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Micro-Broadcasting: License-Free Campus Radio

In this issue:

- Carey Junior High School ARC
- WEFAX Reception on an iPad
- MT Reviews: MFJ Mini-Frequency Counter

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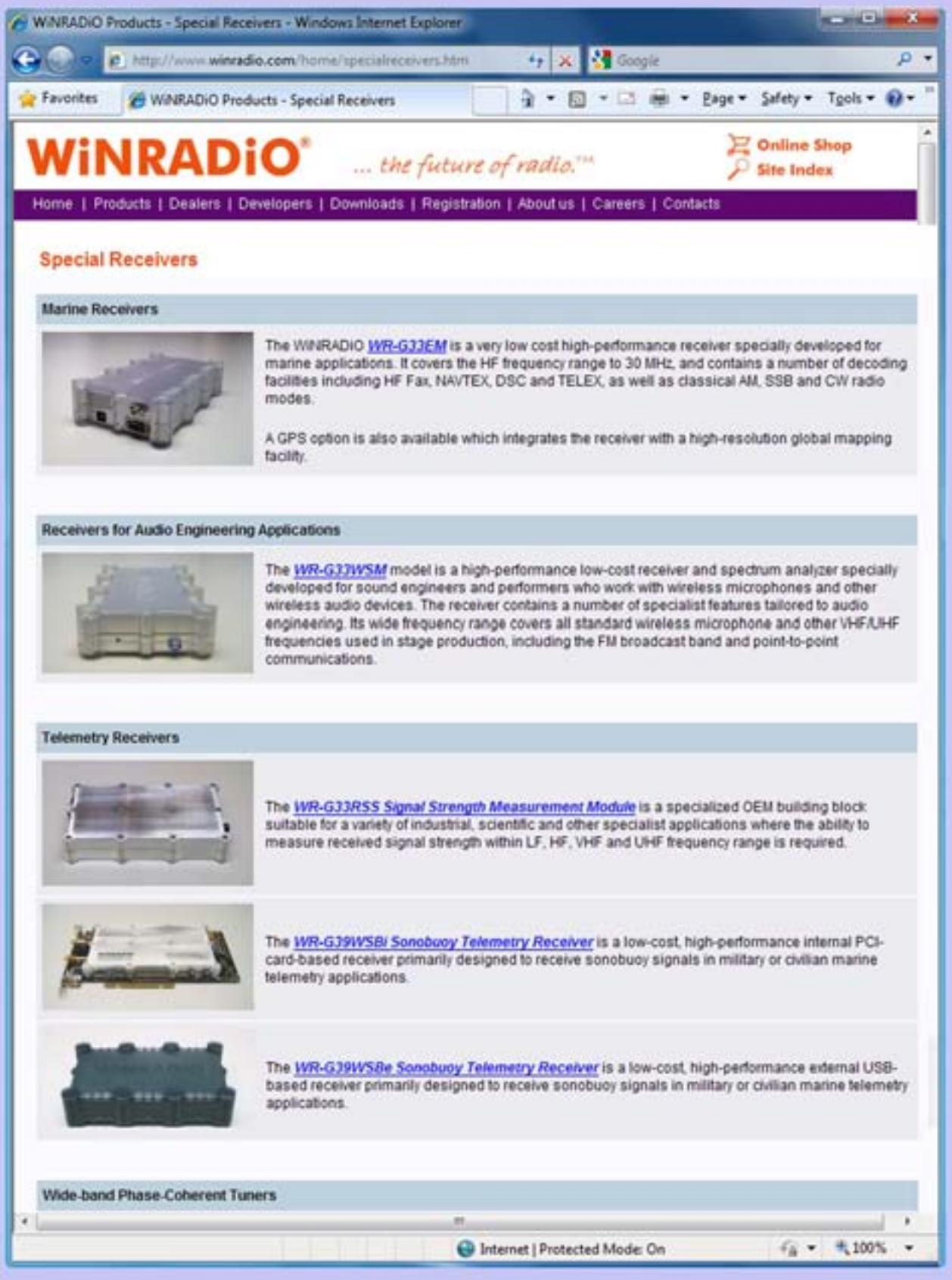

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Monitoring Times

Vol. 30 No. 9 September 2011

On Our Cover
Author Bill DeFelice with Anna Rae Newland (front) and John Charles Mortiz (back left), two students from McMahon FM the Part 15 FM radio station at Brien McMahon High School in Norwalk, Connecticut. (Courtesy: Bill DeFelice)

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MT 2011 Reader Survey

We are always looking for ways to improve *Monitoring Times*. Please take a few minutes to answer the questions below and mail the form to: MT 2011 Survey, 7540 Highway 64 West, Brasstown, NC 28902-0098. *MTXPress* subscribers who wish to participate in the drawing can send a pdf or text copy of their survey via email to mtsurvey@monitoringtimes.com or can mail it in. The results of the survey will help us plan future editorial direction.

(Participants will earn a place in a drawing for a $100 gift certificate from Grove Enterprises and each subscriber participating will get a one month extension on their current Monitoring Times subscription)

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_____ Shortwave - broadcasting

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AMATEUR

If you are an amateur radio operator, please check your license class.

Novice___ Technician___ General___ Advanced___ Extra___

Are you planning to upgrade your license in the next year or so?

Yes_____ No_____

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Yes _____ No _____

How many of the following amateur transceivers do you own?

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How old are the transceivers that you own? _____

SHORTWAVE

How many shortwave receivers (including portables) do you own?

_____

How old are the shortwave receivers that you own? _____

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How many scanners do you own? _____

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COMMUNICATIONS

by Ken Reitz

AMATEUR /SHORTWAVE

BBC Cuts Offer Poor Trade-off

After taking a 16 percent cut in its foreign broadcast budget and silencing its shortwave transmissions to regions of the globe most in need of them, BBC World Service announced that, in a self-fulfilling prophecy, global listening to the venerable radio voice is now down by 14 million listeners; from 180 million in 2009/10 to 166 million in 2010/11, according to BBC's own numbers released in mid-July.

It was also announced that BBCWS online listening had risen 40 percent from 7 million in 2009/10 to 10 million in 2010/11, a scant 156 million *fewer* listeners than tune in via the radio. Even British government bean counters should be able to see they've crafted a very poor bargain.

Push to Save RNW

According to the English language Radio Netherlands Worldwide website, a global call has been issued to save the storied Dutch international broadcaster. On their website RNW offers a lengthy list of quotes from celebrities, officials, even one Nobel Peace Laureate, in protest of the proposed 70 percent cut to the broadcaster's budget, from 46 million Euros to 14 million Euros per year.

RNW General Director Jan Hoek and Editor-in-Chief Rik Rensen called the cutback unprecedented. They issued this statement that appears on the RNW website: "In today's international world, each self-respecting country has to live up to its responsibilities. The Education and Culture Ministry (OCW) is making it impossible for us to do this. Without any preliminary research, nor any consultations, a decision has been taken that will leave a global audience of millions out in the cold and will cost 250 jobs."

AM/FM/TV/CABLE

LPFM Window to Re-open

In a mid-July press release, the FCC took initial steps to implement the Local Community Radio Act (LCRA) to promote community radio through the licensing of low power FM (LPFM) and FM translator stations. But, as usual, don't expect any quick action. The release notes that the Commission plans to open the LPFM window by summer 2012. That's actually a good thing, because you'll need plenty of time to put together a civic group in your area in order to apply to set up your own LPFM station. For updates on LPFM license details, go here: **www.prometheusradio.org**.

The press release also noted that the FCC is trying to decide on the processing of some 6,500 pending FM translator applications (LPFM licenses and FM translator licenses are treated the same by the Commission); whether the Commission should take steps to prevent "trafficking in FM translator construction permits," and whether to permit FM translator applications pending as of May 1, 2009 to rebroadcast AM stations in the same manner as FM translator stations authorized prior to that date.

The FCC's action regarding LPFM licensing is directly a result of tremendous effort by the Prometheus Radio Project which also hit pay dirt in Federal District Court in early July, when a judge struck down FCC policy that allowed media cross-ownership in a single market. That policy had been put in place during former FCC Chairman Michael Powell's term and was challenged in court by Prometheus. The judge called the policy "undemocratic."

FCC Looks at Ad Limits to Kids

With states trying to balance their budgets on the backs of PBS programming, including their world renowned and respected children's programming, it's easy to forget that the free market falls notably short when it comes to suitable things for children to watch on TV. Anyone who's watched what passes for commercial TV or cable-TV children's programming might think, "Isn't there supposed to be a limit on advertising and content on this stuff?" Yes, but it's mostly a joke.

According to an article in *Multichannel News* from July 15, the FCC has revived the practice of auditing cable and satellite TV operators' compliance with rules about ad limits in programming aimed at children. Not that the Commission spends a whole lot of time scrutinizing similar practices for Over-the-Air (OTA) TV stations; that's only done on a voluntary basis once every ten years when a station's license is up for renewal. Even so, that procedure has resulted in some 7,000 citations being issued over the last 10 years to TV stations for violations of those rules.

PBS Kids doesn't have the 12 minutes per hour of commercials allowed by the FCC.

By contrast, according to the article, cable and satellite TV have *never* "self-reported" a violation. Commercial TV, cable and satellite TV programming is allowed 10.5 minutes per hour on weekends and 12 minutes per hour on weekdays for commercial messages to children.

TV Consolidating/Cashing Out

A sign of the times, and a glimpse into the future for OTA broadcasting, comes in two recent reports: An article in early July appearing in the *Montgomery* (Alabama) *Advertiser* explained a three station deal by Montgomery's ABC, CBS and CW affiliate stations to merge their operations. According to the article, less is more with the three stations now able to invest in a state of the art HD broadcast facility they'll share. You might say the stations jumped before they were pushed. This is exactly what the FCC is hoping will happen across the country as OTA TV broadcasters could be asked to voluntarily surrender their licenses and consolidate spectrum space to be auctioned off to mobile TV interests.

The other story comes from the *Tampa Tribune* and details the plight of St. Petersburg (Florida) city-owned television station WSPF, channel 35, which broadcasts city related programs including city council sessions. In an effort to cut expenses, the city would like to sell this broadcast property, but there's a problem. It's a low power station and its signal doesn't go beyond the city limits. The city believes there are so few viewers watching the OTA signal, which is also simulcast on cable-TV systems city-wide, that there's no point in maintaining the station. There may be no buyers as well.

PUBLIC SERVICE

PA Town Wary of Digital Upgrade

An article in the *Pottstown* (Pennsylvania) *Mercury* in early July explained the issues facing cash-strapped municipalities forced by larger administrative governments to buy into dubious public service radio projects. Pottstown's council is concerned about an unfunded mandate by the county government to bring the borough's po-

lice radio system in line with the county's P-25 digital radio system. Their current analog radio system, in use since 1996, cost half a million dollars at the time. Now the municipality will have to shell out big money to upgrade to the new system. Even with financing help from the county, the article explained, the city could find itself paying over a 10 year period for radios not expected to last more than five years. One councilman worried that the plan could end up bankrupting municipalities forced to sign up.

FL Paper Decries "No-bid" Contract

Another familiar story is playing out in Seminole County, Florida where, according to an editorial in early July appearing in the *Seminole Chronicle*, the county is being asked to buy into Motorola's P-25 radio system under an unclear pricing scheme in a no-bid sale. Cost of upgrading the county's analog system to digital is said to be $36 million, but, according to the editorial, nothing's certain about that number, and terms of the contract forbid competition until 2016.

TECHNOLOGY

Georgia Tech Engineers find "Free" Energy

While many worried that electromagnetic energy streaming out of every cell tower, WiFi hotspot and radio/TV antenna would harm them, engineers at Georgia Tech College of Engineering sought to capture that energy. In a press release from July 6, researchers at Georgia Tech said, "By scavenging the ambient energy from the air around us, the technique could provide a new way to power networks of wireless sensors, microprocessors and communications chips."

At a presentation at the IEEE Antennas and Propagation Symposium in Spokane, Washington, the group explained that they used simple inkjet printers, specially formulated ink, and printing on flexible polymers to make antennas designed to capture enough ambient RF radiation to power simple devices.

Courtesy: Georgia Tech College of Engineering

"Scavenging experiments utilizing TV bands have already yielded power amounting to hundreds of microwatts, and multi-band systems are expected to generate one milliwatt or more. That amount of power is enough to operate many small electronic devices, including a variety of sensors and microprocessors," the report said.

LightSquared/GPS Interference Shambles

The genius of the free market and the slow-footed inner workings of government bureaucracy have combined to create hysteria among GPS device manufacturers and owners. The upshot is that one company, LightSquared, a 4G wireless broadband company, spent billions to build its satellite and terrestrially based high speed Internet service to all regions of the U.S., particularly rural regions which is all part of the FCC's grand plan. So what's the problem?

While LightSquared was building their system, GPS manufacturers, engaged in the cutthroat business of staying competitive, have made their units cheaper and cheaper and thus now susceptible to interference from the LightSquared transmission network. GPS companies have cried foul and the FCC is up against a clock, ticking toward launch of the service in the first half of 2012.

But, there's no placating GPS's nearly frantic customers driven to distraction by the thought that their GPS devices won't work properly. Can the FCC get it into high gear to save the day? Will anyone even buy LightSquared's service? Do you know the way to San Jose? Stay tuned!

JetBlue to offer LiveTV on Overseas Flights

According to industry reports, JetBlue Airways will be offering LiveTV's Ku-band satellite delivered programming to passengers aboard their overseas flights. But, the only way you'll see the three to five channels of live programming will be through apps on your own personal viewing device. Next year, LiveTV will be offering a Ka-band satellite service to domestic U.S. flights with the same personal device reception scheme. The channels on offer were not listed specifically, but will include live news and sports channels.

FCC ENFORCEMENT

Minnesotans Cited for Pirate AM Violations

Operating on information received at its Chicago field office, FCC field agents visited two people in St. Paul, Minnesota and issued Notices of Unlicensed Operation (NOUs) for illegally operating AM radio stations. According to FCC documents, one person was operating two AM transmitters on 1620 and 1630 kHz with 470 microvolts per meter at 1,243 meters and 450 microvolts per meter at 599 meters respectively. The second individual was operating 550 microvolts per meter at 353 meters on 1650 kHz using a system of five antennas mounted on the roof. The maximum power allowed by Part 15 rules is 14.5 microvolts per meter at 30 meters for 1650 kHz.

Nevada FM Pirate cited for QRO

A number of FM pirate broadcasters were issued NUOs by FCC field agents, in the thirty day reporting period since last month's *Communications* column was filed. They include an operator in Cambridge, Ohio broadcasting on 98.3 FM; an operator in Chester, Pennsylvania broadcasting on 101.3 FM, and another Pennsylvania operator on 106.7 FM.

But, this month's high power (QRO) pirate operator was a man in Lovelock, Nevada, who was discovered operating an FM transmitter on 105.3 MHz at nearly 2.5 million microvolts per meter at 114 meters (maximum FM power allowed under Part 15 device rules is 250 microvolts per meter at 3 meters), that's 10,000 times the legal power limit. But wait, there's more! Spurious emissions from his massive transmitter pumped out a second harmonic on 210.6 MHz measured at 1,852 microvolts per meter at 114 meters. That also exceeded the Part 15 rule of 150 microvolts per meter at 3 meters allowed on that frequency.

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

Micro-Broadcasting: Getting the most out of Part 15 Radio

By Bill DeFelice

I was an electronics enthusiast all the way back to my pre-teen years. It all started with my introduction to low power radio "broadcasting" – a Radio Shack AM wireless microphone, called a "P-Box" kit, which I built back in the mid-1960's. I decided to attend a vocational-technical high school to pursue an education in electronics. My curiosity continued as I started designing and building transmitters with a handbook from the Amateur Radio Relay League serving as a guide. Radio intrigued me and I wanted to learn more about the world of radio broadcasting.

In my teen years I got involved with what was then a 330-watt community FM station located at my hometown high school. The station's founder and technical director became my mentor and, under his guidance, I served as student chief engineer during most of my tenure prior to graduating and moving into the working world. This valuable experience opened doors for me later in life to not only become chief engineer for a 1000 watt directional AM daytimer, but to work as a contract engineer for several other AM and FM stations.

For nearly three decades I've been employed as an electronics technologist for a municipal school district. With the renovation of one of the district's high schools, I was surprised to learn that, not only did they plan on building a television media center, but they planned a two-studio radio station as well. As is typical with such things, little thought was given on how to put it all together. Since many people in the school district were aware of my broadcast background it was up to me to figure out how to build the station, given limited funds and coming in after much of the renovation had already taken place. I did know that I wanted to give our students an opportunity similar to what I was fortunate enough to have had.

The campus is a stone's throw away from both the New York City and Long Island radio markets, meaning that the radio spectrum is crowded to the point where it would be impossible to apply for even the smallest licensed radio facility, a low power FM (LPFM) station.

St. Leo University (Florida) Part 15 campus radio station, on the air since 2008

Limited by both spectrum space and available budget, I knew I would have to be creative. I realized I would need to make the station a campus-limited operation. Luckily for me, this was the perfect opportunity to explore Part 15 radio.

What Is Part 15?

The Code of Federal Regulations is a compilation of all final regulations issued by United States federal agencies. Title 47 of this compilation is specific to telecommunications. Contained within Title 47 is Part 15, the section addressing the regulation and use of license-free, low power radio devices that emit signals across the radio spectrum. Subpart C addresses the use of an intentional radiator, otherwise known as an antenna. I focused on the regulations addressing operation within the AM and FM broadcast bands.

There are several rules governing the use the Part 15 radio devices on the AM broadcast band. Part 15.209 explains that legal operation is defined as field strength dependent on the operating frequency. The formula of 24000 divided by the operating frequency in kilohertz equals the allowable signal strength in microvolts per meter, which is measured at a distance of 30 meters from the antenna. Other than the specified field strength there are no physical limitations imposed regarding the antenna or ground system.

Since a typical hobbyist doesn't have access to calibrated measurement equipment, there is an alternative regulation. Part 15.219 allows operation by defining the input power to the transmitting device's final amplifier as not exceeding 100 milliwatts in combination with a total length of transmission line, antenna and ground lead not exceeding 3 meters in length.

Pertinent to operating on the grounds of an educational institution, Part 15.221 outlines field strength measurement requirements for three different operating modes: carrier-current (where the transmitted signal is injected into the AC power lines of the campus), radiating coax (special "leaky" coaxial cable that allows a controlled amount of the transmitted signal to radiate along its entire length) and antenna-based or "free radiating" transmission.

Building the Campus Station

Carrier current broadcasting goes back to the 1960's as the original budget-friendly method that allowed colleges and universities to have their very own license-free, student-run campus radio station. Carrier current transmission equipment and studio accessories are available from Radio Systems, Inc. of Logan Township, New Jersey, and were formerly offered by the now-defunct Low Power Broadcasting, Inc. of Pennsylvania.

I performed some limited carrier current test transmissions using borrowed equipment and found that carrier current signals do not travel well through the large power transformers commonly used by the electric utility. Because of how the AC power is distributed around our campus, I decided to use a free-radiated, antenna-based solution instead. Our AM transmitter was mounted on the roof of our main campus building with the assistance of our staff electrician. A fellow broadcast engineer loaned me his station's AM field intensity meter to allow me to perform my compliance measurements for operation under Part 15.221.

Our AM signal covers the campus grounds and parking areas quite well, in addition to portions of the main building's second floor. Operating with such a low signal level does not provide for optimal signal penetration, due to the concrete and steel that serve as major components of the building's structure. With that in mind, I wanted to give the students something more.

What about FM?

The regulations for Part 15 on the FM band are more limiting than those dealing with AM. As outlined in Part 15.239, the maximum field strength allowed in the FM broadcast band cannot exceed 250 microvolts per meter measured at a distance of 3 meters from the antenna. Under the most ideal conditions this would provide a listenable signal within 200 feet or so. It was clear that a typical Part 15 FM transmitter, equipped with a whip antenna, would not provide ample coverage for a sizable school campus.

During the initial phase of this project, I discovered that radiating coaxial cable would work as part of an engineered FM system, thanks in part to the folks at the now-defunct LPB Incorporated. Their staff gave me enough information to get me on the path to constructing a suitable in-building FM system. Fortunately, I was able to

order a quantity of their special radiating coaxial cable prior to their demise.

One of my co-workers assisted me with the installation of the cable within the drop ceiling of the main campus building. I purchased an adjustable 5-watt professional FM stereo transmitter so the output signal feeding the coax could be regulated.

Having the radiating cable co-mingled with other wires made it difficult to properly measure the signal coming from it. The folks at LPB were aware of this, and informed me that in their informal discussions with the FCC it appears an acceptable measurement could be obtained at 3 meters from the exterior wall of the campus building. After completion of the system we adjusted the signal with the assistance of an FM field intensity meter. Our cable will probably have to be lengthened eventually to provide improved coverage to the outer reaches of the building.

The free radiating Part 15 AM transmitter atop the McMahon main campus building. The transmitter was fitted with a short whip antenna during initial field strength testing.

It's Not Just for Schools

Part 15 broadcasting has had a place in daily life outside of its use for on-campus broadcasting. Everybody from the radio hobbyist to the fledging businessperson can utilize this method of legal, license-free, low-power broadcasting.

Real estate agents have been using low power radio transmitters for decades. Typically these "talking sign" transmitters are set up at a property for sale with a sign informing prospects to tune their car radio to a particular frequency while parked in front of a property for sale. The agent records his or her sales pitch, including contact information, into the transmitter's built in message repeater. Hundreds, if not thousands of these transmitters have been sold and are in use today. Most of these transmitters operate on AM with a much smaller percentage utilizing FM.

Music enthusiasts often use low power transmitters in conjunction with their portable music players, allowing them to listen to audio through their car radio without the headache of requiring a wired connection. Due to their intended use for music, most all Part 15 transmitters manufactured for use with these players broadcast in FM stereo.

Should you Build a Transmitter?

Those wanting to jump into Part 15 radio may decide to purchase a pre-assembled transmitter. Part 15 regulations state that any manufactured transmitter sold to the public must be certified as well as labeled clearly with its FCC identification number.

Budget priced AM transmitters are available with an indoor antenna, and some include accommodations for an approved outdoor antenna, which allows for improved range. The more expensive AM units are equipped with an integrated antenna and require outdoor installation. These transmitters often include options for either crystal controlled or frequency agile channel selection, automatic antenna tuning, output power regulation, and some are even equipped with basic audio processing, such as automatic gain control.

Kit transmitters offer those with basic soldering experience a less expensive alternative to purchasing a manufactured transmitter. Typically, kit transmitters offer less than satisfactory results that may disappoint those spending significant money for products claiming high performance operation. It's important to balance the kit building experience with the quality of the product.

For the true do-it-yourself hobbyist, Part 15 regulations allow you to home-brew up to 5 transmitters for your own personal use. This may be the best option for those with sufficient understanding of both radio electronics and the applicable regulations.

Your Very Own Radio Station

Programming your own Part 15 "radio station" may take less effort than you imagined. Many people simply use these low power transmitters to enable listening to various audio devices around their home. Portable music players and home audio systems, streaming audio from personal computers, satellite, cable, and over-the-air television are all candidates that may be used as audio sources.

Hardcore broadcast enthusiasts have been known to outfit full blown radio studios complete with mixing consoles, CD players, computerized automation systems and audio processors such as compressors, limiters and equalizers. Studios can be built using anything from basic gear found at any musician's supply store, right up to hand-me-down equipment discarded from your local radio station.

How Far Will It Go?

