 6160na	
2200	2300		Equatorial Guinea, Radio Africa/Malabo	15190af
2200	2300		Malaysia, RTM/Traxx FM 7295do	
2200	2300		Micronesia, The Cross Radio/Pohnpei	4755 as
2200	2300		New Zealand, Radio NZ International	15720pa
2200	2300	DRM	New Zealand, Radio NZ International	17675pa
2200	2300		Palau, T8WH/World Harvest Radio International	
			9930as	
2200	2300		Russia, Voice of Russia 7300eu	
2200	2300	Sat/Sun	Spain, Radio Exterior de Espana	6125eu
2200	2300		Syria, Radio Damascus 9330va	12085va
2200	2300		Turkey, Voice of Turkey 9830va	
2200	2300		UK, BBC World Service 3915as	5875as
			5910af 5965as 6135as	6195as
			9740as 9915af	
2200	2300		USA, American Forces Network	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
2200	2300		USA, EWTN/WEWN Irondale, AL	15610me
2200	2300		USA, FBN/WTJC Newport NC 9370na	
2200	2300	smtwh	USA, Voice of America 5915va	7480va
			7575va 11955va	
2200	2300		USA, Voice of America 7555as	
2200	2300		USA, Voice of America/Radio Ashna	7560as
2200	2300		USA, WBCQ Monticello ME 9330am	
2200	2300	fasmt	USA, WBCQ Monticello ME 7415am	
2200	2300	Sat	USA, WBCQ Monticello ME 5110am	
2200	2300		USA, WHRI Cypress Creek SC	9615na
			15180na	
2200	2300		USA, WINB Red Lion PA 9265am	
2200	2300		USA, WJHR International Milton FL	15550usb
2200	2300		USA, WTWW Lebanon TN 9480na	9990va
2200	2300		USA, WWCR Nashville TN 3195na	5070na
			9980na 13845na	
2200	2300		USA, WWRB Manchester TN 2390na	5050va
2200	2300		USA, WYFR/Family Radio Worldwide	5950na
			15255sa 15440ca	
2200	2300		Zambia, CVC Radio Christian Voice	4965af
2230	2300	mtwhf	Moldova, (Transnistria) Radio PMR	6240eu
2230	2300		South Africa, AWR Africa 15320as	
2230	2300		USA, Voice of America/Special English	7460af
			9570va 11840va 15340va	
2245	2300		India, All India Radio/External Service	6055as
			7305as 11645as 13605as	9705al
			9950al	

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

2300	0000		Anguilla, Worldwide Univ Network	6090am
2300	0000		Australia, ABC NT Alice Springs	4835do
2300	0000		Australia, ABC NT Katherine 5025do	
2300	0000		Australia, Radio Australia 9660pa	12080pa
			13590va 13690pa 15230as	15360pa
			15145as 15560pa 17795pa	
2300	0000		Bahrain, Radio Bahrain 6010me	
2300	0000	smtwhf	Canada, CBC Northern Quebec Service	9625na
2300	0000		Canada, CFRX Toronto ON 6070na	
2300	0000		Canada, CFVP Calgary AB 6030na	

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2300	0000		Canada, CKZN St Johns NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		
2300	0000		Cuba, Radio Havana Cuba	5040ca		
2300	0000		Egypt, Radio Cairo	11590am		
2300	0000		India, All India Radio/External Service	6055as		
			7305as	11645as	13605as	9705al
2300	0000		Malaysia, RTM/Traxx FM	7295do		
2300	0000		Micronesia, The Cross Radio/Pohnpei	4755 as		
2300	0000		New Zealand, Radio NZ International	15720pa		
2300	0000	DRM	New Zealand, Radio NZ International	17675pa		
2300	0000		Russia, Voice of Russia	7250na	11830as	
2300	0000		UK, BBC World Service	3915as	5875as	
			6135as	6195as	7385as	9740as
2300	0000		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2300	0000		USA, EWTN/WEWN Irondale, AL	15610me		
2300	0000		USA, FBN/WTJC Newport NC	9370na		
2300	0000		USA, Voice of America	5895va	7555as	
			7575va	11955va		
2300	0000		USA, Voice of America/Radio Ashna	7560as		
2300	0000		USA, Voice of America/Special English	7460af		
			9570va	11840va	15340va	
2300	0000		USA, WBCQ Monticello ME	9330am		
2300	0000	fasmt	USA, WBCQ Monticello ME	7415am		
2300	0000	Sat	USA, WBCQ Monticello ME	5110am		
2300	0000		USA, WHRI Cypress Creek SC	7315na		
2300	0000	smtwhf	USA, WHRI Cypress Creek SC	5920na		
2300	0000	Sat	USA, WHRI Cypress Creek SC	7335na		
2300	0000		USA, WINB Red Lion PA	9265am		
2300	0000		USA, WTWW Lebanon TN	5080va	5755va	
2300	0000		USA, WWCR Nashville TN	3195na	5070na	
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN	2390na	5050va	
2300	0000		USA, WYFR/Family Radio Worldwide	5950na		
			11580sa	15440ca		
2300	0000		Zambia, CVC Radio Christian Voice	4965af		
2300	2330		Australia, Radio Australia	11695pa	15240pa	
2300	2330	DRM	Vatican City State, Vatican Radio	7370am		
2300	2345		USA, WYFR/Family Radio Worldwide	11740na		
2300	2357		China, China Radio International	5915as		
			5990ca	6040na	6145eu	7350as
			7415as	9610pa	11790as	11970na
2315	2330	mtwhf	Croatia, HRT Voice of Croatia	3985eu		
			7375sa			
2330	0000		Australia, Radio Australia	17750as		
2330	0000		UK, BBC World Service	6170as		
2330	0000		Vietnam, Voice of Vietnam	9840as	12020as	

SHORTWAVE GUIDE

MT SHORTWAVE STATION RESOURCE GUIDE

Albania, Radio Tirana .....**http://rtsh.sil.at/**
Anguilla, Worldwide Univ Network .....**www.worldwideuniversitynetwork.com/**
Argentina, RAE .....**www.radionacional.gov.ar**
Argentina, RAE .....**www.radionacional.gov.ar**
Australia, ABC NT Alice Springs.....**www.abc.net.au/radio/**
Australia, ABC NT Katherine.....**www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek .....**www.abc.net.au/radio/**
Australia, HCJB Global Australia .....**www.hcjb.org/**
Australia, Radio Australia .....**www.abc.net.au/ra/**
Austria, AWR Europe.....**www.awr2.org/**
Austria, Radio Austria International **http://oe1.orf.at/service/international**
Bahrain, Radio Bahrain.....**www.radiobahrain.fm/**
Bangladesh, Bangladesh Betar .....**www.betar.org.bd/**
Bangladesh, Bangladesh Betar/Home Service **www.betar.org.bd/**
Belarus, Radio Station Belarus .....**www.radiobelarus.tvr.by/eng/**
Belgium, TDP Radio .....**www.airtime.be/schedule.html**
Belgium, TDP Radio/Disco Palace .....**www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Service .....**www.bbs.com.bt**
Bulgaria, Radio Bulgaria .....**www.bnr.bg/**
Bulgaria, Radio Bulgaria/Euranet.....**www.bnr.bg/**
Canada, Bible Voice Broadcasting Network **www.biblevoice.org/**
Canada, CBC Northern Quebec Service .**www.cbc.ca/north/**
Canada, CFRX Toronto ON .....**www.cfrb.com**
Canada, CFVP Calgary AB.....**www.classiccountryam1060.com**
Canada, CKZN St Johns NF .....**www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC.....**www.cbc.ca/bc**
Canada, Radio Canada International .....**www.rcinet.ca/**
China, China Radio International .....**www.cri.cn/**
China, Voice of the Strait (News Channel) Fuzhou **www.vos.com.cn**
Clandestine, Sudan Radio Service/SRS .....**www.sudanradio.org**
Congo Dem. Republic, Radio Kahuzi.....**www.radiokahuzi.com**
Croatia, HRT Voice of Croatia .....**www.hrt.hr/**
Cuba, Radio Havana Cuba .....**www.radiohc.cu/**
Egypt, Radio Cairo.....**www.ertu.org**
Equatorial Guinea, Radio Africa/Malabo.**www.panambc.com**
Equatorial Guinea, Radio African 2/Malabo **www.panambc.com**
Equatorial Guinea, Radio East Africa/Malabo **www.panambc.com**
Ethiopia, Radio Ethiopia .....**www.erta.gov.et**
Ethiopia, Radio Ethiopia/Home Service ....**www.erta.gov.et**
France, Radio France Internationale.....**http://rfienglish.com**
Germany, AWR Europe.....**www.awr2.org/**
Germany, Deutsche Welle .....**www.dw-world.de/**
Germany, European Music Radio.....**www.emr.org.uk/**
Germany, Overcomer Ministries.....**www.overcomerministry.org/**
Germany, Pan American Broadcasting .....**www.radiopanam.com/**
Germany, TWR Europe.....**www.twr.org**
Greece, Voice of Greece .....**www.voiceofgreece.gr/**
Guam, AWR/KSDA **www.awr2.org/**
Guam, TWR Asia/KTWR .....**http://nea.ktwr.net/**
India, All India Radio, Delhi-Kingsway.....**www.allindiaradio.org/**
India, All India Radio/Aligarh .....**www.allindiaradio.org/**
India, All India Radio/Dehli-Khampur .....**www.allindiaradio.org/**
India, All India Radio/External Service .....**www.allindiaradio.org/**
India, All India Radio/Gorakhpur.....**www.allindiaradio.org/**
India, All India Radio/Panaji, Goa.....**www.allindiaradio.org/**
Indonesia, RRI Cimanggis/Jawa Barat.....
Indonesia, Voice of Indonesia/Jawa Barat **www.voi.co.id**
Iran, VOIRI/IRIB .....**www.irib.ir/English/**
Italy, IRRS-Shortwave/NEXUS .....**www.nexus.org**
Japan, Radio Japan NHK World .....**www.nhk.or.jp/english/**
Kuwait, Radio Kuwait.....**www.media.gov.kw/**
Laos, Lao National Radio .....**www.lnr.org.la**
Liberia, Star Radio .....**www.starradio.org.lr/**
Malaysia, RTM/Traxx FM.....**www.traxxfm.net/index.php**
Malaysia, RTM/Voice of Malaysia.....**www.rtm.gov.my**
Mali, RTV Malienne.....**www.ortm.ml**
Micronesia, The Cross Radio/Pohnpei .....**www.pmapacific.org/**
Monaco, TWR Europe .....**www.twr.org/**
Nepal, Radio Nepal.....**www.radionepal.org/**
Netherlands, R Netherlands Worldwide ....**www.radionetherlands.nl/**
New Zealand, Radio NZ International .....**www.rnzi.com**
Nigeria, Voice of Nigeria/Ikorodu.....**www.voiceofnigeria.org**
Oman, Radio Sultanate of Oman .....**www.oman-tv.gov.om**
Pakistan, PBC/Radio Pakistan.....**www.radio.gov.pk**
Palau, T8WH/World Harvest Radio International **www.whr.org/**
Philippines, PBS/ Radyo Pilipinas.....**www.pbs.gov.ph/**
Poland, Polskie Radio Warsaw .....**www.polskieradio.pl**
Romania, Radio Romania International ....**www.rri.ro/**
Russia, Voice of Russia .....**http://english.ruvr.ru/**
Rwanda, Radiodiffusion Rwandaise.....**www.orinfor.gov.rw/**
Saudi Arabia, BSKSA/Saudi Radio.....**www.saudiradio.net/**
Serbia, International Radio Serbia.....**www.glassrbije.org**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa.....**www.channelafrica.org**
South Africa, RTE Radio Worldwide **www.rte.ie/radio1/**
South Africa, SA Radio League.....**www.sarl.org.za**
South Korea, KBS World Radio .....**www.worldkbs.co.kr**
Spain, Radio Exterior de Espana .....**www.ree.rne.es/**
Sri Lanka, SLBC .....**www.slbc.lk**
Swaziland, TWR Swaziland .....**www.twrafrica.org**
Syria, Radio Damascus.....**www.rtv.gov.sy/**
Taiwan, Radio Taiwan International .....**http://english.rti.org.tw/**
Thailand, Radio Thailand World Service ...**www.hsk9.org/**
Turkey, Voice of Turkey.....**www.trt-world.com**
Uganda, Dunamis Shortwave .....**www.biblevoice.org/stations/east-africa**
UK, BBC World Service.....**www.bbc.co.uk/worldservice/**
UK, FEBA Radio .....**www.febaradio.net**
USA, American Forces Network .....**http://myafn.dodmedia.osd.mil/**
USA, EWTN/WEWN Irondale, AL .....**www.ewtn.com/**
USA, FBN/WTJC Newport NC .....**www.fbnradio.com/**
USA, KNLS Anchor Point AK.....**www.knls.org/**
USA, Overcomer Ministries.....**www.overcomerministry.org/**
USA, Voice of America .....**www.voanews.com/**
USA, Voice of America/Radio Ashna .....**www.voanews.com/**
USA, Voice of America/Special English.....**www.voanews.com/**
USA, Voice of America/Studio 7.....**www.voanews.com/zimbabwe/news**
USA, WBCQ Monticello ME.....**www.wbcq.com/**
USA, WHRI Cypress Creek SC .....**www.whr.org/**
USA, WINB Red Lion PA .....**www.winb.com/**
USA, WRMI/Radio Prague .....**www.wrmi.net/**
USA, WRMI/Radio Slovakia Intl.....**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 Radio Worldwide.....**www.familyradio.com/**
Vatican City State, Vatican Radio.....**www.vaticanradio.org/**
Vietnam, Voice of Vietnam.....**www.vov.org.vn**
Zambia, CVC Radio Christian Voice.....**www.voiceafrica.net**

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Twitter: MilcomMP

CAP Sprouting Up Regional Nets

As mentioned in my April 2011 *Milcom* column, the Civil Air Patrol (CAP) recently announced that they are creating new regional HF ALE networks to supplement their national ALE net. From an official CAP source:

"Each of the eight regions is being assigned a suite of HF frequencies to be used as the region ALE net. Conventional voice nets remain valuable for confidence checks and training and may also be scheduled on these frequencies. Conventional operations, however, must share the channel with ALE operations – to include automatic ALE soundings. With training and experience, operators will become accustomed to pausing voice operations during a sounding and then continuing when the channel is clear."

Since that initial announcement, we have uncovered several of the new regional nets, including their frequencies and stations seen sounding on them. Our list of this information below is far from complete, but will give you a starting point to launch your monitoring effort if you want to follow the HF happenings of the CAP. (All frequencies are in kHz and the mode is ALE/USB).

Great Lakes Region
4604.0 7630.0 10504.0
Station List: 0034ILCAP 0070ILCAP 0004WICAP
Middle East Region
3385.0 4585.0 4633.0 5447.0 6773.0 7665.0 9082.0 10518.0
Station List: 0001NCCAP 0002NCCAP 0003NCCAP 0011DCCAP 034MERCAP 043MERCAP 0002SCCAP 0204SCCAP 0902NCCAP
North Central Region
4505.0 10510.0 12098.0 14450.0 16353.0
Station List: 0004IACAP 101NCRCAP
Northeast Region
4576.0 4630.0 6773.0 7656.0 10557.0 12218.0
Station List: 0021CTCAP 0016MECAP 0010PACAP
Rocky Mountain Region
4509.0 4601.0 7618.0 7665.0 10542. 14430.0 18516.0 22875.0
Station List: 0093COCAP 004RMRCAP
Southeast Region
4469.0 4502.0 4630.0 7704.0
Station List: 0004GACAP 0004MSCAP 0008MSCAP 0181ALCAP 201SERCAP 202SERCAP
Southeast Region
4512.0 4627.0 7416.0 10550.0 10557.0 12183.0
Station List: 0004AZCAP 0004TXCAP 0011ARCAP 0048ARCAP 0058ARCAP 0989OKCAP

We still do not have any information or intercepts of regional channels from the Pacific Coast Region of the CAP. Hopefully that will change in the near future. You can watch for future updates on our *Milcom Monitoring Post* blog and our Twitter feed. Both addresses are listed in the masthead of this column.

❖ Milcom Air Show Military Base Profiles

If an air show with one of the two major aerial demonstration groups (Blue Angels or Thunderbirds) is performing at a military base during the month, I will present a basic frequency profile for that base in this column. That will give you the tools to track pretty much anything that happens before, during and after the event via your scanner.

My only request is that if you use our list, please send us some feedback. Did you hear any frequencies on our list? Did you pick up some that weren't on our list? We want to know. You can send your feedback to us to the email address in the masthead.

All frequencies are in MHz and mode is AM unless otherwise indicated.

The big show this month will be held at Andrews AFB, Maryland. It is being billed as a reunion show with both the Blue Angels and the Thunderbirds performing during that weekend. More than likely this is because 2011 is the Centennial of Naval Aviation, and the Andrews show is considered a Tier 1 event during this year. So, Andrews gets both DoD premier flight demo teams this year. It should be quite a show.

