Scanning - Shortwave - Ham Radio - Equipment
Internet Streaming - Computers - Antique Radio

Monitoring Times

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Volume 27, No. 5
May 2008

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Working the World with Digital Modes

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- Morse Code Still Fun
- This Ham's no Pork
- Taking the Technician Exam
- Fun with Emergency Comms

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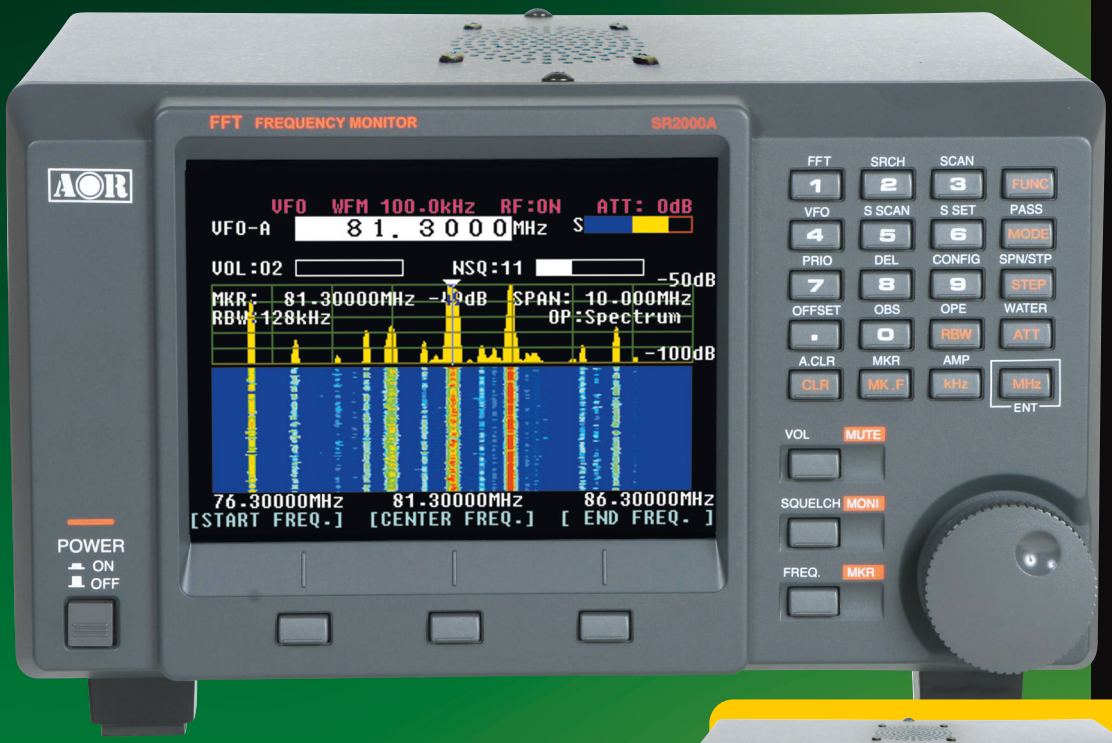

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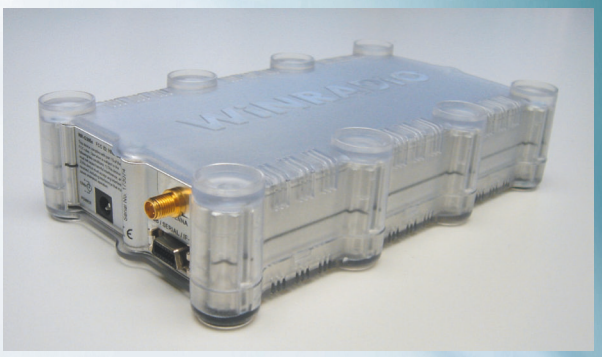

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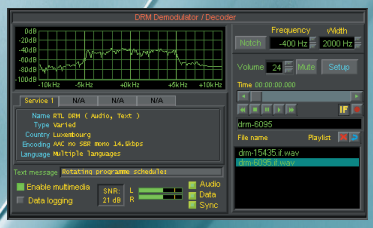
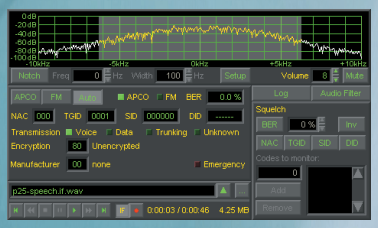


DRM Decoder Option

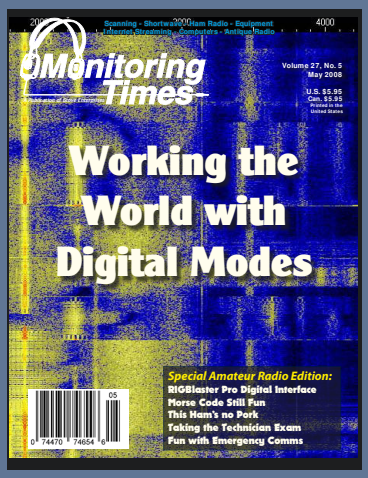


APCO P25 Decoder Option

For more details about WR-G315 receivers, visit www.winradio.com

Monitoring Times

Vol. 27 No. 5 May 2008



Lead Story

Working the World with Digital Modes

By Larry Van Horn N5FPW

The new frontier in amateur radio is found in the realm of digital communications. Thanks to the personal computer and digital sound cards, digital modes – valued for reliability and speed – are more accessible than ever to the ordinary hobbyist. The field is evolving so rapidly, it is impossible to put together a comprehensive list of modes and software programs that are available. Nonetheless, this article presents as complete a look at the current state of amateur radio digital sound card modes as you may find in one place. Whatever isn't covered in this feature can be found in the reference sources provided in the article.

The feature starts on page 9. On our cover is a screen capture of a PSK mode using Digipan software.

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Reviews

Already hooked on digital modes, Larry Van Horn was looking for something to simplify the tangle of cords and boxes required for rig control and sound card demodulation. He found it in the RIGBlaster Pro from West Mountain Radio. In addition to providing the needed features in one unit, RIGBlaster Pro also serves as a microphone equalizer, speech processor, and noise gate. (See page 66.)

"The introduction of a new super receiver into the radio communications marketplace is always marked by hope and anticipation," begins reviewer Bob Grove. "Such is the case of AOR's brand-new entry, the AR-Alpha."

Bob's review of the Alpha finds it an impressive piece of engineering, both cosmetically and technically. "With a continuous tuning range of 10 kHz through 3500 MHz (3.5 GHz), custom step sizes, five VFOs, scan and search capability, and 2000 alphanumeric memory channels, this instrument brings a lot to the table." (See page 64.)

Last month *Computers & Radio* looked at the Antec Notebook Cooler. Three other laptop coolers have surfaced since then, so John Catalano compares all four – representing three different technical approaches. Want to see which is the coolest? Turn to page 72!

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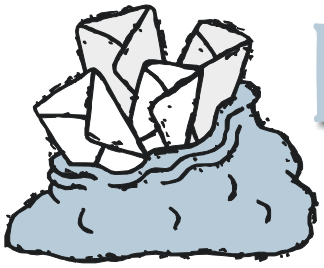


LETTERS TO THE EDITOR

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

Welcome to MT's Amateur Radio Edition

We open our special coverage of amateur radio with the leading edge of amateur radio technology: digital operations. If you want to discover the excitement of early radio experimenters, this is the place to explore.

On the other hand, maybe you don't have your amateur radio license and are just a little unsure what's involved. Our article on how to get a ham license will answer your questions and help get you started.

Next up is an *MT* reader who did just that – studied and got his Technician license as an old dog learning new tricks. A second "old dog" reminded himself of how much fun CW contacts are (the "original" digital mode!). And a 14-year-old YL reminds all of us that practicing for emergency communications – one of the mandates for the amateur radio service – can be fun for young and old alike!

Remember the Dayton Hamvention takes place May16-18. Or find a hamfest near you by visiting **www.arrl.org/hamfests.html**

ICOM/Grove/MT Donation

ICOM has a reward program in which they provide their leading dealers with selected products for distribution without charge at their discretion. *Monitoring Times* was asked to help Grove Enterprises locate a deserving recipient for some ICOM D-STAR digital repeater equipment.

Bill N2CSA and Tim N2LTQ opening boxes from ICOM and Grove Enterprises.

"We were delighted to learn of the goals of Jersey Cape Digital Users Group in their effort to expand emergency communications in the digital age," said Bob Grove. "Their resolve and commitment was a driving force in our decision. We are pleased to provide major assistance to their program by providing over $4000 worth of ICOM D-STAR equipment."

Members of JCDUG opened the boxes with great excitement as their equipment rack contained the only the bare beginnings of a digital repeater system. Typical of the thanks received is this one from George Strayline N3GZ, "As a member of the newly formed Amateur Radio Club, *The Jersey Cape Digital Users Group*, I gratefully extend to you my deepest gratitude for your generous contribution to our radio service and hobby. I assure you that your kind gift will be used to further enhance public service to our community as well as bring many years of enjoyable fun to all radio amateurs throughout the world."

To learn more about the D-STAR system, please read this month's *On the Ham Bands* column on page 60. You can follow their progress at **www.jcdug.org** and in future issues of *Monitoring Times*.

MT at NASB

The National Association of Shortwave Broadcasters is meeting in Cary, North Carolina, May 8-9, hosted by TransWorld Radio at their headquarters. Being in *MT*'s home state, the NASB has invited your editor Rachel Baughn to speak on behalf of shortwave listeners and the hobby publication. Have something you want me to communicate? Email me without delay at *editor@monitoringtimes.com*

Corrections

Judy May and Will Martin both caught the error in Ken Reitz's March *Communications* column. The official phone number to request a $40 coupon toward buying a digital converter for your analog TV is 1-**888**-DTV-2009. If you dial 1-800-DTV-2009 you get someone trying to sell you satellite TV service.

Bob MacDougall KC9JUB wrote regarding the February *On the Ham Bands* article "Do You Know How Much You Know"? In a slip of the finger Skip had written "...as our Part 95 mandate expects..."

Bob points out, "Part 95 has no mandate to advance or improve the radio art. Some would say that Part 95 operators do not actually practice the radio art..."

Part 95 governs Personal Radio Services such as Citizens Band, General Mobile Radio Services, Family Radio Services, and low powered devices. **Part 97** is the section which regulates the Amateur Radio Service.

We regret any confusion which may have resulted from these inadvertent errors.

High Flying Ham

Tom Rum caught Ken Reitz's "High Flying Hams" feature in the March issue and wrote: "I've been a corporate pilot for the last 30 years or so... Thought you like to see my QSL card that I designed last year. It's unusual in that I was actually flying the aircraft when the photo was taken... An amateur photographer snapped it when I was taking off at Naples Florida one Sunday. He posted it on the internet without my knowledge. I mistakenly found it, about a year later.

"The rear of the card is my actual cockpit, with additional info such as altitude and Lat/Long....Another unusual item is the HF antenna that the aircraft uses...It's a 5 ft section of the vertical stabilizer insulated from the rest of the airframe...Output on the Collins HF is 250 watts, going through an automatic antenna tuner before going to the antenna. The HF in the aircraft works better on the higher bands...20 meters and above.

P.S.: I have been operating HF and VHF Aeronautical mobile for many years. Typically 180 miles with a 5w HT @41,000ft...20m and 17m are my favorite bands when I'm Aeronautical Mobile.

"A few months ago I worked my first aeronautical mobile to aeronautical mobile contact. It was an Air Canada flight. In all the years I've been flying, that was a first."

73, Tom Rum W5RUM

COMMUNICATIONS

by Ken Reitz

AMATEUR RADIO/SHORTWAVE

NASB-USA DRM Confab

The annual National Association of Shortwave Broadcasters and USA DRM Group meets this month in Cary, North Carolina. According to a preliminary agenda, the meeting will include tours of Trans World Radio HQ; a DRM Consortium update; a report on the DRM Diversity Receiver project, a receiver designed particularly for use in the tropics, and a number of other shortwave and DRM related discussions. *MT* Editor Rachel Baughn will also make a presentation.

BROADCASTING

HD-Radio Engineers Go Old School

A heavy snowstorm that dumped copious amounts of snow on Wyoming's Copper Mountain this winter interfered with telecom gear at the summit. According to a report in *Radio World*, a Wyoming Public Radio engineer and program director needed to get to the site that's home to KUWT-FM's tower, analog and HD transmitter as well as their network satellite installation. With roads closed and no snowmobiles available, the pair did what any western cowboy would do: they went on horseback.

Satellite Radio

While the debate simmers more than 12 months after it began about whether or not the only two satellite radio licensees should merge, both services are enjoying a period of prosperity not seen in terrestrial broadcasting. The FCC and the Department of Justice are both said to still be studying the proposed merger of XM and Sirius with new arguments being floated nearly every week by various groups with an interest for or against the merger.

Meanwhile, reports by both services showed an increase in subscribers, a decrease in losses and a decrease in the all-important churn rate, subscribers who drop out after an initial free or discounted subscription. XM is said to have just over 9 million paid subscriptions while Sirius, once trailing XM badly, has now almost caught up to XM with 8.3 million listeners for a combined total of 17.3 million people paying to listen to the radio.

CONSUMER'S CORNER

Say Goodbye to Portable Analog TV Sets

A report in the Orlando *Sentinel* reminds consumers that those cheap little portable, analog TV sets, that many have turned to in the event of an emergency such as a hurricane, will have no use after February 19, 2009, the date analog TV transmissions end in the U.S. The article points out that, while in most cases, converter boxes can be used with portable sets, it may be impractical given the power requirements of such units and the lack of power during such an emergency.

No doubt the next year will see the introduction of many new portable TV sets capable of digital reception. Meanwhile, here are few things to know: Digital TV sets, no matter what size they are, require better signals than analog TV sets to watch programs. With digital it's all or nothing. Look for sets that have external antenna connections.

This Accurian 7" portable TV from Radio Shack ($199.99) is one of a very few that tune digital broadcasts. This will be the last hurricane season for old analog portable TV sets. (Courtesy: Radio Shack)

In addition, portable digital sets may have limited internal battery reserves and take hours to re-charge. If your power is out longer than a few hours you should have an alternative power supply. A better alternative is to have a crank-up emergency radio that tunes the AM/FM and shortwave bands. But remember, crank powered radios that tune TV audio will lose that feature, since the analog audio stream will be gone.

PUBLIC SERVICE

Scanner Listener Busts Crime

An article in the Vail *Daily*, a newspaper in Vail, Colorado, tells of a local gas station operator working the night shift who monitors his scanner when things get slow. According to the article, just by listening and paying attention the man has reported over 60 criminal activities and helped local police nab 16 DUI suspects. When drunks show up in his parking lot he calls the cops. Once, a local "most wanted" suspect came into his shop and he was able to recognize the suspect because he also looks up suspects' mug shots on his computer.

District's DHS Loses Radios

An article in the Washington, D.C. *Examiner* reported that the District's local department of homeland security apparently lost dozens of radios worth an estimated $250,000. According to the *Examiner* piece, the department could only account for about half of the 151 radios, identified as Motorola 800 MHz units it had purchased and that the loss first surfaced in 2004. The article quotes an official government report as warning "The possession of these pre-programmed radios compromises the integrity and security of the D.C. Metropolitan area…"

FCC

Cell Companies Balk at FCC Back-up Rule

It's off to court for some cell phone service providers seeking relief from a new FCC rule that would require cell phone providers to have back-up power generators for each cell site in the event of an emergency during which commercial power would be off. Claiming it could cost up to $15,000 per site, the companies want the Commission to change its mind. But, the FCC is unmoved, saying in a filing regarding the issue, "The need for back-up power in the event of emergencies has been made abundantly clear by recent events, and the cost of failing to have such power may be measured in lives lost."

Lame-Excuse Pirate Fined

The FCC fined a Philadelphia man, $10,000 for operating an unlicensed FM radio station. It was reported that, while admitting that he had been operating the FM station without a license since 1994, he believed the FCC lost his application for a construction permit. The Commission affirmed the fine noting that the man had not provided any evidence of having ever filed for such a permit and further pointed out that filing for a permit isn't a license to operate.

GPS IN ACTION

Bear Swipes Dead Goat's Tracking Collar

Scientists all over the world are making extensive use of radio-linked tracking devices and GPS systems to study the movements of wildlife. That's not news. But when the tracking collar of an apparently deceased goat that had been tracked by a scientist disappears for a while only to surface later on a black bear, it is news.

The swap apparently took place near Alaska's Meade glacier and was reported in the Juneau *Empire*. The article notes that each collar has its own computer related address and suggests that the bear must have come across the remains of the goat, liked the collar and put it on.

"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, Alokesh Gupta, Norman Hill, Rick Kissel, Doug Robertson, Larry Van Horn.

Working the World with Ham Digital Modes

By Larry Van Horn, N5FPW

Turn on your television set here in the States and you won't have to wait long for a commercial promoting the latest text messaging plan for various cellular telephone services. In fact, texting is the "in" thing to do these days. Walk around the office, at school, in a restaurant and you will see that everybody is texting.

But texting isn't limited to just a cellphone or Blackberry. You might be surprised to learn that in the ham radio world we have been texting long before it became popular among other portions of our populace.

With the advent of more powerful computers and the sound card, hams have been texting using digital modes since the end of 1998. Peter Martinez, G3PLX, was the first amateur to exploit the computer sound card by creating the PSK31 mode, a keyboard to keyboard digital mode that lets amateurs text each other via radio. Since that milestone event, sound cards have become more powerful and versatile, resulting in digital communications becoming one of the fastest growing segments of the amateur radio hobby.

In this article we will explore some of the newer digital modes currently being used by not only the amateur radio community, but some other inhabitants of the HF spectrum as well.

What do I need to get started?

If all you want to do is to receive some digital communications or if you are a shortwave radio listener, all you will need is a computer equipped with a sound card, an audio cable, a shortwave receiver with SSB capability, and a soundcard software package (see Table 1) that will decode the digital stream you want to receive.

If you are a licensed amateur radio operator, replace the receiver with a transceiver, add a hardware interface between the computer and the transceiver, and you can get in on the fun of working the world via digital modes.

The simplest and quickest computer to ham radio interface is to connect the line output from the sound card to the transceiver audio input with a 100:1 voltage divider to reduce the voltage output, and the sound card line input to the audio output of the radio. You can use the transceiver VOX to switch from receive to transmit and back. You can learn more about this method on the WM2U website (see our resource guide, Table 2).

If you want to roll your own interface, Jack, KE0VH, has an interesting website with information on building a computer to transceiver interface. If you can read a schematic, have a few junk parts and can handle a soldering iron, then his ham brewed project may be just what you need to get into the fun of digital ham radio without breaking the bank.

If you have two thumbs, burn yourself frequently with a soldering iron, or just have some cash to spare, you can purchase one of the commercial interface units that are available in the ham radio marketplace. Manufacturers such as MFJ, RigExperts, Saratoga, Tigertronics, and West Mountain Radio all make inexpensive interface units (see our link to the DX Zone Digital and Packet Radio Resource Guide).

When setting up to transmit or receive, sound card digital modes are used using upper side band (USB). Do not use LSB. The older, more conventional digital modes such as Clover, RTTY, PACKET, AMTOR and PACTOR typically use LSB.

Before we move on, there is one important point that needs to be mentioned. Most of the problems in setting up the computer, interface, and radio can be attributed to the proper setup of the sound card and mixer panels on the computer. Del Schier, K1UHF, wrote an excellent article on all of this in the October 2003 issue of *QST*.

The good people at West Mountain Radio have made this article available in Adobe PDF form on their website. I highly recommend you download this file (link in our Resource Guide) and study it thoroughly. It will save you a lot of time and grief when you start setting up your station to work the various digital sound card modes.

Digital Modes

The rate of software and hardware development has moved so fast that it is nearly impossible for even an article with short turn-around

Saratoga's EZ PSK USB Interface

to keep up with the rapid changes in the ham digital world. If you want the latest information I recommend subscribing to the Digital Radio newsgroup based on the Yahoo website (see resource guide).

On the other hand, there are some digital modes that are the staple of the digital ham community. CW and RTTY are still widely used. These modes are widely supported by quite a few of the software decoder packages in our sampler in Table 2.

Other modes that have been in common use by the amateur radio community over a number of years include: AMTOR, APRS, Clover, G-TOR, Packet, PACTOR I (DOS freeware package that requires a PSA chip set sound card and will not do Airmail, Sailmail or WinLink2000), and Slow Scan Television (SSTV).

A lot of reference material is already available on the Internet and in printed form regarding these modes, so I won't cover them in-depth in this article. If you want more information

Key to Abbreviations/Acronyms

BPSK	Binary Phase-Shift Keying
CW	Continuous Wave (aka Morse code)
DSP	Digital Signal Processing
FEC	Forward Error Correction
IFK	Incremental Frequency Keying
MFSK	Multi-Frequency Shift Keying
PSK	Phase Shift Keying
QPSK	Quadrature Phase-Shift Keying
QRM	Interference
QRP	Low Power
RTTY	Radio Teletype
SSB	Single Side Band
WARC	World Administrative Radio Conference

on these modes, an excellent reference is the ARRL's *HF Digital Handbook* by Steve Ford, WB8IMY (see the February *MT What's New* column, page 74).

The Sound Card Revolution

It was the mode that started the amateur radio sound card digital mode revolution and is still today the big daddy of them all: the PSK31 mode.

Phase modulation communication modes have many more advantages than the CW mode, which uses amplitude (On/Off) keying. In a noisy or distorted propagation environment, the amplitude of a signal will shift and vary much more than the phase of a signal. When compared to CW, PSK31 is a much more reliable operating mode.

PSK31 uses a varicode character coding that provides the operator with a top data rate of around 50 wpm (31.25 baud). Instead of using FSK or on/off keying, PSK31 uses Binary or Quadrature Phase-Shift Keying with a Viterbi decoder. Based on a RTTY style of operation, this mode is most useful for live keyboard to keyboard conversations at 31.25 baud (31 Hz bandwidth). It is easy to use and monitor, highly immune to noise and QRM, and is suitable for low power (QRP) operations.

The MFJ-1275 Sound Card Interface

Software packages used to operate in this mode are available for free for many computer platforms, including Windows with Sound Blaster type soundcards.

There are several variant modes of PSK that hams are now using on the bands. Some of the variant modes include:

BPSK: PSK31 (31.25 baud) PSK63 (62.5 baud) PSK125 (125.0 baud)
QPSK: QPSK31 (31.25 baud) QPSK63 (62.5 baud) QPSK125 (125.0 baud)
PSK-F: PSK63F (62.5 baud) PSK125F (125.0 baud) PSK220F (220.5 baud)
PSK-FEC: PSKFEC31 (31.25 baud)
PSK10: PSK10 (10.0 baud)
PSKAM: PSKAM10 (10.0 baud) PSKAM31 (31.25 baud) PSKAM50 (50.0 baud)
PSK-Hell: PSK-Hell-105 (105.0 baud) PSK-Hell-245 (245.0 Baud)
GMSK: GMSK31 (31.25 baud) GMSK63 (62.5 baud)
CHIP: CHIP64 (300.0 baud) CHIP128 (300.0 baud)

RIGblaster Models

MT63: MT63 500 Hz (5.0 baud) MT63 1000 Hz (10.0 baud) MT63 2000 Hz (20.0 baud)
Q15X25: Q15X25 (15 x 83.333 baud)

You can expect to find PSK digital communication in and around the following HF/VHF/UHF frequencies:

HF – 1838 3580 7035 (ITU Region 1) 7070 10140 14070 18100 21080 24925 28120 kHz
VHF/UHF – 50.290 144.144 222.070 432.200 and 909 MHz

A CHIP off the old PSK block.

One of the PSK modes mentioned above that is heard occasionally in the ham bands is the CHIP 64/128 mode. CHIP 64/128 is a Direct Sequence Spread Sequence (DSSS) mode using an original algorithm. CHIP 64/128 is a very robust mode, getting through when conditions are poor.

In the United States, 7090.0 kHz USB appears to be the most active frequency CHIP frequency, but 14077.0 and 14110.0 kHz have also been reported.

Be aware that on 7090.0 kHz there is also Olivia (see section below) activity. Olivia has a chirpy sounding tone, a kind of combination of MFSK16 and SSTV sounding signals. Chip 64 is nothing like this: It is more a "whooshing" or "roaring" white noise type of signal, not as low in tone as MT63.

Is it Analog or Digital?

The Hellschreiber mode was invented by Dr. Rudolf Hell in 1929. It was an early form of facsimile communications where only upper case letters were transmitted and received. It was used by the Germans during WW2 and some receivers were built by the British and Americans to intercept enemy communications.

In the late 1990s, hams have emulated the mode using computer sound cards. The resulting mode is referred to by the amateur radio community as Hellschreiber, Feld-Hell, or simply Hell. We also refer to this mode and its variants as the fuzzy modes.

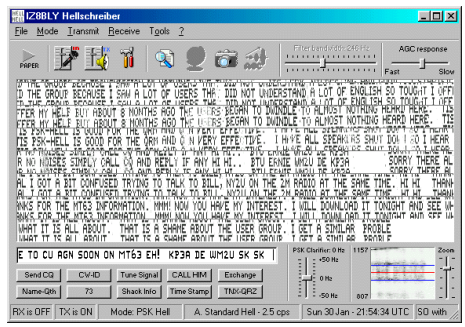
Hellschreiber is an asynchronous transfer mode where the signal is discretely coded. This means two things:

- It is transmitted with either an on or off signal.
- The transmitter does not tell the receiver how fast it transmits. It simply sends the message in its own speed and the receiver must do its best.

There was a bit of a dust-up among the digital community regarding the Hell modes. A debate initially raged whether Hellschreiber should be considered an analog or digital mode. Regardless of what type of mode you want to call it, Hell has a small, but devoted following.

There are several Hell variants and these include:

Feld Hell is the traditional Hell mode with a baud rate of 245 baud but, in fact, it is a pseudo-122.5 baud (one "pixel" is 8.163 ms long).
PSK Hell encodes the pixel's brightness in the carrier phase instead of the amplitude. Strictly speaking, it's encoded in the change of the phase (differential phase shift keying): an unchanged phase in the beginning of a pixel means white, and a reversed phase means black. It operates at 105 or 245 baud. It has the same traits as standard PSK31 including its great sensitivity. Great for DX work in bad QRM. It is, however, sensitive to drift.
FM Hell uses frequency modulation with a careful control of phase, essentially minimum-shift keying.
Duplo Hell is a dual tone mode which sends two columns at a time at different frequencies (980 Hz and 1225/1470 Hz). Wide shift, but better immunity to noise. LSB recommended.
C/MT Hell or concurrent multitone Hell sends all rows at the same time using tones at different frequencies. The transmission can be read using an FFT display. It allows for high resolutions. Not very sensitive, but it has great noise immunity.
S/MT Hell or sequential multitone Hell is like C/MT but with a discrete number of tones (characters are restricted to 5x7 pixels).
Slowfeld is a very slow mode (2 characters per minute) intended for beacon use.



A screen capture of Hellschreiber mode

You will find most Hell mode activity concentrated around these frequencies:
3559 3590 7063 10135 14063 18063 21063 24963 28063 28110 kHz

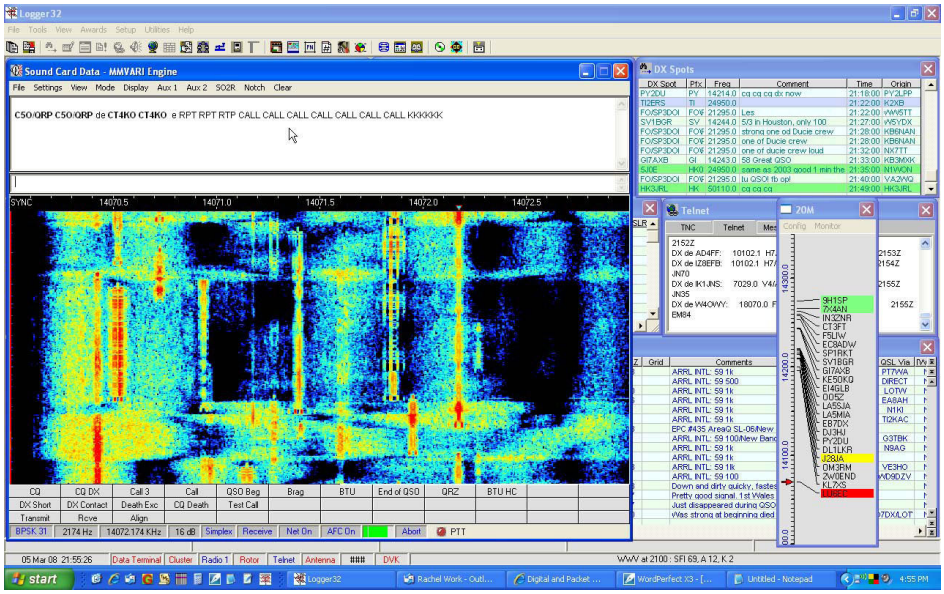
MFSK – The Super RTTY

Until recently, few hams had even heard of MFSK, while some that had may have dismissed MFSK as being "old fashioned." MFSK was used successfully by the British Foreign Office, the Belgian and French military, and others. Some of you may recognize this mode by its other names – Coquelet and Piccolo.

As has been clearly demonstrated by the recent successful revival and acceptance of Hellschreiber, old ideas combined with modern techniques such as DSP can prove to be very effective.

MFSK is a technique for transmitting data using multiple tones. Unlike RTTY with its two-tone method of data delivery, MFSK sends many tones, usually, but not always, one tone at a time.

There are a number of different techniques, using concurrent (or parallel) tones, sequential (one after another) tones, and com-



Logger32 screen capture of BPSK31 mode

binations of tones. MFSK transmissions have a unique sound, almost musical, which is why Piccolo and Coquelet received their names. (Coquelet means rooster.)

You will encounter three variants in the MFSK family. MFSK16 uses 16 tones and has a baud rate of 15.625 baud. It was first showcased in a software package known as *Stream*. Another variant is MFSK8 which has a baud rate of 7.8125 baud and uses 32 tones.

MFSK SSTV is a slow scan TV mode without transmission of a synchronization ray, in color or in black and white mode, where the picture may be transmitted among MFSK16 text. The picture format is not fixed as in classical SSTV, but is variable (and limited to small pictures).

MFSK modes have an excellent tolerance for ionospheric effects such as Doppler, fading and multi-path. Most important of all, with an MFSK system, the error rate improves as the number of tones is increased. So with as many as 32 tones (MFSK8), the performance is unrivaled. With PSK systems the opposite is true.

Look for MFSK activity around these frequencies:

10148 14080 18105 21063 kHz USB

Other MFSK Type Modes

A new MFSK mode that uses incremental frequency keying (IFK) has been created by Murray Greenman, ZL1BPU, and is known as **DominoEX** and **DominoF** (with FEC coding). It is a simple amateur radio mode that is popular for keyboard to keyboard conversations. Unlike other MFSK modes, Domino will handle TX/RX offsets and mistuning of up to 200-Hz with ease, and will provide perfect copy of drifting signals up to 200-Hz per minute.

DominoEX sends short bursts using 18 different tones at one time. Each tone carries four bits of data. By using IFK, DominoEX overcomes problems with frequency stability and tuning accuracy that plague other MFSK modes.

The following is a list of known DominoEX variants:

Mode	Baud	Bandwidth	Speed
DominoEX 4	3.90625	173 Hz	~25 wpm
DominoEX 5	5.38330	244 Hz	~31 wpm
DominoEX 8	7.81250	346 Hz	~50 wpm
DominoEX 11	10.76600	262 Hz	~70 wpm*
DominoEX 16	15.62500	355 Hz	~100 wpm
DominoEX 22	21.53300	524 Hz	~140 wpm

* the default speed for this mode.

The DominoEX digital modes shine the best in the lower ham bands (30, 40, 80 and 160 meters) where multipath reception is an issue.

Another MFSK type mode is **Olivia**, which is becoming very popular in the amateur radio community. Olivia is one of the most robust methods of text keyboarding, performing superbly for long distance communications. Conversations can take place with nearly 100% copy even when signals are 10 dB below the noise floor. Many Olivia operators report perfect copy even when the signal audio is completely inaudible.

An Olivia signal consists of two layers of code. One is an FEC code using MFSK. The second is another FEC code based on a mathematical analysis known as Walsh functions.

Look for Olivia activity on 20 meters between 14105 and 14109 kHz. More information on Olivia frequencies, format and software can be found on the HFLink website (see resource section).

Then there are the **Throb** and **ThrobX** modes. Developed by Lionel Sear, G3PPT, these two modes take their names from the "throbbing" sound their signals make on the air. ThrobX is an evolution of Throb.

The baud rate is very slow 1 or 2 baud using 11 tones with two tones sent at the same time (which gives 55 possibilities including the two possible idle characters).

Look for Throb and ThrobX along with the other MFSK modes (MFSK16, MFSK8, Throb, ThrobX, DominoF, DominoEX) around the following frequencies:

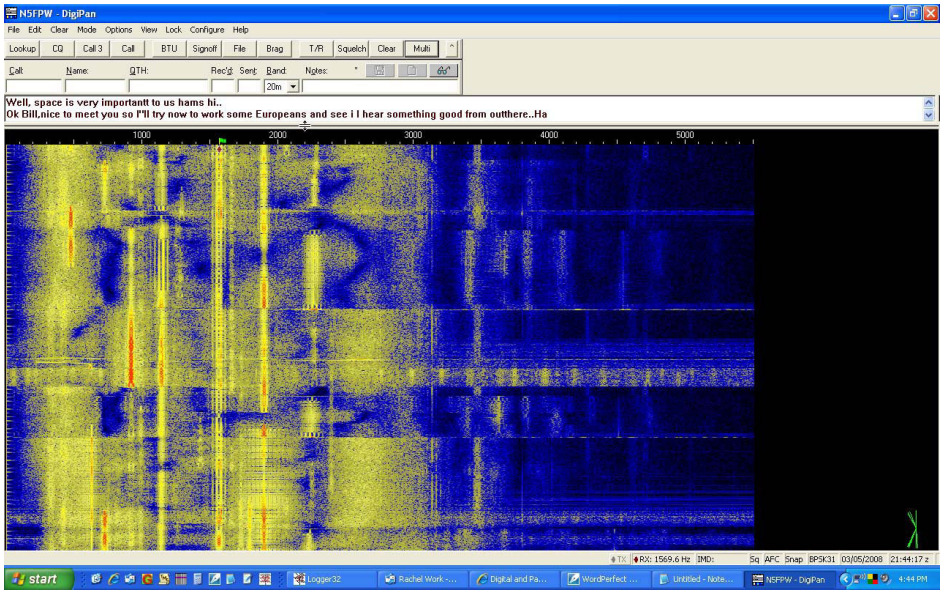
1838.0 3580.0 7037.0 10147.0 14080.0 18105.0 21080.0 24929.0 28080.0 kHz

The WSJT Modes

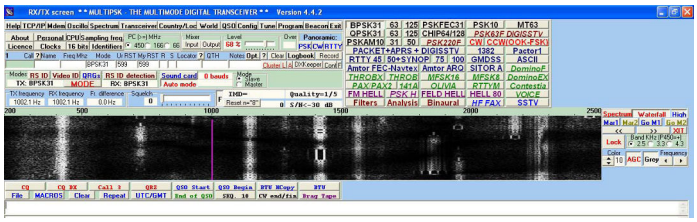
WSJT is not a mode, but it is a computer program with modes for amateur VHF/UHF communication using state of the art digital techniques. Developed by Joe Taylor, K1JT, the WSJT program can help you to make contacts using fraction-of-a-second signals reflected from meteor trails, as well as steady signals more than 10 dB weaker than those needed for conventional CW. WSJT supports five principal operating modes:

FSK441 is used for meteor scatter communications
JT65 is used for EME and other extremely weak signals.
JT6M is used for meteor and ionospheric scatter (optimized for 50 MHZ).
EME Echo is used for measuring your own echoes from the Moon
CW is used for EME QSOs using 15 WPM Morse code

You will find much more on the WSJT modes on Joe Taylor's website (address in re-



Digipan software's rendering of BPSK31 mode



Digital MultiPSK software screen capture

source section).

A final digital thought...

The world of amateur radio digital communications has grown by leaps and bounds in the last five years, and shows no signs of slowing down. It is a lot of fun to make a contact with a fellow ham using low power and receiving a weak signal. It is even more fun to carry on an international text conversation with others all over the world.

So check out our resource list, download some software, and give the digital modes a listen. I guarantee you won't be on the sidelines long. CU on my waterfall soon.

Table 1 – Digital Modes Program Sampler

Program ..... URL

AAVoice ..... **www.dxsoft.com/en/products/aavoice/**
ACARS ..... **www.airnavsystems.com/**
AGW Packet Engine **www.agwtracker.com/**
APRS ..... **www.winaprs.org//**
Blaster SSTV ..... **www.hampubs.com/sstvwith.htm**
Blaster TeLetype ..... **www.geocities.com/SiliconValley/Heights/4477/?20085**
Cluster Blaster..... **www.qrz.com/mftp/morse/cb_217.zip**
CW Decoder ..... **www.amqrp.org/projects/cwdecod/decoder.htm**
CWGet..... **www.dxsoft.com/en/products/cwget/**
CWType ..... **www.dxsoft.com/en/products/cwtype/**
DigiPan..... **www.digipan.net/**
DigiPic **www.qsl.net/kh6ty/digipic/**
DigiTalk..... **www.qsl.net/kh6ty/digitalk.htm**
DIGTRX..... **http://paginas.terra.com.br/lazer/py4zbz/hdsstv/teste1.html**
DSC Plotter*..... **www.coaa.co.uk/dscdecoder.htm**
DX PSK..... **http://dxfile.free.fr/dxpsk.htm**
EPIRB Plotter* ..... **www.coaa.co.uk/epirbplotter.htm**
EXTFSK..... **http://mmhamsoft.amateur-radio.ca/extfsk.htm**
Fldigi (Linux)..... **www.w1hkj.com/Fldigi-2.x.html**
FlexNet ..... **www.afthd.tu-darmstadt.de/~flexnet/**
FTV **http://ftv.3amsystems.com/**
gMFSK (Linux) ..... **http://gmfsk.connect.fi/**
Ham Dream (DRM).. **www.qslnet.de/member/hb9tlk/**
Ham Fax (Linux) ..... **http://hamfax.sourceforge.net/**
HDSSTV **www.svs.net/wyman/examples/hdsstv/0q.htm**
Hellschreiber..... **http://xoomer.alice.it/aporcino/Hell/index.htm**
HF (Linux)..... **www.baycom.org/~tom/ham/linux/hf.html**
Intercom **http://pa3byz.uwnet.nl/rttymade.htm**
HamScope ..... **www.qsl.net/hamscope/**
Jason ..... **www.weaksignals.com/jason/**
JVComm32*..... **www.jvcomm.de/**
Logger 32 ..... **www.logger32.net/** (Now includes the Zakanaka digital program)
MacAPRS (MacIntosh)**www.winaprs.org/MacAPRS.htm**
MacMultiMode* (MacIntosh) **www.blackcatsystems.com/software/multimode.html**
MixW*..... **http://mixw.net/**
MMTTY ..... **http://mmhamsoft.amateur-radio.ca/mmtty/index.html**
MMSSTV ..... **http://mmhamsoft.amateur-radio.ca/mmsstv/**
MRP40 ..... **www.polar-electric.com/Morse/MRP40-EN/index.html**
Mscan Meteo ..... **http://mscan.com/products.html**
Mscan SSTV..... **http://mscan.com/products.html**
MT63 ..... **http://xoomer.alice.it/aporcino/MT63/index.htm**
Multimon* (Linux).... **www.baycom.org/~tom/ham/linux/multimon.html**
MultiPSK*..... **http://members.aol.com/f6cte/index_anglais.htm**
N1MM Logger..... **www.n1mm.com/**
NBTV 32 Line **www.qsl.net/g4hbt/nbtv/nbtv32.zip**
NDB Finder*..... **www.coaa.co.uk/ndbfinder.htm**
Orbcomm Plotter* ... **www.coaa.co.uk/orbcommplotter.htm**
Phase Shift (Linux) ... **www.qsl.net/n1vtn/phaseshift.html**
PC ALE..... **www.chbrain.dircon.co.uk/pcale.html**
PC HFDL*..... **www.chbrain.dircon.co.uk/pchfdl.html**
Plane Plotter* ..... **www.coaa.co.uk/planeplotter.htm**
Precision CW..... **www.qsl.net/dj7hs/download.htm**
PSK31SBW **www.qsl.net/wm2u/p31sbw108.zip**
PSK63 ..... **www.qsl.net/kh6ty/psk63/**
PSK Software by Peter Martinez **www.aintel.bi.ehu.es/software.html**
QSSTV **http://users.telenet.be/on4qz/**
RadioCom* ..... **www.bonito.net/**
RCKrtty ..... **www.rckrtty.de/**
SeaTTY..... **www.dxsoft.com/en/products/seatty/**
Selcal ..... **www.airnavsystems.com/**
Ship Plotter*..... **www.coaa.co.uk/shipplotter.htm**
SkySweeper* **www.skysweep.com:80/**
SlowFeldXPAS..... **www.lsear.freeserve.co.uk/aircraft%20scatter.html**
Smart PSK ..... **http://dxfile.free.fr/dxpsk.htm**
StaRCV (AO-40 FEC decoder)**www.amsat.org/amsat/sats/ao40/fec.html**
Stream (MFSK8/16) . **http://xoomer.alice.it/aporcino/Stream/index.htm**
Train Plotter* ..... **www.coaa.co.uk/trainplotter.htm**
TrueTTY..... **www.dxsoft.com/en/products/truetty/**
TWCW (Linux) **http://wa0eir.home.mchsi.com/**
TWPSK (Linux) **http://wa0eir.home.mchsi.com/**
UI-View..... **www.ui-view.org/**
Voice Key Express **www.qsl.net/n7qjp/**
W1SQLpsk **www.faria.net/w1sql/psk31.htm**
Wdecode ..... **www.xs4all.nl/~yskes/progcorn/index.html**
WinAPRS ..... **www.winaprs.org/downloads/WinAPRS/**
WinDRM **http://n1su.com/windrm/**
WinMSDSP..... **www.qsl.net/w8wn/hscw/msdsp.html**
WinPix32 ..... **http://hjem.get2net.dk/sstv/sstv2.htm**
WinPSK..... **www.moetronix.com/ae4jy/winpsk.htm**
WinPSKSE ..... **www.hamsource.com/winpskse/**
WinSkan ..... **http://webpages.charter.net/jamie_5/**
WinWarbler..... **www.dxlabsuite.com/winwarbler/**
WOLF ..... **www.scgroup.com/ham/wolf.html**
WO-PSK **www.qsl.net/zs5wo/**
WriteLog ..... **www.writelog.com/**
WSJT **http://physics.princeton.edu/pulsar/K1JT/**
WS Tools (Linux) **www.qsl.net/g4klx/software.htm**
WXSat..... **www.hffax.de/**
Wyman1x..... **www.svs.net/wyman/examples/hdsstv/index.html**
X-APRS (Linux) ..... **www.winaprs.org/xaprs.html**

*includes digital modes not used by amateur radio operators

Table 2 – MT Digital Resource Guide

AC6V Digital Modes Software List - **http://ac6v.com/software.htm#DIGITAL**
Amateur Radio Sound Blaster Software Collection - **www.muenster.de/~welp/sb.htm**
Digital and Packet Radio Resource Guide **- www.dxzone.com/catalog/Manufacturers/Digital_and_Packet_Radio/**
Digital Radio - **www.Yahoogroups.com**
Digital Voice on HF - **www.chbrain.dircon.co.uk/dvhf.html**
DominoEX - **www.qsl.net/zl1bpu/DOMINO/Index.htm**
KE0VH Digital Interface Project - **www.hamuniverse.com/ke0vhproject.html**
Olivia – The Magic Band - **http://hflink.com/olivia/**
PSK31 and other PC Magic - **www.psk31.com/**
PSK31 by WM2U - **www.qsl.net/wm2u/psk31.html**
PSK31 Official Homepage - **http://aintel.bi.ehu.es/psk31.html**
PSK Handbook - **www.buxcomm.com/pdfzips/pskhandbook.pdf** (a must read)
Sound Card Interfacing by WM2U - **www.qsl.net/wm2u/interface.html**
The In's and Out's of a Sound Card - **www.westmountainradio.com/pdf/Ins&Outs.pdf**
West Mountain Radio Software Links - **www.westmountainradio.com/links.htm**
WSJT Website - **http://physics.princeton.edu/pulsar/K1JT/**

Morse Code: Still a Fun Way of Communicating

By Arthur R. Lee WF6P

I wanted to be a ham since my high school days when I took a Radio Shop class. This was long before the term "electronics" came into popular use. Our shop teacher was a great guy who carefully guided his students through their construction projects. The nine-tube super heterodyne receiver was our dream project and the capstone of the course. What a joy it was when we put power on, the tubes glowed, and it worked!

This was in 1944, back during the closing years of WWII. I was trying to learn Morse code, but we didn't have the tapes, CDs, and on-line practice sessions available to hams today. My blue-gray Hallicrafters S-20R receiver was always tuned to a CW station, somewhere in the world. It was fascinating to pick out a few characters, now and then, even though I couldn't put them together to make any sense. Later, as a young sailor stationed on Guam, I listened to our radiomen sending code, the navy's chief means of communicating in 1950.

In 1980 I signed up when our Santa Cruz County Amateur Radio club sponsored a Novice class. I was attending college on the G.I. Bill at the time and had room to squeeze in some extra learning. Within six weeks, most of the fifteen of us could pass the required five wpm code speed and get our licenses. My thrill of getting on the air finally arrived.

With an old hand key, I banged out code with anyone who was game enough to work me. There were two YLs in my class living close by, so we'd all get on the air in the mornings after breakfast. After our practice sessions, we'd pick up the phone and ask, "Hey, did you copy those numbers and call signs I sent?"

Soon our speeds picked up to 13 wpm and eventually, for me, 20 wpm. Later, both they and their husbands became sailors. We continued to work each other as they cruised south Pacific waters.

During this process, my operating skills increased, as did my list of CW friends. In the evenings I tried to spend an hour or so sending out "CQs" and getting into rag chew sessions whenever possible. I found that carrying on a conversation required a bit more than just sending a few bits of rehearsed information. The act of thinking of what to say, choosing the correct words to convey your thoughts, then, coming up with the correct spelling (without a spell checker!) put a challenge to pounding brass.

While not a bone-fide DX chaser, I did stumble across loads of Asian and European stations. That was exciting. With my beam pointed south or west from California, my contacts included stations in the Antarctic, South America, Japan, Australia, New Zealand and many Pacific Islands.

I worked a station on Guam one night and recalled an incident, decades ago, when I stood on a cliff on that island overlooking the broad expanse of the sea. A ham sat in his car nearby, operating mobile, talking to another ham in the United States. Back when long distance telephone calls were rare and prohibitively expensive, that greatly impressed me. Now *I* was the ham in the States being talked to from Guam.

A Lifetime of Memorable Contacts

I found that CW could get through when voice transmissions were hopeless. This was especially important under marginal conditions when contacting cruising sailboats on the Maritime Mobile nets. Before Emergency Positioning Indicating Radio Beacons (EPIRBS) were common, knowing the last position of a boat in distress was a vital bit of information for Coast Guard searches.

A world-class sailor, Skip Allan, N6NEN, was one I kept contact with on a nightly basis while he cruised waters of the northwest. He would lie in his bunk at night and send code. His key was fastened to the overhead of the cramped, tiny cabin of his 34 foot sloop *Wildflower*. Later, I was in constant contact with him on his voyage to and from Tahiti. On his return trip he single-handed his boat. He claimed that his contacts with me boosted his morale. It can be a lonely ocean out there.

In September 1983, Korean Airlines Flight 007 strayed off course and was shot down by Russian jet fighters at Sakhalin Island. Two hundred and sixty nine people were killed. A week later, I answered a CQ from a club station there. Recall that this was at the height of the Cold War, long before the fall of the Berlin Wall. We carried on for a short while, neither of us mentioning the political situation nor the airliner tragedy. The QSO was quite enjoyable.

Another notable contact I made was from a friend's cabin cruiser. We were en route to Monterey from Santa Cruz, and several miles at sea. I asked the skipper if I could use his ham rig to send some CW. When I made a contact, we exchanged the usual names, QTH and signal strength reports. I told him I was on a boat on Monterey Bay. He replied that he was in Romania! Our antenna was a simple whip mounted on the fly-bridge 25 feet above the water.

Our QSO didn't last too long, as my signal interfered with the boat's autopilot. Whenever I keyed the transmitter, the RF would get into the autopilot's circuitry and the boat would turn in circles! This is a common problem with many boats.

CW Friends

Long lasting friendships often develop through ham radio. I think Morse code helps in a unique way. My philosophy is that anyone can talk using voice communications. Pounding out a message on a paddle or straight key is – well, it's different. Not everyone can do it or wants to do it. Friends met through CW somehow seem special.

My wife and I visited a CW friend in Arkan-

The author's granddaughter, Justin, sits at the radio filling out log sheets of CW contacts.

sas one summer. Our friend, Rod Lowe, KA7NIM, and his wife wouldn't let us leave for three days! He was a former army radio operator who had avoided capture in the Philippines when it was invaded by the Japanese in 1942. He lived in the jungle with other soldiers for months until picked up by a U.S. submarine. He had many fascinating tales to tell.

One morning there was a knock at our door here in Santa Cruz. An Englishman who I worked on isolated Macquarie Island (south of New Zealand and just above Antarctica) stopped by for a cup of coffee. He was vacationing in California and accepted my invitation of a year earlier to visit. Regrettably, after his return to the island it was impossible for me to work him again due to the DX pileups at his rare location.

A few years ago I had the good fortune to answer a CQ being sent in a clear and precise manner. The operator had a smooth fist that was very easy to copy at about 13 wpm. We exchanged the customary information and I was pleasantly surprised that the operator had been a former navy WAVE.

She and her husband and children were all hams living in Yacolt, the state of Washington. Marsha Messer, AB7RJ, and I worked CW on a daily basis, sometimes for up to two hours at a stretch. We generally began with "Well, how was your day?" We became good on-the-air friends, so she and her sister once flew down to visit us.

Never-ending Surprises

After a period of being inactive on the CW portion of the bands, I put on my headphones and tuned through the 15 meter band. My first CQ was answered by a ham, WD4BQE. He lived in Mosheim, a very small town in eastern Tennessee. We chatted for 15 minutes, then I changed frequency and caught the tail end of another QSO as they signed off. I wrote down the strange sounding call sign and gave him a quick call.

It was RA9HDM. He had a nice, easy-to-copy speed and his signal strength was good. He repeated his QTH several times, "Tomsk, Tomsk." Where in the world was that? His name was Stan. I came back, asking him which country he was in. "Russia, Russia." That was a surprise. All I had up was a simple dipole only 20 feet off the ground and directed north. I was working him over the pole.

He went on to clarify, "Asia, Asia. West Siberia. West Siberia." I asked if he was English, as he had no trouble with the language. Was his name Stanley? "No, it is Stanislav, Stanislav. I am Polish." There was some fading but we remained in contact for 45 minutes. Regrettably, I was so excited that I failed to set up a future schedule. With a feeling of euphoria, I shut my rig down for the night.

Yes, CW can be fun. This was true for me from the very start. From the sweaty palms of fear and uncertainty when getting on the air for the first time to the satisfying completion of an around-the-world contact, it is fun.

With Morse code no longer required by the FCC for licensing purposes, our Santa Cruz County Amateur Radio Club still has new hams asking for code tapes and classes. Why? The answer given most often is that it is still an intriguing and exciting part of the hobby – something that not everyone can do, a totally different skill.

There will likely always be those who will use CW as a means of communications, just as there are black powder shooters or aficionados of quilting, ragtime piano, classic automobiles or steam trains. With the current wide interest in constructing and using QRP rigs, I expect to see code as a part of the amateur radio hobby for decades to come.

THIS HAM'S NO PORK

Getting Your Amateur Radio License

By Jon Dainty Sr.
A writer at **www.helium.com**

So you want to expand your horizons into the ham radio frontier? I have good news for you: it's not hard to do, and there are lots of folks to help you along the way.

I became a ham – "got my ticket" – in 1979, so I can tell you that there have been amazing changes in the ways we communicate. How about you? Why do you want to become an Amateur Radio Operator?

Is it because you recently listened as the President congratulated hams for their communications assistance in national weather emergencies? Maybe you've watched a family member or friend speaking to radio operators in other countries. Did you know you could participate in radio experimentation? Many hams have made discoveries that benefited the whole world. Whatever it is, becoming a ham will help you meet more people, travel more interestingly, and, above all, be better informed about the world.

A Personal Beginning

My own journey into ham radio began about 1977 in Colorado Springs, Colorado, where a friend showed me an intriguing "toy." He was manipulating this electronic box with a couple of paddles with one hand, and it produced the sound of perfect Morse Code as he did. I was curious and asked what he was doing. When he told me he was "studying for a ham ticket," I got the bug myself.

Since I was in the military, my budding foray into radio was sidetracked by a couple of busy years in the Far East. I read magazines, though, and when I came back to the States in 1979, I got busy. I contacted local hams, found a couple of code tapes and a study guide, and began slowly to enter a whole new world. Studying the code was the hardest, I think. It took a while for me to make sense of those little dits and dahs.

Finally, with the help of my mentor (also known as an "Elmer"), I sat down to decode a sentence he was going to type into a Code generator keyboard. He set it to 5 words per minute, and I nervously copied every letter onto an empty sheet of paper.

What did he send? I'm glad you asked: His Morse Code transmission read, "If you can read this, you passed the test." I applied that day for my Novice ticket, and since then have worked up the ladder to Amateur Extra Class (callsign NM0O). You can, too!

Study and Get It Right

Let's get started on your trip to an FCC Amateur Radio Service license. The Federal Communications Commission ("Commission") has a process for aspiring amateur licensees ("hams") to study, decide what their interests are, and get tested. According to the Commission, "The Amateur Radio Service is a voluntary noncommercial communication service, used by qualified persons of any age who are interested in radio technique with a personal aim and without pecuniary interest."[1]

In plain language, hams enjoy using radios, don't get paid for it, and get licensed to do it legally.

Don't get ahead of yourself. License examinations are usually nail-biters for people who thought they left examinations behind in school. While ham radio exams are not at Ph.D. level, most people do need to study. Depending on your electronics knowledge, you may enter the Amateur Radio Service as a Technician Class, General Class, or Amateur Extra Class operator. (You may take only one or multiple tests in the same day).

What does it actually mean to be an "operator"? Operating as a licensed amateur is much different from CB radio (though the band they use was once allocated to hams). First, it is part of a well-ordered system, robust and self-policing. Technician-class licensees are at entry level, but still they may enjoy talking with others on many bands (Commission-defined spectrum allocations) such as 3.5 MHz, 7 MHz, 21 MHz,

28 MHz (a little higher than the CB band), 50 MHz, 144 MHz, and even higher bands. You don't need to study Morse Code any more, either; Technician-class licensees pass a written exam and they're in! If you're one of those lucky folks, your license grant could appear in the Commission database as quickly as three days; when it does, you can legally operate.

Secondly, as you will experience for yourself, hams pride themselves on playing by the rules. Citizens' Band more or less "works," but the Amateur Radio Service glides along very smoothly by comparison. The possibilities are nearly endless, and the equipment variety incredible, in this service.

Now – back to those study materials! Where do you get them?

The same organizations that give the exams (the Volunteer Examiner Coordinators or VECs) make study guides available at reasonable prices. For example, look online at **www.w5yi.org**; go down to the middle of the page, under "Amateur Radio," and find "Shop for Study Materials." They have all you need, either in paper or on disk, to learn the information covered in the 35-question Technician Class Exam.

W5YI-VEC is just one place for study books and disks. If you want to view other materials, go to **www.arrl.org**. These folks are the national association for amateur radio, so you just know they have stuff that will help you get your license. ("ARRL" stands for the "American Radio Relay League," from the early days of successful radio transmissions.)

Sure enough, click on "Licensing" in one of the little yellow boxes near the top of the home page. When that page opens, you will see "Getting Started in Amateur Radio" under the big yellow sub-heading. Clicking on that topic will open **www.hello radio.org**, which is a new ARRL service meant to inspire, excite, and educate newcomers to the art of ham radio.

There are fourteen VECs contracted with the Commission to conduct examinations for American citizens around the world. You can contact them easily by searching the FCC site **wireless.fcc.gov** or by using Google and searching for "Volunteer Examiner Coordinator," "ham radio licensing," or "ARRL." Their published study guides may have different covers on them, but believe me, they all give you what you're going to need to pass the test, no matter which VEC printed it.

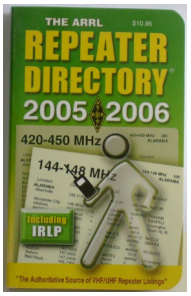
Study the principles and answer the questions; then when you're ready, get in touch with one of the VECs and ask about their next series of exams. Usually it's easy to find an exam session within a couple of hours of where you live, and if it's not, teams of examiners can make special arrangements. Hams want more people to qualify and get licensed, and this helps to make that a reality.