Coverage for the typical Part 15 station is dependent on the transmitter used as well as antenna placement. Part 15 FM is only really usable for approximately 200 feet or so due to the limitation on field strength. Usable coverage can be improved slightly if the transmitter's stereo circuitry can be disabled, as this can reduce the noise level received in the fringe coverage area. Some operators have successfully provided limited radio coverage to smaller apartment buildings and condominiums using Part 15 FM transmitters.

AM transmitters may provide better coverage, especially since some transmitters are designed for outdoor antenna placement. I've heard of instances citing coverage upwards of 2 miles with a well-engineered transmitter installation operating under Part 15.219.

Bear in mind that modifying a certified transmitter for extended coverage, such as using an antenna other than the one supplied by the manufacturer not only voids the unit's certification but may also open yourself to a visit from a local FCC field office should a complaint be received regarding your transmissions.

What Should I Play?

There are no legal programming restrictions for Part 15 radio, but I say that with one caveat. By spreading out multiple transmitters it's possible to reach a sizable audience. With that in mind it may prove beneficial for the operator to obtain clearances for any programming aired on their station. Campus stations may wish to do likewise, especially if online audio streaming is also a consideration.

Local over-the-air programming choices (or lack thereof), in most radio markets, often encourages those who consider building their own Part 15 station. If you're looking to garner an audience, you may wish to provide programming often overlooked by the stations that serve your community. Bear in mind that controversial con-

Author Bill DeFelice, right, in the control room of "McMahon FM", the campus limited station located at Brien McMahon High School in Norwalk Connecticut. Accompanying DeFelice are students Anna Rae Newland and John Charles Moritz.

tent with objectionable (i.e., obscene) language may draw complaints which could possibly result in a visit from the FCC, so you'll want to be conscious of what you decide to air.

Business owners may want to try their hand at using Part 15 radio. Car dealerships can provide information for after hours customers browsing their lots and fast food shops can tell their drive-thru customers about their daily specials. Some tourist attractions have employed Part 15 transmitters to provide information regarding parking, shuttle bus schedules and special events information.

Knowledge is Power

Building a campus-limited radio station may require engineering knowledge or equipment not readily available to most people. Engineered systems using specialty transmission methods, such as carrier current and radiating coaxial cable, may require special test and measurement equipment to confirm the as-built system is in compliance with Part 15 regulations. You may be able to seek assistance from the engineer from a local radio station. Chances are they not only have the equipment to take the required system measurements, but they may also see the possibility of acquiring their future employees from your station's talent pool.

Appling my own knowledge of both low power radio and broadcast engineering has allowed me to pull my campus station project together. One thing that I noticed, when I performed my initial research, was that very little quality information is available regarding the construction of a Part 15 station in an academic setting. And, what limited information I did locate wasn't well organized.

I realized that there was growing interest in Part 15 broadcasting, not only as a hobby diversion but also for school campus and business radio applications. With that in mind I pulled all my resources together and created the web site **www.hobbybroadcaster.net**. The site combines technical and legal references, equipment reviews, as well as copious resources to allow anybody to get the most out of their desired radio experience. And, community forums allow like-minded individuals to pool tips and tricks as well as share advice. It just made sense to help others so they wouldn't waste time like I initially did.

The technical hurdles are only part of the bigger picture of building a campus-limited radio station. Everything from funding the station's construction, finding a suitable location to house the studios and transmission equipment, getting support from the school faculty and support staff, locating the right volunteers to champion the station with the student body, as well as fundraising, are some of the challenges that need to be planned for and addressed.

Because of the multitude of uses, Part 15 radio can be educational, informative and entertaining. Your use for Part 15 broadcasting is limited only by your imagination.

About the Author

Bill DeFelice is former chief engineer of WMMM-AM/WCFS-AM in Westport, Connecticut and Webmaster of HobbyBroadcaster.net and the History of Westport Connecticut Radio web sites.

The specialized test equipment along with some Part 15 FM transmitters waiting to be evaluated in the* HobbyBroadcaster.net *evaluation labs.

THE PART 15 TRANSMITTER MARKET

By Bill DeFelice

There are a variety of Part 15 transmitters available for both the AM and FM broadcast bands and, depending on the intended use and desired coverage area, you may find one better suited to your own purpose. Here's a look at some available transmitters. Part 15 regulations have different specifications for AM and FM transmitters. Quoted are current list prices.

FM Transmitters

The standard regulation for any Part 15 compliant FM transmitter (Part 15.239) is that a transmitter's maximum field strength may not exceed 250 microvolts per meter, measured at a distance of 3 meters from the antenna.

Whole House 2 **$525** (pictured, left-most transmitter)

This FM transmitter is the second generation of the popular Whole House transmitter. Improvements include full coverage on the FM band, stereo/mono transmission modes, digital tuning display as well as the ability to be powered 4 ways (AA cells, AC power, computer USB, or auto cigarette lighter). It's equipped with a flexible wire instead of the traditional whip antenna.

BroadcastVision AXSFMT **$295** (older version pictured, second from left)

BroadcastVision provides equipment often used with audio/visual entertainment systems found in sports and health clubs. This manufacturer provides mini-entertainment systems where patrons can watch various television programs on monitors throughout the facility. The audio portion is transmitted on the FM band, allowing the patron to tune to the audio for the screen they're viewing. This transmitter also includes stereo/mono transmission mode, digital tuning as well as a whip antenna. It provides a better than average signal strength compared to some other units. I have evaluated older generations of their FM transmitters and would expect similar performance from their current product. www.broadcastvision.com

C Crane FM Transmitter **$69** (pictured, third from left)

The C Crane was one of the less expensive FM transmitters that provides portability and ease of use. Digital tuning, programmable automatic shut-off, an attached coiled audio input cable and included AC power adapter are among this unit's features. The audio quality is quite good for this budget priced transmitter. As of this writing I am awaiting the arrival of a test specimen of their newly updated FM Transmitter 2, which will be compared alongside the original. www.ccrane.com/radios/fm-transmitters/fm-transmitter.aspx

Decade CM-10 FM Transmitter **$199** (pictured, right side of group)

Decade is no stranger to manufacturing quality FM transmitters. The CM-10 is their consumer level transmitter offering a lower price alternative to their professional line of low power FM transmitters. With separate inputs and volume controls for both microphone and stereo line, this transmitter is housed in a sturdy aluminum case and features digital tuning. It is one of the few certified for use in both the US (Part 15) as well as Canada (Industry Canada certification).

Decade MS-100 **$515** (stereo model) (not pictured)

The MS-100 is the flagship product of Decade's professional grade Part 15 line. Unlike less expensive transmitters, the use of discrete electronic components allows this transmitter to have superior sonic clarity. This transmitter has selectable mono/stereo transmission mode, full band tuning and switchable bass boost. The MS-100 is also certified for use in both US and Canada. www.decade.ca/

AM Transmitters

Most of the AM transmitters evaluated were meant to be used for free radiating operation with an antenna. There are some transmitters that have special installation requirements to be Part 15 compliant. These conditions usually apply to AM transmitters utilized for carrier current operation.

Hamilton AM1000 Rangemaster **$800** (AM1000c Outdoor model)

This is one of the premium priced Part 15 transmitters. The Rangemaster is a crystal controlled AM transmitter that utilizes standard 102-inch whip antenna for ease and convenience. Options include frequency agile tuning as well as a professional audio interface adapter. One advantage of this transmitter is that all integrated circuits are socketed for easy in-field replacement. www.am1000rangemaster.com

ChezRadio Procaster **$695**

The Procaster AM transmitter is a frequency agile AM transmitter built and certified for use in both Canada and the United States. In addition to an integrated telescopic antenna, this transmitter features a built-in tuning meter and basic audio processor. It costs less than the Rangemaster, thanks to the use of surface mounted electronic components. www.chezradio.com

Talking House / I AM Radio Transmitter: **$99** (basic model)

The Talking House AM transmitter was originally available only to real estate agents to use as a "value added" service to sell homes. The Talking House transmitter is frequency agile and features a completely automatic output tuning system when using the included wire antenna. An optional external antenna tuning unit allows the operator to locate an external whip antenna outdoors while keeping the transmitter protected from adverse weather conditions. The transmitter also contains a built-in digital message repeater allowing up to 5 minutes of total audio with a maximum of two messages. www.iamradio.net

Professional broadcast equipment manufacturer Radio Systems, Inc., of Logan Township, New Jersey acquired the product line back in May, 2009, and their engineers have developed an improved version of the Talking House transmitter. The I AM Radio transmitter features improved audio fidelity and is currently one of the least expensive options available for Part 15 AM broadcasters. Radio Systems also manufactures the TR-6000 transmitter and companion CP-15 carrier current coupler for use for campus-limited AM broadcasting. www.talkinghouse.com

Kit Transmitters

Unlike commercially manufactured Part 15 transmitters, kit transmitters do not require FCC certification. Kit transmitters provide the electronics enthusiast with the opportunity to acquire a transmitter at a reduced cost by performing their own assembly. Kit transmitters often offer lesser grade performance than their manufactured counterparts you have to weigh the performance verses potential cost savings when considering a kit.

Ramsey Kits **$35** and up

A long time manufacturer of a variety of electronics kits, Ramsey offers AM and FM transmitter kits ranging from entry level to something more complex. www.ramseyelectronics.com

SSTran AM Transmitter Kits **$99** (AMT-3000)

The SSTran AM transmitter kit is a long time favorite amongst antique radio collectors. The web site touts a standard coverage area of 50 – 200 feet with the standard wire antenna. This kit includes a built-in basic audio gain control circuit in addition to its crystal controlled frequency synthesizer. www.sstran.com

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CQ DX from KC7OEK

By Nick Casner K7CAS, Cole Smith KF7FXW and
Rayann Brown KF7KEZ
Photos by Paul Crips KI7TS

Watching students line up at the door in anticipation of getting on the airwaves, in hopes of capturing that long distant station, is just one of the many joys that are part of being an advisor for the Carey Junior High School Amateur Radio Club in Cheyenne, Wyoming. The walls of the room are full of QSL cards, and student hams are always looking in the atlas for the many places they have visited through the microphone.

This all started 18 years ago when Bob Mathews K7FDL and Paul Crips KI7TS wrote a grant through the Wyoming Department of Education to procure some amateur radio equipment. They received enough money to buy two Ten-Tech radios – a Delta and Argonaut, along with a three element beam, vertical antennas, and a complete two meter system. The school also picked up the necessary CW equipment to demonstrate and practice Morse code skills.

Every morning before school started, Mathews and Crips would see how many distant contacts they could make around 14.010 MHz using a well adjusted and trusted key. Most of their contacts were made using only 5 watts of power that the Ten-Tech Argonaut would produce. After logging contacts, they would report to their students and a pin was placed on the map showing the location of the operator.

We all know from our public school experience, that a lot of time is spent sitting in neatly lined desks listening to teachers talk about the day's lessons and preparing for the constant barrage of tests, so it is no surprise to see the curiosity that follows a demonstration on the radio. "How is that done?" is the most frequently asked question, followed by, "Can I do that?"

Both Mathews and Paul Crips have almost 70 years of combined teaching experience, so the professional tools to mentor many young people and "light the fires" of exploration are always present in their instruction. So, when a student asks if they can become an amateur radio operator, the Elmer role kicks into high gear with both of these seasoned educators.

During the first two years of operation with the Carey Junior High School Amateur Radio Club, the program licensed eight student hams. Seven of these students earned their General Class licenses and one earned her Extra Class license. This was when the Morse code requirement was still in place with the FCC. The following years brought many more young people into the amateur ranks.

A little coaching on the art of catching that rare DX is the job of Beth Wood KJ7FC (right), former Carey Junior High School student and club advisor who is spending time with ninth grader Cole Smith KF7FXW (left). Wood was the Hiram Percy Maxim winner with the American Radio Relay League in 1995. Wood is always encouraging the students to learn the art of Morse code, her favorite mode of operation, which is no longer required to earn a ham radio license.

Beth Wood KJ7FC earned her Extra Class ticket in 11 months at the age of 14 and went on to become the American Radio Relay League's Hiram Percy Maxim Award winner for the United States in 1995. Wood is still an active participant with the club and has been a guest operator on numerous occasions.

March 12, 1998, proved to be an exciting day at the club's radio station when the Carey ARC was selected to talk with the *Mir* Space Station and astronaut, Andy Thomas. Working alongside NASA and AMSAT, 14 students were able to talk with Thomas for five minutes as the *Mir* traveled at five miles per second in its orbit around earth. This provided a valuable lesson on physics and radio operations using a two meter uplink and a telephone patch system.

Over the years, the trusty old Ten-Tech radios have worked well, but thanks to donations from silent key amateur radio operator estates and other donors, the station has grown. We operate with all brands of radios and have a portable station that our club takes on mountain field trips.

The station is responsible for visits from three astronauts to our school including Captain Dick Richards, who took a Wyoming flag on one of his space shuttle missions, which is now displayed above our station.

The daily operations of KC7OEK are exciting as students get their log books out and start their daily hunt for contacts by asking if the frequency is in use and then starting their operation. Students are required to log their contacts and immediately send a QSL card. They are often encouraged to write a brief description of Wyoming and a little about themselves.

Our club president, ninth grader Rayann Brown KF7KEZ, set a new club record of 58 contacts in a one hour period for single sideband in April at the station. "I called CQ and gave our location. It seemed everyone on the east coast wanted to talk with me," Brown said. She was experiencing what ham radio operators call a pile up. Brown patiently picked through the calls and worked as many stations in the one hour time frame as possible. "I really like to rag chew because there is so much to learn about locations, occupations, and other valuable

"Calling CQ makes the school day so much more exciting," says ninth grader Rayann Brown KF7KEZ. On this particular afternoon 15 meters was very active indicating that solar cycle 24 was giving up more sun spots thus making the ionosphere more receptive to higher frequency bounce.

information, but today I just wanted to get call signs, QTHs and signal reports to see on the map where my signal was reaching. It's kind of like fishing, but with Amateur Radio there is no limit!"

Brown had one particularly interesting contact while being released from orchestra class to work the radio. "Most people who talk on the ham radio like to boast about their favorite contacts; those contacts that are far away on some small island located on the equator. I have talked with rare countries, but the contact that I really enjoyed so far was Allen K2ACB in New York. This contact showed me the true meaning of Ham Radio. We talked for over an hour, mostly discussing the westward expansion of the early pioneers in our country. Like me, Allen loved history. We talked about numerous American Indian Wars. We also talked about the influence the cowboy had on westward expansion and the large cattle drives that took place," Brown said. In addition they talked about how technology changed the country from weapons like the Winchester Model 1873 to the telegraph and the railroads."

Cole Smith KF7FXW, is another 9th grader who earned his General Class license so that he could enjoy the wonders of high frequency operations. Smith said it's not always about making a lot of contacts but how technology has brought our world closer together. "Being an amateur radio operator allows a person to communicate independently. You can talk all over the world regardless of cell phone companies or Internet service providers. My favorite contact on ham radio wasn't even mine. In the aftermath of the 2010 Haitian earthquake, while the rest of the world was standing back in awe at the tragedy that had just occurred, we listened to the relief efforts of emergency ham operators communicating with the Haitian hams. I would say that seeing how my hobby helped those Haitians get the supplies and services they needed was my favorite experience on the radio and, knowing that I possessed the capacity to do the same thing for help others, strengthens that feeling."

Ninth grader Nick Casner K7CAS, has been an inspiration for seventh graders working towards their licenses. Casner has technical skills that have helped keep equipment operational and enjoys helping amateur radio candidates understand the often complex technical questions that are on the FCC test. According to Casner, radio operations are more than just talking over the airwaves. "Amateur radio provides an opportunity to meet people, maybe just around town, around the country, or, if you are lucky, around the world. Amateur radio is also a great way to learn about electronics, principles of radio wave propagation, and even a little bit of math that's associated with building an antenna. I believe that the skills and knowledge gained from the hobby will be very beneficial and useful down the road. And, knowing that the hobby can be very useful in the future, and the fact that it is just great fun, makes it all worth it to me."

The Carey group is on the air frequently, fishing around the ionosphere listening to see if anyone will take the bait. If you hear a young person calling CQ and that person is searching for something to say, be patient; it's just one of the many Carey Junior High School students getting their start in one of the coolest technical hobbies that anyone can enjoy. After all, you might be this young person's first contact!

Antenna construction and wave propagation have always interested this amateur radio operator. Nick Casner K7CAS, is constructing a portable beam antenna in hopes of working operators on both 20 and 15 meters. Solar Cycle 24 is providing the necessary geophysical climate to work the upper high frequency bands around 21 to 28 MHz.

KC7OEK ARC CLUB STATS

The Carey Junior High School Amateur Radio Club has been going for about 18 years and is responsible for nearly 40 students becoming licensed. This past school year we had 24 students in the club, seven of whom are almost ready to take their exams. Our Volunteer Examiner group will assemble this month in hopes of getting the new batch of students licensed for the beginning of the school year. We have introduced amateur radio to some 5,000 students with numerous demonstrations and on air talks. Our wall has 195 QSL cards from this past school year alone (I moved rooms last year, so we took the old ones down). It is hard to accurately account for the number of actual contacts our station has made in 18 years, because when students leave they take their log books with them even when they use the club call. Starting this fall we will be entering all calls using an electronic logging program.

- Paul Crips KI7TS

NOAA's Radio System for all Seasons

By Ken Reitz KS4ZR

Each year a series of tropical storms and hurricanes stalk the U.S. coastline from New England to Mexico as wary Americans monitor their activity with great interest. While the hurricane season stretches from June through November, September has marked the season's peak for the last 150 years. And, for tens of millions of us, that's reason enough to own a NOAA Weather Radio.

But, these little radios are not just for summer weather; the rest of the year can bring uncertainty during months of hazardous winter storms and the outbreak of violent spring storms. That's reason enough for the rest of the country to own one of these radios, too.

Born in Chicago

The concept of 24 hour per day weather radio broadcasts began in Chicago in 1954 and was actually aimed at aviation interests. Those broadcasts were terminated in 1958 but, by 1960, the Meteorologist in Charge of the Chicago U.S. Weather Bureau Office suggested that the broadcasts be resurrected, this time directed toward local mariners. The new radio service was an immediate success, and in May of 1960 the service became permanent.

Upgrades to the Chicago station, known as KWO-39, throughout the 1960s and '70s, included moving the 300 watt transmitter to the top of a six story building and, on August 14, 1975, upgrading to 500 watts and moving to the top of the Sears Tower, at that time the world's tallest building. The new equipment – a rack of tape decks that would play recorded weather messages in a rotating fashion – would remain in action for more than 20 years.

By the late 1970s the NOAA Weather Radio system had expanded to 300 stations across the U.S., due in part to the "Super Outbreak of 1974," a 16 hour period between April 3 and 4 during which 148 tornadoes touched down in 13 states, killing 330 people, injuring over 5,500, in paths of destruction that totaled 2,500 miles. There were striking similarities between that outbreak and what could be called the "Super Outbreak of 2011." This year was actually two three-day periods: April 14-16 and April 26-28, which resulted in the spawning of more than 455 tornadoes that killed at least 380.

NOAA Weather Radio has changed dramatically in the last thirty years. From labor intensive analog transmissions on widely scattered and under powered transmitters, NOAA now has more than 1,000 transmitters across the fifty states and U.S. territories, many putting out 1,000 watts, and all using state of the art computer-synthesized voice messages that can be changed almost instantly.

The ubiquitous synthetic voice delivers routine forecasts and severe weather warnings in the same unflappable tone that, if not exactly warm and inviting, is at least imminently understandable. The original voice, dubbed "Paul," was developed in the late 1990s, the product of research by the late Dr. Dennis Klatt of MIT, a speech and hearing scientist.

But, the public was not happy with Paul. So, by late 2000 the National Weather Service began a Voice Improvement Processor program which resulted in the implementation of two new and more human voices in 2002 known as "Craig" and "Donna." One year later both voices received upgrades with Craig becoming "Tom" and Donna keeping her original name. A Spanish speaking voice, known as Javier, has been added to NOAA Weather Radio stations in predominantly Spanish speaking areas.

Weather Radios Get a Big Make-over

Early Weather Radios were simple, analog-tuned radios designed to receive a very narrow set of frequencies from162.400 to 162.550 MHz. Those radios had basically an on/off switch/volume control and a small tuning knob that consumers would use to find a nearby NOAA Weather Radio station, not an easy task in the 1970s. Stations were few and far between with just enough power to typically cover nearby areas.

In 2005, NOAA, along with a Consumer Electronics Association (CEA) working group, developed guidelines to help receivers adopt certain receiver capability standards that would qualify them as NOAA Weather Radios. These standards were revised in 2010 and include Public Alert™ device equipped radios with the ability to receive, in addition to normal NOAA weather bulletins, Specific Area Message Encoding (S.A.M.E.) alerts that warn those in the affected area of a specific reason to be alert.

While SAME messages are usually weather related, such as Hurricane Watch, Tornado Warning, Flood Watch, etc., there are three other categories that will trigger SAME radios to automatically turn on. These include: Technological (chemical or oil spill; nuclear power plant emergency; maritime accidents or train derailments); AMBER Alerts (reports of child abductions), and Terrorist Attacks. These non-weather related incidents aren't originated from the National Weather Service. Instead, they come from local, state or federal agencies and need to have met three criteria: the public safety is involved; the message comes from an official government source, and time is critical.

The technology for these alerts is the same as the Emergency Alert System (EAS) which is why, when such alerts are issued, they trigger broadcasts on over-the-air TV and radio stations as well as cable-TV and satellite systems. Radios, whether table-top, hand held or other devices displaying the Public Alert logo, are CEA and NOAA certified to receive SAME and EAS alerts.

While manufacturers have added Public Alert capability to all kinds of radios including shortwave radios, scanners, Family Radio Service hand-held units and

Radio Shack's Weather Cube® ($20) battery-operated, no-frills weather radio. (Courtesy: Radio Shack)

The big M stands for Midland in this stylized weather radio, the WR-10 ($40) features Weather Alert and user selectable voice, flashing LED or siren warning and is powered by a 9 volt battery with AC wall adapter. (Courtesy: Midland Radio)

Midland HH54VP hand-held, portable S.A.M.E. with Public Alert ($50) comes with wall charger/power supply, but battery pack is extra. HH54VP2 ($60) is available with a charging cradle instead of wall charger. (Courtesy: Midland Radio)

Flashing strobe for hearing impaired ($20) fits Midland brand radios. (Courtesy: Midland Radio)

CB sets, the most effective weather radios are desk-top stand-alone radios placed in a central location in the home and designed just to receive Public Alert messages.

CEA/NOAA requirements for Public Alert certification include the ability to receive the 1050 Hz tone alarm sent by the local weather radio station that brings all Public Alert-equipped radios to life and lets the SAME message play; have built-in SAME technology, and have battery backup. Other options, that aren't required for certification but are useful, include an external device jack that can be used to power a strobe light or "bed shaker" for hearing or sight impaired, and an external antenna jack.

Sangean CL-100 S.A.M.E., Weather Alert tabletop AM-FM weather radio ($80 at Universal Radio) features WX/FM external antenna jack, AM and ground antenna terminals, auxiliary alert jack, headphone jack and auxiliary input jack for your iPod or other MP3 player. (Courtesy: Sangean)

In some areas an external antenna may make the difference between getting a signal and not; however, not all Public Alert Certified radios have such antenna jacks. In addition, certain rooms or parts of houses may block signals from triggering the alert tone and an external antenna may help.