Andrews AFB, Maryland.....KADW
May 21-22.....Joint Service Open House 2011
The Blue Angel/Thunderbird Reunion Show

89AW Special Air Mission Wing Air-to-Air.....136.725 292.800
Callsign: SAM
89AW SAM Command Post (AM mode) 138.200 141.550 378.100
Callsign: Griffin Ops
89AW Operations (AM mode).....141.700 142.750
113 Wing/121FS Air-to-Air (AM mode)139.150 143.150 143.600
113 Wing/121FS Command Post/Supervisor of Flight.....139.900 234.800
113 Wing/201AS Operations/Supervisor of Flight.....314.250
Callsign: Boxer Ops
375AMW/457AS Squadron Common ... 283.750
Callsign: Caribou Ops
459ARW/756ARS Command Post 143.800 351.200 378.100
Callsign: Liberator Ops
VAQ-209 Star Warriors Squadron Common.....372.250
VR-48 Capital Skyliners Squadron Common.....360.400
VR-53 Capital Express Squadron Common 328.400
(328.250 will or has replaced this frequency)

Approach Control (Potomac TRACON)
118.675 118.950 119.300 126.550 128.350 257.200 269.000 269.500 270.275 279.575 281.475 292.200 306.300 322.300 323.175 119.300/335.500
ATIS 113.100/251.050
Clearance Delivery..... 127.550/285.475
Departure Control..... 125.650/348.725
Ground Control..... 121.800/275.800
Ground Controlled Approach (GCA)..... 354.025 379.200
Maintenance..... 252.850 316.400
Metro..... 344.600
Miscellaneous Air-to-Ground..... 138.4375 138.600 139.275 139.400 139.850 143.725 259.850 305.600
NORAD Huntress..... 139.150 277.600 288.400 364.200
NORAD Huntress DC Area/Guard Dog CAP.....135.525 260.900 324.000 350.250
Potomac TRACON Arlington National Cemetery Fly-by control 124.000/279.275
Tower..... 118.400/349.000
USAF AMC Air Operations..... 293.600
USAF ANG Squadron Common..... 237.350 252.100 389.000
USAF AFRC Command Post..... 257.100 376.100
USAF Pilot-to-Dispatcher (PTD)..... 139.300 372.200
USCG..... 345.000 (Primary)
USN Pilot-to-Dispatcher (PTD)..... 362.900 (ex-257.625)
USN Squadron Common..... 265.700 346.500
Washington Helo Control (DCA) 134.250
USAF Maintenance..... 148.500 (NBFM)
USAF Tactical Aircrew Alert Net (TAAN).....413.450 (NBFM)
US Air Force P25 Trunk Radio System
385.2125 385.3125 385.9000 385.9125 386.0375 386.2000 386.3375 386.5000 386.6375 386.8000 (NBFM)

In addition to the Andrews event above, the Blue Angels will be performing at two military bases this month – NAS Pensacola and NAS New Orleans. Profiles for both of those bases follow. The profile for NAS Pensacola includes its two satellite bases of NAS Whiting Field North/South.

NAS Pensacola, Florida KNPA
May 3-4 Centennial of Naval Aviation Week
U.S. Navy Blue Angels

Blue Angels.....251.600 (Solos) 263.500 275.350 (Diamond/Delta)
VT-4/TAW-5 Squadron Common.....315.800 360.400
VT-4/TAW-5 Squadron Maintenance Common 320.550
VT-10/TAW-5 Squadron Common.....355.400

ATIS 124.350/266.800
Approach Control
120.050 120.650 270.800 288.325 289.800 298.900 314.000 322.525 343.650 372.000 363.050 372.000
Clearance Delivery.....134.100/268.700
Departure Control.....120.650/270.800
FACSFAC Pensacola 274.200 275.600 284.625 306.800 317.675 346.500 348.000 353.775 360.725 363.050 379.225 383.800 385.200
Ground Control 121.700/336.400
Ground Controlled Approach (GCA) 239.050 284.625 285.625 318.800 348.000 379.225
Metro .....359.600 (360.150 will or has replaced this frequency)
Naval Air Rework Facility .....266.700 Callsign: Victory Base
Pararescue Training.....236.000 251.900
Pilot-to-Dispatcher (PTD).....282.825
Search and Rescue (SAR) Training 302.300 336.750
Sherman Base Ops 312.100
Single Frequency Approach (SFA) 305.200 348.725
Tower 120.700/340.200
USAF Air-to-Air 250.150 259.900 351.750 364.150

USN Air-to-Air.....235.400 274.850 289.600 298.800 339.850 371.250 379.500
USN Air-to-Ground.....250.800 251.300 312.200
USN Squadron Common.....265.800 271.400 275.400 281.350 303.150 303.525 318.600 326.600 385.000

Whiting Field NAS North KNSE
TAW-5 Fixed Wing Instruction Training Unit (FITU) 273.750
VT-2/TAW-5 Squadron Common.....350.150
VT-3/TAW-5 Squadron Common.....342.800
VT-6/TAW-5 Squadron Common.....355.550

Approach Control.....127.350 128.250 278.800 291.625
ATIS.....290.325
Base Operations.....233.700
Clearance Delivery.....257.775
Ground Control.....251.150
Metro.....316.950
Tower.....121.400/306.925

Whiting Field NAS South.....KNDZ
HT/TAW-5 Secondary Formation Flying.....328.200
HT-8 FDO/TAW-5 Squadron Common.....303.600
HT-18 FDO/TAW-5 Squadron Common.....255.100
HT-18/TAW-5 Western Area Common.....308.200
TAW-5 HITU Common.....253.100

Approach Control.....124.850/385.400
ATIS.....273.575
Base Operations.....233.700
Black/Orange Route.....262.700
Clearance Delivery.....355.600
Ground Control.....346.800 317.475
Metro.....316.950
Tower.....121.400/348.675
Ground Electronics:384.4875 390.2125 (NBFM)

P25 Enterprise ELMR Gulf Coast Regional Trunk Radio System
NAS Pensacola: 385.3125 385.5125 386.0125 386.2500 386.5125 386.8500 388.0625 388.2375 388.3375 388.3625 388.6000 388.7875 388.8000 (NBFM)
NAS Whiting Field: 385.2125 385.9125 386.2625 386.4375 386.7625 386.9750 388.0375 388.2875 388.4875 388.5375 (NBFM)

NAS/JRB New Orleans, Louisiana ..... KNBG
May 7-8.....Nawlins Air Show 2011
US Navy Blue Angels

159FW Air-to-Ground: 250.125 261.200 262.950 271.100 303.275
159FW/122FS Command Post/Air-to-Air ...262.750
159FW Supervisor of Flying.....355.100
HMLA-773 Air-to-Air.....264.200 268.900 285.300 301.000 363.300
VFA-204 River Rattler Squadron Common .289.600

Approach Control.....123.850/256.900 269.025 270.350 288.250 291.650 299.200 356.650
ATIS 276.200 (279.550 will or has replaced this frequency)
Base Operations.....379.150
Clearance Delivery.....370.850
Ground Control.....121.600/382.800
Ground Controlled Approach (GCA).....284.600
Metro 265.800
Tower 123.800 340.200 360.200
USAF ANG Squadron Common.....227.525
USAF ANG Supervisor of Flying.....234.800
USCG NMG-8 Air Operations.....237.900 326.150 345.000 379.050
USCG Search and Rescue (SAR).....282.800
USN C-12 Aircraft Maintenance.....233.825
USN Squadron Common.....225.500
USMC Helicopter Landing Zone.....233.750

P25 ELMR South Regional Trunk Radio System
386.1375 386.2875 386.4375 386.5875 386.7375 386.9500 388.1125 388.2625 388.3500 388.4125 (NBFM)
P25 Medical Emergency Services.....385.2125 388.6500
P25 Law Enforcement.....385.6250 385.8875 386.0375 386.2000 386.8250 388.1500

Langley AFB, Virginia ..... KLFI
May 14-15: Air Power Over Hampton Road
US Air Force Thunderbirds

1FW Air-to-Air.....228.175 269.900
1FW Command Post Have Quick Timing 372.175
1FW F-15 Flight Demo Team.....238.835
1FW F-15 Squadron/Wing Common.....341.800
1FW Pilot-to-Dispatcher (PTD).....233.525 238.825 257.075 276.675 285.150 296.900 315.850 358.850 360.150
1FW Squadron Common (AM mode).....138.200 141.650 142.300 142.600 143.750 143.825
1FW Supervisor of Flight (SOF).....305.600
1FW/27FS Air-to-Air.....228.450 Callsign: First/Bull/Rumble/Tonga
1FW/71FS Squadron Common .....236.650 357.100 Callsign:Tonga Ops/Iron
1FW/94FS Air-to-Air.....252.775
1FW/94FS Squadron Common .....364.125 Callsign: Spud Ops
192FW/149FS ANG Air-to-Air 262.025

Approach/Departure Control (Norfolk) 124.900 125.700 126.050 127.900 269.425 298.850 335.625 370.925 379.100
ATIS 270.100
Clearance Delivery.....118.850/257.625
Consolidated Command Post (Have Quick Timing).....251.250 311.000 287.450 Callsign: Raymond 16
Ground Control.....121.700/275.800
Langley Aero Club.....123.500
Metro 239.800
NASA Operations.....123.375 310.400
Pilot-to-Dispatcher (PTD) 139.600 141.750 376.200
Pilot-to-Maintenance (PTM).....289.000
Single Frequency Approach (SFA).....284.000
Tower 125.000/253.500
USAF Air-to-Ground Training.....308.600
USAF Squadron Common 233.325

P25 Motorola Trunk Radio System
406.1625 406.3625 406.5625 406.7625 406.9625 407.1625 407.3625 407.5625 407.9625 408.1625 408.3625 408.5625 408.7625 409.1625 409.3625 409.5625 409.9625 410.3625

The air show schedules mentioned in this article are current as of press time, but they are subject to change without notice, and are weather permitting, for everyone's safety. You can get the latest and late breaking information on our Internet blog – the *Milcom Monitoring Post* at **http://mt-milcom.blogspot.com**.

❖ US Army MARS ALE Going Regional

Right on the heels of the USAF Civil Air Patrol establishing regional HF ALE networks (see the lead topic in this column), it now looks like the US Army MARS folks are following in their footsteps.

Recently *Monitoring Times Digital Digest* columnist Mike Chace reported the following on the UDXF newsgroup:

> 14846.0 kHz dig 125bd/1750 MIL-188-141A, ALE stations "9UA", "R9C", "A9F", "R9UACARMYMAR", "A9FARMYMAR" UNID MIL organization (on USB)

14846.0 kHz is a definite US Army MARS frequency, and Mike's intercept was the first ever report of ALE activity on this frequency. In addition, the ALE addresses observed by Mike were different than what has been used in the past. That sent me packing to the Internet to see if something had changed.

It didn't take long to uncover the following from a public website with some selected Army MARS docs:

" . . . HQ Army MARS has authorized ALE operations at the regional level for training and familiarization.

"The sole purpose of this authorization is to develop skill, knowledge and familiarization with ALE operation and technologies inside the Army MARS membership. It is not Army MARS intent to develop large scale or permanent ALE networks involving the general membership at this time.

"Region Directors are in charge of the frequencies assigned to the Region. Scheduling nets, assigning frequencies, management of operations, etc. is under the authority of the Region Director or his designee. ALE training is a Regional Activity. Only those stations so approved by the Region Director, or his designee may participate in ALE training. ALE training will only occur during the times and on the frequencies so designated by the Region Director. This will only occur if the Region Director determines there is a need for the training, and when he has the staff resources and time to accomplish it. There shall be NO ALE activity of any kind on Army MARS frequencies outside of the times specified by the Region Director, unless otherwise expressed by HQ Army MARS.

"Each station operating ALE shall have an ALE Address unique to the network it is operating. The ALE address is commonly derived from the station's call sign, but this is not always the case. It is improper to refer to these as 'ALE Call Signs.'

"ALE Addresses are made of three-character 'words.' A three digit address is one ALE Word. A four to six digit address will be two ALE Words, and so on. The more words used in an address, the slower the network becomes. It is for this reason, only three or six character addresses will be used.

"The most common ALE Addressing convention used in MARS corresponds to FTR 1047/3-1998. This method uses two ALE Words and is used where a network made up of stations from several services is expected (such as the Tri-Service ALE Network). The first ALE Word contains the unique portion of the station's address. It is repeated several times by the ALE equipment when making calls, etc. The second ALE word is only sent once, and indicates the station's affiliation or home organization. The ALE address may be based on the station's call sign as follows:

"An Army MARS station call sign is broken into two parts. The first three characters of the Army MARS call sign is unique to the Army MARS organization, eg, AAA, AAM, AAN, AAR, AAT, AAV. The last three characters are unique to the station, eg, 8RE, 1XY, etc. Since ALE sends these parts in opposite order, the word unique to the station first, the word unique to the organization second, we reverse the order of these elements of the station call sign to create an ALE address."

So, between the CAP and Army MARS, we have some new and interesting monitoring activity ahead and my aspirin bottle will get some use. If you observe any CAP or US Army MARS ALE activity, regardless of frequency, we would certainly appreciate it if you would pass it along to the email address in the masthead.

FED FILES

GOVERNMENT COMMUNICATIONS

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Scanning Super Bowl XLV

The championship game of the National Football League, Super Bowl XLV in Arlington, Texas may be remembered for many things – snow and ice, a botched National Anthem, and a military flyover with the roof closed. The winter-like weather caused some interesting issues at Cowboys Stadium. At one point firefighters from the Arlington Fire Department were sent up to the roof of the stadium to help remove ice and snow after large sheets of ice fell from the domed roof and injured some workers around the outside of the stadium.

This year I was once again in the middle of the activities in North Texas, working as an engineering manager as part of the technical crew providing television coverage to the international broadcast outlets. I was able to set up some monitoring gear in both my nearby hotel room and the office trailer outside the stadium to search out radio traffic. Plus I had some contact with local scanning groups that helped with sharing frequencies and logs during my visit.

As with past Super Bowls since 2002, this was designated as a National Security Special Event. Many public safety, federal law enforcement and military agencies participated in security protection and intelligence for the game and associated events. Some additional information about these types of events can be found at the Secret Service and DHS web sites here:

www.secretservice.gov/nsse.shtml
www.dhs.gov/xnews/releases/pr_1167323822753.shtm

The Super Bowl related scanning activity increased over the days as the big game drew closer. Much testing went on during the weeks prior to the game and some new federal VHF frequencies were heard on the air. In mid January I received reports of some initial testing being performed by the Air Marine Division of CBP Customs. Some video of the CBP air assets in action around Cowboys Stadium can be seen here:

http://nemo.cbp.gov/opa/videos/2011/spbl_xlv.wmv

The CBP aircraft using the OMAHA call sign were heard testing live video feeds to the Joint Information Center, the headquarters for the security and intelligence operations at Super Bowl XLV. All local, state and federal agencies had personnel and communications positions at the JIC. This year, the JIC was housed in a nondescript, unmarked office complex away from the stadium area.

For weeks prior to the game there were rumors of a Presidential visit to the Super Bowl stadium, most likely if the Chicago Bears made it to the game. Many folks wondered how that would affect the security operations on game day. It turns out that a visit from the POTUS is already worked out in all the security and emergency planning by the various agencies involved. They plan for worst-case scenarios and hope for the best.

Even without a Presidential visit, the Secret Service was busy with at least two protective details. The first was a few days prior to game day when DHS Secretary Janet Napolitano came to the stadium and held a press conference about the DHS preparations for security at the game. The second was on game day when President Bush (43) came to watch the game.

One agency that seemed to have an increased presence at this year's game was DHS Immigration and Customs Enforcement (ICE). ICE appeared to be using quite a few radio channels around the event, and radio traffic indicated the agency was apparently supervising some sort of video surveillance around the stadium. I will have more information on ICE radio channels later in this column.

U.S. Immigration and Customs Enforcement

As with other recent Super Bowls, there was plenty of military air traffic as well as the DHS air support. There was a much-publicized national anthem flyover of F-18C fighters of the VFA-131 Wildcats out of Navy Oceana NAS. Air National Guard fighter jets flew a Combat Air Patrol (CAP) mission around the stadium during the big game, The CAP flights started with two ANG F-15s of the 159th Fighter Wing from NAS New Orleans, using the CAESAR call sign. Later, reports were that two ANG F-16s from Buckley AFB in Colorado joined in and replaced the CAESAR aircraft, but I did not catch that.

During the mission, KC-135R tankers using the NATION call sign from the 22nd Air Refueling Wing at McConnell AFB refueled all the fighters. And BIGFOOT, the Western Air Defense Sector of NORAD, controlled the whole show. BIGFOOT could be heard via remote transmitters communicating with the fighters as well as calling out to aircraft violating the Temporary Flight Restrictions (TFR) around the stadium.

An interesting land-based military frequency that was heard active prior to the game was 387.5125 MHz. It was being used by the 6th Civil Support Team of the Texas Army National Guard at Cowboys Stadium and was heard both in simplex and repeater mode. What exactly the 6th Civil Support Team was doing at the stadium was initially unclear by their radio communications. But, a little research shows that they are one of 55 National Guard units available to respond to incidents involving possible weapons of mass destruction, as well as to other disasters and catastrophes.

Here is a listing of what several of us in the area were able to log, either via listening or logging software and computers. All frequencies are in Megahertz (MHz) and if the user was identified, that information is provided. While many of these frequencies may be new allocations used for Super Bowl operations, some may be normal channels for the North Texas region and may still be in use.