Join Up with Others

This is a good time to think about the social side of ham radio. You see, when you're getting licensed, it's a good idea to join up with a group of like-minded people who enjoy doing what you're preparing yourself to do. They'll let you hang around, join in their meetings, and have something for you to do during service events, too. You're not a third wheel: you're the future of ham radio. So you'll want to find a club close to you.

This is where the ARRL site can really shine, because most clubs are registered with them, especially if the club owns and operates one or more radio repeaters. Go back to **www.arrl.org** and click on "Clubs" in the lefthand box at the top of the page. As of 14 September 2007, there were 2092 clubs in their database[2], and there's a good chance you can find one or two of them near enough that you can join them and find out even more about joining this fraternity.

By the way, if "fraternity" sounds like girls and women don't take part in this hobby, well, perish that thought. Thousands of them do, enjoying the camaraderie, the technical challenges, and the support available in this pool of trained operators who are nice, regular people above all.



Location, type of machine, and access information are all contained in this book, essential for VHF/UHF users.

A club is also a wonderful place to find out what radio equipment might work best for you. Members use wide varieties of gear, and they will gladly tell you about the pitfalls of certain pieces of equipment or types of operating that can make your life difficult. Most of all, a club can give you the opportunity to watch what works, find out what you want to do, and get an idea of what kind of setup might appeal to you at your chosen location (which will be on your license, by the way).

Lots of "Toys"

What kind of equipment would be appropriate at this stage? If you anticipate operating all voice, all the time, you're likely to be looking for affordable radios that cover one or more bands from 50 MHz up to 450 MHz. These will be the most common new and used radios available, and Technicians are authorized both voice and data transmissions in these bands.

Technicians also have Morse Code privileges – you don't HAVE to learn it, but you can! – at 3.5, 7, 21, and 28 MHz (the "high frequency" parts of the radio spectrum). So you can see that a broad range of equipment could well be in your near future.

That's nice: So where do you get it?

You can buy the new gear all over the country, and some places have good selections of high-quality used gear, too. A couple of the well-known outfits are Amateur Electronic Supply (**www.aesham.com**), with stores in Milwaukee, Cleveland, Las Vegas, and Orlando; and Ham Radio Outlet (**www.hamradio.com**), with stores in eight states and contact information under "Store Location" on the home page.

Old or new? Purchased in 1984, this Kenwood radio still does the job for me.

These are just two of the largest distributors. There are hundreds more to be found on the Web and by asking club members. Check "*QST*" magazine in your local library for ads and you will see a variety of gear for every pocketbook and wallet.

If you want to look exclusively at new gear and read up on its specifications and features (and look at the pretty pictures!), go to **www.yaesu.com** for Yaesu equipment, **www.kenwood.net** for Kenwood USA, **www.icomamerica.com** for ICOM products, or perhaps **www.tentec.com** for the U.S. manufacturer of high-end radio gear for several services. They're in Sevierville, TN. Yaesu, ICOM and Kenwood are Japanese brand names, and all are heavily involved in amateur radio.

If you have the desire for experimentation and are good with or want to learn more about radio theory and practice, there are opportunities to explore the spectrum above what your microwave oven uses. Some of that gear you will have to build.

The Rewards

Does this sound like a lot of work? Probably it does, but let me assure you it's time well spent. Over the course of a year as a licensed operator, you may join a radio club, take part in an emergency exercise (or a real emergency!), or provide communications for a local marathon or bike ride.

The chances are good that someone will suggest you join them and operate during Radio Amateur Field Day, a demonstration of the capability to provide emergency radio communications under conditions in the "field." Not all the activities are tests or drills. But even Simulated Emergency Tests give you chances to meet people with similar interests, build your knowledge of operating practices, and make the community aware that you are another available communicator for them in times of need. They make the ham radio community a stronger service.

Finally, would you like to travel internationally once you get the FCC license? If so, contact ARRL, 225 Main Street, Newington, CT 06111-1494, in advance of your departure. On the Web, go to **www.arrl.org/contact.html**. They will help you with information on how to apply for a local radio callsign in order to operate from the foreign country while you're there.

Go Ahead! Take the Plunge!

Becoming a ham is a unique achievement. You can become an ambassador of goodwill as a communicator, and you will also meet a lot of talented, active friends along the way. I have, and I have always been happy to be a communicator.

Are you up to the challenge? Call one of the Volunteer Examiner Coordinators today and ask them to help you get started in this exciting hobby. It's your life; ham radio can make it better.

Taking the Technician Exam

By Brian Rogers, KD8HAZ

One of my grandmother's favorite clichés was "You can't teach an old dog new tricks." She used it any time she wanted to avoid learning a new technology, like using an automatic pop-up toaster.

What no one in the family ever considered was that maybe the old dog could recall some of the tricks he performed as a puppy, even if a long time had passed since puppyhood.

The latter statement might be true, because I just became a licensed ham radio operator again after a break of more than half a century.

It happened because a local community college, through its "College of Lifelong Learning," offered a class called "Discover Amateur Radio." Provided by the Motor City Radio Club, a Detroit area ham radio organization, the course aims to take someone with no previous radio knowledge and prepare him or her for the entry level Techician level amateur radio operator's license examination.

The 11-week course would culminate with the administration of the Techician exam by ARRL (American Radio Relay League) certified Volunteer Examiners during the final session.

Why not take the class, I thought? I'd acquired a Novice ham license while in high school. To earn it, I'd traveled to downtown Detroit and, at the Federal Office Building there, sent and received five words per minute of radiotelegraph (Morse) code and taken a written examination.

But the license was valid for only one year and could not be renewed. Near the end of that year, I went away to college, lived in a dorm, studied hard (occasionally) and played low brass instruments in the marching and concert bands. The Novice ham license lapsed, and I barely noticed.

I even sold my receiver, a Hallicrafters S-38C, for $20 to finance a date to the college's annual ROTC Military Ball.

Back to the Books

At the first meeting of the community college class, the instructors – husband and wife team, Dave, KC8OBH, and Linda, KC8PKY – sold us the class's textbook, the *ARRL License Manual, Level 1, Technician*.

Getting into the book the following day reminded me of a whole lot of things I'd learned to pass the Novice exam in 1954. Ohm's Law – a formula for calculating resistance, current and voltage in an electrical circuit when two of the values are known – was exactly the same as it had been then. The law had not been, as the attorneys I worked for in the intervening years might have said, "overturned on appeal." It was still good law.

The "Q" code, ham operator shorthand for such items as interference, location and static, had not changed. The formula for calculating transmitter power was the same; and believe it or not, the ionosphere's layers, through which some radio waves are refracted and returned to earth, still have the same letter labels they had half a century ago.

Sure, there was new stuff to learn. There were no computers 50 years ago, so there was no material then about linking ham transmitters to the Internet or going on the FCC's Website to investigate your license status.

The *ARRL Technician License Manual* is well written and in the back is the entire 300 plus question pool from which are chosen the 35 questions on the Technician exam. There are references to applicable questions from the pool at the end of each manual section.

Getting Testy!

After about two weeks of study, I thought I was ready to try the test, even though the class testing session was yet a couple of months away. I didn't want to wait that long!

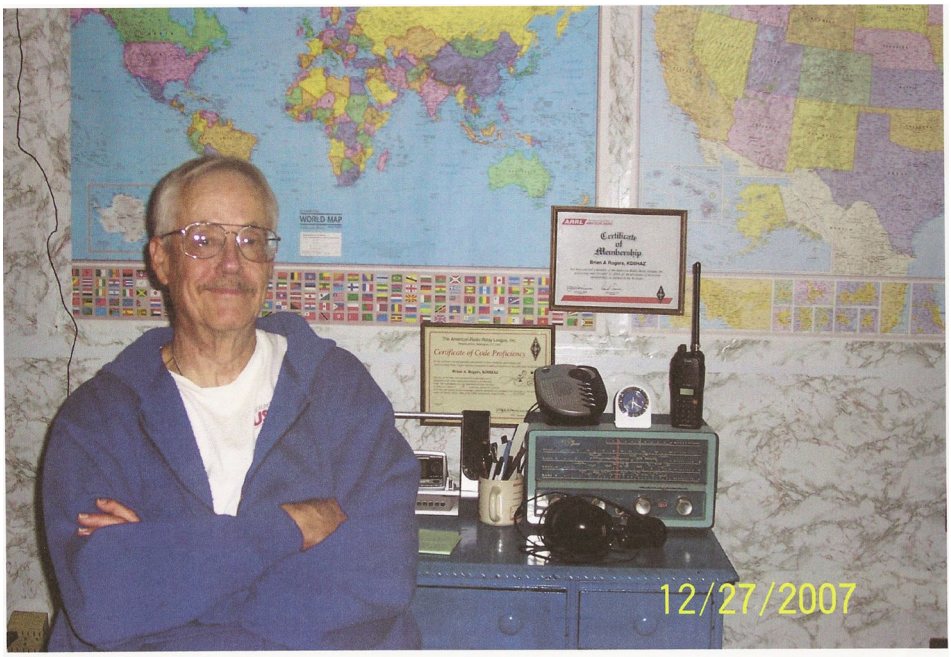
On the ARRL's Web site (**www.ARRL.org**) is a schedule of Volunteer Examiner administered tests. You can find one close to you by inputting your Zip code. I found one in a city about 20 miles away and contacted the test organizer whose e-mail address appeared as a link from the schedule listing to tell him I'd be there. Some tests allow walk-ins and others don't, but it's probably a good idea either way to let the organizer know in some fashion you're going to attend.

There were six members of the radio club at the testing session. Three were Volunteer Examiners; one distributed paperwork to the examiners and the test-takers, one collected the $14 fee and checked IDs, and one directed newcomers to the room in which the test was to be given. It's necessary to show two pieces of identification, one of which must display a photo. I used my driver's license and voter registration card.

There is no longer a code examination to become a licensed amateur radio operator in the United States, so the three of us being tested each received a yellow test booklet and an answer sheet as soon as our IDs had been checked and money paid.

The examiners situated us far apart in a large room, so there was no possibility we could see each others' answer sheets.

Another gentleman and myself were taking the Technician exam and the third was upgrading from General Class to Extra. Those are the three classes of Amateur Radio license presently autho-



Longtime MT contributor Brian Rogers, with his newly-minted amateur license and ARRL membership.

Brian Rogers KD8HAZ, shows off his Icom 2-meter handheld to grandson Connor Lang. His vintage 1960 National NC Sixty Special receiver sits in the background. (Photos by Allison Lang, age 13.)

rized by the FCC (Federal Communications Commission), Technician, General and Extra. Each advancing class offers the licensee additional modes of operation and frequency privileges.

There are four possible answers for each question, and the examinee blackens in on the answer sheet the number of the answer he or she believes is correct. The answer sheet is then reviewed by each of the three Volunteer Examiners using a holed template over the answer sheet. All three examiners check the answer sheet and must each, individually, agree on the number of correct responses. Twenty-six out the 35 questions must be answered correctly.

If a candidate is successful, he or she will receive a Certificate of Successful Completion of Examination (CSCE) signed by each of the three examiners and specifying which exam has been passed. An illustration of the document appears on page 5-5 of the *Technician License Manual* along with a picture of the Application for Amateur Radio Operator/Station License, called Form 605, parts of which are filled out by the candidate and others by the examiners.

Bated Breath

In the pre-Internet olden days, like when I took my first ham test, you didn't learn your call letters, assuming you passed the test, until the mailman dropped your license into your mailbox two or more weeks later. But now, after as little as a week or less, you can go on line to one of several Web sites to look yourself up. Among these sites are **hamdata.com** and **qrz.com**.

There are other sites that are a big aid in preparation. Among these are **eham.com**, and, of course, the ARRL site mentioned previously.

It's great to again be a licensed ham! To any senior citizen who was a ham when young, or anyone of any age who wants to learn about radio and electricity and be a licensed ham, I say a hearty "go for it!"

Fun with Emergency Communications

By Brittany Decker KB1OGL

Does that sound like a contradiction? While practicing for emergency communications can be a lot of fun for everyone, their importance is not to be taken lightly. In times of disaster, such as Hurricane Katrina, amateur radio emergency communicators have always been ready to provide their services wherever they are needed.

Many organizations use amateur radio to help in emergency communications, such as ARES, RACES, and SKYWARN. Their services are crucial to the response in a disaster-stricken area because, without regular means of communication, emergency officials cannot be informed as to where people are in danger in order to save or help them. This is certainly something to think about, since next time there is a disaster, *you* could be the one relying on emergency communications to help rescue you!

The Big Three

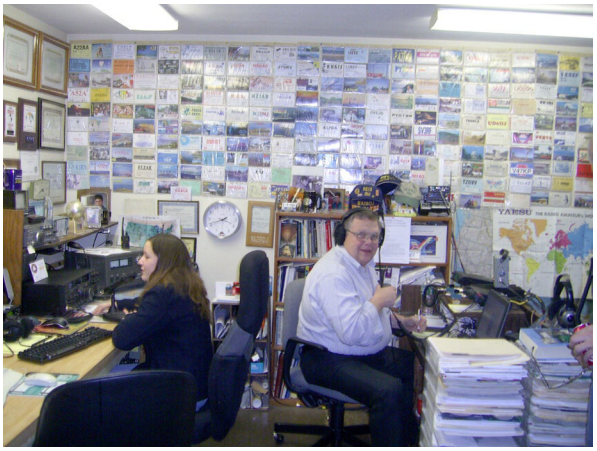
While it is possible to help with emergency communications as an individual ham who is in the right place at the right time, this is not the norm. Most emergency communications require a network of organized, experienced hams. There are three major groups whose primary purpose is to train amateurs and provide communications in an emergency.

ARES

One of the service organizations is the Amateur Radio Emergency Services, or ARES. ARES is organized in four levels; national, section, district, and local. Sections too large to organize effectively may be broken down into smaller districts.

Each local area, district, and section has an Emergency Coordinator. There are also Assistant Emergency Coordinators which make up local planning committees. At the local level, organization is key, as it is the level where most of the emergencies occur, and ARES leaders make direct contact with the volunteers and with agency officials.

Even with all this pre disaster preparation, the emergency net is where it really counts. Handling traffic efficiently, calmly, and with little



Brittany and Dave (K1WER) worked about 100 contacts during 2008 Winter VHF contest, using Bill NE1B's shack.

During the 2008 Winter contest, Brittany and her brother Andrew racked up an additional 2,000 points by operating outdoors on generator power. The tarp provided little heat once the sun went down!

error can be difficult. That is why every ARES volunteer undergoes training in this area.

RACES

Another emergency organization is Radio Amateur Communication Emergency Services, or RACES. Created in 1952, it is RACES' job to provide communications between officials and police and firefighters, provide assistance to victims of disaster, and if the RACES volunteer cannot assist victims directly, to find someone who can.

Both ARES and RACES have provided their services during various disasters, including 9/11 and, in August of 2005, Hurricane Katrina. Many volunteers have helped in New Hampshire and Massachusetts when there was massive flooding in the spring of 2006. They also helped during the California wildfires in 2007, and in areas devastated by tornadoes. These organizations also help in various search and rescues.

SKYWARN

SKYWARN is another organization oriented more toward weather warnings than assisting with disasters. SKYWARN is made up of volunteers dedicated to watching and reporting weather patterns and storms to the National Weather Service.

Some volunteers chase these storms to track and report their path. These reports are then used to warn people of incoming tornadoes, hurricanes, or other natural disasters. SKYWARN's purpose is to prevent people from being injured by natural disaster, while RACES and ARES help the people who have been injured.

During the flooding in New Hampshire and Massachusetts, SKYWARN reported cloud formations and precipitation to the National Weather Service, who then informed the public about possible flooding.

In January 2007 a disastrous ice storm in New England knocked power out for weeks. SKYWARN had helped to predict this massive ice storm and helped inform the public. A SKYWARN net was established on 2 Meters for amateurs to share weather reports during the storm as well as information about the power outages for their town. Since there was no power, this helped my family to stay informed about current weather conditions.

I also enjoy reporting weather information to the local SKYWARN net. When a winter storm approaches, I always go onto the SKYWARN net when I get home from school. I find that by listening to temperature and precipitation amounts in the surrounding towns, I can form my own conclusions about the path of the storm. With SKYWARN, who needs the weather channel?

Field Day

Though amateur operators are encouraged to join one of these emergency communications groups, amateurs can also prepare for emergencies by participating in field days, using emergency power supplies. As the ARRL web site says, "ARRL Field Day is the most popular on-the-air operating event in amateur radio. On the fourth full weekend in June, tens of thousands of amateur radio operators gather for a public demonstration of our service. Field Day is part educational event, part operating event, part public relations event – **and ALL about FUN!"**

There are two field days: Winter Field Day and Summer Field Day. Winter Field Day is very new and is sponsored by the Society for the Preservation of Amateur Radio, or SPAR. The objective of Winter Field Day is to test an amateur's ability to operate in times of emergency during the winter time. The first Winter Field Day was in 2007 – also my first Winter Field Day.

It was my first real contest, and I found out that contesting was harder than it looked. My dad and I decided to try to win the contest. Though it was fun, I fell asleep at around midnight. We had not really prepared much for Winter Field Day, but I still enjoyed it.

The regular ARRL Field Day tests an amateur's ability to operate in an emergency during the summer time, and my first field day was with the local Nashua Area Radio Club in 2007. I did not know what to expect, and when we arrived, the clearing where the club was setting up was bustling. It was a camp site, a radio room, and a kitchen all mixed together.

Huge antennas adorned either side of the clearing, and there were many tents in all different sizes, shapes, and colors. The Salvation Army provided the food and drinks, and the local communications department was also there. My dad and I welcomed anyone who was interested in amateur radio and told them a bit more about it.

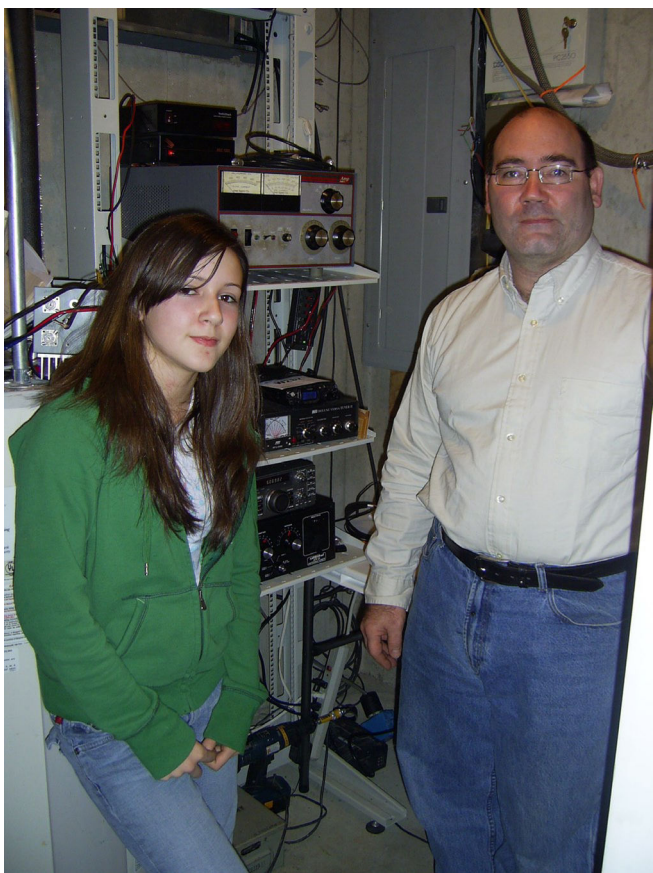
When the sun set, we were in charge of making 10 Meter contacts. I was able to jump over to the 40 meters tent and make many contacts from there. It was pretty difficult to do high speed contesting like that. I also got a chance to practice my logging.

When I went back to my own tent, it was around 2 a.m. and I was exhausted. My dad encouraged me to keep making contacts on 10 meters, but I couldn't keep my eyes open. I climbed into my sleeping bag with mosquitoes biting my face and buzzing in my ears, but I was too tired to care.

In the morning, we got breakfast and I got to see how the hundred foot towers were taken down. It was a slow process, but the club got them taken down safely.

Both Field Days were very enjoyable, but they also gave me peace of mind. They made me realize that with amateur radio, help is a lot closer when you need it.

My name is Brittany Decker, and my call sign is KB1OGL. I am 14 years of age, and I participate in SKYWARN nets every time there is any kind of storm. In New Hampshire, there are few life-threatening natural disasters, so many people become careless about preparing for an emergency. However, in 1978 there was a blizzard that caused the deaths of nearly 30 people. I know that next time something like that happens, it will be the SKYWARN, RACES, and ARES officials and volunteers who are organized and ready to help.



Brittany and her dad, Paul (KG7HF), in their ham shack, in front of their equipment: a Kenwood TS-680S and a Yaesu FT-817 with the help of a kilowatt amp.

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *What is the speed of electrical current in a wire? (Previous inquiries)*

A. While radio waves travel through the vacuum of space at the speed of light (299.8 million meters, or 186,282 miles, per second), those are electromagnetic fields of energy, not electrons. When you switch on a light or turn on your radio, there is an instantaneous kick of potential energy (voltage) which travels through the wire at about one million meters, or 621 miles, per second. But the actual movement of electrons through the wire, called "drift velocity," is a sluggish 1 millimeter per second, or about 12 feet per *hour*!

Q. *I recently purchased a digital camera and a laptop which came with small, lightweight battery chargers. Since they don't have a heavy transformer, how do they work? (Bob Kirchhoff, Olympia, WA)*

A. Switching-type power supplies use solid-state electronics to reduce and rectify the higher AC line voltage down to lower voltage to operate the equipment and charge the batteries. Their only drawback is that if not properly designed (the cheaper ones), their switching circuitry generates severe hash noise interference in nearby radio receiving equipment.

Q. *I need to improve my 800 MHz digital reception with a better antenna than my present Radio Shack discone. My Scantenna got downed by ice and wind. What would be the difference between LMR400 and RG-6/U coax for 100 feet at 800 MHz? Would a preamp like the GRE Super Amplifier or the Ramsey preamp help? (Michael Henderson, email)*

A. Keep in mind that digital streams often require a fixed, readable signal level, sometimes higher than analog, to operate successfully. I have always found the ScanTenna (which has gain) to be the best of all multiband omnidirectional antennas, including discones (which have no gain). If you need additional gain, you have two choices: switch to a commercial, single-band collinear; or switch to a rotatable beam like the Grove Scanner Beam (lowest cost, but weakest in weather) or the Create LPDA (highest cost, but strongest in weather). Both perform about the same.

Pricey LMR400 has a slight edge over inexpensive RG-6/U in low loss, but at 800 MHz and 100 feet it's too close to call (about 2 dB).

A preamp is a good option, but for overcoming coax loss, you have to place it up near the antenna and feed the DC through the coax. Masthead preamps are vulnerable to nearby lightning strikes and strong-signal overload; if you have strong signals nearby, you may need to add one or more trap filters, often between the antenna and the preamp.

The GRE and Ramsey preamps both work very well, but both would have to be slightly modified and weather protected to be mounted outdoors near the antenna.

Q. *In the December 2007 issue you gave a brief treatment about grounding radio equipment to reduce electrical noise interference. But what if you live in an apartment building that doesn't allow wire grounds? Will grounding to an electrical outlet help? (Mark Black, Austin, TX)*

A. If you're a ham and you need to have low VSWR to transmit, then you need a counterpoise like a resonant length of ground wire for the operating frequency. Another possibility is an "artificial ground" like the units made by MFJ.

But those devices simply match the impedances properly, and don't do anything for received noise. Generally speaking, living in a high-rise apartment doesn't let you have an earth ground near enough to affect the electrical noise problem, and that includes the third-wire ground on the power line. About the only thing that works is a noise canceller such as those made by MFJ, Timewave and others. These connect to your antenna and also have a random indoor wire antenna to purposely pick up the interference. The interference signal is added out of phase to the noise on the antenna, thus canceling it, or at least reducing it.

You can also try an audio filter which discriminates against the noise even when present in the receiver, enhancing the desired audio: **www.grove-ent.com/dsp599zx.html**

Q. *I have a choice between two high-voltage transformers for a climbing-spark Jacob's ladder; one is 10 kV, the other 12 kV; should I choose the higher current or the highest voltage for the best spark gap? (Mark Burns, Terre Haute, IN)*

A. Use them both. Connect the primaries in parallel and the secondaries in series and you'll have 22 kV! But they have to be properly phased so that the output voltages add to each other rather than subtract! You won't know without actually drawing an arc and seeing if it's longer or shorter than with just one transformer, and that's OK to do.

If you need to reverse the connections on one of the transformers, it won't matter whether you do it with the primary or the secondary. Just be careful with these lethal voltages, and don't let the transformers overheat!

The best Jacob's ladder I ever had as a kid was made with the transformer out of an old Xray machine – 100,000 volts! It was immersed in oil and covered with a layer of beeswax. The first time I tried it, it actually threw a 4" arc and climbed up until it was about a foot across! Unfortunately, that short adventure spelled doom for the transformer, and all I had left was a boiling pot of oil and beeswax!

Q. *Can you identify this family heirloom? It's a 4-pin, 4-1/4" vacuum tube with a line-up pin on its side, and it's marked "Trepassey Azore Plymouth NC May 1919" and the designation "GCIG2." It is accompanied by a news photo clipping: "Navy Curtiss NC-4 flying boat, first aircraft to cross the Atlantic 1919." (Ed Diamond, Evansville, IN)*

A. It was in Trepassey Harbour, between Labrador and Newfoundland, where Amelia Earhart boarded "The Friendship" in 1928 to become the first woman to fly across the Atlantic Ocean. But nearly decade earlier, on May 16, 1919, the U.S. Navy's Curtis Flying Boat, the NC-4, departed Trepassey and flew to Portugal via the Azores, completing the first transatlantic flight; it returned on May 31 to Plymouth, England.

The NC-4 was equipped with in-flight wireless equipment capable of up to 300 miles communications in both voice and telegraph. I suspect the tube is actually a CG-1162 five-watt oscillator, common for military gear of the period.

As to whether this tube was actually used in one of the flights, or for Navy surface support which was extensive for that historic voyage, or just the same type as used in that period is open for conjecture. But it's a valuable artifact, so don't break it!

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.)

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10 METERS: Beginner's HF Wonderland

The 10 meter band is HF's attic and it's also a wonderland for new operators. No other band is so big (28.000 to 29.700 MHz) with so many modes and so many quirks. When conditions are good it takes minimum equipment, minimum power, and minimum-sized antennas to work stations across the county or around globe. And, it's a shortwave listener's dream band, too. No other single band offers AM, FM, SSTV, SSB, CW, RTTY, PSK31, repeaters, and satellite downlinks. It's truly a magical place.

But, the first step to success on 10 meters is to know what the band plan is. If you don't have a copy of the *ARRL FCC Rule Book* ($12.95 at **www.arrl.org**) you should get one. It's the last word on what you can do and where you can do it. It also helps settle arguments with those who only *think* they know the rules. Rudiments of the plan are found in the chart on page 21.

Who's on 10?

Sometimes you'll turn on your transceiver or shortwave radio and you won't hear a thing on 10 meters. Is the band dead, antenna disconnected, something wrong with your radio? The answer can often be found by seeing what others around the world are hearing. To do this, go to a web site called DX Summit (**www.oh2aq.kolumbus.com**) and click on 28 MHz. This brings you to a global list of what's being heard on ten meters. The list is updated every three minutes. The last 50 spots are listed, which gives you an idea of how things have been going over a period of time. For instance, if the last spot was made at 1100 Z and it's now 1800 Z, that should let you know that, world-wide, the band is just not open.

On the other hand, it may only indicate that nobody's transmitting. Now go to the beacon portion of the band (28.200-28.300 MHz) and listen for CW signals that keep repeating. These are 10 meter transmitters set to automatically send the operator's call sign and occasionally other bits of information (see my detailed article about 10 meter beacons in *MT* May 2007 and on-line at **www.monitoringtimes.com**). These are usually low power stations operating at 10 watts or less. Make a couple of slow passes through the band and listen carefully. Sometimes there's a lot of QSB (fading) on the band where a signal will not be heard and then it will suddenly rise to a good enough level to copy. If you can copy any signals on the beacon band, then 10 is open.

As with most bands, the CW portion is at the bottom (28.000-28.070 MHz) and phone activity is higher up (28.300- 29.700). But, 10 meters is so big and there are so many modes that there are specific places to operate each mode. It's important to observe these operating guidelines in order to be "a considerate operator."

The FM simplex calling frequency is 29.600 MHz (Don't forget to switch your mode to FM.) Leave the transceiver or radio tuned to that frequency for a while and see if anyone shows up. There are FM repeaters that are set up at various locations, notably in the Caribbean. The repeater inputs are found from 29.510 to 29.590 MHz. When the band is open you'll hear hams from all over using them.

The BPSK31 digital frequency is 28.120 MHz. Listen for the distinctive whine of a PSK31 signal. If you have a program such as HamScope, plug the speaker output of your radio or transceiver into the mic input of your computer's sound card and decode the data. You may be surprised who's on the band!

Tune from 28.070 to 28.189 for the familiar RTTY "deedle-deedle" sound. Listen for AM operators from 29.000 to 29.200 MHz; you'll hear quite a few operators using modified CB radios here. You can catch SSTV images on 28.680 and David Woolstrum K3ASI operates an SSTV repeater at 28.690 MHz.

Satellite downlinks are heard between 29.300 and 29.510 MHz. There's a 6 meter meeting frequency on 28.885 where avid 6 meter enthusiasts group to discuss DX openings and general conditions on 6 meters. Rare DXpeditions often operate on 28.495 in USB. They'll sometimes operate simplex (use the same frequency to listen and transmit), but sometimes they'll operate split (transmitting on 28.495, for example, and listening up or down 2 kHz, depending on what they say).

When a station is operating split, it's very important to follow the protocol. Use the split function on your transceiver and make sure you're using the right VFO (listening on VFO-A and sending on VFO-B). If you listen to 28.1010 (CW), 28.380 and 28.480 (USB), you'll hear members of Ten-Ten International, a long-time organization of hams whose mission is to see that 10 meters is used.

There has always been a fear that hams would lose this band if it appeared to commercial interests that these frequencies weren't being used. So, Ten-Ten set out to make sure there would always be at least some legitimate operators on the band. For more information check out **www.ten-ten.org**.

One problem with 10 meters is that it does attract a number of CB operators who got bored with 40 channels but haven't been told how easy it is to get a ham ticket. They've found that it's easy to buy transceivers capable of operating 10 meters at many truck stops across the country where a ham ticket isn't even an afterthought. But, even legitimate ham radio dealers can sell to operators who have no intention of getting a license.

So, you'll sometimes hear truckers happily chatting away, South American and Caribbean unlicensed operators yakking, and a few escapees from CB, all of whom pop up anywhere they like on the band and in an unconventional mode. You'll know them by their bad audio, cussing, and no ID. When the band is really open, they're usually easily chased back to 27 MHz by the hoards of licensed hams invading their territory. No doubt they wonder where in the world all of these operators are the rest of the time!

What You Need to Get on 10

Any radio capable of transmitting and receiving the 10 meter band will work. I've heard operators using vintage gear, converted CB sets, home-brew transmitters with a store-bought receiver – you name it! In the last great sunspot cycle (22) a number of manufacturers had 10 meter-only rigs available, including Uniden, Radio Shack and Ranger Communications Inc. (RCI).

Only RCI still makes 10 meter-only sets (see below). Unfortunately, they seem to be marketed to the CB/Trucker crowd (no other amateur radio manufacturer designs a rig with an echo button!). But, used Uniden 2510 and 2600 models as well as Radio Shack's HTX100 are found regularly at hamfests and occasionally on **www.eham.net**.

One drawback to the 10 meter-only rigs is

One of the last 10 meter-only transceivers still in production is made by Ranger Communications and comes in a variety of models. The RCI-6900F-25 features AM/FM/CW/SSB 10 watts output (25 SSB) and sells for about $290. (Courtesy: Ranger Communications)

Two great 10 meter rigs: Uniden's 2510, and Radio Shack's HTX100 are relics of Cycle 22 when the band was hot. Both have long been out of production but are often found at hamfests. (Courtesy: Eham.net)

that they don't feature split operation as discussed earlier. If you come across a DX station operating split, you'll just have to pass it by.

Because of the peculiarities of 10 meters, there's no need for a lot of power on this band. That's why the older 10 meter-only rigs were typically 10-25 watts output. That's plenty of power to work the world when the band is open, and that makes these little rigs perfect for RTTY and BPSK31 modes where low power is all it takes to make DXCC. Of course, you'll need an out-board power supply to power any transceiver unless you operate on a battery.

Antenna requirements for 10 are also minimal. When the band is open, almost anything can be used as an antenna. I've worked hams using everything from wires tossed out windows to rain gutters as antennas. A rotatable dipole for 10 meters takes up very little room and can be placed on top of your outdoor TV antenna mast. Even three element beams for 10 meters are relatively small, inexpensive and lightweight (see below).

A mag-mount CB antenna can be trimmed to 10 meters and used as a mobile antenna. Similarly, a CB ground-plane antenna can also be trimmed for use on 10 and has the advantage of being omni-directional. You'll hear many hams using converted CB antennas on 10 meters when it's open.

Your Key to Cycle 24 Fun

As Cycle 24 develops you'll be amazed at the activity that can be found on 10. At the peak of 22 I can remember tuning 10 meters any evening in the fall and hearing nothing but JA's (Japan). It's a snap to work DXCC on 10.

Or, you can invent your own contest. I worked a ham that was in a lunch-time contest with a buddy to see who could work all states during lunch hour first. Their contest rules were simple: M-F, lunch hour only on 10 meters. First one to get 50 states confirmed wins!

Ten meters is the perfect place to learn new modes. It's not as crowded as 20 meters and you'll find the operators are far more friendly. There is a much more collegial atmosphere on 10 and you'll come across lot of old-timers who are more than willing to take the time to help new-comers improve their signals or operating skills, or just to chat.

So, now is the time to plan your 10 meter activities. Check out the local hamfests for a Uniden or Radio Shack 10 meter rig. Plan to build your own 10 meter beam. Think about putting a 10 meter rig in your car. I've worked dozens of countries while on the morning and evening commute on 10.

If you don't have your ham ticket yet, this is the perfect time to get one. No Code, what are you waiting for?!

ARRL 10 METER BAND PLAN

28.000-28.070	CW
28.070-28.150	RTTY
28.120	PSK31
28.131	Propnet Beacon Project
28.115-28.199	International Beacons
28.200	NCDXF Beacon project
28.200-28.300	Beacons
28.250	Synchronized beacons
28.300-29.300	Phone
28.680	SSTV
29.000-29.200	AM
29.300-29.510	Satellite Downlinks
29.520-29.590	Repeater Inputs
29.600	FM Simplex
29.610-29.700	Repeater Outputs

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VoIP and Ham Radio

Imagine talking to a ham in Australia without a bit of interference! How would you like to use your Technician class license to have a QSO with a ham in Europe? Can you imagine being mobile in your car and talking through a repeater in another country, or running a net on each coast of the US?

That is the promise of VoIP (Voice Over Internet Protocol) and we have seen several different ways that this protocol is being used in the amateur radio community. Each method of ham radio VoIP implementation has its supporters and detractors, but everyone does agree that it has made VHF/UHF repeater communications more interesting to use and has increased repeater coverage well beyond their normal line of sight range.

❖ IRLP

The Internet Radio Linking Project (IRLP) is a program that links amateur radio stations around the world by using this VoIP technology. Each gateway in the IRLP network consists of a dedicated computer running custom software that is connected to both a radio and the Internet. This arrangement forms what is known as an IRLP Node. Since all end users communicate using a radio, as opposed to using a computer directly, IRLP has adopted the motto "Keeping the Radio in Amateur Radio."

IRLP was invented by David Cameron, VE7LTD. Cameron installed the first three IRLP nodes in November of 1997. They used the Windows operating system (OS) with VocalTec's iPhone installed. There were problems with the software, mainly in the fact that iPhone is not very stable nor is it controllable. After running iPhone for close to six months on active connections to nodes in Canada, Cameron decided to rebuild the nodes. This is when the Linux operating system and the Speak Freely software were first tested.

Using IRLP lets amateur radio operators within range of a local node to use DTMF to initiate a node-to-node connection with any other available node in the world. Each node has a unique four digit node number in the range of 1000-8999. A real-time searchable list of all nodes worldwide (including their current status) is available on the net by viewing the IRLP Network at a glance page (see resources). As of March 2008, there are 1454 nodes in 43 countries.

Stations wishing to communicate with three or more nodes at the same time may accomplish this by connecting to an IRLP Reflector. Most reflectors on this network have 10 channels (0-9) with channel 0 being the main channel. Each reflector has a unique four digit node number in the range of 9000-9999. The first three digits consist of the reflector number, while the fourth digit represents the channel number. At press time there are 22 operational reflectors. Since most reflectors have 10 channels, the result is approximately 220 unique reflector channels available for use.

Some of the pluses and negatives of IRLP include:

- Specialized interface is required and is strictly repeater to repeater system. Connects repeaters not individual users
- Requires a proprietary interface board costing around $100. There is also a donation that is suggested by the network owners to keep the system operational.
- Linux operating system

There is a link on the IRLP website that will let you stream audio from some of the IRLP nodes over the net (see the resource section).

❖ WIRES-II

The Wide-Coverage Internet Repeater Enhancement System or WIRES™ is a standard created by Yaesu Vertex and is designed to link compatible amateur radio repeaters over VoIP. This allows any home stations using those repeaters to communicate with each other using the VoIP protocol..

WIRES uses DTMF signaling to make a connection over the Internet from a repeater or home station to another WIRES-equipped station that is accessible over the Internet. No proprietary tones or connection formats are used, so any manufacturer's radio (equipped with a DTMF encoding keypad) may be used to bring up the Internet link.

This network began as an experimental Internet linking project in California and the initial Beta testing led to the development of an expanded and enhanced protocol, known as WIRES-II.

WIRES-II is a system of using the Internet's voice-communication capability as a bridge between distant stations. Where simplex- and repeater-based communications were basically limited to a local coverage area, with WIRES-II it is now possible to use the Internet as a long-distance link, allowing city-to-city, country-to-country, or continent-to-continent contacts from your hand-held or mobile rig. With WIRES system linking, the distance between mobile or hand-held units becomes irrelevant, and the world becomes a much smaller place!

The heart of a WIRES-II node is the HRI-100 interface box. At the repeater site, a personal computer is connected to the HRI-100, which serves as a command and audio-patching controller for the Internet bridge to your computer. Either a dial-up connection or a high-speed line such as a DSL or ISDN line, may be used for connecting to the Internet.

❖ eQSO

eQSO is a client/server software program designed by hams for linking amateur radio RF gateways and repeaters via the Internet. The software may be used by licensed amateur radio operators and Short Wave Listeners provided some basic rules are followed.

Essentially, there is an eQSO server which hosts the network bandwidth (its domain is **Server.eQSO.net**) and which "users" (meaning either eQSO RF Gateways or PC users) connect to from their computers via the internet.

The eQSO software was developed by Paul, M0ZPD, and was intended specifically for use by hams, RF gateways and PC users.

The system requires approximately 15-kbs (kilo-bytes per second) per audio stream. As a user starts talking, either the gateway he is working through or the PC Client he is connected through, sends an audio stream to the server. The server then relays by separate streams the audio to each other client connected to the room. That makes a system like this bandwidth intensive (if there's 10 people in the room, that requires a constant bandwidth of 150-kbs)

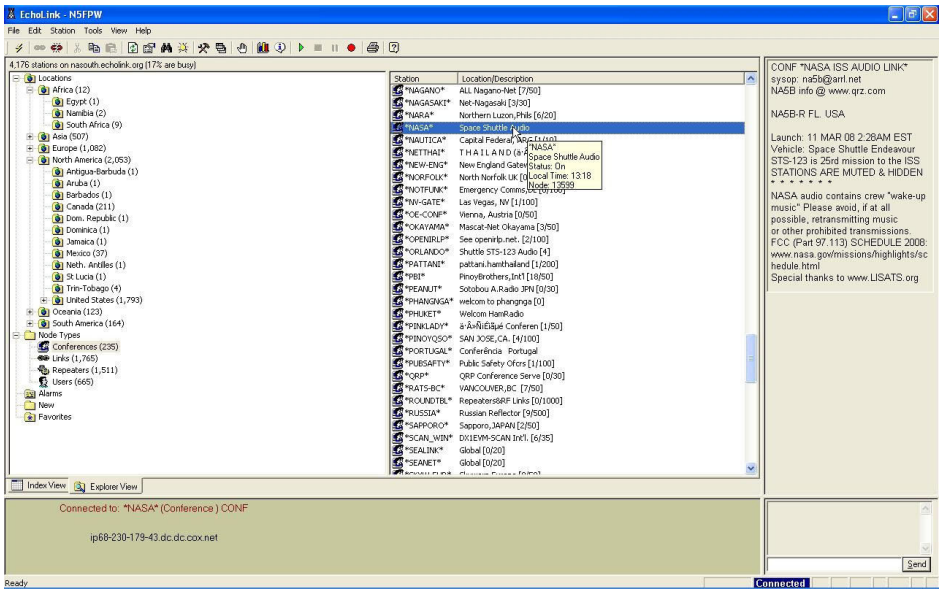
It's the upstream bandwidth that does most of the work, since only one user can talk at a time. So the talking user sends a 15-kbs audio stream down to server which then has to send 'x' number of 15-kbs streams upstream to the listening users and gateways This 'x' is the number of people connected to the server less one (the person talking).

The software is free, the bandwidth is donated and the developers do accept donations via PayPal.

❖ Echolink

One of the least expensive and most extensively used VoIP services used by hams is the Echolink network. Echolink was developed by Jonathan Taylor (K1RFD) in 2002. He received the Dayton Hamvention 2003 Special Achievement Award for this innovative system.

EchoLink® software allows "licensed" amateur radio stations only to communicate



with one another over the Internet. The program allows worldwide connections to be made between stations, or from computer to station, greatly enhancing ham radio's communications capabilities.

There are more than 200,000 validated users worldwide — in 162 of the world's 193 nations — with about 4,000 online at any given time.

EchoLink is a computer program that runs under Microsoft Windows, Linux, or Macintosh and allows radio amateurs to communicate with one another on the internet for at least part of the path between them. The program provides reliable worldwide connections between radio amateurs, greatly enhancing amateur radio's communications capabilities. In essence, it is the same as other VoIP applications (such as Skype), but with the additional unique ability to link to an amateur radio station's transceiver. The software is made available free of charge.

Before using the system it is necessary for a prospective user's callsign to be validated. The EchoLink system requires that each new user provide positive proof of license and identity before his or her callsign is added to the list of validated users.

Radio amateurs using the EchoLink software can operate it in one of two modes:

Single User Mode. If you have an Internet-connected computer, you can use the computer's microphone and speakers to connect to (or through) other EchoLink-enabled computers over the Internet and talk to the amateur at the other end.

Sysop Mode. This entails connecting a VHF/UHF transceiver to an Internet-connected PC with a specially-designed hardware interface (a RigBlaster interface will do just nicely). Doing this enables another radio amateur with their own transceiver, who is within radio range of this station, to communicate with (or through) any other EchoLink-equipped station anywhere in the world. This is a unique feature of EchoLink.

Radio amateurs without the EchoLink software or a computer connected to the Internet can take advantage of the EchoLink network if they are within radio range of a sysop mode EchoLink station. It is also possible to link a sysop mode EchoLink station to a local repeater, further enhancing the communication possibilities.

As I mentioned before, open source software packages that are largely compatible with EchoLink (original version was developed for Windows) are available for Macintosh (EchoMac) and Linux (echoLinux or SvxLink/Qtel), but at the present time they have limited features compared to the Windows version.

The EchoLink software designed for Windows has also been known to work on several Linux builds as well, if loaded through Wine. This route may be the best route to go for the beginner Linux user, as many of the Linux applications require some expertise to install.

If only the sysop mode is required, the SvxLink Server for Linux is a good alternative. It has features that go beyond the original software and its openness makes it quite easy to extend with new functionality.

EchoIRLP is a recent software add-on for IRLP which enables an IRLP node to operate as a sysop mode EchoLink station.

Some of the pluses of the Echolink system include:

It allows individual user connections
The interface used to tie your transceiver to the sound card can be home brewed. This will let you put your transceiver on the air for Echolink use.
No on-going support expenses
Software is available for all three major computer operating system platforms.
Echolink allows hams traveling may stay in contact with hams at home through a repeater link.
Allows Technician class hams the chance to experience DX contacts.
World regulatory agencies like the FCC, ART, IBPT, OFCOM, SRR, etc. have recognized it as another ham "tool" like SSTV or PSK31.

The big thing to keep in mind is that when using these VoIP links is that you must still ID with your ham callsign and follow all regulations including international rules and all third party agreements.

So there you have it. Another facet of the world of radio that is using the Internet to support its communications capability. Now even licensed hams can use the Internet to be a part of the GlobalNet radio community.

HAM VOIP RESOURCE GUIDE

VoIP Applications	URL
Echolink	www.echolink.org/
eQSO	www.eqso.org/
IRLP	www.irlp.net/
IRLP Network at a glance	http://status.irlp.net/
IRLP Streaming audio page	www.irlp.net/listen_live.html
Free Radio Network	www.freeradionetwork.eu/
WIRES II	www.vxstd.com/en/wiresinfo-en/

Dan Veeneman
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www.signalharbor.com

The Changing Scanner Landscape

Faced with aging radio equipment and the need to provide reliable, interoperable, and effective public safety communications, many government organizations are working their way through decisions of how best to spend the public's money. This month we take a look at some of the choices being made, and re-made, across the country. Some of these decisions are not favorable for scanner listeners, as we'll see.

❖ New York

A decade ago the State of New York began planning for a statewide radio network that would provide interoperability between different agencies and jurisdictions. The events of September 11, 2001, emphasized the need for reliable radio equipment and, equally important, the ability for different public safety organizations to communicate with each other quickly and efficiently.

In 2005 the State finalized a contract with M/A-COM, awarding it a contract to be the prime contractor for a $2 billion radio project that would cover all of New York. M/A-COM sold the state on a proprietary technology called OpenSky, a radio-based networking scheme using digital techniques borrowed, in part, from the Internet. A handful of other state and local governments, including the State of Pennsylvania, had previously signed contracts with M/A-COM for OpenSky networks of their own.

Under the New York contract, an installation and deployment plan was developed that started at the western end of the state. It included Erie County and the City of Buffalo.

Last fall the initial installation underwent a series of tests and the results were so poor that in February, Erie County decided not to join the statewide network. According to county officials, all of the public safety agencies that participated in the tests came out against joining, including the Sheriff's Department and the Buffalo Police and Fire Departments. Reportedly the system provided adequate coverage in only 60 percent of the test area, far short of the 95 percent that was promised. Another concern for the county was the estimated $36 million cost to build and maintain the system in their area for the next 20 years.

State officials are claiming that Erie County made a decision too early in the installation process, before all of the necessary network components were operational. They also defend the billions of dollars allocated to the statewide system, insisting that if the OpenSky system doesn't meet the contract requirements then the State does not have to pay M/A-COM.

For their part, M/A-COM defends their technology and its performance, assuring New York residents that OpenSky is reliable and that any delays in the installation of equipment in Erie County was the fault of the county. They point to a lack of access at two repeater sites due to weather and protesters, and explain that the purpose of testing is to discover problems and shortcomings in system performance.

Erie County will provide a "gateway" service for public safety agencies to reach the state network in case of a major emergency, but will otherwise move ahead with upgrades to their existing equipment independently of the state.

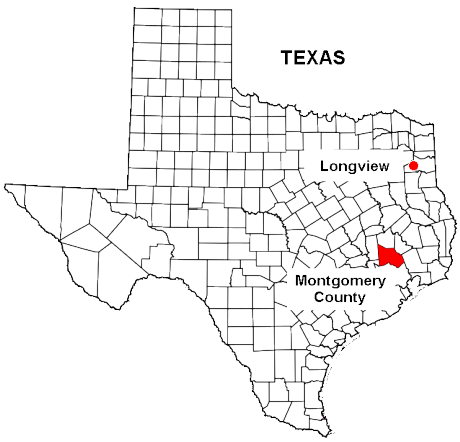
OpenSky is a problem for scanner listeners, since there is no consumer scanner available on the market that can monitor transmissions from these systems. It can be seen as a competitor to Project 25, which is a set of standards established by the Association of Public Safety Communications Officials (APCO).

These standards are recommended by the Department of Homeland Security, which has been a major source of funding for new radio projects across the country. Not coincidentally, a majority of new public safety radio networks follow one or more of the Project 25 standards.

❖ Montgomery County, Texas

Down in the southeast part of Texas, near Houston, Montgomery County is offering $4 million to help the city of Conroe and the Hospital District switch to a new radio system. Back in December the county signed a $10 million contract with Motorola for radio equipment that will enable police and fire departments to communicate directly with each other and with agencies in the greater Houston area.

Harris County operates a Motorola SmartZone radio system supporting 33,000 users in more than 500 departments across nine counties in the Houston region. This system, called the Harris County Regional Radio Network, uses 23 repeater sites and 230 radio channels. Member counties are Brazoria, Chambers,



Galveston, Fort Bend, Harris, Liberty, Montgomery, Walker and Waller.

The system grew out of the merger of 15 different radio systems and is operated and maintained by the county's information technology department rather than a public safety agency. Radio communication on the Harris system is treated like a utility, similar to a telephone company, and participating agencies pay a fee for airtime and radio programming.

Two major efforts are underway for the Regional Radio Network. The first effort is a migration plan to move from the existing SmartZone equipment to new radio gear and infrastructure that follows the APCO Project 25 standards. Such an effort will make the network directly compatible with federal Homeland Security recommendations.

The second effort is to look at the possibility of using frequencies in the 700 MHz band, since there are no remaining 800 MHz frequencies available for the network to expand. The Federal Communications Commission (FCC) reallocated UHF television channels 63, 64, 68 and 69, all of which were in the 700 MHz band, for use by public safety agencies.

The City of Conroe also serves as the backup site for the older SmartZone network and will be the master site for the new Project 25 radio system. This backup site is referred to as "the Bunker" and is located 50 feet underground, making it more survivable in case of major disaster.

Despite the offer of $4 million worth of help, there are still questions of coverage and what will happen to local agencies that cannot afford to join the regional network. Until these issues are worked out and the county completes a transition to the regional network, you can hear activity on the existing Mont-

gomery County EDACS system. It uses five repeater sites located in Conroe, Grangerland, Magnolia, Tamina and Willis. The frequencies used are:

LCN	Frequency
01	866.3250
02	866.7750
03	867.2500
04	867.7750
05	868.2750
06	868.8375
07	866.3500
08	866.8250
09	867.1000
10	867.3250
11	867.8000
12	868.3500
13	868.6875
14	867.3000
15	867.8500

Dec.	AFS	Description
30	00-036	Texas Parks and Wildlife
33	00-041	Patch to 155.340 MHz (Life Flight)
89	00-111	Montgomery County Hospital District
95	00-117	Cypress Creek Emergency Medical Services
97	00-121	Conroe Regional Medical Center
98	00-122	Woodlands Memorial Hospital
99	00-123	Kingwood Medical Center
100	00-124	St. Luke Hospital
101	00-125	Tomball Regional Hospital
110	00-136	County Fire 1 Dispatch (patched to 158.820 MHz)
111	00-137	County Fire 2 Tactical (patched to 158.895 MHz)
121	00-151	NOAA Weather Alerts
281	02-031	Conroe Fire 1 (link to 154.190 MHz)
282	02-032	Conroe Fire 2 (possible link to 154.250 MHz)
265	02-011	County EMS (link to 155.325 MHz)
266	02-012	County EMS 2
267	02-013	County EMS (Tactical 1)
268	02-014	County EMS (Tactical 2)
269	02-015	County EMS (Tactical 3)
270	02-016	County EMS (Tactical 4)
273	02-021	County EMS (Medical Director)
278	02-026	County EMS (Talk)
284	02-034	County Supervisors
417	03-041	Woodlands Fire Dispatch (patched to 155.040 MHz)
418	03-042	Woodlands Fire Tactical (patched to 154.965 MHz)
521	04-011	Sheriff (North)
522	04-012	Sheriff (South/West)
523	04-013	Sheriff (East)
524	04-014	Sheriff (Supervisors)
525	04-015	Sheriff (Detectives)
526	04-016	Sheriff Dispatch (District 4)
529	04-021	Sheriff (Talk 4)
530	04-022	Sheriff (Talk 1)
531	04-023	Sheriff (Talk 2)
532	04-024	Sheriff (Talk 3)
534	04-026	Sheriff (Auto Theft)
535	04-027	Sheriff (Narcotics)
537	04-031	Road Crews (Precinct 1)
538	04-032	Road Crews (Precinct 2)
539	04-033	Road Crews (Precinct 3)
540	04-034	Road Crews (Precinct 4)
542	04-036	Road Crews
545	04-041	County Tactical 1
546	04-042	County Tactical 2
547	04-043	County Tactical 3
553	04-051	Constables (Precinct 1)
554	04-052	Constables (Precinct 2)
555	04-053	Constables (Precinct 3)
556	04-054	Constables (Precinct 4)
557	04-055	Constables (Precinct 5)
558	04-056	Constables
559	04-057	Constables
565	04-065	Animal Control
571	04-073	County Jail
585	04-091	Texas Department of Public Safety
586	04-092	Texas Department of Public Safety (Car-to-Car)
619	04-133	Constables
642	05-002	Detectives
643	05-003	Courthouse Security
657	05-021	Town Center Improvement District (TCID)
778	06-012	Conroe Public Works
779	06-013	Conroe Public Works
780	06-014	Conroe Building Inspectors
782	06-016	Conroe Public Works
785	06-021	Conroe Fire 3 (possible link to 154.325 MHz)
786	06-022	Conroe Fire
801	06-041	Conroe Police
802	06-042	Conroe Police 1
803	06-043	Conroe Police 2
804	06-044	Conroe Police
805	06-045	Conroe Police (Traffic)
806	06-046	Conroe Police (Supervisors)
809	06-051	Conroe Police (SWAT)
817	06-061	Conroe Police (Operations 1)
818	06-062	Conroe Police (Operations 2)
820	06-064	Conroe Police (Detectives)
1601	12-081	County EMS (Tactical 5)
1606	12-086	County EMS (Tactical 6)
1609	12-091	Medical Helicopters
1999	15-097	Medical Helicopters

❖ Longview, Texas

Longview is a city of about 75,000 in East Texas, about 200 miles north of Houston and 130 miles east of Dallas. The city is considering several options to upgrade their existing trunked radio equipment. Like most municipalities, Longview is looking for ways to make it easier for emergency responders to communicate with nearby agencies. They have five proposals from various vendors to consider, which have price tags that run from half a million dollars to over $8 million. The least expensive option is to maintain the existing system, while the high-priced options move the city into the digital age and integrate them with surrounding jurisdictions.

Some of the proposals have elements in common, including the addition of a new repeater site to improve coverage on city outskirts and a transition to APCO Project 25 digital standard equipment. A summary of the options are as follows:

Option/Cost	Lifespan	Description
1 $500,000	5 years	Maintain the current trunked radio system but upgrade and expand the existing dispatch workstations
2 $1 million	5 years	Upgrade two repeater sites
3 $2.4 million	5 years	Upgrade existing analog system and add another repeater site
4 $7 million	15 years	Upgrade existing

repeater sites tower sites to Project 25, add another repeater site and integrate with the Harris County Regional Radio System

5 $8.7 million 15 years Upgrade existing repeater sites to Project 25, add another repeater site and purchase a gateway switch

Longview has been operating a Motorola Type II trunked radio system since 1998 from three repeater sites. Frequencies in use are: 855.2125, 856.7625, 857.3625, 857.7625, 857.9375, 858.3625, 858.7625, 858.9375, 859.7625, 859.9375, 860.7625, 860.9375, 866.4500 and 866.9500 MHz.

Decimal	Hex	Description
16	001	City Tactical 1
48	003	City Tactical 2
80	005	Police (Administration)
112	007	Police
144	009	Police (Supervisors 1)
176	00B	Police (Supervisors 2)
208	00D	Police (Dispatch)
240	00F	Police (Records)
272	011	Police (Car-to-Car)
304	013	Police (Special Operations)
336	015	Police (Special Operations)
368	017	Police (Narcotics)
400	019	Fire/Medical Dispatch 1
432	01B	Fire/Medical Dispatch 2
496	01F	Fire (Administration)
528	021	Fire (Supervisors)
560	023	Fire Talkaround
592	025	Fire Fireground 1
624	027	Fire Fireground 2
656	029	Fire Fireground 3
688	02B	Fire Fireground 4
720	02D	Fire (Training)
752	02F	City Department Supervisors
784	031	Building Inspections
816	033	Collection and Distribution
848	035	Drainage
880	037	Engineering
912	039	Environmental Health
944	03B	Parks
976	03D	Sanitation
1008	03F	Street
1040	041	Traffic Department
1072	043	Wastewater Treatment
1104	045	Water Supply
1136	047	Radio System Administration
1168	049	Utilities
1200	04B	Longview Regional Hospital
1232	04D	Good Shepherd Hospital

❖ Clarksville, Tennessee

For the life of me, I have not been able to figure out how to load Clarksville, TN into my PRO-97 Tx3 scanner. I have read about it using the EDACS and that those frequencies have to be in LCN order. How can I find out the correct order to monitor Clarksville police, fire and EMS? Thank you for your time.