All Public Alert radios have an LCD display that scrolls across a small screen literally spelling out the nature of the warning and all have a series of three colored LEDs that indicate: Green (for an advisory), Amber (for a watch) and red (for a warning). All desk-top sets and even hand-held units, such as the Midland HH54VP, have these features ,which is why any radio that is First Alert certified is more expensive than a similar radio that offers only general Weather Radio reception.

The Fair and Foul Weather Radio

Weather emergencies are usually not a daily event. Most of us turn to our Weather Radios at the beginning of the day to see what's ahead. But, when a storm hits and the power is out, what happens? Weather Alert certified radios will stay powered on battery backup, but for how long? If you're using Weather Radios with built-in AM/FM radios or with other audio sources for entertainment during the power outage, they won't stay powered long. Hand-held Weather Radios will likely last longer during a power outage. Your non-Public Alert certified hand-held scanner with Weather Radio reception will likely last days or weeks with considerable use before depleting the batteries.

It could be that your radio's lack of power may not be your only obstacle to listening to NOAA weather reports. During a tropical storm that hit the area where I live several years ago, the local NOAA Weather Radio station was still reporting old forecasts long after the storm had hit. Eventually, the station disappeared from the air, which was just as well; no update was better than an old update.

For maximum bad weather coverage, keep a plug-in desktop Weather Radio on at all times in alert mode; it will turn on when bad weather is expected. If your power goes off, have a backup scanner or hand-held Weather Radio ready to use for the latest updates. Have an external antenna that can pick up Weather Radio stations outside your area. I've found that

Sangean DT-400W ($70 at CCrane) is a portable AM/FM/WX radio with Weather Alert. (Courtesy: Sangean)

Sangean PR-D9W ($70 at Universal Radio) AM/FM/WX with Weather Alert features rechargeable batteries. (Courtesy: Sangean)

even an old Radio Shack Pro-79 scanner operating on old batteries and attached to a VHF one quarter wave-length, outside-mounted ground plane antenna (Radio Shack catalog #20-176 $29) can receive three Weather Radio stations from different directions 80-90 miles apart. An amateur radio 2 meter beam or scanner beam will provide even better results. The odds are that one of the stations in listening range will be functioning in an emergency.

You can find out how near your next closest NOAA Weather Radio station is to you by checking out the official list here: **www.weather.gov/nwr/nwrbro.htm**. Click on "NOAA Weather Radio coverage maps," then click on your state; a map locating all NOAA Weather Radio stations with their assigned call letters will appear. If you click on any station you'll get another map showing the details of the transmitter's location, counties served and the frequency on which it transmits. By going back to the station list you can find out exactly how much power each station is transmitting, and whether or not a station is operating under "degraded" conditions.

I found that all but two Virginia NOAA Weather Radio stations operate on 1,000 watts output. NOAA also maintains a list of stations operating under degraded performance or which are currently out of service. As this is written 10 stations were operating with degraded performance and 12 were out of service nationwide.

NOAA Weather Radio's Future

NOAA's Weather Radio signal covers 98 per cent of the U.S. population. The cost of covering that last two per cent is huge, but NOAA is open to discussions with local groups that are interested in partnering with NOAA to accomplish that goal. NOAA has also been investigating low cost solutions to increase signal strength in shadow areas where terrain affects signal propagation.

NOAA is also investigating technological advances that will allow digital data to be broadcast over their network. This capability will also allow broadcast of polygon shapes generated with their storm based warnings, and text information for use by the hearing impaired, along with other text-based display systems.

Hunting Seagulls
Monitoring and Decoding WEFAX Broadcasts

By Christopher Friesen VE4CWF

The National Oceanic and Atmospheric Administration's (NOAA) logo is a white seagull in full flight, its wings spanning a circular, two-tone blue background. According to NOAA's website, the seagull, "represents life that exists and interacts within the areas of NOAA's primary concern: the sea, the land, the air and, more specifically, life's dependence on the interface of these elements."

The logo adorns all their official communications including the radio facsimile (usually abbreviated as WEFAX) transmissions that are broadcast from coastal radio stations to vessels at sea. It's important to know what the logo looks like because once it's been rendered in the monochromatic black-and-white of a WEFAX transmission, flown through the ionosphere and perched on the wires of an antenna it can be fuzzy and barely discernable amongst the other shapes on the page. But being able to identify the logo is important because it is confirmation that an official NOAA transmission has indeed been received.

NOAA WEFAX transmissions contain scientifically accurate data on a number of weather related items including ocean weather patterns, sea ice and surface analysis. Receiving and decoding these broadcasts requires a computer, software and some method of interfacing those with your shortwave radio. The broadcasts are intended for serious use by those in the maritime industry, but they are also fascinating for the radio hobbyist.

NOAA's WEFAX Service

According to NOAA's website, WEFAX transmission is 85 years old. "The earliest broadcast of weather maps via radio facsimile appears to have been made in 1926 by American inventor Charles Francis Jenkins in a demonstration to the Navy," it states. "While radio facsimile has been used for everything from transmitting newspapers to wanted posters in the past, the broadcasting of marine weather charts is today the primary application."

Following the *Titanic* disaster, the International Maritime Organization passed the International Convention for the Safety of Life at Sea (SOLAS). Periodically updated in 1929, 1948, 1960 and finally in 1974, the SOLAS convention is still in force today, and mandates that signatory governments, among other things, broadcast weather information in text and, if possible, graphic form. In the U.S., the Communications Act of 1934 also provides domestic statutory obligations for broadcasting relevant safety information to vessels at sea. Both require that the transmissions be free of charge.

Today NOAA's WEFAX information originates in the National Weather Service's Ocean Prediction Center (OPC). The Ocean Forecast Branch (OFB) of the OPC is located in Camp Springs, Maryland; near Washington, D.C. Timothy Rulon is in charge of webpages and dissemination with the National Weather Service (NWS). "They are created using a variety of Linux-based software programs by experienced marine forecasters," Rulon said, "The resulting images are placed on WEFAX servers supplied by the Marta Corporation and sent to the United States Coast Guard (USCG) and Navy as audio tones over leased lines."

The USCG has been authorized to transmit the facsimile bulletins on behalf of the NWS. The USCG currently maintains 23 U.S.-based transmitters dedicated to transmitting weather information in voice, simplex teletype over radio (SITOR) or WEFAX.

WEFAX transmissions are sent from 14 of those transmitters located at four USCG transmitter sites around the United States. Boston has three transmitters, New Orleans and Pt. Reyes, California have four, and Kodiak, Alaska, has the last three. Each transmitter broadcasts with 4 kW and together they provide coverage to the area for which the United States is obligated under the mandate of the SOLAS convention.

One of the first charts I received. Note the blurry logo on the right-hand side.

Marine Weather Bulletins and Their Use

Lee Chesneau is passionate about weather and NOAA's WEFAX products. Now retired, his career as a forecaster has spanned 40 years, 18 of which were spent at the OPC preparing forecasts for broadcast. Chesneau, whose name appeared on thousands of charts over that time period, now uses his knowledge to teach mariners about marine weather and the correct use of NOAA WEFAX products. He says mariners of every persuasion use WEFAX charts daily, "From professional merchant marine and commercial fishermen to your every day average coastal and blue water racer and cruiser."

Chesneau says NOAA's WEFAX products are important because they start with real weather feedback from mariners and buoyed instruments and don't rely solely on mathematical models. "They are derived through the human intelligence process," he explains. Chesneau's own website **www.marineweatherbylee.com** contains information on NOAA's WEFAX charts and how to interpret the graphics and symbols they contain. The OPC publishes a "Radiofacsimile Charts User's Guide" which also contains details interpreting the charts.

NOAA's Timothy Rulon says the graphical representation of weather forecasts is critical for maritime safety because ocean weather is much different than weather on land. "Winds that may be curiosity on land can be deadly at sea," he said. He also notes that WEFAX charts are reliable and simple to receive, making them accessible to mariners, armchair sailors and radio hobbyists alike.

"WEFAX can also be received with minimal hardware, little operator intervention, unattended, and momentary noise/signal problems do not necessarily result in loss of value of the product as it can with text," he explained.

What you need to Tune in WEFAX

Many commercial mariners use dedicated equipment to receive and print WEFAX charts, but it's not necessary for radio hobbyists to invest in expensive equipment. In fact, many will already have the required equipment. You'll need a stable shortwave receiver capable of accurately tuning to frequencies and receiving single side band (SSB) transmissions. You will also need a computer with a sound card and facsimile decoding software.

There are several sources of free trial soft-

ware available for download. The listed sources work well for decoding a variety of broadcast modes, but to receive and decode WEFAX transmissions they must all be set to their HF Fax mode and adjusted to the correct lines-per-minute and Index-of Cooperation as specified by the broadcaster.

"All WEFAX broadcasts of NWS products employ a WEFAX signal of 120 lines-per-minute (LPM) and an Index-of Cooperation (IOC) of 576," the NOAA website explains. "These values must be entered into the user's equipment or software program in order for the WEFAX image to be displayed properly."

Audio from the radio must be fed into the computer via the sound card, and the cheapest and easiest way to interface the two is with a simple patch cord with proper plugs at each end. Plug one end into the speaker out or headphone output of the receiver and the other end into the microphone input of the computer.

Depending on the software you're using, the audio from the WEFAX transmission will appear as a frequency waveform known as a "waterfall" with varying amplitude on a bar at the top of the software screen or a spectrum display with a spike in the spectrum indicating the carrier center. You typically have the option to use either display which can be used to determine correct audio level and verify the radio frequency.

Most WEFAX decoding programs begin to decode immediately. Once all the software and hardware adjustments are made, a low-resolution black and white image should slowly begin to emerge. The sharpness of that image will be affected by the strength of the signal the quality of the audio being fed into the computer and the amount of on-air atmospheric noise. Fading signals will produce less distinct lines on in an image.

Decoding programs often have the option of producing a reverse image and may allow received transmissions to be saved as JPEG files. A complete image will take about 13 minutes to receive.

Tuning in WEFAX

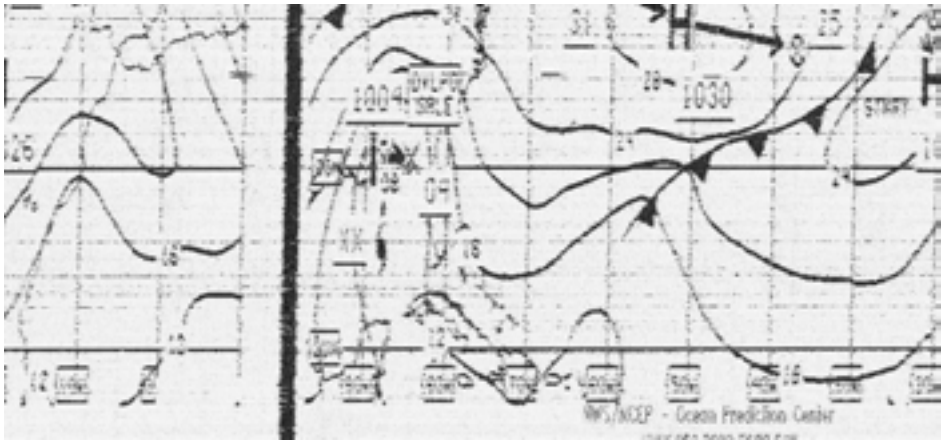
NOAA publishes a comprehensive schedule that details their broadcasts from the USCG transmitter sites called the *Worldwide Marine Radiofacsimile Broadcast Schedule*. The guide also includes a country-by-country listing of WEFAX transmissions broadcast by foreign governments and companies.The complete schedule is available free for download as a PDF file on the NOAA website. The most recently updated version of the schedule is from May 13, 2011 and lists the following active frequencies:

BOSTON:
- 4235 kHz
- 6340.5 kHz
- 9110 kHz
- 12750 kHz

NEW ORLEANS:
- 4317.9 kHz
- 8503.9 kHz
- 12789.9 kHz
- 17146.4 kHz

PT. REYES:
- 4346 kHz
- 8682 kHz
- 12786 kHz
- 17151.2 kHz
- 22527 kHz

KODIAK:
- 2054 kHz
- 4298 kHz
- 8459 kHz
- 12412.5 kHz



A chart from the Ocean Prediction Center.

Reception Reports

A clear logo on a clear chart may be the only confirmation of reception ever received. NOAA is interested in receiving feedback on their broadcasts, but mostly from mariners who use their WEFAX products. They do occasionally get reception reports and requests for QSLs from radio hobbyists which, Rulon says, are passed along to the Coast Guard.

But, even though they don't respond to reception reports, Rulon says hobbyists can provide a valuable service to NOAA by alerting them of possible technical problems. "We would mostly be interested in hearing of significant changes from what is heard routinely at a particular location, so we can quickly identify possible equipment issues," he says.

The Future of WEFAX

In 2007, the USCG began to question the need for continued WEFAX service. Their aging fleet of transmitters were becoming difficult and costly to maintain. With repair parts increasingly difficult to find and more expensive it can take months to repair such transmitters. The USCG issued a call for comments and found overwhelming support for continuing the WEFAX service among mariners who would be affected if it were terminated.

Based on those responses, the Coast Guard prepared a business case for investing in new transmitter equipment. At a cost of about $200,000 each, replacing the transmitters used for broadcasting high frequency (HF) weather bulletins would cost almost $4 million. Despite the high cost, the Coast Guard decided to continue their broadcasts. But, how long will that last? It's difficult to say, but the conclusion of the business case study offers hope to those who depend on the WEFAX service and radio hobbyists who are interested in monitoring these broadcasts.

"This study concludes that the responding public collectively perceives that the USCG HF broadcasts are essential to their safety," the web site says. "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."

That could change quickly as new technology emerges and new methods of communicating to ships at sea become available. Captain Len Ritter of the USCG, in a presentation given to the Radio Technical Commission for Maritime Services (RTCM) Assembly in May 2007, predicted the end of WEFAX. "Weather facsimile will likely end once low cost, high speed internet becomes generally available throughout ocean areas."

Until that happens, Timothy Rulon says WEFAX is still on a "relatively solid foundation." He says the USCG may re-examine the issue once it is time to recapitalize their transmission equipment, but says that is seven to ten years away. Until then, NOAA's WEFAX transmissions will continue to keep mariners safe and provide radio hobbyists a daily opportunity to hunt seagulls.

About the Author:

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RESOURCES FOR RECEIVING RADIO FAX

Software:

SeaTTY: **www.dxsoft.com/en/products/seatty**

MultiPSK

Freeware from Patrick Lindecker F6CTE not only decodes HF FAX but a multitude of other modes as well including SSTV, PSK31, CW, Packet, NAVTEX, RTTY, FeldHell,
www.f6cte.free.fr/index_anglais.htm

NOAA Broadcast Schedule:
www.nws.noaa.gov/om/marine/rfax.pdf

Understanding Weather Charts:
www.marineweatherbylee.com
www.opc.ncep.noaa.gov/UGbegin.shtml

HF FAX on iPad: Yes, There's an App for that!

By Ken Reitz KS4ZR
(All photos courtesy the author)

I've used a lot of HF Weather Facsimile (WEFAX) programs dating back to the Dark Ages (yes, the DOS era), when about the only thing available was a program that was delivered via the mail and arrived in the form of a floppy disc (yes, a real 5.25 inch floppy disc!). Depending on whether your copy got creased in the mail or came to you pre-loaded with viruses, it may or may not have worked on your machine. Even if it did, there was still plenty of work to do just to get an image to appear on your bulky, monochromatic, CRT monitor as your IBM 8088 groaned under the strain.

Black Cat's $2.99 Solution

Fast forward to 2011, and getting NOAA WEFAX to magically appear on your iPad screen couldn't be easier. First, there's a trip to the iTunes store to download Black Cat System's iPad HF FAX Weather FAX App for $2.99, a process that takes only minutes. You can find out all you need to know about the program here: **www.blackcatsystems.com/ipad/iPad_HF_FAX_Weather_Fax_App.html**.

The application loads quickly and an icon labeled "HF FAX" appears on your iPad's desktop. Simply touching the icon with your fingertip opens and automatically starts the program. What you also get with the program is NOAA's 128 page Worldwide Marine Radiofacsimile Broadcast Schedules, a list of WEFAX broadcast stations, their frequencies and a complete list of transmission products sent via WEFAX. There's a button at the top of the HF FAX screen labeled "Schedule" that brings the entire PDF file to your fingertips.

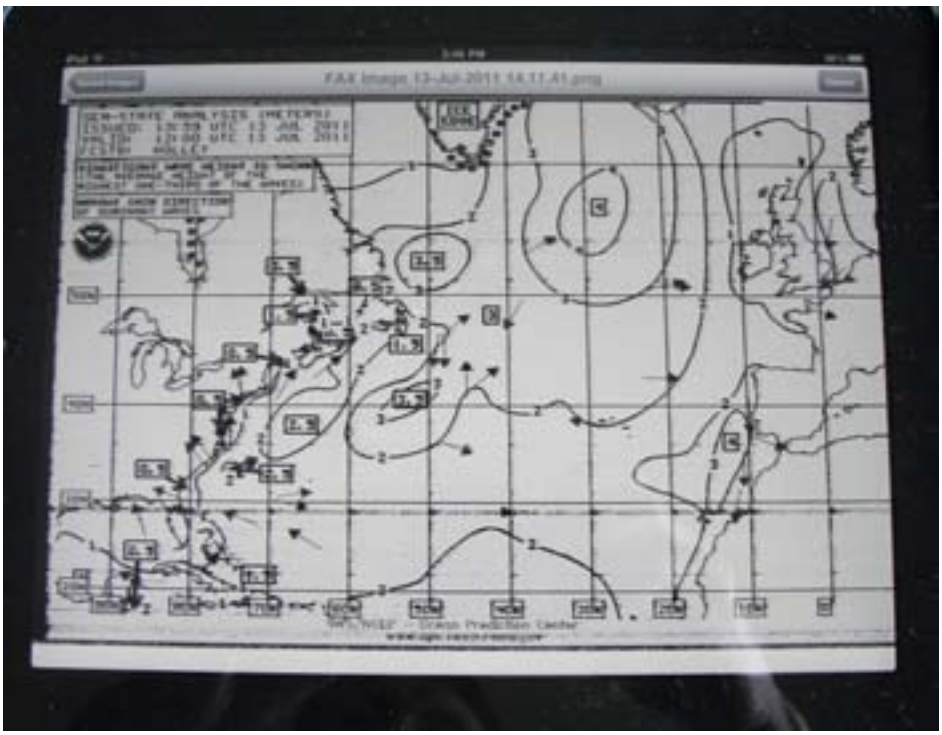
Getting started, I first tuned my receiver to 9108.1 kHz (the carrier is 1.9 kHz down from the assigned frequency 9110 kHz, that's the case on all WEFAX transmissions). I had an S9 signal from NMF, the National Weather Service's Boston, Massachusetts transmitter, so my expectations were high.

To display any FAX transmissions on any computer you simply take the audio out from either the headphone jack or speaker jack and plug it into the microphone input on your computer, adjust the volume control, and let the sound card do the rest. But there was a problem: Where the heck was the microphone input on the iPad?

Everything is small about an iPad and very cleverly done. I found the headphone jack just fine, but actually had to resort to the owner's manual to discover that the tiny little dot next to the headphone jack was the microphone. With no actual jack to use, there was only one thing to do: acoustic coupling; the old-school method of using a phone modem with your computer in the Dark Ages. So, plugging a pair of head phones into the headphone jack of the receiver, I placed one of the ear cups over the microphone on the iPad and watched as a WEFAX image from Boston began to appear.

Once an image is finished, you have the option of saving it by just touching the "save" button at the top of the screen. To view your collection of WEFAXs touch the "View Saved" button next to it. That brings up a file that lists by date what you've chosen to save. Touching any of the items in the list brings that FAX image to the screen. While a saved imaged is being viewed, you have the option of deleting it by just pressing the "delete" button on the right at the top of the viewed image.

Viewing a WEFAX image on an iPad is interesting, too, because, using your fingers, you can scroll through the image and either expand a portion for closer examination or shrink it.



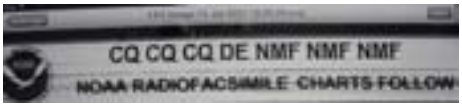
NOAA WEFAX showing Sea State Analysis received on an iPad via Black Cat Systems HF FAX App.

Tips for WEFAX iPad Success

Here are a couple of tips to maximize your iPad and your shortwave radio for WEFAX imagery: Use your receiver's memory to store the frequencies that work best at your location. The only way you'll know this is by trial and error, but it won't take too long to see which frequencies give best results. Remember that propagation throughout the day will require you to use frequencies in different bands.

The NOAA NWS product broadcast schedule goes years without change, so make a note of the products you're particularly interested in and work those into your listening schedule. It's likely your interests will be very narrow. I don't have any need for the ice charts, sea state analysis, or 48 hour wave period/swell direction image. My main interests are the "GOES IR Tropical Satellite Image" and the "Cyclone Danger Area" chart.

Note too, that transmitters in different regions offer different products. For example, Point Reyes, California offers Pacific and Northeast Pacific GOES IR Satellite Imagery; Boston offers Ice Charts and New Orleans offers a High Seas Forecast. Many of the other products are



NOAA WEFAX test pattern for NMF, Boston is the shortest FAX sent and IDs the transmitter site.

the same but are sent on different schedules.

To save time while band hopping, print out the frequency/contents pages of the Marine Radiofacsimile PDF file; it's only 20 pages of the entire 128 page file. It's a whole lot easier than going back and forth from the schedule to the program on the iPad.

Chasing WEFAX DX

DXing WEFAX transmitters around the world is an interesting challenge, particularly in the summer when atmospheric noise is highest. Luckily, we're just coming into the DX season and the possibility of hunting WEFAX transmitters is much greater, but identifying a particular transmitter site can be difficult; the audio sounds identical on each. All U.S. WEFAX stations helpfully provide a "Test Pattern," at times that are announced on their schedule, which appears on screen as a strip of WEFAX that reads "CQ CQ CQ de NMF," for example, clearly identifying the transmitter site as Boston.

Other stations around the world can be identified by other means, for example, HSW64 Bangkok, Thailand runs a "Test Chart" at 0050Z on 7395.0 kHz (good luck catching that station's 3 kW transmitter). BMF Taipei runs a "Broadcast Schedule" at 0040Z on four frequencies, all at 10 kW. HLL2 Seoul, Korea runs a "Special Weather Report" at 0000 and 1200Z on five frequencies, but at 3 kW. PWZ-33 Rio De Janeiro, Brazil sends a "Test Chart" at 0745 and 1630Z from its 1 kW transmitters on 12665 and 16978 kHz. Chilean stations CBV and CBM send "Test Charts" at 1100Z and 1550Z from their five 1 kW transmitters. Germany's DDK3 has a "Test Chart" at 1132Z on 7880 kHz and 13882.5 kHz, both 20 kW stations.

For QSL hunters, the Worldwide Marine Radiofacsimile Broadcast Schedule lists the mailing addresses for each station. With WEFAX DX, the better your antenna and radio, the more impressive your received images will be.

Last Word

As I tested the NOAA WEFAX program on the iPad over a several day period, I was impressed with how much easier this WEFAX program was to use than some more sophisticated programs I've used with my office-based IBM computer. It took all the guesswork out of receiving and storing WEFAX images; automatically stopping and starting with no slant or shift adjustments required.

Aside from the audio-coupling, it was clear that using an iPad and a shortwave radio made for the smallest and easiest method of decoding HF WEFAX I've seen to date. It's a good set-up for mobile operating, whether shipboard, in a car, or at home under emergency power conditions. Being able to view satellite imagery and weather maps without having access to the Internet or Over-The-Air TV is a big plus in emergency preparedness.