123.0250	AM	Helicopter air-to-air
121.5000	AM	VHF Guard, BIGFOOT calling out to aircraft in violation of the TFR
123.4500	AM	Local air traffic
126.4750	AM	Ft. Worth Center frequency given out over 121.5 MHz
136.3750	AM	CBP Office of Air and Marine (OAM) VHF "Company" channel
162.6125		
162.7625	N167	FBI input to 171.6125 repeater
162.8250	100.0 pl	CBP Customs
162.8250	N033	ICE input to 163.6250 repeater
162.8250	N034	ICE input to 163.6250 repeater
162.8500	N033	ICE
162.8750	N039	ICE
162.9000	N653	Input to 170.7250 DFW EAST Federal Interoperability repeater
162.9125	N069	ICE input to 171.2500 repeater
162.9500	N167	FBI input to 170.9625 repeater
162.9750	N653	Input to 171.4375 DFW WEST Federal Interoperability repeater
163.1000	100.0 pl	CBP Customs
163.1125	N496	
163.1875	N167	FBI input to 170.6625
163.2125	100.0 pl	
163.4000	N653	Unknown, possible Federal Interoperability
163.4625	114.8 pl	

163.6250	100.0 pl	CBP Customs units at VACIS area
163.6250	N032	ICE
163.6500	N167	Possible FBI
163.7000	N031	ICE UNITS HEADED TOWARDS STADIUM
163.7250	151.4 pl	CBP UNITS
163.7750	N036	ICE
163.8625	N167	FBI
163.8875	N167	FBI
163.9500	N167	FBI input to 172.1875 repeater
164.2500	167.9 pl	FBI analog?
164.4000	N001	USSS PAPA
164.4250	CSQ	Possibly the Environmental Protection Agency
164.4375	N001	
164.5500	N7FE	Organized Crime Drug Enforcement Task Force (OCDETF)
164.6000	100.0 pl	CBP NET Customs air operations and units at VACIS near stadium
164.6500	N001	USSS TANGO
164.7000	114.8 pl	
165.2125	N001	USSS MIKE
165.2375	100.0 pl	DHS CBP Customs NET 1
165.2875	N650	BATFE NET 1
165.3750	N001	USSS CHARLIE used by Napolitano Security detail
165.4625	173.8 pl	
165.6875	100.0 pl	DHS CBP NET 4, OMAHA air assets
165.8750	N167	FBI
165.9250	N167	FBI
165.9500	N001	IRS repeater
165.9500	N003	IRS repeater
166.0000	N7FE	Possibly related to 164.55 MHz OCDETF
166.2250	100.0 pl	CBP NET 4 input to 165.6875 repeater
166.4000	N001	USSS GOLF
166.4375	100.0 pl	CBP NET 1 input to 165.2375 repeater
166.4875	100.0 pl	CBP NET 5 input to 164.6000 repeater
166.5375	N651	BATFE NET 1 input to 165.2875 repeater
166.5875	100.0 pl	CBP NET 3, NET 7 or NET 49 input
166.5875	N001	USSS input to DFW area TANGO (164.6500) repeater
167.1625	N650	BATFE TAC 1
167.2375	N167	FBI
167.2625	N167	FBI
167.2875	N167	FBI
167.3625	N167	FBI
167.4875	N167	FBI
167.5375	N167	FBI
167.5625	N167	FBI
167.5625	167.9 pl	FBI analog with DES
167.6875	N167	FBI
168.5875	N169	ICE A4-NATIONWIDE TAC 2
168.8625	N001	ICE A12-OCDE Direct (simplex)
168.8875		
168.9750	N167	FBI
168.9875	N167	FBI
169.4500	100.0 pl	CBP NET Air Operations
169.5000	136.5 pl	
170.1000	N043	ICE repeater "DAL 4"
170.3375	N001	DHS TSA Coordination Center at DFW Airport
170.6250	N167	FBI
170.6625	N167	FBI call signs 32-13, 32-14 heard
170.6750	N167	FBI G-5
170.7250	N94C	Unknown
170.7250	N653	DFW EAST Federal Interoperability repeater
170.7500	N293	US Marshals
170.8375	N167	FBI
170.9125	N167	FBI
170.9375	N167	FBI
170.9500	118.8 pl	
170.9500	171.3 pl	
170.9500	N167	FBI
170.9625	N167	FBI, call signs 07 ALPHA, RED 1, BLUE 1, CHOCTAW, NEW ORLEANS
171.0750		
171.2500	N069	ICE A-1, Nationwide Repeater channel
171.4375	N653	Federal Interoperability repeater DFW WEST
171.6875	N167	FBI
171.9375		
171.9875		
172.1875	N167	FBI
172.2125	N167	FBI
172.9000	N001	DHS TSA, may have been at game Behavior Detection Officers
173.0125	N650	BATFE TAC 3
173.6250	118.8 pl	
173.8125	N167	FBI
235.4000	AM	F18C anthem flyover, air-to-air
243.0000	AM	UHF GUARD channel with traffic from BIGFOOT
271.0000	AM	Combat Air Patrols with OMAHA CBP aircraft and BIGFOOT
282.6000	AM	BIGFOOT broadcasting warnings to aircraft about violating TFR
298.6000	AM	Ground unit with timing hack for anthem flyover
320.8750	AM	
353.9500	AM	Ft. Worth Center Air Traffic Control
387.5125	151.4 pl	Texas Army National Guard, 6th Civil Support Team
397.5125	151.4 pl	Input to 386.5125 repeater
406.3375	N482	US Postal Inspectors RED repeater
407.3625	N045	Naval Air Station Joint Reserve Base Ft. Worth TRS
407.9625	N045	"
408.5625	N045	"
408.9625	N045	"
409.4375	N045	"
409.9625	N045	"
410.3625	N045	"
410.7625	N045	"
410.8000	N731	DHS Federal Protective Service
415.3375	N482	US Postal Inspectors input to 406.3375 repeater
415.6875	N293	Unknown
415.8750	N293	Unknown
416.8250	N293	Unknown
418.6250	156.7 pl	DEA
418.9750	156.7 pl	DEA
419.7500	N293	Unknown

❖ New Nationwide ICE Channels

After the Super Bowl, I received reports that some of the frequencies that were used by ICE personnel were being heard in other parts of country as well. For a long time, it appeared that ICE was using a patchwork of old Border Patrol and Justice Department frequency allocations, as well as some new frequencies. I published a portion of the ICE radio networks in the March 2010 *Fed Files*. However, these channels seemed to be utilized very locally, with very little common use between different parts of the country. This appears to be changing.

Recently I became aware of some new frequencies and new names assigned to channels in the ICE radio programming. They indicate that there are now additional channels that should be available for nationwide, common use among ICE, other DHS agencies, and other federal agencies. Here are the latest in nationwide common channels for ICE:

ICE Nationwide Repeater	171.2500, N069, Repeater OUT 162.9125, N069, Repeater IN
ICE Nationwide Direct	163.7500, N169, simplex
ICE Nationwide TAC 1	163.7000, N169, simplex
ICE Nationwide TAC 2	168.5875, N169, simplex
ICE Nationwide TAC 3	163.1125, N169, simplex
ICE Nationwide TAC 4	164.7875, N169, simplex
ICE Common	168.3500, N001, simplex
ICE DHS Common Analog	168.8375, 100.0 pl, simplex
ICE DHS Common Digital	168.8375, N001, simplex
Federal Common Analog	166.4625, 103.5 pl, simplex
Federal Common Digital	166.4625, N001, simplex
ICE OCDE 1 Analog	168.8625, 103.5, simplex
ICE OCDE 1 Digital	168.8625, N001, simplex
ICE OCDE 2 Analog	164.5500, 103.5, simplex
ICE OCDE 2 Digital	164.5500, N001, simplex

Some of these are well known in other agencies channel lineups, such as the OCDE (Organized Crime Drug Enforcement) channels, which are often used by the FBI. And 166.4625 MHz, which for many years was known as Treasury Common, then DHS Common, appears now to be called a Federal Common channel.

So, put these in your radio and let me know what you hear. I have heard from some monitors in the northeast US that these channels are in use out there.

❖ Mt. Rainier National Park

Beginning with the January *Fed Files* column, I have been focusing on federally managed forest areas in the Pacific Northwest, specifically the Mt. Hood National Forest and Gifford Pinchot National Forest. This month I wanted to take a look at the Mt. Rainier National Park in central Washington State:
www.nps.gov/mora/index.htm

Mt. Rainier National Park was established in 1899 as the fifth national park in the United States. The park is situated in both Pierce and Lewis Counties in Washington State, and covers about 370 square miles. Mt. Rainier itself rises to over 14,000 feet in the center of the park.

As with many other national parks, they utilize some radio repeater sites with a common output frequency to help cover the park boundaries. There are also a number of simplex channels and portable repeaters used as needed. Here is the most current list from Mt. Rainier National Park that I could access:

PARK NET Radio Channels	Repeater OUT	Repeater IN
Direct (simplex)	169.7250, CSQ	169.7250, 97.4 pl
GOBBLERS (Southwest)	169.7250, CSQ	163.0750, 107.2 pl
PACKWOOD	169.7250, CSQ	163.0750, 118.8 pl
SHRINER (Southeast)	169.7250, CSQ	163.0750, 141.3 pl
CRYSTAL (Northeast)	169.7250, CSQ	163.0750, 131.8 pl
FREMONT (North)	169.7250, CSQ	163.0750, 146.2 pl
TOLMIE (Northwest)	169.7250, CSQ	163.0750, 103.5 pl

COMMON USE Radio Channels	
COMMON 1	168.6125, 97.4 pl, simplex
COMMON 2	163.7125, 97.4 pl, simplex

OFF NET Radio Channels	
OFF NET (Local use)	172.4500, 173.8 pl, simplex
PORTABLE REPEATER	172.4500, 173.8 pl167.1250, 173.8 pl

MRNP Fire Mobilization	171.7750, 97.4 pl, simplex

In addition to these channels, I have scrounged up some additional frequencies that may be in use at Mt. Rainier, but have no confirmation of their current use. If you visit the area, put these in and let me know what comes up:

163.2375 163.3875 164.4750 164.9875 166.8750 167.1500 172.6250 406.2500 419.9500

That is all for this edition of the *Fed Files*. I will be back in the July *Monitoring Times* with even more federal frequencies. Keep searching!

BOATS, PLANES, AND TRAINS

PLANES

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Flight Delays and Stoppages

Flight delays, cancellations, and stoppages can be an annoyance and an inconvenience. They can be problematic for travelers and for those who go to airports to pick them up. The extra workload and flight safety concerns that Air Traffic Controllers have in dealing with delayed flights can, at times, be considerable.

Flight delay occurrences and how they are managed have many facets. They can result from adverse weather at the departure airport, the destination airport, or from enroute weather and flight path diversions along the way. Needless-to-say, an unscheduled runway closure or the closure of a typically busy commercial airport can really gum things up, with difficulties rippling throughout the system across the country.

Scanner listeners can often hear firsthand what pilots and controllers are dealing with.

❖ Flight Delay Information

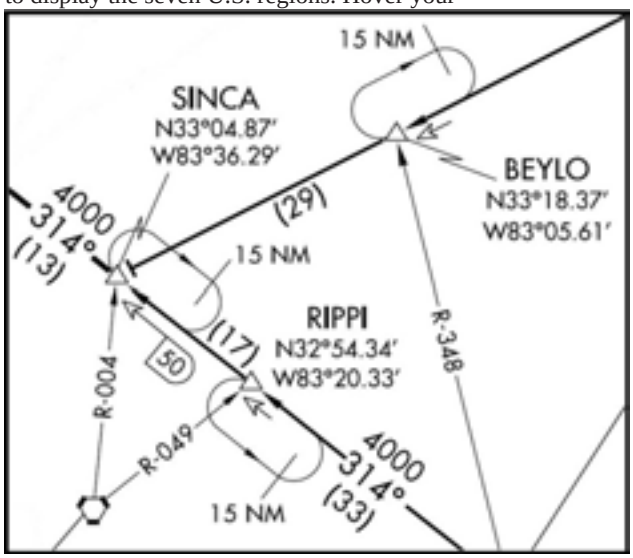
The FAA provides flight delay information for major airports on a full U.S. map or by maps of U.S. regions. The starting point is here **www.fly.faa.gov/flyfaa/usmap.jsp**.

The larger airports are shown on the full U.S. map. Near the top left is a "View by Region" selection box. Click on the down-arrow to display the seven U.S. regions. Hover your cursor over a region name to display the included states. The regional maps show more airports for a given region than the full U.S. map.

The airports are represented by colored dots and the associated three-letter airport identifiers. Green dots: "General Arrival/Departure delays are 15 minutes or less." Yellow dots: "Departures are experiencing taxi delays of 16 to 45 minutes and/or arrivals are experiencing airborne holding delays of 16 to 45 minutes." Orange dots: "Traffic destined to this airport is being delayed at its departure point." Red dots: "Departures are experiencing taxi delays greater than 45 minutes and/or arrivals are experiencing airborne holding delays greater than 45 minutes." Black dots: "This denotes a closed airport!"

To obtain brief info for an airport represented by a dot on the map, hover your cursor over the dot. A small information window will pop up. To obtain specifics, click on the dot.

Example notice: "Due to WX / WIND, departure traffic destined to Newark International Airport, Newark, NJ (EWR) is currently experiencing delays averaging 1 hour and 14 minutes."



This is part of the SINCA FIVE ARRIVAL "plate" at Atlanta International (ATL). The racetrack looking symbols represent holding patterns where an aircraft can fly one or more laps to use up time to delay an arrival when necessary. Courtesy FAA

❖ What is ATCSCC?

In the words of the Air Traffic Control System Command Center: "Operated by the FAA, the role of ATCSCC is to manage the flow of air traffic within the continental United States. The ATCSCC has been operational since 1994 and is located in Herndon, VA, in one of the largest and most sophisticated facilities of its kind."

Traffic Flow Management (TFM) doesn't deal so much with individual flights as do Air Traffic Controllers, but instead it manages flight routes based on current conditions. Airliners, for the most part, fly from point to point along established, charted routes like connecting the dots from one airport to another. For example, here is one of two routes listed for Los Angeles (LAX) to Boston (BOS): J9 MLF J107 OCS J94 DBQ BAE J16 ALB GDM–STAR. This is called a "route string" and can be followed by looking at IFR aeronautical charts.

Weather considerations and congested airspace can result in the changing of routes between airports. Instead of controllers creating them as needed every time, they can refer to the ATCSCC *National Severe Weather Playbook*. Also, notices of "Current Reroutes" may be found here: **www.fly.faa.gov/ratreader/jsp/index.jsp**.

The objective of Traffic Management is to balance the demand for aircraft to get where they need to go as expeditiously and safely as possible *with* the system's capacity, in terms of airports and routes, to accommodate them throughout the day under changing and sometimes adverse conditions.

Air Route Air Traffic Control Center (ARTCC) and Terminal Radar Approach Control Facility (TRACON) controllers relay projected and real-time National Airspace System (NAS) information to Traffic Management specialists who, in turn, decide if and what Traffic Management Initiatives (TMIs) to implement.

❖ ATCSCC Advisories

ATCSCC Advisories are commonly used for Ground Stops, Ground Delay Programs (GDPs), Airspace Flow programs (AFPs), Route Information, Planning Telcon Advisories (phone teleconferences related to events that impact the NAS), Facility outages, and Volcanic Activity Bulletins.

"The Most Recent ATCSCC Advisory" may be found here: **www.fly.faa.gov/adv/advADB.jsp**. It refreshes every five minutes. It may or may not have information on airports or routes in your monitoring radius; even so, it can be interesting to look at. Even if you cannot understand some notices, all this helps to point out some of the behind-the-scenes activity to control air traffic flow for the best outcomes.

You will see that these notices use many abbreviated terms. Please do not be discouraged by this. The *Air Traffic Management Glossary of Terms* at **www.fly.faa.gov/FAQ/Acronyms/acronyms.jsp** isn't very long and is helpful in reading the ATCSCC notices. Not all terms are listed, however. Part of the fun of aircraft listening is figuring out all of this "stuff."

AWC Contractions is a 60-page (150 KB) weather glossary which can also be useful **http://aviationweather.gov/static/info/awc-contractions-contsort.pdf**.

Ground Delay Program notice for San Francisco International (SFO). Courtesy FAA ATCSCC

❖ Airspace Flow Programs

The major cause of delays is arrival airport congestion. The capacity to land airplanes is called "acceptance rate" which fluctuates with weather, runway configuration (landing/take-off direction) changes, and other things.

Air Traffic Controllers do their very best to keep flight delays to a minimum but it can be complicated by various weather conditions. When needed, Airspace Flow Programs (AFP) are put into effect. The object is to identify constraints in the NAS and identify scheduled flights that could be affected – but prior to departure.

In turn, based on the best information, the calculated departure times are distributed to control towers and airline dispatchers, then to the pilots. These are more accurately called Expect Departure Clearance Times (EDCTs).

Pilots of those flights and Airport Ground Controllers work to meet the EDCTs within plus or minus five minutes. This is to provide the most efficient metering (sequencing) of the flights through sometimes narrow and/or congested pieces of airspace and/or at the arrival airports.

For an aircraft enroute, an AFP can result in airborne holding or require an aircraft to land at an intermediate airport to provide the required delay. Aircraft may also be rerouted to avoid the AFP. Ideally, with the AFP, aircraft can be sequenced into the arrival flow without additional delays.

Even on good days, you will hear controllers telling some pilots to speed up or slow down or the controller will vector a flight in a way that it uses up more time. His goal is to fit them all in, with proper spacing – in an orderly and safe manner.

❖ Ground Delay Program

The ATCSCC administers software-assisted Ground Delay Programs (GDP). GDPs are implemented based on circumstances at arrival airports where acceptance rates are reduced for some reason and reflect back to the airports and pilots at the departure airports.