Raymond in Tennessee

Clarksville is a city of about 125,000 in north central Tennessee and is the county seat of Montgomery County. Ten miles northwest of Clarksville lies Fort Campbell, a United States Army base and home to the famous 101st Airborne Division. It is also home to the 160th Special Operations Aviation Regiment (SOAR), also known as the Night Stalkers, made famous during the events in Somalia as described in the book and film *Black Hawk Down*.

In 2001 the city contracted with M/A-COM for a new trunked radio system with three repeater sites operating across eight frequencies. The $3 million system replaced the older conventional equipment operating in the 450 MHz band. The new system is an EDACS (Enhanced Digital Access Communication System) radio network for the Police and Fire Departments as well as Austin Peay State University.

EDACS uses *Logical Channel Numbers* (LCNs) to identify the frequencies in use during a conversation. These LCNs must be entered in the proper order in your scanner for it to track properly. The following table lists the LCNs and corresponding frequencies for the Clarksville system:

LCN	Frequency
01	866.0750
02	866.9375
03	867.3375
04	867.7125
05	868.1375
06	868.4750
07	868.7250
08	868.9750

Voice transmissions in an EDACS network can be in either analog or digital format. Unfortunately for scanner listeners, Clarksville chose to use the digital format, known as *ProVoice*, for their public safety activity. Because there is currently no consumer scanner that can monitor ProVoice transmissions, the city conversations on this system are out of reach. The best that you'll be able to do is observe talkgroup identifiers on an EDACS-capable scanner.

The Clarksville system also hosts talkgroups for Tennessee Homeland Security (THS), which are reported to use analog voice format, so you may be able to hear THS if their talkgroups are active. There is also an unconfirmed report that the dispatch talkgroup for the Clarksville Fire Department, 04-021, may actually be transmitted in analog format.

Dec.	AFS	Description
273	02-021	Clarksville Police (District 1 Dispatch)
274	02-022	Clarksville Police (District 2 Dispatch)
275	02-023	Clarksville Police (District 3 Dispatch)
276	02-024	Clarksville Police (Records Check)
277	02-025	Clarksville Police (Records Check)
279	02-027	Clarksville Police (Command)
282	02-032	Park Rangers
295	02-047	Clarksville Police (Narcotics)
305	02-061	Clarksville Police (Talkaround 1)
306	02-062	Clarksville Police (Talkaround 2)
529	04-021	Clarksville Fire (Dispatch)
530	04-022	Clarksville Fire (Tactical 2)
531	04-023	Clarksville Fire (Tactical 3)
545	04-041	Clarksville Fire (Administration 1)
546	04-042	Clarksville Fire (Administration 2)
547	04-043	Clarksville Fire (Administration 3)
785	06-021	Patch to County Sheriff (460.350 MHz)
788	06-024	Patch to County Sheriff on Tennessee Homeland Security
820	06-064	Clarksville Police (Administration)
881	06-141	City Events 1
882	06-142	City Events 2
883	06-143	City Events 3
929	07-041	Austin Peay State University (Security)

Dayton Hamvention®
Sponsored by Dayton Amateur Radio Association
Since 1952

❖ Dayton Hamvention

Springtime means it's time for the annual Hamvention in Dayton, Ohio. 2008 marks the 57th show, scheduled for May 16, 17 and 18. During those three days there will be forums for radio enthusiasts, as well as indoor exhibitors and an outdoor flea market. Major equipment vendors often make new product announcements during the Hamvention, and there are bargains galore to be found in the thousands of parking lot flea market stalls.

As the home of Orville and Wilbur Wright, Dayton has an *Aviation Trail* featuring several historical sites in and around the city. Wright-Patterson Air Force Base, just east of Dayton, is home to the National Museum of the U.S. Air Force. An hour north of Dayton in Wapakoneta, Ohio is the *Neil Armstrong Air and Space Museum*.

The Hamvention is held at the Hara Arena located at 1001 Shiloh Springs Road in the town of Trotwood, Ohio. You can read more about the convention and check the planned activities at **www.hamvention.org**. If at all possible, take the time to come and spend a weekend with fellow radio enthusiasts.

That's all for this month. More information about scanners is available on my web site at **www.signalharbor.com**. I'll be hunting the flea market isles at the Hamvention in the middle of the month, but will otherwise be checking electronic mail at *dan.veeneman@monitoringtimes.com*. Until next month, happy scanning!

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When you buy your Bearcat 796DGV Trunktracker package deal from Communications Electronics, you get more. The GV means "Great Value." With your BC796DGV scanner purchase, you also get a **free deluxe scanner headphone** designed for home or race track use. Headset features independent volume controls and 3.5 mm gold right angle plug. The 1,000 channel Bearcat 796DGV is packed with features to track Motorola Type I/II/IIi Hybrid, EDACS, LTR Analog Trunk Systems and Motorola APCO 25 Phase I digital scanner including 9,600 Baud C4FM and CQPSK. Also features control channel only mode to allow you to automatically trunk many systems by simply programming the control channel, S.A.M.E. weather alert, full-frequency display and backlit controls, built-in CTCSS/DCS to assign analog and digital subaudible tone codes to a specific frequency in memory, PC Control and programming with RS232C 9 pin port (cable not supplied), Beep Alert, Record function, VFO control, menu-driven design, total channel control and much more. Our CEI package deal includes telescopic antenna, AC adapter, cigarette lighter cord, DC cord, mobile mounting bracket with screws, owner's manual, trunking frequency guide and one-year limited Uniden factory warranty. For maximum scanning enjoyment, order magnetic mount antenna part number ANTMMBNC for $29.95. For complete details, download the owners manual from the **www.usascan.com** web site. For fastest delivery, order on-line at www.usascan.com.

Bearcat® BCT8 Trunk Tracker III

Manufacturer suggested list price $299.95

CEI Special Price $169.95

250 Channels • 5 banks • PC Programmable

Size: 7.06" Wide x 6.10" Deep x 2.44" High

Frequency Coverage: 25.0000-54.0000 MHz., 108.0000-174,.0000 MHz., 400.0000-512.000. MHz., 806.0000-823.9950 MHz., 849.0125-868.9950 MHz., 894.0125-956.0000 MHz.

The Bearcat BCT8 scanner, licensed by NASCAR, is a superb preprogrammed 800 MHz trunked highway patrol system scanner. Featuring TrunkTracker III, PC Programming, 250 Channels with unique BearTracker warning system to alert you to activity on highway patrol link frequencies. Preprogrammed service searches makes finding interesting active frequencies even easier and include preprogrammed police, fire and emergency medical, news agency, weather, CB band, air band, railroad, marine band and department of transportation service searches. The BCT8 also has preprogrammed highway patrol alert frequencies by state to help you quickly find frequencies likely to be active when you are driving. The BCT8 includes AC adapter, DC power cable, cigarette lighter adapter plug, telescopic antenna, window mount antenna, owner's manual, one year limited Uniden warranty, frequency guide and free mobile mounting bracket. For maximum scanning enjoyment, also order the following optional accessories: External speaker **ESP20** with mounting bracket & 10 feet of cable with plug attached $19.95. Magnetic Mount mobile antenna **ANTMMBNC** for $29.95.

Bearcat® BCD396T Trunk Tracker IV

Suggested list price $799.95/**CEI price $519.95**

APCO 25 9,600 baud compact digital ready handheld TrunkTracker IV scanner featuring Fire Tone Out Paging, Close Call and Dynamically Allocated Channel Memory (up to 6,000 channels), SAME Weather Alert, CTCSS/DCS, Alpha Tagging. Size: 2.40" Wide x 1.22" Deep x 5.35" High

Frequency Coverage:

25.0000-512.0000 MHz., 764.0000-775.9875 MHz., 794.0000-823.9875 MHz., 849.0125-868.8765 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

The handheld BCD396T scanner was designed for National Security/Emergency Preparedness (NS/EP) and homeland security use with new features such as **Fire Tone Out Decoder**. This feature lets you set the BCD396T to alert if your selected two-tone sequential paging tones are received. Ideal for on-call firefighters, emergency response staff and for activating individual scanners used for incident management and population attack warning. **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. Useful for intelligence agencies for use at events where you don't have advance notice or knowledge of the radio communications systems and assets you need to intercept. The BCD396T scanner is designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS, LTR and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. **Dynamically Allocated Channel Memory** - The BCD396T scanner's memory is organized so that it more closely matches how radio systems actually work. Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 3,000 channels are typical but **over 6,000 channels are possible** depending on the scanner features used. You can also easily determine how much memory you have used and how much memory you have left. **Preprogrammed Systems** - The BCD396T is preprogrammed with over 400 channels covering police, fire and ambulance operations in the 25 most populated counties in the United States, plus the most popular digital systems. **3 AA NiMH or Alkaline battery operation and Charger** – 3 AA battery operation - The BCD396T includes 3 premium 2,300 mAH Nickel Metal Hydride AA batteries to give you the most economical power option available. You may also operate the BCD396D using 3 AA alkaline batteries. Unique Data Skip - Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. Memory Backup - If the battery completely discharges or if power is disconnected, the frequencies programmed in the BCD396T scanner are retained in memory. Manual Channel Access - Go directly to any channel. LCD Back Light - A blue LCD light remains on when the back light key is pressed. Autolight - Automatically turns the blue LCD backlight on when your scanner stops on a transmission. Battery Save - In manual mode, the BCD396T automatically reduces its power requirements to extend the battery's charge. Attenuator - Reduces the signal strength to help prevent signal overload. The BCD396T also works as a conventional scanner to continuously monitor many radio conversations even though the message is switching frequencies. The BCD396T comes with AC adapter, 3 AA nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, SMA/BNC adapter, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO or ESAS systems. Order on-line at www.usascan.com or call 1-800-USA-SCAN.

More Radio Products

Save even more on radio scanners when purchased directly from CEI. Price includes delivery in the continental USA excluding Alaska.

Bearcat 898T 500 channel Trunktracker III base/mobile	$209.95
Bearcat 796DGV 1,000 channel Trunktracker III base/mobile	$519.95
Bearcat BCD396T APCO 25 Digital scanner with Fire Tone Out	$519.95
Bearcat 246T up to 2,500 ch. Trunktracker III handheld scanner	$214.95
Bearcat Sportcat 230 alpha display handheld sports scanner	$184.95
Bearcat 278CLT 100 channel AM/FM/SAME WX alert scanner	$129.95
Bearcat 248CLT 50 channel base AM/FM/weather alert scanner	$104.95
Bearcat 92XLT 200 channel handheld scanner	$109.95
Bearcat 72XLT 100 channel handheld scanner	$99.95
Bearcat BR330T up to 2,500 ch. Trunktracker III with Tone out	$274.95
Bearcat BCT8 250 channel information mobile scanner	$169.95
Bearcat 350C 50 channel desktop/mobile scanner	$104.95
AOR AR16BQ Wide Band scanner with quick charger	$199.95
AOR AR3000AB Wide Band base/mobile receiver	$1,079.95
AOR AR5000A+3B Wide Band 10 KHz to 3 GHz receiver	$2,599.95
AOR AR8200 Mark IIIB Wide Band handheld scanner	$594.95
AOR AR8600 Mark II Wide Band receiver	$899.95
AOR AR-ONE Goverment/Export sales only 10 KHz-3 GHz.	$4,489.95
Scancat Gold For Windows Software	$99.95
Scancat Gold for Windows Surveillance Edition	$159.95

Bearcat® BC246T Trunk Tracker III

Suggested list price $399.95/**CEI price $214.95**

Compact professional handheld TrunkTracker III scanner featuring Close Call and Dynamically Allocated Channel Memory (up to 2,500 channels), SAME Weather Alert, CTCSS/DCS, Alpha Tagging. Size: 2.72" Wide x 1.26" Deep x 4.6" High

Frequency Coverage:

25.0000-54.0000 MHz., 108.0000-174.0000 MHz., 216.0000-224.9800 MHz., 400.0000-512.0000 MHz., 806.0000-823.9875 MHz., 849.0125-868.9875 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

The handheld BC246T TrunkTracker scanner has so many features, we recommend you visit our web site at www.usascan.com and download the free owner's manual. Popular features include **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. **Dynamically Allocated Channel Memory** - Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 1,600 channels are typical but **over 2,500 channels are possible** depending on the scanner features used. You can also easily determine how much memory is used. **Preprogrammed Service Search (10)** - Makes it easy to find interesting frequencies used by public safety, news media TV broadcast audio, Amateur (ham) radio, CB radio, Family Radio Service, special low power, railroad, aircraft, marine, racing and weather frequencies. **Quick Keys** - allow you to select systems and groups by pressing a single key. **Text Tagging** - Name each system, group, channel, talk group ID, custom search range, and S.A.M.E. group using 16 characters per name. **Memory Backup** - When power is lost or disconnected, your BC246T retains the frequencies that were programmed in memory. **Unique Data Skip** - Allows the BC246T to skip over unwanted data transmissions and birdies. **Attenuator** - You can set the BC246T attenuator to reduce the input strength of strong signals by about 18 dB. **Duplicate Frequency Alert** - Alerts you if you try to enter a duplicate name or frequency already stored in the scanner. **22 Bands** - with aircraft and 800 MHz. The BC246T comes with AC adapter, 2 AA 1,800 mAH nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. For more fun, order our optional deluxe racing headset part **#HF24RS** for $29.95. Order now at www.usascan.com or call 1-800-USA-SCAN.

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US Coast Guard Continues HF Weather

Literally hours after last month's column was sent off, the US Coast Guard (USCG) announced its decision on the future of its high-frequency (HF) weather and navigation broadcasts. As everyone probably knows by now, the news is good:

"The responding public collectively perceives that the USCG HF broadcasts are essential to their safety. There is no viable alternative to the USCG HF broadcasts because present alternatives are perceived by the public to be out of financial reach. Also, marine weather forecasts available through these alternative sources may not guarantee the same level of accuracy, timeliness, and/or sufficiency as provided by the USCG HF broadcasts."

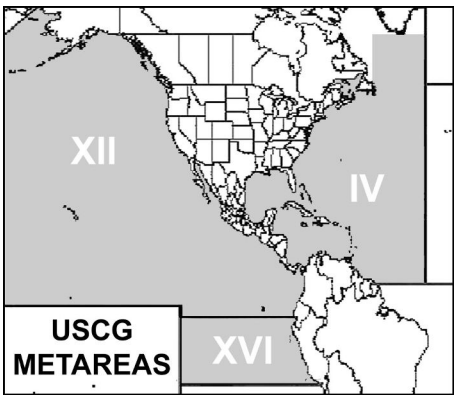
Full information on this decision is at **www.navcen.uscg.gov/marcomms/high_frequency/HF-WX_notice.htm** .

The Problem

According to extensive data provided by the Coast Guard, the problem is the same one that usually comes up in HF radio. It's money, or the lack of same, to replace the Guard's rapidly aging radio equipment. In particular, the immediate issue seems to concern the large HF transmitters it has deployed to cover a huge portion of two oceans.

The Coast Guard operates seven large communication stations, using 123 of these transmitters. Nearly all have a power of 10 kilowatts (kW). Ninety of these are the high-power version of the venerable Rockwell-Collins AN/URT-41, better known to civilian users as the HF-80. Twenty-five more are the Harris RF-755. The remaining eight are the low-power (1 kW) version of the AN/URT-41.

As the Coast Guard notes, these transmitters are becoming expensive to maintain, and they should be regarded as at the end of their service life. The Rockwell-Collins RT-2200 is mentioned as a replacement, and some have already been installed at a total cost exceeding 200 thousand dollars each. These radios are close to the current state of the art, though they take something of a hit on power, down to only 4 kW. The Coast Guard estimates something like 25 million dollars to do all 123. While funding exists, it will never cover this whole amount.



Therefore, the US Coast Guard must cut back its HF communications services. The only question as of last summer was which ones should go. As part of its decision, the Coast Guard hired a consulting firm to prepare a "business report" on whether the voice, teleprinting, and facsimile weather and navigation broadcasts could justify their continued existence on HF.

Public Comments

Last year, the Coast Guard announced a public comment period for this issue. It was seeking answers from mariners to several general questions regarding their use of the weather broadcasts, whether they had been of service, and whether they could find satisfactory alternatives at a reasonable cost.

All the comments are posted to Coast Guard web sites, in two appendices to the main report. In general, the great majority came from owners of pleasure boats, charter yachts, or smaller commercial vessels exempt from the Global Maritime Distress and Safety System.

Nearly all commenters agreed that they used the Coast Guard services every day. Many told harrowing tales of narrowly escaping hurricanes or other threats due to something heard or copied on one of these broadcasts. A few commenters even thanked the Coast Guard for saving their lives with timely information, and hoped future mariners would be equally protected.

Most commenters had no reasonable alternatives. Satellite weather services exist, but not with full coverage of the Coast Guard's huge area of responsibility. HF e-mail is available from commercial providers, at a price, but it is not necessarily as timely or comprehensive.

A minority of commenters said that they had no use for HF weather broadcasts or navigation warnings. In all cases, these were operators of large vessels like oil tankers, who were required by international treaties to use satellites and other alternatives. Obviously, this is a different class of user, with different needs and different financial capabilities. They can get Internet and other resources on the high seas. They can afford it.

The Future

For now, US Coast Guard weather and information broadcasts will continue as before on HF. We will still hear "Iron Mike" (the computer voice who is replacing "Perfect Paul"). Along with these upper-sideband voice (USB) services, we will still have the extensive schedule of weather faxes, and the teleprinting weather and information bulletins in Simplex Telex Over Radio, mode B (SITOR-B).

"Simplex" just means that both stations use the same frequency and transmit in turn. Actually, most two-way SITOR is duplex, using two frequencies, but the capability for simplex is there. Simplex operation is used in the amateur version of this mode, called AMTOR for Amateur Teleprinting Over Radio. AMTOR puts heavy demands on amateur equipment, and is not used much.

The schedules of all USCG's various modes and broadcast products would fill a column in themselves. They are available at the various web sites of the Coast Guard and National Oceanic and Atmospheric Administration (NOAA). *[Also see this month's Fed Files for updated VHF channels - ed.]*

The first HF service to go away may well be the SITOR-A traffic received by the Coast Guard stations on several maritime bands. This mode resembles the AMTOR we mentioned just above, with a distinctive chirp-chirp sound. You've probably heard the markers used in the utility maritime service. They make a banshee screech that's impossible to mistake. Once you've heard it, you'll remember it. Stations also give their callsigns in Morse code.

The markers may well be all you've heard, because this mode is in serious decline. Ships call on another frequency (duplex mode), and the screech changes to the chirp. The contact is very short and easy to miss, making it a good catch under any circumstances.

The Coast Guard can only accept traffic that is limited to several types of emergency or non-commercial messages. These use an automated system that slightly resembles the old (and largely obsolete) Telex. While the formatted position ("AMVER") and weather ("OBS") data is still important, today there are other ways for ships to pass it.

Happy maritime listening, and see you next month.

UTILITY WORLD

UTILITY LOGS

Hugh Stegman

ABBREVIATIONS USED IN THIS COLUMN

AFB.....Air Force Base
ALE.....Automatic Link Establishment
AM.....Amplitude Modulation
AWACS.....Airborne Warning and Control System
CAMSLANT.....Communication Area Master Station, Atlantic
CAMSPAC.....Communication Area Master Station, Pacific
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DEA.....US Drug Enforcement Administration
DSC.....Digital Selective Calling
E03.....UK MI6/SIS "Poacher," Cyprus, 5-figure groups
E11b......"Oblique," 30-group message, "77777" delimited
EAM.....Emergency Action Message
FEMA.....US Federal Emergency Management Agency
HFDL.....High-Frequency Data Link
HF-GCS.....High-Frequency Global Communication System
LDOC.....Long-Distance Operational Control
M08a.....Cuban 3-msg CW/MCW, ANDUWRIGMT = 1-0
M12.....Various Russian CW formats, T=0, ends "000 000"
MARS.....Military Affiliate Radio System
MCW.....Modulated CW or AM tone Morse telegraphy
NASA.....US National Aeronautics and Space Administration
NDB.....Non-Directional Beacon (Aero/maritime navigation)
PR.....Puerto Rico
S11b......"Strich," 30 groups plus "77777," ends "Konyets"
Selcal.....Selective Calling
SITOR-A.....Simplex Telex Over Radio, Automatic Repeat Request
UK.....United Kingdom
Unid.....Unidentified
US.....United States
USAF.....United States Air Force
USCG.....United States Coast Guard
V02a......"Atencion" Spanish numbers, 3-msg format
VOLMET....."Flying Weather," formatted airport observations

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 ( ).

232.0 "GT"-NDB, Grand Turk Island, identifying in MCW, at 1422. (Tom Sevart-Caribbean) *[All Tom's logs this month are from a cruise. -Hugh]*

248.0 "MI"-NDB, Miami, FL, MCW at 1818. (Sevart-Caribbean)

330.0 "SJ"-NDB, San Juan, PR, MCW at 1858. (Sevart-Caribbean)

391.0 "DDP"-NDB, San Juan, PR, MCW at 1504. (Sevart-Caribbean)

426.0 KSM-Maritime Radio Historical Society commercial coastal station, Pt. Reyes, CA, with Masters, Mates, and Pilots newsletter in CW, simulkeyed on 6474, at 2033. (Hugh Stegman-CA)

2252.0 November Foxtrot-US Navy, and Oscar, US Navy, both unsuccessfully calling each other, at 0142. (Mark Cleary-SC) *[Another listener heard them finally hook up at 0156. -Hugh]*

2259.5 AASF2-US Army Aviation Support Facility, ALE sounding at 0151. (Jack Metcalfe-KY)

2306.0 AAT7WE-US Army MARS, went to 2305 at 0213. (Metcalfe-KY)

2899.0 Shanwick-Shannon/Prestwick Radio, Ireland, working a flight for selcal check JQ-HS *[returns to British Airways Boeing 777 G-VIIP -Hugh]*, at 0344. (Allan Stern-FL)

2962.0 Santa Maria-Santa Maria Radio, Azores, North Atlantic air traffic control of aircraft at 0401. (Stern-FL)

3167.0 "6-H-A"-US Navy, link coordination with "7-A-I" at 1221. (Cleary-SC)

3299.0 AFA2XZ-USAF MARS Net, working stations at 0024. (Metcalfe-KY)

3315.0 AFA1HS-USAF MARS Training Net, working stations at 0024. (Metcalfe-KY)

3455.0 New York-New York Radio, oceanic air traffic control with unknown Delta Airlines flight, at 0352. (Stern-FL)

3476.0 Shanwick Radio, North Atlantic air traffic control with various aircraft, at 0342. (Stern-FL)

3810.0 HD2IOA-Ecuador Navy, time beeps and Spanish voice announcements each minute, lower-sideband reduced-carrier emission, at 0504. (Stegman-CA)

4038.5 NNN0QMK-US Navy/ Marine Corps MARS, working several stations in the Florida net, at 0029. (Cleary-SC)

4149.0 WBN 3013-Crowley Maritime seagoing tug *Sentry*, working WPE Jacksonville at 0559. (Cleary-SC)

4216.0 TAH-Istanbul Radio, Turkey, CW identifier in SITOR-A marker, at 0345. (Barry Williams-AL)

4372.0 "U-0-E"-US Navy, working "8-L-Y," others, at 0004. (Cleary-SC)

4426.0 Unid-Marine weather, no identifier heard, at 0340. (Williams-AL) *[Sounds like VMC, Charleville Meteo, Australia. -Hugh]*

4515.0 "Gulf-1-Lima"-Unknown US military, with a 22-character EAM at 0329. (Stern-FL)

4721.0 E31607-USAF E-3 AWACS, calling OFF (Offutt AFB, NE), ALE at 2131. (Cleary-SC)

4724.0 Gas Tube-US military, possible airborne command post, with three 28-character EAMs, simulcasting on 8992 and 11175, ended with "standing by for traffic," at 0110. (Jeff Haverlah-TX)

4757.0 FR5FEM-FEMA, IL, also identified as WGY 9865, working WGY9030, also on 4780, ALE at 1753. (Metcalfe-KY)

4790.0 R26609-US Army UH-60L helicopter, calling B1Z171 (1-171st Aviation), ALE at 1704. (Cleary-SC)

4924.5 HQ702N-US National Guard Bureau headquarters, calling ARC61NG (61st Weapons of Mass Destruction Civil Support Team, Arkansas), ALE USB at 1532. (Cleary-SC)

5351.5 INGEZ-Indiana National Guard, Shelbyville, ALE sounding, also on 2540 and 2816, at 2010. (Metcalfe-KY)

5388.5 NF1-US Federal Bureau of Investigation, Norfolk, VA, calling RH1, Richmond, VA, ALE at 1554. (Cleary-SC)

5517.0 D2-MBD-Angolan Air Force Antonov-12, *[Russian-made 4-engine turboprop transport aircraft -Hugh]*, working Khartoum oceanic air traffic control, at 2100. (Patrice Privat-France)

5550.0 New York-New York Radio, NY, selcal check with American 1582, at 2124. (Sevart-Caribbean)

5696.0 Coast Guard Rescue 2114-USCG helicopter working CAMSLANT Chesapeake, VA, on a search and rescue operation, at 0546. (Stern-FL) CAMSLANT, working unheard aircraft "U-5-P" on law enforcement mission, at 2009 (MDmonitor-MD)

5708.0 E30560-USAF E-3 AWACS, calling JDG (Diego Garcia), ALE at 0659. (Patrice Privat-France) 190003-USAF C-5, calling CRO (Croughton AFB, UK), ALE at 1341. (Cleary-SC)

5711.0 DoD Cape-US Department of Defense (military), Cape Canaveral Air Force Station, FL, working NASA Booster Recovery Vessel *Liberty Star* regarding position for a space shuttle launch, at 1757. (Stern-FL) *Freedom Star*-NASA Booster Recovery Vessel, working Booster Recovery Director and Cape Radio, FL, right after liftoff at 1944. (Sevart-Caribbean)

5732.0 CAMSLANT Chesapeake-USCG, VA, getting position from unheard aircraft at 0037. (MDMonitor-MD)

5833.5 TX18NG-Texas National Guard, ALE sounding, also on 5351.5, 7650, 9081.5, and 10275, ALE at 2151. (Metcalfe-KY)

6316.0 NMN-USCG, Portsmouth, VA, CW identifier in SITOR-A marker, at 2325. (Williams-AL)

6586.0 New York, working a flight for selcal check EG-CH *[used by 4 different aircraft -Hugh]*, at 0422. (Stern-FL)

6604.0 New York Volmet-US Federal Aviation Agency, aviation weather for Northeast US airports, at 0310. (Stern-FL)

6637.0 Big-A 158-Arrow Airways flight over Santiago, Chile, working Miami LDOC, at 0820. Giant 48-Atlas Air flight over Bogotá, Colombia, went to 10033 to work company LDOC, at 0823. (Stern-FL)

6640.0 New York, working American 134 with weather from company LDOC, at 0349. (Stern-FL)

6694.0 Halifax Military-Canadian Forces, Halifax, NS, advising unknown aircraft of a possible fishery violation, at 2130. (MDMonitor-MD)

6697.0 Clean Coat-US military, possible Nightwatch net, EAM at

2249. (MDMonitor-MD)

6721.0 Andrews-USAF, Andrews AFB, MD, working helicopter Coast Guard 2129, at 1530. (Cleary-SC)

6754.0 Trenton Military-Canadian Forces Volmet, formatted aviation weather at 2320. (Williams-AL)

6800.0 Unid-Lowest of many carriers spaced 1.2 kHz all the way to 6900, each with low Cuban numbers audio (V02a), and completely blanketing 100 kHz, at 2100. (Chris Smolinski-MD)

6855.0 Cuban Spanish AM female "numbers" in 5-figure groups (V02a), callup 06021 71656 01881, at 2101. V02a, AM callup 04241 51360 33758, also at 2101. (Cam Castillo-Panama)

6925.0 Unid-Pirate sending slow-scan television signals at 2130, also on 6950 at 2133. (Sevart-Caribbean) *[Common illegal activity, with some pretty raunchy pictures. -Hugh]*

7527.0 Panther-DEA, Bahamas, working Rescue 6029, a USCG helicopter on a search, at 0047. (MDMonitor-MD) 29C-DEA aircraft, coded position for Panther (Operations Bahamas and Tortugas), at 2213. (Cleary-SC)

7648.5 R23558-US Army helicopter, calling T1Z147 (WI National Guard 1-147th AVN), ALE at 2349. (Cleary-SC)

7650.0 T1Z137-Ohio National Guard 1-137th Aviation, calling 34M, ALE at 2338. (Cleary-SC)

7887.0 Cuban AM numbers (V02a), callup 27648 38508 06352 at 2001. V02a, callup 06021 85505 75512, at 2002. (Castillo-Panama) V02a, AM in progress, weak-readable at 2035. (Williams-AL)

8023.0 087CDCS51-Virginia Department of Health, Richmond, ALE sounding at 1822. (Metcalfe-KY)

8047.0 BUCKEYE52-Ohio Air National Guard, passing "52TEST" to NGTROOPCMD, ALE at 0131. (Stegman-CA) Ruby Red-US military Nightwatch net, troubleshooting data exchange with Offutt (USAF ground station, NE), at 1756. (Cleary-SC)

8097.0 Cuban MCW "cut" numbers (M08a), callup UINDW ANRTN NWNTN (47235 12602 25202), at 1801. M08a, MCW callup 28604 41075 47561, at 1801. M08a, MCW callup 88415 41174 24204, at 1901. (Castillo-Panama) M08a, 5-figure cut number groups in progress at 1820, 1832, and 1900. (Sevart-Caribbean)

8171.5 T12-US Army 12th Aviation, calling helicopter R23742, ALE at 2320. (Cleary-SC)

8190.0 TARANTO-Italian Guarda Di Finanza, Taranto, calling ROSATI (Coast Guard Vessel *Rosati*, G-89), ALE at 0657. (Privat-France)

8414.5 273299600-Russian vessel *Revoljutija* (UBHT), DSC safety test with Lyngby Radio, Denmark, at 0918. 271000773-Turkish tanker *Ottoman Nobility* (TCDA2), DSC safety test with Olympia Radio, Greece, at 1003. 207040000-Bulgarian container ship *Geo Milev* (LZHP), DSC safety test with Madrid Radio, at 1139. (Privat-France)

8776.0 Lifeboat-US military Nightwatch net, EAM at 1911. (Cleary-SC)

8806.0 WLO-Mobile Radio/ Shipcom, AL, weather broadcast at 1622. (Cleary-SC)

8912.0 Service Center-US Customs, working helicopter Juliet 18, at 1925. (Cleary-SC)

8918.0 New York-New York Radio, NY, taking position from American 1325, at 1345. (Sevart-Caribbean)

8957.0 Shannon Volmet-Shannon Radio, Ireland, aviation weather at 2052. (MDMonitor-MD)

8971.0 Cardfile 714-US Navy P-3C, calling Fiddle (USN, Jacksonville, FL) with no joy, at 2100 and 2142. Cardfile 714, finally raising Fiddle for clear and secure voice at 2329. (MDMonitor-MD) Goldenhawk-US Navy, ME, working P-3C Wafer 21, at 2113. (Cleary-SC)

8983.0 CAMSLANT-USCG, working Coast Guard Rescue 2117, a helicopter on a search, relaying its status to Sector San Juan (PR), at 1432. CG Rescue 2117, passing location of found target at 1714, then advising CAMSLANT they are bingo fuel at 1723. (MDMonitor-MD) Sector Long Island Sound-USCG, also CAMSLANT, VA, both calling "U-5-P," at 2125. (Cleary-SC)

8992.0 McClellan-USAF HF-GCS remote base, CA, running a patch for Legislate, probable airborne command post, at 1352. Andrews-USAF HF-GCS control point, EAM at 2056. (MDMonitor-MD)

9007.0 "231"-Unknown Spanish speaking male, probably a military aircraft, working a ground station at 2245. (MDMonitor-MD)

9025.0 NW1-US military Nightwatch net, working NW2, same net, ALE at 0052. (Stegman-CA)

9414.5 123CDCS27-US Centers for Disease Control National Public Health Radio Network, working FEMA WGY 9030, ALE at 1658. (Metcalfe-KY)

9610.0 Unid-Slavic language numbers, preamble 213/34, message in 5-figure groups beginning and ending "77777 77777" (S11b), at 0900. (Mike-West Sussex, UK)

10033.0 Giant 48-Atlas Air, came from 6637 to pass traffic to company LDOC, at 0826. (Stern-FL)

10051.0 Gander Volmet-Gander Radio, Canada, formatted aviation weather at 0022. (Cleary-SC)

10202.0 KGD825-US Environmental Protection Agency, MA, ALE sounding at 2034. (Metcalfe-KY)

10242.0 CAMSLANT-USCG, VA, working Juliet 41 for ops-normal report, at 1637. (Sevart-Caribbean)

10426.0 Lincolnshire Poacher-UK intelligence (E03), poacher tune and callup 87666, at 2001. (Sevart-Caribbean)

10608.1 Shark 47-USCG Cutter *Pea Island* (WPB 1347), working Shark 21 (Cutter *Gallatin*, WHEC 721), clear and secure at 1931. (Cleary-SC)

10993.6 Shark 39-Unknown USCG cutter working Shark 21, another cutter (possibly *Gallatin*) in Sector Key West, clear and secure at 2028. (Cleary-SC)

11175.0 Andrews-USAF HF-GCS, working Blue Knob, possible airborne command post, at 1429. Andrews, SKYKING broadcast at 1809. (MDMonitor-MD) Card File 711-US Navy, patch to Fiddle (FL), at 1457. (Sevart-Caribbean) Nighthawk 11-US Marine Corps helicopter in "Marine One" presidential party, working Puerto Rico HF-GCS at 1819. (Stern-FL) Scranton-US military, patch via Andrews to Point Man, at 1639. (Haverlah-TX) Tuff 14-USAF B-52H, patches to Raymond 06 and Mudbug, both at Barksdale AFB, LA, at 1946. Reach 876-USAF Air Mobility Command, patch via McClellan HF-GCS to Pope AFB, NC, for arrival arrangements at 2215. (Cleary-SC)

11226.0 HAW-USAF, Ascension Island, ALE sounding at 0707. (Privat-France)

11232.0 NATO 29-North Atlantic Treaty Association mission, patch via Trenton Military for arrival weather, at 1837. (Cleary-SC) Atlas 23-Canadian Forces C-130, working Trenton Military on search and rescue training, at 2113. (MDMonitor-MD)

11330.0 New York Radio, position from Continental 1883 at 2041. (Sevart-Caribbean)

11354.0 "09"-HFDL ground station, Barrow, AK, with squitters and logging on Lufthansa MD-11 freighter D-ALCS, at 0656. (Stegman-CA)

12133.5 Unid-US Navy, Saddlebunch Key, FL, repeating American Forces Network interruptible voice channel broadcasts, at 2059. (Sevart-Caribbean)

12153.0 Unid-English callup "257 Oblique 35, message of 30 5-figure groups, with "77777 77777" at beginning and end (E11b), at 0845. (Mike-UK)

12164.0 WGY9032-Unknown FEMA, working 119CDCS05, at 1558. (Metcalfe-KY)

12353.0 WBN 6510-Crowley Maritime seagoing tug *Sentinel*, working WPE Jacksonville at 1812. (Cleary-SC)

12603.0 E03, 5-figure groups in progress, parallel on 14487, at 1842. (Sevart-Caribbean)

13089.0 NMN-USCG, VA, weather at 1538. (Sevart-Caribbean)

13110.0 WLO-Mobile Radio/Shipcom, AL, synthesized weather voice, also on 13152, at 2114. (Sevart-Caribbean)

13257.0 Atlas 33-Canadian Forces CC-130, working Trenton Military for traffic from Rescue Coordination Centre Trenton, at 1811. (Cleary-SC)

13354.0 New York Radio, position and selcal check with American 69, at 1446. (Sevart-Caribbean)

13907.0 CAMSPAC-USCG, Pt. Reyes, CA, working Coast Guard 1704 (an HC-130), at 1800. (MDMonitor-MD)

13927.0 AFA1QW-USAF MARS, patching tanker Rocco 71 to Davis Monthan AFB for arrival arrangements, at 1735. (Stern-FL)

14487.0 E03, callup 23049, parallel on 15682 and 16084, at 1400. (Sevart-Caribbean)

14893.0 Unid-CW station with 5-figure groups (probably M12), ended "000 000," at 1503. (Sevart-Caribbean)

21937.0 "02"-HFDL Ground Station, Molokai, HI, working TZ7279, ATA Airlines Boeing 737, registration N315TZ, at 2253. (Stegman-CA)

DIGITAL DIGEST

DIGITAL MODES ON HF

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Digital Smorgasbord

We have a mixed bag for you this month as we update some recently covered networks and look at the 11MHz region for digital signals.

❖ New PEMEX Frequencies

More frequencies have come to light on the Mexican government's oil and gas company network. Here is the list so far: 2165, 2182, 7450, 8243, 8291, 9265 and 11095 kHz USB.

There is no change in the participants on the network, which were outlined in the February 2007 column. Still no reports of any traffic other than soundings by the stations concerned.

❖ Yet More Russian 75bd Activity

As reported in last month's column, activity levels of the Russian 75bd/200Hz or 75bd/250Hz on-line encrypted signals continue to rise. Military exercises? A resurrected military network? Some former Soviet state or completely new user?

More new channels carrying this modem have been logged in the past three months than over the entire previous decade of listening here at Digital Towers, which is quite a staggering statistic. Check them out while the signal is still on the air. At the time of writing, a quick check at 2000EST produced half a dozen frequencies actively carrying this signal:

3170, 4018, 4243, 4378, 4396, 4447, 4577, 4983, 5129, 5152, 5296, 5322, 5442, 5454, 5736, 6452, 6987, 7696, 8138, 8204, 8302, 9192, 10280 and 10984kHz (center of data)

❖ Pakistani Navy PacTOR

As outlined in the August 2007 issue of this column, the Pakistani Navy is an active user of shortwave communication and its ships and shore stations can be heard regularly on a number of frequencies.

Aside from the use of standard MIL-188-141A and 3G ALE, PacTOR-II is also used at times. Here's an example of traffic heard recently on 8143 kHz, which usefully illustrates the kind of message formatting (typical NATO style) used on their network:

ZCZC
ARL4 DE T/SULTAN/AROU/GR
NR.....002/17

-T-

ROUTINE 170345Z NOV
FROM TIPPU SULTAN
TO COMCEN KARACHI

BT
RESTRICTED (.)
SVC (.)
AQQ 4/5/8 ZBZ NIL/NIL/3/4
ZID PNRC 35
AQQ 4/5/8 ZBZ NIL/NIL/3/4
ZID PNRC 355
ZDK PNRC 346,348,349 P-I,II,III AND IV,351 AND 355
BT
NNNN
NNNN

In this case, we have a message from the Frigate *Tippu Sultan* to the naval HQ in Karachi (which is being addressed by the callsign ARL4). It appears that the warship is asking for a repeat (using the Z code "ZDK") of messages 346, 348 and 349. A few minutes later, one of the messages duly arrives – an off-line encrypted message using 5 letter groups.

ZCZC
KBJZE UOIQW FAHYA GEXRB JZLYZ CADYK CNWWO DWIXP ZCAYK NHXOK PBKYX WBBDW VWZSZ NSXIA KFQRG RFIKE IFLCH EOIXN VTATT JUUBO IKRCG QRKVJ MTOVZ PQQZP HDFLC YZKPK HQHIK ACYER XIEMK EBICD ZBBYQ CEGPN OWWGO CNOQY EBXKW OJVUY SJCEK CKFZY WSRQK SHPMM NWOUT GGFMV WFMZX OFYZI RIETW UDBFE PRSKK VMZGM LSESF JHNBF APEOB ...etc.

❖ T12 ALE Network

This is another odd network which uses both regular (unencrypted) MIL-188-141A ALE and the link-protected kind, all in the same-sounding transmission – the first such network we've come across with this behavior.

The only station in the network uses the identifier T12, which has been attributed to US Army activity from 12th Aviation Battalion, Davison AAF/Ft Belvoir, VA. Reports of this station seem confined to the US, so that seems like a reasonable guess, but the behavior is certainly not usual.

Here are the frequencies on which this network have been heard:

2341.5, 4521.5, 6985, 7361.5, 8161.5, 9129.5, 10670.5kHz USB

❖ PR0NN Network

More frequencies continue to appear of this network, the most recent of which is 14740 kHz USB.

❖ Digital Bandscan

This month we look at the busy segment between 11000 kHz and 11500 kHz, which gives good results both day and night for digital listening. All frequencies are center of data, so remember to subtract 1.6 kHz from the ALE channels to arrive at the USB dial frequency.

That's it for this month. Enjoy your digital listening.

DIGITAL BANDSCAN: 11000 - 11500 kHz

Freq kHz	ID	User	Signal Type
11000.00	RIL5	Russian Navy	CW
11001.80	ILA	Algerian Customs	PacTOR
11005.70	UNID	Norwegian Navy	STANAG4285 HF modem
11006.70	UNID	Egyptian MFA	SITOR-A
11011.60	GWPWF33	Brazilian Navy	MIL-188-141A ALE
11023.70	UNID	Egyptian Embassy	SITOR-A from Havana
11029.20	NETCCS	Missionaries	PacTOR from Venezuela
11030.00	AXM34	Canberra Meteo	Fax from Australia
11075.10	ME1 etc	US FBI	MIL-188-141A ALE
11089.90	KVM70	Honolulu Meteo	Fax from Hawaii
11096.60	REBOM1	PEMEX	MIL-188-141A ALE from Mexico
11100.10	OARNNN	US Navy MARS	MIL-188-141A ALE
11116.38	UNID	N. Korean Diplo	600bd DPSK modem
11104.00	RDL	Russian Navy	50bd/200Hz BEE
11141.50	UNID	Colombian Navy	Clover-2000
11145.00	HEC	Globe Wireless	Free Signal from Berne
11156.50	UNID	Egyptian MFA, Cairo	Codan 9001 HF modem
11156.70	UNID	Egyptian Embassy	SITOR-A from Havana
11159.60	BIS etc	US National Guard	MIL-188-141A ALE
11182.60	OFFSPR	US Air Force SIPRNET	MIL-188-141A ALE
11185.44	UNID	ARINC	HF DataLink from Iceland
11213.00	MKL	Royal Air Force	75bd/850 KG84
11218.60	KNY82	US SHARES	MIL-188-141A ALE
11224.60	XSS etc	UK MoD TASCOM	MIL-188-141A ALE
11251.60	ADW etc	US Air Force	MIL-188-141A ALE
11313.44	KXH6	ARINC, Hawaii	HF DataLink
11349.44	UNID	ARINC, Canary Isl.	HF DataLink
11403.60	034MICAP	US Civil Air Patrol	MIL-188-141A ALE
11406.10	LCR154	Polish Army	MIL-188-141A ALE
11421.70	UNID	French Forces	192bd/400 ARQ-E3
11428.36	7RQ20	Algerian MFA	Coquelet-8 from Algiers
11430.60	TAC etc	Chilean Navy	MIL-188-141A ALE
11445.00	UNID	US Navy	Link-11
11486.60	WGY9030	US FEMA	MIL-188-141A ALE

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The Curious Case of Radio Solh

R. Solh, the US Psyop station transmitted via UK back to Afghanistan, in A-08 is back on 17700 at 1200-1800. In B-07 it was on 15265 at 1200-1500 and well-heard also in Central North America. The music was identical from day to day at the same minutes, and also we suspected, the announcements. But what's it all about? We asked *WORLD OF RADIO* correspondent Aslam Javaid, a native Pashto speaker in Pakistan, to monitor and tell us about it –

Checked at 1400-1430: a bilingual service. Announcements and music are both in Dari (Afghan Persian) and Pushto. An Indian Hindi film song was also played. The major part of announcements and songs were in Dari. The announcements in Pushto during the transmission are translated are as follows:

"Islam is a religion of peace. Taliban are misguided people. They are indulged in misinterpretation of Islam. They are killing innocent people which include women and children. What kind of Islam is this? If you have any information about people related to Taliban, please contact your nearest police station or Army unit."

The songs in Pushto and Dari were being played without announcing the name of singers which were mostly of Afghan origin and not known well in Pakistan; though I recognize the voices and songs of prominent Pakistani Pushto singers, even if their names are not announced, which include Khayal Muhammad, Javed Akhter, Rahim Shah and female singers like Ms. Zarsanga, Ms. Gulnar Begum, Ms. Mahjabeen Qizilbash, Ms. Mashooq Sultan, etc. You can find a lot of Pushto music at the following link **www.musafar.com/index_004.htm**

ALASKA KNLS A-08 English: 0800-0900 7355, 1000-1100 6890, 1200-1300 7355 9780, 1400-1500 7355 (via Alokesh Gupta via Rachel Baughn)

ANGUILLA [and non] Pastor Melissa Scott conducted one of her morning church services live from Anguilla, where she visited her Caribbean Beacon. After 9 years of operation, the Caribbean Beacon has fallen into a state of disrepair. Evidently, there had been a small fire at the broadcast facility about three months before. She wants to make the Caribbean Beacon the crown jewel of her shortwave empire. In fact, she said she might close some or all of her other stations (Costa Rica). She wants to bring the Caribbean Beacon up to date, including the FM transmitter. She has started a $5 million fundraiser called "Secret 2" to upgrade the Caribbean Beacon, which will conclude on August 14 (Chaz Lambrusco, *DX LISTENING DIGEST*)

ARGENTINA RAE, 11710, Japanese service heard 0930-0950 with tango music. Surprisingly good signal (Dan Goldfarb, England, *DXLD*) Per Aoki, azimuth is 348 degrees, almost due north, while everything else on 11710, including evenings to NAm, is at 335 degrees. What?? The true azimuth of Tokyo from Buenos Aires is 280 degrees, nowhere near the azimuth of this transmission, in fact aimed at New York! Perhaps RAE didn't think it worth the cost to build another antenna for only 10 hours usage per week, just hoping some of the signal dribbles into Japan anyway. Of course, it should be well heard by all those Japanese immigrants in Brasil. Also, Tokyo and Buenos Aires are near-antipodal; if they were exactly opposite, all beams would converge, although polar paths should still be avoided. Due to 2.5 months of DST in Argentina, the Japanese service was one hour earlier at 0900-1100 until mid-March (Glenn Hauser, *DXLD*) RAE is the most difficult station to hear in Japan. There was less interference at 0900 (Toshi Ohtake, *NASWA Journal*)

ARMENIA [and non] A state of emergency in early March led to FM relays of RFE/RL being put off the air here, and its internet site blocked (*kimandrewelliott.com*) After about a week, RFE/RL president Jeffrey Gedmin announced that shortwave had been resumed, ''a step backward to an outmoded frequency'' without mentioning what they were! (gh, *WORLD OF RADIO*) 1500-1600 daily on 9830, 11695, per the RFE/RL Armenian page (Sergei Sosedkin, IL, *ibid.*) Site for both: Biblis, Germany. May have changed by now if still needed (gh)

Shortwave was never "moded." It was never the popular medium of choice. Shortwave has always been the frequency of necessity, to get programs into remote parts of one's own country, or into countries where that content is not allowed, or otherwise unavailable, through the domestic media. That was the case in the Armenia of the USSR, and it has become the case again. Shortwave is "remoded." And it remains necessary for such occasions (Kim Andrew Elliott, *kimandrewelliott.com*)

AUSTRALIA Barry Seeber, who presented RA's DX program *Talkback* in the mid-1980s, and retired from RA in 1997, has died at age 65 after a 4-year battle with cancer. Barry was one of the best broadcasters I ever worked with. His professionalism and his beautiful voice were legendary. He was also one of the most considerate and caring people I have ever had the honour to meet and become friends with (Mike Bird, *Media Network* blog Feb 28)

BHUTAN Bhutan Broadcasting Service, which is a tough catch in North America on 6035, has started webcasting via **www.bbs.com.bt/** at 0000-1500 UT, including English during the final hour (Asia-Pacific Broadcasting Union via Mike Terry, Ron Howard, *DXLD*)

BOLIVIA unID on 4110 at 0013-0039 mentioning Bolivia (Lúcio Otávio Bobrowiec, Brasil, *DXLD*) 4111.602 is Radio Virgen de los Remedios, 1030-1040, per tip by Rogildo F. Aragão. Previously on 4545.396 with a weaker signal (Bob Wilkner, FL, Cumbre DX) On 4111.64, at 2240-2300, very long Catholic talk from Parroquia Nuestra Señora de la Candelaria (Arnaldo Slaen, Argentina, DXLD) Further days on 4111.62 at 1020-1040 (Robert Wilkner, FL, Cumbre DX)

CANADA RCI suspended Wojtek Gwiazda without pay for 3 days, in retaliation for his defending RCI's international mandate, and testifying before a parliamentary committee investigating the matter. Gwiazda, spokesman for the RCI Action Committee, has been threatened with more severe measures if he persists in raising questions about RCI's being refocused into a service for immigrants. The union representing RCI workers, FNC-CSN indignantly denounces CBC trying to muzzle the union (via Dan Say, *DXLD*) See **www.geocities.com/rciaction**

On 6160, CKZU and CKZN were taking turns dominating at 0705 – maybe not such a good idea to have them on same frequency, even from opposite coasts, with programming 4 hours apart. On another occasion only one of them was audible at this hour, due to strange propagation or transmitter trouble. When *CBC Overnight* is in play from WRN, relays from SW stations abroad are on 6160, possibly confusing (gh, OK)

CHAD From landmark speeches made at independence to recordings of beloved musicians long since dead, historic audio archives in Chad were lost in the looting frenzy that accompanied a rebel assault on its capital in February. Every public audio archive since Chad's independence has gone up in smoke, including recordings of the former French colony's independence day itself (Stephanie Hancock and Moumine Ngarmbassa, Reuters, via Myke Weiskopf, *DXLD*) I would offer phone cards as a reward for any tapes/discs which are returned to the station – a kind of historic amnesty, since the tapes and discs are useless to most people. Use the opportunity to rethink the current way of working! (Jonathan Marks, *Critical Distance* blog) Meanwhile, RNT resumed reliably on 4905 around 0600 (gh)

COSTA RICA 5954.115, unidentified ELCOR transmitter station, Guápiles; *2227-2327*. Usual cycled nonstop music format until last track ended at 2326, transmitter off at 2327, a seven-day operation. Bet it's all on a timer. Another date it was on 5954.181 (Terry L Krueger, FL, *DXLD*) Closes just before Democratic V. of Burma opens via Germany on 5955 (Anker Petersen, Denmark, *playdx yg*) Incredible as this may sound, a friend of mine at Control Nacional de Radio told me they don't even know what this is all about. So, go figure what kind of "control" that is (Raúl Saavedra, Costa Rica, *ibid.*)

For at least three weeks in Feb and Mar, REE relay on 5965 was really on 5964, causing a big het to Vatican at 0620 (gh, OK) And to Cuba before 0500 (Wolfgang Büschel, Germany, *DXLD*) Then in mid-March another REE relay frequency here, 9765, also shifted 1 kHz down to 9764, heard at 1313; but why? Some others, 15170 and 3350 had not shifted (gh) Also on 9764 at 0022 (Terry L Krueger, FL, *DXLD*)

CUBA We had been noticing that whenever Arnie Coro appears on RHC, it sounds like he is phoning in, rather than with studio-quality audio. But Arnie explains (gh) Every time when I arrive at RHC Studio 6, my sound engineer of

All times UTC; All frequencies kHz; * before hr = sign on, * after hr = sign off; // = parallel programming; + = continuing but not monitored; 2 x freq = 2nd harmonic; sesqui = one and a half; A-08=spring/summer season; [non] = Broadcast to or for the listed country, but not necessarily originating there; u.o.s. = unless otherwise stated

many years, José Costa Pupo, sets the audio frequency equalizer according to my own optimized frequency response curve, so you won´t hear audio below 250 cycles per second, or above 3000 cycles per second. It does sound much better under difficult propagation conditions. Pepe also boosts the frequency range from 500 to 1500 kiloHertz by 6 dB over our reference, to further boost the talk power of RHC transmitters when *DXers Unlimited* is on the air (Arnie Coro, CO2KK, RHC *DXUL*)

It's a jarring degradation compared to other announcers in higher fi (gh) Perhaps RHC might consider such modification for Ed Newman in English news, whose voice often does not cut through very well and is quite difficult to understand (Roger Chambers, NY, *DXLD*)

Anomalies and defects at RHC: at 2305, 17705 and 13760 are supposed to be in Portuguese as on RHC's own schedule, but instead found them in French, 28 seconds apart. The same Sunday at 2330 found 5965 in Esperanto instead of scheduled Creole. Another day at 0015, reconfirmed a few days later, RHC Spanish on new and unlisted 11680, apparently ex-11875 (gh)

DJIBOUTI Website for Radio Télévision de Djibouti **www.rtd.dj** has numerous links to downloadable and streaming audio programming in various formats, video, newscasts in Somali and Afar. Beware of many pop-up ads when you click anywhere – I was offered a trip to France with some nice young ladies (Paul E. Guise, Click!, ODXA *Listening In*)

DOMINICAN REPUBLIC Madagascar often runs all-night just below 5010 kHz, but R. Cristal here also activated occasionally (gh) In mid-March on 5009.78 until 2400* very weak station seemed in Spanish (Anker Petersen, Denmark, *playdx yg*) Tentatively Cristal, or R. Pueblo transmitter on 5009.75 on a Friday, 5009.77 on a Monday until abruptly off at 0000* but not on Saturday or Sunday (Terry L Krueger, FL, *DXLD*)

EGYPT Radio Cairo for A-08 on new 6860, in Turkish, Arabic and Russian (Gordon Brown, UK, NWDXC via *BC-DX*)

GABON What can this be? At 1459, music on 14540 with utility QRM (Marcel, France, *A-DX* via Wolfgang Büschel, *harmonics yg*) RTV Gabonaise, 7270 x 2 (gh) Yes, 14540 // Gabon 7270 until 1558* (Carlos Gonçalves, Portugal, *DXLD*) Also look for 19160 = 2 x 9580 if the MUF builds up, as we were hearing it last year, especially when fundamental 17630 is strong (gh)

GERMANY DW A-08 English, nothing intended for NAm, but try these: 0000-0100 to SEAs 9885 Sri Lanka; 15595 & 17525 FE Russia. 0400-0500 C&EAf 7225 UK, 7245 Rwanda. 0500-0530 C&SAf 9700 Rwanda, 9825 RSA. 0600-0630 WAf 7310 Portugal, 15275 Rwanda. 1600-1700 SAs 15640 UK. 1900-1930 EAf 11795 UK, 17860 Portugal. 2000-2100 C&SAf 11865 & 15205 UK. 2100-2200 WAf 9735 UK, 11865 & 15205 Rwanda – the last two probably best (gh, from a full sked via Alokesh Gupta)

GUATEMALA I would never give up shortwave, my preferred band, unless the government prohibits it. When I tried to obtain a 1000-watt SW transmitter, all the manufacturers I contacted in the world said they don't make any low-powered ones, but 50 or 100 kW minimum. Yet we are reaching the entire world with 600-800 watts on 4052.5 (Édgar Amílcar Madrid, manager, R. Verdad, via Magidel Cruz Rodríguez, Mexico, *DXLD*)

He should ask CFRB where they got their new 1 kW transmitter for 6070, still not back on the air by mid-March (gh) RIZ (Radioindustry Zagreb) offers this niche product, apparently as the only mainstream transmitter manufacturer. Unfortunately their website **www.riz.hr** has now turned into a fancy Flash presentation of "under construction" pages (Kai Ludwig, Germany, *ibid*.)