NOAA WEFAX GOES IR satellite imagery on an iPad.

And, as more amateur and radio hobby-related apps are dreamed up, small devices such as the iPad will increase in popularity with hams and radio enthusiasts. The iPad is quickly working its way toward being an all-mode radio device that, for its size, portability and usefulness, may also be fast working its way up your wish list. MT

SCANNING REPORT

THE WORLD ABOVE 30MHZ

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Keeping Up with Upgrades

When an agency disappears from a previously active frequency, it often takes some detective work to find out what happened and where to find them again. Once they're found, a listener may need to upgrade scanner equipment in order to resume listening. This month we help a reader sort out the details of his local police department's recent move to a new radio system and answer a few questions about a scanner he's contemplating.

❖ Huntington, West Virginia

Hi Dan,

I live in Huntington, West Virginia where within the last few weeks the Huntington Police Department has made the move to all digital (so I've been told anyway), and that's about the time that I stopped picking them up on my GRE PSR 300. I have just a couple of questions, but first of all I would like to thank you for the GREAT article on understanding trunking, very informative and easy to understand.

Now for the questions: as I stated previously, our police agency went digital. Now will they use the same frequency or will it change, and if it changes how long do you think it will be before someone publishes it?

I'm obviously going to have to change scanner radios, and I was looking at a used Radio Shack PRO 106. In your opinion is this a good scanner radio? Also I have the ARC 300 software by BUTEL on my computer but I don't think that this will work with the PRO 106. If not what software would you recommend? And, do you know if the USB cable that came with my GRE PSR 300 will work with the PRO 106?

Thanks in advance for your help.

Tom in West Virginia

Huntington is the second-largest city in West Virginia with about 50,000 residents, located along the Ohio River where West Virginia meets Ohio and Kentucky. Huntington is the county seat of Cabell County, but also extends into Wayne County to the southwest. It is home to Marshall University, a public university with nearly 10,000 undergraduates, most recently made famous in the 2006 movie *We Are Marshall*.

According to reports, the Huntington Police Department joined the West Virginia Interoperability Radio Project (WVIRP), a statewide digital radio system, on July 1 of this year. During the transition period from their old system, you may still occasionally hear them, along with other public safety operations, on the following Ultra High Frequency (UHF) frequencies.

Frequency	Description
451.8875	Huntington Police Department
452.3750	Huntington Police Department (Dispatch)
452.6500	Tri-State Transit Authority Dial-A-Ride (Base)
452.7375	Huntington Police Department
453.6750	Huntington Fire Dispatch
453.7000	Cabell County Police / Fire / EMS Tactical
453.7250	Cabell County Sheriff (Dispatch)
457.6500	Tri-State Transit Authority Dial-A-Ride (Mobiles)
458.4750	Huntington Police Department (TX Link)
460.0250	Marshall University Police Department
460.2250	Cabell County Fire (Dispatch)
460.4250	Cabell County EMS (Dispatch)
461.6000	Tri-State Transit Authority
461.6500	Cabell County Schools (Buses)
461.8250	Marshall University (Maintenance)
854.9875	Tri-State Transit Authority

When a public safety agency migrates from an old radio system to a new one, the frequencies may change and the type of signal may change. In some cases, an agency upgrades their radio hardware but keeps using the same frequencies, resulting in new signals to monitor. In other cases, an agency may keep their existing equipment but move to a new set of frequencies, as is happening in the 800 MHz band in a process called *rebanding*. In the case of the Huntington Police Department, they joined an existing system that uses more advanced radio technology, so both the frequencies used and the type of radio signal have changed.

Whether a new scanner is needed will depend on exactly what frequencies are used and what radio signals are employed, and of course the capabilities of the old scanner. Monitoring WVIRP requires a digital-capable scanner that can track "pure" digital trunked systems.

The WVIRP is a statewide public safety radio network operating in the UHF band. It uses APCO (Association of Public-safety Communications Officials) Project 25 (P25) standards, which specify digital radio signals between repeater sites and user radios. WVIRP is also a trunked system, meaning that frequencies will be shared between different users on a dynamic basis rather than permanently assigned to specific agencies or departments. The trunking signals are also fully digital and follow the P25 trunking standard rather than the older Motorola 3600-baud format.

❖ USB Cables

The GRE PSR-300 is a 1000-channel handheld scanner capable of tracking analog trunked systems including Motorola, EDACS (Enhanced Digital Access Communications System) and LTR (Logic Trunked Radio) systems. However, it cannot monitor or track digital signals, so it is unable to follow activity on WVIRP.

The manual indicates the USB cable is an optional accessory, so the cable Tom is currently using with the PSR-300 may be an aftermarket device or it could be a GRE product. According to the GRE America website (**www.greamerica.com**), the GRECOM USB Scanner Data Manager Cable works with the PSR series of scanners (Models 100, 200, 300, 310, 400, 410, 500 and 600) as well as a number of Radio Shack models including the PRO-93, PRO-95, PRO-96, PRO-97, PRO-106, PRO-197 and PRO-2067.

Radio Shack also sells a cable, part number 20-546, that works with all GRE scanners and many Radio Shack models: PRO-83, PRO-92, PRO-93, PRO-94, PRO-95, PRO-96, PRO-97, PRO-99, PRO-106, PRO-163, PRO-164, PRO-197, PRO-405, PRO-2029, PRO-2051, PRO-2053, PRO-2054, PRO-2055, PRO-2096, PRO-2067 and most new models. It is not compatible with some older scanners, including the PRO-82, PRO-2018 and the PRO-2052. This cable also comes with a demonstration version of ARC500 scanner management software.

The PRO-106 is a handheld scanner built for Radio Shack by GRE America, Inc. and introduced in 2007. It is very similar to the GRE PSR-500 and can scan and track APCO Project 25 digital systems, as well as Motorola, EDACS and LTR analog systems. Although the firmware is different between the PRO-106 and the PSR-500, they do use the same cables and can be controlled with the same PC software.

The PRO-106 does not come with a USB cable, but it will work with either of the cables mentioned above, and if Tom's cable works with the PSR-300 it should also work with the PRO-106.

The PRO-106 would be an excellent choice for monitoring the WVIRP. The scanner is fully capable of scanning and tracking the system and is easily programmed to do so. Enter the

control channels for each of the repeater sites to be monitored, then set the TSYS (Trunked System) to P25. Once programmed, the PRO-106 will monitor each control channel and tune to the correct voice channel when a talkgroup is active.

Older scanners, even if advertised as capable of following P25 trunked systems, may have difficulty correctly following activity in the UHF band. Because P25 systems were first built to operate in the 800 MHz band, early digital scanners were only designed to track activity in that band. As later P25 systems came on-line in the UHF and 700 MHz bands, those early scanners needed additional programming steps and even firmware updates to properly follow them.

❖ PRO-106 Firmware

If you're buying a used PRO-106, it might be worthwhile to check the firmware versions. By pressing the '3' key while the scanner is showing the Welcome Message during start up, you should see three version numbers. Each of these numbers corresponds to a particular part of the scanner. Radio Shack periodically makes available upgrades to the microprocessor ("uP") central processing unit (CPU) and the Digital Signal Processor (DSP) firmware applications.

The most recent CPU firmware is version 1.9 and the most recent DSP firmware version is 1.4. If the scanner shows versions earlier than these, you can download the upgrades from the Radio Shack web site at **www.radioshack.com/product/index.jsp?productId=3348287**

You can also search for the support page using the PRO-106 product number 20-106.

With a personal computer running Windows and the proper USB cable, applying the upgrades is a relatively easy and straightforward process that will only take a few minutes. The most common point of confusion appears to be getting the operating system to use the proper communications port, so be sure to read the directions and confirm the port settings are correct before attempting an upgrade.

❖ Scanner Software

The Butel software compatible with the PRO-106 is called ARC500. If you're already familiar with ARC300 and are happy with it, then using ARC500 might be the easiest choice. A demonstration version comes with the Radio Shack USB cable, product number 20-546, or you can download the software from the Butel website (**www.butelsoftware.com**). It has a list price of $39.95.

Another popular software package is Win500, available from StarrSoft (**www.starrsoft.com**). You can download a 30-day trial version, but if you intend to use it on an ongoing basis it will cost $35 to register.

❖ West Virginia Interoperability Radio Project

There are currently four repeater sites listed for locations in and around Huntington.

The following table lists the control channel frequencies for these sites, which are all that is necessary to program the PRO-106.

Repeater Site	County	Control Channel Frequencies
Huntington	Cabell	453.3500, 460.1375
Milton	Cabell	453.5125, 460.1125
Missouri Branch	Wayne	460.7250
Wayne	Wayne	460.6500

Detailed programming instructions can be found in the PRO-106 User's Guide beginning on page 32. An "easier to read" manual can be found at **marksscanners.com/106_197/106_197.shtml** that describes the object oriented memory organization of the scanner and lists step-by-step instructions for programming trunked systems. Of course, the use of software programs like ARC500 or Win500 would eliminate the need to perform these steps by hand.

As local scanner listeners monitor the WVIRP, they correlate the voice activity they hear with the talkgroup numbers that are displayed on the scanner. Over time they develop a comprehensive list of talkgroup numbers and the activity that occurs in each group. The following is a list of local talkgroups that have been monitored and reported so far.

Decimal	Hex	Description
4105	1009	Cabell County Emergency Medical Services (Dispatch)
4109	100D	Huntington Police Department (Dispatch)
4115	1013	Cabell County Fire (Dispatch)
4133	1025	Huntington Police Department Tactical (Drug Units)
4707	1263	Wayne County Sheriff (Dispatch)
4741	1285	Wayne County Sheriff (Tactical)
9015	2337	State Police Troop 5 (Huntington Dispatch)
9017	2339	State Police Troop 5 (Logan Dispatch)
9025	2341	State Police Troop 5 (Car-to-Car)
9129	23A9	Department of Natural Resources District 5 (Tactical)
9141	23B5	Department of Natural Resources District 5 (Dispatch)
9142	23B6	Department of Natural Resources District 5 (Private)

❖ Verbal Shorthand

In previous columns we've discussed the use of codes and other verbal shorthand that public safety agencies use to facilitate rapid communication between officers and dispatchers. The Huntington Police Department uses the following Signals and 10-Codes.

Signal	Description
1	Officer Needs Help
2	Accident
3	Accident with Injuries
4	Transfer Money
5	Hit and Run
6	Driving while Intoxicated (DWI)
7	Drunk
8	Fight
9	Armed Robbery
10	Burglary
11	Burglary, Suspect in Building

12	Murder
13	Suicide
14	Suspicious Person
15	Drowning
16	Destruction of Property
17	Disorderly Crowd
18	Sex Offense
19	Discharging Firearms
20	Assault
21	Traffic Violation
22	Meet Complainant
23	Fire
24	Rest Stop
25	Drug Related
26	Glue Sniffing
27	Bomb
28	Silent Alarm
29	Stolen Auto
30	Larceny
31	Shoplifting
32	Found Property
33	False Pretense
34	Prowler
35	Injured Person
36	Ill Person
37	Missing Person

Ten Code	Subcode	Description
10-1		Unable to Copy
10-2		Signals Good
10-3		Affirmative
10-4		Message Received
10-5		Relay _____
31	Personnel	
32	Property	
10-6		Busy, Stand By
10-7		Out Of Service
10-8		In Service
10-9		Repeat
10-10		Subject to Call
10-11		Remain in Service
10-12		VIP'S Present
10-13		Weather and Road Conditions
10-14		Correct Time
10-15		Have _____
31	Prisoner	
32	Papers	
33	Personnel	
34	Property	
10-16		Pick Up At _____
10-17		Urgent: Present Detail
10-18		Anything for Us?
10-19		Nothing For You
10-20		Location
10-21		Call by Telephone
10-22		Report in Person To
10-23		Arrived at Scene
10-24		Finished with Assignment
10-25		Disregard Last
10-26		Holding Subject - Rush Reply
10-27		Operator or Officer On Duty
10-28		Vehicle Registration
10-29		Check for Wants and Warrants
10-30		Does Not Conform to Regulations
10-33		Emergency Traffic at Station
10-34		Help Needed at Headquarters
10-35		Confidential Information
10-36		Major Crime Alert
10-40		Lunch
10-41		Beginning Duty Shift
10-42		Ending Duty Shift
10-51		Tow Truck Needed
10-52		Ambulance Needed
10-59		Convoy or Escort
10-99		Unable to Receive Your Signals

❖ Derry, New Hampshire

The main reason scanner listeners keep track of frequencies with such detail is to be able to monitor activity when events are underway. A reader from New Hampshire writes in with an event report, detailing the equipment and frequencies used to handle a residential fire. His knowledge of the local public safety frequencies and how they are used helped him to keep track of firefighters and police during the operation.

Dan,

An apparent laundry room trash can fire at a condominium on Saturday, 18 June 2011 at 0015 hours, was found by a Derry, New Hampshire Police Detail Officer. It was also called in to the Derry Fire Department by residents, who were milling around outside.

The Derry Police on-line log identifies the 911 call on 17 June 2011 at 2345 hours as "Arson-Bomb-Pembroke Dr". An Engine, a Ladder Truck, Car 1 (Command Chevrolet SUV) and K-2 (Derry Fire Prevention Chevrolet SUV) responded, as well as a Derry Police patrol car. Derry Police can be heard on 151.010 MHz (a digital P-25 signal) and Derry Fire on 154.130 MHz. When the Battalion Chief cleared his fire trucks, they " turned the scene over to the Police."

They have quite a few other frequencies. Call sign KBD339, assigned to the Derry Fire Department, shows 154.130 and 159.2925 MHz. The 154.190 MHz frequency is a Southern New Hampshire regional channel, dispatched by Rockingham Sherriff's Department. A common New Hampshire statewide fire ground is 154.280 MHz.

Another licensed call sign, WNKT923, is listed under the Police Department and shows 465.275 MHz, but is actually assigned to the Fire Department. It is a Chester, New Hampshire Fire Department link to Derry Fire headquarters. Call sign WPJQ468 lists 153.995 MHz under Derry Fire and Chester Fire KNIG885 shows the same frequency. Also, Derry EMS on 170.995 MHz sometimes appears to simulcast on 154.130 MHz.

Derry Fire Department dispatch links on 457.925 MHz to Windham, New Hampshire Fire out on 154.175 MHz. Derry Fire dispatches for Hampstead, Windham, and Chester Fire Departments.

Jim in New Hampshire

Derry is a town of about 33,000 in Rockingham County, located in southeastern New Hampshire. It is the hometown of Alan Shepard, the first American in space, who piloted the Mercury capsule *Freedom 7* and flew to the Moon in *Apollo 14*.

The Derry Police Department operates a conventional (non-trunked) digital Project 25 system on several frequencies. Other local agencies operate conventional analog systems, all listed below.

Frequency	Description
151.0100	Derry Police (Dispatch)
153.9950	Derry Fire (Tactical 2)
154.1300	Derry Fire (Dispatch)
154.1600	Derry Fire (Tactical 3)
154.1900	Seacoast Fire Mutual Aid
154.2650	Southeast New Hampshire Hazardous Materials Mutual Aid
154.2800	New Hampshire Fireground (statewide)
154.7325	Derry Police Direct 5
154.8075	Derry Police Direct 6
154.8150	Rockingham Sheriff (Car-to-Car)
154.9500	Rockingham Sheriff (West Dispatch)
155.4150	Rockingham Sheriff (East Dispatch)
155.4750	National Law Enforcement Emergency Frequency (statewide Car-to-Car)
155.4975	Southern New Hampshire Special Operations Unit (SOU)
155.6625	Derry Police (Secondary)
156.0900	New Hampshire State Police (South)
159.2925	Derry Emergency Medical Services
170.9950	Derry Fire Mobile Repeater
457.9250	Derry Fire dispatch to Windham Fire Department on 154.175 MHz
465.2750	Chester, New Hampshire Fire Link to Derry Fire

Jim identifies several call signs related to Derry. These call signs refer to Federal Communications Commission (FCC) licenses issued to the town. Each license includes a list of frequencies that the town is legally allowed to use.

Call Sign	Department	Frequencies
KBD339	Derry Fire	154.130, 154.190, 159.2925, 460.575
WNKT923	Derry Police	453.525, 458.525, 460.275, 465.275
WPJQ468	Derry Fire	153.995
KNIG885	Chester Fire	153.995

FCC license information can be found on the Universal Licensing System (ULS) web page at **wireless2.fcc.gov/UlsApp/UlsSearch/searchLicense.jsp** The "Advanced Search" option allows you to find licenses by state, frequency, and many other parameters.

As mentioned in Jim's letter, the Derry Police Department maintains a log of police calls on Internet that you can read here: **www.derry-nh.org/Pages/DerryNH_PoliceLogs/** These logs are organized by date of record and are in Adobe Acrobat format.

That's all for this month. Please continue to send your event reports and frequency listings to me via electronic mail at *danveeneman@monitoringtimes.com*. You can also find more radio-related information, including digital scanner details, on my website at **www.signalharbor.com**.

Until next month, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *I operate two HF transceivers on different bands, with each rig having its own amplifier and antenna. When using either radio with its amplifier, I'll turn the other radio off so that I don't blow-out its front end. Should I really be concerned with this, or am I just being too careful? (Mike Elcsisin, KK2DOG, Watertown, NY)*

A. The unused amplifier will block any signal voltage developed by the other rig from coming back into the radio that's it's connected to. I don't think you have a thing to worry about.

Q. *When using a linear amplifier on a transmitter or transceiver, where do you put the low-pass filter, before or after the linear? (Brian, email)*

A. I would put the filter between the rig and the linear amplifier. The reason for this is more practical than technical. Reasonable-cost components are more readily obtainable for low power than high power.

Theoretically, since the filter is designed to suppress unwanted, usually out-of-band spurious signals by a fixed number of decibels, it really wouldn't matter where you put it in relation to the amplifier. Since the amplification is linear, the spurs would be reduced the same amount before or after the amplifier.

But what if the spurs are in-band? Then the filter would have no effect. It would probably be better to reduce those before they get to the linear so that the amplifier doesn't magnify or even remix those spurs at a higher level. Since they are in band, you would have to reduce them with tunable notch filters, again more easily accomplished at low power.

Q. *I agree with a columnist's comment that the "premium" category of Shortwave Portable radios is a category without any qualifying members. What do you think of a ham transceiver, such as the Yaesu FT-817 or FT-897 as an alternative? They are certainly much more expensive, but do they fit the bill, or are they lacking in features? (Joe Schierer, KC2BZB)*

A. I also agree with that perspective of shortwave portables. Just because a particular model of a portable is the most expensive doesn't mean it's equal in performance to a desktop receiver like the ICOM R-75 or, in your case, the receiver section of a transceiver.

HF transceivers are specifically designed for competitive reception under noisy, crowded band conditions. No portable ever made has the combination of dynamic range, selectivity, stability, rugged construction, noise blanking, and signal processing available in the majority of amateur HF transceivers.

Q. *I use two end-fed PAR antennas from Grove in the past month for shortwave listening. My goal is to have a north-south antenna and an east-west antenna, either as horizontal wires or slopers.*

Right now I've configured this so that the north-south line is a sloper. The east-west antenna slopes to the east from the same mast. Both are attached at 20 feet up. I just don't know if there is any interference between the two antennas erected this way. I use an A-B switch and I'm not seeing much signal difference. (Matt, KD8NCP)

A. A sloper favors a lobe in the direction of the lower end with a 3-6 dB improvement in that direction, but that's only when its length is under 1 wavelength at the frequency of interest, the slope angle is right, and there's a proper ground plane.

I suspect that the PAR is not operating as a resonant sloper and so there's little difference in reception between the two antennas. You would be better off erecting the two end-fed antennas horizontally at 90 degrees to one another; that way you would see true directivity.

A wire one wavelength or shorter for the frequency of interest will provide a major lobe at right angles to each of the two sides of the wire and virtually nothing off the ends.

The 45-ft length of the Par End Fedz makes it full-wave resonant near 20 MHz; reception up to 20 MHz will be off the sides of the wire. But if you are listening to, say, CB or hams near 30 MHz, you have multiple lobes, and directivity begins to suffer. Higher, more lobes begin to form and they start to favor the ends of the wire.

To choose the best directivity on a wire antenna, stretch a string on a world globe between your location and your major targets. Your wire should be erected at right angles to this line so that it is broadside to arriving signals.

Q. *Should a TV-style 75-300 ohm impedance-matching transformer have continuity between the two windings? (Pat O'Renick, Cottage Grove, OR)*

A. Even though it's a transformer, some do. These are called "DC passive," and allow a mast-mounted preamp to receive its operating power through the transmission line.

Q. *I have two mag-mount, dual-band (2 m/70 cm) antennas mounted on my window air conditioner as a ground plane for a transceiver and a scanner. One antenna is tall, the other much shorter. Will their close proximity affect their pattern? If the scanner is turned on while I'm transmitting, is it likely to be damaged when I transmit? (Jim Rubin, KC2IMH, Forest Hills, NY)*

A. If you are using a hand-held transceiver at a couple of watts and the antennas are separated by several inches, there is little danger of front-end burnout. If you are using higher power such as a mobile/base transceiver and they are quite close, I'd be concerned for the scanner being turned on.

So far as separation affecting directivity of the antennas, keep them at least a quarter-wavelength apart (19" on 2 M, 7" on 70 cm) to avoid noticeable interaction. If you want to experiment with directivity, tune in a weak signal and place the short one close to the window. Move the tall one a few inches behind the short one (away from the window) and move it around to listen for improved reception, but don't expect miracles. We're talking a couple of dBs at most.

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

UTILITY WORLD

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In Search of UVB-76

A lot of people are still keeping track of the various odd transmissions coming from the Russian military command-control station on 4625 kilohertz (kHz), in amplitude modulation (AM). This is the one that caused such a flap last year when it vanished for a few weeks, causing some people to worry that a nuclear war was imminent.

The station's actual call sign remains a mystery. In the hobby, it's generally known as UVB-76, from an early call sign heard in the first voice messages. Other names, which make as much sense as anything, are The Buzzer, from the sound of its marker, or S38, from the designator given by the European Numbers Information Gathering and Monitoring Association, better known as ENIGMA.

The latest big news on this one is that it might not originate from the large radio site outside Moscow that's always been suspected. Ary Boender reports, in his *Numbers and Oddities Newsletter* #165, on considerable efforts to triangulate the signal. A number of directional bearings have been taken from various locations in Estonia, Latvia, Lithuania, Sweden, Switzerland, and the Netherlands. Even allowing for the uncertainties inherent to high-frequency direction finding, this looks like good evidence that the UVB-76 transmitters are considerably northwest of the previously suggested location.

The area of interest is south of St. Petersburg, running along the western border with Estonia. All of the closer-in bearings point roughly to a 50-kilometer radius of Pskov.

Pskov (pronounced "PSS-cough") is a historic city of about 200,000 along the Velikaya River. Its coordinates are roughly 57 degrees, 49 minutes north latitude, and 28 degrees, 19 minutes east longitude. There is a large military air base just outside of town, and the whole region bristles with mysterious antennas. Farther south, Russia has a number of hardened missile sites.

UVB-76 continues to broadcast its buzzy marker, and occasional coded voice messages. The brief voice transmissions are usually in a format which strongly suggests that they are high-priority command control overrides for unknown assets.