The GDP imposes ground delays on selected flights in an attempt to not exceed acceptance rates at arrival airports. Departures are delayed on the ground in order to limit holding while airborne. This is safer and less costly.

Common causes that impact acceptance rates are low ceilings (LO CIGS or LOCIGS), visibility (VSBY or VIS), wind, or storms. The estimated times enroute are used to calculate the EDCT for each aircraft which are assigned in 15 minute increments, sometimes up to several hours.

When a GDP has expired at an impacted airport, the ATCSCC advisory will read THE PHL GDP HAS EXPIRED and PHL, in this case, is the three-letter code for Philadelphia International Airport.

The FAA notes that: "GDPs provide for equitable assignment of delays to all system users."

❖ Ground Stop

A Ground Stop (GS) holds aircraft on the ground that are destined to depart to an affected airport that has a severely reduced acceptance rate, or a zero acceptance rate – for a short period of time. These can be caused by, but not limited to, a closed runway or airport, snow removal, airport grid-lock, or by aircraft accidents or incidents.

A GS can be specific to a particular airspace that might be at or near saturation or due to an Air Traffic Control (ATC) facility outage. A GS can be initiated with little warning and when alternate routings are unavailable due to severe weather or a catastrophic event.

They can be implemented locally but if longer than 30 minutes, it requires prior ATCSCC approval. Ground Stops are the most restrictive of the Traffic Management initiatives and override all others. A GS can be a quick fix until a longer-term solution like a GDP can be implemented.

Ground Stops have priority over EDCTs. New EDCTs have to be reissued later if the AFP is still in effect.

❖ ATC Zero

It is not unheard of for an ATC facility to have a catastrophic failure where all or a significant portion of radar data is lost (planes disappear from controllers' screens), some or all of the radio communications with pilots fail, and/or much of the voice communications to other ATC facilities fail.

ATC Zero is declared when a situation arises that renders an entire Air Traffic Control Facility, or a significant portion thereof, unable to safely provide air traffic services. The ATCSCC Crisis Management Center in Virginia is activated when it involves an ARTCC, a TRACON, or any of the 35 major airport Control Towers – as the consequences of the event ripple well into the NAS system.

The ATCSCC notifies all the affected facilities in whose airspace air traffic originates or passes so that they can stop or divert it. Adjacent ATC facilities must help however possible to lessen the severity of the ATC Zero event.

Operational Contingency Plans (OCPs) are in place to provide "operational and administrative instructions and procedures to be implemented by a facility that experiences a degradation or loss of ability to provide ATC services."

When operations are resumed and stable for the given facility, the ATC Zero is cancelled. Needless to say, an ATC Zero event can cause ground delays, airborne delays, and rerouting of air traffic.

❖ ESCAT

"ESCAT (Plan for The Emergency Security Control of Air Traffic) is an emergency preparedness plan that prescribes the joint action to be taken by appropriate elements of the Department of Defense (DoD), the Department of Transportation (DOT) and the Department of Homeland Security (DHS) in the interests of national security to control air traffic under emergency conditions."

ESCAT "… applies to all U.S. territorial airspace and other airspace over which the FAA has air traffic control jurisdiction by international agreement." During national emergency conditions, particularly air defense emergencies, procedures are implemented to identify and control air traffic within identified air defense areas.

Under certain conditions, North American Aerospace Defense Command (NORAD) and United States Pacific Command (USPACOM) Commanders may individually implement ESCAT for their own Areas of Responsibility as agreed upon by DoD/DHS/DOT.

"Flight operations vital to national defense, as determined by appropriate military commanders, will be given priority over all other military and civil aircraft." Each ARTCC must have a plan "for diverting or landing expeditiously all aircraft according to the ESCAT priorities imposed upon implementation of ESCAT."

If and when ESCAT is put into effect, there will be flight delays and stoppages!

❖ The Longest Delays

Prior to ESCAT was SCATANA (Security Control of Air Traffic and Air Navigation Aids). That is what was implemented during 9/11. The immediate objective was to clear the skies of all civil air traffic, much military air traffic, and identify who was left and which ones among them might be threats.

The longest delays and the most extensive rerouting in history resulted on this day. It was unprecedented! I was monitoring aircraft on HF, VHF, and UHF. All civil air traffic in the U.S. and some out of the U.S. was ordered to land, period! It was hard to get a grip on what was happening at first. That seemed to be the case for many pilots as well. A few I heard were rude and indignant to controllers, which did not help matters.

From a radio hobbyist perspective, it provided some outstanding and amazing listening as aircraft were grounded, plus all the military aircraft communications that ensued.

Travelers ended up at airports far from where they wanted to go and some didn't get to their destinations for many days. One situation worthy of note involved U.S. bound trans-Atlantic airliners that were directed to land in Newfoundland and Nova Scotia. The people there were particularly accommodating, prompting at least one good TV documentary on the experience. If a book on the subject might interest you, consider: *The Day The World Came To Town: 9/11 In Gander, Newfoundland.*

See you next time!

GLOBALNET

Exploring the World of Internet Radio and Television

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Tweaks, Pops and Chirps... Online

For centuries, man has stared into space contemplating the expanse of the universe and the possibility of life on other planets. In the last century, we have taken that fascination into our own hands by sending satellites, probes and even ourselves into space, searching for answers and information to help unlock celestial mysteries.

One of the unexpected methods of exploring space was through the search of radio signals from the cosmos. It took off in earnest with the discovery during the 1950s, that Jupiter was talking to us via radio signals.

Jovian storms shoot radio signals from its magnetic poles. These storms can be heard on Earth under certain conditions in the forms of clicks, pops and swooshes.

Now, thanks to the Internet, the sounds of Jupiter and other space phenomenon are available to tune in from the comfort of your own home, without the expensive equipment or antenna arrays usually required.

Now, the majority of what is available to hear online is the stuff that is more regularly occurring. The sounds of the sun, Jupiter and even here on Earth are fully on display online. To hear the more rare and difficult to tune-in stuff, you need a little more luck and knowledge. There are plenty of examples of what these different types of audio sound like, and I highlight some of those towards the end of the column.

Overall, if you are hunting for the sounds of space, the Internet is not a bad place to start your search. One of the more interesting and rewarding audio sources is in our distant solar system neighbor: Jupiter.

❖ Jovian storm chasing

One of the more interesting audio phenomenon that can be tuned in here on Earth is from magnetically charged storms on Jupiter. These storms fall in predictable patterns and require the right timing to be heard.

Amateur radio operators have heard these signals for years when patrolling HF. A radio observatory at the University of Florida has their receivers tuned between 18 to 32 MHz, listening for sounds from Jupiter.

You can listen in to these signals from Jupiter in multiple places online. The University of Florida observatory has a stream of their receiver audio on their Web site. This opens a .m3u stream, so you will need a player that supports .m3u streams, with iTunes being among the most popular to handle these kind of streams.

On the Web site for the University of Florida observatory, you can find information about their antenna array (including a picture), as well as more information about the radio signals emanating from Jupiter on their Radio Jove educational Web site. Typically, the summer is not as productive a time to hear Jupiter via radio, due to increased solar activity. But during low solar activity periods, Jupiter can be audible, even during the day!

There are programs you can download which take alignment of Jupiter, the Sun, the Earth and other factors into consideration to show when the best times for listening for Jupiter are. With a little research, some patience and the right timing, Jupiter can be a bountiful harvest of radio signals.

For those in the northern hemisphere, use this time to build your radio astronomy observatory, or at least bookmark the Web sites listed here. For those in the Southern hemisphere, you are in prime Jupiter listening time as we speak! Fire up your computer and listen to the sounds of Jupiter!

If you do build your own radio observatory, try putting a stream of your receiver online to share it with all of us!

Another Web site to check out for Jupiter audio is the WCC observatory in Hawaii on the campus of Windward Community College in Oahu. They also have a solar radio observatory there, but links to streaming audio for this were not available as of press time.

❖ It's Raining Meteors!

Another fun event to tune in to is the sound of meteor showers! The ionized trail of meteors has long been a favorite tool for long distance FM and TV reception (the rare "meteor scatter" DX), but it also can be audible reflecting a radar audio signal off of the ionized beam.

The best place to listen to such a transmission is on SpaceWeatherRadio's stream of the Air Force Space Surveillance Radar signal. The Air Force broadcasts a nearly 800 kW continuous wave signal on 216.98 MHz from an antenna near Lake Kickapoo near Wichita Falls, Texas. This signal is then observed by a listener near Roswell, New Mexico which is then streamed online. You can hear the occasional tell-tale sounds of passing meteors and even satellites over the skies of Northern Texas. (***www.spaceweatherradio.com*** *is sponsored by the Roswell Astronomy Club, for which MT's radio astronomy columnist Stan Nelson is webmastered.*)

There are samples on the Web site so you will know what to listen for. There is a meteor shower coming this month, May 5-7. The shower, the Eta Aquarids, is most prevalent in the pre-dawn hours of May 6. Even if viewing conditions in your area are not optimal, there should be some good listening through the SpaceWeatherRadio Web site.

You can find more information about this meteor shower, as well as other upcoming showers, including the Big One, the Perseids meteor shower in August. Viewing conditions for this popular shower will likely not be as good this year due to moonlight, but there should still be some audible shower activity.

Links to the Space Surveillance Radar can be found in the GlobalNet links table at the conclusion of this column.

❖ Pulsars, black holes and sferics, oh my!

The sky is literally full of radio signals that Earth-bound listeners can enjoy. In addition to meteors and storms on Jupiter, how about tuning in the super-massive black hole at the center of our galaxy? How about tuning in the spinning bursts of energy from a far-away pulsar? Or for something a little closer to home, how about tuning in the clicks, pops and other atmospheric noises from right here on Earth?

While live streaming audio of some of these events can be difficult to find, examples of signals abound on the Internet.

I have mentioned in this column previously the streaming audio available of VLF signals of Earth events such as lightning storms and even the sounds of the aurora. There are numerous resources for VLF listening on the Internet, including several locations where you can listen to streaming VLF receivers. The most famous is that of NASA's Marshall Space Center VLF receiver in Huntsville, AL. A few recent listening sessions were unsuccessful with the streaming link not operational. However, NASA maintains that this can be normal, so it is worth a glance now and then.

Another great source for streaming VLF signals is Phil Collier's (AB9IL) VLF monitoring page. Phil has a ton of information on VLF monitoring, and several links for tuning in online VLF receivers around the world. There is a link source

of streaming VLF receivers from around the world at the Abelian.org Web site.

VLF is one of the more interesting ways to tune in to what is happening on our own planet. But there are even more interesting things that are causing a radio ruckus in our universe, some even in our own backyard.

DXers for years have cursed the effect that the sun has on propagation of radio signals. Depending on what type of listening a person wanted to do, the sun could either enhance or obliterate the reception of distant radio stations across many different bands. But if you want to observe the sun, radio can be a very effective way.

Listeners have actually observed radio bursts during solar activity. There are examples available for streaming online at The Radio Sun Web site.

Wanting to hear something on a bigger scale? There are few things that are as big as the supermassive black hole that sits at the center of galaxies, even our own. Listening to a black hole takes a considerable amount of expertise and study, but it can be done. An example of the sound emanating from black holes can be found at the NASA Web site included in the links table below.

Another celestial body that can be heard via radio signals is a pulsar. Again, the science of tuning in a pulsar is pretty advanced, but there are examples of audio coming from pulsars that can be found online, including on the NASA "spooky sounds" Web site in the table below.

❖ The broader picture – radio astronomy

All of this points back to the tremendous amount of things that can be observed through the hobby of radio astronomy. This is a highly popular hobby and can be one that is extremely rewarding for those willing to apply the time and resources to learning how to effectively pursue it.

If you are interested in radio astronomy, *MT* has a quarterly column devoted to the subject, and the Internet has a wealth of information available to you. Beyond just online streams of space sounds, there are tons of resources available for creating your own home-radio observatory, software for tracking and documenting observations, and more.

If you do get a running radio astronomy observatory going, put it online! Let us all hear the fascinating and captivating sounds of the cosmos!

❖ GlobalNet Mailbag

After our March column highlighting the resources available for air show and other aeronautical listening online, I received an email from Phil, W2LIE, operator of W2LIE's Airshow Page – **www.w2lie.net/airshow –** one of the Web sites that was highlighted in the column. Here is part of that email:

I missed where you mentioned me on my first pass through the March copy of MT, but I was surprised when one of my website's members e-mailed me to tell me about your article. Thank you for posting information on my website and information in your column.

I had a few items to clarify, if you don't mind. There is a membership requirement for the live feeds, but that membership was and will always be free. The premium grants you access to the web receiver, which was upgraded from a PCR-100 to a PCR-1000 this year. A long wire will be set up in the yard this spring in hopes that some HF signals will make it to the PCR-1000. This, of course, will be done after the XYL goes to sleep.

Archives are for premium customers only for the first 24 hours. After that, they move to the free membership domain 4 days later, they are flushed from the server to make room for the new archives which are always being added every 30 minutes. Archives for special events, such as the Air Shows, are moved to another area of the website so they aren't deleted by the CRON.

Phil – Thanks for the information! All of us really do appreciate the abundance of streams available on your Web site, especially during air show time. It is because of dedicated operators such as yourself that the rest of us can enjoy streaming audio from around the globe. It will always be part of the aim of this column to promote Web sites such as yours, in the hopes that more people will join in on the sharing of streaming information!

Another email came in, concerning the link to our GlobalNet Facebook fan page:

Loyd, the search on FB for the fan page you indicated in your MT article does not produce the results to find it. Can you E mail me the FB URL? Respectfully, Geo.

Geo – Thanks for your email and your interest in our fan page! I am putting this in the mailbag, so that everyone has a chance to see the link for the fan page, found at the end of the GlobalNet links table below. I am also including links to my GlobalNetMT Twitter page, as well as the blog. Some current projects have prevented me from updating the blog as often as I want to, but I am hoping that this will change in the coming months.

Have something you want to ask? Send me an email at *loyd@globalnetmt.com*!

GLOBALNET LINKS

Sounds of Jupiter Observatory - **http://science.nasa.gov/science-news/science-at-nasa/2004/20feb_radiostorms/**
Radio Jove - **http://radiojove.gsfc.nasa.gov/**
WCC Observatory - **http://jupiter.wcc.hawaii.edu/streamingaudio.htm**
Space Surveillance Radar - **www.spaceweather-radio.com/**
EarthSky's Meteor Shower Guide - **http://earthsky.org/astronomy-essentials/earthskys-meteor-shower-guide**
AB9IL's VLF Monitoring Page - **www.ab9il.net/vlf/vlf1.html**
NASA's Marshall Space Center VLF receiver - **www.spaceweather.com/glossary/inspire.html**
The Radio Sun - http://radiosky.com/suncentral.html
Listen to a Black Hole! - **http://heasarc.nasa.gov/docs/xte/learning_center/listen.html**
NASA's JPL 'Spooky Sounds' Page - w**ww.jpl.nasa.gov/multimedia/sounds/index-flash.html**
Radio astronomy information - **www.radiosky.com/rsplinks.html**
GlobalNet Facebook Fan Page - **www.facebook.com/pages/GlobalNet/171840602849214**
GlobalNetMT Twitter Page - **www.globalnetmt.com/**
GlobalNet Internet Radio Blog - **http://twitter.com/globalnetmt**

BELOW 500 kHz

DXING THE BASEMENT BAND

Kevin Carey, WB2QMY
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Opening Your Mail

We have a full bag of reader mail this month. This has become a welcome springtime tradition, and I'm quite sure it has to do with the winter DX season now being officially closed. Folks are reflecting on their longwave success over the past season, or perhaps thinking of ways to do better the next time around. Whatever the cause, we always welcome reader mail at *Below 500 kHz*.

The past few winters have given us some phenomenal LF propagation, as sunspot activity (which can have a negative effect on longwave), was in an extended period of low activity. Things finally seem to be heating up as the Sun makes a steady climb upwards in Cycle 24. In general, this is great news for the HF operator, but not so good for those who spend a lot of time below the BC band.

Lately, I've noted almost regular openings on another favorite band of mine, 10-meters (28 MHz). There have also been a few openings on 6 meters as well. Speaking of these bands, you may want to check them for CW propagation beacons that operate in the lower portion of the bands. We typically limit our topics to longwave reception, but will occasionally run beacon reports from other parts of the spectrum, so tell us what you're hearing and how strong.

❖ Website Resource

Robbie Spain (WY) passed along an excellent website for identifying beacons. The URL for it is: **www.classaxe.com/dx/ndb/reu**. This website also has a helpful map function that lets visitors see where a beacon has been heard in the past. As one example, beacon AOP/290 kHz (recently decommissioned) was heard as far away as Greenland, the East Coast of the U.S., and even the Caribbean.

Regarding AOP, Robbie writes: "Thanks for the story in the January issue on AOP. I live in Rock Springs, and used to hear it often. Too bad it's gone. Gary (the old airport manager) shut it down about six months before he retired, as the FAA said that the beacon was no longer needed for navigation."

"I have also heard INE here several times. I got a real kick out of the guy down in AZ (Dick Palmer - K.C.) who had 705 beacons in his log – that's really something! Last week I received my 21st beacon on 519 kHz. I haven't been able to positively ID this one yet. I also received one from China as well as two from the EU!"

Thanks for the nice report, Robbie, and keep up the good work in Wyoming. We get very few reports from your area, so it's nice to see that there is some DXing going on there.