Dr Madrid was celebrating R. Verdad's 8th anniversary in Feb, and invited us to send a new reception report. Received not only a Quetzal QSL card, but a nice pennant and sticker, visible at **www.worldofradio.com/QSL.html**

Our congratulations to Dr Madrid on the anniversary, and appreciation for an individual broadcaster enthusiastic about shortwave, who is trying to make a difference in his country and beyond. Although he says, ''Lightning have destroyed a part of our main short wave transmitter several times, and we have made many vain efforts to convince our Government to provide us with an FM frequency besides the SW.'' (gh)

HONDURAS Open carrier several times late at night on 3340; I can only assume this is HRMI, e.g. 0446 between CHU and REE. Wonder if they just turn on the transmitter and assume it is actually modulating, wasting wattage. Supposedly scheduled at least until 0600 (gh, OK)

INDIA Monitoring on the East Coast of India, showed AIR stations missing: Itanagar: 4990, 6150. Ranchi: 4960, 5985. Kohima seems to broadcast on SW 4850, 6065 only during important occasions (Jose Jacob, *DXLD*) A few weeks later, Itanagar reappeared on 4990 from *0025, and 1330 (G. Victor A. Goonetilleke, Sri Lanka, *dx_india yg*) With low modulation (Anker Petersen, Denmark, *DSWCI*)

IRAN Certain channels have been off-frequency and drifting, such as 13801.4, at 1135 IRIB Teheran in Arabic (Michele IZ2EAS d'Amico, Italy, *bclnews.it yg*) Zahedan site, 13801.545 until 1428* (Terry L Krueger, FL, *DXLD*)

[non] IRIB via Lithuania in English 1945-2029* on 7565 // 6010, 7320 and 11695 direct; then *2029-2130* moves to 6055 for Spanish, mixing with Rwanda, clear from 2100. Much better on // 7130, 7350-via Iran (Brian Alexander, PA, *DXLD*)

ISRAEL Israel Radio English news announced March 2 that all Israel Radio shortwave broadcasts would cease as of March 31, 2008. As of April 1, you can continue to listen to Israel Radio live and on-demand (recordings maintained for 24 hours) at another website, which did not yet exist:

www.intkolisrael.com (Doni Rosenzweig, *DXLD*)

By now you know if it really happened this time. All languages except Persian had been domestic relays only; how about the Hebrew home service relays? (gh)

The IDF station Galei Zahal should remain, anyway. Some logs of it: 15784.7 at 1545 until covered by WEWN at 1555 (Harold Frodge, MI, *Cumbre DX*) 15785 at 1248-1302+ strong and alone with Hebrew folk, ballads, ID jingles. And 6973.005, Galei Zahal, Lod, 0050-0230 "Marblemouth Jewman," the totally coolest jock out there – sounds like he's about 65 years old. He's usually, but not always, on GMT Sundays around this time and forward. He always comes up with multiple themes or angles, if you're sharp enough to pick up on it (Terry Krueger, FL, *DXLD*) On March 17 only, GZ also showed up on 5000-USB at 1735, two seconds behind 6973 AM, tnx to Roland Schulze tip (Anker Petersen, Denmark, *DXLD*) 5000 also barely audible here 2130-2220 (Brian Alexander, PA, *ibid*.)

JAPAN [non] On NHK's *World Interactive*, Sat March 1, the haiku segment implied that was its last edition, not to return next month. April always brings program changes with new fiscal year (gh)

KOREA NORTH [non] Clandestines monitored: *1200 on 9630, North Korea Reform Radio; *1200 on 9950, Radio Free Chosun; *1300 on 9940, V. of Wilderness (Kouji Hashimoto, *Japan Premium*)

Unidentified on 11995, 1435-1459* with continuous instrumental music, very repetitive loop test? No announcement. CVC Darwin listed at 3 degree azimuth on behalf of JCI; what's that? (gh, OK) Japan Center for Intercultural Communications (Wolfgang Büschel) JCIC is an enforcement group of *Furusato no Kaze* on 9780 at 1600-1630 UT and Wind of Nippon / *Ilubon-e Baaram* on 9820 at 1700-1730 (S. Hasegawa, *NDXC*) The new 1430 broadcast should be on 13725 now; first time CVC Darwin involved in clandestine time brokerage? (gh) I received *Furusato no Kaze* at 1430-1500 Mar. 12 on 11995 in Japanese. And *Ilbon-e Baram* at 1502-1530 on 13725 in Korean. Both were added to the Taiwan transmissions, for twice per day (S. Hasegawa, *NDXC-HQ*)

KOREA SOUTH KBS Radio One, HLKA QSYed to 6155 from 3930, 10 kW non-directional at 0300-0100 from Hwasong site (S. Hasegawa, *NDXC-HQ*)

KUWAIT R. Kuwait, Pinoy service in Tagalog at 1130 off-frequency on 17886.000; at first assumed the samba music was Portugal (Tim Bucknall, England, *harmonics yg*)

LITHUANIA The Sitkunai relay site abruptly vacated all its frequencies above 6.2 MHz, including KBC Radio and V. of Islamic Republic of Iran. Iran moved above 7.5 MHz, KBC inside the crowded 49m band, 2200-2300 on 6055, Sunday to NAm 0100-0200 on 6040 (gh)

MÉXICO Radio Unam on 9599.3v has been broadcasting outstandingly good classical music programming, surpassing anything I have heard on shortwave, on par with National Public Radio, for example before and after 0600 UT with the Stuttgart Symphony, superlative reception (Joe Wood, TN, *DXLD*)

MONGOLIA VOM 12085: The 1530 English broadcast is announced at the end of the 0930 one; however, not heard here despite good conditions towards Asia. Also inaudible via an online receiver in New Zealand (Mike Barraclough, England, World DX Club *Contact*)

NETHERLANDS Reductions in SW services to NAm from RNW, following analysis of listener feedback: the 1100 UT morning transmission was not widely listened to, and signal sometimes poor, so that is dropped. Also disappearing: extra transmissions on Sat/Sun, started several years ago to find out if an audience existed for a daytime shortwave service at weekends (Andy Sennitt, *Media Network*)

Sat/Sun afternoon 1900-2100 UT broadcast had been on 3 frequencies to NAm, via Bonaire and/or Sackville. It's also to Africa via Bonaire on 17810, which we can easily hear every day, but not so well as the doomed frequencies aimed our way weekends; however in A-08, 17810 Bonaire at 80 degrees is being cut back to only one hour at 20-21 – but then, that's all you really need for one new hour of programming in English produced per day. Other African evening frequencies before 2000 may not be much use in NAm: 15535, 15335 and 11660 from Germany and France (gh)

NEW ZEALAND RNZI A-08 From 30 March, supposedly effective until 28 Sept; however, there are always interim changes at least in May, AM only here (gh): from 0459 on 9615, 0659 7145, 1059 9655, 1300 6095, 1551 7145, 1851 9615, 1951 11725, 2051 15720, 2236-0458 13840 (via Alokesh Gupta, Rachel Baughn)

PAPUA NEW GUINEA Two-page personal QSL letter from Michael Samuga, Acting Asst. Mgr., Radio Madang, 3260, notes that the station is now known as NBC Madang, as part of NBC's reorganization, which will also phase out all SW transmitters by 2015. Current schedule is 0700-1200, though extended to 1400 with election results when I heard it (Mark Schiefelbein, MO, *DXLD*) Each station also had colorful Pidgin slogan, this one being *Maus bilong Garamut*, i.e. Mouth, or voice of, a local drum (Jari Savolainen, *ibid*.)

RCI was scheduled to shift from 7310 to 7325 on March 9 at 1105-1405, thereby blocking Wantok Radio Light, but in fact stayed on 7310, and a number of NAm listeners were able to hear a weak signal in the 1230-1345+ period, hard to ID for certain. 7325 was still on the RCI schedule from March 30. However, in A-08 no one else is supposed to be on 7325 before 1105, so try for WRL then (gh) On 7324.96, Wantok R. Light, at 0754-0805, English, music, 0801 ID (Kouji Hashimoto, *Japan Premium*)

PERÚ R. Altura, Cerro de Pasco, 5014.423 at 2320-2338 with flauta andina

songs, ID, strong, narrow filter to avoid Cuba 5025, in early March; station seldom on the air (Robert Wilkner, FL, *Cumbre DX*) 5014.4, OBZ4B, 0029-0038+ campo tunes without announcements between; single word Altura ID over tune at 0030, copyable only in LSB (Harold Frodge, MI, *ibid.*)

POLAND [non] A-08 tentative frequencies for PRW English, all via Germany: 1200-1300 7330 Nauen, 9525 Wertachtal; 1700-1800 7140 Jülich, 7265 Wertachtal (Glenn Hauser, OK, *DXLD*)

Sitkunai, Lithuania, appears to be the only SW site relaying Radio Racja, for Belarus. Leaked rumors from a well-placed source indicate that Emitel, the Polish transmitter operator, had put the Leszczynka site out of its misery by yearend 2007 (Kai Ludwig, Germany, *DXLD*)

PORTUGAL Just as I tuned across RDPI, 11620 at 2249, it was in Spanish! This turned out to be an interview with some sports figure from Spain. The interviewer spoke in Portuguese and the interviewee answered in Castilian, neither taking the trouble to speak the other's language, and no translations were included, nor apparently were they thought to be needed. So you may hear Spanish from RDPI under these circumstances. Also // on much weaker 11960 (gh, OK)

11280, RDPI at 2218-2242+ with game call, discussion, all in Portuguese // 11825. Spur or mixer? (Harold Frodge, MI, *MARE*) Aha, leapfrog, 11960 over 11620 at 340 kHz intervals (gh)

PRIDNESTROVYE Radio PMR missing from 6240 on a Friday at 2332, UT Sat 0023 checks, but 6240 on as usual with VOR choral music later at 0255 (gh, OK) Believe correct sked of Radio PMR has always been Mon-Thu only, not Fri (Harry Brooks, England, *DXLD*) In A-08 should be on 9665 at 2300-0045 if not one hour earlier, English at hourtops (gh)

ROMANIA RRI now has two main services: **RRI1**, Romania in Direct, features broadcasts in Aromanian (for Romanians in Macedonia), Romanian, and on Sundays a special Romanian program called *Doar Dominical*.

RRI2, Radio Bridges, broadcasts in Arabic, Chinese, French, German, Italian, Russian, Serbian, Spanish, Ukrainian and English (Rumen Pankov, Bulgaria, BDXC-UK *Communication*)

RUSSIA In early March I was getting the Family Radio relay via Samara on 6020 at 1400 in Telugu. This overlapped Radio Australia until 1359* with typical Russian tones, then clear. It's notable only because it was long-path, just before sunset in Samara, and after sunrise in OK. After crossing India, path is all-water over Indian Ocean, near McMurdo, across the Pacific until west coast of Mexico. See also TURKEY (gh)

6075, GTRK Kamchatka via Petropavlovsk, 0810-0900, with local programming as "Kamchatka Radio," interviews, songs in English and several IDs for "This is Kamchatka", fair to good. A nice change from the usual R. Rossii programming (Ron Howard, CA, *WORLD OF RADIO*) One hour earlier now? (gh)

SAUDI ARABIA The buzzy transmitter of BSKSA 15170, Holy Qur'an covered 15164 to 15178 at 0540 UT, scheduled 0300-0555. Also at 1800-2300 centered on 11915 but covering 11906 to 11924 (Wolfgang Büschel, *BC-DX TopNews*)

SWEDEN R Sweden A08 English on SW:

1230 15240 NAm
1330 15735 As/Pac
1430 13820 Eu/Af/ME/As/Pac, 15240 via Sackville NAm
1530 11590 Eu/Af/ME
1730 6065 Eu/Af/ME Wed-Fri
2030 7395 via Madagascar Eu/Af/ME, 7420 via Madagascar Au
2130 6065 Eu/Af/ME
0130 6010 via Sackville NAm
0230 11550 via Madagascar As/Pac, 6010 via Sackville NAm

There is also now a 30 day sound archive at **http://RadioSweden.org** (via Alokesh Gupta, *DXLD*)

TAIWAN [non] RTI English hour is run twice in a row on 5950 via WYFR at 0200 and 0300, but on different azimuths, switching from 355 to 285 degrees – But also two different transmitters, as we heard them overlapping at 0258-0300. This makes it unnecessary to make a quick antenna change on the same transmitter. The second transmitter's carrier suppresses the audio from the first one (gh, OK)

RTI has listener clubs in India, and in late February held meetings in three major cities, Chennai, Kolkata and New Delhi, with RTI personnel present and speaking. The meetings were very well attended and the listeners enjoyed a Chinese lunch, as reported in the press via Jaisakthivel, Alokesh Gupta and Swopan Chakroborty.

Can you imagine any SW station doing that in North America? And RTI does not even broadcast in any Indian language, just English to South Asia at 1600-1700. You might think that Taiwan could reach SAs perfectly well from Taiwan, but instead uses a relay in faraway France which in March changed from 9785 to 11995. This has a propagational advantage allowing a less interfered higher frequency to be used from the west in the local evening (gh) In A-08 from May to Sept this is on 15515, before and after on 11600. RTI has several other relays via Issoudun to Europe and at 1700-1800 on 15690 to Africa (*DX Mix News*, Bulgaria)

THAILAND R. Thailand, A-08 from Udorn to NAm: 0030-0200 12120 ex-12095, 6 degrees to the east; 0200-0330 15275, 54 degrees to the west; 0030 and 0200 English half-hours, the rest Thai (gh)

TIBET The last place to listen for objective news about the riots in Lhasa would be Tibet PBS, which probably said nothing, but they do have that English show, *"Holy Tibet"* (gh) 1630-1700 on 4905, 4920, 5240, 6110, 6130, 6200, 7125, 7385. Also at 0700-0730 on 4905, 4920, 5240, 6110, 6130, 6200, 7385, 9490, 9580 (Chris Greenway, England, *DXLD*)

[and non] VOA Tibetan had been jammed by CNR-1 programming and Firedrake, but in mid-March added Tibet PBS/XZDT programming on 9645 at 0000-0100 (Hiroshi via S. Hasegawa, *NDXC-HQ*)

BBG Chairman James K. Glassman announced that from March 17, US broadcasts to Tibet would increase by 4 hours daily, two each from VOA and Radio Free Asia (VOA press release via Alokesh Gupta) Which gave no details and did not bother to mention that all these broadcasts are heavily jammed by the Chinese (gh)

TURKEY Very surprised to hear unmistakable VOT IS on 6175, Feb 29 at 1456 with flutter. This is scheduled as Emirler site, S of Ankara, about to open two-hour Arabic service at 168 degrees. That azimuth aims toward Al Quds, down the Red Sea, across Ethiopia, and the southern tip of Madagascar, hitting Antarctica at the Mac Robertson Coast. However, long-path to Enid is a bit further east, right across the Arabian Peninsula, and then totally over water all the way to Culiacán, Sinaloa, after tangenting 62 degrees south near the Adélie Coast; more likely than short path, which would reach 62 degrees north where it is noon at the southern tip of Greenland (gh, OK) See also RUSSIA for another long-pather

UKRAINE RUI A-08 English: NAm 0000 & 0300 7440; WEu 0500 9945, 0900 & 1100 11550; 1900 7490; 2100 7510 (Alex Yegorov via Alokesh Gupta)

U K Further cuts in BBCWS on SW during March: Caribbean service, which we could overhear in NAm, ending; Spanish may remain only on internet, or a 1200 broadcast via WHRI on 9410; East and Southeast Asia reduced, no longer in the daytime or after midnight, but unclear what timezones referred to (gh)

U S A Did you know Delano has connections to XER, and to the first atomic bomb explosion? See this excellent illustrated article on the history of the late VOA Delano relay: **http://radioworld.com/pages/s.0106/t.11328.html** (gh)

What is RFA telling the Uyghurs? "'We love the United States!' one man told me. 'They will come help us kick out China.' The largest Uyghur independence group, the ETIM, seeks the re-creation of the free Republic of East Turkestan declared by earlier Uyghur rebels. The Home of East Turkestan Youth, known as 'Xinjiang's Hamas,' has two thousand members. 'I listen to Radio Free Asia,' added an older guy knowingly. Radio Free Asia aired broadcasts in the Uyghur language. 'America is coming to give us our freedom, we know that, but when exactly?'" Gary Palast, *Pacific Free Press*, 21 February 2008 (*kimandrewelliott.com*)

As the only useful external station broadcasting in Uighur, RFA has a sizable audience in that region. I assume RFA is not leading its Uyghur audience to mistaken conclusions, à la RFE Hungarian in 1956 (Kim Andrew Elliott, *ibid.*)

Besides ARMENIA, TIBET [q.v.], there was a flurry in March of additional VOA broadcasts to trouble spots: Amharic in the morning, Swahili to Kenya at local noon. Meanwhile, VOA moved its Creole services one UT hour earlier March 9, even though Haiti did not go on DST when we did!

[non] In A-08 from March 30, IBB tentatively planned its first use of the Bonaire relay station for some transmissions due eastward toward Africa, presumably in partial replacement for Briech, Morocco: 0700-0730 17500; 1430-1500 17530; 1700-1730 9565; 1730-1800 12080; 1800-1830 17865, 1830-2000 17895, 1830-2030 9830 (gh)

WBCQ's tentative plan to use 15120 was soon replaced by 15420 – a frequency which has been registered for many years by WRNO, but that station has not returned to the air despite the *MT* cover story. WBCQ 15420 replaces 17495 in the daytime, and 5835 available at night. In turn inactive WRNO is listed on new 15590 day and 7505 night – those being the longtime frequencies of KTBN! So what becomes of KTBN? Going off the air? (gh)

WWRB is registered on 5050 only at 0000-0500 UT, both in A and B seasons; nevertheless, it fires up much earlier with an unannounced big band music prélude, one date heard as early as 2259. This is WWRB's most enjoyable programming, by far (gh)

Coincidentally, two 1480 stations have been reported on their third harmonics, 4440 (gh) WSPY, Geneva IL, 2345-0002, nostalgia music (Harold Frodge and Don Moore, *MARE DXpedition*, MI) And WSRC, Fair Bluff NC, 0205-0420 with country music (Brian Alexander, PA, *DXLD*)

VATICAN Attention, those compiling lists of broadcasts in English: Vatican Radio has a very brief one of 3 minutes at 2311-2314, heard several times on 9600. This is actually the Vietnamese service at 2315, transmitter always turned on early and colliding with XEYU. The strange thing is, there is no English broadcast on the VR schedule before 2315; it must be filler on their satellite feed (gh)

ZIMBABWE [non] SW Radio Africa moved from 7125 to 12035 for A-08 at 1700-1900 (David Pringle-Wood, Zimbabwe, *DXLD*) Unclear as usual whether via UK or Norway (gh) Strong and very good signal, already testing in mid-March (Brian Alexander, PA, *DXLD*)

Until the Next, Best of DX and 73 de Glenn!

BROADCAST LOGS

NOTEWORTHY LOGS FROM OUR READERS

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

0020 UTC on 9680
Radio Thailand. World news on Kosovo and United States political race. Station ID and promo "Radio Thailand News" at 0027. *Travel News to Thailand* segment abruptly off at 0029, shifting to 12095 at 0030 with *Business News.* (Stewart MacKenzie WDX6AA, Huntington Beach, CA)

0143 UTC on 7205
TURKEY: Voice of Turkey. Announcer duo discussion on the degree of freedom in Turkey compared to other Islamic nations. (Joe Wood, Greenback, TN) Signal strength S7. *Press Review* program on 12035 at 1343. (Bob Fraser, Belfast, ME)
Internet live streaming audio and on-demand video **www.trt.net.tr/voiceofturkey/vot.htm**

0202 UTC on 5010
MADAGASCAR: RTV Malagasy. Tune-in to choral national anthem. Malagasy talk at 0204 into local and instrumental musicals. Good signal, reduced carrier USB. Audible 7250, 1229-1247. English service ID, local music and newscast. Despite occasional amateur radio interference strong carrier observed with weak hum and low modulation. (Brian Alexander, PA). 5010, 0309. First log of this station despite poor signal quality. (Wood) Deutsche Welle-Madagascar relay 7380, 2204-2217. Indonesian news update on politics with English sound bites. Station ID to African continent news, (Scott Barbour, Intervale, NH)
Internet streaming and on-demand audio **www.dw-world.de/**

0205 UTC on 3340
HONDURAS: HRMI/Radio Misiones Internacional. Announcer's rapid-fire program delivery with lite and pop style music. Tentative station ID in passing at 0213. Weak signal but clear with mild fading. Honduran **Radio Luz y Vida** 3249.92, 1116-1131 with Spanish religious format (Barbour) **HRMI** 3340, 0712-0800 Spanish religious programming. (Alexander)

0210 UTC on 4840
INDIA: All India Radio (via Mumbai). Two announcers Hindi text and comments to 0218. Musical bridges to station identification and website URL. **http://allindiaradio.org/** Signal fair. (Chuck Bolland, Clewiston, FL). **AIR (via Aligarh)** 11620, 1920. SIO 454. (Fraser)

0249 UTC on 6225
EGYPT: Egyptian Radio. (ERTU) Presumed General Program including Qu'ran recitations, Abruptly off at 0259.* Fair-poor signal, surprised not to hear on usual 6290. (Ron Howard, Monterey, CA). **Radio Cairo** 6250, 2130. Report on North African Summit. (Fraser). 6250, 2140-2147. (Jim Evans, Germantown, TN)
Internet streaming audio and video **www.ertu.org**
Egypt's **Radio Wadi el Nike** 9250, 2150-2259.* Local pops to instrumental music, including a Beethoven tune. Arabic text to Qu'ran. Time pips at 2230 and Arabic announcement. Sign-off with national anthem for good signal. (Alexander).

0300 UTC on 3984.85
CROATIA: Croatian Radio/Voice of Croatia. ID announcements to *Croatia Today* news program. Euro pop music amid weak but readable signal. Reception better on // 7285 via Germany. (Alexander) 7285 at 2320. News on Croatian peacekeepers in Afghanistan. (Fraser).
Internet streaming audio **www.hrt.hr/index.xml** *Web Magazine-Voice of Croatia* **http://voiceofcroatia.net/**

0359 UTC on 6240
MOLDOVA: Voice of Russia relay. Sign-on ID as "this is Moscow." World news coverings briefs from United States, Iraq and the Czech Republic. Notice that Dakar Rally 2008 has been cancelled for 2008. Reception good (S.Wood).
Internet streaming and on-demand audio **www.ruvr.ru/**

0432 UTC on 4960
SÃO TOMÉ: Voice of America relay. VOA identification to discussion of the U.S. jobs market and forecast. Fair signal at S5. 6080, 2109-2126. *American Gold* oldies music program to ID. (Harold Frodge, Midland, MI) **VOA Botswana** relay 12080, 2038-2050. (Wood)
Internet streaming and on-demand audio and podcast **www.voanews.com**

0520 UTC on 4777
GABON: RTV Gabonaise. French announcer's opening "bonjour" to listeners for Saturday morning wake-up show. Afro pops and 1970's pop music format for best ever signal heard from this station. Subsequent monitoring 0535-0607 on 4777. (Wood).
Internet streaming audio **www.africa1.com**

1050 UTC on 9624.86
BOLIVIA: Radio Fides, La Paz, 1050-1105, Jan 12, Spanish. *La Hora del Pais* to local time check, " las seis de la mañana con 53 minutos..." Station ID, "Atencion...todas las emisoras de la Cadena Fides, entramos en Cadena Nacional." Additional station announcements. SINPO 33433. (Arnaldo Slaen, Argentina)
Internet streaming audio **www.radiofides.com**

1229 UTC on 7250
BANGLADESH: Bangla Betar. Tune-in to interval signal. Time tips at 1230 to English service sign-on ID. Thirty seconds of local music at 1239, followed by newscast. Strong carrier with low modulation making reception very difficult. (Alexander)
On-demand audio **www.betar.org.bd/**

1335 UTC on 15105
ROMANIA: Radio Romania Internaitonal. Segment on touring spice gardens and local festivals. SIO 454. (Fraser) 6115, *2130-2135. Interval signal to waltz tune. English ID and schedule with programming preview and news. SIO 443 better than // 9755. (Harold Frodge, Midland, MI)
Internet streaming audio **www.rri.ro/**

1351 UTC on 6065
SWEDEN: Radio Sweden. *Network Europe* program, good signal quality. (Fraser). Station ID to interval signal and sign-on announcements, to news and economic briefs. Initial poor signal improving quickly to SINPO 33223. (Jim Evans, Germantown, TN).
Internet streaming and on-demand audio **www.sr.se/rs**

1359 UTC on 3275USB
CANADA: XLB51-La Ronge, Saskatchewan. Fair signal for English weather broadcast for the far north areas of Uranium City, Fond du Lac and Stony Rapids. Closing comments at 1402, "This is XLB51 clear on all channel. Have a good morning." Logged and verified station in 2004 on 4610 kHz. Broadcasts are used primarily by trappers and fishermen, don't believe they have a set schedule. (John Wilkins, Wheat Ridge, CO)

1500 UTC on 7370
PRIDNESTROVIE: Radio PMR. Station ID, "Here is Tiraspol," followed by *History of the Creation and Development of the PMR*. Program included item that there was once a proposal for Pridnestrovie Moldovian Soviet Socialist Republic. French programming commenced 1515. Quite strong signal quality. (Wilkins)

1700 UTC on 11610
CLANDESTINE: Radio Voice of the People via Radio Netherlands, Talata-Volondry, Madagascar. Sign-on with vernacular and English identifications. Announcements in African vernacular during brief breaks of African music. ID to English at 1740, though difficult to understand. Postal and email addresses at 1754. Good signal despite very weak music loop jammer heard underneath station. (Alexander)
This Zimbabwean opposition station continues to promote peace in the ongoing troubled political times with hopes of building a democratic society. Station is reportedly being jammed by the Zimbabwe government Website**: www.radiovop.com/** Station address: Radio Voice of the People, P.O. Box 5750, Harare, Zimbabwe (address via *World QSL Book*)

Additional loggings, excluded for space constraints, are posted as **Blog Logs** on the **Shortwave Central Blog** at the above web address.

Thanks to our contributors – Have you sent in YOUR logs?
Send to Gayle Van Horn, c/o Monitoring Times
English broadcast unless otherwise noted.

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

Science in the Spotlight

At first blush, one might think that most radio programming about science matters is in the realm of the tin-foil helmet crowd. Many programs, especially on US based shortwave stations, the internet, and the omnipresent *Coast to Coast AM* program (heard overnight on hundreds of stations throughout North America, see last month's cover feature) tend to stray into subjects like UFOs, the moon landings as hoax and other government conspiracies, to name a few.

But, there are also many, many programs worldwide which concern themselves with legitimate science and health matters, which are both entertaining and educational.

I've always had an interest in science, which oddly enough didn't translate into high marks in school. My grade 12 Politics teacher one day taught us that we all have a built in "nonsense detector" (he actually used a more colorful metaphor), and that any time we listen to someone or read something, this detector kicks into action and sets alarm bells off, when something "doesn't sound right."

I like to think that this background has given me an intense curiosity about, even an enthusiasm for, science, mixed with a healthy scepticism. This has come in handy, not only while listening to science programming, but any and all programming.

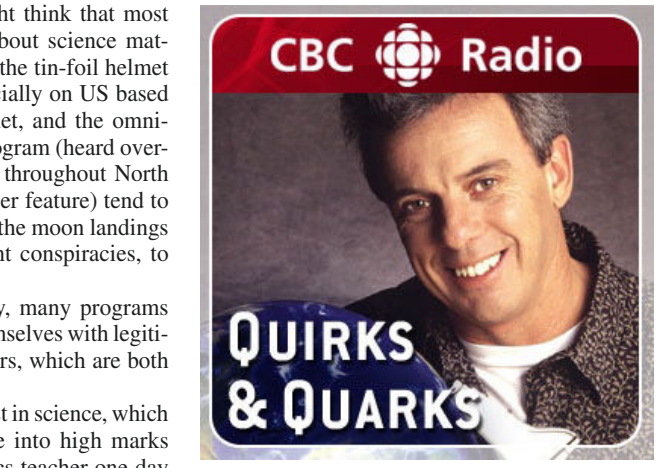
Let's get straight to some of the best of the best science discussions via radio.

❖ CBC Radio One – Quirks and Quarks

Perhaps I am biased, but this may be one of the best science programs around.

"**Quirks & Quarks** is the award-winning radio science program of the Canadian Broadcasting Corporation. The program is heard by a national audience in Canada of nearly 500,000 people, and by thousands more around the world on the weekly podcast.

"For more than 30 years, **Quirks & Quarks** has brought its listeners to the cutting edge of scientific inquiry. Every week, the program presents the people behind the latest discoveries in the physical and natural sciences – from the smallest sub-atomic particle to the largest objects in the sky and everything in between. The program also examines the political, social, environmental and ethical implications of new developments in science and technology.



Quirks & Quarks is a program for people fascinated by the world above, below and around them. And you don't need a PhD to enjoy it." **www.cbc.ca/quirks/summary.htm**

In 30 years, the program has been hosted by Dr. David Suzuki, Jay Ingram and, since 1992, by Bob McDonald. I particularly enjoy the occasional "mailbag" shows, in which they answer listener's questions about anything and everything scientific. The program can be heard Saturdays at 1206 pm local and should be available on the CBC Northern Quebec Service at 1606 UTC on 9625 kHz. The program is also available as a podcast.

www.cbc.ca/podcast

❖ Radio Australia – The Science Show

"**The Science Show** with Robyn Williams on Radio National is one of the longest running programs on Australian radio. Scientific issues, debates, events, personalities, exposing scientific fraud, discoveries and broadcasting pranks have been the hallmarks of the Science Show.

"The unique content of the **Science Show** has given Australians fascinating insights into all manner of things from the physics of cricket to prime ministerial biorhythms. According to Robyn Williams, the **Science Show** has consistently achieved what it originally set out to do in 1975: 'To produce a science program about ideas, not simply facts or bits of boffinry'." (RA Website)

Robyn is a science journalist and broadcaster with a string of degrees and accomplishments. In 2007 Robyn and Bob McDonald of CBC's **Quirks and Quarks** co-hosted a number of joint broadcasts, heard in both countries. Like Quirks, the program covers everything from the public perception of nanotechnology to microbes to 30-meter telescopes. And of course it's all tinged with an Australian perspective. **The Science Show** can be heard via Radio Australia UTC Sundays at 1600 UTC on 11650, 11660, 12080, 13630, 15230, 15515, 17785 and 17795 kHz.

If these frequencies prove difficult to hear, one can also hear the program on demand online or via a podcast at

www.abc.net.au/rn/scienceshow/

There are other science themed programs heard via Radio Australia. These are available online and include:

All in the Mind - A weekly foray into the mental universe, the mind, brain and behavior.

In Conversation - Conversations with scientists, and those interested in the subject, about what it's meant in their lives.

Innovations - A showcase of Australian design, discovery, invention, engineering and research skills.

Ockham's Razor - Thoughtful people have their say.

The Philosopher's Zone - Explore the big philosophical questions and arguments.

www.abc.net.au/ra/programguide/?tab=guideGenre#guideScie to listen or download/subscribe to podcasts.

❖ DW-Radio - Living Planet

"**Living Planet** brings you environmental news, background reports, interviews and features from our international network of correspondents. The half-hour program is broadcast every Thursday and Friday, or you can download the podcast.

"As man's impact on the planet becomes more evident, there is a growing need for independent and impartial environmental reporting. **Living Planet** analyzes environmental policies, looks at new technologies, visits innovative projects and keeps you up-to-date on the state of the planet's environment.

"**Living Planet** has won gold and silver medals for environmental programming at the renowned New York International Radio Festival, and has received a special United Nations gold award for an 'outstanding radio program which best exemplifies the ideals and goals of the United Nations.'"

www.dw-world.de/dw/article/0,2144,2571682,00.html

While DW has posted its summer frequency schedule it has not published the summer program schedule (as this was written). To hear this pro-

gram via the radio, try Thursdays at 2030 UTC on 11795, 11865, 15205 kHz.

❖ DW-Radio – Spectrum

"**Spectrum** is a half-hour weekly programme looking at developments in the fields of science and technology.

"Whether it's advances that will change our lives or offbeat oddities, our team of reporters around the world keeps you up to date.

"**Spectrum** is broadcast every Saturday, Sunday, Monday and Tuesday or listen to the podcast on the internet."

www.dw-world.de/dw/article/0,2144,2789896,00.html

As with **Living Planet**, I am guessing you should try Tuesdays at 2030 UTC on 11795, 11865, 15205 kHz

❖ Radio Netherlands - Earthbeat

Earthbeat is the closest Radio Netherlands comes to a science show. It touches on many aspects of science among other things. "Monitoring the Earth's heartbeat is our task. We look at our footprint on this big round world of ours and run stories of the people trying to make that footprint lighter.

"Climate change, global warming and other environmental issues are a large part of sustainable development, but if we recognise the interconnectedness of the world, we will see that it is actually linked to all the ways in which we live – what we eat, how we school our children, the way we look at the future."

The program is hosted by Dheera Sujan, and encourages listener input.

www.radionetherlands.nl/radioprogrammes/earthbeat/

❖ Radio New Zealand National - Our Changing World

Our Changing World broadcasts every Thursday evening after the 9pm news (UTC 2000 Wednesday), featuring the latest in science, environment and health.

A mix of in depth interviews, packages and sound rich features, **Our Changing World** covers topics across all scientific disciplines, natural history and environmental issues, and developments in health as well as exploring the human side of science and the personalities behind it.

Segments are played during **Afternoons with Jim Mora** at 3.45pm on Tuesdays to Fridays (0245 UTC). Produced and presented by Dacia Herbulock & Amelia Nurse

www.radionz.co.nz/nr/programmes/ourchangingworld

❖ Voice of Russia - Science Plus

"Estelle Winters brings you a wide range of themes related one way or another with scientific matters. The program is aired during the week and also includes short interviews with the people around our world who specialize in Russian scientific affairs." This program succeeds the long-running "**Science and Engineering**" hosted in Soviet times by Boris Belitsky.

Tune in to **Science Plus** on Monday at 07.00 and 17.00, Wednesday at 05.00 and 17.00 and Thursday at 04.00 UTC.

As America's "partner" in the space race, there are often items dealing with the Russian space program, as well as Russian scientific achievements, without some of the cold war braggadocio of the past. The Voice of Russia website also has a vast text archive of science items as broadcast on the program. It's well worth checking out.

www.ruvr.ru/main.php?lng=eng&rt=119&p=

❖ BBCWS – Science in Action

The World Service provides the long running program **Science in Action**. A recent episode looked at "Mesopotamia 5 Years On" and the devastation war has caused at archaeological sites. Other subjects covered included Wheat Rust, Science in Africa (and efforts to promote it) and the search for undiscovered species in the rainforest. The program is available on demand via the web page or the BBC Player and as a podcast. Check out

www.bbc.co.uk/worldservice/programmes/science_in_action.shtml

The BBC website for the domestic Radio 4 network lists dozens of science oriented programs. Far too many to list, let alone describe. As you can imagine, the quality of these BBC programs is top notch. If you have an interest in science matters, by all means check out their science page: **www.bbc.co.uk/radio4/science/**

❖ Various - Earth and Sky

"EarthSky Communications' first and best-known product – the popular, internationally syndicated **Earth & Sky** radio series – began broadcasting in 1991 on a few dozen radio stations scattered throughout the U.S.

"Today, the **Earth & Sky** radio series is a clear voice for science, broadcast more than 10 million times every day across the globe. The year 2008 marks 17 years of broadcast – and nearly 6,000 science radio shows – for **Earth & Sky**.

"Deborah got the idea for the Earth & Sky radio series after reading an article in the *New Yorker* magazine by Bill McKibben. It was the

late 1980s, and the subject was 'the end of nature.' Deborah was moved. She wanted to present the work of scientists trying to understand and solve human challenges here on Earth. She said, 'The idea for the Earth & Sky radio series was simply to talk about the sky above us and the planet under our feet.'

"The response to the show, from both radio stations and listeners, was positive from the first. By the end of EarthSky's first year of broadcast, the show was heard on more than 100 radio stations." **www.earthsky.org/about/history**

The **Earth & Sky** radio series plays seven times daily on Voice of America's most popular news program, **VOA News Now**. That makes Voice of America the single biggest outlet for **Earth & Sky** radio programs overseas.

The **Earth & Sky** science radio series plays during a variety of rotating times during the day on the following World Radio Network platforms:

WRN English to Europe: 1557 BST/1657 CEST; 2157 BST/2257 CEST; 2357 BST/0057 CEST
WRN English to Africa/ Middle East: 1257 UTC
WRN English to Asia Pacific: 2158 AEST

This is just a brief look at what's out there in the world of science. Originally I intended to look at Science and Health programs, but there are just so many to choose from. I might even venture to suggest that health programming may be one of the fastest growing genres of programming. We may pursue this in a future column.

And finally, if you still like watching continuous coverage of space flights, check out NASA TV online. **www.nasa.gov/multimedia/nasatv/** No Walter Cronkite, but it will both take you back to those heady days of the 1960s and give you a glimpse of the future. And like my mentors taught me all those years ago, stay curious!

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

Summit DXing for the *Mountain Goats* and *Sloths*

Summits on the Air (SOTA) is an award scheme for shortwave listeners and amateur radio operators that encourages portable operation in mountainous regions. This is just not for mountaineers, but has been designed to enable participation by everyone.

Awards include the **activators** (those that ascend to the summits) and **chasers** (who either operate at home, at a local hilltop, or who are even activators on other summits). Each summit earns the activator and chasers a score which is related to the height of the summit. Certificates are awarded for various scores, leading to the prestigious *Mountain Goat* and *Shack Sloth*.

Activators need a radio station that is portable, but operation from cars is not allowed. All bands and modes may be used, and chasers need only a normal home station. Many operators document their activities with a personal blog or website. One example of earlier expeditions is *Mountain Adventures with a Radio* **www.gm4zfz.com** .

SOTA Associations are operational in the United States, Ireland, Germany, Greece, Austria, South Africa, Czech Republic, Hungary, France, Switzerland and the United Kingdom. Additional rules and regulations may be downloaded in PDF from the SOTA Documents page. For more details about *Summit on the Air* program, refer to **www.sota.org.uk**

Islands on the Air (IOTA) promotes amateur radio contacts in qualifying IOTA island expeditions. Electronic submissions are encouraged and it is open to amateur radio and shortwave listeners. For additional information on rules, future contesting, latest IOTA DX Spots and more, consult **www.rsgbiota.org/**

ARRL's *Logbook of the World (LOTW)* continues to expand its repository of amateur radio log records. When both operators participate in a one-on-one contact (QSO) and submit their records electronically to the *Log Book of the World,* the result is a cardless verification, used for ARRL credit. With over 75 million operators, *LOTW* has been deemed a success by the worldwide community of DXers.

LOTW is open to all amateur radio operators, and applying for a digital certificate is the first step toward taking advantage of the system. Digital certificates authenticate the user's identity. For more information about *Logbook of the World,* go to **www.arrl.org/lotw/**

AMATEUR RADIO

Canada VE1OTA (IOTA NA-154). 20 meters SSB. Full data color photo card. Received in 309 days for an SASE and $1.00US to: QSL Manager VE1VOX Dana Rushton, P.O. Box 1862, Truo, NS B2N 6C7 Canada. (Larry Van Horn,NC)

Colombia- HK3 JJH, 12 meters SSB. Full data black/white logo card. Received in 462 via ARRL. (Van Horn)

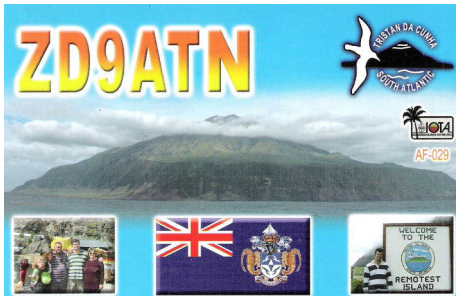
Honduras- HQ9R, 40 meters SSB. Full data tri color card. Received in seven days for an SASE to: Richard J. Wolf, 25295 Seventh Ave., Los Molinos, CA 96055. (Van Horn)

Saint Brandon 3B7C (Agalega and St. Brandon Islands) (IOTA AF-001) 20 meters SSB. Full data color card. Received in 61 days for $2.00US and a nested SAE to: G3NUG-Neville Cheadle, Lower Withers Barns, Middleton On the Hill, Leominster, Herefordshire HR6 0HY United Kingdom. (Ken Reitz KS4ZR, VA)

Tristan Du Cunha ZD9ATN (IOTA AF-029) 20 meters SSB. Full data color scenery card. Received in one year and ten months for $2.00US and a nested SAE to: IZ0CKJ Alessio Roma, Via Sterparo, 03023 Ceccano (FR) Italy. (Reitz).

FRENCH GUIANA

Radio France Internationale relay 5995 kHz.



Full data letter from French Guiana, signed by Jean François LeCoeuvre. Received in 133 days for English report, applause card and local postcard. Station address: TDF SAS, Boite Postal 7024, 97307 Cayenne Cédex, ,French Guiana. (Joe Wood, Greenback, TN).

GERMANY

Voice of Croatia, 7285 kHz. Full data color electronic QSL received via email in one day after several email noted as "returned mail." EQSL includes "Best Regards, Zlatko Kureti_". Original report emailed to *glas.hrvatske@hrt.hr* (Dan Malloy, Everett, WA).

MEDIUM WAVE

CHWO, 740 kHz AM. Full data *51st Anniversary* card, signed by Brian Smith-QSL Manager, plus book marks and info sheet on the station's history. Received a large color certificate for participating in "two birthday challenge." Received in one month for an AM report and Canadian postage stamps (not used on reply). QSL address: ODXA, 155 Main St. North. Ste. 313, Newmarket ON Canada L3Y 8C2 (Bill Wilkins, Springfield, MO).

CKEC, 1320 kHz AM. Full data verification on station letterhead, signed by Peter W. Lann VE1LAN-Chief Engineer. Received in 14 days for an AM report and SASE. Station address: 84 Provost St., Box 519, New Glascow, Nova Scotia B2H 5E7 Canada. (Eric Hopkins, Ayer, MA). Station now on FM as CKEC 94.1 *(East Coast FM)*

Internet streaming audio **www.ckec.com**

WSTJ, 1340 kHz AM. No data confirmation on station letterhead, signed by David Labounty. Received in 21 days for an AM report and SASE. Station address; P.O. Box 249, 1303 Concord Ave St., Johnsbury, VT 05819 USA. (Hopkins)

Sri Lanka, 1548 kHz AM. Full data QSL card with site noted, unsigned. Received in 13 days for CD report sent to Deutsche Welle in Germany, plus $2.00US. Two stickers and program schedule enclosed. New country for me-very pleased! QSL address: Deutsche Welle, 53110 Bonn, Germany. (Patrick Martin, Seaside, OR).

NORTHERN MARINAS

Radio Free Asia, 13625 kHz. Full data station logo card, unsigned. Received in 35 days for an English report to: *qsl@rfa.org* (Tom Banks, Dallas, TX).

UTILITY

Coastal Station- KLB, 12917 kHz CW, Seattle, WA. Partial data studio sheet with incorrect data. Received in 19 months for a utility report and $1.00US. No explanation why it took so long. QSL address: c/o WLO/ Shipcom LLC, 7700 Rinla Avenue, Mobile, AL 36619 USA. (Wilkins)

Non-Directional Beacons: YLJ 406 kHz. Full data prepared QSL card. Power listed on card as 15 watts. Received for a utility report $1.00US and SAE. QSL address: Meadow Lake Airport, Atten: Mr Timothy Mckay-Airport Manager, Box 9000, Meadow Lake, SK Canada S9X 1V8. (Jim Pogue KH2AR, Memphis, TN)

ZHD 399 kHz. Full data prepared QSL card. Power listed on card as25 watts. Received for a utility report $1.00US and SAE. QSL address: Dryden regional Airport, Atten: Mr George Friensen, 1012 Airport Road, Dryden, ON Canada P8N 2ZR (Pogue)

How to Use the Shortwave Guide

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

① ② ⑤ ③ ④ ⑥ ⑦

Convert your time to UTC.

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

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 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 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

MT Monitoring Team

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Thank You …

Additional Contributors to This Month's Shortwave Guide:

Rich D'Angelo/*NASWA Flash Sheet*; Rachel Baughn/MT; Alokesh Gupta, New Delhi, India; Anker Petersen/*DSWCI-DX Window*; Adrian Sainsbury/R NZ Intl; Evelyn Marcy/WYFR; Leo van der Woude, Netherlands; Ivo Ivanov; Tom Taylor, UK; Harold Sellers/*ODXA/DX Ontario*; Wolfgang Büeschel, Germany; Jaisakthivel, Chennai, India; Robert Scaglione, Italy; Daniel Sampson, WI; Andreas Volk, Germany*; Ardic DX Club; BCL News; Cumbre DX; BDX Club; DX Mix News, Bulgaria; Hard Core DX; NASWA Journal/NASWA Flashsheet; ;World Wide DX Club-Top News*.

Shortwave Broadcast Bands

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

Notes

Note 1 Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.

Note 2 Broadcasters can use this frequency range on a (NIB) non-interference basis only.

Note 3 WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007

Note 4 WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

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

0000	0010	vl	Croatia, Croatian Radio	7285va		
0000	0020		Japan, NHK World/Radio Japan			5920eu
			6145na	13650as	17810as	
0000	0030		Australia, HCJB Global	15525as		
0000	0030		Egypt, Radio Cairo	9465na		
0000	0030		Thailand, Radio 9680af			
0000	0030		UK, BBC World Service	7340as		17615as
0000	0030		USA, Voice of America	7405af		
0000	0045		India, All India Radio	9705as		9950as
			11620as	11645as	13605as	
0000	0045		USA, WYFR/Family Radio Worldwide			17805sa
0000	0057		Netherlands, Radio Netherlands			9845na
0000	0100		Anguilla, Worldwide Univ Network			6090am
0000	0100		Australia, ABC NT Alice Springs			2310do
			4835do			
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Creek			4910do
0000	0100		Australia, Radio Australia	9660as		12080as
			13690as	15240pa	17715as	17750va
			17775va	17795va		
0000	0100		Canada, CFVP Calgary AB	6030na		
0000	0100		Canada, CKZN St John's NF	6160na		
0000	0100		Canada, CKZU Vancouver BC			6160na
0000	0100		China, China Radio Intl	6020na		6075as
			7130eu	7180as	9570na	11885as
			13750as	15115as		
0000	0100		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	
0000	0100		Germany, Deutsche Welle	9885as		15595as
			17525as			
0000	0100		Guyana, Voice of 3291do			
0000	0100		Malaysia, RTM/Traxx FM	7295as		
0000	0100	DRM	New Zealand, Radio NZ Intl	15720pa		
0000	0100		New Zealand, Radio NZ Intl	13840pa		
0000	0100	vl	Papua New Guinea, Wantok R. Light			7325va
0000	0100		Singapore, MediaCorp Radio			6150do
0000	0100		Spain, Radio Exterior Espana	6055na		
0000	0100		UK, BBC World Service	6195as		9740as
			15335as	15360as		
0000	0100	f	UK, Bible Voice BC	6140as		
0000	0100		Ukraine, Radio Ukraine Intl	7440na		
0000	0100		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12132usb	13362usb	
0000	0100		USA, KTBN Salt Lake City UT	7505na		
0000	0100		USA, WBCQ Monticello ME	5110am		7415am
			9330am			
0000	0100	h	USA, WBCQ Monticello ME	17495am		
0000	0100		USA, WBOH Newport NC	5920am		
0000	0100		USA, WEWN Vandiver AL	5810am		
0000	0100		USA, WHRA Greenbush ME	5890eu		
0000	0100		USA, WHRI Cypress Creek SC			7315am
0000	0100		USA, WINB Red Lion PA	9265am		
0000	0100		USA, WRMI Miami FL	9955am		
0000	0100		USA, WTJC Newport NC	9370na		
0000	0100		USA, WWCR Nashville TN	3215na		7465na
			13845na			
0000	0100		USA, WWRB Manchester TN	3185va		5050va
			5745va	6890va		
0000	0100		USA, WYFR/Family Radio Worldwide			6985na
			9505na	11835ca		
0005	0100		Canada, Radio Canada Intl	9755am		
0030	0045	twhfas	Albania, Radio Tirana	9390na		
0030	0045	Sun	Germany, Pan American BC	6165as		
0030	0100		Australia, Radio Australia	15415as		
0030	0100	mtwhf	Austria, Radio Austria Intl	7325am		
0030	0100		Lithuania, Radio Vilnius	9875na		
0030	0100		Thailand, Radio 12095na			
0030	0100	fas	UK, Bible Voice BC	6030as		
0030	0100		USA, Voice of America	7200va		7405va
			9620va	11695va	11705va	11805va
			12005va	15185va	15205va	
0043	0100	Sat	Austria, Radio Austria Intl	7325am		

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

0100	0105		Greece, Voice of Greece	7475va		9420va
			12105va			
0100	0110	vl	Croatia, Croatian Radio	7285sa		
0100	0127		Czech Rep, Radio Prague	6200na		7345na
0100	0128		Vietnam, Voice of Vietnam	6175na		
0100	0130		Australia, Radio Australia	17775as		
0100	0130	mtwhfa	Serbia, International Radio Serbia			7115na
0100	0130		Slovakia, Radio Slovakia Int	5930na		9440sa
0100	0156		Romania, Radio Romania Intl			6145na
			9515na			
0100	0157		China, China Radio Intl	6005na		6075eu
			7130eu	7180eu	9570eu	9580na
0100	0157		Netherlands, Radio Netherlands			9845na
0100	0159		Canada, Radio Canada Intl	5840va		7255va
0100	0200		Anguilla, Worldwide Univ Network			6090am
0100	0200	twhfa	Argentina, RAE 11710am			
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Creek			4910do
0100	0200		Australia, Radio Australia	9660as		12080as
			13690as	15240pa	15415as	17715as
			17795va			
0100	0200		Canada, CFVP Calgary AB	6030na		
0100	0200		Canada, CKZN St John's NF	6160na		
0100	0200		Canada, CKZU Vancouver BC			6160na
0100	0200		China, China Radio Intl	9535as		11870as
			15115as	15785as		
0100	0200		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	
0100	0200		Cuba, Radio Havana	6000na		6180na
0100	0200		Guyana, Voice of 3291do			
0100	0200		Indonesia, Voice of Indonesia			9525al
			11785pa	15150as		
0100	0200		Malaysia, RTM/Traxx FM	7295as		
0100	0200	DRM	New Zealand, Radio NZ Intl	15720pa		
0100	0200		New Zealand, Radio NZ Intl	13840pa		
0100	0200		North Korea, Voice of Korea	7140as		9345as
			9730as	11735sa	15180sa	
0100	0200	vl	Papua New Guinea, Wantok R. Light			7325va
0100	0200		Singapore, MediaCorp Radio			6150do
0100	0200		Sri Lanka, SLBC 6005as		9770as	15745as
0100	0200		Taiwan, Radio Taiwan Intl	11875as		
0100	0200		UK, BBC World Service	6195as		7320as
			11750as	15335as	15360as	
0100	0200	f	UK, Bible Voice BC	6140as		
0100	0200		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
0100	0200		USA, KTBN Salt Lake City UT	7505na		
0100	0200		USA, KWHR Naalehu HI	17525as		
0100	0200		USA, Voice of America	7205va		9740va
			7205va	11705va		
0100	0200		USA, WBCQ Monticello ME	7415am		9330am
0100	0200	Sat	USA, WBCQ Monticello ME	17495am		
0100	0200		USA, WBOH Newport NC	5920am		
0100	0200		USA, WEWN Vandiver AL	5810am		
0100	0200		USA, WHRA Greenbush ME	5890eu		
0100	0200	sm	USA, WHRI Cypress Creek SC			7315am
0100	0200		USA, WHRI Cypress Creek SC			7490va
0100	0200		USA, WINB Red Lion PA	9265am		
0100	0200		USA, WRMI Miami FL	9955am		
0100	0200		USA, WTJC Newport NC	9370na		
0100	0200		USA, WWCR Nashville TN	3215na		5935na
			7465na			
0100	0200		USA, WWRB Manchester TN	3185va		5050va
			5745va	6890va		
0100	0200		USA, WWRB Manchester TN	3185va		5050va
			5745va	6890va		
0100	0200		USA, WYFR/Family Radio Worldwide			6985na
			9505na	15195as		
0100	0200		Uzbekistan, CVC International			9480as
0105	0200	twhfa	Canada, Radio Canada Intl	9755am		
0130	0200		Iran, Voice of the Islamic Rep of Iran			6120na
			7160na			
0130	0200		Sweden, Radio 6010na			
0130	0200	twhfa	USA, Voice of America	5960va		7405va
0145	0200	twhfas	Albania, Radio Tirana	9390na		

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

0200	0205	twhfa	Canada, Radio Canada Intl	9755am		
0200	0210	vl	Croatia, Croatian Radio	7285va		9470eu
0200	0227		Czech Rep, Radio Prague	5995na		6200na
			7345na			
0200	0230		Iran, Voice of the Islamic Rep of Iran			6120na
			7160na			
0200	0230		Serbia, International Radio Serbia			7115na
0200	0230		South Korea, KBS World Radio			15575sa
0200	0230		Thailand, Radio 15275na			
0200	0245		USA, WYFR/Family Radio Worldwide			11835ca
0200	0300		Anguilla, Worldwide Univ Network			6090am
0200	0300		Australia, ABC NT Alice Springs			2310do
			4835do			
0200	0300		Australia, ABC NT Katherine	5025do		
0200	0300		Australia, ABC NT Tennant Creek			4910do
0200	0300		Australia, Radio Australia	9660as		12080as
			13690as	15240pa	15415as	15515as
			17750va	21725va		
0200	0300		Bulgaria, Radio 9700na		11700na	
0200	0300		Canada, CFVP Calgary AB	6030na		

0200	0300		Canada, CKZN St John's NF	6160na		
0200	0300		Canada, CKZU Vancouver BC			6160na
0200	0300		China, China Radio Intl	11770as		13640as
0200	0300		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	
0200	0300		Cuba, Radio Havana	6000na		6180na
0200	0300		Egypt, Radio Cairo	7270na		
0200	0300		Guyana, Voice of 3291do			
0200	0300		Malaysia, RTM/Traxx FM	7295as		
0200	0300	DRM	New Zealand, Radio NZ Intl	15720pa		
0200	0300		New Zealand, Radio NZ Intl	13840pa		
0200	0300		North Korea, Voice of Korea	13650as		15100as
0200	0300	vl	Papua New Guinea, Wantok R. Light			7325va
0200	0300		Philippines, Radio Pilipinas	12025va		15285va
			17770va			
0200	0300		Russia, Voice of Russia	6240na		7250na
			12040na	13735na		
0200	0300		Singapore, MediaCorp Radio			6150do
0200	0300		Sri Lanka, SLBC 6005as		9770as	15745as
0200	0300		Taiwan, Radio Taiwan Intl	5950na		9680na
0200	0300		UK, BBC World Service	6030af		6195me
			6195me	7320va	11750as	15360as
			17760as			
0200	0300		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
0200	0300		USA, KJES Vado NM	7555na		
0200	0300		USA, KJES Vado NM	7555na		
0200	0300		USA, KTBN Salt Lake City UT	7505na		
0200	0300		USA, KWHR Naalehu HI	17525as		
0200	0300		USA, WBCQ Monticello ME	5110am		9330am
0200	0300	whfas	USA, WBCQ Monticello ME	7415am		
0200	0300		USA, WBOH Newport NC	5920am		
0200	0300		USA, WEWN Vandiver AL	5810am		
0200	0300		USA, WHRA Greenbush ME	5890eu		
0200	0300		USA, WHRI Cypress Creek SC			7490va
0200	0300	twhfa	USA, WHRI Cypress Creek SC			5835na
0200	0300	sm	USA, WHRI Cypress Creek SC			7315am
0200	0300		USA, WINB Red Lion PA	9265am		
0200	0300	Sun/Mon	USA, WRMI Miami FL	9955am		
0200	0300	twhfa	USA, WRMI Miami FL	7385na		
0200	0300		USA, WTJC Newport NC	9370na		
0200	0300		USA, WWCR Nashville TN	3215na		5935na
			7465na			
0200	0300		USA, WWRB Manchester TN	3185va		5050va
			5745va	6890va		
0200	0300		USA, WYFR/Family Radio Worldwide			5985am
			6985na	9505na	11855am	
0200	0300		Uzbekistan, CVC International			9480as
0215	0230		Nepal, Radio 3230as		5005as	6100as
			7165as			
0230	0258		Vietnam, Voice of Vietnam	6175na		
0230	0300	twhfas	Albania, Radio Tirana	7425na		
0230	0300		South Korea, KBS World Radio			9560na
0230	0300		Sweden, Radio 6010na		11550va	
0245	0300		Myanmar, Myanma Radio	9730do		
0250	0300	vl	Vatican City, Vatican Radio	6040na		7305na
0255	0300	vl	Rwanda, Radio Rwanda	6055do		