Perhaps these broadcasts have a function similar to the ones that might or might not still be called "Foxtrot" messages on the US Air Force radio networks. These are still heard on occasion. Typically, a voice with distinctive multiple-transmitter echoes cuts in with a short time-stamped code announced by, "Sky King, Sky King, do not answer." A good example of this ominous sounding US voice of doom is at **www.youtube.com/watch?v=oF-DMhpJOAI**

The point is a simple one. It seems obvious that both UVB-76 and the US messages are extremely important stuff. It's just not for us to know what that exact stuff is.

Those out of range who want to keep tabs on the strange and compelling UVB-76 operation can use an Internet stream reached at **uvb-76.blogspot.com/** It's a blog maintained by a technically sophisticated utility listener who is also doing interesting things with software-defined radios (SDRs).

Anyone who likes to follow numbers stations, beacons, and other generally offbeat short wave signals is strongly advised to read Ary Boender's various writings. He's done a huge service to all of us for as long as I can remember. He's always been there with friendly advice and well-researched information. *Numbers & Oddities* and other material of interest can be found at **www.numbersoddities.nl/**

❖ WWV Geoalert Lives!

A month earlier, the July column reported that the US Space Weather Prediction Center (SWPC) had announced that it would discontinue its 18th/45th minute "Geoalert" messages. These are the ones broadcast on standard time and frequency stations WWV, Ft. Collins CO, and WWVH, Kekaha, Kauai, HI.

Well, someone changed their mind, or found enough money, or both. The relevant World Wide Web page has been changed to read, "SWPC is no longer planning to discontinue the broadcast of its synoptic Geo-Alert products on the WWV and WWVH radio stations. SWPC plans to continue this service for the foreseeable future."

In fact, the product may be changed to include an additional solar flux taken on another frequency, or other data. It appears that the comments they received at their listed e-mail drop might have made a big difference.

It's nice to see the Geoalert survive. It's a handy way to get numbers for propagation forecasting. It's also another one of those little historical things no one notices until they are about to go away.

WWV broadcasts continuously in AM on 2500, 5000, 10000, 15000, and 20000 kHz. The middle three frequencies use 10-kilowatt transmitters, while the others are 2.5 kW. All antennas are omnidirectional.

WWVH broadcasts continuously in AM, on all but 20000 kHz. 5000 uses a directional antenna. Others are omnidirectional. 2500 is 5 kW, while the rest are 10 kW.

In the US, the mix heard on these frequencies can be a good propagation indicator. Since both time and frequency are determined by atomic standards, there is no audible heterodyne. WWV uses a male voice, and WWVH a female. The audio tones are different, also making identification possible. When the tones mix, it can sound pretty spectacular, especially under deep fading. This gets really interesting in major geomagnetic storms.

Both stations broadcast no tone in minutes when the other one has voice announcements. Along with the Geoalerts, these are usually maritime weather bulletins.

The web page mentioned here is at **www.swpc.noaa.gov/wwv/**

❖ ONEMI Update

ONEMI is the Chilean government emergency office, out of the Ministry of the Interior. The name is a Spanish abbreviation for "Oficina Nacional de Emergencia - Ministerio del Interior." As those who saw the previous column remember, it recently appeared in an Automatic Link Establishment (ALE) radio network that is audible pretty much worldwide.

Call signs are usually ECO (Echo?) plus a 2-digit number corresponding to the Chilean administrative region of the station. There is also an OMEGACERO ("Omega Zero") which is possibly a local headquarters in Valparaiso. Along with the ALE soundings and linkings, some follow-on voice traffic in Spanish has been heard.

Well, now we have confirmation, by way of a Utility DXers Forum (UDXF) posting from a German listener, that ONEMI does indeed maintain a far-flung alerting network. This comes in a verification ("QSL") e-mail from the communications department, on Chilean government electronic "stationery."

The ALE addresses for Rapa Nui/ Easter Island (ISLADEPASCUA) and the Juan Fernandez Islands (JFERNANDEZ) are indeed what

they say they are. These are emergency radio stations on Chilean island possessions.

Just about everyone's heard of Rapa Nui, Easter Island, with the giant stone faces. It's one of the most remote spots on the planet. The Juan Fernandez Islands are a fairly spread-out archipelago between Rapa Nui and the Chilean coast. Both of these entities are part of the Valparaiso administrative region.

Chile is near a very active tectonic area. There have been some very large earthquakes, which have caused disastrous tsunamis on islands and mainland alike. Emergency communication is potentially life-saving in these circumstances.

Both stations are using the sturdy little Kenwood TK-90 transceiver, with around 100 watts out and internal hardware ALE. The antennas are horizontal, multi-band dipoles. It's not known whether the auto-tuner made for this radio is used, but one would think that it would be.

Additional listening has filled in some more of the frequencies used by this net. The full list now goes as follows: 6834, 6843, 6861, 6871, 6877, 9084, 9087, 9091, 9140, 9150, 10128, 10135, 10160, 10176.5, 10187, 10193, 10218, 10222, 10234, 10244, 17411, 17426, 17446, 17450, and 17454. All of these are upper sideband (USB) ALE.

Presumably, the frequencies in the 30-meter amateur range are grandfathered in under the regulations that created this band from a utility allocation. At press time, the only reception in California is in the 17-megahertz band, during the local afternoon around 0000 UTC. This comes as no surprise, since it has always been the best time to hear faxes and other broadcasts from Valparaiso/ Playa Ancha Radio.

The modest equipment and extremely remote locations make these island stations some pretty nice ALE catches, especially since they QSL. The contact used for this verification was Vladimir Maturana, Communications Officer, ONEMI Centro de Alerta Temprana (Early Warning Center). E-mail goes to *onemi@gorevalparaiso.cl*

❖ CFH Update

Last month, this column reported that CFH, the large Canadian Forces station in Halifax, NS, had changed its channel availability markers. Suddenly, they'd switched from radioteletype (RTTY) to a newer phase-shift keying mode called STANAG 4285. The latter name comes from the military standard used, Standardization Agreement number 4285.

This was true at the time, but at least right now as we go to press, they've changed it back. Yes, the markers, sent on assigned frequencies of 5097, 10945, and 15920 kHz, are back in plain old Baudot RTTY as if nothing had ever happened.

The RTTY parameters remain the same as before any of this changed. Speed is 75 baud, and shift is 850 Hertz. When tuned in USB (around 2.2 kHz below assigned channel center), the signal idles on the lower tone of the frequency-shift keying pair. Every 30 seconds, a marker similar to this one is sent in the International Telegraph Alphabet #2 (ITA2): "NAWS DE CFH ZKR F1 2822 3394 4158 6242 8324 12371 16552 AR."

Check last month's column for details on what all this means. Suffice it to say that it's a list of available channels on which warships may call CFH. Many militaries in the North Atlantic Treaty Organization (NATO) send these, in one form or another.

Will CFH go back to STANAG 4285? Well, stay tuned.

❖ EN875TOC Update

Lonely EN875TOC, the Automatic Link Establishment (ALE) station with a whole net to itself, finally got some company. In fact, it's rarely heard any more. Meanwhile, the net is growing rapidly.

Readers might remember that EN875TOC was very strongly suspected to be the Tactical Operations Center of the Arkansas Army National Guard's 875th Engineer Battalion. At the time, bad weather had made this unit very active in road clearance and general aid.

A more recent ALE address being copied is SCJFHQ, the South Carolina Joint Forces Headquarters. They're heard calling SCJOC, the SC Joint Operations Center, and 228SIG, the 228th Theater Tactical Signal Brigade.

It does look as if this is definitely some kind of regional National Guard operations net. A more complete list of possible frequencies for this one is as follows: 6985, 6985.5, 8000, 8058.5, 9065, 9145, 9295, 10151.5, 10703, 10818, 11008.5, 12163.5, and 16120 kHz, all USB ALE.

See you next month!

ABBREVIATIONS USED IN THIS COLUMN

AFB	Air Force Base
ALE	Automatic Link Establishment
AM	Amplitude Modulation
ARQ	Automatic Repeat reQuest
CAMSLANT	USCG Communications Area Master Station, Atlantic
CAMSPAC	USCG Communications Area Master Station, Pacific
CAP	US Civil Air Patrol
CIS	Commonwealth of Independent States
COTHEN	US Customs Over-The-Horizon Enforcement Network
CW	On-off keyed "Continuous Wave" Morse telegraphy
DHFCS	UK Defence High-Frequency Communications Service
DSC	Digital Selective Calling
FAX	Radiofacsimile
FEMA	US Federal Emergency Management Agency
HFDL	High-Frequency Data Link
LDOC	Long-Distance Operational Control
LSB	Lower Sideband
M08a	Cuban CW/MCW, 1-0 substitutes ANDUWRIGMT
M12	Russian CW numbers, format resembles E07 et al
MFA	Ministry of Foreign Affairs
MX	Generic for Russian single-letter beacons/markers
MARS	US Military Auxiliary Radio System
MCW	Modulated CW, direct or in AM
MFA	Ministry of Foreign Affairs
NAT	North Atlantic oceanic air control, families A-F
NATO	North Atlantic Treaty Organization
PACTOR	Packet Teleprinting Over Radio, modes I-III
PSK	Phase-Shift Keying
RTTY	Radio Teletype
S28	"Buzzer" marker for UVB-76 etc, short voice messages
S30	"Pip" marker for occasional Russian voice and data
S32	"Squeaky Wheel" marker for Russian voice and data 2110
Selcal	Selective Calling
SIPRNET	Secure Internet Protocol Routed Network
SITOR	Simplex Telex Over Radio, modes A & B
STANAG 4285	NATO 8-ary PSK teleprinting
UK	United Kingdom
Unid	Unidentified
US	United States
USAF	US Air Force
USCG	US Coast Guard
VC01	Chinese voice chip robotic numbers
V13	Taiwan "New Star," music and numbers
Volmet	Formatted aviation weather broadcasts
X06	Russian Intelligence "Mazielka" selcal
XPA	Russian Polytone for auto-receive, format like M12

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 ().

11.90	Unid-Probably Russian Alpha radio navigation chain, Krasnodar, pulsed carrier sounding like "TM" in CW Morse code, at 0326 (Hugh Stegman-Netherlands). [Remote receiver set up for next day's Alexanderson alternator transmission from Sweden. -Hugh]
3756.0	The Pip-Russian military MCW beeping marker (S30), at 2110 (Ary Boender-Netherlands).
3772.0	2CG7-CIS military, CW message to unknown station at 2116 (ALF-Germany).
3829.0	The Squeaky Wheel, Well-named Russian military marker (S32), at 2111 (Boender-Netherlands).
4150.0	"V"-Russian CW solitary beacon/ marker (MX), Khiva, Uzbek, at 2113 (Boender-Netherlands).
4325.9	"R"-MX, Izhevsk, CW at 2115 (Boender-Netherlands).
4422.0	The Chinese Robot, Rapid-fire Chinese machine "female" (VC01), messages, at 1059 and 1558 (Boender-Hong Kong remote).
4550.0	PL1-Polish military contingent in Kosovo United Nations peacekeeping, ALE link check with TOC, probably Camp Bondsteel headquarters; also on 4700, 5550, 5800, and 6400; at 0002 (ALF-Germany).
4625.0	The Buzzer-Russian military, possible emergency mobilization channel (S28), buzzy AM marker at 2109 (Boender-Netherlands).
4760.0	Unid-Female working many tactical callsign stations in UK accented English, at 0642 (Michel Lacroix-France).
5077.5	WNU-Globe Wireless, Slidell Radio, LA, Globedata identification header D8 in hexadecimal, at 0352 (PPA-Netherlands).
5090.0	HBD20-Swiss MFA, Bern, ALE linking and encrypted e-mail with unknown station, at 0524 (PPA-Netherlands).

5250.0 Trenoga-Kharkov Aero, Ukraine, Russian-speaking female in radio checks with Assistent (Mosdok Aero, Russia), and Ogurshik (Moscow-Scheremetjevo Aero), at 2255 (ALF-Germany).

5253.5 NF01JJ-USCG Auxiliary, very strong signal, working NF07PP and NF07QA, went to frequency "A3G" after discussing interference with MARS, at 0010 (Jack Metcalfe-KY).

5361.5 Unid-Algeria Net, calling BEBALA in PACTOR-I, probably Sidi bel Abbes, also on 5591.5 and 8003.5, at 2204 (ALF-Germany).

5649.0 Gander-NAT-C/ Gander Radio, NFD, selcal JQ-HR to Speedbird 61T, a B777 registration G-VIIO, at 0421 (PPA-Netherlands).

5680.0 Rescue 137-UK Coast Guard Sea King helicopter working Kinloss, at 1153. Rescue 135-UK Sea King working Kinloss, at 2033 (Lacroix-France).

5725.0 Unknown-several stations using tactical call signs in apparent naval exercise, UK accented English, at 0624 (Lacroix-France).

5800.0 A07-Netherlands military, ALE link check with ANCS ("Alpha Net" control), at 1033 (ALF-Germany).

5898.0 Unid-Cuban "cut number" station (M08a), 1 kHz AM tone-modulated MCW, callup (missed) and three messages in 5-figure groups sent as letters, at 0500 (Stegman-CA).

5909.5 J10-USCG MH-60J helo #6010, also J24 (MH-60J #6024), both sounding in ALE, at 0300 (ALF-Germany).

6640.0 New York-New York LDOC, sending Delta 656 to 8933, at 1616 (Allan Stern-FL).

6668.0 344-Unknown military net, ALE link checks and some follow-on voice with 225, 205, 639, 344, and 768; at 2144 (ALF-Germany).

6712.0 Unid-French Air Force, selcal and voice in French, at 1220 (Lacroix-France).

6721.0 299208-USAF C-17A #09-9208, ALE sounding at 1900 (ALF-Germany).

6733.0 Tascomm-UK military Terrestrial Air Sea Communications, working unknown unit at 1723 (Lacroix-France).

6754.0 Trenton Military-Canadian Forces Volmet, Ontario, formatted aviation weather at 0428 (PPA-Netherlands).

6815.0 X9Q-Unknown beacon, CW identifier and long dash, at 2019 (MPJ-UK).

6815.9 HA-Unknown beacon, possibly in US, CW identifier at 0239 (ALF-Germany).

6825.0 FAV-French Forces, coded CW message and op chatter, at 1148 (Lacroix-France).

6846.0 IUKM-Russian military, CW message and op chatter with 9PKW, at 2310 (ALF-Germany).

6871.0 ECO02-Chilean Oficina Nacional de Emergencia - Ministerio del Interior (ONEMI), Antofagasta, ALE sounding at 0057 (ALF-Germany).

6874.0 EYC66-CIS military, coded CW message and op chatter in Russian Morse, using time stamps of UTC+6 and 0 cut to T, at 0020 (ALF-Germany).

6957.0 049116 -Unknown German Red Cross, LSB ALE sounding at 2055 (MPJ-UK).

6985.0 SCJFHQ-South Carolina National Guard, Joint Forces Headquarters, calling SCJOC, South Carolina Joint Operations Center, also on 9295, ALE at 1735. SCJFHQ, calling 228SIG, 228th Theater Tactical Signal Brigade, SC, also on 10818, ALE at 2043 (Metcalfe-KY).

6989.0 RAL2-Russian Navy, possibly Baltic Sea Fleet, CW simplex radio checks with RIB2 and RHQ2, at 1808 (PPA-Netherlands).

6995.0 CAS-Chilean Navy, ALE text chatter with P7H, at 0145 (ALF-Germany).

6996.5 7P9M-CIS or Russian military, simplex CW check with unid station, at 2138 (ALF-Germany).

7038.7 "D"-Russian Navy CW cluster beacon (MX), Sevastopol, Ukraine, at 2102 (Boender-Netherlands).

7038.8 "P"-MX cluster, Kaliningrad, Russia, CW at 2102 (Boender-Netherlands).

7039.0 "C"-MX cluster, Moscow, Russia, CW at 2102 (Boender-Netherlands).

7391.5 NNN0AHH-US Navy/ Marine Corps MARS, net at 2302 (Metcalfe-KY).

7628.0 "8-V-0"-Unknown trigraph station, clear and secure with French Navy headquarters, at 2101 (Lacroix-France).

7710.0 JUABIL-Saudi Arabian Border Guard, Al-Juabil, ALE sound, also JAZEERA, MADINAH (Al-Madinah), and ALJOUF (Al-Jouf); also on 8751; starting at 2231 (ALF-Germany).

7725.5 M4W-Probable Ecuadorean Navy, voice chatter with unknown station, then raised another in PACTOR-I, and shifted to PACTOR-III for traffic, at 0255 (ALF-Germany).

7740.0 QVPX-CIS or Russian military, calling 2INF at 0354 (ALF-Germany).

7754.0 CNC-Unknown Algerian Air Force, raised CM3 in ALE, then scrambled voice, at 2020 (MPJ-UK).

7763.0 RMBB-Russian Navy vessel, working RCV, Black Sea Fleet headquarters, Sevastopol, Ukraine, CW at 0309 (ALF-Germany).

7801.0 RMBD-Russian Navy vessel, CW signal check with RCV, at 0124 (ALF-Germany).

7928.0 RJF94-Russian Naval Air Central Station, Moscow, CW signal checks with RJC48 (Southern Sector, Sevastopol) and RCB (Western Sector, Kaliningrad), at 0305 (ALF-Germany).

7954.0 Unid-Russian government, RTTY message at 0955 (ALF-Germany).

8000.0 TOC-US National Guard, unknown Tactical Operations Center, calling LL1 and LL2, ALE at 1530 (Metcalfe-KY).

8012.0 RIC-CAP National Technology Center, Richmond, VA, ALE sounding at 0343 (PPA-Netherlands).

8042.0 FVJ-Chilean Navy, ALE link check with CAS, at 2109 (ALF-Germany).

8056.0 SL-Possible Niger military, with digital mode data and then voice op chatter in French, at 2310 (ALF-Germany).

8058.6 WNG740-US State Department Emergency Net, possibly DE, ALE sounding at 0200 (ALF-Germany).

8096.0 APM-Chilean Navy, calling CAS and TAC, ALE at 0255 (PPA-Netherlands).

8123.5 Unid-Undecoded PACTOR-I calling, then simplex traffic in PACTOR-II, at 0254 (ALF-Germany).

8162.0 035-Hungarian military, raised 093 in ALE, then clear and scrambled voice, at 1312 (ALF-Germany).

8207.0 ABA-Armed Forces of Malta, Maritime Squadron headquarters, ALE link check with AB2 (Inshore Patrol Boat #P22), at 0245 (ALF-Germany).

8236.0 Unid-Unknown South American station, radio exercise in Spanish with NATO phonetics, at 0105 (ALF-Germany).

8281.2 Unid-Unauthorized South American fishing boat calling channel, chaotic Spanish chatter with whistles, daily at 0100 (ALF-Germany).

8297.0 ZLM-Taupo Maritime Radio, New Zealand, male with gale warnings, at 0345 (ALF-Germany).

8324.5 "2-U-Q"-Trigraph call in unknown multinational naval exercise, working "T-9-D," at 0043 (ALF-Germany).

8421.0 WLO-ShipCom/ Mobile Radio, AL, CW identifier in SITOR-A burst marker, at 0246 (PPA-Netherlands).

8503.9 NMG-USCG, New Orleans, LA, FAX sea state analysis at 0217 (PPA-Netherlands).

8540.2 CFH-Canadian Forces, Halifax, NS, encrypted STANAG 4285 traffic, at 0216 (PPA-Netherlands).

8687.5 WHL28-Augtec, St. Augustine, FL, CW identifier "WHL" every 3 minutes in PACTOR-I bursts, at 0210 (PPA-Netherlands).

8764.0 NMN-USCG CAMSLANT Chesapeake, VA, female with 24-hour weather forecast at 0520 (PPA-Netherlands).

8894.0 Nouakchott-African air route control, Mauritania, positions from Air Maroc 517 and Air Portugal 257, at 0022 (ALF-Germany).

8918.0 Kestrel 13-Thomas Cook Airlines, position for New York at 2357. Speedbird 61T-British Airways, position for New York at 2359 (Stern-FL).

8930.0 Karachi-Pakistan International Airlines company LDOC, weather for Pakistan 786, at 0017 (ALF-Germany).

8933.0 New York LDOC, selcal check GS-JP for JetBlue 155, A320 registration N523JB, at 2350 (Stern-FL).

8942.0 MTX-Georgian military net control, ALE link checks with ALG, TRM, and MTK, at 0206 (ALF-Germany).

8968.0 PLASPR-USAF SIPRNET gateway, Lajes, Azores, ALE sounding at 1953 (MPJ-UK).

9053.0 NMCB7S6-US Naval Mobile Construction Battalion 7, MS, calling SIERRAS6, ALE at 2048 (Metcalfe-KY).

9056.0 Unid-Russian 6-tone selcal (X06), call 615243, at 0435 (PPA-Netherlands).

9082.0 0902NCCAP-CAP North Carolina Wing, ALE sounding at 2350 (ALF-Germany).

9090.0 POH-Unknown LSB ALE net, calling KN2, at 0200 (ALF-Germany).

9120.0 400001-Unknown ALE net control, calling 400003 and 400004, at 1900 (ALF-Germany).

9134.0 N1CP-Russian military, calling ZOBE, CW at 0543 (PPA-Netherlands).

9173.0 Unid-Russian intelligence (M12), CW callup "111 111 111 1" and message in 5-figure groups, also different time with same message on 10173, at 0400 (PPA-Netherlands).

9192.0 VC01, weak numbers at 0605 and 0616 (Boender-Hong Kong).

9200.0 1103-Moroccan National Police, ALE link check and text "//A02" with 2001, at 2250 (ALF-Germany).

9253.0 NPABOC-Brazil Navy Patrol Vessel Bocaina, CW identifier after G-TOR (Golay Teleprinting Over Radio) traffic, at 0301 (ALF-Germany).

9288.0 HLZV-Russian military, CW op chatter at 1907 (PPA-Netherlands).

9725.0 New Star Radio Station-Taiwanese female with Chinese music and messages (V13), at 0500, 0520, 0600, 0615, and 0626 (Boender-Hong Kong).

10066.0 VP-BRX-Aeroflot SU1670, HFDL position for Muharraq ground station, Bahrain, also VP-BUN, Aeroflot SU0820, at 1617 (Lacroix-France).

10075.0 B-6779-Si Chuan Airlines 3U8760, Chinese domestic flight over Chongqing, position and message traffic with unheard ground station, probably Al Muharraq, at 1655 (Stegman-CA).

10108.0 Unid-Russian military, urgent message in frequency-shifted Morse to RED4 and RDL, then reversals and RTTY traffic, at 1128 (ALF-Germany).

10150.0 XSS-DHFCS, Forest Moor net control, also 11208, ALE sounding at 1914 (MPJ-UK).

10174.0 Unid-Russian Polytone (XPA), callup "101 101 101 1 101 100 100," and message in 100 5-figure groups, using multitone frequency-shift keying, at 0440 (PPA-Netherlands).

10194.0 FR4FEM-FEMA Region 4, GA, ALE sounding at 0432. FR3FEM, Region 3, MD, ALE sounding at 0433. FC8FEM004, Region 8, CO, ALE sounding at 0435. FR1FEM, Region 1, MA, ALE sounding at 0510 (PPA-Netherlands).

10255.0 Unid-Vietnamese "Lighthouse" station, male voice with callup and numbers messages in Vietnamese, at 1607 (Boender-Netherlands).

10445.0 Unid-Cuban "cut number" station (M08a), CW message in 5-figure groups, at 0300 (PPA-Netherlands).

10943.2 CFH-Canadian Forces, Halifax, NS, usual idler and channel availability marker every 30 seconds, but sent in STANAG 4285, at 1836 (MPJ-UK).