❖ European Broadcast

John Bishop wrote with some exciting news from Florida: "For the first time, I've received longwave broadcasts from Europe and Africa! I received 162 kHz Allouis, France, and 171 kHz Nabor, Morocco. These stations started coming in around 11 PM EST/0400 UTC. I'm using a WiNRADiO G303e connected to a 100-foot longwire antenna with the ends aligned North-South and passing through a 9:1 balun."

Hi John, and thanks for the report from Florida. That's especially significant DX considering your location. More commonly, we here Euro-DX reports from the Northeastern states or from Eastern Canada, so your antenna is apparently working very well for you, indeed. I am getting more and more reports from people using software defined receivers, such as the WiNRADIO that you use. I have wondered if these units were quiet enough for serious DXing on longwave, but the verdict seems to be in. In all cases the users have given strong ratings to their PC-based receivers. Your report further strengthens this trend.

Also along the lines of European DX, Daniel Gillet, VE4PBX (MB) writes, "I'm a bit behind in my reading but yesterday I finally took a peek at your December article in *Monitoring Times*. In November 2009 I was able to listen to France Inter from Allouis LW transmitter in France from my QTH in Winnipeg! I was grateful for the experience. An .mp3 sound sample of my DX can be heard on my webpage at **http://ve4pbx.angelfire.com/**."

Good to hear from you, Daniel, and I took a listen to the sound clip you posted. Very interesting to hear how clear the Allouis signal was. I suspect one of the reasons for this was the time of the year, as static crashes would be virtually very minimal in November. Nevertheless, to hear Europe so far inland is quite an accomplishment, indeed! Stay in touch and keep us posted on what else you are hearing from Manitoba.

❖ Loggings

Tom Humes (AZ) held a 2-day long "sprint" of DXing this past winter. He reported that signals were coming in from all directions, and that the only drawback was staying up late and waking up cranky! Tom makes frequent use of Michael Oexner's excellent beacon guide and has found it helpful in identifying the stations he hears. Table 1 shows the results of his efforts.

TABLE 1. SELECTED NDB LOGGINGS (AZ)

kHz	ID	Location	ST/PR/ITU
236	YZA	Ashcroft	BC
248	WG	Winnipeg	MB
275	GUY	Guymon	OK
284	MXR	Raton	NM
326	MA	Midland	TX
329	TAD	Trinidad	CO
329	PZO	Peebles	OH
332	QT	Thunder Bay	ON
338	PBT	Red Bluff	CA
338	RYN	Tucson	AZ
339	MKR	Glasgow	MT
344	FCH	Fresno	CA
344	GNC	Seminole	TX
350	NY	Enderby	BC
356	ODX	Ord	NE
356	YBG	Bagotville	QC
356	SJ	San Angelo	TX
359	BO	Boise	ID
359	YQZ	Quesnel	BC
362	RPX	Roundup	MT
365	HQG	Hugoton	KS
368	SX	Cranbrook	BC
368	ZP	Sandpit	BC
371	ITU	Great Falls	MT
371	TVY	Tooele	UT
371	HNO	Henderson	TX
375	GL	Gaylord	MI
375	DWL	Tulsa	OK
375	FS	Fort Simpson	NT
376	YAG	Fort Frances	ON
380	GC	Gillette	WY
380	BBD	Brady	TX
380	GR	Grand Island	NE
382	GRN	Guerrero Negro	MEX
382	YPL	Pickle Lake	ON
383	CNP	Chappell	NE
384	PVJ	Pauls Valley	OK
385	WL	Williams Lake	BC
386	SYF	St. Francis	KS
392	PNA	Pinedale	WY
400	QQ	Comox	BC
400	AK	King Salmon	AK
404	MOG	Montague	CA
406	YLJ	Meadow Lake	SK
407	CHD	Chandler	AZ
407	CO	Colorado Springs	CO
410	GDV	Glendive	MT
410	DAO	Sierra Vista	AZ
410	HMM	Hamilton	MT
412	JHH	Griffen	GA
413	YHD	Dryden	ON
414	RPB	Belleville	KS
414	ATS	Artesia	NM
423	PCW	Port Clinton	OH
426	FTP	Ft. Payne	AL
428	SYW	Greenville	TX
428	POH	Pocahontas	IA
430	AYB	Auburn	NE
512	HMY	Lexington	OK
521	INE	Missoula	MT

❖ Report from BC

Brian Chapel, VE7AUL (BC) writes: "I enjoy your column and have made extensive use of the *BeaconFinder II* directory. You recently asked for reports of INE-521. It is one of my regulars here in Victoria, BC. My log indicates that it was one of the first ones I heard when I got serious about longwave DXing in 2007, but I know I occasionally heard it at the bottom of the MW band of an old car radio well before that. Most of my listening is now done with a Wellbrook ALA-1530 receiving loop. In 2007 it was most likely feeding my Icom R75 equipped with 2 CW filters.

Beacon CBE (317 kHz), Cumberland, MD at Nightfall (File Photo)

"Before reading your article I did not know that the number of complete IDs is a fingerprint for each beacon, so I have not been logging that characteristic. Checking INE this evening I got 8 IDs every 64 seconds or 7.5 IDs per minute. From my QTH the distance is 686 km. For a 400 Watt beacon that's not exactly a fabulous catch. I'm sure some of your other readers have done better with this one.

"Thanks for the information on AOP in the January issue. Unfortunately, I never caught that one, possibly because of YYF in Penticton, BC. So far on longwave I have heard 228 NDBs, 27 DGPS stations, 7 NAVTEX stations, 1 ham, and 1 broadcaster."

Hi Brian, and thanks for your report on INE/521. With respect to the ID cycle being a fingerprint" of a beacon, this is very true, and it allows 99% confirmation without submitting an audio recording of a transmission. One web site you might find useful (that shows ID timing info) is the **www.classaxe.com/dx/ndb/rna/** mentioned earlier. Look under the "Sec" column to see this information. This site may help you in positively identifying the beacons you hear.

❖ Crystal Set DX

We don't get many reports from folks who use crystal receiving sets on LW, but what else would you expect from Phil Anderson, W0XI, of the Xtal Set Society? Phil writes that he plans to DX the Topeka, KS airport beacon from his location, about 20 miles away using one of his crystal sets. He frequently hears the beacon when driving along the Kansas turnpike at the bottom of the AM broadcast band.

Phil also inquired about the future of beacons on longwave, and asked when we might see an amateur allocation there. Phil, what I am hearing is that many U.S. beacons could be gone within five years, but as you note, predictions of demise for radio services have been wrong before. One of my sources in Canada who services beacons there says Canadian beacons may last a bit longer – perhaps 10 years – but that some reductions have already occurred. The situation bears watching.

As for an amateur radio allocation for the U.S., I predict that will occur within the next three years +/-. There is widespread support for an allocation near 500 kHz, and some countries already have it in place. The World Radiocommunication Conference to be held in 2012 may bring some new developments on LF usage.

The World Radiocommunication Conference to be held in 2012 may be voting on some issues relating to LF usage by amateur radio.

Finally, Phil suggests taking a look at the article and graph on his website (**www.midnightscience.com**) showing the number of AM broadcast stations from 500-1500 kHz. This could be especially helpful if you DX experimental/ham stations in the vicinity of 500 kHz where competition from AM broadcasters can sometimes be a challenge.

❖ Rochester Hamfest, June 4th

Many of you know that I have volunteered on a committee to produce the Rochester Hamfest since 2009. The event continues under the leadership of the Rochester Amateur Radio Association (**www.rochesterham.org**). We've worked hard to return the hamfest to its glory days, while also recognizing the interests of today's hams and radio hobbyists. So far the results have been very encouraging to our club.

A great flea market, delicious grilled food, and lower admission prices have been the building blocks of the new event, and once again, the hamfest will be the site of the ARRL Atlantic Division Convention. There will be interesting programs, and a brand new feature: a "Last Chance Auction," to be held at 2pm. We welcome *all* hams and SWLs to join us on Saturday, June 4th (8am-4pm) at the Barnard Hamfest grounds, 360 Maiden Lane, Rochester, NY 14616. Check the website above for complete information.

Just wanted you to know that I just discovered that the electronic version of Monitoring Times looks just great on an Apple iPad. You can save the download in the iBooks directory and then pull it up at your leisure. Since I spend a large amount of time riding airplanes internationally for my work, this is a great way to read my most favorite magazine. The "links" to external web pages in the electronic version also seem to work well (as long as you have a WiFi connection). I am one happy long-time reader who will now be reading Monitoring Times on my iPad while burning up the skies (I travel about 200,000 miles per year).

- Gordon B.

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

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The Philco's Voice is Heard

❖ From the Readers

Greg Kirk writes that his introduction to this column came about when his wife purchased an inexpensive shortwave radio and found a copy of *Monitoring Times* on the rack at Barnes and Noble to go with it. Perusing the magazine, Greg came across "Radio Restorations" and became an instant fan. Previously he had no idea that enthusiasts were restoring vintage gear.

As it happens, he still has his family's 1953 Zenith L721 table radio complete with the original sales receipt ($39.61 plus tax on 08/17/1953) and owner's brochure. It will become his initial restoration project, but first he is going back to basics and studying some electronics. And in response to a question I asked in the column some time ago now, he responds, "While I enjoy all your projects, I appreciate your restoring a good old kitchen radio from time to time."

Greg, and others who encouraged me to add an occasional household radio to our project mix, are hopefully enjoying our recently completed Majestic a.c.-d.c. project and the Philco project now well underway. And, of course, hearing from readers who have been stimulated by the column to do their own restoration work is music to my ears. Don't hesitate to contact me so I can share your experience with the other readers of the column.

❖ Getting Back to the Philco

Our Philco restoration was unfortunately interrupted last month because my left wrist was in a brace (I had slipped on some black ice after one of our severe Midwest storms), making the necessary bench work difficult if not impossible. I hope that our readers found the replacement column on receiver realignment to be timely and useful. At least I was able to put it together without using a soldering iron!

But I'm back at the bench now and ready to pick up the thread again. In the March column, when the Philco was last worked on, we replaced the i.f. transformers (previously removed to facilitate the repainting of the top of the chassis – which had some seriously rusted areas thanks to a mouse occupancy sometime in the past).

We disconnected the original multi-section electrolytic capacitor (which would be left in place for cosmetic reasons) and replaced it with three individual units. These were mounted on a new terminal strip that was mounted in a convenient clear spot under the chassis. All of the individual paper capacitors were also replaced, leaving only three of those annoying Philco Bakelite block capacitors to deal with.

The wiring of one of those, containing two line bypass capacitors, was such that the capacitors could be checked without disconnecting them. And they both checked ok. The other two contained one capacitor each. I decided just to take a chance of those; I would deal with them later if subsequent troubleshooting should suggest a problem.

❖ Preparing for the Smoke Test

In preparation for the smoke test, I reinstalled the tubes – all of which had previously tested ok and wiped clean of grime – as well as the tube shields. Much of the bright plating of the latter had disappeared, to be replaced by patches of rust. There wasn't much I could do about it short of replating, hardly recommended for this restoration, which is definitely not competition grade. However, I did the best I could with some fine steel wool.

Speaker clip-leaded to the Philco for a "smoke test."

Now I ran into a puzzling situation. Even though I had reinstalled the shields in the proper orientation so that the notches for the grid cap wires were in the proper positions, the one for the 6Q7G second detector/first audio tube was barely long enough for the clip to be installed on the cap. It had to be stretched to the limit.

It took me awhile to figure out what was wrong. The tube was definitely pushed all the way into its socket and none of the recapping or i.f. transformer rewiring I had done had affected the length of the wire. Nor had the wrong shield been installed on the tube; the two shields were identical.

It finally dawned on me that this must be a replacement tube with a slightly taller envelope than the original. Evidence that backs up this theory is that the 6Q7 is not a Philco branded tube, while some of the other tubes are. I decided that it was preferable to leave the original cloth-covered wire as is instead of replacing it with a plastic-covered one that would be my only alternative.

Now I neeeded a line cord – having clipped off the original rotted zip cord early in the restoration to get it out of the way. And I needed to hook up the speaker, at least temporarily. A new line cord was quickly installed and I removed the speaker from the cabinet, where it was still installed. I liked the speaker – a nice big 7"-diameter dynamic job – but it was covered with the same nasty mouse rust that had defaced the chassis proper.

Luckily the mice had not managed to pee on any part of the speaker cone – most of the damage was located on the frame. I planned on painting this as I had the chassis. But before taking on this somewhat detailed job I wanted to make sure that the speaker – and indeed the radio itself – was in working condition.

For now, I would simply connect the speaker, as is, via clip leads. But first I would have to do something about the speaker wires, which were cracked badly enough to compromise their insulation where they emerged from the hole in the rear chassis apron. Again, I thought it better to retain the cloth wires with their original color coding, rather than use modern plastic-covered replacements. Some short lengths of shrink-wrap tubing, slipped over the wires and activated with a heat gun made a neat and reasonable fix.

❖ Applying Power at Last

For now, I decided not to install the fragile plastic dial. It could easily be broken or cracked if the radio had to be turned upside down for troubleshooting. Once the set was operating properly, the dial could be installed, because all of the alignment adjustments were accessible on top of the chassis.

Generally, if a set has been completely recapped, it can be started up with full line voltage. But in this case, the set had obviously been stored under poor environmental conditions, I was taking a chance on a couple of bakelite block capacitors, and I had done quite a bit of disconnecting and rewiring – especially with the two i.f. transformers. So I took the cautious route.

Right now, for slow startups, I have a line transformer with three taps – at about 60, 80 and 100 volts. Once I reach the 100-volt point incident free, I then feel confident plugging the set directly into the 120-volt line.

Powering up a set for the first time in per-

haps 70 years – especially if it's one on which many wiring revisions have been made – is always a tense and exciting moment. And it's also an amazing moment when circuits that have been dormant for so long spring to life almost immediately, as frequently happens, and work together as they were meant to do.

In this case, at the 80-volt tap the set began to hum and pick up static at certain positions of the tuning capacitor. Brushing a screwdriver across the antenna terminal created more static – an excellent sign. And I could even hear a few weak signals once I connected a long wire to the terminal. Moving up to 100 volts brought in many signals at good volume all over the dial. I almost didn't have to plug the set directly into the line to obtain a variety of signals at normal volume.

❖ A Distortion Problem

Of course, with the speaker operating "baffle-less" out of its cabinet, I was prepared to find the audio to be quite thin. Yet there was a slight edge to it that didn't sound quite right and couldn't be resolved even with careful tuning. I'd experienced that phenomenon before and didn't even bother to test for it. I was sure that the coupling capacitor between the plate of the first audio tube and the grid of the audio output tube was leaky. Of course this capacitor was one that I hadn't changed because it was encased in a Bakelite block.

Back in my March column, I had repeated a couple of excellent reader suggestions for dealing with these problem components. One was to clip the fine wires from the internal capacitor(s) to the external solder lugs, back off the mounting screw, and turn the unit on its side so that the bottom would be exposed.

If a few leads are too tight to allow this rotation, they can be temporarily disconnected. Then, application of gentle heat from a hair dryer would be enough to loosen the compound so that the capacitor block could be pulled out and new caps installed in the shell.

The other suggestion was to simply clip the fine capacitor wires from the solder lugs as in the first scheme and just install an outboard capacitor across the lugs. If the wires can't be reached with sidecutters, they can be disconnected by drilling through the hole where they emerge at the top of the block. Use a drill just big enough to do the job.

In my case, though, I took the easy way out. There were only two external connections to the solder lug on the output tube grid side of the internal capacitor. I disconnected those, effectively removing the capacitor from the circuit, and transferred them to a single tie point that I installed nearby. I then connected a new capacitor between the tie point and the lug where the other end of the internal capacitor was connected. The result: much smoother audio.

External coupling capacitor bypasses internal block unit. Added tie point is at right (see text).

References to the wiring connections for various Bakelite block part numbers can be found on Ron Ramirez's Philco web site. Go to **www.philcoradio.com/tech/images/blocks1.jpg** and also to the same URL with the suffix "blocks2.jpg"

❖ The High Police Band "Mystery"

With the Philco working nicely on the broadcast band, I thought I'd try to see if I could hear anything on the "high" police band. This radio covered two bands where one could originally hear police calls. One was just above the high end of the broadcast band from about 1575 to 1750 kHz; the other – selectable by a bandswitch – ran from about 2.3 to 2.5 kHz. Of course the police have abandoned these frequencies long ago and now conduct their operations on UHF or maybe microwave. And the broadcast band has been extended upwards to 1700 kHz.

I switched to the "Police Band" while listening to a station on the broadcast band. I expected the station to disappear and be replaced by atmospheric noise if not by a shortwave broadcaster. But the local broadcast station kept coming in, though much reduced in volume. That was the case with several other broadcast stations I tried, though I didn't have the tuning dial in place so I didn't know where I was in the band.

I tried spraying the bandswitch with contact cleaner and even used clip leads to take over the shorting function that the bandswitch was meant to do. The result was just the same. I studied the coil connections to see if wires had been cut. During World War II radio service people were required to disable shortwave bands of radios owned by nationals or former nationals of enemy countries residing in the U.S. I have seen more than one radio disabled in this way – but not this one!

Segment of Philco tuning dial shows both police bands.

So why didn't the bandswitch change the band? A little study of the schematic suggests an answer. In the "Police" position, the bandswitch shorts out part of the r.f. coil to make it resonate at the higher "Police Frequency." But does not affect the oscillator coil and thus does not change the oscillator frequency. But, the oscillator frequency, which beats with the frequency of the incoming radio signal to generate the 455 kHz i.f. "difference frequency," determines the frequency of the signal that passes through the i.f. channel to the audio sections of the radio.