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

0300	0310	vl	Croatia, Croatian Radio	7285va		
0300	0320	vl	Vatican City, Vatican Radio	6040na		7305na
0300	0330		Egypt, Radio Cairo	7270na		
0300	0330		Myanmar, Myanma Radio	9730do		
0300	0330		Philippines, Radio Pilipinas	12025va		15285va
			17770va			
0300	0330	mtwhf	UK, Sudan Radio Service	5975af		
0300	0330		USA, KJES Vado NM	7555na		
0300	0330		Vatican City, Vatican Radio	7360af		9660af
0300	0400		Anguilla, Worldwide Univ Network			6090am
0300	0400		Australia, ABC NT Alice Springs			2310do
			4835do			
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek			4910do
0300	0400		Australia, Radio Australia	9660as		12080as
			13690as	15240pa	15415as	15515as
			17750va	21725va		
0300	0400	twhfas	Canada, CBC NQ SW Service			9625na
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St John's NF	6160na		
0300	0400		Canada, CKZU Vancouver BC			6160na
0300	0400		China, China Radio Intl	9690na		9790na
			11770as	13750as	15110as	15120as
			15785as			
0300	0400		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	
0300	0400		Cuba, Radio Havana	6000na		6180na
0300	0400		Germany, Deutsche Welle	13770as		15595as
0300	0400		Greece, Voice of Greece	7475va		9420va
			12105va			
0300	0400		Guyana, Voice of 3291do			
0300	0400		Malaysia, RTM/Traxx FM	7295as		
0300	0400		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
0300	0400	DRM	New Zealand, Radio NZ Intl	15720pa		
0300	0400		New Zealand, Radio NZ Intl	13840pa		
0300	0400		North Korea, Voice of Korea	7140as		9345as
			9730as			
0300	0400		Oman, Radio Oman	15355as		
0300	0400	vl	Papua New Guinea, Wantok R. Light			7325va
0300	0400		Russia, Voice of Russia	6155na		6240na
			7350na	12040na	13735na	
0300	0400	vl	Rwanda, Radio Rwanda	6055do		
0300	0400		Singapore, MediaCorp Radio			6150do
0300	0400		South Africa, Channel Africa	3345af		7390as
0300	0400		Sri Lanka, SLBC 6005as		9770as	15745as
0300	0400		Taiwan, Radio Taiwan Intl	5950na		15215sa
			15320as			
0300	0400		UK, BBC World Service	3255af		6005af
			6145af	6190af	6195me	7130af
			7160af	9510va	9740af	11760as
			15335as	15360as	21660as	
0300	0400		Ukraine, Radio Ukraine Intl	7440na		
0300	0400		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
0300	0400		USA, KTBN Salt Lake City UT	7505na		
0300	0400		USA, KWHR Naalehu HI	17525as		
0300	0400		USA, Voice of America	4930af		6080af
			9885af	15580af		
0300	0400		USA, WBCQ Monticello ME	5110am		9330am
0300	0400	whfas	USA, WBCQ Monticello ME	7415am		
0300	0400		USA, WBOH Newport NC	5920am		
0300	0400		USA, WEWN Vandiver AL	5810am		
0300	0400		USA, WHRA Greenbush ME	5890eu		
0300	0400		USA, WHRI Cypress Creek SC			7490va
0300	0400	twhfa	USA, WHRI Cypress Creek SC			5835na
0300	0400	sm	USA, WHRI Cypress Creek SC			7315am
0300	0400		USA, WINB Red Lion PA	9265am		
0300	0400	Sun/Mon	USA, WRMI Miami FL	9955am		
0300	0400	twhfa	USA, WRMI Miami FL	7385na		
0300	0400		USA, WTJC Newport NC	9370na		
0300	0400		USA, WWCR Nashville TN	3215na		5935na
			7465na			
0300	0400		USA, WWRB Manchester TN	3185va		5050va
			5745va	6890va		
0300	0400		USA, WYFR/Family Radio Worldwide			6085na
			9505na	11740sa	15255sa	
0300	0400		Uzbekistan, CVC International			13685as
0330	0335		Bahrain, Radio Bahrain	6010as		
0330	0358		Vietnam, Voice of Vietnam	6175sa		
0330	0400	twhfas	Albania, Radio Tirana	7425na		
0330	0400		UK, BBC World Service	11665af		

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

0400	0427		Czech Rep, Radio Prague	5990na		6200na
			7345na			
0400	0430	mtwhf	France, Radio France Intl	7315af		9805af
0400	0430		Sri Lanka, SLBC 6005as		9770as	15745as
0400	0430		USA, Voice of America	4930af		4960af
			6080af	9885af	15580af	
0400	0430		USA, WBCQ Monticello ME	5110am		9330am
0400	0430		USA, WWRB Manchester TN	3185va		
0400	0445	whfas	USA, WBCQ Monticello ME	7415am		
0400	0445		USA, WYFR/Family Radio Worldwide			6985na
			9505na			
0400	0455		Turkey, Voice of 6020va		7240va	
0400	0456		Romania, Radio Romania Intl			6115va
			9515na	9690va	11895va	
0400	0457		Netherlands, Radio Netherlands			6165na
0400	0458	DRM	New Zealand, Radio NZ Intl	15720pa		
0400	0458		New Zealand, Radio NZ Intl	13840pa		
0400	0459		South Africa, Channel Africa	3345af		
0400	0500		Anguilla, Worldwide Univ Network			6090am
0400	0500		Australia, ABC NT Alice Springs			2310do
			4835do			
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek			4910do
0400	0500		Australia, Radio Australia	9660as		12080as
			13690as	15240pa	15415as	17750va
			21725va			
0400	0500	twhfas	Canada, CBC NQ SW Service			9625na
0400	0500		Canada, CKZN St John's NF	6160na		
0400	0500		Canada, CKZU Vancouver BC			6160na
0400	0500		China, China Radio Intl	6020na		6080as
			13750as	15120as	15785as	17725as

SHORTWAVE GUIDE

			17855as				
0400	0500		Costa Rica, Worldwide Univ Network				5030va
			6150va	7375va	9725va		
0400	0500		Cuba, Radio Havana		6000na		6180na
0400	0500		Germany, Deutsche Welle		7225af		7245af
			12045af	15445af			
0400	0500		Guyana, Voice of 3291do				
0400	0500		Malaysia, RTM/Traxx FM		7295as		
0400	0500		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0400	0500	vl	Papua New Guinea, Wantok R. Light				7325va
0400	0500		Russia, Voice of Russia		6155na		6240na
			7150na	7350na	9550as		9840na
			9855na	12010na	12030na		12040na
			12090na	13580as	15455as		15530as
			15765as	17695as	17840as		
0400	0500	DRM	Russia, Voice of Russia		15735as		
0400	0500	vl	Rwanda, Radio Rwanda		6055do		
0400	0500		Singapore, MediaCorp Radio				6150do
0400	0500	vl	Uganda, UBC Radio		4976do		5026do
0400	0500		UK, BBC World Service		3255af		6005af
			6190af	7120af	7160af		9410as
			11665af	12095af	15335as		15360as
			17760as	21660as			
0400	0500		USA, American Forces Radio				4319usb
			5446usb	5765usb	6350usb		7811usb
			10320usb	12133usb	13362usb		
0400	0500		USA, KTBN Salt Lake City UT		7505na		
0400	0500		USA, KWHR Naalehu HI		17525as		
0400	0500		USA, WBOH Newport NC		5920am		
0400	0500		USA, WEWN Vandiver AL		5810am		
0400	0500		USA, WHRA Greenbush ME		5890eu		
0400	0500		USA, WHRI Cypress Creek SC				7490va
0400	0500	twhfa	USA, WHRI Cypress Creek SC				5835na
0400	0500	sm	USA, WHRI Cypress Creek SC				7315am
0400	0500		USA, WMLK Bethel PA		9265va		
0400	0500		USA, WRMI Miami FL		9955am		
0400	0500		USA, WTJC Newport NC		9370na		
0400	0500		USA, WWCR Nashville TN		3215na		5890na
			5935na				
0400	0500		USA, WWRB Manchester TN		3185va		
0400	0500		USA, WYFR/Family Radio Worldwide				6915na
			7780va	9715ca			
0400	0500		Uzbekistan, CVC International				13685as
0430	0457		Czech Rep, Radio Prague		9890va		
0430	0500		Australia, Radio Australia		15415as		
0430	0500		Nigeria, Radio/Kaduna		6090do		
0430	0500		Swaziland, Trans World Radio				3200af
			4775af				
0430	0500		USA, Voice of America		4930af		4960af
			9885af	15580af			
0430	0500	Sun	Zambia, CVC Intl/Christian Voice				6005as
			9770as	15745as			
0459	0500	DRM	New Zealand, Radio NZ Intl		9890pa		
0459	0500		New Zealand, Radio NZ Intl		9615pa		

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

0500	0507	twhfas	Canada, CBC NQ SW Service				9625na
0500	0510	vl	Croatia, Croatian Radio		7285na		9470pa
0500	0515	Sun	Sri Lanka, SLBC	6005as	9770as		15745as
0500	0530	mtwhf	France, Radio France Intl		11995af		13680af
0500	0530		Germany, Deutsche Welle		9700af		9825af
0500	0530		Japan, NHK World/Radio Japan				5975eu
			6110na	11970af	15325as		17810as
0500	0530		Vatican City, Vatican Radio		7360af		9660af
			11625af				
0500	0600		Anguilla, Worldwide Univ Network				6090am
0500	0600		Australia, ABC NT Alice Springs				2310do
			4835do				
0500	0600		Australia, ABC NT Katherine		5025do		
0500	0600		Australia, ABC NT Tennant Creek				4910do
0500	0600		Australia, Radio Australia		9660as		12080as
			13630as	13690pa	15160as		15240pa
			17750va				
0500	0600		Bhutan, BBS	6035as			
0500	0600		Canada, CKZN St John's NF		6160na		
0500	0600		Canada, CKZU Vancouver BC				6160na
0500	0600		China, China Radio Intl		11710af		11880as
			15350as	15465as	17505as		17540as
			17725as	17855as			
0500	0600		Costa Rica, Worldwide Univ Network				5030va
			6150va	7375va	9725va		
0500	0600		Cuba, Radio Havana		6000na		6060na
			6180na	9550na	11760am		
0500	0600		Germany, CVC Intl/Voice Africa				9430af
0500	0600		Guyana, Voice of 3291do				
0500	0600		Malaysia, RTM/Traxx FM		7295as		
0500	0600		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0500	0600	DRM	New Zealand, Radio NZ Intl		9890pa		
0500	0600		New Zealand, Radio NZ Intl		9615pa		
0500	0600		Nigeria, Radio/Kaduna		4770do		6090al
0500	0600	vl	Papua New Guinea, Wantok R. Light				7325va
0500	0600		Russia, Voice of Russia		7150na		7350na
			9550as	9840na	12040na		12090as
			13580as	15455as	15530as		15765as
			17695as	17840as			
0500	0600	DRM	Russia, Voice of Russia		15735as		
0500	0600		Singapore, MediaCorp Radio				6150do
0500	0600		South Africa, Channel Africa		7230af		9685af
0500	0600		Swaziland, Trans World Radio				3200af
			4775af	9500af			
0500	0600		Thailand, Radio	11730va			
0500	0600	vl	Uganda, UBC Radio		4976do		5026do
0500	0600		UK, BBC World Service		3255af		6005af
			6190af	6195va	7160af		9410va
			11665af	11695as	11765af		11955as
			12095eu	15335as	15360as		15420af
			17640af	17760as	21660as		
0500	0600	DRM	UK, BBC World Service		5895eu		
0500	0600		Ukraine, Radio Ukraine Intl		9945eu		
0500	0600		USA, American Forces Radio				4319usb
			5446usb	5765usb	6350usb		7811usb
			10320usb	12133usb	13362usb		
0500	0600		USA, KTBN Salt Lake City UT		7505na		
0500	0600		USA, KWHR Naalehu HI		11565as		15610as
0500	0600		USA, Voice of America		4930af		5855af
			6080af	9885af	15580af		
0500	0600		USA, WBCQ Monticello ME		5110am		7415am
0500	0600		USA, WBOH Newport NC		5920am		
0500	0600		USA, WEWN Vandiver AL		5810eu		5850va
0500	0600		USA, WHRA Greenbush ME		7465va		
0500	0600		USA, WHRI Cypress Creek SC				7490va
0500	0600	twhfa	USA, WHRI Cypress Creek SC				5835na
0500	0600		USA, WMLK Bethel PA		9265va		
0500	0600		USA, WRMI Miami FL		9955am		
0500	0600		USA, WTJC Newport NC		9370na		
0500	0600		USA, WWCR Nashville TN		3215na		5890na
			5935na				
0500	0600		USA, WWRB Manchester TN		3185va		
0500	0600		USA, WYFR/Family Radio Worldwide				6915na
			9355va				
0500	0600		Uzbekistan, CVC International				13685as
0500	0600		Zambia, CVC Intl/Christian Voice				6065af
0515	0530	vl	Rwanda, Radio Rwanda		6055do		
0530	0600		Australia, Radio Australia		15415as		
0530	0600	vl	Rwanda, Radio Rwanda		6055do		
0530	0600	mtwhf	UK, Sudan Radio Service		9525af		9560al
			13720af				

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

0600	0600	sm	USA, WHRI Cypress Creek SC				7315am
0600	0610	vl	Croatia, Croatian Radio		9470na		11690pa
0600	0615	Sat/Sun	South Africa, Trans World Radio				11640af
0600	0630	Sat/Sun	Australia, Radio Australia		15415as		
0600	0630	mtwhf	France, Radio France Intl		9765af		13680af
			15160af	15605af			
0600	0630		Germany, Deutsche Welle		7310af		15275af
0600	0630		Nigeria, Radio, Natl Svc/Abuja				7275do
0600	0630		Vatican City, Vatican Radio		4005eu		5965eu
			7250eu				
0600	0645	mtwhf	South Africa, Trans World Radio				11640af
0600	0657		China, China Radio Intl		6115na		
0600	0658		New Zealand, Radio NZ Intl		9615pa		
0600	0700		Anguilla, Worldwide Univ Network				6090am
0600	0700		Australia, ABC NT Alice Springs				2310do
			4835do				
0600	0700		Australia, ABC NT Katherine		5025do		
0600	0700		Australia, ABC NT Tennant Creek				4910do
0600	0700		Australia, CVC International		15360as		
0600	0700		Australia, Radio Australia		9660as		12080as
			13630as	13690as	15160as		15240pa
			17750va				
0600	0700	mtwhfa	Austria, Radio Austria Intl		17870me		
0600	0700		Bhutan, BBS	6035as			
0600	0700		Canada, CFVP Calgary AB		6030na		
0600	0700		Canada, CKZN St John's NF		6160na		
0600	0700		Canada, CKZU Vancouver BC				6160na
0600	0700		China, China Radio Intl		11870as		11880as
			13660as	15140as	15350as		15465as
			17505as	17540as	17710as		
0600	0700		Costa Rica, Worldwide Univ Network				5030va
			6150va	7375va	9725va		11870va
0600	0700		Cuba, Radio Havana		6000na		6060va
			6180na	9550na	11760na		
0600	0700		Germany, CVC Intl/Voice Africa				11720af

0600	0700		Guyana, Voice of Guyana	3291do		
0600	0700		Malaysia, RTM/Traxx FM	7295as		
0600	0700		Malaysia, RTM/Voice of Malaysia	6175as	9750as	15295as
0600	0700	DRM	New Zealand, Radio NZ Intl	9890pa		
0600	0700		Nigeria, Radio/Kaduna	4770do	6090al	
0600	0700	vl	Papua New Guinea, Wantok R. Light	7325va		
0600	0700		Russia, Voice of Russia	9550as	13580as	15765as
			17665pa	17805pa		
0600	0700		Singapore, MediaCorp Radio	6150do		
0600	0700	vl	Solomon Islands, SIBC	5020do	9545al	
0600	0700		South Africa, Channel Africa	7230af	15255af	
0600	0700		Swaziland, Trans World Radio	3200af	4775af	9500af
0600	0700		UK, BBC World Service	6005af	6190af	7160af
			9410va	9825af	11760va	11765af
			11940af	11955as	15335as	15360as
			15420af	17640af	17760as	21660as
0600	0700	DRM	UK, BBC World Service	5895eu		
0600	0700		USA, American Forces Radio	4319usb	5446usb	5765usb
			6350usb	7811usb	10320usb	12133usb
			13362usb			
0600	0700		USA, KTBN Salt Lake City UT	7505na		
0600	0700		USA, KWHR Naalehu HI	11565as	15610as	
0600	0700		USA, Voice of America	6080af	9885af	15580af
0600	0700		USA, WBCQ Monticello ME	5110am		
0600	0700		USA, WBOH Newport NC	5920am		
0600	0700		USA, WEWN Vandiver AL	5810eu	5850va	
0600	0700		USA, WHRA Greenbush ME	7465va		
0600	0700		USA, WHRI Cypress Creek SC	5835va	7315am	
0600	0700		USA, WMLK Bethel PA	9265va		
0600	0700		USA, WRMI Miami FL	9955am		
0600	0700		USA, WTJC Newport NC	9370na		
0600	0700		USA, WWCR Nashville TN	3215na	5070na	5890na
			5935na			
0600	0700		USA, WWRB Manchester TN	3185va		
0600	0700		USA, WYFR/Family Radio Worldwide	5850na	7520va	9680na
			11530af	11580va		
0600	0700	vl	Vanuatu, Radio	7260do		
0600	0700		Zambia, CVC Intl/Christian Voice	6065af		
0630	0700		Bulgaria, Radio	7200na	9400eu	
0630	0700		Romania, Radio Romania Intl	7180va	9690va	15135va
			17780va			
0630	0700		Vatican City, Vatican Radio	7360af	9660af	11625af
0659	0700		New Zealand, Radio NZ Intl	7145pa		

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

0700	0706		UK, BBC World Service	6005af		
0700	0710	vl	Croatia, Croatian Radio	9470pa	11690pa	
0700	0730		France, Radio France Intl	15605af		
0700	0730		Slovakia, Radio Slovakia Int	9440pa	11650pa	
0700	0730		UK, BBC World Service	15575va		
0700	0745		USA, WYFR/Family Radio Worldwide	7520va		
0700	0758	DRM	New Zealand, Radio NZ Intl	9890pa		
0700	0800		Anguilla, Worldwide Univ Network	6090am		
0700	0800		Australia, ABC NT Alice Springs	2310do	4835do	
0700	0800		Australia, ABC NT Katherine	5025do		
0700	0800		Australia, ABC NT Tennant Creek	4910do		
0700	0800		Australia, CVC International	15360as		
0700	0800		Australia, Radio Australia	9475as	9710as	11880as
			12080as	13630pa	15160as	15240pa
0700	0800		Bhutan, BBS	6035as		
0700	0800		Canada, CFVP Calgary AB	6030na		
0700	0800		Canada, CKZN St John's NF	6160na		
0700	0800		Canada, CKZU Vancouver BC	6160na		
0700	0800		China, China Radio Intl	11785eu	11880as	13660as
			15350as	15465as	17490eu	17540as
			17710as			
0700	0800		Costa Rica, Worldwide Univ Network	5030va	6150va	7375va
			9725va	11870va		
0700	0800		Germany, CVC Intl/Voice Africa	15640af		
0700	0800		Greece, Voice of Greece	7475va	9420va	12105va
0700	0800		Guyana, Voice of Guyana	3291do	5950do	
0700	0800	Sat	Latvia, Radio SWH	9290eu		
0700	0800		Liberia, Star Radio	9525af		
0700	0800		Malaysia, RTM/Traxx FM	7295as		
0700	0800		Malaysia, RTM/Voice of Malaysia	6175as	9750as	15295as
0700	0800		Myanmar, Myanma Radio	9730do		
0700	0800		New Zealand, Radio NZ Intl	7145pa		
0700	0800		Nigeria, Radio/Kaduna	4770do	6090al	
0700	0800	vl	Papua New Guinea, Wantok R. Light	7325va		
0700	0800		Russia, Voice of Russia	9550as	13580as	
0700	0800	DRM	Russia, Voice of Russia	11615eu	11635eu	
0700	0800		Singapore, MediaCorp Radio	6150do		
0700	0800	vl	Solomon Islands, SIBC	5020do	9545al	
0700	0800	vl	South Africa, Channel Africa	9625af		
0700	0800		Swaziland, Trans World Radio	4775af	6120af	9500af
0700	0800		Taiwan, Radio Taiwan Intl	5950na		
0700	0800	DRM	UK, BBC World Service	5875eu		
0700	0800		UK, BBC World Service	6190af	6195va	9410va
			11760me	11765af	11940af	11955as
			12095va	13620af	15360as	15400af
			15420af	17760as	21660as	
0700	0800		USA, American Forces Radio	4319usb	5446usb	5765usb
			6350usb	7811usb	10320usb	12133usb
			13362usb			
0700	0800		USA, KTBN Salt Lake City UT	7505na		
0700	0800		USA, KWHR Naalehu HI	11565as	15610as	
0700	0800		USA, WBCQ Monticello ME	5110am		
0700	0800		USA, WBOH Newport NC	5920am		
0700	0800		USA, WEWN Vandiver AL	5810eu	5850va	
0700	0800		USA, WHRI Cypress Creek SC	5835va	7315am	
0700	0800		USA, WMLK Bethel PA	9265va		
0700	0800		USA, WRMI Miami FL	9955am		
0700	0800		USA, WTJC Newport NC	9370na		
0700	0800		USA, WWCR Nashville TN	3215na	5070na	5890na
			5935na			
0700	0800		USA, WWRB Manchester TN	3185va		
0700	0800		USA, WYFR/Family Radio Worldwide	5985na	6915na	9505na
			9715na	9930af		
0700	0800	vl	Vanuatu, Radio	7260do		
0700	0800		Zambia, CVC Intl/Christian Voice	6065af		
0730	0800	Sat/Sun	UK, BBC World Service	15575va		
0745	0800	Sun	Germany, TWR Europe	6105eu		
0759	0800	DRM	New Zealand, Radio NZ Intl	6095pa		

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

0800	0810	vl	Croatia, Croatian Radio	11690pa		
0800	0825		Malaysia, RTM/Voice of Malaysia	6175as	9750as	15295as
0800	0827		Czech Rep, Radio Prague	7345eu	9860eu	
0800	0830		Australia, ABC NT Katherine	5025do		
0800	0830		Australia, ABC NT Tennant Creek	4910do		
0800	0830		Myanmar, Myanma Radio	9730do		
0800	0845	Sat	Guam, TWR/KTWR	11840pa		
0800	0845		USA, WYFR/Family Radio Worldwide	5950ca	9930af	
0800	0850	mtwhf	Germany, TWR Europe	6105eu		
0800	0857		China, China Radio Intl	11785eu	17490eu	
0800	0900		Anguilla, Worldwide Univ Network	6090am		
0800	0900		Australia, ABC NT Alice Springs	2310do	4835do	
0800	0900		Australia, CVC International	15360as		
0800	0900		Australia, Radio Australia	5995va	9475va	9580as
			9590va	11880as	12080as	13630as
0800	0900		Canada, CFVP Calgary AB	6030na		
0800	0900		Canada, CKZN St John's NF	6160na		
0800	0900		Canada, CKZU Vancouver BC	6160na		
0800	0900		China, China Radio Intl	11620as	11880as	15350as
			15465as	17540as		
0800	0900		Costa Rica, Worldwide Univ Network	5030va	6150va	7375va
			9725va	11870va		
0800	0900		Germany, CVC Intl/Voice Africa	15640af		
0800	0900	DRM	Germany, Deutsche Welle	12005as		
0800	0900	Sun	Germany, TWR Europe	6105eu		
0800	0900	mtwhf	Guam, TWR/KTWR	11840pa		
0800	0900		Guyana, Voice of Guyana	3291do	5950do	
0800	0900		Indonesia, Voice of Indonesia	9525al	11785pa	15150as
0800	0900		Malaysia, RTM/Traxx FM	7295as		
0800	0900		New Zealand, Radio NZ Intl	7145pa		
0800	0900	DRM	New Zealand, Radio NZ Intl	6095pa		
0800	0900		Nigeria, Radio/Kaduna	4770do	6090al	
0800	0900		Nigeria, Voice of/ Ext. Svc Lagos	9690af		
0800	0900		Papua New Guinea, NBC	4890do		
0800	0900	vl	Papua New Guinea, Wantok R. Light	7325va		
0800	0900		Russia, Voice of Russia	9550as	13580as	13660as
			15195as	17495pa	17665pa	17805pa
0800	0900	DRM	Russia, Voice of Russia	11615eu		
0800	0900		Singapore, MediaCorp Radio	6150do		
0800	0900	vl	Solomon Islands, SIBC	5020do	9545al	
0800	0900	vl	South Africa, Channel Africa	9625af		
0800	0900		South Korea, KBS World Radio	9570as		
0800	0900		Swaziland, Trans World Radio	4775af		

			6120af	9500af		
0800	0900		UK, BBC World Service		6190af	6195as
			9740as	11760me	11940af	12095va
			15285as	15400af	17640af	17760as
			17830af	21470af	21660as	
0800	0900	Sat/Sun	UK, BBC World Service		15575va	
0800	0900	fas	UK, Bible Voice BC		5945eu	
0800	0900		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
0800	0900		USA, KNLS Anchor Point AK		7355as	
0800	0900		USA, KTBN Salt Lake City UT		7505na	
0800	0900		USA, KWHR Naalehu HI		9930as	11565as
0800	0900		USA, WBCQ Monticello ME		5110am	
0800	0900		USA, WBOH Newport NC		5920am	
0800	0900		USA, WEWN Vandiver AL		5850am	
0800	0900		USA, WHRI Cypress Creek SC			5835va
			7315am			
0800	0900		USA, WMLK Bethel PA		9265va	
0800	0900		USA, WRMI Miami FL		9955am	
0800	0900		USA, WTJC Newport NC		9370na	
0800	0900		USA, WWCR Nashville TN		3215na	5070na
			5890na	5935na		
0800	0900		USA, WWRB Manchester TN		3185va	
0800	0900		USA, WYFR/Family Radio Worldwide			5985na
			6915na			
0800	0900	vl	Vanuatu, Radio	7260do		
0800	0900		Zambia, CVC Intl/Christian Voice			6065af
0805	0900	mthf	Guam, TWR/KTWR		15170as	
0815	0850	Sat	Germany, TWR Europe		6105eu	
0820	0900	w	Guam, TWR/KTWR		15170as	
0830	0900		Australia, ABC NT Katherine		2485do	
0830	0900		Australia, ABC NT Tennant Creek			2325do
0845	0900	Sun	Monaco, TWR Europe		9800eu	skd0508

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

0900	0910	vl	Croatia, Croatian Radio		11690pa	
0900	0915	Sat	UK, Bible Voice BC		5945eu	
0900	0920	Sun	Germany, TWR Europe		6105eu	
0900	0920	Sun	Monaco, TWR Europe		9800eu	skd0508
0900	0930		Japan, NHK World/Radio Japan			9625as
			9825pa	11815as	15590as	
0900	0945	Sun	UK, Bible Voice BC		5945eu	
0900	0950	mtwhf	Monaco, TWR Europe		9800eu	skd0508
0900	0957		China, China Radio Intl		15270eu	17490eu
			17570eu			
0900	1000		Anguilla, Worldwide Univ Network			6090am
0900	1000		Australia, ABC NT Alice Springs			2310do
			4835do			
0900	1000		Australia, ABC NT Katherine		2485do	
0900	1000		Australia, ABC NT Tennant Creek			2325do
0900	1000		Australia, CVC International		15360as	
0900	1000		Australia, Radio Australia		9475va	9580va
			11880as			
0900	1000		Bhutan, BBS	6035as		
0900	1000		Canada, CFVP Calgary AB		6030na	
0900	1000		Canada, CKZN St John's NF		6160na	
0900	1000		Canada, CKZU Vancouver BC			6160na
0900	1000		China, China Radio Intl		11620as	15210pa
			15535as	17690pa	17750as	
0900	1000		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	11870va
			13750va			
0900	1000	DRM	Germany, CVC Intl/Voice Africa			7120as
0900	1000		Germany, Deutsche Welle		15340as	17705as
0900	1000		Guyana, Voice of Guyana		3291do	5950do
0900	1000		Malaysia, RTM/Traxx FM		7295as	
0900	1000	Sun	Monaco, TWR Europe		9800eu	skd0508
0900	1000		New Zealand, Radio NZ Intl		7145pa	
0900	1000	DRM	New Zealand, Radio NZ Intl		6095pa	
0900	1000		Nigeria, Radio/Kaduna		4770do	6090al
0900	1000		Nigeria, Voice of/ Ext. Svc Lagos			9690af
0900	1000		Papua New Guinea, NBC		4890do	
0900	1000	vl	Papua New Guinea, Wantok R. Light			7325va
0900	1000		Russia, Voice of Russia		9550as	13580as
			13660as	15195as	17495pa	17665pa
0900	1000	DRM	Russia, Voice of Russia		11615eu	
0900	1000		Saudi Arabia, BSKSA		15250af	
0900	1000		Singapore, MediaCorp Radio			6150do
0900	1000	vl	Solomon Islands, SIBC		5020do	9545al
0900	1000	vl	South Africa, Channel Africa		9625af	
0900	1000		UK, BBC World Service		6190af	6195as
			9740as	11760me	11895as	11940af
			12095va	15285as	15400af	15575va
			17640af	17760as	17830af	21470af
			21660as			
0900	1000		Ukraine, Radio Ukraine Intl		11550eu	
0900	1000		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
0900	1000		USA, KTBN Salt Lake City UT		7505na	
0900	1000		USA, KWHR Naalehu HI		9930as	11565as
0900	1000		USA, WBCQ Monticello ME		5110am	
0900	1000		USA, WBOH Newport NC		5920am	
0900	1000		USA, WEWN Vandiver AL		5850am	
0900	1000		USA, WHRI Cypress Creek SC			5835va
			7315am			
0900	1000		USA, WRMI Miami FL		9955am	
0900	1000		USA, WTJC Newport NC		9370na	
0900	1000		USA, WWCR Nashville TN		3215na	5070na
			5890na	5935na		
0900	1000		USA, WWRB Manchester TN		3185va	
0900	1000		USA, WYFR/Family Radio Worldwide			5985na
			6915na	9465as	9755ca	
0900	1000	vl	Vanuatu, Radio	7260do		
0900	1000		Zambia, CVC Intl/Christian Voice			6065af
0915	0945	Sat	UK, Bible Voice BC		5945eu	
0915	0950	Sat	Monaco, TWR Europe		9800eu	skd0508
0930	1000		Lithuania, Radio Vilnius		9710na	

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

1000	1027		Czech Rep, Radio Prague		9955na	15710as
			21745af			
1000	1030		Mongolia, Voice of		12085as	
1000	1030		UK, BBC World Service		15285as	17760as
1000	1030		Vietnam, Voice of Vietnam		7285as	
1000	1057		Netherlands, Radio Netherlands			11895as
			12065as	13820as	15110as	
1000	1058		New Zealand, Radio NZ Intl		7145pa	
1000	1100		Anguilla, Worldwide Univ Network			11775am
1000	1100		Australia, ABC NT Alice Springs			2310do
			4835do			
1000	1100		Australia, ABC NT Katherine		2485do	
1000	1100		Australia, ABC NT Tennant Creek			2325do
1000	1100		Australia, CVC International		15270as	
1000	1100		Australia, Radio Australia		9475va	9580va
			11880as			
1000	1100		Canada, CFVP Calgary AB		6030na	
1000	1100		Canada, CKZN St John's NF		6160na	
1000	1100		Canada, CKZU Vancouver BC			6160na
1000	1100		China, China Radio Intl		5995as	6040na
			11610as	11635as	11650as	11795as
			13590as	13620as	13720as	15190as
			15210as	15350as	17490eu	17690pa
1000	1100		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	11870va
			13750va			
1000	1100	DRM	Germany, CVC Intl/Voice Africa			7120as
1000	1100		Guyana, Voice of Guyana		3291do	5950do
1000	1100		India, All India Radio		7270as	13710pa
			15020as	15235as	15260as	17510pa
			17800as	17895pa		
1000	1100		Italy, IRRS		9510va	
1000	1100		Malaysia, RTM/Traxx FM		7295as	
1000	1100	DRM	New Zealand, Radio NZ Intl		6095pa	
1000	1100		Nigeria, Radio/Kaduna		4770do	6090al
1000	1100		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1000	1100		North Korea, Voice of Korea		6185as	6285sa
			9325sa	9850as		
1000	1100		Papua New Guinea, NBC		4890do	
1000	1100	vl	Papua New Guinea, Wantok R. Light			7325va
1000	1100		Saudi Arabia, BSKSA		15250af	
1000	1100		Singapore, MediaCorp Radio			6150do
1000	1100	vl	Solomon Islands, SIBC		5020do	9545al
1000	1100	vl	South Africa, Channel Africa		9625af	
1000	1100		UK, BBC World Service		6190af	6195as
			9740as	11760me	11895as	11940af
			15575va	17640af	21470af	
1000	1100	Sat/Sun	UK, BBC World Service		15400af	17830af
1000	1100		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1000	1100		USA, KNLS Anchor Point AK		6890as	
1000	1100		USA, KTBN Salt Lake City UT		7505na	
1000	1100		USA, KWHR Naalehu HI		9930as	11565as
1000	1100		USA, WBCQ Monticello ME		5110am	
1000	1100		USA, WBOH Newport NC		5920am	
1000	1100		USA, WEWN Vandiver AL		5850am	
1000	1100		USA, WHRI Cypress Creek SC			5835va
			9865am			
1000	1100		USA, WRMI Miami FL		9955am	
1000	1100		USA, WTJC Newport NC		9370na	
1000	1100		USA, WWCR Nashville TN		5070na	5890na
			5935na	9985na		
1000	1100		USA, WWRB Manchester TN		3185va	
1000	1100		USA, WYFR/Family Radio Worldwide			5940na

			5985na	6915na	9465as	9755ca
1000	1100		Zambia, CVC Intl/Christian Voice			6065af
1015	1045	Sun	UK, Bible Voice BC		5985as	
1030	1100		Guam, AWR/KSDA		11780as	
1030	1100		Iran, Voice of the Islamic Rep of Iran			15460as
			17660as			
1059	1100		New Zealand, Radio NZ Intl		9655pa	

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

1100	1128		Vietnam, Voice of Vietnam		9840as	7220as
			7285as			
1100	1130		Iran, Voice of the Islamic Rep of Iran			15460as
			17600as			
1100	1130		UK, BBC World Service		15400af	
1100	1145		USA, WYFR/Family Radio Worldwide			9550sa
			9755ca			
1100	1158	DRM	New Zealand, Radio NZ Intl		6095pa	
1100	1200		Anguilla, Worldwide Univ Network			11775am
1100	1200		Australia, ABC NT Alice Springs			2310do
			4835do			
1100	1200		Australia, ABC NT Katherine		2485do	
1100	1200		Australia, ABC NT Tennant Creek			2325do
1100	1200		Australia, CVC International		13635as	
1100	1200		Australia, Radio Australia		5995va	6020va
			9475va	9560as	9580va	9590va
			11880as	12080as		
1100	1200	Sat/Sun	Canada, CBC NQ SW Service			9625na
1100	1200		Canada, CFVP Calgary AB		6030na	
1100	1200		Canada, CKZN St John's NF		6160na	
1100	1200		Canada, CKZU Vancouver BC			6160na
1100	1200		China, China Radio Intl		6040na	11750na
			13655eu	17490eu		
1100	1200		Costa Rica, Worldwide Univ Network			5030va
			6150va	7375va	9725va	11870va
			13750va			
1100	1200	DRM	Germany, CVC Intl/Voice Africa			7120as
1100	1200		Italy, IRRS	9510va		
1100	1200		Malaysia, RTM/Traxx FM		7295as	
1100	1200		New Zealand, Radio NZ Intl		9655pa	
1100	1200		Nigeria, Radio/Kaduna		4770do	6090al
1100	1200		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1100	1200		Papua New Guinea, NBC		4890do	
1100	1200	vl	Papua New Guinea, Wantok R. Light			7325va
1100	1200		Saudi Arabia, BSKSA		15250af	
1100	1200		Singapore, Radio Singapore Intl			6080as
			6150as			
1100	1200	vl	South Africa, Channel Africa		9625af	
1100	1200		Taiwan, Radio Taiwan Intl		7445as	
1100	1200		UK, BBC World Service		5875am	6190af
			6195as	9660am	9740as	9750am
			11760me	11895as	11940af	15575va
			17640af	17830af	21470af	
1100	1200	Sat	UK, Bible Voice BC		5950as	
1100	1200		Ukraine, Radio Ukraine Intl		11550eu	
1100	1200		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1100	1200		USA, KTBN Salt Lake City UT		7505na	
1100	1200		USA, KWHR Naalehu HI		9930as	
1100	1200		USA, WBOH Newport NC		5920am	
1100	1200		USA, WEWN Vandiver AL		5850am	
1100	1200		USA, WHRI Cypress Creek SC			5875va
			7315na			
1100	1200		USA, WINB Red Lion PA		9265am	
1100	1200		USA, WRMI Miami FL		9955am	
1100	1200		USA, WTJC Newport NC		9370na	
1100	1200		USA, WWCR Nashville TN		5070na	5890na
			5935na	15825na		
1100	1200		USA, WWRB Manchester TN		3185va	
1100	1200		USA, WYFR/Family Radio Worldwide			5950na
			5985na	7780sa	9625sa	
1100	1200		Zambia, CVC Intl/Christian Voice			6065af
1105	1200		Greece, Voice of Greece		9420va	15650va
1115	1130	mtwhf	UK, Bible Voice BC		5950as	
1115	1200	Sun	UK, Bible Voice BC		5950as	
1120	1157		Czech Rep, Radio Prague		11640eu	
			175451euva			
1130	1200		Bulgaria, Radio	11700eu	15700eu	

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

1200	1215	f	UK, Bible Voice BC		5950as	
1200	1230		Australia, HCJB Global		15400as	
1200	1230		France, Radio France Intl		21620af	
1200	1230		Germany, AWR Europe		15435as	
1200	1230		Japan, NHK World/Radio Japan			6120na
			9625as	9695as	17585eu	
1200	1230	Sun	UK, Bible Voice BC		5945eu	
1200	1245		USA, WYFR/Family Radio Worldwide			5950na
			5985na			
1200	1257		China, China Radio Intl		13655eu	13790eu
			17490eu			
1200	1258		New Zealand, Radio NZ Intl		9655pa	
1200	1300		Anguilla, Worldwide Univ Network			11775am
1200	1300		Australia, ABC NT Alice Springs			2310do
			4835do			
1200	1300		Australia, ABC NT Katherine		2485do	
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300		Australia, CVC International		13635as	
1200	1300		Australia, Radio Australia		6020va	9475as
			9560pa	9590as	11880as	
1200	1300	DRM	Australia, Radio Australia		5995va	
1200	1300	Sat/Sun	Canada, CBC NQ SW Service			9625na
1200	1300		Canada, CFVP Calgary AB		6030na	
1200	1300		Canada, CKZN St John's NF		6160na	
1200	1300		Canada, CKZU Vancouver BC			6160na
1200	1300		China, China Radio Intl		5995as	9460as
			9730as	9760pa	11650as	11660as
			11690as	11760pa	11980as	13645as
1200	1300		Costa Rica, Worldwide Univ Network			9725va
			11870va	13750va		
1200	1300		Italy, IRRS	9510va		
1200	1300	Sun	Latvia, Radio SWH		9290eu	
1200	1300		Malaysia, RTM/Traxx FM		7295as	
1200	1300		Nigeria, Radio/Kaduna		4770do	6090al
1200	1300		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1200	1300		Papua New Guinea, NBC		4890do	
1200	1300	vl	Papua New Guinea, Wantok R. Light			7325va
1200	1300		Saudi Arabia, BSKSA		15250af	
1200	1300		Singapore, Radio Singapore Intl			6080as
			6150as			
1200	1300		South Korea, KBS World Radio			9650na
1200	1300	Fri/ DRM	Taiwan, Radio Taiwan Intl		9850eu	
1200	1300		UK, BBC World Service		5975as	6190af
			6195as	9660am	9740as	9750am
			11760me	11895as	11940af	15575va
			17640af	17830af	21470af	
1200	1300		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1200	1300		USA, KNLS Anchor Point AK		7355as	9780as
1200	1300		USA, KTBN Salt Lake City UT		7505na	
1200	1300		USA, KWHR Naalehu HI		12130as	
1200	1300		USA, Voice of America		9640va	9760va
			11705va	11730va	15190va	
1200	1300		USA, WBOH Newport NC		5920am	
1200	1300		USA, WEWN Vandiver AL		5850am	
1200	1300		USA, WHRA Greenbush ME		13650va	
1200	1300	mtwhf	USA, WHRI Cypress Creek SC			7520na
1200	1300		USA, WHRI Cypress Creek SC			9660am
1200	1300		USA, WINB Red Lion PA		9265am	
1200	1300		USA, WRMI Miami FL		9955am	
1200	1300		USA, WTJC Newport NC		9370na	
1200	1300		USA, WWCR Nashville TN		5070na	5890na
			5935na	15825na		
1200	1300		USA, WWRB Manchester TN		3185va	
1200	1300		USA, WYFR/Family Radio Worldwide			11520as
			11560as	17555sa	17795ca	
1200	1300		Zambia, CVC Intl/Christian Voice			6065af
1215	1300		Egypt, Radio Cairo		17835as	
1230	1258		Vietnam, Voice of Vietnam		9840as	12020as
1230	1300	mtwhfa	Australia, HCJB Global		15540as	
1230	1300		Bangladesh, Bangla Betar		7185as	
1230	1300		Sweden, Radio	15240na		
1230	1300		Thailand, Radio	9810va		
1245	1300	Sat/Sun	UK, Bible Voice BC		5950as	

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

1300	1330	mtwhfa	Australia, HCJB Global		15540as	
1300	1330		Egypt, Radio Cairo		17835as	
1300	1330	Sun	Italy, IRRS	15750as		
1300	1330	Sun	Slovakia, Universal Life		15750as	
1300	1356		Romania, Radio Romania Intl			15105eu
			17745eu			
1300	1357		China, China Radio Intl		13610eu	13790eu
			15540sa			
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, CVC International		13635as	
1300	1400		Australia, Radio Australia		6020va	9560as
			9580va	9590va		
1300	1400	DRM	Australia, Radio Australia		5995va	
1300	1400	mtwhf	Austria, Radio Austria Intl		17715va	
1300	1400	Sat/Sun	Canada, CBC NQ SW Service			9625na
1300	1400		Canada, CFVP Calgary AB		6030na	
1300	1400		Canada, CKZN St John's NF		6160na	

1300	1400		Canada, CKZU Vancouver BC			6160na
1300	1400		China, China Radio Intl	5995as		9570na
			9650na	9730as	9760pa	9765as
			9870as	11660as	11760pa	11980as
			13755as	15260na		
1300	1400		Costa Rica, Worldwide Univ Network			9725va
			11870va	13750va		
1300	1400		Malaysia, RTM/Traxx FM	7295as		
1300	1400		New Zealand, Radio NZ Intl	6095pa		
1300	1400		Nigeria, Radio/Kaduna	4770do		6090al
1300	1400		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1300	1400		North Korea, Voice of Korea	7570eu		9335na
			11710na	12015eu		
1300	1400		Papua New Guinea, NBC	4890do		
1300	1400	vl	Papua New Guinea, Wantok R. Light			7325va
1300	1400		Poland, Polish Radio	5975eu		9450eu
1300	1400		Singapore, Radio Singapore Intl			6080as
			6150as			
1300	1400		South Korea, KBS World Radio			9570na
			9770as			
1300	1400		UK, BBC World Service	5975as		6190af
			6195as	9740as	11895as	11940af
			15420af	15575va	17640af	17830af
			21470af			
1300	1400		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1300	1400		USA, KJES Vado NM	11715na		
1300	1400		USA, KTBN Salt Lake City UT	7505na		
1300	1400		USA, KWHR Naalehu HI	12130as		
1300	1400		USA, Voice of America	9760va		11705va
1300	1400		USA, WBOH Newport NC	5920am		
1300	1400		USA, WEWN Vandiver AL	5850am		
1300	1400		USA, WHRA Greenbush ME	15665va		
1300	1400		USA, WHRI Cypress Creek SC			9840na
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC			11785na
1300	1400		USA, WINB Red Lion PA	13570am		
1300	1400		USA, WRMI Miami FL	9955am		
1300	1400		USA, WTJC Newport NC	9370na		
1300	1400		USA, WWCR Nashville TN	5890na		9985na
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN	3185va		9385va
1300	1400		USA, WYFR/Family Radio Worldwide			11560as
			11820na	11865na	11910na	17795ca
1300	1400		Zambia, CVC Intl/Christian Voice			6065af
1305	1330	Sat	Austria, Radio Austria Intl	17715va		
1310	1340		Japan, NHK World/Radio Japan			11985as
1330	1345	Sun	Austria, Radio Austria Intl	17715va		
1330	1357	DRM/Fri-Sat	Czech Rep, Radio Prague	9750eu		
1330	1400	mtwhfa	Guam, AWR/KSDA	15275as		
1330	1400		India, All India Radio	9690as		11620as
			13710as			
1330	1400		Laos, National Radio	7145as		
1330	1400		Turkey, Voice of	11735va	12035eu	

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

1400	1415	Sat	Germany, Pan American BC	13645me		
1400	1415		Russia, FEBA	7150eu		
1400	1425		Turkey, Voice of	11735va	12035eu	
1400	1429		Czech Rep, Radio Prague	11600as		13580na
1400	1430	Sun	Australia, HCJB Global	15425as		
1400	1430		Australia, HCJB Global	15400as		
1400	1430	w	Germany, Pan American BC	15205as		
1400	1430	mhf	Guam, TWR/KTWR	9975as		
1400	1430	`	Japan, NHK World/Radio Japan			11705va
			11985as	13630eu	21560eu	
1400	1430		Serbia, International Radio Serbia			7240eu
1400	1430		Thailand, Radio	9725va		
1400	1457		China, China Radio Intl	9700eu		9795eu
1400	1500		Anguilla, Worldwide Univ Network			11775am
1400	1500		Australia, CVC International	13635as		
1400	1500		Australia, Radio Australia	5995va		6080va
			7240va	9590va		
1400	1500		Bhutan, BBS	6035as		
1400	1500	Sat/Sun	Canada, CBC NQ SW Service			9625na
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St John's NF	6160na		
1400	1500		Canada, CKZU Vancouver BC			6160na
1400	1500		China, China Radio Intl	5995as		9560as
			9765as	9870as	11675as	11765as
			11775as	13685af	13740na	17630af
1400	1500		Costa Rica, Worldwide Univ Network			9725va
			11870va	13750va		
1400	1500	DRM	Germany, CVC Intl/Voice Africa			7145as
1400	1500		Germany, Overcomer Ministries			6110va
			13810va	15325va		
1400	1500	tw	Guam, TWR/KTWR	9975as		
1400	1500		India, All India Radio	9690as		11620as
			13710as			
1400	1500		Libya, Voice of Africa	17725af		21695af
1400	1500		Malaysia, RTM/Traxx FM	7295as		
1400	1500		Netherlands, Radio Netherlands			9345as
			9890as	11835as		
1400	1500		New Zealand, Radio NZ Intl	6095pa		
1400	1500		Nigeria, Radio/Kaduna	4770do		6090al
1400	1500		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1400	1500	vl	Papua New Guinea, Wantok R. Light			7325va
1400	1500		Singapore, MediaCorp Radio			6150do
1400	1500	vl	South Africa, Channel Africa	9625af		
1400	1500		UK, BBC World Service	5975as		6190af
			6195as	9740as	11760va	11895as
			11920as	11940af	17830af	21470af
			21660af			
1400	1500	Sat	UK, BBC World Service	9410va		
1400	1500	Sat/Sun	UK, Bible Voice BC	11695as		
1400	1500		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1400	1500		USA, KJES Vado NM	11715na		
1400	1500		USA, KNLS Anchor Point AK	7355as		
1400	1500		USA, KTBN Salt Lake City UT	7505na		
1400	1500		USA, KWHR Naalehu HI	9930as		
1400	1500		USA, Voice of America	4930af		6080af
			9760va	9865va	11885va	12150va
			15205va	15580af	17715af	17895af
1400	1500	Sun	USA, WBCQ Monticello ME	17495am		
1400	1500		USA, WBOH Newport NC	5920am		
1400	1500		USA, WEWN Vandiver AL	5850am		
1400	1500		USA, WHRA Greenbush ME	15665va		
1400	1500	mtwhf	USA, WHRI Cypress Creek SC			9495na
1400	1500		USA, WHRI Cypress Creek SC			9840na
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC			11785na
1400	1500		USA, WINB Red Lion PA	13570am		
1400	1500		USA, WRMI Miami FL	9955am		
1400	1500		USA, WTJC Newport NC	9370na		
1400	1500		USA, WWCR Nashville TN	5890na		9985na
			13845na	15825na		
1400	1500		USA, WWRB Manchester TN	9385va		
1400	1500		USA, WYFR/Family Radio Worldwide			11560na
			11830na	11910na	13695na	17795ca
1400	1500		Zambia, CVC Intl/Christian Voice			6065af
1415	1430	mtwhfa	Germany, Pan American BC	13645as		
1415	1430		Nepal, Radio	3230as	5005as	6100as
			7165as			
1415	1445	Mon	UK, FEBA	12045eu		
1430	1445	Sun	Germany, Pan American BC	13645as		
1430	1445	twf	UK, FEBA	12045eu		
1430	1500	mtwhfa	Albania, Radio Tirana	13640na		
1430	1500		Australia, Radio Australia	9475va		11660pa
1430	1500		Ethiopia, Radio Ethiopia	5990af		7110af
			9704af			
1430	1500	DRM	South Korea, KBS World Radio			9750eu
1430	1500		Sweden, Radio	13820va	15240na	
1430	1500		USA, Voice of America	6105va		7225va
			9715va	15130va		

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

1500	1510	mtwhfa	Turkmenistan, Turkmen Radio			5015eu
1500	1527		Czech Rep, Radio Prague	7385na		
1500	1528		Vietnam, Voice of Vietnam	9550va		9840va
			12020va	13860va		
1500	1530		Guam, AWR/KSDA	11985as		
1500	1530		Nigeria, Radio, Natl Svc/Abuja			7275do
1500	1530		UK, BBC World Service	11860af		15420af
			17640af			
1500	1530	ta	UK, Bible Voice BC	11895as		
1500	1530	Sat/Sun	UK, Sudan Radio Service	9840af		
1500	1530		USA, Voice of America	6105va		9760va
			15460va			
1500	1545		USA, WYFR/Family Radio Worldwide			15770sa
1500	1550		New Zealand, Radio NZ Intl	6095pa		
1500	1557		Canada, Radio Canada Intl	9635va		11975va
1500	1557		China, China Radio Intl	9435eu		9525eu
1500	1557		Netherlands, Radio Netherlands			9345af
			9890as	11835as		
1500	1600		Anguilla, Worldwide Univ Network			11775am
1500	1600		Australia, CVC International	13635as		
1500	1600		Australia, Radio Australia	5995va		6080va
			7240as	9475va	9590as	11660pa
1500	1600	Sat/Sun	Canada, CBC NQ SW Service			9625na
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St John's NF	6160na		
1500	1600		Canada, CKZU Vancouver BC			6160na
1500	1600		China, China Radio Intl	5955as		6100af
			7160as	7325as	9785as	9870as
			11775as	13685af	13740na	17630af

1500	1600		Costa Rica, Worldwide Univ Network			9725va
			11870va	13750va		
1500	1600		Finland, Overcomer Ministries			9595me
1500	1600	DRM	Germany, CVC Intl/Voice Africa			7145as
1500	1600		Germany, CVC Intl/Voice Africa			15680af
1500	1600		Germany, The Overcomer Ministries			6110va
			13810va	15325va		
1500	1600		Italy, IRRS	9825af		
1500	1600		Libya, Voice of Africa		17725af	21695af
1500	1600		Malaysia, RTM/Traxx FM		7295as	
1500	1600		Myanmar, Myanma Radio		5985as	
1500	1600		Nigeria, Radio/Kaduna		4770do	6090al
1500	1600		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1500	1600		North Korea, Voice of Korea		7570eu	9335na
			11710na	12015eu		
1500	1600	vl	Papua New Guinea, Wantok R. Light			7325va
1500	1600		Russia, Voice of Russia		7350as	7260as
			9660as			
1500	1600	DRM	Russia, Voice of Russia		5905eu	
1500	1600		Singapore, MediaCorp Radio			6150do
1500	1600	vl	Slovakia, Miraya FM		9825af	
1500	1600		South Africa, Channel Africa		17770af	
1500	1600		UK, BBC World Service		6040as	6190af
			6195as	9740as	11920as	11940af
			12095va	15105af	17640af	17830af
			21470af	21660af		
1500	1600	Sat	UK, BBC World Service		9410va	
1500	1600		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1500	1600		USA, KTBN Salt Lake City UT		7505na	
1500	1600		USA, KWHR Naalehu HI		9930as	
1500	1600		USA, Voice of America		4930af	6080af
			7125af	9520va	9865va	11525va
			11765va	12150va	13735va	15580af
			17715af	17895af		
1500	1600	Sun	USA, WBCQ Monticello ME		17495am	
1500	1600		USA, WBOH Newport NC		5920am	
1500	1600		USA, WEWN Vandiver AL		11530am	
1500	1600	mtwhfa	USA, WHRA Greenbush ME		15665va	
1500	1600		USA, WHRI Cypress Creek SC			9840na
1500	1600		USA, WHRI Cypress Creek SC			11785na
1500	1600		USA, WINB Red Lion PA		13570am	
1500	1600		USA, WRMI Miami FL		7385na	
1500	1600		USA, WTJC Newport NC		9370na	
1500	1600		USA, WWCR Nashville TN		9985na	12160na
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN		9385va	
1500	1600		USA, WYFR/Family Radio Worldwide			6280as
			11830na	11910na	17795ca	
1500	1600		Zambia, CVC Intl/Christian Voice			4965af
1510	1545		Swaziland, Trans World Radio			4760af
1515	1600	Sat	UK, Bible Voice BC		12035as	
1530	1545		India, All India Radio		7255af	9820af
			9910af			
1530	1600		Germany, AWR Europe		15225as	
1530	1600		Iran, Voice of the Islamic Rep of Iran			6160as
			7330as			
1530	1600		Mongolia, Voice of		12085as	
1530	1600		Sweden, Radio	11590va		
1530	1600	mh	UK, Bible Voice BC		12035as	
1530	1600		UK, Sudan Radio Service		9840af	
1530	1600		USA, Voice of America		6105va	7175va
			9760va	15460va		
1551	1600	DRM	New Zealand, Radio NZ Intl		6095pa	
1551	1600		New Zealand, Radio NZ Intl		7145pa	

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

1600	1615		Pakistan, Radio	6230eu	7520eu	11570eu
1600	1628		Vietnam, Voice of Vietnam		7280va	9550va
			9730va	11630va	13860va	
1600	1630		Guam, AWR/KSDA		11805as	11985as
1600	1630		Iran, Voice of the Islamic Rep of Iran			6160as
			7330as			
1600	1630		Myanmar, Myanma Radio		9730do	
1600	1630		Nigeria, Voice of/ Ext. Svc Lagos			9690af
1600	1630	Sat/Sun	Swaziland, Trans World Radio			4760af
1600	1630		Yemen, Rep of Yemen Radio		9780me	
1600	1645		USA, WYFR/Family Radio Worldwide			11830na
			11865na			
1600	1657		China, China Radio Intl		7255eu	9435eu
			9525eu			
1600	1659		Finland, Overcomer Ministries			9595me
1600	1700		Anguilla, Worldwide Univ Network			11775am
1600	1700		Australia, CVC International		13635as	
1600	1700		Australia, Radio Australia		5995va	6080va
			7240as	9475va	9710pa	11660pa
1600	1700	mtwhf	Austria, Radio Austria Intl		13675am	
1600	1700	Sat	Canada, CBC NQ SW Service			9625na
1600	1700		Canada, CFVP Calgary AB		6030na	
1600	1700		Canada, CKZN St John's NF		6160na	
1600	1700		Canada, CKZU Vancouver BC			6160na
1600	1700		China, China Radio Intl		6100af	9570af
			11800af			
1600	1700		Costa Rica, Worldwide Univ Network			11870va
			13750va			
1600	1700		Egypt, Radio Cairo		11740af	
1600	1700		Ethiopia, Radio Ethiopia		7165af	9560af
1600	1700		France, Radio France Intl		15605af	
1600	1700		Germany, CVC Intl/Voice Africa			15680af
1600	1700		Germany, Deutsche Welle		6170as	9540as
			15640as			
1600	1700		Germany, The Overcomer Ministries			6110va
1600	1700	1st Sun	Germany, The Overcomer Ministries			6110eu
1600	1700		Italy, IRRS	9825af		
1600	1700		Jordan, Radio	11690na		
1600	1700		Malaysia, RTM/Traxx FM		7295as	
1600	1700	DRM	New Zealand, Radio NZ Intl		6095pa	
1600	1700		New Zealand, Radio NZ Intl		7145pa	
1600	1700		Nigeria, Radio/Kaduna		4770do	6090al
1600	1700		North Korea, Voice of Korea		9990va	11545va
1600	1700	vl	Papua New Guinea, Wantok R. Light			7325va
1600	1700		Russia, Voice of Russia		4965va	4975va
			6130eu	7260as	7305as	7320eu
			9470me			
1600	1700	vl	Rwanda, Radio Rwanda		6055do	
1600	1700	vl	Slovakia, Miraya FM		9825af	
1600	1700		South Korea, KBS World Radio			9515eu
1600	1700		Taiwan, Radio Taiwan Intl		11550as	15515as
1600	1700		UK, BBC World Service		3255af	3915as
			6190af	6195as	11665va	11920as
			11940af	12095va	15105va	15400af
			17830af	21470af	21660af	
1600	1700	Sat	UK, BBC World Service		9410va	
1600	1700		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1600	1700		USA, KJES Vado NM		11715na	
1600	1700		USA, KTBN Salt Lake City UT		15590na	
1600	1700		USA, KWHR Naalehu HI		9930as	
1600	1700		USA, Voice of America		4930af	6080af
			15580af	13600va	13615va	15445va
			17715af	17895af		
1600	1700	Sun	USA, WBCQ Monticello ME		17495am	
1600	1700		USA, WBOH Newport NC		5920am	
1600	1700		USA, WEWN Vandiver AL		11530am	15785eu
1600	1700		USA, WHRA Greenbush ME		17650af	
1600	1700		USA, WHRI Cypress Creek SC			9840na
			15285am			
1600	1700		USA, WINB Red Lion PA		13570am	
1600	1700	smtwhf	USA, WMLK Bethel PA		9265va	
1600	1700		USA, WRMI Miami FL		7385na	
1600	1700		USA, WTJC Newport NC		9370na	
1600	1700		USA, WWCR Nashville TN		9985na	12160na
			13845na	15825na		
1600	1700	Sun	USA, WWRB Manchester TN		11920af	
1600	1700		USA, WWRB Manchester TN		9385va	12180va
1600	1700		USA, WYFR/Family Radio Worldwide			6085ca
			13695na	17795ca	18980va	21525af
			21455va			
1600	1700		Zambia, CVC Intl/Christian Voice			4965af
1605	1630	Sat/Sun	Austria, Radio Austria Intl		13675am	
1605	1700		Canada, Radio Canada Intl		9610na	
1615	1645	mtwhf	Swaziland, Trans World Radio			6130af
1615	1700	Sat/Sun	UK, BBC World Service		11860af	15420af
			17640af			
1630	1645	Sun	Germany, Pan American BC		9850me	
1630	1700		Guam, AWR/KSDA		6155as	
1630	1700		Nigeria, Voice of/ Ext. Svc Lagos			15120af
1630	1700		Slovakia, Radio Slovakia Int		5920eu	6055eu
1630	1700	Sat/Sun	Swaziland, Trans World Radio			6130af
1630	1700	Sun	UK, Bible Voice BC		9460me	
1640	1650	mtwhfa	Turkmenistan, Turkmen Radio			4930eu
1640	1700	mtwhf	UK, Bible Voice BC		9460me	
1645	1700		Tajikistan, Tajik Radio		7245as	
1645	1700	Sat	UK, Bible Voice BC		9460me	