10987.0 LGBH-Russian military, CW checks with CXFE, S5JQ, SZZJ, WHG8, THM9, and 2YA1; at 2021. LTCB, CW message traffic for YBMW, at 2110 (MPJ-UK).

11143.0 RCV-Russian Navy, Sevastopol, Ukraine, working RMBB, CW at 1720 (PPA-Netherlands).

11181.0 HAWSPR-USAF SIPRNET gateway, Wideawake Air Field, Ascension Island, ALE sounding at 1823 (MPJ-UK).

11256.0 Holloway-Ethiopian Airlines company LDOC, Addis Ababa, selcalling PQ-LS (Ethiopian 604, B777 registration ET-ANO), at 1659 (PPA-Netherlands).

11300.0 Unid-Egyptian MFA, Cairo, calling Nairobi in voice, at 1726. Mogadishu-Egyptian Embassy, Somalia, answering Cairo to tell them Nairobi is off-air, also at 1726 (PPA-Netherlands).

11540.0 OMFUF-Possible French Navy, calling 20MFUM, heard before on 5455 and 8000, ALE at 2254 (Metcalfe-KY).

12577.0 9HDV9-Maltese flag oil tanker Faez, DSC safety call to Karachi rescue center, at 1636. 3EFZ8-Panamanian flag container ship OEL Dubai, DSC to Charleville/ Wiluna rescue, at 1653. S6BB8-Singapore flag tanker Arabian Orchid, DSC to Charleville/ Wiluna, at 1707. LAGB7-Norwegian flag vessel Ocean Europe, DSC with Cape Town, at 1737 (MPJ-UK).

13101.0 GWPWN33-Brazilian Navy, Natal, calling GWPWBL and GWPWMM, at 1847 (PPA-Netherlands).

13107.0 XSQ-Guangzhou Radio, China, weather in Chinese at 1910 (PPA-Netherlands).

13110.0 WLO-ShipCom/ Mobile Radio, weather in female voice at 0523 (PPA-Netherlands).

13600.0 Unid-Probable Venezuelan Navy, coded LSB voice message in 51 groups, at 2042 (PPA-Netherlands).

13841.2 RFFXCAB-French Forces, N'Djamena, Chad, ARQ idler on Paris circuit, at 0700 (Eddy Waters-Australia).

13927.0 AFA5AD-USAF MARS, WI, patching B-52 Chill 31 to Minot AFB (ND) for weather, at 2110 (Stern-FL).

14450.0 Unid-Russian 6-tone selcal, sequential variant (X06c), weak at 1047 (Mike-West Sussex, UK).

14616.0 Unid-New over-the-horizon radar, Akrotiri, Cyprus, pulsed signal 41.5 kHz wide, at 1425 (MPJ-UK).

14630.5 Unid-North Korean MFA, Pyongyang, encrypted text in 600/600 ARQ, at 1252 (Waters-Australia).

14890.0 P3ALE1-Moroccan government/ military, calling a net in ALE; including Z2, N4, and G2; at 0637 (Waters-Australia).

17456.7 Unid- Egyptian MFA, Cairo, Arabic SITOR-A messages to unknown embassy, at 0600 (Waters-Australia).

18594.0 PAC-USCG CAMSPAC, CA, ALE with COTHEN players RUF (Cutter Mohawk) and 714 (HC-130H #1714), also clear and secure voice, at 0520 (Waters-Australia).

19016.0 Unid-Russian military, encrypted text in AT-3004D (a 12-tone PSK modem), at 0600 (Waters-Australia).

21866.0 FC0FEM-FEMA Region 10 communications, WA, working 498FEMAUX, unknown FEMA auxiliary, ALE at 1903 (Stegman-CA).

26955.0 13KM/p-German "freenet" packet gateway from 149-megahertz band, working Adler 5, at 1200 (ALF-Germany).

DIGITAL DIGEST

DIGITAL MODES ON HF

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Another Mystery PacTOR Network

Here's an interesting one I stumbled across a few months ago. Signals from the stations concerned are very weak here on the Eastern seaboard, nor have most monitors in Europe been able to hear them, which is very unusual given the suspected location.

The stations use PacTOR-II modems using the standard Amateur Radio CRC (cyclic redundancy check, aka error checking code) of 65535. A regular schedule at 0930 EDT (1330UTC) is maintained Monday to Thursday and again on Sunday, though rarely on that day. Callsigns change each day, but I'm fairly confident that the same two (or more) stations are involved. Amateur-style tactical calls like ME6NT, EP4RO, TO5RP, OF2TH and OP8OY etc are always used.

Since the call-ups use standard PacTOR-I, you will at least be able to identify the calls in use on each day with decoders that don't support PacTOR-II. Signals must not be great between these stations, either, given the often lengthy call-ups before the connection is made and traffic switches over to PacTOR-II.

The main channel used is 19228.2 kHz (center of data), which, with the standard frequency offset for PacTOR modems, would correspond to 19226 kHz USB. However, it is clear from the sign-off messages that there is at least one more frequency in use, as the operator mentioned that they were QSYing after a successful transfer on the 19 MHz channel.

Similar style calls have been logged by me on 14808.5 kHz (center of data) with PacTOR tfc again, but I'm not sure if it's the same organization, as the CRC used in this case was a custom one of 30028 and it would seem likely that the stations would maintain the same frequency offsets.

Traffic is sent using the free Airmail bulletin board software and B2F compression is used to reduce the amount of data to be sent. Usually no more than 2 or 3 encrypted messages are transferred each day. The encrypted text files are headed like "out123.cry". Here is the typical start-up sequence:

```
[AirMail-2.17x-B2FHIM$]
(am|pq:03250850,em:h)
LO7RA de AU6JA>
F 2
out1317.cry (encrypted text)
```

There does not appear to be any header or trailer information in the message, just encrypted text. Operator chatter in between messages and during the sign-off is in English with good procedure (using Q-codes, AR, SK etc) and Islamic greetings and sign-off, which suggests an Urdu origin. Here are a few samples:

```
BR CALL SIGN AUTO ANSWER MAY WELCOME
     TEXT MAY KHATAM KARLAI. OUR ABHEE
     DOBAR PLZ. ALLAH HAFIZ

BR AOA.PLZ QSL OF OUR 2 QTC.THEN QRU AND
     QRX IF U HAVE QTC SEND. ALLAH HAFIZ.

BR YOUR 1 QTC RECD QSL. NOW QRX AND OUT
     PLZ. ALLAH HAFIZ.
```

It also appears that operators need to login to access their messages since I've often seen failed password attempts and registration failure messages. Another puzzle, or perhaps clue to the possible location, is that the forwarding requests between stations often have text afterwards, like this:

```
OF2TH,stan
OF2TH de OP8OY>

PG3TY,nimu
PG3TY de MN7NI QTC 1 Msg 7525 bytes>

TG5AO,achi
TG5AO de LS4SI>
```

Could "achi" be Karachi? This would certainly agree with the kinds of Islamic greetings seen above. Perhaps more monitoring will yield more clues; any new reports from readers with stronger signals from this interesting network are warmly welcomed.

❖ Update on US NS/EP ALE Network

Back in the May 2010 edition of this column we profiled the National Security/Emergency Preparedness ALE network operated by a number of cooperating telecommunications companies here in the US. Some recent monitoring has yielded a few more stations either joining the network recently or which were missed during the last update:

DLLSTX144	Dallas, TX
DTRTMI150	Detroit, MI
GADNAL156	Gadsden, AL
LNPNAK175	Juneau, AK
MDTNNJ188	Middletown, NJ
RDMDWA223	Redmond, WA
SANATX236	San Antonio, TX
SPFDIL248	Springfield, IL

As a reminder, here are the frequencies on which you can hear these stations:

2194, 2289, 3155, 3170, 4438, 5005, 6765, 6803.1, 7300, 7480.1, 7697.1, 9496, 10155, 11451, 12225, 14360, 14396.5 (Voice), 15175, 15605, 18035, 18063 and 20095 kHz USB

Do please let me know if you hear any more stations, as there are still plenty of gaps in the numbering sequence that are possibly occupied by or reserved for other locations.

❖ US Navy Fleet Broadcast Update

With improving conditions comes the opportunity to hear near stations that make their way out of the noise. Also with improving conditions, organizations start to make use of their higher frequency channels to finally connect their stations.

Back in the December 2009 and July 2010 issues of this column, I documented a US Navy broadcast system which operates a large global network of RTTY transmissions, but is rarely logged by listeners.

The signals from station NKW on Diego Garcia on 22471, 22906 and 22910 kHz are now very strong on most mornings. There is also a newly logged signal from station NPN on the island of Guam on 15603.5 kHz. which carries 50bd traffic with 850Hz shift. In the mornings, I have also been able to hear this station's other outlet on 8540 kHz using the same mode.

The easiest catches in this network are the stations closer to home at NAR Saddlebunch Key FL, NAA Cutler ME and NPG Dixon CA. These can be heard on the following channels:

NAR 5340, 9030, 12015, 12120 and 13870 kHz
NAA 3133, 10130, 11687.5, 15959 and 16122.3 kHz
NPG 7597, 8694, 9085, 10428 and 16268.5 kHz

❖ Canadian Forces Using STANAG4825

For a brief time during early June, all of CFH's regular 75bd/850 RTTY channels converted over to the STANAG4285 HF modem with 75bps data rate and long interleaving. The same NAWS (Notice to Allied Warships) text was sent.

Frequencies used were the expected 1800 Hz below the usual center of data point, i.e. 5095.2, 10943.2 and 15918.2 kHz USB.

This event caused much discussion on the UDXF forum, where utility listeners lamented the loss of yet another RTTY transmission in the clear. However, the loss was only brief and the stations were back to RTTY after a few days in the digital domain.

That's it for this month, so enjoy your digital listening.

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

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The Magic Band: More Mysterious Than Ever!

As I finish this month's column, I'm working stations here and there on 6 meters during the CQ World Wide VHF Contest. Although this on-air VHF operating event isn't as well-attended as the ARRL's June VHF QSO Party – or even Field Day – there are stations to work and grid squares to collect. Any excuse to put VHF QSOs in the logbook can only be good, right?

I even took one for the team... While periodically checking out the CW calling frequency at 50.090 MHz, I saw what looked to be a voice signal at 50.104 MHz on the band scope of my FLEX-1500 SDR. That signal turned out to be VP5CW on the Caribbean Islands of Turks and Caicos, more than 2,000 miles southeast of Rochester, MN! Being somewhat "landlocked" on VHF here in the upper Midwest, VP5 is a juicy target. Alas, I couldn't work him with my pipsqueak station, but after a quick phone call, Kevin, AC0TA, put him in the log.

See last month's column for photos of AC0TA's home-brew antennas. In his first month of fooling around on 6 meters, AC0TA has worked about 90 grid squares and nearly 40 states! Way to go, Grasshopper!

As you can probably see, I've been a bit obsessed with my reintroduction to 6 meters. Until recently my rig didn't cover 50 MHz, and I had been mostly ignoring the band for several years.

As I described in last month's column, however, helping Kevin, AC0TA, get his home-brew antennas set up for his first VHF QSO Party rekindled my interest in operating above the HF bands. Despite the fact that my FLEX-1500 transceiver puts out only 5 W, and that my 6-meter antenna is really a 40-meter horizontal loop strung up in the attic of my condo, I have been working stations coast to coast since the June contest.

That's a big part of the Magic Band's … well, *magic!* When 6 meters is open, you can have amazing results with low power and just about any antenna. And if you can muster 50 W to a small beam (remember, all beams are small at 50 MHz), you can be a Big Gun with a small station (and a small budget). As detailed last month, Kevin, AC0TA, worked 80 grid squares and 26 states in a couple afternoons of casual contesting. That's not bad for a beginning ham's first weekend on the band!

If he can do it, you can, too. Heck, even running QRP to an indoor HF antenna, I managed to work 42 grid squares and 22 states during the same QSO Party (plus a few new ones during Field Day and the CQWW).

Whether you're a beginning ham or a long-time operator who's looking for a new way to enjoy amateur radio, exploring 6 meters has never been easier. And thanks to the wide availability of 6-meter gear, activity is up, up, up! As a follow-up to last month's write-up about Kevin's Magic Weekend (and our friendly competition), this column is a bit more down to earth and offers "nuts and bolts" information about getting started on 6 meters.

❖ Six Meters: Definitely Unusual!

Parked in the no-man's land between "the HF bands" and "the definite VHF bands" (2 meters and up), propagation and operation on 6 meters are often interesting and even strange. Depending on your perspective, 6 meters is a VHF band with HF tendencies, or an HF band with VHF features!

Propagation can be sporadic – pun intended – with no openings for a week followed by ridiculously strong openings to just about everywhere (or to a specific geographic region).

Six-meter ops tend to be a friendly, accommodating bunch, and the equipment and antennas are physically small and easy to manage, whether at home or in the field. Once informally known as the "forgotten band" or the "television interference band," 6 meters is now lovingly known as "The Magic Band."

Activity on 6 perked up a bit in the 1960s, but mostly fell off the radar until the early '90s, when equipment became plentiful and affordable. What was true in the '90s is even more true today. Most new "HF" transceivers, base and mobile, cover 6 meters, which provides easy access and has prompted unprecedented activity.

Like the other VHF and UHF bands, 6 meters offers reliable ground-wave communications up to 100 miles or so with low power (SSB, CW and FM), but unlike the other bands, 6 meters offers much easier access to long-distance QSOs through a wide variety of propagation modes.

It's true that 6-meter propagation tends to be best in the spring and summer months, but because there are so many ways to propagate signals at 50 MHz, opportunities exist for year-round activity. At a minimum, consider this a heads-up for the spring of 2012!

❖ Propagation Potpourri

At HF, signals are typically propagated via groundwaves or skywaves. In the simplest sense, groundwaves travel a short distance before fading away, and skywaves, if we're lucky, reflect from the ionosphere to the ground (and back again), covering longer distances.

At 50 MHz, in the transition zone between HF and VHF, we have a crazy variety of possible propagation modes. These include F-skip (the holy grail of 6-meter propagation, but only at sunspot cycle "super peaks" and only rarely) sporadic-E (also known as E-skip), tropospheric ducting (tropo), field-aligned irregularities (FAI), backscatter, auroral propagation, meteor scatter, trans-equatorial propagation (TEP), moonbounce and more.

Covering these propagation modes in detail would take a lot more space than I have available, but if you're interested, check out the resource boxes for this month and last month. It's all in there! Because of our relatively unfortunate position in the present sunspot cycle, the most important propagation mode for most 6-meter ops is sporadic-E.

RESOURCES

6-meter Q&A – www.eham.net/articles/933
Propagation Links – www.eham.net/DX/propagation
6-Meter Beacons – a reasonably updated list of beacons is compiled by Martin Harrison, G3USF, at www.keele.ac.uk/depts/por/50.htm.
Grid Square Maps – www.gatorradio.org/Operating_Training_Aides/Ham_US_Grids%202005.pdf
Tropo Forecast Maps (nifty!) – www.dxinfocentre.com/tropo.html

Sporadic-E propagation, which occurs throughout the solar cycle and does not depend in any way on sunspots, usually follows a seasonal pattern. Metallic ion clouds form in the E layer of the ionosphere act as large "floating radio mirrors" that reflect and refract 6-meter signals back to earth. Yay! Because these ion clouds, which scientists think are formed from meteors and other sources, don't exactly form on schedule, we call this sporadic-E propagation.

Typical sporadic-E contacts can span several hundred to 1000 miles or more. When two or more sporadic-E clouds are lined up just right, "double-hop" contacts can take place at distances of 2000 miles or more. This is how East Coast hams are occasionally able to work European hams on 6 meters when the sunspot cycle is bottomed out, or how Midwest hams can work stations in Alaska (or Turks and Caicos!).

Most sporadic-E action takes place between May and August, although winter openings in December and January are not uncommon. Time-

wise, 9 a.m. to noon and the early evening hours (local time), seem to offer the most activity.

Although sporadic-E openings can last for hours, brief openings are the norm. Distant stations will pop in and out of the noise, become quite strong, and disappear just as quickly. This is exciting, and a bit unnerving. It's part of the Magic.

❖ Plenty of Affordable Hardware

In the early days, 6-meter gear was nonexistent or prohibitively expensive. Today, 6-meter radios are readily available and quite affordable. Most new HF transceivers offer 6-meter coverage, and dedicated 6-meter multimode radios are now available at price points that were once impossible.

Perhaps the best "value" in 6-meter gear is to acquire a used mobile transceiver that covers HF+6 (or HF through 440 MHz) such as ICOM's IC-706 series or Yaesu's FT-817/857/897 series, which are available for $300 to $500. Alinco's DX-70, which covers 160-6, my first 6-meter radio, circa 1998, is often available for about $300. An added advantage is that these compact little rigs are equally at home in the shack or in the field, and 6 meters is perfect for hilltopping or other portable operations.

Dedicated 6-meter transceivers have been available from most major equipment manufacturers since the 1960s, but these units – often 20-30 years old – usually cost as much or more than modern dc-to-daylight transceivers (mentioned above) that offer better performance and a lot more versatility. In terms of modern offerings that won't break the bank, MFJ's 9406X, a 10-W analog 6-meter SSB transceiver, costs less than $250, but for $319, consider Ranger's RCI-5054DX-100, a 100-W digital multimode rig that's much more functional (see the photo).

When it comes to antennas, 6 meters is an "easy access" band. A half-wave dipole is only 112 inches long, and full-size beams look like teeny television antennas! Rotators, masts and antenna hardware all seem small by HF standards. Wire dipoles and full-wave loops work very well at 50 MHz and are easy to conceal, if necessary.

About the only antenna requirements that are more stringent on 6 meters are feed lines. If you use junky, bargain-basement coax, you'll waste precious RF energy. Coax losses at 50 MHz are about double those experienced at 10 meters. So do yourself a favor and spend a few more dollars on high-quality coax that's rated for use at 50 MHz or higher. You'll be glad you did! I use 75-ohm cable TV coax (RG-6), which is inexpensive and performs better than most "HF coax" (see the March 2011 column for details).

When it comes to affordable 6-meter multimode radios, the Ranger RCI-5054DX-100 is pretty much the only game in town. About the size and weight of a mobile CB radio, the $319 Ranger covers AM, FM, SSB and CW at power outputs of up to 100 W. The handy little rig runs on 12-V dc and is equally suited for home or mobile operation. Features include memories, split-frequency operation, RIT, variable power output, repeater offsets for FM, and more. Check it out at www.rangerusa.com/rci-5054dx.html.

❖ Frequencies

Because 6-meter activity often comes in "waves," hams tend to use calling frequencies to find each other. Once contact has been established the operators can move up the band to a clear frequency. The FM calling frequency is 52.525 MHz. On USB, listen to 50.125 MHz. (Some ops have been trying to shift the SSB calling frequency to 50.2 MHz for several years, with mixed results.) On CW, try 50.090 MHz.

Unfortunately, 6 meters is "closed" more than it's "open," so hams use a variety of techniques to determine when conditions are good. A large group of Morse code beacons can be found between 50 and 50.1 MHz. If you can hear these low-power stations, you know the band is open between you wherever the beacon is located.

Some ops monitor distant FM broadcast signals or VHF public-safety channels to detect band openings, while others monitor real-time propagation maps and DX-spotting networks (see the resource box) Some web sites can even send you a text message when there's a band opening in your area!

❖ Awards and Activities

In addition to 6-meter WAS (Worked All States), WAC (Worked All Countries) and DXCC (DX Century Club) – lofty goals for any ham – VHF ops have their own awards that can be pursued by just about anyone. Working "grid squares" is a primary pursuit and is integral to a lot of 6-meter wallpaper.

Getting "technologically smaller" with each passing year, our planet has been arbitrarily divided into thousands of grid squares based on small increments of latitude and longitude. The US, for example, contains nearly 500 contiguous grid squares. If you confirm contacts with hams in 100 of these little squares you qualify for the ARRL's VUCC award (VHF/UHF Century Club award).

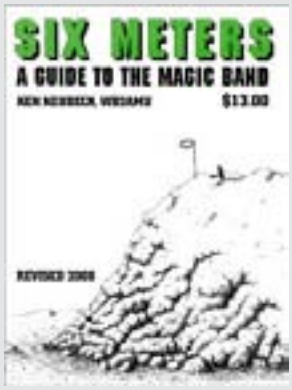
If you manage to confirm contacts with all 488 grids that comprise the lower 48 states you qualify for the prestigious Fred Fish Memorial Award, which only four hams have achieved at press time! Fred Fish, W5FF, now a Silent Key, completed the monumental task mostly during the Magic Band's early years, when activity levels were much lower than today's. See **www.arrl.org/ffma** for more info.

The designators for each grid square have two letters and two numbers. When I lived in Connecticut I was in grid square FN31. Now that I'm in Minnesota, it's EN33. When you hear 6-meter ops frantically exchanging grid squares during E- or F-skip QSOs, you'll know why. Grid square maps or the world and of the US can be downloaded from the internet or can be purchased pre-printed.

If you're used to HF, working The Magic Band is definitely something new and intriguing. I've only scratched the surface here, so I encourage you to follow the links in the resource boxes to see the magic for yourself. See you on six!

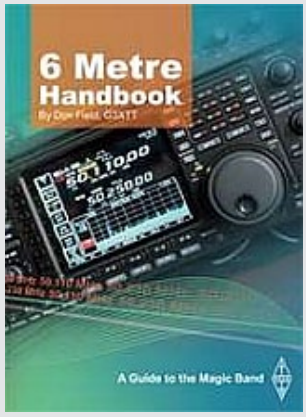
READING MATERIAL

The links in the Resource Boxes (this month and last) will keep you busy for hours, but if you want hard information in hard copy, these two books are worth a look.



Despite the fact that it's in its fourth edition, updated in 2008, *Guide to the Magic Band*, by Ken Neubeck, WB2AMU, can be very hard to find, but well worth the effort. If I remember correctly, Ken actually coined the phrase "The Magic Band," and if he didn't, he sure as heck popularized it!

WB2AMU's 128-pager is the definitive newcomer's guide to 6 meters and is written by a Real Fanatic. Published by Worldradio Publishing and priced at a very reasonable $12.95, you may get lucky and find Ken's primer at your favorite amateur radio bookseller, but if you don't, point your browser to **www.universal-radio.com/catalog/books/5249.html**.



From across the pond (VHF Nirvana) comes *The 6 Metre Handbook*, funky spelling and all. Written by well known DXer and 6-meter enthusiast Don Field, G3XTT, *The Handbook* is a comprehensive guide for ops who have yet to experience the band, and a handy reference for Magic Band regulars.

Published by the Radio Society of Great Britain (RSGB), ARRL's sister society, the 176-pager covers equipment, antennas, propagation, operating techniques, portable ops, DX tips, contesting, awards, and more.

Priced at $24.95, *The 6 Metre Handbook* is available from your favorite amateur radio bookseller, **www.arrl.org**, or **www.universal-radio.com/catalog/books/3482.html**.

GETTING STARTED

THE BEGINNER'S CORNER

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Want a Truly EZ-up Antenna? *Try a 20 Foot Extension Ladder!*

This past Field Day had me in my usual Field Day-panic mode. The clock was ticking toward the 1800Z official start of the 24 hour event that is intended to highlight amateur radio's ability to put a signal on the air that can be used for emergency communications. Last year I set up my Field Day operations on the front deck of my house, loaded a nearby rain gutter and downspout with 10 watts and worked a total of 23 states and one Canadian province in five hours of operation.