Thus it seems that the strong local broadcasting signals coming in through the antenna leak through the r.f. tuning circuit even though it is not tuned to their frequency, and then beat with the oscillator signal to enter the i.f. chain and appear at their normal spot on the dial even if much attenuated.

So, even if the r.f. coil is shorted by the bandswitch to resonate at the higher police frequencies, if the oscillator signal is not changed how can the radio pick up signals on the high "Police Band?"

Well, all r.f. generators, whether they are transmitters or small local oscillators, generate harmonically related frequencies at 2X, 3X, etc. the fundamental frequency.

Doing the simple math and comparing the positions of the broadcast band calibrations and the high "police band" calibrations on the dial, it looks like the second harmonic of the basic oscillator frequency is beating with the signals selected by the shortened r.f. coil to bring them in at the appropriate spots on the dial.

We'll investigate this further when we get the tuning dial installed and carry out the alignment. See you next time!

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

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NO MORE EXCUSES

Get Active on HF NOW!

Well, friends, springtime is here at last. That means two important factors as regards HF: It's now possible to get outside and work on antennas, and the bands are beginning to open up. As the solar cycle progresses, this spring and summer (and fall) look to be even better on HF than last year.

So what's your excuse? I know there are a lot of folks out there licensed to operate HF who aren't actually using it. Some are still on VHF only, perhaps having started out that way; some intend to put up some sort of HF antenna, but "haven't gotten around to it"; some are immobilized by fear of the neighborhood restrictions and so forth that seek to ban our outdoor antennas; some are living in an apartment or condominium and can't imagine how they can have an HF antenna where they live; and some are feeling hopeless, thinking that if they don't have a triband beam on a one hundred foot tower they can't work anybody.

I'm here today to try to convince all of you otherwise. Because – believe it, people – if we don't populate and use our HF bands we will end up losing them! Besides, you're missing a giant world of fun on HF, with DXing, ragchewing with hams all over the nation and the world, in every mode you can think of (and some you may never have encountered.) Let's look at these roadblocks one at a time, and see how we can surmount them.

ROADBLOCK #1:

I've never been on HF. Those huge antennas look scary!

There's some truth in the notion that HF antennas are physically larger – after all, a quarter-wave on two meters is only 19 inches. And, if you're only accustomed to the "rubber duckie" on a hand-held two meter FM transceiver, antennas for the lower frequencies no doubt seem enormous.

But, you might be surprised at how small they're making some HF antennas these days. Consider, for example, the elegant space-saving antennas sold by Isotron. The very compact 20 meter version is only 21 inches long and a few inches wide. Even the bird-feeder-resembling 40 meter antenna is only 22 by 16 by 15 inches. A full range of models is available, covering every band from 160 through 6 meters.

Isotron's elegant, compact 40 meter antenna. Looks like a bird feeder, gets you on the air easily and quickly. (Photo courtesy Isotron Antennas)

Isotron antennas are also quite flexible as to mounting position and location, and are easily fed with coaxial cable. (See photo.) Plus, you'll get the chance to talk to folks a lot farther away than your local 2 meter repeater can reach!

ROADBLOCK #2:

I've been meaning to put up an HF antenna; I just haven't gotten around to it.

What are you waiting for? You're missing all the fun on HF while you're "not getting around to it." Putting up an HF antenna is just too easy for this excuse to carry you. If you don't believe it, see my May 2010 column ("How's It Hangin'?") for the enthralling tale of how a fat, aging baby boomer with a bad elbow – yours truly – put up a 102 foot dipole between two trees on his property in about 45 minutes, with no human help, but ably abetted by the E-Z Hang. This neat little marriage of a slingshot and a fishing reel, with various accessories, will enable just about anyone to get an antenna up in the trees and on the air. (See photo.)

A clever and effective solution for getting wire antennas up in the trees. (Photo courtesy E-Z Hang)

If you don't have two trees to support a dipole, consider a single wire, commonly called a longwire or a random wire. Any decent tuner will load this single wire up on bands where the wire is at least a quarter-wave long, so even if you can only manage a single 25 foot wire, you'll still be able to work every band from 30 through 10 meters. Just be sure to get the far end as high as you can, and you're all set to chase DX with the rest of us!

ROADBLOCK #3:

Outdoor antennas are completely banned where I live. What can I do?

First let me say that I sympathize completely with your plight, and that nothing chaps my hide quite like these modern-day gestapos that work tirelessly to keep anyone from having an outdoor antenna. You could believe that maybe they're at least trying to beautify the neighborhoods, if it weren't for the millions of satellite dishes sprouting everywhere like so many toadstools. Apparently these jackbooted thugs aren't bright enough to realize that a dish is also an outdoor antenna, or else they're complete hypocrites.

But there's good news. An entire underground revolution has been taking place for some years now, and many are working tirelessly to design, build, and sell antennas that you can either "hide in plain sight" outdoors, or that you can install in an attic, upper room, or on a balcony or roof. The Isotron antennas I mentioned in item #1 above fit right in here. The ones for 160, 80 and 40 meters look enough like bird feeders to fool many people, and the ones for the higher bands also look completely un-antennalike. You may very well be able to get away with one of these in plain sight. Or – ahem – you can consult my earlier columns, particularly January, February, and August 2010, which discuss construction of some rather nifty stealth antennas, if I do say so myself. *[Also see this month's feature article on stealth antennas by Kirk Kleinschmidt-ed.]*

If you Google "stealth antennas" and "indoor ham radio antennas" you will find an astonishing number of do-it-yourself projects, as well as commercial products, made available by those who are working to combat antenna oppression. Some of the notions are quite ingenious, like the fellow who turned a hummingbird feeder into an outdoor antenna in plain sight, and the perennial favorite of putting up a "flagpole" made of PVC pipe that contains a wire or copper pipe conductor which makes a very nice vertical antenna.

So take heart! The gestapo thinks they've quashed your HF operation, but there's a million ways you can have a stealthy antenna and enjoy HF with the rest of us. Just don't tell your neighbors!

ROADBLOCK #4:

I live in an apartment (or condominium). I'm in even worse shape than the folks at Roadblock #3, aren't I?

Not really. Much of the information derived from the two Google searches I mentioned in item #3 is presented with you in mind. And the commercial antenna purveyors have come up with a thing or two that's made especially for your situation. I'm thinking here of, for example, MFJ Enterprises's model 1622, which is touted as an "apartment antenna" covering every band from 40 through two meters. (See photo.)

A short whip forms the antenna element, which is loaded at its base by a coil. By clipping the "wander lead" onto the appropriate coil tap, you can select any of the bands. A spool of "counterpoise" wire forms the ground – you simply unreel the right amount for a given band and hang it out a window, or lay it on the balcony, or even across the floor. Most people would probably mount the whip on a balcony railing, but MFJ points out that you can even clamp it to, for example, a table edge indoors, and enjoy complete concealment.

My August 2010 column details a balcony dipole I built that was completely concealed from view and gave very good results on the HF bands from a second-story apartment. I would expect that on higher floors it would do even better. You can work HF from your apartment or condo!

MFJ's nifty "apartment antenna" gets even high-rise dwellers on the air with a minimum of fuss. (Photo courtesy MFJ Enterprises)

ROADBLOCK #5:

I don't have a big tri-bander beam on a tall tower like the big guns. So why even try? It's hopeless.

Oh, please. This isn't even a roadblock. Sure, there are operators that have the big beams and towers. But so what? I have made, over the last 40 years, thousands and thousands of CW contacts on the HF bands, and I can say that, for one, the beams on towers were a lot more prevalent at DX stations than they were here in the States, and for another, for every US operator that I did work that was running a beam, there were twenty or thirty running a vertical, a dipole, a longwire, or a small, stealthy, or indoor antenna of some sort. Yet they were all having a lot of fun, and some of the stations with these "lesser" antennas were rolling up some really impressive DX totals, by dint of skill and patience.

Don't get me wrong. I've got nothing against the op that's lucky enough to have the real estate, the freedom, and the extra cash to have the big tower and beam. But for the discouraged operators who think they're doomed without it, let me make you a little analogy: We'd all love to drive a Ferrari, right? But just because there's a Lexus or Buick sitting in the driveway instead, it's a silly excuse not to go to work or the store. And that Lexus or Buick not only costs you a lot less to buy and insure than the Ferrari, it'll get you down the same road. They're all cars that get you from A to B. Stop whining just because you can't have the Ferrari, and get behind the wheel and drive!

I'd like to commend once again MFJ Enterprises, E-Z Hang, and Isotron Antennas, for their excellent products and their quick and friendly customer service. Here's the contact info for these three vendors:

MFJ Enterprises – **www.mfjenterprises.com**, or call 1-800-647-1800.
E-Z Hang – **http://ezhang.com**, or call 540-286-0176.
Isotron (The Bilal Company) – **http://isotronantennas.com**, or call 719-687-0650.

I hope my little pep talk has convinced everyone who is not HF antenna-equipped to correct that situation as soon as possible. HF is a lot of fun. Don't miss out on it! Get an HF antenna going at your location, and I'll see you on the bands. Until next time, friends, happy operating!

SKY SURFING

RADIO FROM THE OUTER REACHES

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Manned Space and Amateur Radio

Many readers might be surprised to learn that amateur radio's presence in space goes well beyond the amateur radio satellites. Amateur radio has also been an integral part of operations aboard the US Space Shuttle, the Russian *Mir* Space Station, and more recently, the International Space Station (ISS). In fact, amateur radio's presence in various nations' manned space activities now goes back well over 25 years!

The whole idea grew out of the work of some forward thinking Radio Amateur Satellite Corporation (AMSAT) people back in the late 1970s and early 1980s. The first opportunity came when Owen Garrett, W5LFL, was selected to fly on NASA's Skylab…. the USA's first "manned orbital laboratory" that was made out of an old Saturn 5 upper stage. And while a formal request *was* made to NASA for Owen to carry his amateur radio along on that mission, it unfortunately came too late in the planning stages for NASA and others to make the necessary preparations for its use aboard the Skylab.

Some ten years later, and with the encouragement of several AMSAT people working both in and outside of NASA (along with the good offices of the American Radio Relay League) permission was eventually secured for Owen to operate amateur radio during his STS-9 mission aboard the Space Shuttle *Columbia* in the fall of 1983.

And what a success it was! During his 10-day voyage, Owen made contacts with a number of Earth-bound hams from the Shuttle, including a few notables such as Jordan's King Hussein, JY1 and US Senator Barry Goldwater, K7UGA (both now Silent Keys).

❖ The Birth of SAREX

Needless to say, this activity eventually led NASA to conclude that carrying amateur radio aboard the Space Shuttle garnered benefits to both NASA and the Amateur Radio Service, so much so that ham radio equipment eventually became a "frequent flier" on a number of subsequent Space Shuttle missions.

For many years, the Shuttle Amateur Radio Experiment (or SAREX as it came to be known) put school children (and ordinary hams) in direct, "voice-to -voice" contact with astronauts orbiting the Earth from the Space Shuttle. No doubt, those contacts launched countless careers in science, technology, engineering and math (STEM) from those who participated.

❖ Ham Radio and *Mir*

But, the idea of carrying along amateur radio on space voyages also wasn't lost on other nations, including the Russians orbiting aboard their Russian Space Station *Mir*. In late 1988, Team Commander Vladimir Titov and Dr.Valeri Poliakov made several contacts with amateurs on the ground from *Mir*. The *Mir* eventually carried a 2-meter voice transceiver as well as a packet radio transponder and Bulletin Board System (BBS). The packet radio BBS acted much like an early ham radio version of those Internet social networking sites we all now take for granted. At one point, even an amateur Slow Scan Television (SSTV) system was carried aboard the craft.

Long-time AMSAT member and former NASA Astronaut Ron Parise, WA4SIR (SK), makes a SAREX contact during one of his two flights aboard the Space Shuttle "Columbia" in the 1990s. (Courtesy: NASA and AMSAT)

Amateur radio was in operation aboard *Mir* for over 10 years, and its ham equipment was used not only by hams from the (then) Soviet Union, but also licensed amateurs from Japan, Great Britain, Austria, France, and the USA, all of whom spent various periods of time aboard *Mir* augmenting the permanent Russian crew.

❖ ARISS is Born

In late 1986, another meeting organized by Roy Neal (K6DUE (SK) of NBC-News TV fame) once again brought together representatives of NASA, AMSAT and the American Radio Relay League (ARRL) to consider a program leading to amateur radio literally being built into the new International Space Station (ISS) then under development by NASA. The meeting established a formal working group to develop a proposal to be submitted to NASA for amateur radio's participation on the ISS.

The group known today as the Amateur Radio on the International Space Station (ARISS) committee grew out of those early meetings and has since become the driving force behind keeping amateur radio aboard the ISS.

The ARISS project has since evolved into a volunteer program whose principle aim is to inspire students, worldwide, to pursue careers in science, technology, engineering and math by providing amateur radio communications opportunities with the International Space Station (ISS) on-orbit crew. Students learn about life on board the ISS and explore Earth from space through their classroom participation in such things as orbital tracking and radio wave propagation studies to and from space.

Currently, the ARISS working group consists of delegations from nine different countries, including several countries in Europe as well as Japan, Russia, Canada, and the USA. Volunteers from the national amateur radio organizations of each country run the organization in partnership with their respective AMSAT organizations. Since ARISS is international in scope, the team also coordinates locally with their country's space agency (e.g. ESA, NASA, JAXA, CSA, and the Russian Space Agency) as well as through ARISS working group meetings, teleconferences and via electronic mail.

With the able assistance of experienced amateur radio volunteers from amateur radio clubs and coordination with representatives of the ARISS Team, the program puts ISS crewmembers "voice-to-voice" with large audiences in a variety of public forums where students, teachers, parents, and communities can learn about space and space technology (and, of course, amateur radio) first hand.

More information about ARISS (including how and where to request an ARISS school contact) can be found at: **www.rac.ca/ariss/.** Also, NASA's "official" Web link to the ARISS project is at: **www.nasa.gov/mission_pages/station/research/experiments/ARISS.html**

ARISS Operating Frequencies
(Call Sign: NA1SS)

2m Crew Contact (ITU Regions 2 & 3)
Uplink: 144.4900 MHz FM
Downlink 145.8000 MHz FM

2m Crew Contact (ITU Region 1):
Uplink: 145.2000 MHz FM
Downlink 145.8000 MHz FM

2m APRS (Worldwide APRS Digipeater):
Simplex: 145.8250 MHz FM 1200 BPS
Downlink 145.8250 MHz FM 1200 BPS

2m Imaging:
Downlink 145.8000 MHz SSTV

70Cm/2m FM Voice Repeater (Worldwide):
Uplink: 437.8000 MHz FM
Downlink 145.8000 MHz FM

More than School Contacts

Besides getting students interested in scientific careers, the ARISS equipment aboard the ISS also provides an emergency backup communications capability for NASA for use when their official communication channels to the ISS go down. While such occurrences are rare, the ARRIS equipment aboard the ISS has actually been used for this purpose on at least two occasions.

What's more, ARISS provides the onboard crew with an unofficial way for them to speak directly with friends and family as well as other amateur radio operators on Earth during their off duty time. In many ways, ARISS provides the ISS crew with a great way for them to stay connected with other human beings (besides their crewmates) during their many months of isolation aboard the ISS. This may also be why nearly 75 percent of NASA astronauts now hold FCC-issued Amateur Radio Licenses.

Former AMSAT VP of Operations Stacey Mills, W4SM, helps students from the Western Albemarle High School in Crozet, Virginia speak with Frank Culbertson, KD5OPQ, during an ARISS school contact in September 2001 (Courtesy: ARISS and NASA)

To help Earth bound hams get a better idea of what it's like to operate via amateur radio from orbit, one of AMSAT's project engineers for ARISS, Ken Ransom N5VHO, recently posted a fascinating YouTube video from NASA TV on the Internet (**www.youtube.com/watch?v=h73EYcyszf8**) that shows ISS Expedition 25's Commander Colonel Doug Wheelock KF5BOC, operating the ARISS equipment from onboard the ISS. After taking viewers on a quick tour of the Space Station, Colonel Wheelock then puts the ARISS ham station on the air during an ISS pass over North America.

What to Listen For

As of this writing, the ARISS equipment aboard the ISS was capable of operating on a variety of frequencies as well as in a number of different modes in the 2m and 70cm amateur bands. Using the ISS's officially assigned FCC call sign NA1SS, these operating modes included FM voice, Slow Scan Television (SSTV), Automatic Packet Reporting System (APRS)® tracking and a 70cm to 2m cross-band repeater.

While NASA has recently approved the addition of a second ham station aboard the new *Columbus* module, only one amateur station (currently consisting of a Kenwood D-700 amateur transceiver) is fully operational at this time (see the ISS frequency chart).

When to Listen

It is important to remember that the ISS is in a *very* low Earth orbit. As such, your available "talk time" during an ISS pass from any single location will be noticeably shorter than for most other amateur radio satellites. What's more, because the station does a lot of on-orbit maneuvering, having a fresh set of Keplerian Elements loaded into your computer's tracking program is absolutely critical when trying to make contact with the ISS.

Remember, too, that, aside from school contacts, the crew uses the ARISS equipment primarily during their off-duty time and may actually be asleep when the ISS passes over your part of the planet. This, in turn, means that making a non-scheduled contact with the ISS crew will usually be a rare treat that is very much subject to the "luck of the draw."