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

1700	1715		Swaziland, Trans World Radio			6130af
1700	1715	twhfa	UK, Bible Voice BC		9460me	
1700	1720	twhfa	Moldova, Radio PMR/Pridnestrovie			6235eu
1700	1727		Czech Rep, Radio Prague		5930eu	15710af
1700	1730		Jordan, Radio	11690na		
1700	1740	f	Moldova, Radio PMR/Pridnestrovie			6235eu
1700	1745		UK, BBC World Service		6005af	9630af
1700	1757		China, China Radio Intl		6100eu	7205eu

SHORTWAVE GUIDE

			7255eu	7335eu		
1700	1800		Anguilla, Worldwide Univ Network			11775am
1700	1800	mtwhf	Argentina, RAE	15344eu		
1700	1800		Australia, CVC International	13635as		
1700	1800		Australia, Radio Australia	5995va	6080va	
			9475as	9580va	9710as	11880as
1700	1800	Sat	Canada, CBC NQ SW Service			9625na
1700	1800		Canada, CFVP Calgary AB	6030na		
1700	1800		Canada, CKZN St John's NF	6160na		
1700	1800		Canada, CKZU Vancouver BC			6160na
1700	1800	DRM	Canada, Radio Canada Intl	9800na		
1700	1800		China, China Radio Intl	9570af		11900af
1700	1800		Costa Rica, Worldwide Univ Network			11870va
			13750va			
1700	1800		Egypt, Radio Cairo	11740af		
1700	1800		Eqt. Guinea, Radio Africa	15190af		
1700	1800		Germany, CVC Intl/Voice Africa			15680af
1700	1800		Italy, IRRS	9825va		
1700	1800		Italy, IRRS	9825af		
1700	1800		Malaysia, RTM/Traxx FM	7295as		
1700	1800	DRM	New Zealand, Radio NZ Intl	6095pa		
1700	1800		New Zealand, Radio NZ Intl	7145pa		
1700	1800		Nigeria, Radio/Kaduna	4770do		6090al
1700	1800		Nigeria, Voice of/ Ext. Svc Lagos			15120af
1700	1800	vl	Papua New Guinea, Wantok R. Light			7325va
1700	1800		Russia, Voice of Russia	6125as	7125as	
			7235as	7270va	7320eu	9470me
1700	1800	vl	Rwanda, Radio Rwanda	6055do		
1700	1800	vl	Slovakia, Miraya FM	9825af		
1700	1800		South Africa, Channel Africa	15235af		
1700	1800		Swaziland, Trans World Radio			3200af
1700	1800		Taiwan, Radio Taiwan Intl	11705af		15690af
1700	1800	DRM	UK, BBC World Service	5895eu		
1700	1800		UK, BBC World Service	3255af		3915as
			6190af	11665va	11755af	11955as
			12095af	15400af	17830af	21470af
1700	1800	Sun	UK, Bible Voice BC	9460me		
1700	1800		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1700	1800		USA, KTBN Salt Lake City UT	15590na		
1700	1800		USA, KWHR Naalehu HI	9930as		
1700	1800		USA, Voice of America	6080af		13710af
			15580af	17895af		
1700	1800	Sun	USA, WBCQ Monticello ME	17495am		
1700	1800		USA, WBOH Newport NC	5920am		
1700	1800		USA, WEWN Vandiver AL	11530am		15785eu
1700	1800		USA, WHRI Cypress Creek SC			15285am
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800	smtwhf	USA, WMLK Bethel PA	9265va		
1700	1800		USA, WRMI Miami FL	9955am		
1700	1800		USA, WTJC Newport NC	9370na		
1700	1800		USA, WWCR Nashville TN	9985na		12160na
			13845na	15825na		
1700	1800	Sun	USA, WWRB Manchester TN	11920af		
1700	1800		USA, WWRB Manchester TN	9285va		12180va
1700	1800		USA, WYFR/Family Radio Worldwide			13690na
			17795ca	18980va	21455va	
1700	1800		Zambia, CVC Intl/Christian Voice			4965af
1715	1730	h	UK, Bible Voice BC	9460me		
1715	1745	t	UK, Bible Voice BC	9460me		
1730	1745	h	UK, Bible Voice BC	9460me		
1730	1800		Bulgaria, Radio 7200eu	9400eu		
1730	1800		Guam, AWR/KSDA	9980me		
1730	1800		Swaziland, Trans World Radio			9500af
1730	1800	Sat	UK, Bible Voice BC	9460me		
1730	1800	Sun	UK, Bible Voice BC	9615me		
1730	1800	mtwhf	UK, Sudan Radio Service	9840af		
1730	1800	Sat/Sun	USA, Voice of America	4930af		12080af
			15775af			
1730	1800		USA, Voice of America	4930af		12080af
			15775af			
1730	1800	mtwhf	USA, Voice of America	4930af		12080af
			15775af			
1730	1800		Vatican City, Vatican Radio	9755af		11625af
			13765af			
1745	1800		Bangladesh, Bangla Betar	7185as		
1745	1800		India, All India Radio	7410eu		9445af
			9950eu	11620eu	11935af	13605af
			15075af	15155af	17670af	
1745	1800	t	UK, Bible Voice BC	9460me		

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

1800	1805	DRM	Canada, Radio Canada Intl	9800na		
1800	1809		Tanzania, VO Tanzania-Zanzibar			11735af
1800	1815	t/vl	UK, Bible Voice BC	9460me		
1800	1815	Sat	UK, Bible Voice BC	7210as		
1800	1827		Czech Rep, Radio Prague	5930eu		9400va
1800	1828		Vietnam, Voice of Vietnam	5955eu		7280va
			9730va			
1800	1830		Austria, AWR Europe	15315af		
1800	1830		Nigeria, Radio, Natl Svc/Abuja			7275do
1800	1830	DRM	Romania, Radio Romania Intl			7465eu
1800	1830		South Africa, AWR Africa	3215af		3345af
			9610af			
1800	1830		UK, BBC World Service	11955as		
1800	1830	Sat/Sun	UK, Bible Voice BC	9460me		
1800	1830		USA, Voice of America	4930af		6080af
			11975af	13710af	15580af	17895af
1800	1850	DRM	New Zealand, Radio NZ Intl	6095pa		
1800	1850		New Zealand, Radio NZ Intl	7145pa		
1800	1856		Romania, Radio Romania Intl			7215eu
			9640eu			
1800	1857		China, China Radio Intl	6100eu		7110eu
1800	1857		Netherlands, Radio Netherlands			6020af
			15535af			
1800	1900		Anguilla, Worldwide Univ Network			11775am
1800	1900		Australia, Radio Australia	6080va		7240as
			9475va	9580as	9710as	11880as
1800	1900		Bangladesh, Bangla Betar	7185eu		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St John's NF	6160na		
1800	1900		Canada, CKZU Vancouver BC			6160na
1800	1900		Canada, Radio Canada Intl	7185af		11875af
			13650af	15365af	17790af	
1800	1900		Costa Rica, Worldwide Univ Network			11870va
			13750va			
1800	1900		Egypt, Radio Cairo	11740af		
1800	1900		Eqt. Guinea, Radio Africa	15190af		
1800	1900		Germany, CVC Intl/Voice Africa			9490af
1800	1900		India, All India Radio	7410eu		9445af
			9950eu	11620eu	11935af	13605af
			15075af	15155af	17670af	
1800	1900	fas	Italy, IRRS	7285va		
1800	1900		Kuwait, Radio Kuwait	11990na		
1800	1900		Malaysia, RTM/Traxx FM	7295as		
1800	1900		Nigeria, Radio/Kaduna	4770do		6090al
1800	1900		Nigeria, Voice of/ Ext. Svc Lagos			15120af
1800	1900		North Korea, Voice of Korea	7570eu		12015eu
1800	1900	vl	Papua New Guinea, Wantok R. Light			7325va
1800	1900		Poland, Polish Radio	6015eu		7130eu
1800	1900		Russia, Voice of Russia	6125as		7105eu
			7125as	7235as	7270af	7320eu
			7335va	11510af		
1800	1900	Sat/Sun	Russia, Voice of Russia	6055eu		6175eu
1800	1900	vl	Rwanda, Radio Rwanda	6055do		
1800	1900		South Korea, KBS World Radio			7275eu
1800	1900		Swaziland, Trans World Radio			9500af
1800	1900		Taiwan, Radio Taiwan Intl	3965eu		
1800	1900		UK, BBC World Service	3255af		5875va
			5955as	6005af	6190af	6195va
			9410af	9480va	11755af	12095af
			15400af	17830af		
1800	1900	DRM	UK, BBC World Service	5895eu		
1800	1900	Sat	UK, Bible Voice BC	9615me		
1800	1900		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
1800	1900		USA, KJES Vado NM	15385na		
1800	1900		USA, KTBN Salt Lake City UT	15590na		
1800	1900	Sat/Sun	USA, WBCQ Monticello ME	9330am		17495am
1800	1900		USA, WBOH Newport NC	5920am		
1800	1900		USA, WEWN Vandiver AL	11530am		15785eu
1800	1900	mtwhf	USA, WHRI Cypress Creek SC			15670va
1800	1900	Sat/Sun	USA, WHRI Cypress Creek SC			15285va
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900	smtwhf	USA, WMLK Bethel PA	9265va		
1800	1900		USA, WRMI Miami FL	9955am		
1800	1900		USA, WTJC Newport NC	9370na		
1800	1900		USA, WWCR Nashville TN	9985na		12160na
			13845na	15825na		
1800	1900	Sun	USA, WWRB Manchester TN	11920af		
1800	1900		USA, WWRB Manchester TN	9385va		12180va
1800	1900		USA, WYFR/Family Radio Worldwide			13615na
			13690na	17795ca	17845af	18980va
1800	1900		Yemen, Rep of Yemen Radio	9780me		
1800	1900		Zambia, CVC Intl/Christian Voice			4965af
1830	1900		Slovakia, Radio Slovakia Int	5920eu		6055eu
1830	1900		UK, BBC World Service	6005af		9630af
1830	1900	f	UK, Bible Voice BC	9460me		
1830	1900	Sun	UK, Bible Voice BC	9615me		
1830	1900		USA, Voice of America	4930af		6080af
			6105va	7220va	9650af	11975af
			13710af	15580af	17895af	
1845	1900	mtwhfa	Albania, Radio Tirana	7430eu		13640eu
1845	1900	Sun	UK, Bible Voice BC	7260af		
1851	1900	DRM	New Zealand, Radio NZ Intl	9890pa		
1851	1900		New Zealand, Radio NZ Intl	9615pa		

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

1900	1928		Vietnam, Voice of Vietnam	7280va	9730va	
1900	1930		Germany, Deutsche Welle	9565af	11795af	17860af
1900	1930	Sat	UK, Bible Voice BC	9460me		
1900	1930	Sun	UK, Bible Voice BC	6010eu	7245af	
1900	1930		USA, Voice of America	9785va	12020va	
1900	1935	DRM	New Zealand, Radio NZ Intl	9890pa		
1900	1945		India, All India Radio	7410eu	9445af	9950eu 11620eu 11935af 13605af 15075af 15155af 17670af
1900	1945	Sat	UK, Bible Voice BC	6010eu		
1900	1945		USA, WYFR/Family Radio Worldwide	6085ca		
1900	1950		New Zealand, Radio NZ Intl	9615pa		
1900	1957		Netherlands, Radio Netherlands	11660af		15335af
1900	2000		Anguilla, Worldwide Univ Network	11775am		
1900	2000		Australia, Radio Australia	6080va	7240as	9500va 9580va 9710as 11880as
1900	2000		Canada, CFVP Calgary AB	6030na		
1900	2000		Canada, CKZN St John's NF	6160na		
1900	2000		Canada, CKZU Vancouver BC	6160na		
1900	2000		Canada, Radio Canada Intl	17790af		
1900	2000		China, China Radio Intl	7295va	9435va	9440va
1900	2000		Costa Rica, Worldwide Univ Network	11870va		13750va
1900	2000		Egypt, Radio Cairo	15375af		
1900	2000		Eqt Guinea, Radio Africa	15190af		
1900	2000		Finland, Overcomer Ministries	6060eu		
1900	2000		Germany, CVC Intl/Voice Africa	9490af		
1900	2000	fas	Italy, IRRS	7285va		
1900	2000		Malaysia, RTM/Traxx FM	7295as		
1900	2000		Netherlands, Radio Netherlands	5905af		7425af
1900	2000		Nigeria, Radio/Kaduna	4770do	6090al	
1900	2000		Nigeria, Voice of/ Ext. Svc Lagos	15120af		
1900	2000		North Korea, Voice of Korea	7100af	9975va	11910af 11535va
1900	2000		Papua New Guinea, NBC	4890do		
1900	2000	vl	Papua New Guinea, Wantok R. Light	7325va		
1900	2000		Russia, Voice of Russia	5955as	6175eu	7105eu 7290eu 7335af 11510af
1900	2000	vl	Rwanda, Radio Rwanda	6055do		
1900	2000	vl	Solomon Islands, SIBC	5020do	9545al	
1900	2000	vl	South Africa, Channel Africa	3345af		
1900	2000		Thailand, Radio	9805eu		
1900	2000	vl	Uganda, UBC Radio	4976do	5026do	
1900	2000		UK, BBC World Service	3255af	5875va	6005af 6190af 6195va 9410af 9480va 9630af 12095af 15400af 17830af
1900	2000	DRM	UK, BBC World Service	5895eu		
1900	2000	Sat/Sun	UK, Bible Voice BC	9470me		
1900	2000	Sun	UK, Bible Voice BC	7260af		
1900	2000		Ukraine, Radio Ukraine Intl	7490eu		
1900	2000		USA, American Forces Radio	4319usb		5446usb 5765usb 6350usb 7811usb 10320usb 12133usb 13362usb
1900	2000		USA, KJES Vado NM	15385na		
1900	2000		USA, KTBN Salt Lake City UT	15590na		
1900	2000		USA, Voice of America	4930af	6080af	11975af 13710af 15580af 17895af
1900	2000	Sat/Sun	USA, WBCQ Monticello ME	9330am	17495am	
1900	2000		USA, WBCQ Monticello ME	7415am		
1900	2000		USA, WBOH Newport NC	5920am		
1900	2000		USA, WEWN Vandiver AL	11530am	15785eu	
1900	2000		USA, WHRA Greenbush ME	11785va		
1900	2000		USA, WHRI Cypress Creek SC	9840na		17640am
1900	2000		USA, WINB Red Lion PA	13570am		
1900	2000	smtwhf	USA, WMLK Bethel PA	9265va		
1900	2000		USA, WRMI Miami FL	9955am		
1900	2000		USA, WTJC Newport NC	9370na		
1900	2000		USA, WWCR Nashville TN	9975na	12160na	13845na 15825na
1900	2000	Sun	USA, WWRB Manchester TN	11920va		
1900	2000		USA, WWRB Manchester TN	9385va	12180va	
1900	2000		USA, WYFR/Family Radio Worldwide	13615na		13690na 17795ca 17845af 18930eu 18980va
1900	2000		Zambia, CVC Intl/Christian Voice	4965af		
1900	2000		Kuwait, Radio Kuwait	11990na		
1930	2000	Sat/Sun	Germany, Pan American BC	6020va		
1930	2000		Iran, Voice of the Islamic Rep of Iran	6010eu		6225eu 7320eu 9855af 11695af
1930	2000		Lithuania, Radio Vilnius	6010eu	6225eu	7320eu
1930	2000		Serbia, International Radio Serbia	6100eu		7240eu
1930	2000		Turkey, Voice of	6050eu		
1930	2000	f	UK, Bible Voice BC	9470me		
1930	2000		USA, Voice of America	6105va	7220va	9650va 9785va 12020va
1936	2000	DRM	New Zealand, Radio NZ Intl	11675pa		
1951	2000		New Zealand, Radio NZ Intl	11725pa		

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

2000	2015	Sun	Germany, Pan American BC	6020va		
2000	2025		Turkey, Voice of	6055eu		
2000	2028		Lithuania, Radio Vilnius	6010eu	6225eu	7320eu
2000	2030	mtwhfa	Albania, Radio Tirana	7460eu	13600na	
2000	2030		China, China Radio Intl	7160eu		
2000	2030		Egypt, Radio Cairo	15375af		
2000	2030	fa	Germany, Pan American BC	6020me		
2000	2030		Iran, Voice of the Islamic Rep of Iran	6010eu		6225eu 7320eu 9855af 11695af
2000	2030		South Africa, AWR Africa	9655af		
2000	2030	Sun	UK, Bible Voice BC	6010eu		
2000	2030		USA, Voice of America	4930af	4940af	6080af 11975af 13710af
2000	2030		Vatican City, Vatican Radio	7365af	9755af	11625af
2000	2045		USA, WYFR/Family Radio Worldwide	17750eu		
2000	2050	DRM	New Zealand, Radio NZ Intl	11675pa		
2000	2050		New Zealand, Radio NZ Intl	11725pa		
2000	2057		China, China Radio Intl	7190eu	9600eu	
2000	2057		Netherlands, Radio Netherlands	5905af		7425af 17810af
2000	2059		Finland, Overcomer Ministries	6060eu		
2000	2100		Anguilla, Worldwide Univ Network	11775am		
2000	2100		Australia, ABC NT Alice Springs	2310do		4835do
2000	2100		Australia, ABC NT Katherine	2485do		
2000	2100		Australia, ABC NT Tennant Creek	2325do		
2000	2100	Sat/Sun	Australia, Radio Australia	12080as		
2000	2100		Australia, Radio Australia	6080va	7240as	9500va 11650as 11660pa 11880as
2000	2100		Canada, CFVP Calgary AB	6030na		
2000	2100		Canada, CKZN St John's NF	6160na		
2000	2100		Canada, CKZU Vancouver BC	6160na		
2000	2100		China, China Radio Intl	5960eu	7285eu	7295af 9440af 11640af 13630af
2000	2100		Costa Rica, Worldwide Univ Network	13750va		
2000	2100		Eqt Guinea, Radio Africa	15190af		
2000	2100		Germany, CVC Intl/Voice Africa	7285af		
2000	2100		Germany, Deutsche Welle	6150af	11795af	11865af 15205af
2000	2100		Germany, The Overcomer Ministries	5995eu		
2000	2100		Indonesia, Voice of Indonesia	9525al		11785pa 15150as
2000	2100		Kuwait, Radio Kuwait	11990na		
2000	2100	vl	Liberia, ELWA	4760do		
2000	2100		Malaysia, RTM/Traxx FM	7295as		
2000	2100		Nigeria, Radio/Kaduna	4770do	6090al	
2000	2100		Nigeria, Voice of/ Ext. Svc Lagos	15120af		
2000	2100		Papua New Guinea, NBC	4890do		
2000	2100	vl	Papua New Guinea, Wantok R. Light	7325va		
2000	2100		Russia, Voice of Russia	6145eu	7105eu	7330eu
2000	2100	vl	Rwanda, Radio Rwanda	6055do		
2000	2100	vl	Solomon Islands, SIBC	5020do	9545al	
2000	2100	vl	South Africa, Channel Africa	3345af		
2000	2100	mtwhf	Spain, Radio Exterior Espana	9665eu	11625af	
2000	2100	vl	Uganda, UBC Radio	4976do	5026do	
2000	2100		UK, BBC World Service	3255af	6005af	6190af 6195va 9410af 9630af 12095af 15400af 17830af
2000	2100	DRM	UK, BBC World Service	5875eu		
2000	2100		USA, American Forces Radio	4319usb		5446usb 5765usb 6350usb 7811usb 10320usb 12133usb 13362usb
2000	2100		USA, KJES Vado NM	15385na		
2000	2100		USA, KTBN Salt Lake City UT	15590na		
2000	2100		USA, WBCQ Monticello ME	7415am	9330am	
2000	2100	Sat/Sun	USA, WBCQ Monticello ME	17495am		
2000	2100		USA, WBOH Newport NC	5920am		
2000	2100		USA, WEWN Vandiver AL	11530am	17595af	
2000	2100	mtwhf	USA, WHRA Greenbush ME	7520va		
2000	2100	Sat/Sun	USA, WHRA Greenbush ME	11785af		
2000	2100		USA, WHRI Cypress Creek SC	17640sa		
2000	2100	mtwhfa	USA, WHRI Cypress Creek SC	11765na		
2000	2100	f	USA, WHRI Cypress Creek SC	15665af		
2000	2100		USA, WINB Red Lion PA	13570am		

SHORTWAVE GUIDE

2000	2100	smtwhf	USA, WMLK Bethel PA	9265va		
2000	2100		USA, WRMI Miami FL	9955am		
2000	2100		USA, WTJC Newport NC	9370na		
2000	2100		USA, WWCR Nashville TN	9975na	13845na	15825na
2000	2100	Sun	USA, WWRB Manchester TN	11920af		
2000	2100		USA, WWRB Manchester TN	9385va	12180va	
2000	2100		USA, WYFR/Family Radio Worldwide	13615na	17725sa	17795ca 17845af 18980va
2000	2100		Zambia, CVC Intl/Christian Voice	4965af		
2005	2100		Syria, Radio Damascus	9330eu	12085eu	
2030	2045		Thailand, Radio 9535eu			
2030	2048		Vietnam, Voice of Vietnam	7220va	7280va	9550va 9730va
2030	2100		Cuba, Radio Havana	9505va	11760va	
2030	2100		Sweden, Radio 7395va	7420pa		
2030	2100		USA, Voice of America	4930af	4940af	6080af 7595af 11975af 13710af
2045	2100		India, All India Radio	7410eu	9445eu	9910pa 9950eu 11620eu 11715pa
2045	2100	DRM	Vatican City, Vatican Radio	9800am		
2050	2100		Vatican City, Vatican Radio	4005eu	5885eu	7250eu
2051	2100		New Zealand, Radio NZ Intl	15720pa		
2051`	2100	DRM	New Zealand, Radio NZ Intl	13840pa		

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

2100	2120		Vatican City, Vatican Radio	4005eu	5885eu	7250eu
2100	2127		Czech Rep, Radio Prague	5930va	9430va	
2100	2130		Australia, ABC NT Katherine	2485do		
2100	2130		Australia, ABC NT Tennant Creek	2325do		
2100	2130	Sat	Canada, CBC NQ SW Service	9625na		
2100	2130		China, China Radio Intl	11640af	13630af	
2100	2130		Cuba, Radio Havana	9505va	11760va	
2100	2130		Nigeria, Radio, Natl Svc/Abuja	7275do		
2100	2130		South Africa, AWR Africa	11955af		
2100	2130		South Korea, KBS World Radio	3955eu		
2100	2145		USA, WYFR/Family Radio Worldwide	13615na	17795ca	18980va
2100	2157		China, China Radio Intl	5960eu	6135eu	7190eu 7285eu 9600eu
2100	2159		Canada, Radio Canada Intl	5850eu	9770eu	
2100	2200		Anguilla, Worldwide Univ Network	11775am		
2100	2200		Australia, ABC NT Alice Springs	2310do		4835do
2100	2200		Australia, Radio Australia	9500as	9660as	11650pa 11660pa 11695as 12080as 13630as 15515as
2100	2200		Belarus, Radio 6090eu	7360eu	7390eu	
2100	2200		Bulgaria, Radio 5900eu	9700eu		
2100	2200		Canada, CFVP Calgary AB	6030na		
2100	2200		Canada, CKZN St John's NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200		Costa Rica, Worldwide Univ Network	13750va		
2100	2200		Eqt Guinea, Radio Africa	15190af		
2100	2200		Germany, Deutsche Welle	9735af	11865af	15205af
2100	2200		Germany, The Overcomer Ministries	5995eu		
2100	2200		Guyana, Voice of Guyana	3291do	5950do	
2100	2200		India, All India Radio	7410eu	9445eu	9910pa 9950eu 11620eu 11715pa
2100	2200	vl	Liberia, ELWA 4760do			
2100	2200		Malaysia, RTM/Traxx FM	7295as		
2100	2200	DRM	New Zealand, Radio NZ Intl	13840pa		
2100	2200		New Zealand, Radio NZ Intl	15720pa		
2100	2200		Nigeria, Radio/Kaduna	4770do	6090al	
2100	2200		Nigeria, Voice of/ Ext. Svc Lagos	7255af		
2100	2200		North Korea, Voice of Korea	7570eu	12015eu	
2100	2200		Papua New Guinea, NBC	4890do		
2100	2200	vl	Papua New Guinea, Wantok R. Light	7325va		
2100	2200		Russia, Voice of Russia	6145eu	7290eu	7330eu
2100	2200	vl	South Africa, Channel Africa	3345af		
2100	2200	Sat/Sun	Spain, Radio Exterior Espana	9840eu		
2100	2200		Syria, Radio Damascus	9330eu	12085eu	
2100	2200		UK, BBC World Service	3255af	3915as	5965as 6005af 6125as 6190af 6195va 9410af 9525am 11675am 15400af
2100	2200	DRM	UK, BBC World Service	5875eu		
2100	2200		Ukraine, Radio Ukraine Intl	7510eu		
2100	2200		USA, American Forces Radio	4319usb		5446usb 5765usb 6350usb 7811usb 10320usb 12133usb 13362usb
2100	2200		USA, KTBN Salt Lake City UT	15590na		
2100	2200		USA, Voice of America	6080af	15580af	
2100	2200		USA, WBCQ Monticello ME	7415am	9330am	
2100	2200		USA, WBOH Newport NC	5920am		
2100	2200		USA, WEWN Vandiver AL	11530am	17595af	
2100	2200		USA, WHRA Greenbush ME	7520af		
2100	2200		USA, WHRI Cypress Creek SC	9575am		
2100	2200	mtwhfa	USA, WHRI Cypress Creek SC	11765na		
2100	2200		USA, WINB Red Lion PA	13570am		
2100	2200		USA, WRMI Miami FL	9955am		
2100	2200		USA, WTJC Newport NC	9370na		
2100	2200		USA, WWCR Nashville TN	9975na	12160na	13845na 15825na
2100	2200	Sun	USA, WWRB Manchester TN	11920af		
2100	2200		USA, WWRB Manchester TN	9385va	12180va	
2100	2200		USA, WYFR/Family Radio Worldwide	11565eu		17845af
2115	2200		Egypt, Radio Cairo	6250eu		
2130	2156		Romania, Radio Romania Intl	6055va		6155va 7145va 9755va
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200		Australia, ABC NT Tennant Creek	4910do		
2130	2200	mtwhfa	Canada, CBC NQ SW Service	9625na		
2130	2200		Guam, AWR/KSDA	11850as		
2130	2200		Sweden, Radio 6065va			
2130	2200		Turkey, Voice of 7180va			
2130	2200		USA, Voice of America	7405af		

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

2200	2210		Syria, Radio Damascus	9330eu	12085eu	
2200	2220		Japan, NHK World/Radio Japan	13640as		
2200	2230		India, All India Radio	7410eu	9445eu	9910pa 9950eu 11620eu 11715pa
2200	2230		Papua New Guinea, NBC	4890do		
2200	2230		Serbia, International Radio Serbia	6100eu		7240eu
2200	2230		Turkey, Voice of 7180va			
2200	2240	DRM	New Zealand, Radio NZ Intl	13840pa		
2200	2240		New Zealand, Radio NZ Intl	15720pa		
2200	2245		Egypt, Radio Cairo	6250eu		
2200	2245		USA, WYFR/Family Radio Worldwide	15770af		
2200	2257		China, China Radio Intl	7170eu		
2200	2300		Anguilla, Worldwide Univ Network	6090am		
2200	2300		Australia, ABC NT Alice Springs	2310do		4835do
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, ABC NT Tennant Creek	4910do		
2200	2300		Australia, Radio Australia	9660va	11840va	12010va 12080as 13630pa 15230va 15240pa 15515as 15560pa
2200	2300		Belarus, Radio 6090eu	7360eu	7390eu	
2200	2300	smtwhf	Canada, CBC NQ SW Service	9625na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St John's NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300	DRM	Canada, Radio Canada Intl	9800na		
2200	2300		China, China Radio Intl	9590as		
2200	2300		Costa Rica, Worldwide Univ Network	13750va		
2200	2300		Eqt Guinea, Radio Africa	15190af		
2200	2300		Guyana, Voice of Guyana	3291do		
2200	2300	vl	Liberia, ELWA 4760do			
2200	2300		Malaysia, RTM/Traxx FM	7295as		
2200	2300		Nigeria, Radio/Kaduna	4770do	6090al	
2200	2300		Nigeria, Voice of/ Ext. Svc Lagos	7255af		
2200	2300	vl	Papua New Guinea, Wantok R. Light	7325va		
2200	2300	vl	Solomon Islands, SIBC	5020do	9545al	
2200	2300		Taiwan, Radio Taiwan Intl	9355eu		
2200	2300		UK, BBC World Service	5955as	5965as	5975am 6195as 9410af 9525am 9740as 15400af
2200	2300	DRM	UK, BBC World Service	5875eu		
2200	2300		USA, American Forces Radio	4319usb		5446usb 5765usb 6350usb 7811usb 10320usb 12133usb 13362usb
2200	2300		USA, KTBN Salt Lake City UT	15590na		
2200	2300		USA, Voice of America	5910va	7120va	7220va 7405af 7425va 9490va 11725va
2200	2300	Sat	USA, WBCQ Monticello ME	17495am		
2200	2300		USA, WBCQ Monticello ME	7415am	9330am	
2200	2300		USA, WBOH Newport NC	5920am		
2200	2300		USA, WEWN Vandiver AL	7560eu	9975am	
2200	2300		USA, WHRA Greenbush ME	7520af		
2200	2300		USA, WHRI Cypress Creek SC	9575am		
2200	2300	Sun	USA, WHRI Cypress Creek SC	7490na		
2200	2300		USA, WINB Red Lion PA	13570am		
2200	2300	mtwhfa	USA, WRMI Miami FL	9955am		
2200	2300	Sun	USA, WRMI Miami FL	7385na		
2200	2300		USA, WTJC Newport NC	9370na		
2200	2300		USA, WWCR Nashville TN	7465na	9985na	12160na 13845na

2200	2300		USA, WWRB Manchester TN	12180va		
2200	2300		USA, WYFR/Family Radio Worldwide			11740na
2230	2257		Czech Rep, Radio Prague	5930na		9435af
2230	2300		Guam, AWR/KSDA	15320as		
2230	2300		Papua New Guinea, NBC	9675do		
2230	2300	DRM	Sweden, Radio	9800na		
2230	2300		USA, Voice of America	7230va		9780va
			15445va			
2241	2300	DRM	New Zealand, Radio NZ Intl	15720pa		
2241	2300		New Zealand, Radio NZ Intl	13840pa		
2245	2300		India, All India Radio	9705eu		9950as
			11620as	11645as	13605as	

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

2300	0000		Anguilla, Worldwide Univ Network			6090am
2300	0000		Australia, ABC NT Alice Springs			2310do
			4835do			
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, ABC NT Tennant Creek			4910do
2300	0000		Australia, Radio Australia	9660as		11840va
			12010pa	12080pa	13690pa	15230va
			15240pa	15560va	17795va	
2300	0000		Bulgaria, Radio	9700na	11700na	
2300	0000	smtwhf	Canada, CBC NQ SW Service			9625na
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St John's NF	6160na		
2300	0000		Canada, CKZU Vancouver BC			6160na
2300	0000		China, China Radio Intl	5915as		5990va
			6145na	7180as	11685as	11840na
2300	0000		Costa Rica, Worldwide Univ Network			13750va
2300	0000		Cuba, Radio Havana	9505am		9550am
2300	0000		Egypt, Radio Cairo	9465na		
2300	0000		Guyana, Voice of Guyana	3291do		
2300	0000		Malaysia, RTM/Traxx FM	7295as		
2300	0000	DRM	New Zealand, Radio NZ Intl	15720pa		
2300	0000		New Zealand, Radio NZ Intl	13840pa		
2300	0000		Papua New Guinea, NBC	9675do		
2300	0000	vl	Papua New Guinea, Wantok R. Light			7325va
2300	0000		Singapore, MediaCorp Radio			6150do
2300	0000	vl	Solomon Islands, SIBC	5020do		9545al
2300	0000		UK, BBC World Service	5965as		5985as
			9740as	11955as		
2300	0000		USA, American Forces Radio			4319usb
			5446usb	5765usb	6350usb	7811usb
			10320usb	12133usb	13362usb	
2300	0000		USA, KTBN Salt Lake City UT	15590na		
2300	0000		USA, Voice of America	5910va		7120va
			7405va	9490va	11725va	15185va
2300	0000		USA, WBCQ Monticello ME	7415am		17495am
2300	0000		USA, WBOH Newport NC	5920am		
2300	0000		USA, WEWN Vandiver AL	7560eu		9975am
2300	0000		USA, WHRA Greenbush ME	5850eu		
2300	0000	mtwhfa	USA, WHRI Cypress Creek SC			11765na
2300	0000	Sun	USA, WHRI Cypress Creek SC			7490na
2300	0000	mtwhfa	USA, WHRI Cypress Creek SC			11765na
2300	0000		USA, WHRI Cypress Creek SC			7315am
2300	0000		USA, WINB Red Lion PA	9265am		
2300	0000		USA, WRMI Miami FL	9955am		
2300	0000		USA, WTJC Newport NC	9370na		
2300	0000		USA, WWCR Nashville TN	3215na		7465na
			9985na	13845na		
2300	0000		USA, WWRB Manchester TN	12180va		
2300	0000		USA, WYFR/Family Radio Worldwide			15255sa
			17750sa			
2300	2305		Greece, Voice of Greece	7475va		9420va
2300	2305	vl	Liberia, ELWA	4760do		
2300	2310	vl	Croatia, Croatian Radio	7285na		
2300	2315		Nigeria, Radio/Kaduna	4770do		6090al
2300	2330		USA, Voice of America	6180va		7205va
			15150va			
2300	2345		USA, WYFR/Family Radio Worldwide			11740na
2300	2345		USA, WYFR/Family Radio Worldwide			11740na
2300	2345	DRM	Vatican City, Vatican Radio	7370am		
2300	2355		Turkey, Voice of	5960va		
2300	2356		Romania, Radio Romania Intl			6015va
			6115va	7105va	9610va	
2330	0000		Australia, Radio Australia	15415as		17750va
2330	0000	mtwhf	Austria, Radio Austria Intl	9870sa		
2330	0000		Lithuania, Radio Vilnius	7325na		
2330	0000		UK, BBC World Service	3915as		5935as
			5965as	6170as	6195as	7105as
			7340as			
2330	0000		USA, Voice of America	6180va		7205va
			11655va	13640va	15150va	
2330	2357		Czech Rep, Radio Prague	5930na		7345na
2330	2358		Vietnam, Voice of Vietnam	9840as		12020as
2335	0000	Sun	Austria, Radio Austria Intl	9870sa		
2343	0000	Sat	Austria, Radio Austria Intl	9870sa		

MT ENGLISH LANGUAGE SHORTWAVE STATION RESOURCE GUIDE

Albania, Radio Tirana	**http://rtsh.sil.at/**
Anguilla, Worldwide Univ Network	**www.worldwideuniversitynetwork.com/**
Argentina, RAE	**www.radionacional.gov.ar/rae/rae.asp**
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, CVC International	**www.christianvision.com/**
Australia, HCJB Global	**www.hcjb.org/**
Australia, Radio Australia	**www.abc.net.au/ra/**
Austria, AWR Europe	**www.awr2.org/**
Austria, Radio Austria Intl	**http://oe1.orf.at/service/international**
Bahrain, Radio Bahrain	**www.radiobahrain.net/**
Bangladesh, Bangla Betar	**www.betar.org.bd/**
Belarus, Radio	**www.radiobelarus.tvr.by/eng/**
Bhutan, BBS	**www.bbs.com.bt/**
Bulgaria, Radio	**www.bnr.bg/**
Canada, CBC NQ SW Service	**www.cbc.ca/north/**
Canada, Radio Canada Intl	**www.rcinet.ca/**
China, China Radio Intl	**www.cri.cn/**
Costa Rica, Worldwide Univ Network	**www.worldwideuniversitynetwork.com/**
Croatia, Croatian Radio	**www.hrt.hr/hr/**
Cuba, Radio Havana	**www.radiohc.cu/**
Czech Rep, Radio Prague	**www.radio.cz/en/**
Finland, Overcomer Ministries	**www.overcomerministries.org**
France, Radio France Intl	**www.rfi.fr/**
Germany, AWR Europe	**www.awr2.org/**
Germany, CVC Intl/Voice Africa	**www.christianvision.com/**
Germany, Deutsche Welle	**www.dw-world.de/**
Germany, Overcomer Ministries	**www.overcomerministry.org/**
Germany, Pan American BC	**www.radiopanam.com/**
Germany, The Overcomer Ministries	**www.overcomerministry.org/**
Germany, TWR Europe	**www.twr.org/**
Greece, Voice of Greece	**www.voiceofgreece.gr/**
Guam, AWR/KSDA	**www.awr2.org/**
Guam, TWR/KTWR	**www.twr.org/**
Guyana, Voice of	**http://voiceofguyana.com/**
India, All India Radio	**www.allindiaradio.org/**
Indonesia, Voice of Indonesia	**www.rri-online.com/**
Iran, Voice of the Islamic Rep of Iran	**www2.irib.ir/worldservice/**
Japan, NHK World/Radio Japan	**www.nhk.or.jp/english/**
Jordan, Radio	**www.jrtv.jo/rj/index.php**
Latvia, Radio SWH	**www.radioswh.lv/index.php**
Liberia, ELWA	**www.elwaministries.org/**
Liberia, Star Radio	**www.radioswh.lv/index.php**
Libya, Voice of Africa	**www.ljbc.net/home.php**
Lithuania, Radio Vilnius	**www.lrt.lt/**
Malaysia, RTM/Traxx FM	**www.traxxfm.net/index.htm**
Malaysia, RTM/Voice of Malaysia	**http://202.190.233.9/vom/utama.htm**
Monaco, TWR Europe	**www.twr.org/**
Nepal, Radio	**www.radionepal.org/**
Nepal, Radio	**www.radionepal.org/**
Netherlands, Radio Netherlands	**www.radionetherlands.nl/**
New Zealand, Radio NZ Intl	**www.rnzi.com**
Nigeria, Radio, Natl Svc/Abuja	**http://radionigeriaonline.com**
Nigeria, Radio/Kaduna	**http://radionigeriaonline.com**
Nigeria, Voice of/ Ext. Svc Lagos	**www.voiceofnigeria.org**
Oman, Radio Oman	**www.oman-tv.gov.om**
Pakistan, Radio	**www.radio.gov.pk**
Papua New Guinea, NBC	**www.nbc.com.pg/**
Papua New Guinea, Wantok R. Light	**http://wantokradio.net/**
Philippines, Radio Pilipinas	**www.radiopilipinas.com/**
Poland, Polish Radio	**www.polskieradio.pl/zagranica/gb/**
Romania, Radio Romania Intl	**www.rri.ro/**
Russia, Voice of Russia	**www.vor.ru/world.html**
Saudi Arabia, BSKSA	**www.saudiradio.net/**
Singapore, MediaCorp Radio	**www.mediacorpradio.sg**
Singapore, Radio Singapore Intl	**www.rsi.sg**
Slovakia, Radio Slovakia Int	**www.rsi.sk**
Solomon Islands, SIBC	**www.sibconline.com.sb/**
South Africa, AWR Africa	**www.awr2.org/**
South Africa, Channel Africa	**www.channelafrica.org**
South Africa, Trans World Radio	**www.twr.org/**
South Korea, KBS World Radio	**http://rki.kbs.co.kr/english/**
Spain, Radio Exterior Espana	**www.ree.rne.es/**
Sri Lanka, SLBC	**www.slbc.lk**
Swaziland, Trans World Radio	**www.twr.org/**
Sweden, Radio	**www.sr.se/rs/english/**
Syria, Radio Damascus	**www.rtv.gov.sy/**
Taiwan, Radio Taiwan Intl	**http://english.rti.org.tw/**
Thailand, Radio	**www.hsk9.com/**
Turkey, Voice of	**www.trt,net.tr**
UK, BBC World Service	**www.bbc.co.uk/worldservice/**
UK, Bible Voice BC	**www.biblevoice.org/**
UK, FEBA	**www.feba.org.uk**
UK, Sudan Radio Service	**www.sudanradio.org/**
Ukraine, Radio Ukraine Intl	**www.nrcu.gov.ua/**
USA, American Forces Radio	**http://myafn.dodmedia.osd.mil/**
USA, KNLS Anchor Point AK	**www.knls.org/**
USA, KTBN Salt Lake City UT	**www.tbn.org/**
USA, KWHR Naalehu HI	**www.whr.org/**
USA, Voice of America	**www.voanews.com/**
USA, WBCQ Monticello ME	**www.wbcq.com/**
USA, WBOH Newport NC	**www.fbnradio.com/**
USA, WEWN Vandiver AL	**www.ewtn.com**
USA, WHRA Greenbush ME	**www.whr.org/**
USA, WHRI Cypress Creek SC	**www.whr.org/**
USA, WINB Red Lion PA	**www.winb.com/**
USA, WMLK Bethel PA	**www.wmlkradio.net**
USA, WRMI Miami FL	**www.wrmi.net/**
USA, WTJC Newport NC	**www.fbnradio.com/**
USA, WWCR Nashville TN	**www.wwcr.com**
USA, WWRB Manchester TN	**www.wwrb.org/**
USA, WYFR/Family Radio Worldwide	**www.worldwide.familyradio.org**
Uzbekistan, CVC International	**www.christianvision.com/**
Vatican City, Vatican Radio	**www.vaticanradio.org**
Vietnam, Voice of Vietnam	**www.vov.org.vn**
Yemen, Rep of Yemen Radio	**www.yemenradio.net**
Zambia, CVC Intl/Christian Voice	**www.christianvision.com/**

SHORTWAVE GUIDE

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Milcom in the Pacific Northwest

This month we will focus on the Pacific Northwest and an on-scene monitoring report written by one of *MT* staffers, Chris Parris, the *Fed Files* columnist. Chris recently hit the road with his Radio Shack Pro-96 handheld and Pro96com analysis software (**www.pa2600.com/PRO96.html**) to provide us with an exclusive update on the Navy-Marine Corps Enterprise 14c systems in the Pacific Northwest. Here is that field monitor report from Chris.

❖ DoD Enterprise Land Mobile Radio System – Washington State Subsystems and Repeater Sites

After noticing some new and possibly incorrect information making its way across the Internet regarding the Enterprise Land mobile Radio system in the Navy Region Northwest, I decided to make a road trip and track down some of these trunked sites. Information here was obtained by on-scene monitoring and logging the P-25 control channel data stream using the PRO96COM analysis software.

First, there appear to be two distinct systems using the same P-25 System ID and WACN.(Wide Area Communications Network) code (System ID 14c, P25 WACN: BEE00).

The first system, which I will refer to as the "A" system, is associated with the U.S. Navy facilities in the Puget Sound area. These are the original 12 trunked sites that were first reported on the air in early 2006. A site (#114) at Whidbey NAS was added later. The second, or "B" system, appears to be located on Army bases or facilities in other portions of Washington State.

Some have assumed that both of the Tower 101 and 102 sites are located at Fort Lewis. On scene monitoring has shown this not to be the case.

All of the talk groups monitored on the Navy (A system) sites are numbered 20000 or higher. The talk groups monitored on the Army (B system) sites so far fall between 8000 and 9000. No talk group or radio crossovers between the Navy and Army sites have been noted to date.

And finally, look at the frequency ranges for the repeater outputs that the Navy sites are using (385 MHz and above), and then look at the frequency ranges that the Army sites are using (380-382 MHz). I believe they are operating as two separate systems, but still use the same trunk system identification – 14c.

"A" System – U.S. Navy Pacific Northwest

Tower/Site 101 – Location unknown
385.0625 Primary control channel

This site in this system is a bit of a mystery. I have yet to be able to hear it on the air. Some information posted online seems to indicate this is located at Fort Lewis, but it is not. It must be somewhere on the southern end of the Puget Sound area, since only System sites 102 and 103 seem to show this as a neighboring site.

Tower/Site 102 – Naval Base Kitsap, Bremerton (possible fill/secondary in site?)
385.3125 Primary control channel
385.9000 Alternate control channel
386.0375 Voice and data

Neighboring Towers/Sites
385.0625 (101) 386.1125 (103) 386.4125 (106) 386.3500 (107) 385.8875 (108)

Note: This site becomes audible as you head north into the Puget Sound area. It is not a big site and is probably a secondary or fill in site for Bremerton.

Tower/Site 103 – Naval Base Kitsap, Bremerton (Primary site)
386.1250 Primary control channel
386.2750 Alternate control channel
386.4250 Alternate control channel
386.5750 Alternate control channel
386.7250 Voice
386.9375 Voice
388.0875 Voice
388.2375 Voice and data
388.3875 Voice
388.5375 Voice and data
388.7500 Voice and data
388.9625 Voice

Neighboring Towers/Sites
385.0625 (101) 385.3125 (102) 386.1875 (104) 386.3500 (107)

Tower/Site 104 – Location unknown
(Note: This site has not been found yet to be able to monitor it directly yet.)
386.1875 Primary control channel

Tower/Site 105 – Location unknown
385.3500 Primary control channel
385.9125 Alternate control channel
386.0625 Alternate control channel
386.3625 Voice
386.5125 Voice and data
386.6625 Voice
386.8000 Voice

Neighboring Towers/Sites
386.1875 (104) 386.4125 (106) 386.3500 (107)

Tower/Site 106 – Naval Base Kitsap, Bangor Sub Base
385.0125 Voice and data
385.2125 Voice and data
385.6250 Voice and data
386.0125 Voice
386.2125 Voice and data
386.4125 Primary control channel
386.6125 Alternate control channel
386.8125 Alternate control channel
386.8875 Voice and data
388.0250 Alternate control channel

Neighboring Towers/Sites
385.3125 (102) 386.1250 (103) 385.3500 (105) 386.3500 (107) 385.8875 (108)

Tower/Site 107 – NAVSEA Keyport
386.3500 Primary control channel
386.5000 Alternate control channel
386.6500 Voice and data

Neighboring Towers/Sites
385.3125 (102) 386.1250 (103) 386.1875 (104) 385.3500 (105) 386.4125 (106)

Tower 108 – NAVMAG Indian Island
385.8875 Primary control channel
386.3375 Alternate control channel, voice and data

Members of the 4th Brigade, 2nd Infantry Division, I Corps, at Fort Lewis, Wash., roll out one of the Stryker Nuclear, Biological and Chemical Reconnaissance Vehicles during an Initial Operational Test. (US Army photo)

Seawolf-class fast-attack submarine USS Connecticut (SSN 22) departs Submarine Base New London. The submarine will not be returning to Groton as Connecticut is shifting homeports from Naval Submarine Base New London, to Naval Base Kitsap following her deployment. (U.S. Navy photo by Mr. John Narewski)

386.6375 Voice and data

Neighboring Towers/Sites
385.3125 (102) 386.4125 (106) 386.1000 (109) 386.6750 (110) 386.0750 (111)

Tower/Site 109 – Location unknown
386.1000 Primary control channel

Tower/Site 110 – Location unknown
386.6750 Primary control channel
386.8250 Alternate control channel

Neighboring Towers/Sites
385.8875 (108) 386.1000 (109) 386.1625 (112).

Tower/Site 111 – Location unknown
386.0750 Primary control channel
386.2250 Alternate control channel, voice and data
386.3750 Voice

Neighboring Towers/Sites
385.8875 (108) 386.1000 (109) 386.6750 (110) 386.1625 (112)

The location of this site is a mystery also. It is heard over a wide area, but I haven't found a facility that it really comes in strong yet.

Tower/Site 112 – Naval Station Everett
386.1625 Primary control channel
386.7625 Alternate control channel

Neighboring Towers/Sites
385.0625 (101) 386.1000 (109) 386.6750 (110) 386.0750 (111)

Tower 114 –Naval Air Station Whidbey Island
385.8875 Primary control channel
386.0750 Alternate control channel
386.1000 Alternate control channel
386.3750 Voice
386.5500 Voice
386.6375 Voice
386.6750 Alternate control channel
386.7000 Voice
388.0000 Voice
388.1500 Voice

The information above on tower site 114 has been posted at several locations on the Internet, but I have not confirmed the information through monitoring. This listing for Whidbey is suspect since they are some of the same control channel frequencies that are used at some neighboring sites. That tells me that someone may have assumed they were from the NAS Whidbey Island site, but they probably are not. Additional evidence to support this is that I do not show a tower/site 114 neighbor on any of the monitoring that I did in the area.

NAVY TALK GROUPS
23272 Navy Pacific NW Unknown usage (Encrypted)
23277 Navy Pacific NW Unknown usage
23292 NAS Whidbey Military Police
23301 Navy Pacific NW Unknown usage (Encrypted)
23321 NB Kitsap Fire Department Call Out
23322 NAS Whidbey Fire Dispatch
23327 Navy Pacific NW NAVCOM HAZMAT dispatch, also heard on 140.8250 MHz.
23333 Navy Pacific NW Unknown usage
23337 Navy Pacific NW NAS Whidbey Island Ground Ops – This talk group shows up on a lot of sites.
23338 Navy Pacific NW Unknown user Fire/EMS dispatch. Mentioned building number.
23495 Navy Pacific NW Unknown usage "North Beach, South Beach, going hot…"
23503 Navy Pacific NW Unknown usage
23705 Navy Pacific NW Unknown usage
23718 Navy Pacific NW Unknown usage Security check - called this talk group "Control 1"
23719 Navy Pacific NW Unknown usage
23792 Navy Pacific NW Unknown usage
23793 Navy Pacific NW Unknown usage (Clear and encrypted)
23794 Navy Pacific NW Unknown usage
23795 Navy Pacific NW Unknown usage
23803 Navy Pacific NW Unknown usage
23808 Navy Pacific NW Unknown usage
23810 Navy Pacific NW Unknown usage
23811 Navy Pacific NW Unknown usage
23822 Navy Pacific NW Unknown usage
24292 Navy Pacific NW Unknown usage

"B" System – US Army Pacific Northwest (Western and South-central Washington State)

Tower/Site 101 – Fort Lewis/Gray AAF (Primary site: northwest area of base)
380.0750 Primary control channel
380.1750 Voice and data
380.2750 Voice and data
380.3875 Alternate control channel
380.4250 Voice and data
380.5375 Voice and data
380.5750 Voice and data
380.8750 Voice and data
380.9875 Voice and data
381.0875 Voice and data
381.1750 Voice and data
381.2375 Voice and data
381.3125 Voice and data
381.4250 Voice and data
381.6250 Voice and data
381.8250 Voice and data
381.8500 Voice and data

Neighboring Towers/Sites 380.2125 (102) 380.9375 (103) 380.0750 (105) 380.4250 (106) 380.2750 (107) 380.7250 (108)

Tower/Site102 – Fort Lewis/Gray AAF secondary site (southwest area of the base)
380.2125 Primary control channel
380.5500 Alternate control channel
380.8375 Voice
381.0125 Voice
381.2875 Voice

Neighboring Towers/Sites 380.0750 (101) 380.9375 (103) 380.0750 (105) 380.4250 (106) 380.2750 (107) 380.7250 (108)

Tower/Site 103 – Fort Lewis tertiary site (northeast area of base)
380.7250 Primary control channel
380.9375 Alternate control channel
381.7375 Voice and data channel
381.9250 Voice and data channel

Neighboring Towers/Sites 380.0750 (101) 380.2125 (102)

Tower/Site 104 – Ahtanum Ridge (I-82 mile marker 20 at Yakima county line)
380.5500 Primary control channel

Tower/Site 105 – Location unknown (heard north of Yakima)
380.0750 Primary control channel
380.3875 Secondary control channel

Tower/Site 106 – Location unknown
380.1750 Control channel
380.4250 Control channel

Tower/Site 107 – Yakima Training Center
380.2750 Primary control channel
380.5375 Alternate control channel
380.9875 Voice

Neighboring Towers/Sites 380.2750 (101) 380.2125 (102) 380.9375 (103) 380.0750 (105) 380.1750 (106) 380.7250 (108)

Tower/Site 108 – Yakima Training Range: Rattlesnake Mountain
380.7250 Primary control channel
380.9375 Alternate control channel

Neighboring Towers/Sites 380.2750 (101) 380.2125 (102) 380.9375 (103) 380.0750 (105) 380.1750 (106) 380.2750 (107)

Army Talk Groups
8103 Army Pacific NW Unknown usage
8104 Army Pacific NW Unknown usage
8105 Army Pacific NW Unknown usage
8107 Army Pacific NW Unknown user/Base Security Police, license checks, traffic stops.
8108 Army Pacific NW Unknown usage
8115 Army Pacific NW Unknown usage
8121 Army Pacific NW Unknown usage
8205 Army Pacific NW Unknown usage
8211 Army Pacific NW Unknown usage
8212 Army Pacific NW Unknown usage
8224 Army Pacific NW Unknown usage
8302 Army Pacific NW Unknown usage
8309 Army Pacific NW Unknown usage
8310 Army Pacific NW Unknown usage
8315 Army Pacific NW Unknown usage
8320 Army Pacific NW Unknown usage
8329 Army Pacific NW Unknown usage
8332 Fort Lewis Range Control – repeats 40.200 and 165.0875 MHz
8520 Army Pacific NW Unknown usage
8525 Army Pacific NW Unknown usage
8549 Army Pacific NW Unknown usage
8553 Army Pacific NW Unknown usage
8556 Army Pacific NW Unknown user/Range/Exercise Ops
8584 Army Pacific NW Unknown usage
8612 Army Pacific NW Unknown usage
8613 Army Pacific NW Unknown usage"Tower 3 calling Tower 5…"
8635 Army Pacific NW Unknown usage "EAGLE 1"
8706 Army Pacific NW Unknown usage "Heard on Yakima Tower 108"
8717 Army Pacific NW Unknown usage "Heard on Yakima Tower 107"

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US Coast Guard's New VHF Channel Lineup

The US Coast Guard has always been an interesting part of the radio monitoring hobby. They have always been active on many different frequencies in many different parts of the radio spectrum, with units on the sea and in the air. After beginning their history as part of the US Navy, the Coast Guard later moved to the Department of Transportation in 1967, and on February 25, 2003, it became part of the Department of Homeland Security (DHS).

Much of the local Coast Guard radio traffic occurs on the VHF marine channels allocated exclusively to them. If you are anywhere near a large body of water, keep these channels in your scanner:

(All frequencies in Megahertz - MHz)	
USCG Marine 21A	157.050
USCG Marine 22A	157.100
USCG Marine 23A	157.150
USCG Marine 81A	157.075
USCG Marine 82A	157.125
USCG Marine 83A	157.175

Besides these marine band channels, there are a number of frequencies allocated to the Coast Guard in the VHF federal bands. Many federal listeners will recall seeing frequency lists for the Coast Guard referring to channels by "LANT" and "PAC" numbers. These "LANT" (short for Atlantic) and "PAC" (standing for Pacific) channels were the foundation of the Coast Guard's land-mobile communications networks for quite some time.