I wanted to try something different this year, but hadn't a clue as to what to use for an antenna, until I read Mark Haverstock K8MSH's article in the August issue of *MT* (which we had been putting together just prior to the June 25 start to this year's Field Day), titled "Weird World of Antennas." At the end of the article he mentioned a contest, called the "K0S Strange Antenna Challenge," which featured a photo of an aluminum ladder supported on a trailer as a vertical antenna. The Challenge motto is, "If it's metal, you can tune it!" "Well," I thought, "I've got a 20 foot extension ladder, why not?"

❖ Steps to FD Antenna Success

Setting up the station was quick and easy. I lugged my vintage TS-140s HF transceiver, an equally vintage MFJ Versa Tuner II, the quite dusty code key, 24 hour clock, pad and pen out to the deck, and placed them all on top of a small table. Next I pulled the small 12 volt battery out of the lawn tractor (luckily, I had just mowed the grass so the battery was fully charged) and hooked it up to the rig. Then it was back to the garage to haul the 20 foot aluminum extension ladder over to the deck, extend it fully and lean it up against the wall of the two-story addition.

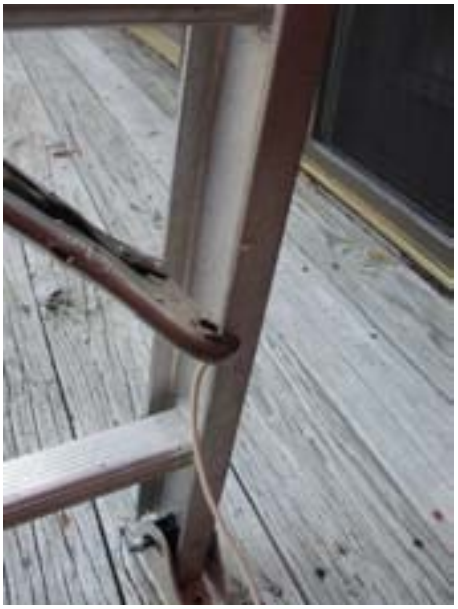
I had to rummage around in the junk drawer for a short piece of RG/8 mini coax which, happily for me, had a PL-259 connector already soldered to one end. I stripped a foot of the vinyl jacket from the other end of the coax, pulled the foam dielectric conductor through a gap I made in the copper braid, stripped off a couple inches of the foam, twisted the conductor tightly and clamped it to the foot of the ladder with a Vise-Grip. The copper braid was clamped to an eight foot ground rod in the moist ground below the deck.

I had some serious questions when I got ready to turn the rig on. The only place I could set up the ladder brought it within inches of the rain gutter and downspout I had used last year as an antenna. Would there be any reactance from the gutter on the ladder antenna? Secondly, the ladder was nearly vertical against the wooden siding of the house, but directly under the 5/8th inch siding is aluminum foil-backed foam insulating board which covers the entire house. What sort of effect would that have on the signal? There was only one way to find out.

It's hard to judge an antenna by a one-shot operation; you never know what the day will bring in the way of propagation, or more likely these days, the lack of propagation. Weather-wise, this Field Day was great: 78 degrees at 1900Z (by the time I got ready to operate), mostly cloudy with a nice breeze, and not even the rumor of a thunderstorm; that passes for a perfect day in Central Virginia at the end of June. I fired up the rig and tuned around the bands which were in full Field Day form; packed with a cacophony of calls, everyone joyfully on top of each other and no one complaining! It was a good sign.

In dummy-load position I set the transmitter to 10 watts output in Single Side Band mode (that qualifies for QRP operation in SSB) and then it was out into the tumult of the HF bands to see what the ladder would do. It actually loaded up nicely on 20, 15 and 10 meters with little effort from the tuner. On 40 and 80 meters the ladder loaded up, but the atmospheric noise was fierce. I chose to ignore these bands and concentrate on the upper bands for the duration of the event.

Field Day 2011 station set-up: HF transceiver with antenna tuner feeding 10 watts into a 20 foot extension ladder leaning up against the wall. Power is provided by a lawn tractor battery. (Courtesy: Author)



How to feed a ladder: The conductor from the transmitter coax is clamped to the base of the ladder with a Vise-Grip; the copper braid shield is clamped to an eight foot ground rod in the moist ground near the base of the ladder. (Courtesy: Author)

The ladder seemed to be noisier than the rain gutter I had previously used and it was tough to say how much was due to atmospheric noise. Still, signals were coming in and in short order I had worked states up and down the East Coast on all three bands and it was quickly apparent that, today, the skip would be short. It's very rare to work nearby Maryland and North Carolina on 20 and 15 meters, yet there it was. In fact, I worked ARRL League Station W1AW on 15 meters, which is usually never heard at this short distance on those bands. Normally, if I want to copy W1AW bulletins I have to listen on 40 or 80 meters.

❖ "You're 10 over S9 into Western Kentucky"

It was typical Field Day fun, lots of young voices were struggling with the phonetics of unfamiliar call signs while older voices were clearly heard prompting in the background;

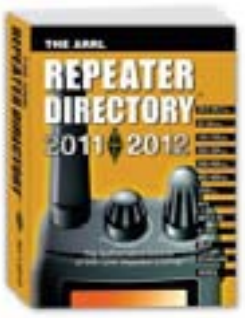
real Elmers in action. Many a grizzled old-timer stood by patiently as the exchanges were made, commenting at the end, "Nice work, you're doing fine!" More than once I heard, "Thanks for your patience, that was rough, but we did it!" Hams were actually cooperating in the sort of spirit that's needed when it's a real emergency.

As the afternoon progressed the bands did lengthen out a bit, but it was nothing compared to previous years when I had worked Montana, Wyoming, even Alaska on an actual dipole at 30 feet. Still, I was able to work as far west as Kansas and Texas (over 1,000 miles away); as far north as Nova Scotia (almost 900 miles away), and as far south as Florida (over 800 miles away). Toward nightfall, with fireflies flitting around the rig, I heard some West Coast stations, but couldn't work them. In all, I did work 24 states and two Canadian provinces over a six hour period running 10 watts into a 20 foot extension ladder. I could have worked many times the 35 different stations I contacted, but my goal was to see how many states I could work and how far the signal would travel on low power and a ladder.

Several times operators told me I had a big signal. "You're 10 over S9," said one operator in Western Kentucky, I guess the foil panels were reflecting the power to the west. One operator in Illinois, after complimenting my signal, had a good laugh when I told him what I was running. Field Day was a great success and I proved that, if this had been an emergency, I could make contact on HF using low power and a ladder up against the wall and be readable, under poor band conditions and with the maximum amount of QRM, out to 1,000 miles. Despite band conditions, I actually did better this year than last year on the rain gutter. Who would have thought?!

You don't have to wait for next year's Field Day to have your own adventures in "random metal" antennas. Look around and see what might be used for an antenna this weekend and give it a try, though I do have a word of caution. Ten watts of RF applied to metal objects within grasp of unsuspecting family members, pets, neighbors, etc. can result in a nasty RF burn, so make sure you practice safe transmitting when loading up metal objects around where you live. And, don't think that stepping up the power will result in better signals; it may instead cause stray RF to get into the rig, distorting your signals. Remember, too, that increasing your power won't help your receive capability one bit.

This old Icom 2SAT 2 meter HT was my backup cell phone on the day I left the cell phone at home. (Courtesy: Universal Radio)



ARRL Repeater Directory ($10.95) lists all repeaters in the U.S. It's your "backup cell phone tower" locator. (Courtesy: ARRL)

❖ Preparing for Everyday Emergencies

Field Day exercises are part fun and part preparedness for large scale disasters that can afflict a region, as we've seen happen so often in just the last few years. Hams play an integral part in setting up and maintaining first-line communications when infrastructure is temporarily shut down. My own Field Day activities gave me plenty of experience when our power was off for days at a time during both hot and cold weather storms.

On one occasion, when all power was down and all cell-towers were out of commission, I used my Field Day training to quickly set up HF communications to notify family members in far flung areas of the country that we were doing fine. But, there are those times when it's only a personal emergency; the rest of the world is humming along quite nicely. Do you have a back-up plan?

A few years ago I was zipping along the Interstate when an engine belt broke and it wasn't long before the engine began overheating. I quickly pulled over to the side of the highway and reached for my cell phone. Of all the days to have left it at home! But, wait, in the glove compartment was an old Icom 2SAT 2 meter HT that I hadn't used in a very long time! It was a spare 2 meter HT that I had put there, along with its cigarette lighter power adapter, for use in emergencies. I felt like an absolute genius, and in no time I was calling for assistance on a repeater that was more than 30 miles away. Once again, ham radio had come to the rescue, this time when I was the only person having an emergency.

The keys to this backup plan were that I had an amateur radio license; a functioning HT stowed away for just such emergencies; that I had a power adapter (the internal battery would not have been charged after so long in the glove compartment); that I had a quarter-wave 2 meter mag-mount antenna stowed in the trunk that could greatly expand my transmitting range, and that I had pre-programmed the local repeaters into the HT. If any one of those things had not been done, I would have been hitch-hiking in the 40º rain to the nearest service station.

I also make sure I have a 2 meter rig on any long distance car trips. But since I'm not going to be traveling in my home base, I also make sure to have the latest ARRL Repeater Directory ($10.95 from **www.arrl.org/shop/The-ARRL-Repeater-Directory-Pocket-Sized**) in the car and can remember how to program the rig (not trusting my memory, I keep a programming cheat sheet in the glove compartment too!). Also, remember that virtually all 2 meter HTs tune local NOAA Weather Radio stations, that can prove to be a real plus when traveling. Being able to listen to local weather alerts and weather forecasts makes planning the return trip a lot easier, too.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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

Around the World in 80 Armchairs

Radio listeners are often called "Armchair Travelers." From the comfort of our own homes via the magic of radio, we can "visit" exotic places all over the world. Without ever leaving Southern Ontario, I have visited exotic places like Pyongyang, Baghdad, Tashkent and Tahiti. And I have also had my virtual passport stamped in places, like London, Berlin, Melbourne and Moscow.

International broadcasters desire to show their countries in the best light, and often want to encourage people to visit. To do this they may have a dedicated "travel show" or a program about the land and peoples that encourages people abroad to consider a trip to their country.

This month we will shine the *Programming Spotlight* on some of these very entertaining and interesting programs.

Back when I first started listening to radio, two programs captured my imagination. The first time I ever tuned in **Radio Yugoslavia**, sometime in the mid-1980s, I heard a captivating feature program about the Dalmatian coast of Yugoslavia. The presenter painted an idyllic word picture featuring scenic coastal vistas, clear ocean waters, and friendly, relaxing beaches. (And large spotted dogs, at least in my mind…)

In later years as this region convulsed with bloody conflict, hatred and ethnic cleansing, I often reflected back sadly on that earlier, happier program.

The other program, which I rather enjoyed, was **Radio Moscow's *Round About the Soviet Union***. Sure, there was a lot of propaganda, but **Radio Moscow** was adept at telling stories about the places and peoples of the then Soviet Union. It was a treat to learn about these locations behind the "Iron Curtain," even if some of the details didn't quite pass the smell test. Programs like this made one want to "see it for yourself," maybe, one day.

Today, we can hear a number of programs like this from broadcasters around the world. Let's pack our bags, ready our passports, and begin meandering around the planet.

***Traveler's Guide* – Radio Romania International**

This program is heard on UTC Thursday broadcasts from RRI. The former **Radio Bucharest** is far from being the Ceausescu mouthpiece that it was prior to 1989, and has become one of the better radio stations out of the former East Bloc.

In ***Traveler's Guide***, as the name suggests, tourism destinations from across Romania are highlighted. Topics in recent months have included the Danube basin, resorts on the Black Sea, historic towns and villages, and scenic rural regions. The program describes a nation of enduring beauty, with many

attractions from cultural to recreational to gastronomical.

Gone are the reports of party achievements and industrial development, which dominated the programming 25 years ago. Instead, one can hear about touring museums, and opportunities for activities as varied as paragliding, white water rafting and bungee jumping!

The program can be heard on UTC Thursdays at 0000 UTC on 7385 and 9580 kHz; 0300 on 7335, 9645, 11895 and 15340 kHz, or listen live online at **www.rri.ro/cat.shtml?lang=1&sec=14** Programs are not archived.

***Excess Baggage* – BBC Radio 4**

Perhaps not surprisingly, the **BBC** has an excellent traveler's program hosted by Sandi Toksvig. It's kind of amusing listening to her host this program after having heard her host the comedy program ***The News Quiz*** (also on **Radio 4**). It's kind of like watching Leslie Nielsen in one of his dramatic roles from the 1960s…you keep waiting for him to do something funny.

Each week, Sandi "explores the adventures, frustrations and joys of travel." Episodes have looked at such topics as the versatility of the bicycle as a method of traveling, the dangers of piracy, the usefulness of learning other languages for one's travels, and she talks to people about travel to such exotic places as the Greek Islands, Catalonia, Mexico and Montserrat. It's always an interesting listen. You can hear the latest episodes at **www.bbc.co.uk/programmes/b006qjds** and there is also a link to subscribe to the podcast.

***Touring Korea* – KBS World**

This is Korea's contribution to travel programming. It can be heard on UTC Tuesdays during the 1200 UTC broadcast (9650 kHz) and at 0200 (9580 kHz) or online at **http://world.kbs.co.kr/english/program/program_touringseoul_detail.htm?no=27976** By tuning in to this program one can visit places as varied as museums, parks, temples and palaces, as well as cultural and recreational sites around the country.

***Travel Russia* – Voice of Russia**

As mentioned earlier, in Soviet times one could listen to travel programs about the many scenic and historical places to see in the former Soviet Union. And while it was not impossible to visit them, it was certainly harder, if not downright problematic. Fast forward to 2011, and traveling to many parts of Russia is much easier.

With the 2014 Sochi Winter Olympics imminent, Russia is making a concerted effort to sell itself as

a travel destination. ***Travel Russia*** airs five days a week, highlighting a city or town somewhere in the Russian Federation. Each episode picks a city or town to visit, tells the listener how to get there, what they might see or encounter (one town was plagued by wild boars!). You will hear about the population, what types of products are manufactured, how it got its name, its climate, and of course, its major attractions and points of interest.

There is an extensive online archive of past programs which have visited such diverse destinations as Kemerevo in Siberia, Nalchik in the Caucasus, and Kursk, scene of the biggest tank battle ever, during World War II. Check out the program archive at **http://english.ruvr.ru/radio_broadcast/36563396/**

Travel Russia airs several times each weekday, but currently only one is scheduled to North America. Try at 0400 UTC on 13775 kHz. Your best bet might be to listen live to the online stream, or to the program archive online.

***Spotlight* – Radio Prague**

This program looks at places around the Czech Republic. There is an extensive online program archive where you can listen to programs about Prague suburbs, beer destinations, botanical gardens, castles, chateaus and other cultural highlights. The Czech Republic has much to offer the traveler, as heard in ***Spotlight***. Check (Czech?) out the program online at **www.radio.cz/en** then click on ***Spotlight***.

***Welcome to Amazing Japan* – Radio Japan**

This program highlighting places to visit around Japan is heard at the end of the broadcast, every second Friday. Try 6110 kHz at 0500 or 6120 kHz at 1200 UTC. Or listen to recent editions online at **www3.nhk.or.jp/nhkworld/travel/english/index.html**

***The Occidental Tourist* – Radio Taiwan International**

Wesley Holzer hosts this program, which allows you to take in the "sights and smells of Taiwan from the comfort of home." Listen on UTC Thursdays online at **http://english.rti.org.tw/default.aspx** or on 5950 kHz at 0200 UTC.

Non-audio

Some stations, while perhaps not having a dedicated travel oriented program, do have loads of information about visiting them online. **China Radio International,** for instance, has a Travel page on its website at: **http://english.cri.**

cn/08travel/index.htm Here you can find out just about anything related to travel in China. Interestingly, there was also a feature on a trip around Taiwan.

In addition to ***Excess Baggage***, the **BBC** has a web page dedicated to stories and tips for world travelers at **www.bbc.com/travel**

❖ Milestones and Memorable Moments

100 years of Radio in New Zealand - Radio New Zealand has been celebrating 100 years of radio transmission in New Zealand by, among other things, "finding out what you feel is the 'sound' that best reflects 'the land of the long white cloud'" There was also an art competition to design a special radio for the 100th anniversary celebrations.

Can't drop into the museum in Auckland on your lunch hour? No problem. **Radio New Zealand National** has been slipping items into their daily lineup to mark the anniversary. And check out the online Sound Archives for photos, information and some audio from the past. **www.soundarchives.co.nz/gallery**

Speaking of centenaries... 2011 also marks the 100th anniversary of the Republic of China. This is an anniversary that won't get much play on **China Radio International** but it is a big deal on Taiwan. There have already been some listener contests featuring prizes and trips to Taiwan for lucky listeners. The national day in Taiwan is October 10, so it may just be a good idea to give Radio Taiwan International a listen as this date approaches. Listen online at **http://english.rti.org.tw/default.aspx**

3AW Melbourne, Australia - Keith McGowan You know someone has had an amazing career when they have lasted over 50 years behind the microphone. Keith McGowan may not be a household name here in North America, but in Melbourne, Australia he is an institution. He hosted his first radio show in 1957, and after having bounced around the country on different stations, he landed at **3AW** in Melbourne where he has owned the overnight hours for the last 22 years. McGowan has announced he will retire this summer.

It's a fluke that I became a regular listener. Around 2001, an Australian friend mentioned she was listening to "**Bruce and Phil.**" **Bruce Mansfield** and **Philip Brady** host ***Nightline***, the evening show on **3AW**. The Sunday night edition is called ***Remember When***, a sort of nostalgic look back at life in Melbourne and the world of yesteryear. This almost always includes discussion of the radio history of Australia, and the callers – some of whom are quite an advanced age – are a delight to hear. On one occasion they spoke to a 100-year-old lady about her childhood and the changes she had seen in her life.

In those early days I was listening to **3AW** via Internet using dial-up, which often made for problematic listening. (Then again, having put up with the vagaries of shortwave propagation for 25 years, I managed.) After upgrading my connection, I could listen more regularly.

Keith is like nothing you might hear in Canada or the United States. Perhaps it's a function of broadcasting in the middle of the night (morning here), but I think it's more of a natural "cheekiness" among Australians. The first time I heard him, I thought he was making fun of his listeners. But the more I listened, the more I realized that it was part of his "shtick," and they were all playing along. For instance, mention prayer and he would cue up the *Hallelujah Chorus* and play that in the background. The Australian sense of humor is earthier and I soon came to realize that Keith and his audience truly enjoyed one another.

For 22 years, Keith has owned the nights in Melbourne, and he leaves some big shoes to fill. While Keith is off photographing the outback, **Andrew McLaren** will take over the overnight shift at **3AW**. Good luck to both! You can listen to Andrew at **www.3aw.com.au** Because of the time difference, ***Remember When*** can be heard at 1000 UTC Sundays. ***The Overnighters*** follows at 1400 UTC.

It is really one of the marvels of our age that we can tune local radio stations from all over the world with a few keystrokes. I discovered **3AW**: perhaps you will discover a radio station in a foreign land that captures your interest as well.

Audio Archives - Another advantage of this inter-web-thingy all the kids are talking about is the ability to hear programs and audio clips from the near and distant past. There is a treasure trove of such material at the **Canadian Broadcasting Corporation** website, an extensive archive of clips from both **CBC Radio** and **CBC Television**. One that I found particularly interesting was a newscast from World War II. It may be the only extant copy of **Lorne Greene** reading the **CBC News**.

Yes, THAT **Lorne Greene**. Years before he settled on the Ponderosa with his boys, or puttered around the universe on Battlestar Gallactica, **Lorne Greene** read the news on **CBC Radio**. His deep, authoritative voice earned him the nickname "The Voice of Doom." In those early days of war (Canada had entered the war in 1939) the news was almost always bad, if not disastrous). I was delighted to stumble onto this clip while browsing the site. You can hear it at **http://archives.cbc.ca/arts_entertainment/television/clips/14705/**

My friend and fellow DXer, Ori Siegel in Toronto notes: "Glad they were able to find this, because not many years ago, there were no known clips of this length. The Voice of Doom was nearly fired following a newscast in, I believe, 1941 or 1942. Following report after report of disasters from the front, there was finally an item about a major success. He began the item by saying "And now some good news." HORRORS! That was blatant editorializing and it was simply NOT permitted by The Corp. The fact alone that thousands of listeners phoned and wrote that they were so relieved and encouraged to hear some good news after so much bad probably saved his job.

"I recall him telling several anecdotes about himself (the 'editorializing' was one of his remembrances). Another story he loved to tell was the time during a major Soviet offensive that he had a string of long Russian names to get out, which, he says, he did fine with. The next item included the phrase "ten ton truck" which he bobbled!

"Of course, we had to take it at his word that he got the Russian place names right! As it is, he is one of the very few mega-stars I've actually met in person and his reminiscences of the **CBC** were quite amusing."

Explore the archives at **http://archives.cbc.ca/** It is a huge website with material added all the time.

So there you have it. We've traveled to the four corners of the planet, and we've traveled back in time all without leaving home or using a really tricked out DeLorean. Isn't radio fun?!

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

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

Ready for the medium wave season?

Radio conditions in September are improving, which means medium wave DXers are approaching their prime listening and QSLing season.

Reception reports must include the date, time (in the station's local time), frequency and program details. Information should include notations of station jingles, slogans, commercials, announcer's name or public service announcements. Sporting events can be mentioned, which can include pre-game interviews and post game analysis.

Keep the reporting friendly and conversational, and perhaps include a brief explanation of the AM hobby or QSLing for staff personal who have no idea this is a hobby.

Send your reception reports to the Program Director, General Manager or Chief Engineer. The latter should have an understanding of the hobby, and on occasion reporters have found a fellow hobbyist or amateur radio operator.

Check **www.google.com** for online station websites which should include email contacts or a physical address. No website? Try Google again, for address listings. Return mint postage is always appreciated, especially from smaller stations operating on a tight budget.

If a follow-up report is needed in three or four months, keep it courteous and to the point. Good luck on your medium wave season, and don't forget to share your QSLs with fellow readers.

CLANDESTINE

Radio Bar-Kulan, 9930 kHz. Full data verification letter, signed by Sikander Hoosen, HF Coverage Planning Operations and Maintenance. Received in 85 days for an English report. QSL address: P.O. Box 234, Meyerton 1960, South Africa. (Frank Hillton, Charleston, SC) Streaming audio **www.bar-kulan.com**

Radio Damal, 11740 kHz. Full data E-QSL from Faith Kwamboka, Station Manager, and station info sheet. Received in 37 days. QSL address: P.O. Box 104638-00101, Nairobi, Kenya (Vashek Korinek-AFS, Dxplorer/BCDC 1021 Top News).

Radio Oromiyaa Liberation, 13830 kHz. Full data WRMI card signed by Jeff White, plus schedule. Received in 27 days for an English report and $1.00US for station relay. QSL address: 175 Fontainebleau Blvd., Suite 1N4, Miami, FL 33172 USA (Luca Botto Flora/playdx).