Over the years, I've found the best way to snag a random ISS contact is to program all of the ARISS 2m downlink (and/or uplink) frequencies (plus a few more immediately above and below the published frequencies to account for Doppler shift) into your radio's memory well ahead of time. Then, as the ISS comes over the horizon at your location, rapidly switching (or scanning) all of these frequencies will quickly tell you which, if any, of the ARISS downlinks are active on the pass.

If you have an amateur radio license and want to try and make a contact, once you've found an active ISS frequency and mode, common practice for voice contacts is to *very* quickly drop your call sign into the fray on the uplink after the ISS crewmember completes a CQ call (or finishes another contact).

Because there will most certainly be many other stations calling them (calls that you probably won't hear), keeping your calls short will significantly improve your chances of being heard above the fray on the other end. Unfortunately, the "capture" effect of FM means that the operator aboard the ISS may sometimes only hear "white noise" interspersed with small fragments of call signs, especially during passes over the more populated parts of the planet like North America and Europe.

So, unless you hear the ISS operator answering someone else, keep repeating your call sign over and over again (with frequent breaks) and be ready to repeat your full call sign once again – or several times – if asked.

On the other hand, if the crewmember answers a call from another station, be courteous and stand by to await your next chance. Eventually, both your courtesy (and your patience!) *will* pay off with a coveted, ISS contact.

ARISsat-1 Update

In late January 2011, AMSAT received the very welcome news that its ARISSat-1satellite had been successfully launched and received aboard the ISS via a Russian *Progress* re-supply vehicle. In addition, while it was connected to one of the external ARISS antennas, crewmembers successfully activated the spacecraft's downlink transmitter from inside the ISS and several of AMSAT's experimenters reported hearing strong downlink signals from the satellite.

However, as of this writing (early March 2011) the ARISSat-1 satellite was still inside the ISS. That's because, in early February, Roscosmos (the Russian Space Agency) announced that the satellite's deployment would be delayed until the next Russian-sponsored Extra Vehicular Activity (EVA), now tentatively scheduled for July 2011.

At the same time, Roscosmos also announced that the satellite would again be turned on inside the ISS while connected to one of the external ARISS antennas on 12 April 2011. This was to be in celebration of the 50th anniversary of Yuri Gagarin's first manned space flight. Appropriately enough, one of the many greeting messages carried aboard ARISSat-1 was a recording of Gagarin's salutation to the people of the Earth during his single orbital ride.

At press time, AMSAT was lending its wholehearted support to this event and was also preparing to issue certificates to those stations reporting reception of ARISSat-1's downlink signals. AMSAT was also assured that ARRISat's battery (the same kind used in the Russian EVA spacesuits) would again receive a full charge by the ISS crew prior to its reinstallation into the satellite and ARISSat-1's subsequent release from the ISS.

Certainly, while all of us were very disappointed to hear that the deployment of ARISSat-1 had been delayed, we veteran amateur satellite operators well understand that such disappointments "go with the territory." Indeed, as I noted in my February *MT* column, most of what AMSAT and its predecessors have accomplished over the years has traditionally fallen into the highly unpredictable realm of "rocket science," and on a fiscal shoestring to boot!

Because AMSAT relies on other agencies to launch its space hardware (often at low or no cost) this means that there will *always* be a number of unknowns – technical, fiscal *and* political – in the organization's best-laid plans to get new satellites successfully into orbit.

And, while a lot of the major hurdles to get ARISSat-1 successfully deployed have now been cleared (at least it is now in space and moving at orbital velocity!) unfortunately, there are still a lot of things yet to come that could negatively impact AMSAT's plans to get ARISSat-1 operational in its own, free-flying orbit. Fingers crossed that, by the time you read this, the deployment and successful orbital activation of ARISSat-1 will have occurred.

In the meantime, I encourage you to stay tuned to the AMSAT Web site (**www.amsat.org**) or the ARISSat Web site (**www.arissat.org**) for continuing updates on the launch and on-orbit status of ARISSat-1 as well as where and how to download computer software to decode its BPSK and SSTV transmissions.

Looking Ahead

In future columns, I'll be taking a closer look at the history and operational characteristics of some other amateur radio satellites now in orbit along with a peek at some of those now under development. See you then.

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Going QRP with an SDR: The FLEX-1500 HF+6 (Part 1)

By Kirk A. Kleinschmidt, NT0Z

With the introduction of its FLEX-1500™ QRP HF+6 transceiver, FlexRadio Systems has really thrown down the performance gauntlet in the entry-level transceiver market. Because the FLEX-1500 is a pure software-defined radio (SDR) that requires a Windows™ PC running PowerSDR software to function, the $649 transceiver has no direct competition in its price class. All competing models are conventional radios with physical knobs, switches and controls (and most put out more RF power).

Buying decisions will likely hinge on the fundamental, functional differences between SDRs and traditional transceivers (plus RF power). If we consider only RF performance, the FLEX-1500 tops its price class and, amazingly, isn't too far below the performance mark set by the best-performing radios at any price.

This tiny software-defined radio is QRP on power and price, but QRO (increase) on performance and flexibility. But should it – or any SDR – be your next rig?

But before we explore the pluses and minuses of the FLEX-1500 in specific, and of SDRs in general, let's briefly look at today's entry-level transceivers and the features that define them.

Whether as a first radio or a backup rig, entry-level HF transceivers have to handle a wide variety of on-air tasks. These low-cost radios often look and feel a lot like their higher-priced siblings, and often benefit from the same technologies and design philosophies. Manufacturers are challenged to produce inexpensive models that are flexible, easy to use, and relatively complete, while offering as much RF performance as possible without making the radio so feature-rich and high-performance that it reduces sales of the company's higher-priced models.

Compared to years past, the functionality built into today's budget radios is truly impressive. With a minor exception or two, every entry-level transceiver has external 13.8-V dc power, dual VFOs, split-frequency capability, general-coverage receiver, optional crystal filters, memories, scanning, RIT (Receiver Incremental Tuning), IF (Intermediate Frequency) shift, noise blanker, QSK (full break-in keying) CW, built-in keyer, variable sidetone pitch/CW offset, CW on USB or LSB, direct frequency entry via keypad, speech processing, attenuator, preamp, ALC (Automatic Level Control) output for external amplifier, accessory ports, AF or IF DSP (Digital Signal Processing) and a PC control interface. Whew!

In addition to these features, FlexRadio's '1500 also has a Windows PC running PowerSDR software (not always a benefit) that provides an interface for all of the radio's displays, controls and settings, unlimited memories, unlimited DSP IF filter bandwidths for all modes, dual independent DSP noise blankers, highly-customizable DSP noise reduction, noise gate, a panadapter/band scope spectrum display, point and click tuning of signals on the spectrum display, 3-band and 10-band audio equalizers for receive and transmit, variable AGC attack settings, binaural stereo receive audio, an intelligent external interface and control bus (FlexWire), built-in connectors and switching logic for driving external transverters, a second receive antenna port, and a port for connecting a high-accuracy 10-MHz time base (only needed when driving external UHF or microwave transverters).

That's a lot of flexibility for a radio that weighs 1.4 pounds and is about the size of a two-inch-thick stack of QSL cards!

Because much of the radio's functionality is defined by software and firmware, new features and improved functionality can be regularly "added" to the radio. SDRs evolve, while conventional radios typically require hardware mods or fixes that are rarely, if ever, practical. (Some high-end radios enjoy software and firmware updates to their digital subsystems, but on a more limited basis.)

Simply listing every feature and spec of the '1500 would consume all of my allotted review space, but you can find plenty of info in Sidebar 1 and a more complete listing at **www.flex-radio.com/Products.aspx?topic=SDR_Feature_Matrix**. At this point it's easier to list the features that you won't find on the FLEX-1500 or in the radio's box on first opening.

You won't find a 100-Watt power amplifier (5-Watt maximum output), VOX (Voice Operated Transmitter), a built-in antenna tuner, a power supply, a microphone or a speaker. High-speed, butter-smooth full break-in keying may also be missing, but the verdict will have to wait until Part 2 of this review (June 2011 issue of *MT*).

Considering the radio's nature and price class, none of the "missing" items is a real shocker. Designed for QRPers, VHF/UHF and microwave enthusiasts who use the unique features of the '1500 to drive stacks of external transverters, and "toe dippers" who want an affordable introduction to SDR technology, the radio was carefully packaged to maximize the SDR user experience while keeping costs down.

I was initially surprised that a hand microphone wasn't included. I didn't have a modern Yaesu mic in my shack (works with the '1500), so I resurrected an old Shure desk mic from my junkbox and made an RJ-45 (LAN jack) plug according to the diagram in the user manual. It worked just fine, and the radio's extensive set of transmit audio enhancement tools (multiband EQ, noise gate, compressor, etc) made it sound better than ever.

The "missing speaker" really wasn't. The FLEX-1500 requires a stereo headset or speakers because it has many features that leverage two-channel audio (binaural filtering and audio processing, independent sideband reception, and more). Until I used these on the air I had no idea what I had been missing.

I can cover only a few aspects of the FLEX-1500 and its operation in this review, so let's get right to the biggie: the FLEX-1500 is a pure software-defined radio, a total black box with no VFO knobs, no front-panel frequency display, no front-panel nothin'. SDRs offer amazing RF performance and features that are impractical or impossible with conventional radios, but because SDRs require a computer and special software to function in any way, and because all of the controls are "soft," the ergonomics can make or break the overall experience.

Love it or hate it, SDR technology likely represents the future of all amateur radio hardware, save for purposefully designed "retro radios" or nostalgically home-brewed hardware. Only recently incorporated into ham radio gear, SDRs are used in billions of cell phones made over the past 15 years, and they're not going away any time soon.

❖ SDR Technology – It's Dynamic!

Conventional superhet receivers convert incoming signals to one or more intermediate frequencies before "detecting" and "demodulating" them by converting them to audio. This requires a carefully orchestrated and optimized sequence of filters, mixers, oscillators and amplifiers (at RF and AF). Careful gain distribution and interstage impedance matching is required to obtain the best performance. Critical functions such as AGC and IF/AF filtering are performed by mature analog circuits or in conjunction with newer IF or AF digital signal processing.

Various conversion schemes place the IF at higher or lower frequencies, or incorporate multiple IF conversions to provide for cascaded filters, increased image rejection, smoother gain and AGC control, etc. To achieve high dynamic range performance – the ability to receive weak desired signals in the presence of nearby strong unwanted signals – requires two or more cascaded IF filters (called roofing filters in some designs), often augmented with DSP. This approach can offer excellent performance, but it's quite expensive.

After a conventional RF front end (bandpass filters, RF amplifier and a first mixer), SDRs replace typical downstream hardware (mixers, amplifiers, filters, AGC, detectors, etc.) with DSP hardware and PC (or embedded) software. Instead of converting incoming RF signals to an intermediate frequency of 455 kHz or 9 MHz, an SDR converts the RF immediately to "baseband" (dc to 20 kHz), where it's digitized and processed by software and DSP. The functions that are traditionally handled by analog circuits and filters are almost completely handled in the digital domain. This makes SDRs sophisticated direct-conversion receivers.

The differences in conversion schemes and filtering methods highlight a key SDR advantage: dynamic range. Even with careful design and cascaded IF filters, conventional superhets offer excellent dynamic range at moderate to wide signal spacings, but performance falls off dramatically when offending signals are nearby. Crystal filters work well if unwanted signals are, say, 50 kHz away from the weak signals you're receiving. But if the unwanted signals are 5 kHz or 0.5 kHz away, the selectivity of traditional analog designs can't keep nearby unwanted signals from triggering the receiver's AGC and causing other undesirable downstream effects.

That's why the dynamic range of conventional superhet receivers is almost always specified at wide signal spacings where these radios can offer 80 to 100+ dB of usable dynamic range. If tested at spacings of 1, 2 or 5 kHz, however, their dynamic ranges often fall to 50 to 80 dB – far worse than the published specifications would suggest. Many conventional (and expensive) radios crumble at close signal spacings, and entry-level units are even worse.

SDRs have the opposite problem. After a single RF conversion to baseband, signals are digitized and processed in the digital domain. For all practical purposes, the dynamic range of the radio's DSP hardware sets the dynamic range for the receiver at all signal spacings. The FLEX-1500 has a specified dynamic range that's "in the 80s," with measured results as high as 88 dB – whether the unwanted signals are 0.1, 1, 2, 5 or 50-kHz away. The implications of this feature of SDR architecture are staggering.

Let's say that a typical conventional radio (that might cost five times as much) can offer a 100-dB dynamic range at a 50-kHz signal spacing. So far, so good. That clearly tops the '1500's performance benchmark. As signal spacings get closer and closer, however, the little FlexRadio holds steady with its constant 88-dB dynamic range as its expensive conventional counterpart starts to collapse. Under

TABLE 1: FLEX-1500 MANUFACTURER SPECIFICATIONS

Receiver Frequency Range	100 kHz - 54 MHz (operation below 480 kHz may require customer-provided pre-selectors or external filters for best performance)
Transmitter Frequency Range	160m - 6m (amateur frequencies only on main antenna port); continuous transmit coverage on low-power transverter output port only
Emission Modes	J3E (USB, LSB), A1A (CW), F3E (FM), A3E (AM, AM-synchronous), F1B (RTTY), F1D (data), F2D (data), DRM (Digital Radio Mondiale, requires the purchase of external third party software).
Frequency Steps	1 Hz minimum
Antenna Impedance	50 Ohms, unbalanced
Frequency Stability	+/- 2.5 ppm (adjustable in PowerSDR to sub-0.1 ppm accuracy)
Audio In	Unbalanced microphone (front panel), unbalanced line input (FlexWire, rear panel)
Audio Out	Headphone out, front panel (stereo only); unbalanced line output (FlexWire, rear panel)
Recommended Headphones	40 mW sensitivity, 8 ohms or higher
Power Consumption	400 mA receive, 2 A transmit (peak)
Supply Voltage	13.8 V dc +/- 10%
Dimensions (WHD)	Approximately 4 x 2 x 6 inches
Weight	22 oz (1.4 lbs)
Receiver Circuit Type	Direct-conversion, low IF
Intermediate Frequency	Software selectable from dc to 20 kHz
MDS	-138 dBm max @ 50-MHz.
Selectivity (-6/-60 dB)	500 Hz CW, 1.28:1 shape factor; 2.6 kHz SSB, 1.06:1 shape factor (filter performance determined by PowerSDR @ 48 ksps)
Image Rejection	70 to 100 dB, 160m-6m amateur bands (PowerSDR has a self-training image-rejection program)
Transmitter Power Output	0.05 - 5 watts (main RF port), 1.0 mW/0 dBm (transverter IF output port only)
Emission Modes	J3E (USB, LSB), A1A (CWL, CWU), F3E (FM narrow), A3E (AM and DSB-SC, double-sideband with suppressed carrier), DIGITAL
Harmonic Radiation	Better than -50 dB (160-10m amateur bands); better than -60 dB (6m amateur band)
SSB Carrier Suppression	At least 55 dB below peak output
Undesired Sideband Suppression	At least 55 dB below peak output
Audio Response (SSB)	Flat response 70 Hz to 20 kHz, 3-band or 10-band software EQ
3rd Order IMD	Better than 28 dB below PEP at 14.2 MHz, 5 W PEP
Microphone Impedance	600 Ohms (200 to 10 k Ohms)

In addition to the usual dc input and antenna output ports, the back side of the FLEX-1500 features some real rarities: transverter ports and an input for a high-accuracy 10-MHz frequency reference.

typical contest conditions, where powerhouse signals may be only 1 kHz away, the FLEX-1500 is now crushing the competition.

A quick look at Sherwood Engineering's receiver test data "scoreboard" at **www.sherweng.com/table.html**, shows that the $649 FLEX-1500, with its measured 88-dB dynamic range at 2-kHz signal spacing, is in the Top 10 of all radios tested at any price (the list is sorted on this category). It's almost ridiculous!

Although the Sherwood list is sorted for close-in dynamic range only, and many factors can determine a radio's ultimate performance and usability, the '1500's perch near the top of that list puts it rarefied company. A handful of more expensive radios outperform it, but the list of expensive radios it tops at 2-kHz signal spacing is also impressive (one radio costs nearly 18 times more than the FLEX-1500)!

Another look at the list reveals that, other than the Perseus RX-only SDR and the FLEX-3000™ and FLEX-5000™ SDRs (both siblings of the FLEX-1500), all of the others radios ranked above the FLEX-1500 are hybrids that combine down-conversion superhets with roofing filters and software-defined IF/AF subsystems. And they all cost thousands of dollars more.

❖ PC Perspectives

As mentioned, a Windows PC running PowerSDR is required for any and all functions. That's not always convenient, but it does provide for another powerful SDR feature: a band scope spectrum display that shows the strength and location of signals up and down the band in real time (in addition to the signal that you're tuning).

This feature is so powerful that I'm now reluctant to be without it. Many SDR operators feel the same way. Being able to *see* a signal, click on it with the mouse and have it perfectly tuned in is simply fantastic. It's a real game-changer, a huge step forward in the evolution of practical amateur radio technology.

Being the baby of the FlexRadio Family, the band scope on the '1500 spans 48 kHz of received spectrum – more than enough to be very useful. More expensive models cover a wider displayed spectrum, but that fact alone doesn't seem sufficient to warrant an upgrade.

Unlike the FLEX-3000 and the FLEX-5000, which use Firewire technology to connect the PC to the radio, the FLEX-1500 uses USB. FlexRadio engineers chose USB because it was universally available and less expensive than Firewire, but I think they might reconsider if they had to do it over again. USB is great for copying data files between hard drives and for many other non-critical tasks. But when it comes to synchronizing time-sensitive operations in real time on either end of the connection, USB can be a real pain.