A list of some of the known LANT channels can be found here at the Fed Files blog: **http://mt-fedfiles.blogspot.com/2006/08/uscg-lant-pac-list.html**. An even more complete list of Coast Guard and marine frequencies can be found here at the n2nov.net web site: **www.n2nov.net/nycmarine.html**.

Photo courtesy of the US Coast Guard

The Coast Guard has recently begun to purchase new narrow-band radio equipment and update their channel plans for better interoperability with DHS and other federal agencies. The new radio equipment appears to have their communications channels available with both analog mode with AES encryption or digital P-25 mode. Also, listeners have reported that the Coast Guard has apparently given up on the old LANT channel plan and started referring to their non-marine band VHF channels by "CG" numbers.

I have been able to confirm the new USCG land mobile radio channel line up from multiple sources. Some of the old LANT frequencies continue to be used in the new channel lineup, but some have disappeared and new frequencies now appear to be in use. Here is the current VHF, non-marine band channel plan for the US Coast Guard:

USCG Land Mobile Channels

CG01	139.9750	CG15	164.3125
CG02	140.4750	CG16	164.5500
CG03	140.7250	CG17	164.5625
CG04	141.6125	CG18	164.9000
CG05	150.7250	CG19	164.9125
CG06	141.5500	CG20	165.2625
CG07	150.3000	CG21	165.3125
CG08	162.0500	CG22	165.3250
CG09	162.1250	CG23	165.3375
CG10	162.2500	CG24	166.1875
CG11	162.3250	CG25	167.9000
CG12	163.0500	CG26	168.8625
CG13	163.1375	CG27	171.2375
CG14	164.3000	CG28	172.3125

You will note that the first seven channels in this new plan are located in the spectrum under the control of the Department of Defense. These frequencies have been allocated to the Coast Guard in the latest DoD band-plan covering the 138-144 MHz and 148-150.750 MHz bands. I have not seen anyone reporting these channels in use, but I can confirm that they are in the Coast Guard radio equipment.

These frequencies all appear to be simplex, but some listeners have reported that repeaters have occasionally shown up in some locations, utilizing these same frequencies. If you find any repeaters operating on these Coast Guard channels, please let us know here at the *Fed Files*.

❖ Monitoring Super Sunday

A Report From Super Bowl XLII

For the second year in a row, my presence was required at Super Bowl XLII in Glendale, Arizona, to help televise the event for the entire world to see. I spent a little over two weeks in the area helping get the international television coverage going. I did bring a few radios along to keep an ear on the preparations by federal and local agencies for this major security operation. Unfortunately, I had a lot more to do this year, so my monitoring time was limited. I relied on computer logging and some fellow listeners in the Phoenix and Glendale areas for help.

One striking difference from the last Super Bowl in Miami is that most transmissions were using encryption. While much of the APCO P-25 digital radio traffic at the Miami stadium was not encrypted, i.e., "in the clear," almost 90% of what we heard on federal channels that was related to the Super Bowl was encrypted this time. Communications security was obviously a high priority at this year's event.

One frequency band that was quite busy with Super Bowl related communications was the VHF & UHF air bands. On a big event like this, it's always good to keep an ear on aircraft communications. Here are a few of the busiest frequencies heard (AM mode):

118.0000	KGEU (Glendale) Ground
119.1000	KLUF (Luke AFB) Tower
120.1000	KGYR (Goodyear) Tower
121.0000	KGEU (Glendale) Tower
121.5000	VHF Guard Channel, busy when the Air National Guard CAP (Combat Air Patrol) flight over the stadium had to divert an aircraft that violated the restricted airspace
123.0250	Phoenix Area helicopter common
123.4000	Air-to-air common
123.4500	Air-to-air common
123.5500	Phoenix Police helicopters
136.3750	DHS Customs and Border Protection Air Marine Division, called the "Company" channel - This seems to be a very common VHF air frequency for CBP in the southwest US
136.7500	DHS CBP AMD operations - This was used for helicopters providing airborne video support of motorcades
237.8000	Blue Angels air to air communications
271.0000	Arizona Air National Guard Combat Air Patrol (CAP) flight over stadium at game time
275.8000	Blue Angels formation communications
282.6000	Primary UHF for the CBP UH-60 helicopters and BIGFOOT, the Northwest Air Defense Sector of NORAD.

284.2500		Blue Angels air-to-ground communications
311.000		Air National Guard CAP aerial refueling

As with last year's game, the VHF federal band was the primary area of activity related to the stadium and the game events. Here is a list of what was heard and logged over the two weeks I was monitoring:

162.6125	P-25	FBI Joint Terrorism Task Force (JTTF), Phoenix area
162.7625	FBI JTTF Phoenix	
163.0250		
163.0625		
163.1875		
163.2250	P-25	CBP NET 30, Customs Sky Harbor Airport Operations
163.3375		
163.3500		
163.4625	P-25	Encrypted, possibly Super Bowl related
163.6375		
163.6500	103.5	CBP Border Patrol South Mountain repeater
163.6500	100.0	CBP Border Patrol
163.7000	P-25	CBP Border Patrol Phoenix
164.3000	Analog, clear mode - unknown agency, possible DHS assignment	
164.4875		
164.5375	P-25	FBI, also logged at Miami Super Bowl
164.5500	FBI Stadium command interior	
165.2375	100.0	CBP NET 1
165.2875	BATF NET 1	
165.3750	P-25	USSS CHARLIE used for unrelated visits to Phoenix by political candidates.
165.6000	110.9	BLM Law Enforcement, White Tank repeater
165.9125	ATF TAC 5	
166.0250		
166.4375	100.0	CBP NET 1 repeater input
166.4875	100.0	CBP NET 5 repeater input
166.5875	100.0	CBP NET 3 repeater input
166.7000	P-25	White House Communications Agency (WHCA) frequency allocation, unsure if related to visits to Phoenix by political candidates. The Department of Justice and the FBI also use this frequency.
166.9250	Bureau of Land Management - White Tank repeater	
167.0250	Unknown agency in analog mode. This is also a WHCA assignment but can be assigned to other agencies, such as the Department of the Interior.	
167.0500	P-25	FCC repeater, heard prior to Super Bowl
167.2125	P-25	FBI Phoenix Metro
167.2625	P-25	FBI Super Bowl Unified Command simulcast with 167.5625 & 171.5750
167.3125	P-25	FBI Phoenix Metro
167.3375	P-25	FBI Phoenix Metro
167.3625	P-25	FBI Phoenix Metro
167.5125	P-25	FBI Super Bowl Unified Command simulcast with 167.2625 & 171.5750
167.5375	167.9	FBI Phoenix Metro
167.5375	P-25	FBI Stadium Exterior operations
167.5625	167.9	FBI common - Super Bowl VIP details
167.6125	P-25	FBI Phoenix Metro
167.6375	P-25	FBI Phoenix Metro
167.6875	P-25	FBI Super Bowl

Photo courtesy of the US Customs web site

167.7625	P-25	FBI Phoenix Metro repeater
168.0250		Radio technicians heard prior to Super Bowl
168.3125	P-25	Unknown agency, new narrow band assignment
168.3500	P-25	Wide area federal common
168.5000	P-25	Unknown agency, possible DHS assignment
168.5250	P-25	Unknown agency
168.5750	P-25	Unknown agency
168.8250	P-25	CBP Screening operations, linked with 170.3500
168.9750	P-25	CBP Border Patrol
169.1250	P-25	FBI Phoenix East repeater
169.1625		
169.4500	DHS NET 2 - Main CBP aviation operations	
170.0250		
170.3500	P-25	CBP Screening operations & VACIS inspections
171.0750	CBP input to 169.4500 NET 2	
171.5750	P-25	FBI Super Bowl operations, linked with 167.5125
171.7500	P-25	Unknown agency, possible Interior Dept. assignment
172.0625		
172.6250		Analog, clear mode – unknown agency
172.9000	P-25	TSA – VIPR Teams at area airports
173.0750		
173.6375	P-25	Unknown agency
173.6625	141.3	Analog, clear mode – unknown agency
173.6625	103.5	Analog, clear mode – unknown agency
173.6875	P-25	FBI JTTF
173.7125	P-25	FBI JTTF
173.9375	P-25	Super Bowl XLII - heard linked with 168.8250 & 170.3500

The UHF federal band also had some surprises in store:

408.4000		
409.3375	CSQ	Arizona National Guard WMD Civil Support Team working on taking air samples prior to and during the game. There were also what appeared to be air quality monitors set up all around the stadium area.
412.8250		
412.9625		
413.3375	CSQ	Input to repeater on 409.3375
418.0500		Federal common
418.0750		Federal common
418.3375		Wide area federal common

Many non-federal public safety frequencies were busy as well. 866.0125 MHz, 156.7 PL (NPSPAC Nationwide Calling channel) was busy with traffic from various agencies about motorcades and security operations. I received reports that the Arizona Department of Emergency and Military Affairs had their mobile communications unit setting up patches between agencies on this repeater.

That's all for this installment of the *Fed Files*. Next time we'll talk more about new federal agency interoperability channels and more!

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Aviation Weather for Aircraft Listeners

All of us pay attention to the weather because it affects our daily driving, work, and recreational activities. Most people think in terms of temperature, humidity, fog, precipitation, lightning, wind, mud puddles, getting the dog inside, and what to wear.

Pilots, often with many lives entrusted to them and held to a high standard, must be aware of weather conditions in three dimensions: not only where they are at any given moment, but along their routes at various altitudes and at their destination airports.

Let's take a look, not at aviation weather per se, but at some of the things that you will hear that refer to weather as you listen.

VFR and IFR

Visual Flight Rules (VFR) flights are restricted to weather that allows the pilot to visually see where he or she is, the ground, landmarks, mountains, and other aircraft. When conditions fall below certain minimums, a pilot cannot legally fly without having extra training and being certified for Instrument Flight Rules (IFR) flying.

The aircraft for such flights must also have the necessary avionics equipment that allows the pilot to fly looking primarily at dashboard instruments rather than out the window. Airliners file IFR flight plans as a matter of course and the pilots stand ready to fly by instruments as needed.

ATIS / ASOS / AWOS

Certain types of ground stations continuously transmit weather and visibility information. You will find them mostly, but not always, in the lower half of the VHF (118-137 MHz) aircraft band. ATIS, AWOS, and ASOS frequencies may be found at **www.airnav.com/airport** for the airports that have these services.

• ATIS (Automatic Terminal Information Service) transmissions are prerecorded and periodically updated. The messages include important airport information, in addition to weather and visibility.

The following is an example of the weather component of an ATIS broadcast. It was copied from Sacramento International ATIS on 126.75:

"WIND TWO ONE ZERO AT ONE ZERO, VISIBILITY ONE ZERO, LIGHT RAIN, CEILING THREE THOUSAND FOUR HUNDRED BROKEN, FOUR THOUSAND FOUR HUNDRED OVERCAST, TEMPERATURE EIGHT, DEW POINT FOUR, ALTIMETER TWO NINER NINER FIVE."

Shown here is the daytime "reverse" / easterly traffic direction at LAX. Image courtesy of AirportMonitor - by Megadata - powered by PASSUR

Explanatory comments: No, Sacramento doesn't get down to 8 degrees Fahrenheit. The temperatures are given in Celsius.

With aviation communications, "nine" is often pronounced as "niner" to help distinguish it from other numbers.

Some military air bases use the UHF aircraft band (225-400 MHz) for ATIS broadcasts.

"Altimeter" means the barometric pressure reading that pilots use to calibrate their altimeters to the current local conditions when flying below 18,000 feet MSL (Mean Sea Level). Barometric pressure varies over hours and days and during the course of a flight. Pilots need to acquire the current reading and input that into the altimeter. When above 18,000 feet / above FL180 (Flight Level One Eight Zero), a set altimeter adjustment of 29.92 is used – until descent below that altitude.

• ASOS (Automated Surface Observing System) and AWOS (Automated Weather Observing System) stations are automated, not prerecorded, but have messages similar to the ATIS quote above. For the most part, only the larger airports have ATIS, but even small, non-towered airports can have ASOS or AWOS stations.

A great ASOS/AWOS site to explore is **www.faa.gov/airports_airtraffic/weather/asos**. It is searchable by state and includes frequencies and links to many on-line stations.

Flight Delay Information

Adverse weather conditions at departure and arrival airports can cause flight delays or even airport closures that require the use of alternate airports. An airport's real-time status may be found at the FAA Flight Delay Information - Air Traffic Control System Command Center **www.fly.faa.gov/flyfaa/usmap.jsp** . The dots on the map represent airports, and the colors can be decoded using the legend below the map. Rest your cursor on a dot to get a brief airport status message. For a more complete status message, click on the dot.

Here is an example of such a status message for San Francisco International:

"Due to WEATHER / LOW CIGS, there is a Traffic Management Program in effect for traffic arriving San Francisco International Airport, San Francisco, CA (SFO). This is causing some arriving flights to be delayed an average of 2 hours and 4 minutes."

"Low CIGS" means "low ceilings" or low cloud base-to-ground distance. For other terms, see *Air Traffic Management Glossary of Terms* at **www.fly.faa.gov/FAQ/Acronyms/acronyms.jsp**

EFAS "Flight Watch"

En Route Flight Advisory Service (EFAS) – The FAA says: "The purpose of EFAS, radio call 'FLIGHT WATCH,' is to provide en route aircraft with timely and pertinent weather data tailored to a specific altitude and route using the most current available sources of aviation meteorological information." FLIGHT WATCH is a weather-only service of Flight Service Stations (FSSs).

Across the country below 17,500 feet MSL,

High Altitude "Flight Watch" Frequencies for each ARTCC

Albuquerque (ZAB)	127.625	Kansas City (ZKC)	123.625
Atlanta (ZTL)	135.475	Los Angeles (ZLA)	135.9
Boston (ZBW)	133.925	Memphis (ZME)	133.675
Chicago (ZAU)	134.875	Miami (ZMA)	132.725
Cleveland (ZOB)	135.425	Minneapolis (ZMP)	135.675
Denver (ZDV)	124.675	New York (ZNY)	134.725
Fort Worth (ZFW)	133.775	Oakland (ZOA)	135.7
Houston (ZHU)	126.625	Salt Lake (ZLC)	133.025
Indianapolis (ZID)	134.825	Seattle (ZSE)	135.925
Jacksonville (ZJX)	134.175	Washington (ZDC)	134.525

the Flight Watch frequency is 122.0. Above 18,000 feet, each Air Route Traffic Control Center (ARTCC) has an EFAS frequency for weather information. The high altitude Flight Watch radio call uses the same name as the ARTCC, such as "Oakland Flight Watch," used by a pilot within the boundaries of Oakland ARTCC. To see an ARTCC map, go to: **http://web.nbaa.org/public/ops/airspace/notices/**

❖ PIREPS

Pilot Weather Reports (PIREPS) – Pilots in-flight who encounter unforecast, significant, or hazardous weather conditions that may have otherwise not been detected and reported may pass on their current observations to FSS Specialists on the Flight Watch / EFAS frequencies or on other FSS frequencies, or to Controllers on normal Air Traffic Control (ATC) frequencies. In turn, the information is offered to other pilots by Controllers and FSS Specialists in response to requests or by way of announcements or broadcasts.

Pilots are encouraged to report their location with reference to the closest VOR navigational station on their first call.

❖ PMSV METRO

Pilot to Metro Service (PMSV) – This is strictly a weather service at selected military airfields for military pilots. A Full Service facility will have Forecasters, and a Limited Service facility will have Observers. An Observer can only pass on radar and surface observations, terminal forecasts, and weather advisories. Forecasters and Observers are also able to accept PIREPS.

The frequency listing for Andrews AFB, as an example, is at **www.airnav.com/airport/KADW** and it lists "PMSV METRO: 344.6" The radio call that the pilot would use, in this case, would be "Andrews METRO."

❖ HIWAS

Hazardous Inflight Weather Advisory Service (HIWAS) broadcasts are continuous, prerecorded, repeating, and are periodically updated. The broadcasts are in voice from selected VOR (VHF Omnidirectional-Range) navigational stations throughout the U.S. for airborne pilots along their routes.

The broadcasts can include Airmen's Meteorological Information (AIRMETS), Significant Meteorological Information (SIGMETS – more severe than AIRMETS), Convective SIGMETS (tornadoes, thunderstorms, etc.), Urgent PIREPS, Center Weather Advisories (CWAs), Radar Reports, and severe weather forecast alerts.

In areas where there are HIWAS broadcasts, Controllers may refer pilots to the appropriate HIWAS VOR frequency. Outside of HIWAS areas, Controllers may direct pilots to Flight Watch or another FSS frequency.

VORs are in the 108.0 to 117.95 MHz range. There are a few ways to find VOR stations that transmit HIWAS. One easy way is to search or tune this range and listen for weather broadcasts.

Some VORs identify in Morse Code and/or voice. Even with no ID, go to **www.airnav.com/navaids** and enter the VOR frequency you have found. It will list all U.S. VORs on that frequency. This includes VORTAC (VOR plus TACAN) and VOR/DME (VOR plus Distance Measuring Equipment) stations. At AirNav, a VOR with HIWAS will say HIWAS BROADCAST under Remarks.

Aeronautical charts show VORs. Included is the Oakland VORTAC graphic from the *IFR Low Altitude L-2* chart: The frequency is 116.8 MHz. The H in the upper right corner indicates HIWAS capability. OAK is the VORTAC station ID.

For brief descriptions of the above terms, see *Pilot/Controller Glossary (P/CG)* at: **www.faa.gov/airports_airtraffic/air_traffic/publications** listed just below "Publications." Also see **http://fergworld.com/cfi/pdf/FAA_Weather_Services_Quick_Reference.pdf**

❖ Active Runway

Aircraft take off and land more efficiently into the wind, rather than with the wind. So, wind direction can determine the direction of take offs and landings for a given runway.

Let's say that you live by a less busy airport with one strip of pavement for a runway and that it is in, or very nearly in, an East-West direction based on magnetic North, which is what pilots use. When landing or taking off toward the East, the plane will be pointed at 90 degrees clockwise from North. When using the runway in the other direction, the plane will be pointed 270 degrees clockwise from North.

The degree numbers are used to create runway numbers by rounding them off to the nearest ten degrees and dropping the final zero. Thus, this airport has one strip of pavement, but it has two runways – RUNWAY NINE and RUNWAY TWO SEVEN. With a reversal in wind direction, you will likely hear a change in the "active runway" mentioned by the Tower and/or Approach Controller and via the airport ATIS broadcast, if one exists.

Some large, high-traffic airports may not as readily switch runway directions with a reversal in wind direction, since it can complicate controller workload, traffic patterns, and possibly have an adverse effect on noise abatement programs, but it does happen.

Los Angeles International (LAX) has two sets of parallel runways. At **www.airnav.com/airport/KLAX** you can see the small airport diagram or download the full version. Landing and departing traffic is normally toward the ocean from 6:30a.m. to midnight for noise abatement. That is, during these hours they normally use RNY 24 Left & Right and RNY 25 Left & Right. Sometimes, due to winds, there have been times during the day when they continued to use RNY 06 L&R and RNY 07 L&R. See the image in this article from **www4.passur.com/lax.html** that shows the "reverse" daytime landing traffic flow. Be sure to visit this site if you haven't seen it before.

San Diego International Airport (SAN) **www.airnav.com/airport/KSAN** has a single East-West runway. At the above AirNav link, on the right under Airport diagram, is a link to download a PDF file. Go there for a closer look.

Listener Greg Blanchard reports that "SAN uses Runway 27 as much as possible. But, this runway has a Localizer Approach only, so if the weather gets down to minimums, they have to switch over to Runway 9 which is equipped with an ILS. They also switch over if we're encountering Santa Ana winds.

"The airport has a big problem when utilizing Runway 9 for departures due to the rising terrain at that end of the runway. A lot of airliners have weight restriction limits if they have to depart that direction. I have been there when they were using Runway 9 for arrivals, and Runway 27 for departures. Talk about a ballet! Approach lines up about five or six arrivals and gets them in, and then the Tower fires off five or six departing flights on 27!"

❖ Live Reports

As you listen, you will hear Air Traffic Controllers vectoring aircraft around weather. You will hear pilot requests for higher or lower altitudes to avoid weather or air turbulence.

Some weather and conditions enquiries from pilots can be a simple as this: "Oakland Center, Southwest Thirteen Ninety-Five, any ride reports for the descent?" Southwest 1395 was arriving from Salt Lake City International (SLC) and was still at altitude and with Metropolitan Oakland International (OAK) as the destination airport.

Oakland Center responded, "Southwest Thirteen Ninety-Five, there have been reports below FL290 occasional chop." The Southwest Airlines flight information was obtained from **http://flightaware.com/live/flight/SWA1395** which shows flight progress when airborne, otherwise the last completed flight.

A controller trying to stay on top of things might ask an airliner in a specific area something like, "Alaska Three Thirty Three, how is your ride now?" In response to Oakland Center on 134.975: "Alaska Three Thirty Three, twenty miles south of Red Bluff, we were climbing up and it definitely got better out of FL350, getting right into the teeth of the jet stream, getting through 320 was continuous moderate and not fun, 340 was a little better, but 360 here is pretty good."

❖ More

If you are interested in aviation weather beyond what you hear reference to on your scanner, see **www.faa.gov/library/manuals/aviation/pilot_handbook** and download "Chapters 10-12 (PDF)" – 4 MB, 60 pages, nice graphics.

Have fun. See you next time.

Kevin Carey, WB2QMY
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Asian Loggings, Q&A

Welcome to the May edition of *Below 500 kHz*! Remember, as we enter the warmer months (which sometimes see a slowdown in longwave activity), we are still interested in hearing from *you*. What are you hearing? What projects are you working on? What aspects of longwave interest you the most?

If you live in the Northeast, consider attending the Rochester (NY) Hamfest on Friday, May 30th and Saturday, May 31st. This hamfest, sponsored by the Rochester Amateur Radio Association, is one of the largest such events in the U.S.

Rochester has always been known for its excellent selection of vintage, classic and longwave gear.. Online auctions are not always the best place to buy your gear… Ever try to ship a National RBL-Series receiver or a DX-100 Transmitter? For more information, visit **http://rochesterhamfest.org/**.

❖ PA Police on Longwave?

My father has often shared with me how *his* dad used to listen to police calls just above the AM radio band in Rochester, NY during the 1930s and '40s. Apparently, this frequency range was quite common for early police radio systems, and even my solid state DX-150 receiver (late 1960s vintage) referred to this service on the tuning dial. What I didn't know is that at least one early police system made use of longwave: 190 kHz to be exact. I received the following note from veteran contributor Perry Crabill, W3HQX (VA). Can any readers offer further insight into this system?

Perry says: "Sometime back in the 1930s I used to see a station listed as WBR, Butler, Pennsylvania, on 190 kilocycles (before kilohertz). It was classed as a police station, but with the limited longwave listening capability I had in those days I never tried to tune it in. I recently researched this frequency in Tom Kneitel's very valuable reference, *Radio Station Treasury 1900-1946,* and discovered that there were also other Pennsylvania police stations on 190 kc, such as WBA, Harrisburg; WDX, Wyoming; WJL, Greensburg; and WMB, West Reading. Presumably this was a point-to-point CW network. The time frame for operating on 190 kc isn't clear, but it appears to have been perhaps 1936 or 1937.

"Further research showed WBA, WBR, WDX, and WJL in a network operating on 257 kc in 1931 and 1932 instead of 190 kc. I suppose that the subsequent shift to 190 kc was to move this operation out of the 200-400 kc band used for the four-course radio range stations coming into use for aerial navigation in those days.

"I Googled the phrase 'Pennsylvania police radio' and uncovered the following item: 'The State Highway Patrol was created in 1923 within the Department of Highways to enforce the vehicle laws of Pennsylvania's burgeoning highway system. The same year saw the State Police install the nation's first state-wide police radio telegraph system. The system remained operational until 1947.' I wonder if you or any of your contacts might have any historical information about these stations? It's quite possible that some of the operators are still around, and conceivably could be amateur radio operators."

So how about it, readers? If you have further information, please drop me a line at the address in the masthead, and I'll pass it along to Perry.

❖ Asian Intercepts

In what may be a first for this column, we have loggings made from a listener in Vietnam. Jim Andrew, who works in Ho Chi Minh City with a major petroleum firm, sent along the following note and loggings:

"Kevin, here are some recent logs from Ho Chi Minh City, Vietnam – a great place to live and to DX, by the way. I use Alex Wiecek's WWSU 6.3 NDB search and logging utility program and credit it as a significant factor in my success here. Equipment used is as follows: Coastal Navigator DF radio, Kenwood TS-940 SAT, and a Palomar Engineers VLF Loop antenna."

Table 1. VIETNAM BEACON LOGGINGS

ID	kHz	Location
XVL	235	Vung Tau, Vietnam
XK	258	Unidentified
CP	279	Chumphon, Thailand
PK	282	Pleiku, Vietnam
OY	300	Bandung, Thailand
BR	303	Buri Ram, Thailand
SM	316	Samui, Thailand
BR	318	Brunei
AC	320	An Loc, Vietnam
SG	326	Ho Chi Minh City, Vietnam
LY	326	Loei, Thailand
HY	328	Hat Yai, Thailand
NZ	330	Banda Aceh, Indonesia
HKG	338	Hong Kong, China
GN	343	Ho Chi Minh City, Vietnam
OC	350	Semarang, Indonesia
TD	358	Ho Chi Minh City, Vietnam
PU	360	Phuket, Thailand
SN	365	Sakon Nakhon, Thailand
SW	366	Unidentified
BM	370	Batam Island, Indonesia
UB	373	Ubon, Thailand
GV	375	Ho Chi Minh City, Vietnam
OJ	375	Hasanuddin, Indonesia
ON	375	Medan, Indonesia
PNP	376	Phnom Penh, Cambodia
NP	383	Nakhan Phanom, Thailand
TRT	384	Trat, Thailand
TI	385	Tanjung Penang, Indonesia
BU	386	Buon Ma Thuot, Vietnam
OU	390	Banuarmasin, Indonesia
KN	393	Khon Kaen, Thailand
KR	399	Nakhon Rathasima, Thailand
P	408	Unidentified
UP	414	U-Taphao, Thailand
CR	414	Cam Ranh, Vietnam
TR	423	Unidentified
WL	426	Baolong, China
PB	440	Phu Bai (Hue), Vietnam
X	450	Unidentified
RP3	454	Unidentified

Jim also notes that he'd like to see a construction article for a longwave loop antenna in this column. In the September '92 issue we covered such a project, but perhaps it's time to revisit the topic and update readers on the designs that are available. This might make a good fall topic, in preparation for the winter DXing season.

Al Bauernschmidt, N3KPJ (PA) wrote with the following question: "I am new to chasing beacons and am having a ball so far. I have logged many Canadian beacons as well as a few from out in the mid-west. It occurred to me that it would be a real hoot if there was some sort of calculator available, online or elsewhere, that could be used to get an idea of what the distance is from my station to the beacon location. Is there such a calculator and what must I do to use it?"

Thanks for the kind words, Al. Yes, there are several online resources available to calculate the distance between your location and the beacons you hear. This is a good way of keeping track of your personal distance records and getting a better understanding of the signal path between you and the beacon stations. Three of my favorite sites are as follows:
www.indo.com/distance/index.html
www.mapcrow.info/
www.infoplease.com/atlas/calculate-distance.html

Want even more information about a beacon's location? How about a bird's eye view from satellite or aerial imagery? Using the resources below, you may be able to see the actual transmitter building, or at least a close-up of the town where the beacon is located:
http://maps.live.com/

George Zeller
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Massive Pirate Radio Bust

Ofcom, the Office of Communications in the United Kingdom, announced a massive crackdown on FM pirate radio stations in the UK. During mid-February Ofcom seized 22 illegal transmitters in metropolitan London during a joint operation with the London Boroughs of Hackney, Haringey, Tower Hamlets, and Islington. Ofcom seized the transmitters and sent threatening letters to London night clubs who had been advertising on the pirates. In cooperation with the London Metropolitan Police, Ofcom said that three individuals were arrested in this sweep, but no names of those arrested were released. We thank *MT* reader Dale Svetanoff for this tip.

Ofcom's Director of Field Operations Robert Thelen-Bartholomew said, "Illegal broadcasters can cause serious interference to safety-of-life services such as the fire brigade and air traffic control, as well as legitimate radio stations. Ofcom takes swift and firm action to remove these illegal stations from the air."

Despite this action, Ofcom officially estimates that over 150 unlicensed pirates remain on the air in the United Kingdom. The *Guardian* newspaper in London reported that nearly one in six adults in metro London are regular listeners to pirate FM broadcasts.

All of the busted stations had operated on the FM band in London. Among the 22 shuttered stations were **Attitude** 107.4 from Hackney, **Rude** 88.2 in Islington, and **Millenium Supreme** 99.8 in Tower Hamlets.

❖ Odd South Pacific Signal

Last month we discussed a very odd signal that Neil Schwanitz, WD8CRT, has been hearing from the Marshall Islands in the South Pacific. That 7953 kHz signal around 0850-0902 UTC on various days of the week is still intriguing. It consists of a repeated series of voice fragments in a typical South Pacific or South Asian sing-song style, with some similarities to a few "spy" numbers stations that we have heard in the past. We are still attempting to identify or classify this unusual signal. Has anybody been hearing it from North America?

❖ Voice of Mojahed

Our regular reporter Joe Wood in TN reports an unidentified Middle East clandestine logging on 4640 kHz from 0340-0700 UTC. This almost certainly is the anti-Iran **Voice of Mojahed**. It's a frequency worth checking out. Per *Clandestine Radio Watch*, their normal ID is "Seda-ye Mojahed, seda-ye Mojahedine Khalq Iran." Their web site at **www.mojahedin.org** may be of interest when it is working, and they allegedly use *radio@mojahedin.org* as an e-mail address.

❖ Omaha FM Pirate

One of our readers writes in to report that a new pirate has been operating on 99.1 MHz from the Benson neighborhood of Omaha, NE. Using **KIND** call letters, the station has a marijuana advocacy format. This format has long been in use by shortwave pirates such as **KNBS** and **Radio Free Euphoria**. But, it is a novelty to see this format on the FM airwaves of Nebraska. The operator claims to be using low power in conformity with FCC part 15 rules, so there is some question about whether this station is an illegal operation. All of us have heard legal low power stations operating in front of restaurants and houses that are for sale, so it is possible that this pirate is fully legal. Has anybody been hearing this one?

❖ International Radio Report

Many *MT* readers know Janice and Steve Karlock, who have been active in the radio monitoring hobby for a very long time. They produce a show called the International Radio Report, which airs on **CKUT** on 90.3 MHz FM in Montreal, Quebec. You can download their programs via their web site at **http://mediajct.homeip.net/radioreport/**. Some North American pirate has also been airing this entertaining program on 6925 kHz at erratic intervals.

❖ Family Radio Relay?

Veteran shortwave personality Adrian Peterson of **Adventist World Radio** forwards an unusual rumor about alleged pirate relays. The February 2008 issue of *Family Radio News* contained reports from a listener in Norway who has been hearing **Family Radio** programming via a relay from a mysterious **WTTZ** on 6350 kHz. Has anybody else been hearing this signal? It is unclear if a pirate is actually relaying Family Radio's religious programming or if some listener in Norway has misinterpeted an internally generated image from his own receiver. The frequency is worth checking on days of good reception from Europe.

❖ On the Shortwaves

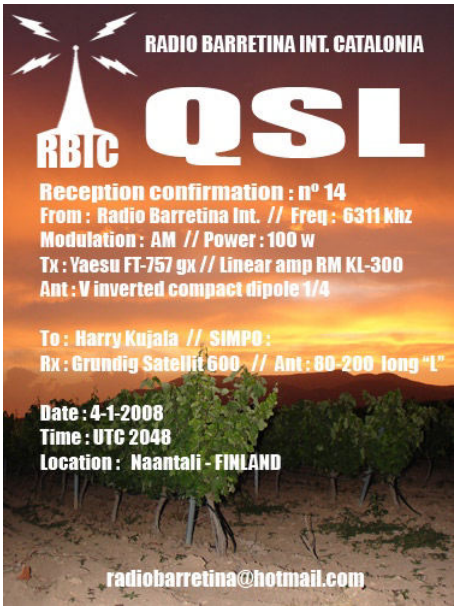
If you're looking for history material about shortwave radio, you should check out Jerry Berg's outstanding web site called "On the Shortwaves." It's chock full of excellent material about the history of shortwave radio. It's mostly about the evolution of broadcasting and DXing, but there is some pirate material there. The URL for this one is **www.ontheshortwaves.com/**

❖ What We Are Hearing

Monitoring Times readers heard two dozen different pirate radio stations this month. You can hear them, too. Pirate radio stations never use regularly announced schedules, but shortwave pirate broadcasting increases noticeably on weekends and major holidays.Just tune your dial up and down 30 or 40 kHz above and below 6925 kHz.

Due to space limitations this month, we print a truncated list, minus program descriptions. Go to **www.monitoringtimes.com/html/outer_limits.html** for the unabridged list.

Captain Morgan- (send loggings to www.frn.net)
CKUT Relay- (None)
Conelrad Radio- (None)
East Coast Radio- (eastcoastradio@hotmail.com)
James Bond Radio- (None)
Long Range Radio- (None)
MAC Shortwave- Also check 3275, 6850, and 6950 kHz. (macshortwave@yahoo.com)
Maple Leaf Radio- (radio.mapleleaf@gmail.com)
Mash Up Radio- (None announced)
Puxatony Potthead Radio- (Belfast)
Radio Barretina- (radiobarretina@hotmail.com)
Radio Cochiguaz- www.dxzone.com/cgi-bin/dir/



This rare pirate from Catalonia in Spain was heard repeatedly during winter weekends on 6311.1 kHz both before and after 0000 UTC with a relay of rock music programming from Radio Arboc in France.

Continued on page 61

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A D-STAR IS BORN

As you know, if you have followed this column for any length of time, I tend to play radio using a Morse Code key. It was good enough for Marconi: It's good enough for me!

That said, in spite of my personal radio preferences, amateur radio communications technology has managed to move ahead quite some distance since the days of Marconi, Fessenden, and Armstrong. Something that always piques my interest is any new radio technology that combines, more or less, traditional radio with computer/digital systems. I first experimented along this line of inquiry when I played with RTTY using a board plugged into a Commodore 64 home computer. I went on to get very involved in the early experiments with packet radio and PSK32. I even played with APRS beaconing.

While all of these digital systems are a joy for someone who likes tinkering and tweaking, few good efforts have come along to create good integrated systems. By that, I mean digital technology that can be bought "off the shelf" by the end user ham and operated without any more fuss than a common handheld 2 meter rig.

Recently, a combined effort on the part of Icom America and Grove Enterprises/*Monitoring Times* put me in the position to experience one of the newest paths to commonplace digital ham communications: D-STAR.

D-STAR stands for Digital Smart Technologies for Amateur Radio. As the name suggests, it is a digital communications protocol, so far implemented primarily by ICOM in the United States. Kenwood has made a D-STAR transceiver for sale in the Japanese market, but has yet to bring the design to this side of the Pacific Ocean.

❖ What does it do?

Speaking of Japan, the D-STAR protocol was initially developed by the Japanese Government in cooperation with the Japan Amateur Radio League (JARL). D-STAR allows for 4.8 kbps digital voice and 128 kbps data communication over the popular VHF/UHF ham bands.

Digital voice is utilized on the 2 meter, 450 MHz and 1.2 GHz ham bands and high speed data can be sent over the 1.2 GHz ham band. What makes D-STAR stand out from the rest of the digital ham modes is its ability to send high volumes of data very rapidly. This makes it a choice worth considering for amateur radio emergency service operations.

While the high speed digital data stream is a powerful tool – allowing for near real time pictures and information related to an ongoing event – the digital voice (DV) protocol also allows for short 20 character messages, easily sent and received on handheld transceivers in field operations. No need to lug a laptop PC with you during a search and rescue hike.

In addition to providing digital communications over the air, D-STAR also establishes a network protocol allowing long distance connectivity by way of Internet "Gateways" or other network systems.

D-STAR complies with the TCP/IP protocols common on the Internet. This allows for the development of Web-based applications directly for the radio environment.

A D-STAR repeater system can also be linked by way of 10 GHz microwave relays. Microwave links and Internet Gateways can be combined to widen the scope of any D-Star system.

D-STAR enhanced transceivers can communicate directly in both voice and data modes if necessary. Also, some D-STAR transceivers can be interfaced with a PC for remote control operation.

D-STAR makes use of a digital squelch system that can work with programmed callsigns or numeric codes. This can go along way to keeping things civil when a lot of folks are on the frequency. There is also an Enhanced Monitor Request (EMR) mode that overrides the squelch settings, allowing priority traffic to be heard on all radios. This is a very important tool for emergency net control operation.

D-STAR protocols allow for exchange of location information with radios capable of interfacing with GPS receivers. D-STAR's protocol does cooperate with the APRS protocol quite nicely.

❖ The D-STAR connection

The current crop of radios available to hams allow for use of the D-STAR protocols *and* standard analog FM transmission. No need to carry two radios to operate on both D-STAR and traditional repeater systems.

The size and scope of a D-STAR system is limited only by the imagination, ingenuity and tenacity of the hams pulling the system together. (More on this later.) 2 meter, 450 MHz and 1.2 GHz ham band D-STAR repeaters can be operated crossband, allowing for greater interoperability among hams in a given region.

As an "end user," all a ham needs is a D-STAR compliant rig. Voice operations will be similar to that on a traditional repeater. Hit the key and talk. Short text messages carried over the digital voice signal could be tapped into the handheld's keyboard in the same manner as folks who text message using their cell phones. High speed data transmission would require the addition of a PC – again, not all that different from a traditional packet radio setup, only with more enhanced features.

Drew KC2JPP installing 1.2 GHz Voice/Slow Speed Data Module

With a $400 street price for the Icom IC-91 A/D dualband digital voice handheld, D-STAR compliant radios have come into the price range of similar full featured amateur transceivers. Currently there are nearly 150 active D-STAR repeater operations throughout the United States and more are planned.

The D-STAR protocol lends itself to experimentation and development (as any good Ham system should!). Supporting applications are being developed all the time. One of many to gain popularity is d*Chat, developed by Brian Roode, NJ6N. d*Chat is a Microsoft Windows based keyboard communication application that uses the D-STAR digital voice (DV) data capability. d*Chat allows text-based communication between multiple stations on a simplex frequency or through a D-STAR repeater system.

The Internet provides several Web sites for D-STAR experimenters to share ideas and develop their systems. **www.dstarusers.org/** is the place to go for recent news and information about current D-STAR activity. (NOTE: "www.dstar.org/" takes you to a corporate entity not related to amateur radio activity.) Of course, Icom provides forums for D-STAR users at: **www.icomamerica.com/en/support/forums/tt.asp?forumid=2**

Many individual D-STAR Clubs and User Groups have their own Web Sites. It is a fast growing community.

❖ A gift from ICOM/Grove/MT

Any new protocol takes time to get established. There are many issues involved. For example, how do you manage frequency coordi-

nation of new services in relationship to existing services? (The Southeastern Repeater Association **www.sera.org/** has been looking into this, as have other coordinating bodies.) The growth of digital communications in the ham, commercial and public service worlds have made for a lot of competing ways to do business.

And then, of course, there is the expense of bringing a system online for area hams to use. Setting up a D-STAR system is quite an undertaking under the best of conditions. But ICOM has made a commitment to putting this technology in the hands of ham radio operators and have backed that commitment with incentive programs to dealers. I found myself involved in this process when I introduced Grove Enterprises to the Jersey Cape D-STAR Users Group (JCDUG).

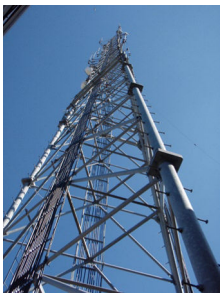
The folks at Grove had been given some D-Star repeater equipment for distribution, at their discretion, to someone who would make good use of it. I knew of the efforts of JCDUG to build up a D-STAR system to support local communication as well as enhancing ARES/RACES operations. The group first organized in November 2007 to explore D-STAR's potential in the amateur radio emergency service environment. Being located between the Atlantic coastline and the Delaware Bay, an advanced communications system would be a very powerful tool during the all too common weather emergencies associated with seaside living. From there I stood back and watched with amazement as the project quickly moved forward.

The Jersey Cape D-STAR Users Group (Drew Butkocy KC2JPP, Bill Cole N2CSA, Tim Cwik N2LTQ, George Strayline N3GZ) had been working closely with Cape May County, NJ, officials, including Ed Taylor N2EWT, Cape May County Emergency Management Communications Officer and RACES/ARES Officer, to move forward with D-STAR as a solution to provide practical real-time digital communications and improved coverage area for voice communications. Their efforts began with an ICOM 70cm Voice/Slow Speed Data Module, a TE Systems 100 watt amplifier and a Phelps Dodge 6 cavity duplexer, all mated to antennas on Cape May County's main public safety radio tower.

When Grove Enterprises/Monitoring Times were made aware of JCDUG's ongoing work with D-STAR, they were pleased to grant them an ICOM Controller, 1.2 GHz High Speed Data Module, and 1.2 GHz Voice/Slow Speed Data Module. The equipment was delivered to JCDUG the first week in February and was in the control rack in the Cape May County Emergency Operations Center within days. Always being one for checking out new gear, even if it means a road trip, I hopped in the car and made my way to the very bottom of The Garden State to see what this new set-up was all about.

❖ Kudos to Cape May County

Let me start out by saying that, in an age where many government entities have been shunting amateur radio to the side, I am very happy to say that Cape May County, NJ, has great respect for the efforts of the hams in their community. The amateur radio repeater systems are given pride of place in the County radio rooms and on the County's antenna tower. Having been involved in ARES/RACES in other places, I had to admit some level of jealousy.



I met the guys at the base of the County tower and got the cook's tour of the operation. The Grove/MT provided ICOM gear was racked along with the group's existing D-STAR system, ready to go but for a bit of tower work and awaiting the latest software update for the Controller Module.

I learned that the group's practical experience showed D-STAR digital audio superior to analog voice. They found that digital voice was still going strong long after an equivalent audio signal was lost in the weeds. The increase in coverage area and signal quality, applied to wide area emergency service support, makes D-STAR a good choice.

The group's plans for expansion are to add the 2 meter Voice/Slow Speed Data Module to create a full D-STAR "stack in the rack." They also plan to construct a number of portable high speed data radio/computer systems that can be easily carried and set up in remote locations during emergency events. This innovative approach to putting real time voice and data communications into a "grab and go" package shows what a group of forward thinking hams with access to emerging technology can accomplish. The JCDUG folks' move to develop this new digital protocol into a full blown County wide emergency service system is not without its risks, but I think the rewards in the long run are going to be enormous.

JCDUG has recently received the Club Callsign KC2SWE from the FCC. By the time you read this article, the internet gateway system should be fully operational. You can follow along with JCDUG's progress on this project at their Web Site **www.jcdug.org/** and Old Uncle Skip will be making a few more trips down to the base of the tower to give you additional eyeball reports on this exciting project. Stay tuned!

I'll see you on the bottom end of 40 meters, or maybe someday soon on your local D-STAR system. You never know: Maybe an Old Ham Radio Dog can still learn a few new tricks!

UNCLE SKIP'S CONTEST CALENDAR

MARAC County Hunter Contest (CW)
May 3 0000 UTC - May 4 2400 UTC

10-10 Int. Spring Contest (CW)
May 3 0001 UTC - May 4 2400 UTC

Indiana QSO Party
May 3 1600 UTC - May 4 0400 UTC

New England QSO Party
May 3 2000 UTC - May 4 0500 UTC
May 4 1300 UTC - 2400 UTC

Mid Atlantic QSO Party
May 10 1600 UTC - May 11 0400 UTC

MARAC County Hunter Contest (SSB)
May 17 0000 UTC - May 18 2400 UTC

CQ WW WPX Contest (CW)
May 24 0000 UTC - May 25 2359 UTC

Outer Limits continued from page 59

jump2.cgi?ID=10323 (Santiago and radio_cochiguaz@yahoo.com)
Radio Conelrad- (None known)
Radio 6X- (None known)
Random Radio- (None; asks for reports via the FRN web site)
Obama Radio- (None)
Sycko Radio- (syckoradio@yahoo.com)
The Crystal Ship- (Belfast and tcsshortwave@yahoo.com)
Voice of the Runaway Maharishi- (Belfast)
Voice of Mike Gaulkin- (None)
WAPR- (None)
WBNY- (Belfast and rodentrevolutionhq@yahoo.com)
Wolverine Radio- (None announced)
WBCQ Relay- Some pirate has been relaying licensed WBCQ broadcasts on 6925 kHz. (None)
WBZO- (None)
WMPR- (None; QSLs only at the Kulpsville Winter SWL Festival)
WPDR- (None)

❖ QSLing Pirates

Reception reports to pirate stations require three first class stamps for USA maildrops or $2 US to foreign locations. Letters go to these addresses, identified above in parentheses:
PO Box 1, Belfast, NY 14711
PO Box 109, Blue Ridge Summit, PA 17214
PO Box 146, Stoneham, MA 02180
Casilla 159, Santiago 14, Chile
PO Box 293, Merlin, Ontario N0P 1W0

The best bulletins for submitting pirate loggings for potential QSL are the e-mailed Free Radio Weekly newsletter, *freeradioweekly@gmail.com* and the Free Radio Network web site, at **www.frn.net**

❖ Thanks

Your loggings and news about unlicensed broadcasting stations are always welcome via 7540 Highway 64 W, Brasstown, NC 28902, or via the e-mail address atop the column. We thank this month's valuable contributors**:** Brian Alexander, Mechanicsburg, PA; John T. Arthur, Belfast, NY; Skip Arey, Beverly, NJ; John T. Arthur, Belfast, NY; Kirk Baxter, North Canton, OH; Jerry Berg, Lexington, MA; Artie Bigley, Columbus, OH; Commander Bunny, Belfast, NY; Harold Cones, Newport News, VA; Bill Finn, Philadelphia, PA; John Figliossi, Halfmoon, NY; Harold Frodge, Midland, MI; Captain Ganja, Blue Ridge Summit, PA; Harry Helms, Smithville, TX; John Herkimer, Caledonia, NY; Ed Insinger, Summit, NJ; Ed Kusalik, Coaldale, Alberta; Bender Kestrel, Tucson, AZ; Chris Lobdell, Tewksbury, MA; Larry Magne, Penns Park, PA; Greg Majewski, Oakdale, CT; Cahito Mamani, Santiago, Chile; George Maroti, Mount Kisco, NY; A. J. Michaels, Blue Ridge Summit, PA; Mark Morgan, Cincinnati, OH; Adrian Peterson, Indianapolis, IN; John Poet, Belfast, NY; Martin Schoech, Eisenach, Germany; Neil Schwanitz, Marshall Islands; Lee Silvi, Mentor, OH; Dale Svetanoff, Monticello, IA; Bob Wilkner, Pompano Beach, FL; Joe Wood, Greenbriar, TN; and an anonymous contributor.

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Sub-Surface and On-Surface Antennas

When we discuss any antenna, we almost invariably assume that that antenna is "immersed" in air, or, if the antenna is on a spacecraft, in the near vacuum of space. And for our antennas here on earth, we generally assume any outdoor antenna to be relatively high in the air.

It's true that many radio operators and experimenters follow the old-time radio operator's rule-of-thumb that antennas should be high, long, and in the clear. So it may surprise you that, for some applications, good results can be had with antennas located underground, or even under water. We'll call these antennas "sub-surface antennas" (SSAs).

❖ Pros and Cons of SSAs

SSAs are reported to support satisfactory communication in such situations as medium and lower frequency reception, reception for submerged submarines, and two-way communications on the lower portion of the high-frequency ham band. Some reports extend this frequency range to include the VHF and even the UHF bands.

Not only do SSAs work sufficiently well for some applications, they also have low-levels of received noise, and thus produce a good signal-to-noise ratio (S/N). S/N is very important in determining quality of reception. Reducing the received-noise level is often more important for good reception than having a high level of antenna gain.

SSAs are less susceptible to station equipment damage, or damage to the antenna itself as a result of lightning strikes or from electromagnetic pulses from nuclear device detonation.

Another sometimes-desirable feature is that SSAs are essentially "invisible," and thus may be useful where laws or covenants prevent home owners from erecting above-surface antennas (ASAs), or where a visible antenna is considered esthetically unacceptable (difficult for me to understand because I love the sight of an antenna). Obviously, for clandestine operations invisible antenna installations are an advantage.

On the downside, SSAs typically produce considerably less signal strength than their comparable ASA counterparts, for both transmitting and for receiving. I've seen differing reports which put the signal-level loss variously from 6 to 40 dB. This means that for SSAs, both the power used for transmitting and the incoming signal strength for reception must be significantly greater than that needed for comparable results with ASAs.

Because of the low signal-level output of the antennas, a preamplifier is sometimes used with them for reception. Because they tend to receive less noise than ASAs, the preamp may, in situations where received noise levels are significant, improve reception compared to an ASA.

The length and spacing equations for determining the dimensions of SSAs must be modified from those used for ASAs to fit the medium (type of earth or water) in which the SSAs are immersed. Because the characteristics of the various media (dry soil, rocky soil, damp soil, salt water, fresh water, etc.) vary from one medium to another, it is next to impossible to give reliable equations for determining element length and spacing for SSAs.

❖ Types of SSAs

A variety of antenna designs have been utilized as SSAs: long-wires, dipoles, beams, loops, and others. The configuration of these SSAs is similar to ASAs, but with dimensions modified due to their immersion in a medium other than air. A favorite for long-distance reception seems to be a long-wire running for a few hundred feet in the direction toward the station to be received.

❖ Let's Make Some SSAs

Random Length:

The easiest SSA to construct is a random length antenna (fig. 1A). Here there is no need to calculate a length; just make the antenna as long as is convenient and bury it 2 to 3 or so inches in the soil, or just lay it on the soil (see OSAs below). An antenna tuner or a 4-to-1 balun between one end of the antenna and the coax feed line completes the installation.

The high-impedance winding of the balun has one terminal to the antenna and one terminal to an earth ground. The low-impedance winding goes to the coax. Of course the antenna wire must be insulated, and all connections must be made waterproof. The longer the wire, the more directional it will be: orient the antenna pointing toward or away from the direction which you want to favor for reception.

Dipole:

A dipole antenna (fig. 1B) can be cut for your favorite band by the formula: Length (in feet) = 312/frequency in MHz, or Length (in meters) = 95/frequency in MHz. This means that a dipole cut for 10 MHz would be 31.2 ft long. The feed line should run away from the dipole at a right angle (fig. 1B).

This formula worked for my soil: yours may be different. On the other hand, it's not necessary for either of these antennas to be resonant to perform, and so you should get some usable performance for your efforts. However, to avoid disappointment, remember that SSAs are expected to give much less signal output than ASAs.

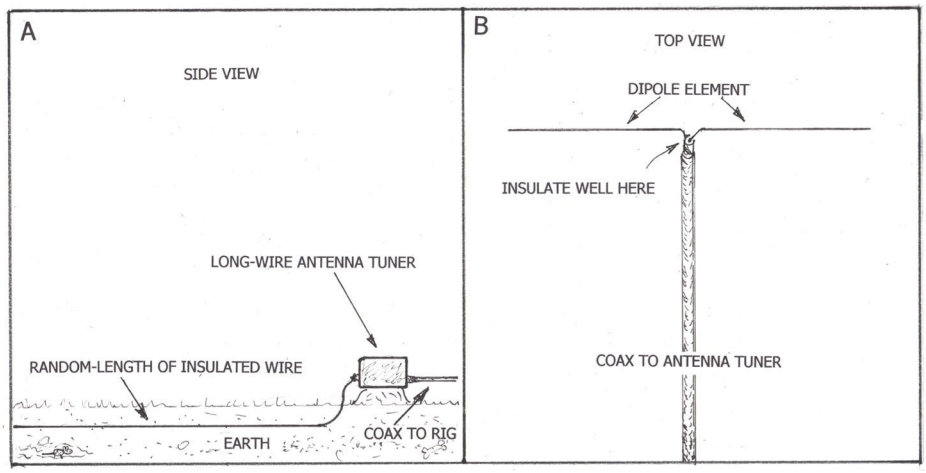

Fig. 1. A RANDOM-LENGTH SUB-SURFACE ANTENNA (A), A DIPOLE SUB-SURFACE ANTENNA (B).

This Month's Interesting Antenna-Related Web site:

A short, informative note on SSAs:
www.smeter.net/daily-facts/10/fact26.php
A free, internet book on early wireless which includes a discussion of SSAs:
http://books.google.com, Search for Experimental Wireless Stations by Philip Edelman, page 54.
A very good history of radio across the years, and in many different applications:
http://earlyradiohistory.us/index.html.
Lots of sources for learning radio-electronics theory in this next one:
www.dmoz.org/Science/Technology/Electronics/Tutorials/
The following two sites have info on making your own snake antenna:
www.isp.ca/ve3nh/snake.htm
www.band.alexandria.va.us/pipermail/tacos/1999/001042.html

RADIO RIDDLES

Last Month:

I asked: "Have you heard of the two 'romantic antennas?' I'm not talking about when they got married (more on that later), I'm asking how their romance started."

Well, last month I described the inventing of the rhombic antenna by putting two long-wire V antennas "mouth to mouth." Due to this "kissing" by the Vs, some wag playfully named the rhombic the "romantic antenna." So the antennas' romance started with a kiss!

This Month:

OK, so we know how the romance started. Now what can you tell me about the wedding of these two V antennas?

You'll find an answer to this month's riddle, another riddle, another antenna-related web site or so, and much more, in next month's issue of *Monitoring Times*. 'Til then Peace, DX, and 73.

On-Surface Antennas:

Antennas are sometimes just laid out on the earth. I've seen a number of reports of success using on-the-surface antennas (OSAs). This approach is better for temporary work, as most folks don't want wires permanently laid out on the ground where they can cause tripping, catch in lawnmowers, and so forth.

A wire laid out on the earth as long as you have enough wire and space for, in a line toward or away from the direction from which you'd like to receive stations, should be rather directional toward those stations. Shorter wires are less directional, and also generally give less output.

A number of amateur radio operators have reported success both receiving and transmitting with various versions of an on-the-ground antenna known as the "snake." One version which is said to cover all HF ham bands uses 125 ft of any kind of coaxial cable as the element of the antenna. Longer lengths give greater signal output, but multiples of a half wavelength on any operating frequency should be avoided.

To construct a snake, short the inner and outer conductor together at one end of the coax. Solder this connection and cover it with some non-conductive, water-proof sealer such as coax sealer. Connect the center conductor of the other end of the coax to the center pin of a coaxial plug appropriate for your receiver's antenna input, but do not connect the shield of the coax to anything at that end.

As with the previous antennas, laying the antenna in a straight line pointing toward or away from the desired direction of communications should work best. But you can also lay the antenna in twists and turns. It can be covered by rain or snow and still function.

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The BC-221 Frequency Meter
Our New Restoration Project

While doing the alignment of the BC-348 World War II aircraft receiver that was our previous project, I wanted to check on its oscillator frequency at a certain dial setting (see March 2008 issue). Trying to come up with a way to do that, I remembered my Navy LM frequency meter. It could not only generate an accurately calibrated signal over a wide frequency range, but also measure a signal from another source to a high degree of accuracy.

In the latter mode, the LM was really intended to check the frequency of a radio transmitter; I didn't know if it would work with the flea-power signal from a receiver's oscillator. But it worked beautifully and told me what I wanted to know.

Prior to that, I hadn't had occasion to use the LM for awhile. But now I was reminded of just how useful such an instrument could be to those of us who love to work on vintage communications gear. And of course there's the added enjoyment of using a test instrument that is, itself, a piece of vintage equipment. That's what prompted the restoration series we are about to embark upon.

❖ Sources for our Frequency Meter

If one is lucky enough to get his hands on an LM with its a.c. power supply and interconnecting cabling, little or no restoration is required. All of the parts are of extremely high quality and not likely to fail. The quartz crystal that is the heart of the unit is hermetically sealed and thus protected from environmental damage. I was fortunate enough to purchase my unit at a time when the operating unit, the power supply, and the special plugs needed to make interconnecting cables were still available at reasonable cost.

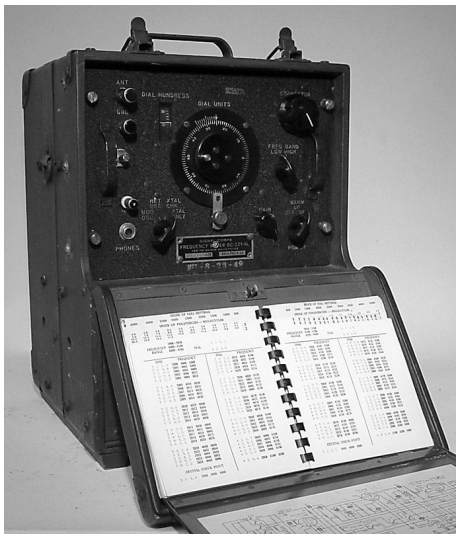


Fig. 1. The BC-221-AL in its wooden cabinet. Use of the calibration book will be discussed next month.

LM units still turn up at radio meets, but rarely with the power supply and cabling. And there is no room in the operating unit case to build in a supply. Not that this would stop a determined person. An outboard supply could be built and one of the interconnecting cable sockets removed to allow the leads to enter. But it's not a particularly neat solution, and one that does compromise the originality of the equipment.

And so, rather than work with an LM, we're going to restore the army version of the same instrument, known as the BC-221. The circuit design of the BC-221 is very similar to that of the LM. Its operating controls and mode of operation are also similar except that all LMs (as far as I know) offer the option of audio modulating the generated signal, while only some models of the BC-221 have this option.

I've chosen the BC-221 as our project because it is very commonly seen at radio meets, and at very reasonable prices – sometimes even for under ten bucks. I don't know why these neat, elegant units are so ignored. Perhaps it's because digital frequency counters have become very affordable and conveniently sized. But so far I haven't come across a budget priced counter that can *generate* an accurately calibrated signal for checking a receiver.

Another important reason for working with the BC-221 is that it is a battery-operated design, and therefore has a nice-sized battery box suitable for holding an a.c. supply.

BC-221s were manufactured in very great numbers during and after World War II. They were needed, among other things, for the critical job of keeping field transmitters and receivers that had to communicate with each other tuned accurately to the same frequency. The instruments were manufactured for many years and in a number of models having various tube complements and other electrical and physical differences.

My technical manual for the series covers the following letter variations: BC-221-A, B, C, D, E, F, J, K, L M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL (I have no idea why the missing letters in the single-character series). You may also see these instruments discussed as SCR-211-A, B, ... etc. Apparently the SCR-211 prefix is used to describe a BC-221 with the same suffix, along with its "accessories," such as calibration book, crystal, spare tubes, carrying strap, technical manual, etc.

I happen to have a few BC-221s to choose from. The one I'm using for the project – unless I change my mind because I've discovered some tragic flaw – is a BC-221-AL. I've chosen that one because it seems to be in the best condition and is one of the three BC-221 models that have the modulation option. (The other two are the BC-221-AJ and the BC-221-AK.)

However, if you decide to look for a BC-221 after we get into this series a bit and you find a nice one without modulation, don't hesitate to pick it up. When using the signal from your BC-221 to check receiver dial calibration, you'll probably find that there is enough minor noise in the signal so that you can tune it in, even if your receiver doesn't have a beat frequency oscillator (BFO).

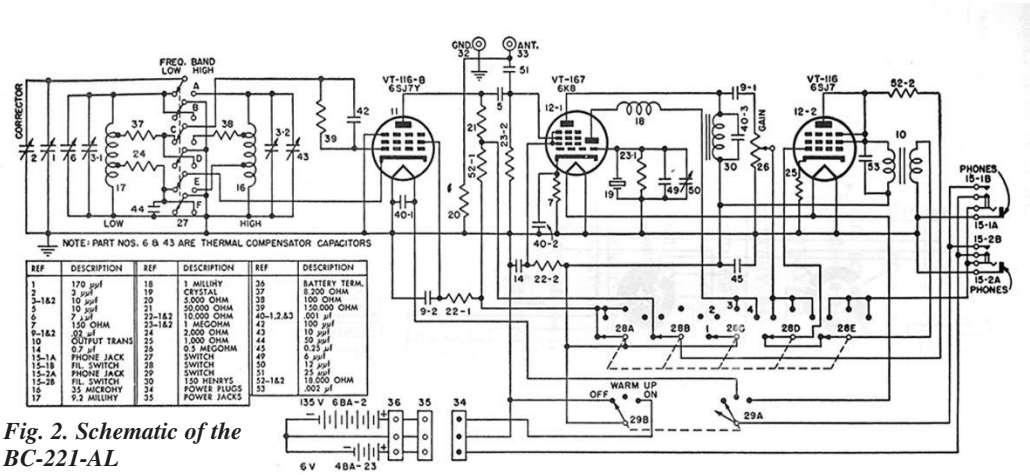
Another consideration in selecting a BC-221 is the cabinet. There are two types: aluminum and wood. Compared to the aluminum cabinet, the wood one is very heavy, bulky and klutzy. My BC-221-AL came in a wood cabinet (Figure 1) – but I may switch it into the aluminum cabinet from one of my other units. I'll decide about that later.

❖ Walking through the BC-221

Circuit details and control functions will vary somewhat from model to model, but the similarities are greater than the differences. Though I'll be describing the BC-221-AL, you'll find the discussion reasonably applicable to whatever model you have.

Take a look at the schematic of Figure 2 and you'll see that the circuit uses three tubes. Moving from left to right, there is a variable frequency oscillator (VFO) using a 6SJ7Y tube (this is a "ruggedized" version of the 6SJ7); a crystal oscillator (the crystal is labeled "19") using the triode section of a 6K8 (the pentode section serves as a mixer – combining the signal from the crystal and the VFO, or from the VFO and the instrument's antenna); and finally an audio amplifier using another 6SJ7.

It is the crystal oscillator/mixer circuit that is at the heart of the operation of the BC-221. It mixes (heterodynes) the output of the VFO with a selected harmonic of the crystal (whose frequency is very precisely known) as a means of correcting the frequency of the VFO so that it exactly matches the setting of the VFO dial. The latter has a micrometer-like vernier readout for precise setting accuracy. We'll be discussing the



REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
1	170 μμf	18	1 MILLIHY	36	BATTERY TERM.
2	3 μμf	19	CRYSTAL	37	8,200 OHM
3-1&2	10 μμf	20	5,000 OHM	38	100 OHM
5	10 μμf	21	50,000 OHM	39	150,000 OHM
6	7 μμf	22-1&2	10,000 OHM	40-1,2,&3	.001 μf
7	150 OHM	23-1&2	1 MEGOHM	42	100 μμf
9-1&2	.02 μf	24	2,000 OHM	43	10 μμf
10	OUTPUT TRANS	25	1,000 OHM	44	50 μμf
14	0.7 μf	26	0.5 MEGOHM	45	0.25 μf
15-1A	PHONE JACK	27	SWITCH	49	6 μμf
15-1B	FIL. SWITCH	28	SWITCH	50	12 μμf
15-2A	PHONE JACK	29	SWITCH	51	25 μμf
15-2B	FIL. SWITCH	30	150 HENRYS	52-1&2	18,000 OHM
16	35 MICROHY	34	POWER PLUGS	53	.002 μf
17	9.2 MILLIHY	35	POWER JACKS		

Fig. 2. Schematic of the BC-221-AL

process by which this is done a little later.

The front panel of our BC-221-AL is shown as Figure 3. The "POWER" switch is seen at the bottom right. Notice that it has a "WARM UP" position as well as an "ON" position. The "WARM UP" position won't have much applicability for us because we will be operating from plug-in power. But it was important for the military types who were operating the instruments in the field from batteries.

In that position, only the heater of the 6SJ7Y VFO tube is activated – allowing that critical frequency-determining circuit to begin stabilizing. The other two tubes would remain cold until an appropriate warm-up time had elapsed. Thus the current drawn from the "A" batteries would be only 1/3 of normal – until switch moved to "ON," energizing all the heaters.

The BC-221-AK seems to be the only other model having a "WARM UP" position. And in that model there is no separate power switch. The power functions are selected at extra positions of the operating mode switch.

To the left of the "POWER" switch is the "GAIN" control. It simply controls the strength of the audio heterodyne heard in the headphones during operation of the instrument. To the left of that control is the operating mode switch. In the "XTAL CHK" position, plate voltage is applied both to the crystal and the VFO so that their frequencies can be compared via heterodyne.

In the "HET OSC" position, only the VFO is powered, so that it can be used to send a signal to a receiver – or receive a signal from a transmitter – without interference from the crystal oscillator. The same is the case in the "MOD OSC" position – except that the audio amplifier stage is now converted into an audio oscillator that modulates the VFO signal with a 400 Hz tone.

This makes it convenient to pick up the signal from the VFO on receivers that do not have a BFO. Of course, the function is available only on the three models, mentioned earlier, that have audio modulation.

The final position of the switch is labeled "XTAL ONLY." In this position, the crystal oscillator is powered and the VFO is off. That makes it possible to use the instrument as a conventional crystal calibrator, generating a signal every 1000 kHz over most, or all, of a receiver's tuning range. In this mode it is also possible to check the crystal's frequency against a transmission from standard time and frequency station WWV (we'll try that later).

A small trimmer (labeled "50" in the schematic diagram), allows for small adjustments in the crystal frequency when checking it against a frequency standard. The screwdriver control is located behind a hole in the nameplate at the bottom of the panel. Interestingly, this hole doesn't show up in the pictures of the BC-221-AL in the manual.

My guess is that the trimmer was supposed to be hidden by the nameplate to discourage tampering and the hole was made by our previous owner. Reinforcing my suspicions are the nameplate's two missing screws.

Fig. 3. Close-up of the front panel will give you a good look at the controls.

To the left of the operating mode switch is the headphone jack used to access the heterodyne tones. Just above that, installed in an opening formerly occupied by an extra headphone jack, is a binding post installed by a former owner and not now in use.

Above that is a screwdriver-operated potentiometer (also installed by the former owner), that is wired in series with the lead to the antenna binding post. Its purpose was obviously to control the strength of the emitted signal – which would be handy if the instrument were to be pressed into service as a signal source for aligning receivers. Above the potentiometer is a ground post – as well as the antenna post through which signals leave or enter the instrument.

The "DIAL UNITS" and "DIAL HUNDREDS" indicators at the center of the panel are for adjusting the frequency of the VFO. We'll cover their operation next time, when we go through the procedure of frequency selection and frequency measurement with the BC-221. At the top right of the panel is the "CORRECTOR" knob, to be discussed next time, that is used to bring the instrument's dial reading into agreement with a crystal calibration point.

Again, the previous owner has stepped in with a modification. He has installed a large round knob in place of the original smaller pointer knob used on the corrector. From previous experience with these instruments, I can say that the extra mechanical advantage would be helpful. The corrector adjustment is very critical, and sometimes the variable capacitor controlled by the knob can be sticky, making exact positioning difficult.

The final control on the panel, "FREQ BAND," simply controls the frequency range of the instrument. In the "LOW" position, it is 125 kHz to 2 MHz; in the "HIGH" position, 2 MHz to 20 MHz.

See you next month, when we'll begin by fnishing our discussion of how to operate the BC-221.

By Larry Van Horn, N5FPW
MT Assistant/Technical Editor

West Mountain Radio RIGBlaster Pro

In the last few years I have really been bitten by the digital radio mode bug. This is very obvious if you look at my amateur radio logbook. When I sit down in front of the ham rig to do a bit of operating, most of the time I'm using digital modes in the ham bands.

Last Christmas I wanted a new interface that would consolidate the many connections and two boxes that I was using to operate on the new modes that used my digital sound card. So, after several years of operation, I replaced my older West Mountain Radio (WMR) RIGBlaster interface unit with a newer model. That new model was the RIGBlaster Pro.

The RIGBlaster Pro is considered by many hams as the Cadillac of all the interface units that are available in the ham marketplace today. And that praise is well earned. The RIGBlaster Pro is the ultimate interface for phone and digital operating.

The Pro model incorporates the proven operation of the WMR M8 and Plus model RIGBlasters with the addition of many new features, while providing the operator with a simplified operation and greater flexibility.

Full front panel LEDs display the status of PTT, CW, FSK, audio source, and transmit audio level operations. An audio level indicator shows the presence of adequate computer transmit audio; the other LEDs show the status of the software's serial control activity, and indicate the automatic switching between computer and microphone audio sources.

❖ Rig Control

One of the biggest selling points for me was the built-in rig control interface. I use an Icom IC-706G MKII transceiver that uses the company's CI-V interface for rig control. By adding the Pro to my setup, I got rid of my old CI-V interface box and several cables that were dedicated to this function.

In addition to the Icom radios, the Pro's built-in computer rig control interface also provides that function for rigs that utilize the Yaesu CAT or Ten Tec TTL technology. This built-in interface facilitates computer control of your transceiver, sound card operation, and CW mode operations using only one serial port with programs such as Hamscope, MixW, Logger 32, MultiPSK and several others. If you are running two separate software programs – one for sound card PTT switching, CW and RTTY and another program for rig control – you have the option to use two serial ports instead of one.

Another interesting feature of the Pro is the ability to utilize transmitted speech processing. By running a sound card based DSP software, the Pro will turn your setup into a high performance microphone equalizer, speech processor, and/or noise gate. Performance and flexibility are far better than with some expensive stand-alone hardware processors. You will be able to optimize your transmit audio exactly the way you want it for DX, rag chewing or even Hi-Fi SSB communications. Downloadable, real-time audio processing programs are available on the Internet, and rumor has it the WMR is developing a custom, high performance, amateur radio software package that will only be available to RIGblaster Pro registered owners.

With this new program now under development, the Pro will automatically switch between DSP transmit speech processing and receive DSP filtering using circuitry in the Pro that "tells" the software that the microphone is in use. This will also allow for optimization of the switching times between transmit and receive.

The West Mountain Radio RIGblaster Pro connects to several items in your shack. Please note that many items in this diagram (mic, PC, radio, foot switch, speakers, etc.) are not included.

❖ Features Galore

There are many new features in this transceiver to computer interface, including:

Receive audio muting. When running the Pro in the transmit speech processing mode, the computer speakers will be muted whenever PTT is activated via the microphone or the foot switch jacks.

Isolated microphone audio output continuously supplies microphone audio to the computer's mic input for contest DVK (digital voice keyer) message recording on the fly. This feature can also be used to process microphone audio and to provide for digital recording of both sides of a QSO at any time.

Not one, but two, independent, keying outputs, one for true FSK, and another for keyboard CW keying.

The Pro has an Electret microphone bias circuit allows you to use an electret condenser microphone with radios that have no provision for using this modern type of microphone.

Second microphone operation. Quick plug-in automatic switch-over between the main station mic and a headset microphone. Special radio microphone adaptors will no longer be needed for the headset connections. You can leave your main station microphone connected when using a headset microphone.

Dual headphone outputs with 1/8" and 1/4" jacks. Both may be used to monitor receive and/or transmit audio. Just like the other RIGBlasters, computer speaker jacks are available for normal use and may be turned down or off while using headphones. Computer speakers are automatically muted when in the transmit processing mode.

Dual RCA type, PTT input and output jacks that can be used with a foot switch or for external control. These may also be separated to provide a transmit sequencer loop for high power amplifier switching.

SPECIFICATIONS

Overall Dimensions: 1.5″ H x 10.75″ W x 5.75″ D (without cables)
Weight: 19 oz (without AC adapter)
AC Power requirements: 120 VAC <2.5 Watts (with supplied AC adapter)
DC Power requirements: 13.8 Vdc nominal < 220 mA

Frequency response
Sound card microphone output: Process mode 100 Hz - 15 kHz, + - 1dB
Sound card input: 100 Hz - 15 kHz, + - 1dB

Distortion sound card input: Less than 0.1 % THD @ 1kHz
Input impedance (from sound card) : 600 ohms resistive, minimum
Sound card level adjustment range: -34 dB to > -120 dB
PTT maximum contact rating: 2 A @ 24 V or 1 A @ 48 V
CW direct keying ratings: Transistor logic only, tube amps not supported. Positive pull down .15 V min. @ 20 ma. max
FSK direct keying ratings: Transistor logic only, tube amps not supported. Positive pull down .15 V min. @ 20 ma. max

Serial interface ports A andB (DB9F connector) Standard RS232
RS232 Pin assignments serial port A (DB9 PC signal set)
Pin 2 Receive Data (Rig control default)
Pin 3 Transmit Data (Rig control default or FSK option)
Pin 4 Data Terminal Ready (CW Keying control)
Pin 5 Signal Ground (isolated digital common)
Pin 6 Data Set Ready (PTT interrupt)
Pin 7 Request To Send (PTT control)
Pin 8 Clear To Send (PTT interrupt)

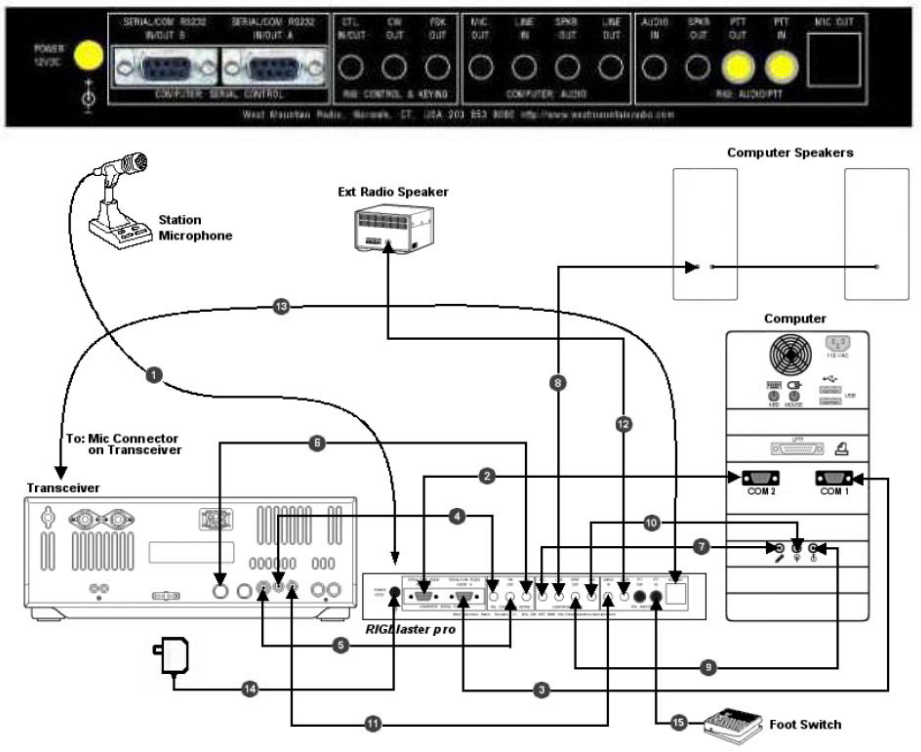
RS232 Pin assignments serial port B (DB9 PC signal set)
Pin 2 Receive Data (Rig control option or pass)
Pin 3 Transmit Data (Rig control option or pass FSK option)
Pin 5 Signal Ground (isolated digital common)

TTL Rig control interface ports:
Standard TTL 5V logic, selectable bi-directional or uni-directional via a dual circuit mini jack connector.

Radio speaker loop through. This allows you to re-connect an external radio speaker when using a radio's speaker output instead of a fixed level audio output.
Radio line level receive microphone jack connection. This provides a line level receive connection for radios that have receive audio on their microphone jack, simplifying the connections.
Power ON/OFF switch. Even though WMR's RIG-Blasters draw almost no power and have fully automatic bypass operation, they have added a power switch on the Pro that disables and bypasses the unit's operation.

The microphone audio is completely isolated from all other grounds. The three sound card audio signals are isolated using three audio transformers. The computer is isolated using three DPDT relays, three opto-isolators, and an isolating DC to DC converter. A high grade DC blocking capacitor is on the sound card to microphone output for use with radios that are designed for use with amplified or electret microphones.

Another interesting feature are the relays that provide current and voltage capability to switch tube rigs. These relays also provide automatic switching between sound card audio, transmit muting and the microphone override and interrupt features on the RIGBlaster Pro unit.



❖ What's in the box?

In addition to the interface box, the RIG-Blaster Pro USB kit includes the items you need to get up and running including: an AC to 12 VDC power supply (wall wart), a software CD (including USB to serial port drivers), transceiver microphone cable [8 pin], USB cable, six stereo mini 6-foot patch cables, a patch cord label stickers sheet, 11 white wire jumpers, six blue shunt jumpers, one adapter (mini to 1/4 inch), and adhesive pads for mounting the unit.

❖ Bottom Line

I found the RIGBlaster Pro very easy to install, easy to integrate with my existing sound card software packages, and easy to use. The added information displayed on the front panel makes digital mode and voice operations a lot more comfortable for the operator. The instruction manual was well written and installing the USB drivers for serial to USB operations with my laptop went off without a hitch.

All-in-all, the West Mountain Radio RIG-Blaster Pro was a wise choice and has added some new capabilities to operations in my ham shack.

The unit retails for $279.96 and is available from Universal Radio and other major ham radio dealers nationwide.

You can learn more about the RIGBlaster Pro (including a downloadable PDF version of the unit's manual) and all the other West Mountain Radio products on their website at **www.westmountainradio.com/**

MT REVIEW

AOR AR-ALPHA
Wide Coverage Receiver

By Bob Grove W8JHD

The introduction of a new super receiver into the radio communications marketplace is always marked by hope and anticipation: such is the case of AOR's brand-new entry, the AR-Alpha. We received an advance model of this receiver for review in *MT*.

The Alpha is an impressive piece of engineering, both cosmetically and technically, with an impressive array of manual and automatic features. With a continuous tuning range of 10 kHz through 3500 MHz (3.5 GHz), custom step sizes, five VFOs, scan and search capability, and 2000 alphanumeric memory channels, this instrument brings a lot to the table. The consumer model for U.S. distribution has cellular frequencies blocked to comply with FCC regulations.

Weighing in at a substantial 17 lbs. and measuring 16-1/2"W x 5-1/8"H x 10-1/8"D, the Alpha is clearly not targeted at the mobile-mount audience. It is, however, equipped with threaded side holes for mounting to 19" rack-panel brackets for serious installations.

The Alpha is a triple-conversion receiver with considerable demodulation capability (see specifications sidebar). It even allows continuous digital voice recording of up to 53 minutes.

The multifunction, 6" TFT display allows full-color television reception in North American and European formats; in addition, composite video output is available from the rear panel.

The crisp, bright LCD also functions as a full-color spectrum display unit (SDU) with Fast-Fourier Transform (FFT) capability and waterfall (activity over time) display of signals over a selectable span of from 250 kHz minimum to 1000 MHz maximum. Simultaneous audio recovery is allowed up to 20 MHz span, but not while displaying the wider span of from 20-1000 MHz width.

Depending on the types of signals and span chosen, the user may select the best resolution bandwidth (RBW) from 1, 4, 32, 64 or 128 kHz.

When not used for graphic presentation, the LCD also doubles as a function display for associated keys.

The Alpha is capable of both CTCSS (52 tones) and DCS (106 codes) squelch activation, and provides convenient DTMF tone decoding when hearing touch-pad signals.

An auto-notch feature assists in rejecting tone interference such as shortwave heterodynes and annoying paging tones.

A speech inversion descrambling function is included only on the government version; while this mode is the least secure of voice privacy measures, it is still widely used among many law enforcement agencies still operating more traditional analog systems.

While the receiver does not have trunk tracking capability, it does provide APCO P-25 digital voice decoding, the fastest growing digital voice technology to be encountered on public safety frequencies in the VHF/UHF spectrum.

Computer control from third-party software can activate the receiver through its rear panel jacks, an RS232C DB9 and a USB 2.0.

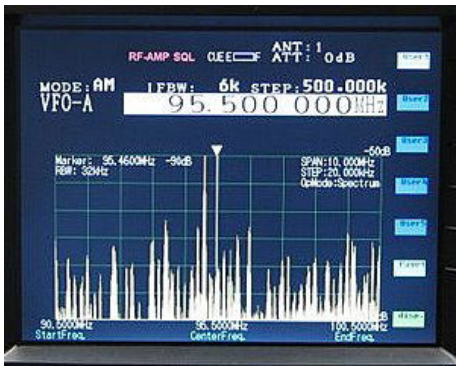
Our Test

The Alpha requires a substantial ramp-up period to get used to it. The accompanying, 130-page manual must be studied in detail for the user to feel comfortable with the receiver's operation; it is not intuitive. Many later pages of directions depend upon your already knowing what's on the earlier pages.

The manual is well written, with hundreds of pertinent illustrations; even so, it is under constant revision due to the complexity of the receiver's operational parameters.

Once understood, the multi-functional capability of this instrument makes it a powerful receiving station for the most populated portion of the radio spectrum, including the emerging 2.4-2.5 GHz wireless digital communications.

The large, finger-indent tuning knob makes accurate slewing a pleasure, and various functions of the receiver can be user-adjusted for the listener's preferences.



The rear panel abounds with input and output ports – two antenna connectors (SO-239 and N), a 10 MHz external oscillator reference input, an external speaker jack, a mute jack, right and left stereo line outputs,

SPECIFICATIONS

FREQUENCY RANGE: 10 kHz-3500 MHz (3.5 GHz) (cellular blocked on U.S. consumer version)
FREQUENCY STABILITY: Better than +/-0.1 ppm over entire frequency range, after 5 minutes warmup
MODES: WFM, FM stereo, narrow FM, AM, sharp AM, USB, LSB, CW, ISB, sideband diversity, real-zero SSB, analog I/Q (for DRM reception utilizing third-party software), APCO P-25, and video (NTSC, PAL, SECAM) displayed on the full-color LCD.
SENSITIVITY (TYPICAL):
AM (10 dB S/N, 6 kHz BW): 5 uV 0.1-25 MHz, 2.3 uV 25-1030 MHz, 1.3 uV 1030-3300 MHz
NFM (12 dB SINAD, 15 kHz BW): 2.5 uV 25-480 MHz, 0.8 uV 480-1030 MHz, 1.5 uV 1030-3300 MHz
WFM (12 dB SINAD, 200 kHz BW): 1.3 uV 25-1700 MHz, 1.5 uV 1700-3300 MHz
SELECTIVITY BW (-3 dB/-90 dB down):
SSB 3kHz/3.6 kHz
CW 500 Hz/700 Hz
AM 6 kHz/15 kHz
NFM 15 kHz/25 kHz
SELECTABLE IF BANDWIDTHS: 0.2, 0.5, 1, 3, 6, 15, 30, 100, 200, 300 kHz, with shift capability
SPURIOUS SENSITIVITY: 60 dB or more
DYNAMIC RANGE: 90 dB or more
THIRD-ORDER INTERCEPT POINT: Better than +2 dBm over entire frequency range
POWER REQUIREMENT: 13.8 VDC @ 2.2 A nom. (AC adaptor included)
ANTENNA JACKS: SO239 and N (selectable)
MEASUREMENTS: 16-1/2"W x 5-1/8"H x 10-1/8"D
WEIGHT: 17 lbs.

an I/Q out, DB-9 and modular digital control connectors, and a multipurpose port which provides two 12 VDC @ 50 mA lines for antenna switching, and an AGC control line.

Shortwave listeners will find listening to the HF spectrum a special pleasure; the variety of selectable bandwidths, ease of tuning and brick-wall filtering seem to slice signals out of the spectrum. Audio quality from the internal speaker is very good as well.

❖ A Few Observations

Sensitivity comparisons submitted by AOR (see accompanying table) varied with frequency range. On the AM broadcast and HF shortwave frequencies, the new Alpha averaged several decibels better than AOR's standard of comparison, the well-established AR5000+3. Of course, large antennas used in that part of the spectrum deliver so much signal that a few dBs difference aren't noticeable.

At VHF and UHF, measured sensitivity, for all purposes, is identical. Above 1 GHz, however, the old AR-5000+3 was clearly the winner. It must be pointed out, however, that there will be unit-to-unit production differences among receivers.

While the spectrum display function is very versatile and accurate, like most other LCD displays with pixel-by-pixel address, rapid events like pulse transmissions are not captured and displayed. Similarly, the rapid envelope-shape changes from modulation are more strobe-like than smooth. The wider the span, the more apparent this becomes.

CRT displays still reign supreme in sweep response time. Nonetheless, the spectrum display function is very useful for the vast majority of tasks in which signal presence is more than a brief spike, and when the modulation-envelope details are not critical.

❖ The Bottom Line

All in all, the new AOR Alpha is a truly remarkable receiving instrument. It is currently available from AOR dealers including Grove Enterprises (1-800-438-8155) and other *MT* advertisers. Street price for the unblocked, government version knocks around $3,000 off the list price of $13,000. Call for pricing on the consumer version, not yet type-accepted by the FCC at press time.

SENSITIVITY COMPARISON BETWEEN AR-ALPHA AND AR-5000+3

Relative Sensitivity in dB

MHz	AR5000A	AR-ALPHA
0.1	-110.0	-98.1
0.9	-112.0	-120.0
1.9	-105.0	-115.1
9.9	-115.9	-120.0
24.5	-115.0	-118.0
25.5	-116.3	-117.4
50.5	-116.5	-119.0
80.5	-115.0	-119.0
120.5	-119.4	-119.0
158.5	-119.0	-119.0
200.5	-120.0	-117.8
300.5	-119.6	-118.1
400.5	-118.9	-117.3
500.5	-118.0	-120.0
700.5	-118.2	-120.0
800.5	-119.2	-119.5
900.5	-118.7	-119.7
1000.5	-118.0	-118.7
1200.5	-121.9	-117.9
1400.5	-121.4	-117.0
1600.5	-122.4	-116.8
1800.5	-119.8	-116.7
2000.5	-122.0	-115.3
2200.5	-122.3	-111.0
2400.5	-120.0	-111.0
2500.5	-121.2	-109.0
2800.5	-119.0	-109.0
2999.5		-105.1

SAFETY – PRIORITY ONE!

By Gregory L. Smith, WB2PPQ

With the advent of low voltage solid-state electronics, hobbyists have acquired an attitude of self-confidence in regard to safety while troubleshooting malfunctioning radio gear. Hobbyists always have the hope of troubleshooting and finding something simple that can be easily repaired. However, this confidence has carried itself forward for many into neglecting to follow basic safety rules regarding high voltage. The interest and restoration of vintage electronics makes safety "priority one."

A cautionary tale

The impetus for writing this article was a major amateur radio magazine that recently published an article on how to build a vacuum tube replica spy transmitter. This article supplied the reader with an electronic schematic diagram, parts list, and front panel fabrication drawing to replicate the original transmitter design. However, a design flaw remained undetected from conception from the original design to the replica in regard to safety.

Just a brief look at the electronic schematic showed that high voltage (several hundred volts DC) was user accessible. Also, the high voltage filter capacitor did not have a bleeder resistor to discharge the capacitor upon on power turn-off. This situation would have high voltage present regardless of the power switch position!

The second potential hazard was the author showing a hinged lid to access the user band change tank circuit. The plug-in band change tank coil assembly consisted of a bare coil form that was connected directly to the B+ high voltage! To make matters worse, there were absolutely no high voltage safety warnings present in the article.

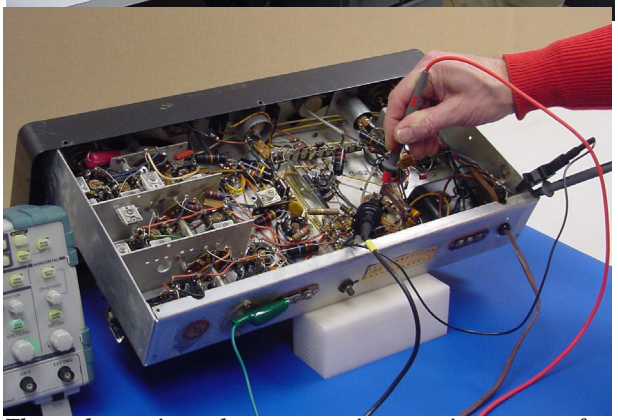
Unfortunately the authors and editor neglected to spot this safety issue. This situation could have disastrous results in sustaining personal injury or a fatality from electrocution.

Vintage and high voltage

There appears to be a great interest in vintage shortwave and amateur radio equipment. This feverish activity can be seen at hamfests, website listings and on on-line auction sites such as e-Bay. Collectors, hobbyists, and fellow hams are anxiously snapping up these historic rigs, sometimes called boat anchors.

Most often high voltage power supplies are problematic, because the electrolytic filter capacitors have dried out and become open or shorted. Upon power-up the DC power supply will malfunction; in receivers, this causes a persistent hum or worse yet, rising smoke for shorted electrolytic capacitors! Resistors may also have gone open circuit or changed in value. To get the equipment functional, repairing these issues are required, along with other repairs or restorations.

The following guidelines may seem obvious to some readers but are well worth reviewing. For the younger generation ham or hobbyist, this may be new information well worth reading and practiced with caution.

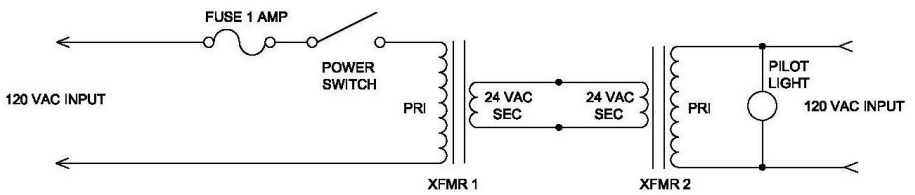


The author testing a shortwave receiver, wearing proper safety glasses, practicing one hand high voltage testing rule and meter properly connected to receiver. Chassis is grounded, power being applied through a fused variac along with breaker protected A.C. power strip.

First, you should evaluate if you have the knowledge and experience to troubleshoot and repair the malfunctioning radio equipment. Technical specialists should service equipment beyond the technical scope of the hobbyist. One example would be troubleshooting linear amplifiers.

If a service manual is available, it should be read and understood. Follow any safety notices if stated. Remember that early electronics may not have published safety warnings. This safety deficiency resulted because safety issues were not addressed aggressively as we see today with appropriate safety warnings on the electronic device and in the operators' manual. Decades ago society was less litigious, leaving safety issues to the repair facility or user.

Inspect the power cord on the equipment under test; most often these AC cord sets are



FABRICATED AUTOTRANSFORMER
FIGURE 1

deteriorated with brittle insulation. If there is any question as to the condition, be safe and replace the cord.

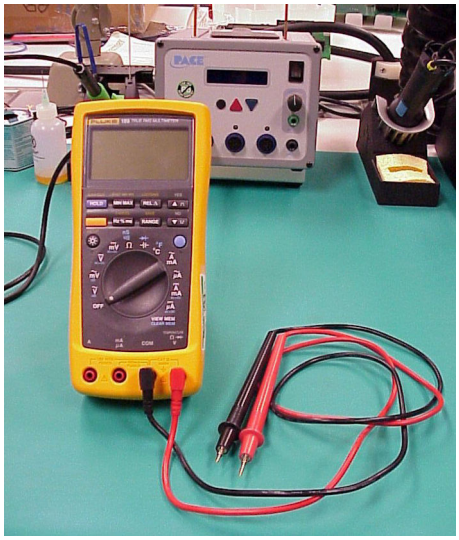
The malfunctioning radio chassis should be placed on a dry, insulated surface.

Be certain that you have rubber sole shoes. Leather sole shoes absorb moisture and can permit electrical current to flow through them, especially on a damp basement floor.

Make certain that the chassis of the equipment under test is grounded, along with other test equipment. If the radio circuit is a transformerless design, it is highly recommended that an isolation transformer be wired between the 120 VAC service outlet and radio device under test. Some older radio sets were designed to operate on AC or DC and utilized this type of design. If there is any doubt, an isolation transformer should be used. A simple isolation transformer can be fabricated from two 24 VAC step-down transformers – *see figure 1*. This technique is only applicable for lower AC current equipment.

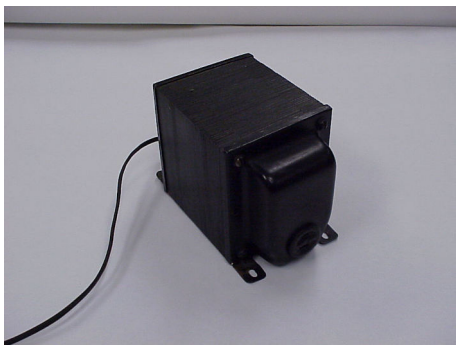
Before plugging in the radio device under test, it is recommended that some preliminary resistive measurements be made. To start, the unit must be unplugged from the service outlet and the radio device must be in the **"on"state.** The first test will be to verify that the transformer primary winding is not shorted. Sometimes with age the transformer's primary winding can short due to insulation breakdown where coil windings no longer are insulated from one another.

A second test should check the electrical leakage from chassis ground to each side of the radio's power cable. This will be a preliminary indication of line by-pass capacitors that may have developed resistive leakage.



A good quality test meter that has safety agency approvals (UL/CSA)

It is always advisable to place a **fused** variac (variable auto transformer) between the service outlet and the radio under test. If the variac is not fused, a fused plug on the service AC cord can be added. An AC power strip is another good method of protection. This method avoids direct contact with the set under test and offers circuit breaker



Low cost test isolation transformer fabricated from inexpensive door bell transformers.

protection for high current short circuits. It is important to note that an autotransformer does not provide line isolation. However, it will permit applying a predetermined low voltage for initial testing.

An AC ammeter in series with the line cord is a great indicator of a serious malfunction. This will avoid the often-disastrous smoke test! If the AC ammeter shows a reasonably low value, the variac may be stepped up another voltage increment in the order of 10 VAC. This gradual increase in voltage can be done until full line voltage is applied to the radio equipment under test**. Safety glasses need to be worn during the process in the event of a catastrophic failure.**

Digital multimeter and other troubleshooting instruments should be evaluated for **maximum input voltage specification** along with **UL/CSA approval mark**. You need to verify that the measured voltage is less than the maximum multimeter input voltage with some safety margin. All instrument leads should be checked for deterioration including open cracks and fraying. If any deterioration is present, the leads should be discarded and replaced with new leads.

One hand in pocket rule – never use two hands when working with equipment powered-up under test or stored voltage in the power supply filtering circuit (electrolytic capacitors). This rule will prevent current flowing through your body in the event that you touch a component having high voltage. This is the most dangerous type of electrical shock. Electrical current can flow from arm to arm causing heart arrhythmia.

AC line operated test oscilloscopes can be another potential hazard if they are not operated with an isolation transformer or from internal battery power. Unless the oscilloscope has an isolated differential input amplifier, one side of the oscilloscope's test input is chassis ground. This ground most often is electrically connected to the electrical 120 VAC service outlet ground. Without proper isolation the grounded test cable will be a short circuit to the hot side of the primary circuit in the unit under test.

Safety glasses – **always wear safety glasses** in the event of a component failure. Some components can literally explode.

Burn potential – many pieces of vintage equipment have resistors that operate hot and have the potential to inflict painful finger burns. Larger physical size resistors having higher wattage indicate higher power dissipation. Vacuum tubes also have the heat potential to cause burns as well. Contacting these resistors or vacuum tubes must be avoided during or just after AC power is applied.

Unexpected high voltage – never assume that DC voltage is not present when the unit under test is powered off. Bleeder resistors often fail to open circuit. Under this condition the high voltage electrolytic capacitor(s) will maintain high voltage. A myriad of other circuit failures can cause unexpected high voltage at unexpected points in the circuit.

It is good practice **to have equipment unplugged from the power source** under test **before connecting test leads.** Again, verify that electrolytic capacitors are completely discharged. This can be accomplished with a heavy insulated clip lead along with a current limiting resistor sized to the voltage being discharged. **The one hand rule is imperative.**

Likewise, to lessen the danger of accidental shock, only **remove test leads with the power off and electrolytic capacitors discharged**.

Remember, even a minor shock can cause you to contact a higher voltage at a nearby circuit. Also, a bad fall might take place with a shock exposure.

Always make certain that **another person is present** when making high voltage measurements to assist in the event of an accident.

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To Fan or Not To Fan? Evaluating Four Laptop Coolers

In the April column we saw how you could extend the life and performance of your laptop PC by using a cooler. The column ended by saying "I'll keep looking for other notebook/laptop cooling products and pass along any unique or outstanding ones in future columns." No sooner had the ink dried, or the data packets been received by the publisher, than three laptop cooling products caught my attention.

Two products are intriguing since they do not use any fan or moving parts! The other laptop cooler received excellent reviews and uses a powered fan approach similar to the Antec product we used in the last column.

This month we'll compare all four products based on their cooling performance. As we did last month, each product will be used for a ten-minute period. PC Wizard 2008 program will monitor the temperature of the CPU chips and hard drive.

However, this time during these ten minutes both CPU cores will be held right at 100% utilization! Not just at 94% as we did last month. This will be accomplished by simultaneously running a number of applications such as: Microsoft Flight Simulator X, Windows Media Player, and an AVI player. Additionally, we will be connected via high speed Internet to three sites. And, of course, PC Wizard will be running monitoring the CPU temperatures.

Before we jump into the test results, let's look at each of the four coolers.

❖ Coolers from a Cool Company

We'll start with the most unique product of the four: iXoft by Thermaltake. The only place I saw this cooler was at Cyberguys.com. If you regularly read this column, you'll know that I'm constantly going to **www.cyberguys.com/**

Why? Well no, I have no financial interest in the company. It's just that they carry a full range of computer products from the most mundane cables to the most unique products. For many of the latter they are the first to carry them, or you may not see them anywhere else! The Cyberguys' byline is on the mark, "Your source for hard-to-find computer parts & accessories." And, in addition, they are nice helpful people to deal with.

The iXoft R150N01 appears to be just a mat that sits under the laptop. That's it. No USB connections or external power supply. It's just an 11-3/4 by 13-1/4 by 1/8-inch thick …mat.

Figure 1 – The iXoft Laptop Cooling Pad. Notice no electrical connections!

See Figure 1. The mat can be rolled or folded and is the lightest of the coolers we evaluated, making it very convenient for travel. Although the mat is padded, if you squeeze it gently you can feel a gritty crystalline material. So what is its cooling mechanism?

Try to recall your high school/college chemistry knowledge. When some materials react or change state they liberate heat. These are called exothermic. But some reactions or state changes actually absorb heat. These are call endothermic.

iXoft is filled with the compound sodium sulfated deca-hydrate, whose chemical formula is $Na_2SO_4 \cdot 10H_2O$. The 10 H_2O is the deca (10) hydrate part; in other words, ten water molecules are attached to each sodium sulfate molecule. But how does this provide cooling?

When sodium sulfated deca-hydrate transitions from a solid crystalline state to a liquid, it absorbs heat. In theory this provides the cooling. No fans. No electrical connections. Just cooling.

I can hear the experience-burned skeptics out there say, "Yeah, good theory, but does it really work?" Hold tight and we'll see a chart comparing all of our coolers' performances.

The iXoft weights in at 640 grams (1.4 pounds) and is available from **www.cyberguys.com/templates/SearchDetail.asp?productID=17880** at $29.99 plus shipping.

❖ Another "No Fan" Cooler?

Yep, this next one is from Belkin, the PC accessories people **www.belkin.com/laptopathome/cushtop/**. Where the iXoft uses chemical technology for its cooling mechanism, the Belkin model F8N044 relies on its mechanical configuration for cooling. It's fairly large, measuring 12.5 by 16.5 by 4.2 inches. Yes, 4.2 inches thick! It weighs 1.6 pounds, is covered in durable "high-quality, furniture-like upholstery," and retails at $34.99. Available at all the major computer shops, I even recently saw it at a wholesale club for around $24.

Figure 2 – A no fan laptop pad from Belkin

Looking at the Belkin product in Figure 2, it appears to be an extra thick, sloping pad. The computer sits on top of the pad. But look again at Figure 2 and you'll notice a space cut out in the center of the pad. Both sides are open. This space runs through the center of the pad, creating a chamber of air between the top and bottom on the pad. The space also acts as an accessories storage compartment when the laptop is not in use. Its website is **www.belkin.com/laptopathome/cushtop/** .

Clearly the Belkin's physical arrangement will definitely keep the user's lap cool. But does it cool the laptop? We shall see.

❖ An Old Friend

You'll remember the Antec Notebook Cooler (0761345-75004-2) from last month, Figure 3. This cooler is mostly constructed of plastic, but the top surface has a perforated metal

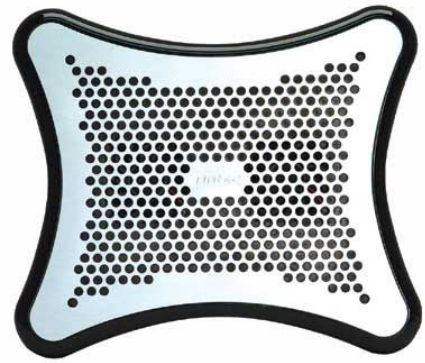


Figure 3 – Top view of the Antec notebook cooler from last month's column

insert. This assists the two double-ball bearing fans in the cooling process. The fans have a high and low speed switch mounted on the side of the platform. A custom USB cable is supplied and provides power to the fans. You can find more details at **www.antec.com/ec/productDetails.php?ProdID=75004** .

This model weights in at 1.6 pounds with measurements of 11.2 by 13 by 0.85 inches. Selling around the $20 mark it is readily available in computer shops, on-line, wholesale clubs and even Staples and Office Depot.

Last month we saw that the Antec does provide a very measurable amount of cooling. But how does it perform compared to the other three?

The One To Beat??

Our last new cooler product is again from Cyberguys.com and is the Zalman Note Book Cooler ZM-NC1000. This one was chosen as a result of the very positive feedback I received from people I know in industry who use them and think very highly of them.

It is very well constructed with a wrap-around total metal top. Two centrifugal fans are buried under the top. A continuously variable fan speed control sits on the side of the unit along with an on/off switch. A common USB cable is provided and connects this cooler to the laptop for power.

Figure 4 – Large top metal construction of the Zalman Note Book Cooler Model ZM-NC1000

The Zalman comes in as the heaviest at 2.5 pounds and measures 12-1/4 by 13 by 1-5/8 inches. It also has the heaviest price tag of $49.99 plus shipping from **www.cyberguys.com/templates/SearchDetail.asp?productID=14720** . No question about it, the ZM-NC1000 is a high quality constructed product, but how does it perform relative to the other four coolers? All will now be revealed!

And The Coolest Is …

Let's get right to it. Figure 5 says it all. Here we have graphed the average temperature of the two CPU core temperatures after ten minutes of operation at 100% CPU utilization and using each cooler. For reference, the first bar on the left is the average core temperature when CPU utilization did not exceed 5%.

We can readily see that the Zalman is the clear winner, achieving a temperature 14.4 degrees cooler than the Belkin and 7.6 degrees cooler than its nearest competitor the Antec. That is an amazing performance advantage. Also, using the Zalman the laptop's hard drive temperature sat at a constant 89.6 degrees. This is about 6 degrees cooler than the Belkin and 4 degrees cooler than the Antec. So the Gold medal goes to Zalman Note Book Cooler ZM-NC1000. Check it out on the Cyberguys.com site.

The Silver Medal Goes To…

In Figure 5 you can see that the other fan-cooled product, the Antec, came in a clear second. Although not providing as much cooling as the Zalman, it did provide a noticable margin of cooling as compared to the other two coolers.

Bringing Up the Rear

The non-fan products, iXoft and the Belkin, produced disappointing results, which were over 12 degrees hotter than the Zalman. At these higher temperatures, the CPU and other laptop components are exposed to quite a bit more thermal stress. Not good for laptop longevity or performance.

The Belkin results were almost indistinguishable from a "no cooler" situation. Therefore, as a user's lap cooler the Belkin works great, but as a laptop cooler…no. There may be some benefit to the Belkin design if you use your laptop in bed, on a thick carpet, or on a soft-cushioned couch. The very thick Belkin product will prevent the laptop's cooling vents from being blocked. This could prevent almost immediate catastrophic thermal failure of the CPU or other components.

Surprisingly, the iXoft performed only slightly better than the Belkin. This may be due to the small amount of mat surface area that actually contacts the laptop's uneven bottom surface. Physical contact is critical for heat transfer to the mat's cooling material. This theory was proven by the fact that after 10 minutes the mat's chemical still felt as if they were in their initial crystalline state and had not gone liquid. Too bad: it sounded like a great idea.

Now I'm A Real Fan

If it's a laptop cooler you want, our results say go with one of the fan units we have evaluated. At $20, the Antec does an acceptable job. Its custom USB cable plug and socket on the cooler are a bit flimsy and may be a source of future problems.

But if you have the additional cash, I would spring for the Zalman. In my opinion, its construction, design, cabling, fan speed control and proven superior cooling performance easily justifies its higher price. It's so quiet I wasn't sure it was on, even at full speed.

Whichever cooler you decide on, tell them you saw it in *Monitoring Times*.

Next Time

So there you have it on laptop cooling. Enough hardware! Next time it's back to the world of radio software. Till then…stay smart and cool.

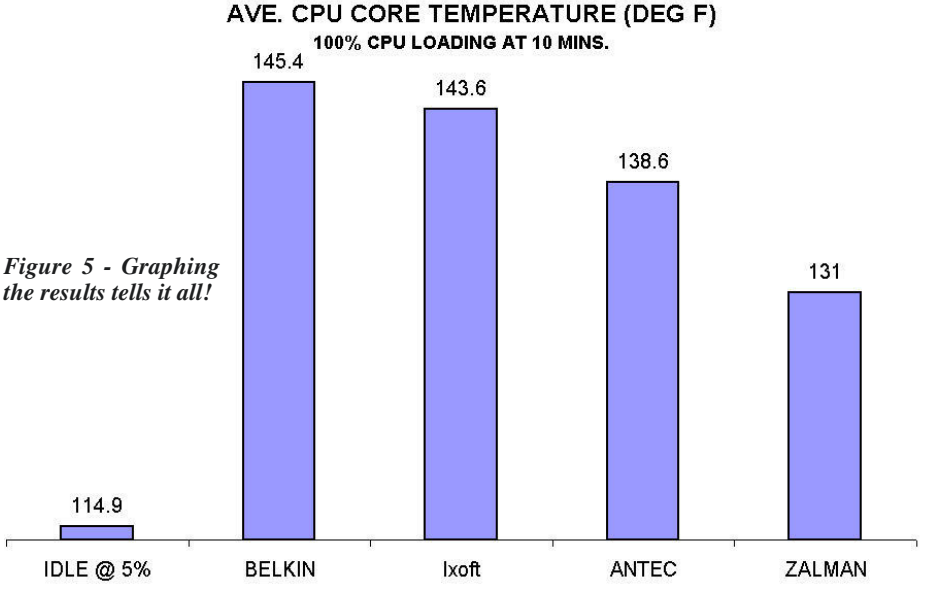


Figure 5 - Graphing the results tells it all!

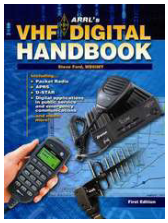
What's NEW

Tell them you saw it in Monitoring Times

ARRL VHF Digital Handbook

Steve Ford, WB8IMY

In the feature section of *Monitoring Times* this month, I profiled ham radio digital modes. But digital modes are not limited to the HF radio spectrum. A lot of us who have been around the bands for many years remember the packet radio craze in the late '80s and early '90s in the VHF/UHF spectrum. Then the Internet became a daily part of life and the amateur radio packet networks sharply declined in activity.



The chatter on the repeaters at that time was that digital radio activity on the VHF/UHF bands was dead.

Nothing could be further from the truth. As the digital mode sound card craze cranked up, it spilled over into the VHF/UHF spectrum as well.

Pioneers such as Joe Taylor, K1JT, have led the way in developing innovative software that let hams conduct digital meteor scatter contacts, and even moonbounce communications with a modest radio station setup. These are just a couple of areas of digital communications that can serve as a jump start to digital communications in the VHF/UHF spectrum.

Now, just in time for our annual amateur radio edition of *MT*, the ARRL has announced the release of their new book – *VHF Digital Handbook* by Steven Ford, WB8IMY.

Without complicated "owners manual" jargon – ARRL's *VHF Digital Handbook* presents the material through a unique how-to approach and friendly, conversational style. Readers will understand how to set up and operate their equipment and software, and make the best use of their VHF digital station. The contents of this new book includes:

Packet Radio Fundamentals – All the basics including Terminal Node Controllers (TNC), operating commands, and networks (such as DX Packet Cluster).

Automatic Position Reporting System (APRS) – Packet radio has been "repurposed" to create the worldwide APRS network. This wide-flung packet radio network exists to support many ham radio public safety activities. You can track moving objects on maps (other stations, public service vehicles, marathon runners, etc.). Connect your own GPS receiver and transmit your location even as you're moving. Even realtime weather conditions and email message traffic is passed over ham packet networks.

D-STAR – Enjoy high-speed digital voice and data on the growing network of D-STAR repeaters. Developed by the Japanese Amateur Radio League (JARL) and marketed by Icom here in the US.

Digital Meteor Scatter and Moonbounce – Explore weak signal operating using the software masterpiece WSJT by Joe Taylor, K1JT.

APCO-25 – While there isn't an APCO-25 ham transceiver yet (as of press time), that hasn't stopped ham from exploring this digital mode commonly found in the public safety spectrum. Hams have started adapting commercial APCO-25 equipment for amateur radio use.

High Speed Multimedia – Discover how you can set up your own wireless Amateur Radio data network by modifying over-the-counter gear such as routers and access points. It's ham WiFi consumers can only dream about!

Technical Descriptions – In-depth information about AX.25, D-STAR and APCO-25 protocols.

There is a lot of information in this 8-1/2 x 11-1/2-inch soft cover book including digital applications in public service and emergency communications: Packet radio, APRS, Winlink 2000 and more.

This first edition, © 2008 is published by American Radio Relay League, Inc. ISBN: 0-87259-122-0), ARRL publication number1220 is $19.95 plus shipping and handling. And as I pointed out in my Ham digital radio feature, I highly recommend you order the ARRL *HF Digital Handbook* (reviewed in the February *MT What's New* column). That book is in its fourth edition, © 2007 and also published by American Radio Relay League, Inc. ISBN: 0-87259-103-4, ARRL publication number 1034 is $19.95 plus shipping and handling. Order details below.

New ARRL Instructor's Manual

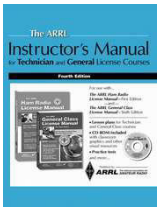
The American Radio Relay League has released a new manual for instructors teaching Technician and General class courses. This new 4th edition now includes course material to teach a General class course.

The ARRL Instructor's Manual is designed for use with the ARRL license manuals below:

The ARRL Ham Radio License Manual - First Edition (ARRL publication number 9639)

The ARRL General Class License Manual - Sixth Edition (ARRL publication number 9965)

This new publication includes: Lesson plans for Technician and General Class courses, practice test, and a CD-ROM with classroom graphics and other visual resources.



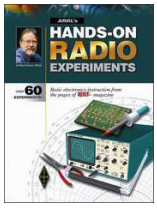
There is an interesting chapter written by Peter Kemp, KZ1Z – *The Teacher's Guide to Amateur Radio Instruction*, that includes such topics such as class organization, teacher qualities, classroom management, a guide to learning styles, and much more.

The *ARRL Instructors Manual* is a 8-1/2 x 11 1/2-inch soft cover book with CD-ROM. Fourth edition, © 2008 is published by American Radio Relay League, Inc. ISBN: 0-87259-126-3, ARRL publication number 1263 is $19.95 plus shipping and handling.

ARRL's Hands-on Radio Experiments

H. Ward Silver, NØAX

Ham radio is where "hands-on" lives on and this new book from the ARRL epitomizes that mantra. This book has 61 short electronics experiments, designed to increase the reader's understanding of basic radio fundamentals, components, circuits and design. Areas covered include: Radio and electronic fundamentals; semiconductor basics; building block circuits; power supplies; filters; oscillators and buffers; transmission lines and impedance matching, workshop and design techniques; and it includes a complete parts list.



These experiments, devised by H. Ward Silver, NØAX, first appeared in *QST* magazine's *Hands-On Radio* column from 2003-2008. The collection covers a wealth of topics designed to educate today's radio experimenters, and inspire others who want to learn what makes their radios work. Even seasoned experts will encounter new approaches to practical methods, new explanations for familiar topics and new ideas that will enhance your understanding of the radio art. Step-by-step, Silver expertly leads you through each experiment and you'll make discoveries along the way.

First edition, © 2008 is published by American Radio Relay League, Inc. ISBN: 0-87259-125-5, ARRL publication number 1255 is $19.95 plus shipping and handling.

You can order any of the new ARRL publication above or any other League publication online at **www.arrl.org**, or via their toll free order line at 1-800-277-5289. The snail mail address is ARRL, 225 Main Street, Newington, CT 06111-1494. Be sure to include shipping and handling.

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*

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Attention all those wanting to know what's going on with ham radio in the New Orleans area, check out: **http://groups.yahoo.com/group/GNOAmateurRadio/**

MT BLOGS

Blogs offer an opportunity for columnists to share information that does not make their columns. The news might be too timely for deadline, too short, confined to a small geographical area, too far away to be heard in North America, or even off the columnist's regular "beat." Bookmark these blogs for frequent visits!

MT: AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

MT: EDITOR'S DESK (Corrections posted here as well as on MT website)
http://mt-editor.blogspot.com/ - by Rachel Baughn

MT: FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

MT: MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

Larry's Monitoring Post
http://monitor-post.blogspot.com/ - by Larry Van Horn

MT: SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

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