FlexRadio engineers and early FLEX-1500 purchasers went through a rough patch for the better part of a year while the kinks were worked out. Thankfully, the latest version of PowerSDR, 2.0.19 RC1, although still technically "in beta," seems to be just what the doctor ordered. I will report my experiences with it in detail in Part 2, at which time the final stable release of version 2.1 may even be available.

After plenty of nail biting and teeth gnashing, FlexRadio engineers discovered that the USB timing issues were mostly dependent on a PC's USB chipset and its USB implementation, and not its operating system. Surprisingly, the newest, most powerful PCs often had the most problems. Beyond the fact that several companies manufacture chip-level parts that add USB capabilities to PC motherboards and add-on cards, specific implementations offload more or less USB processing to the PC's main CPU instead of handling it "in hardware" in the USB chips themselves.

Some USB designers thought that modern, fast PCs could handle plenty of USB housekeeping at the CPU level, allowing for inexpensive, less-capable USB chipsets. This works for simple file transfers, but when it comes to syncing two simultaneous data streams between PowerSDR and the FLEX-1500, problems ensued.

The fix involved software tweaks and the addition of adjustable buffers that allow users to precisely tune PowerSDR to their PC's specific USB hardware. A slider control in one of the many software setup menus makes the adjustment possible. Future versions of PowerSDR may configure these settings automatically.

Now that the USB issues have been largely solved, PowerSDR should be fine on any reasonably powerful PC running Windows XP, Vista or Windows 7. PC's with better USB hardware can run slower CPUs, and vice-versa. Tiny netbooks such as Toshiba's NB-205 (known to have good USB hardware) can run PowerSDR nicely, while some powerhouse i7-class PCs with junky USB chipsets need a lot more of their CPU power to reach the same efficiency.

PowerSDR 2.x is rated for use on 32-bit and 64-bit versions of XP, Vista and Windows 7, although as a veteran PC tech, I strongly advise against using Vista for anything beyond simple web browsing. Friends don't let friends run Vista!

Check the FlexRadio Knowledge Center for up-to-date hardware recommendations. I ran PowerSDR in 32-bit Windows 7 (a 3-GHz dual-core PC with 4 GB of RAM) and in 32-bit XP (an older machine with a 2-GHz single-core CPU and 1 GB RAM). Both worked well, but the CPU utilization on the older PC sometimes spiked to 100% if I was running logging, PSK or web software at the same time. The faster PC was "like butter" no matter what.

❖ Until Next Month...

In Part 2, I will share my experiences installing, using and integrating the latest version of PowerSDR into my previously conventional station. I'll also cover hardware options and using the FLEX-1500 as a receiver (super easy), a transceiver (straightforward), and in conjunction with logging and digital-mode software (doable, but a bit tricky).

In the meantime, feel free to spend some time at **www.flex-radio.com** perusing the photos, specs, articles and user forums. If you're interested in the FLEX-1500 – or SDR technology in general – the web site is a real education.

Software Defined Radios

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- Optional 2nd Receiver
- Optional Auto Tuner
- 100 Watts Output

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FLEX-1500™
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- Transverter Interface
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*Two tone third order dynamic range at 2kHz spacing -as measured by ARRL Labs

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What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

New Edition of Low-Band DXing

Ask me what my favorite amateur radio book is of all time and you may be surprised at my answer. I enjoy them all, but ON4UN's *Low-Band DXing* is the one that will get the juices flowing, the toolkit out, and the gear tuned up to 40, 80 or 160 meters. So it made me happy to see a new 5th edition of this venerable publication, but sad to discover it will be the last by author John Devoldere, ON4UN.

It's been 25 years since Devoldere published the original *Low Band DXing*, sharing his knowledge of techniques for success on 160, 80 and 40 meters. Over the years, the book has evolved to keep pace with our growing knowledge of propagation, equipment, operating techniques, and receiving and transmitting equipment for the low bands. This edition is no different, with significant new additions and updates throughout the book.

The fifth edition of this book by ON4UN – *Low Band DXing: Antennas, Equipment and Techniques for DXcitement on 160, 80 and 40 Meters* – features new and updated material with a CD-ROM included. Every fan of 40 meters through the Top Band needs this book in the shack, and it is definitely loaded with everything you need to succeed on operating in the amateur radio low bands.

The new edition boasts almost 700 pages and includes a thoroughly revised discussion of receiving antennas. In addition, low-signal transformers for Beverages and other receive-only antennas are analyzed in great detail, along with effective common mode filters. You'll also find an examination of phased arrays with new concepts, such as the hybrid-fed 4-square array and opposite-voltage feed system, and dozens of new propagation maps based on the popular DX Atlas program available on the Internet.

Devoldere has also added an in-depth analysis of the influence of sunspot cycles on 160 meter ducting, as well as a new discussion of cutting edge technology, including Software Defined Radio and the revolutionary LP-500 Digital Station Monitor.

The chapters listed in the Table of Contents include:

- Propagation
- DXing on the Low Bands
- Receiving and Transmitting Equipment
- Antenna Design Software
- Antennas: General, Terms, Definitions
- The Feed Line and the Antenna
- Receiving Antennas
- The Dipole Antenna
- Vertical Antennas
- Large Loop Antennas
- Phased Arrays
- Other Arrays
- Yagis and Quads
- Low Band DXing from a Small Garden
- From Low Band DXing to Contesting

As I mentioned before, a CD-ROM is also included with the new fifth edition! This CD-ROM includes the entire book in a fully searchable PDF format, as well as Devoldere's software (Windows XP only), antenna modeling files, photographs and more.

Devoldere is a recognized expert on low band DXing, and his operating achievements speak for themselves. On 80 meters, he has the highest number of DXCC countries confirmed worldwide (he is holder of the DXCC 80 meter award #1 with 357 countries confirmed on that band). When this book was published, Devoldere had the highest country total outside North America with 312 countries confirmed on 160 meters.

ON4UN's *Low-Band DXing* is available from several *MT* advertisers, many local amateur radio stores, or the ARRL Store (**www.arrl.org/shop;** 860-594-0355 or toll-free in the US 888-277-5289) – ARRL Order No 8560, ISBN 978-0-87259-856-0. The book retails for $44.95 plus shipping.

ARRL License Manuals Revised

Speaking of operating on the HF amateur radio bands, if you want additional privileges to operate in the aforementioned 40, 80 and 160-meter bands, then you will need to get a ham license or upgrade to at least General Class.

That is now easier than ever with a new recent enhancement to the all of the popular ARRL License Guide publications. With the release of the ARRL Extra Class License Manual - Revised Ninth Edition, the entire series of manuals from Technician to Extra includes their practice exam software on CD-ROM.

Each of these guides has all you need to pass your written amateur radio exam. Each guide has detailed explanations for all questions, including FCC rules. The CD-ROM runs under Microsoft Windows™. You can use it with your book to review the study material being presented. You can take randomly-generated practice exams using questions from the actual examination question pool. You won't have any surprises on exam day!

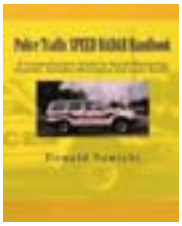
Here is a list of the latest books, order numbers and prices (order from the sources mentioned earlier).

Ham Radio License Manual Revised 2nd Edition (Technician) - ARRL No. 0977 - $29.95
General Class License Manual Revised 6th Edition - ARRL No. 8690 - $29.95
The ARRL Extra Class License Manual Revised 9th Edition - ARRL No. 8874 - $29.95

Police Traffic SPEED RADAR Handbook

While many police departments effectively use radar to control traffic, there are still numerous instances of improper use. To operate traffic radar does not require genius, but it does require proper training as well as a basic understanding of this precision instrument.

Unfortunately, many people have the misperception that police radar is infallible: It is not.



This book is intended to familiarize the reader with the use and misuse of police radar by examining basic scientific and engineering principles in detail. There are numerous instances of unintentional (and a few intentional) abuses. Observing speed limits does not guarantee immunity from an undeserved ticket.

In this new book by Donald Sawicki, you will find information on microwave and laser radar operation – how radar works, proper use, limitations, potential operator errors, and common misreadings and mistakes. General situations are analyzed for potential, probable, and sometimes inevitable speed errors. In many instances, errors are predictable by knowing just the general setup. Basic radar theory, physics, and mathematics are used to prove all findings. All technical information and conclusions are quantifiably described using illustrations, graphs, tables, or mathematical formulas – based on or derived from fundamental scientific and engineering principles, published factory specifications, empirical data, or United States government documents.

According to the publisher, if you have been a victim of microwave or laser police radar (or speed timing systems, automatic or manual, or pacing or visual speed estimate), as well as professionals involved with traffic law enforcement (i.e., judges, defense attorneys, para legals, police, prosecutors), accident reconstruction specialists, science and engineering professionals, educators and students, you will appreciate the detailed technical information on police radar systems.

This 232 page book sells for $29.99 plus shipping and handling and is available online at **www.createspace.com/3541308**. It is also available at the usual online book services (ISBN 1456524283).

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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Milcom Blog Hits the Big-Time

MilcomMP and an old friend Huub in the Netherlands made the pages of Wired magazine (**http://tinyurl.com/6cnke4t**). Thanks to Noah Shachtman for the mention in his March 20 piece on Listen: Secret Libya Psyops, Caught by Online Sleuths.

March 21 set a single site record for this blog of 12,191 visitors. As I type I have had 1.478 million visitors to the site since we opened our doors on May 27, 2006. Guess people know where to come for milcom info!

I also jumped from 270 to 625 followers on the new Twitter feed at ***@MilcomMP*** in one day. I have followers from the Weather Channel, Wired magazine, the editor of Foreign News, a reporter at SkyNews in Europe, a BBC news producer, a TV show producer, a US Congressman and his Washington staff, an AP reporter at the UN in Geneva, a whole Royal Navy HMS ship, a film director and SAG/AFTRA actor, a film producer, an Al Jazeera Online Producer, many journalists and photographers, members of the military, and many more individuals including *MT* subscribers.

Welcome to you all! And many thanks to Gayle Van Horn and Hugh Stegman who also spent the weekend updating followers in blogs and tweets as the situation in Libya evolved. It was a wild ride!

Larry Van Horn N5FPW

Help Preserve Ute History

My web-site **www.utilityradio.com** is a non-commercial site with the aim to feature technical data, sound-clips and pictures of utility radio stations from the past and the presence. Sent in from many contributors, you will find here authentic voice recordings from the 60s, 70s, and 80s, CQ loops from coastal stations, and other interesting items – almost 1,100 sound clips! Pictures mostly feature QSL verifications from the last 50 years (almost 2,000 QSLs), and photos from antenna plants. Additionally, several links lead to dedicated pages for more in-depth information.

As this page is some kind of a museum, I want to invite more people to share their own recordings and verifications on this site. I know that there are many more items around in shoe boxes or dusty cellars that want to return to the light of the day...

I imagine that learning how their forefathers did their communication might even be interesting to the young radio enthusiast... ;-)

Rainer Brannolte

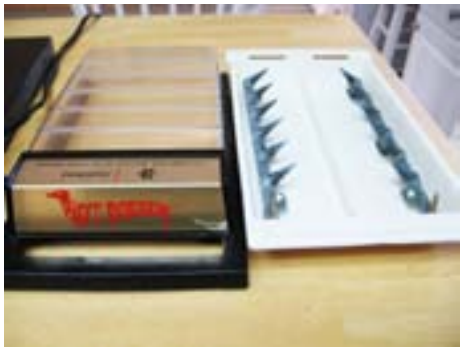
Cook a DUCK

Walter Lindenbach's article "How to Cook a Duck" *(Device Under Caloric Kinesis, February 2011)* about cooking hot dogs with resistive heating by directly connecting them to 120 volts a.c. reminded me that there was once a commercial product for accomplishing this safely. This was the Presto Model PE07A HotDogger, introduced in 1960. It had slots for 1 to 6 hot dogs and cooked them in 60 seconds. A Google search will show that e-Bay and other sources are offering used and unused HotDoggers for sale.

Perry Crabill, W3HQX

This item from the 1960's still works just fine. Takes about 2 minutes for a pack of dogs (pun) but for sure you really must not leave it plugged in for much longer than that or the ends of the hot dogs will be burned. If you like them burned then really best to burn them on the grill:-) Grand kids and cats love to electrocute the dogs!

Sage Viehe KD4KYM



Mast Material

Regarding Radio Shack masts, I recommend to my ham Technician students to avoid RS mast material – it's too expensive. Most new hams are doing it on a shoestring due to the economy. For years I've been telling them to purchase fencing top-rail from Lowes or Home Depot (it's the same gauge metal). I warn them about purchasing only American-Made top-rail. Depot has been getting some of theirs from Vietnam, poorer quality and dimensions are different from the norm. Top-rail is 10-ft for $9.75 at the present time. I tell students to paint the mast the color that's less visible to the neighbors. I recommend Rustoleum as it will stick to galvanized pipe.

After 700+ new Technicians I'm taking down my shingle as an instructor … This last class has 60+ students, more than usual. Most are doing it in case of a governmental situation. That's a new reason! It's usually for recreation or in case of emergency.

Randy Hatfield AG6RH

MT at 30 Years

Congratulations on 30 years of *Monitoring Times*. I expect it to be in business for its 50th anniversary. It has the most up to date information on radios that I have ever seen.

My brother brought the first *MT* home, a small newspaper then ...

Yes, I well remember your SW-100 attempt. I never met anyone in radio who hasn't dreamt of creating the perfect radio. I once bought an expensive broadband thinking it could replace all my other radios. But I was sadly disappointed…

I suppose you are still disappointed on that attempt, but it may be a blessing in disguise. The way newer electronic gadgets are appearing nowadays, anything you buy goes obsolete before you get it out of the store. Even the most perfect radio, the Sony 2010, is now way out of date and any upgrading wouldn't make any difference.

Bob Fraser

Bob, I loved reading your story in the First-Person Radio article (*January 2011*). When preparing to build your first radio, you acquired the usual parts, but then you mentioned a "drilled and punched chassis awaiting sockets and jacks." For everyone that wanted to build radio transmitters and receivers, did they need the skills and shop equipment for metal fabrication, or did some companies actually sell blank chassis to the scratch builder?

Judy May W1ORO

At one time a blank and undrilled chassis, front panel, and metal cabinet were readily available by mail order and from ham radio outlets. The well-equipped home builder would have a set of Greenlee punches for popping large holes for tube sockets, circle cutters for meters, and a variety of drill bits for hardware.

For those with more manual dexterity, shop tools like bench brakes could be employed to make right-angle bends in sheet metal to form a custom-size chassis.

And for the home builder who could afford them, pre-punched and drilled chassis kits along with all parts were available that merely required mounting and soldering from revered companies like Heathkit and EICO.

Such kits are still available, but nowhere near as abundantly.

Bob Grove W8JHD

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!

Rachel Baughn, Editor

AR2300 "Black Box" Professional Grade Communications Receiver

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These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

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http://americanbandscan.blogspot.com/ - by Doug Smith

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

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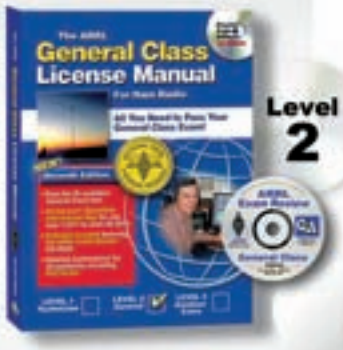

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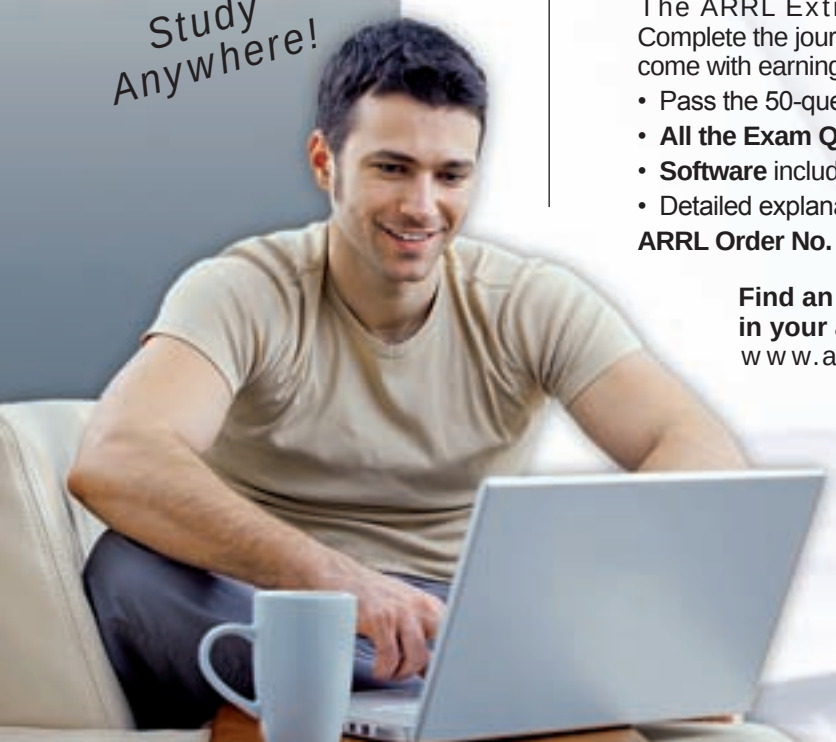

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