GERMANY

Hamburger Lokalradio, 5980 kHz. Full data QSL card unsigned, plus souvenir postcard of Lokalradio FM. Received in 31 days for a CD MP3 report and $1.00US. Full data QSL card for 6045 kHz received in 17 days. Station address: Kulturzentrum Lola, Lohbrügger Landtrsse 8, DE-21031 Hamburg, Germany. (Flora) Website: **http://hhlr.homepage.t-online.de/index.htm**

MEDIUM WAVE

KOA, 850 kHz AM. *News Radio.* Partial data E-QSL from Jan Chadwell, AM Chief Engineer. Received in 23 hours for an AM report to *JanChadwell@clearchannel.com.* Station address: 850 KOA Radio, 4695 S. Monaco St., Denver, CO 80237 (Mauricio Molano, Salamanaca, Spain/DX News). Streaming audio at **www.850koa.com**

KUHL, 1440 kHz AM *The Information Station.* Partial data prepared QSL verified with illegible signature. Received in 15 days for an AM report. Station address: 1101 S. Broadway, Santa Maria, CA 93454 (Ben Clement, Portland, OR). Streaming audio **www.am1440.com**

WDHP, 1620 kHz AM. *The Reef.* Frederiksted, Virgin Islands. E-QSL from DJ Luis at *wrra@islands.vi*.Previous reports and follow-ups had bounced. (Molano) Streaming audio for WDHP 1620, Radio St. Kitts Nevis 90.7 and WAKJ 103.5 available at **www.reefbroadcasting.com**

WFTL 850 kHz AM. E-QSL after fourth follow-up report from Dave McBride, Program Director. Received in two hours for report to: *dave@davemcbride.com* (Molano) Station address: WFTL, c/o James Crystal Radio, Inc., 2100 Park Central Blvd. North, Suite 100, Pompano Beach, FL 33064. Streaming audio **www.850wftl.com**

UTILITY

Capetown Naval Air Radio, ZSJ, 18238 kHz. Full data verification letter, unsigned. Received in 56 days for a utility report. Station address: NAVCOMCEN Silvermine, Communications Office, Private Bag X1, Simonstown 7995, South Africa (Patrick Robic/UDXF).

Non-Directional Beacon, GR Grindstone (Iles de la Madeleine) Quebec, Canada, 370 kHz, 25 watts. Full data prepared QSL card returned as verified by Benoît Bannon. Received in 13 days for a utility report and $2.00US. QSL address: Gestionnaire, Nav Canada Operations Techniques, Aéroport International Jean Lesage, 515 rue Principale, Sainte-Foy, Quebec G2G 2T8 Canada (Jim Pogue, Memphis, TN).

Non-Directional Beacon, ZR Sarnia, Ontario, Canada, 404 kHz, 6 watts. Full data prepared QSL card returned as verified, signed by James Edward, Team Leader/Technical Operations. Received in 21 days for a SAE and $2.00US. QSL address: Nav Canada, 2530 Blair Blvd., London, Ontario N5V 3ZR Canada (Pogue).

Non-Directional Beacon, ZRG Brophy Regina, Saskatchewan, Canada, 414 kHz, 25 watts. Full data prepared QSL card returned as verified, signed by Mr. Ross, Station Manager. Received in 37 days for an SAE and $2.00US. QSL address: Nav Canada, Main Floor, Operations Bldg., 5202 Regina Ave., Regina Airport, Regina, Saskatchewan S4W 1B2, Canada (Pogue).

Seoul Meteo HLL2, 9165 kHz. No-data verification letter signed by Jang-Won Seo, Head of Marine Meteorology Division. Received in 40 days for a utility report. Station address: Korea Meterological Administration, Marine Meteorology Division, 538 Gonghang-Dong, Gangseo-gu, Seoul 157-240, South Korea (Robic).

Tallinn Volmet, 4645 kHz. Full data verification letter. Received in four months. QSL address: Estonian Air Navigation Services, Lennujaama tee 2, P.O. Box 9, 11101 Tallinn, Estonia (Eike Bierwirth, Germany/HCDX).

Trenton Volmet. E-QSL from Jonathan D. Perreault, Master Cpl at *jdpfap@cogeco.ca*. Received in 105 days. Station prefers email reports, those by regular mail, are requested to include return postage. QSL address: 8 Wing Telecommunications and Information Services Squadron, Military Aeronautical Communications System, P.O. Box 1000, Stn. Forces Astra, Ontatio, Canada KOK 3WO (Portzer).

Additional Activity Reminders

Celebrating Labor Day

Sept. 5, 1215-1800 UTC. K1R. Activity on 7.271 (8:15-9:00 AM) , 7.272 (9:00-2:00 AM) Certificate. Robert Lobenstein WA2XZ, 1985 East 36 St., Brooklyn, NY 11234. **www.ragchewers.net**

Guardians of Freedom Airshow

Sept. 9-11, 2300-2300 UTC. NOL, Lincoln, Nebraska. Activity on 28.450, 21.365, 14.330, 7.282 and 3.982. QSL. Lincoln Amateur Radio Club, P.O. Box 5006, Lincoln, NE 68505. Operating times: 2300 UTC Sept 9 to 0300 UTC Sept. 10; 1400 UTC Sept 10 to 0300 UTC Sept. 11; and 1400 UTC to 2300 UTC on Sept. 11. **www.k0kkv.org**

Always Remember - the 10th Anniversary of the Attacks of 9/11/2001

Sept. 10-11, 0200-0400 UTC, N1Y. Hancock, New York. Symbol Technologies Amateur Radio Club. Activity on 50.135, 14.070, 7.240, 3.911 D-Star REF10C. STARC, One Motorola Plaza, 8-13, Holtsville, NY 11742. Will read one name of the fallen with every contact. Special Event QSL with # 10 self-addressed-envelope *w2sbl@motorolasolutions.com*.

How to Use the Shortwave Guide

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

① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

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

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 8:30 pm Eastern, 7:30 pm Central, etc.).

FIND THE STATION YOU WANT TO HEAR

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

If a broadcast is not *daily*, the days of broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

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

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

MT MONITORING TEAM

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

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SHORTWAVE BROADCAST BANDS

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

Notes

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

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

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

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

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

0000 0030 Egypt, Radio Cairo 6270na
0000 0030 USA, BBG/Voice of America 7555as
0000 0045 India, All India Radio/External Svc 6055as 7305as 11645as 13605as
0000 0057 Romania, Radio Romania International 7385na 9580na
0000 0058 Germany, Deutsche Welle 9885as 13780as
0000 0100 Anguilla, University Network 6090na
0000 0100 Australia, ABC NT Alice Springs 4835do
0000 0100 Australia, ABC NT Katherine 5025do
0000 0100 Australia, ABC NT Tennant Creek 4910do
0000 0100 Australia, Radio Australia 9660pa 12080pa 13690pa 15240pa 17715pa 17795pa
0000 0100 Bahrain, Radio Bahrain 6010me
0000 0100 Canada, CFRX Toronto ON 6070na
0000 0100 Canada, CFVP Calgary AB 6030na
0000 0100 Canada, CKZN St Johns NF 6160na
0000 0100 Canada, CKZU Vancouver BC 6160na
0000 0100 Canada, Radio Canada International 11700as
0000 0100 China, China Radio International 6020eu 6075as 6180as 7350eu 7415as 9570na 11790as 11885as 13750as 15125as
0000 0100 Malaysia, RTM Kajang/Traxx FM 7295do
0000 0100 Micronesia, The Cross Radio/Pohnpei 4755 as
0000 0100 New Zealand, Radio NZ International 15720pa
0000 0100 DRM New Zealand, Radio NZ International 17675pa
0000 0100 Palau, T8WH/ WHRI 15700as
0000 0100 Russia, Voice of Russia 9665va 9800va
0000 0100 Spain, Radio Exterior de Espana 6055na
0000 0100 Thailand, Radio Thailand World Svc 15275na
0000 0100 UK, BBC World Service 5970as 6195as 9740as 12095as 15335as 15360as 17685as
0000 0100 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0000 0100 USA, EWTN/WEWN Irondale, AL 11520af
0000 0100 USA, FBN/WTJC Newport NC 9370na
0000 0100 USA, WBCQ Monticello ME 5110usb 7415usb 9330usb
0000 0100 USA, WHRI Cypress Creek SC 5920na 7315na 9860na
0000 0100 USA, WINB Red Lion PA 13570ca
0000 0100 USA, WRMI Miami FL 9955ca
0000 0100 USA, WTWW Lebanon TN 5755va 12100va
0000 0100 USA, WWCR Nashville TN 3215eu 4840na 5935af 7465eu
0000 0100 USA, WWRB Manchester TN 2390na 3185na 3215na 5050na
0000 0100 USA, WYFR/Family Radio Worldwide 7360sa 7520sa 15440ca
0000 0100 Zambia, CVC Radio Christian Voice 4965af
0030 0045 twhfas Albania, Radio Tirana 9860na
0030 0100 Australia, Radio Australia 15415as 17750as
0030 0100 sfa Canada, Bible Voice Broadcasting 7405as
0030 0100 mtwhfa Serbia, International Radio Serbia 9685na
0030 0100 Thailand, Radio Thailand World Svc 15275na
0030 0100 USA, BBG/Voice of America/Special English 7430va 9715va 9780va 11725va 12005va 15205va 15290va 17820va
0030 0100 mtwhf USA, WRMI/Radio Slovakia Intl 9955ca
0035 0045 India, All India Radio/Aizawl 5050do
0035 0045 India, All India Radio/Chennai 4920do
0035 0045 India, All India Radio/Guwahati 4940do
0035 0045 India, All India Radio/Hyderbad 4800do
0035 0045 India, All India Radio/Imphal 4775do
0035 0045 India, All India Radio/Port Blair 4760do
0035 0045 India, All India Radio/Shillong 4970do
0035 0045 India, All India Radio/Shimla 4965do
0035 0045 India, All India Radio/Thiruvananthapuram 5010do

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

0100 0130 Vietnam, Voice of Vietnam/Overseas Svc 6175na
0100 0157 North Korea, Voice of Korea 7220as 9345as 9730as 11735ca 15180sa
0100 0200 Anguilla, University Network 6090na
0100 0200 Australia, ABC NT Alice Springs 4835do
0100 0200 Australia, ABC NT Katherine 5025do
0100 0200 Australia, ABC NT Tennant Creek 4910do
0100 0200 Australia, Radio Australia 9660pa 12080pa 13690pa 15240pa 15415as 17715pa 17750as 17795pa
0100 0200 Bahrain, Radio Bahrain 6010me
0100 0200 Canada, CFRX Toronto ON 6070na
0100 0200 Canada, CFVP Calgary AB 6030na
0100 0200 Canada, CKZN St Johns NF 6160na
0100 0200 Canada, CKZU Vancouver BC 6160na
0100 0200 China, China Radio International 6020eu 6175eu 6180as 9410eu 9470eu 9535as 9570na 9580na 9675eu 9790na 11870as 15215as 15785as
0100 0200 Cuba, Radio Havana Cuba 6000na 6050na
0100 0200 Malaysia, RTM Kajang/Traxx FM 7295do
0100 0200 Micronesia, The Cross Radio/Pohnpei 4755 as
0100 0200 Mongolia, Mongolian Radio 2/Ulaanbaatar 7260do
0100 0200 New Zealand, Radio NZ International 15720pa
0100 0200 DRM New Zealand, Radio NZ International 17675pa
0100 0200 Palau, T8WH/ WHRI 15700as
0100 0200 Russia, Voice of Russia 9665va 9800va
0100 0200 Taiwan, Radio Taiwan International 11875as
0100 0200 UK, BBC World Service 7395as 9410as 9740as 11750as 11955as 12095as 15310as 15335as 15360as 17685as
0100 0200 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0100 0200 USA, BBG/Voice of America 7430va 9780va 11705va
0100 0200 USA, EWTN/WEWN Irondale, AL 11520af
0100 0200 USA, FBN/WTJC Newport NC 9370na
0100 0200 USA, KJES Vado NM 7555na
0100 0200 USA, WBCQ Monticello ME 5110usb 7415usb 9330usb
0100 0200 USA, WHRI Cypress Creek SC 9840na 9860na
0100 0200 mtwhf USA, WHRI Cypress Creek SC 5920na
0100 0200 Sat/Sun USA, WHRI Cypress Creek SC 7315na
0100 0200 USA, WINB Red Lion PA 13570ca
0100 0200 USA, WRMI Miami FL 9955ca
0100 0200 USA, WTWW Lebanon TN 5755va 12100va
0100 0200 USA, WWCR Nashville TN 3215eu 4840na 5935af
0100 0200 USA, WWRB Manchester TN 2390va 3185na 5050na
0100 0200 USA, WYFR/Family Radio Worldwide 15440ca
0100 0200 Zambia, CVC Radio Christian Voice 4965af
0120 0200 Sri Lanka, SLBC 6005as 9770as 15745as
0130 0200 twhfa USA, BBG/Voice of America/Special English 7465va 9820va
0145 0200 twhfas Albania, Radio Tirana 7425na

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

0200 0215 Croatia, Croatian Radio 3985eu 9925am
0200 0230 Thailand, Radio Thailand World Svc 15275na
0200 0230 USA, KJES Vado NM 7555na
0200 0245 USA, WYFR/Family Radio Worldwide 5985ca
0200 0257 North Korea, Voice of Korea 13650as 15100as
0200 0300 Anguilla, University Network 6090na
0200 0300 twhfa Argentina, RAE 11710am
0200 0300 Australia, ABC NT Alice Springs 4835do
0200 0300 Australia, ABC NT Katherine 5025do
0200 0300 Australia, ABC NT Tennant Creek 4910do
0200 0300 Australia, Radio Australia 9660pa 12080pa 13690pa 15240as 15415as 15515pa 17750as 21725pa
0200 0300 Bahrain, Radio Bahrain 6010me
0200 0300 Bulgaria, Radio Bulgaria 9700na 11700na
0200 0300 Canada, CFRX Toronto ON 6070na
0200 0300 Canada, CFVP Calgary AB 6030na
0200 0300 Canada, CKZN St Johns NF 6160na
0200 0300 Canada, CKZU Vancouver BC 6160na
0200 0300 China, China Radio International 11770as 13640as
0200 0300 Cuba, Radio Havana Cuba 6000na 6050na
0200 0300 Egypt, Radio Cairo 9315na
0200 0300 Indonesia, Voice of Indonesia 9526va
0200 0300 Malaysia, RTM Kajang/Traxx FM 7295do
0200 0300 Micronesia, The Cross Radio/Pohnpei 4755 as
0200 0300 New Zealand, Radio NZ International 15720pa
0200 0300 DRM New Zealand, Radio NZ International 17675pa
0200 0300 Palau, T8WH/ WHRI 17800as
0200 0300 Philippines, PBS/ Radyo Pilipinas 11880me 15285me 17700me

0200 0300 Russia, Voice of Russia 7440na 9665sa 15425na
0200 0300 South Korea, KBS World Radio 9580sa
0200 0300 Sri Lanka, SLBC 6005as 9770as 15745as
0200 0300 Taiwan, Radio Taiwan International 5950na 9680ca
0200 0300 UK, BBC World Service 6005af 6195as 12095as 15310as 17790as
0200 0300 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0200 0300 USA, EWTN/WEWN Irondale, AL 11520af
0200 0300 USA, FBN/WTJC Newport NC 9370na
0200 0300 USA, WBCQ Monticello ME 5110usb 7415usb 9330usb
0200 0300 USA, WHRI Cypress Creek SC 5920na 9840na 9860na
0200 0300 USA, WINB Red Lion PA 13570ca
0200 0300 USA, WRMI Miami FL 9955ca
0200 0300 USA, WRNO New Orleans LA 7505am
0200 0300 USA, WTWW Lebanon TN 5755va 12100va
0200 0300 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0200 0300 USA, WWRB Manchester TN 2390va 3185na 5050na
0200 0300 USA, WYFR/Family Radio Worldwide 9385ca
0200 0300 Zambia, CVC Radio Christian Voice 4965af
0215 0300 Nepal, Radio Nepal 5005as
0230 0300 twhfas Albania, Radio Tirana 7425na
0230 0300 Myanmar, Myanma Radio/National Svc 5915do 5920al
0230 0300 Vietnam, Voice of Vietnam/Overseas Svc 6175na
0245 0300 Australia, HCJB Global Australia 15400as
0245 0300 India, All India Radio/Bhopal 7430do
0245 0300 India, All India Radio/Delhi 4860do 6030do 7235do 11830do 15135do
0245 0300 India, All India Radio/Gorakhpur 3945do 6030do 7235do 11830do 15135do
0245 0300 India, All India Radio/Guwahati 4940do
0245 0300 India, All India Radio/Hyderbad 7420do
0245 0300 India, All India Radio/Imphal 7335do
0245 0300 India, All India Radio/Itanagar 4990do
0245 0300 India, All India Radio/Jaipur 4910do
0245 0300 India, All India Radio/Kolkata 7210do
0245 0300 India, All India Radio/Kurseong 4895do
0245 0300 India, All India Radio/Lucknow 4880do
0245 0300 India, All India Radio/Radio Kashmir 4760do
0245 0300 India, All India Radio/Shillong 4970do
0245 0300 India, All India Radio/Shimla 6020do
0245 0300 India, All India Radio/Thiruvananthapuram 7290do
0245 0300 Zambia, ZNBC/Radio Two 6165do
0250 0300 Vatican City State, Vatican Radio 6040am 7305am 9610am
0255 0300 Sat Swaziland, TWR Africa 3200af

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

0300 0315 India, All India Radio/Imphal 7335do
0300 0315 India, All India Radio/Itanagar 4990do
0300 0315 India, All India Radio/Shillong 4970do
0300 0325 Sun Swaziland, TWR Africa 3200af
0300 0327 Iran, IRIB/ VOIRI 11920na
0300 0330 Egypt, Radio Cairo 9315na
0300 0330 Myanmar, Myanma Radio/National Svc 9731do
0300 0330 Philippines, PBS/ Radyo Pilipinas 11880me 15285me 17700me
0300 0330 Vatican City State, Vatican Radio 7305af 7360af 9660af
0300 0355 mtwhf South Africa, Channel Africa 5980af
0300 0355 Turkey, Voice of Turkey 6165as 9515va
0300 0357 North Korea, Voice of Korea 7220as 9345as 9730as
0300 0357 Romania, Radio Romania International 7335na 9645na 11895as 15340as
0300 0358 Germany, Deutsche Welle 12005as
0300 0400 Anguilla, University Network 6090na
0300 0400 Australia, ABC NT Alice Springs 4835do
0300 0400 Australia, ABC NT Katherine 5025do
0300 0400 Australia, ABC NT Tennant Creek 4910do
0300 0400 Australia, Radio Australia 9660pa 12080pa 13690pa 15240as 15415as 15515pa 17750as 21725pa
0300 0400 Bahrain, Radio Bahrain 6010me
0300 0400 twhfas Canada, CBC Northern Quebec Svc 9625na
0300 0400 Canada, CFRX Toronto ON 6070na
0300 0400 Canada, CFVP Calgary AB 6030na
0300 0400 Canada, CKZN St Johns NF 6160na
0300 0400 Canada, CKZU Vancouver BC 6160na
0300 0400 China, China Radio International 9690am 9790na 11770as 13750as 15110as 15120as 15785as
0300 0400 Cuba, Radio Havana Cuba 6000na 6050na
0300 0400 Germany, Deutsche Welle 15595as
0300 0400 Malaysia, RTM Kajang/Traxx FM 7295do
0300 0400 Micronesia, The Cross Radio/Pohnpei 4755 as
0300 0400 New Zealand, Radio NZ International 15720pa
0300 0400 DRM New Zealand, Radio NZ International 17675pa
0300 0400 Oman, Radio Sultanate of Oman 15355af
0300 0400 Palau, T8WH/ WHRI 17800as
0300 0400 Russia, Voice of Russia 9665sa 15425na 15585as
0300 0400 mtwhf South Africa, Channel Africa 3345af
0300 0400 Sat Sri Lanka, SLBC 6005as 9770as 15745as
0300 0400 Taiwan, Radio Taiwan International 5950na 15320as
0300 0400 UK, BBC World Service 3255af 5875af 6005af 6145af 6190af 6195af 7255eu 9410af 9750af 12035as 12095as 15310as 15365as 17790as
0300 0400 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0300 0400 USA, BBG/Voice of America/African Svc 4930af 6080af 9885af 15580af
0300 0400 USA, EWTN/WEWN Irondale, AL 11520af
0300 0400 USA, FBN/WTJC Newport NC 9370na
0300 0400 USA, WBCQ Monticello ME 7415usb 9330usb
0300 0400 USA, WHRI Cypress Creek SC 5920na 7385na 9840na
0300 0400 USA, WINB Red Lion PA 13570ca
0300 0400 USA, WRMI Miami FL 9955ca
0300 0400 USA, WTWW Lebanon TN 5755va 12100va
0300 0400 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0300 0400 USA, WWRB Manchester TN 2390na 3185na 5050na
0300 0400 USA, WYFR/Family Radio Worldwide 11740ca
0300 0400 Zambia, CVC Radio Christian Voice 4965af
0300 0400 Zambia, ZNBC/Radio Two 6165do
0315 0400 Australia, Radio Australia 15240pa
0330 0400 twhfas Albania, Radio Tirana 7425na
0330 0400 Iran, IRIB/ VOIRI 9605na 11920na
0330 0400 Vietnam, Voice of Vietnam/Overseas Svc 6175na
0335 0345 India, All India Radio/Aizawl 5050do
0335 0345 India, All India Radio/Delhi 7235do 11830do 15135do
0335 0345 India, All India Radio/Kolkata 7210do

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

0400 0427 Iran, IRIB/ VOIRI 9605na 11920na
0400 0430 USA, BBG/Voice of America/African Svc 4930af 4960af 6080af 9855af 11670af 15580af
0400 0457 Germany, Deutsche Welle 7240af
0400 0458 New Zealand, Radio NZ International 15720pa
0400 0458 DRM New Zealand, Radio NZ International 17675pa
0400 0459 Germany, Deutsche Welle 13840af
0400 0500 Anguilla, University Network 6090na
0400 0500 Australia, ABC NT Alice Springs 4835do
0400 0500 Australia, ABC NT Katherine 5025do
0400 0500 Australia, ABC NT Tennant Creek 4910do
0400 0500 Australia, Radio Australia 9660pa 12080pa 13690pa 15240as 15515pa 17750pa 21725pa
0400 0500 Bahrain, Radio Bahrain 6010me
0400 0500 twhfas Canada, CBC Northern Quebec Svc 9625na
0400 0500 Canada, CFRX Toronto ON 6070na
0400 0500 Canada, CKZN St Johns NF 6160na
0400 0500 Canada, CKZU Vancouver BC 6160na
0400 0500 China, China Radio International 6020na 6080na 13750as 15120as 15785as 17730va 17855va
0400 0500 mtwhf France, Radio France Internationale 9805af 11995af
0400 0500 Germany, Deutsche Welle 6180af
0400 0500 Malaysia, RTM Kajang/Traxx FM 7295do
0400 0500 Micronesia, The Cross Radio/Pohnpei 4755 as
0400 0500 Palau, T8WH/ WHRI 17800as

0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		Russia, Voice of Russia	13775na	15585as	
0400	0500	mtwhf	South Africa, Channel Africa	3345af		
0400	0500	Sat	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		UK, BBC World Service	3255af	3955eu	
			5875af	6005af	6190af	7255af
			7310af	11945af	12035as	12095af
			13840as	15310as	15365as	17790as
0400	0500		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0400	0500		USA, EWTN/WEWN Irondale, AL			11520af
0400	0500		USA, FBN/WTJC Newport NC			9370na
0400	0500		USA, WHRI Cypress Creek SC			5920na
			7385na	9825na		
0400	0500		USA, WINB Red Lion PA	13570ca		
0400	0500		USA, WRMI Miami FL	9955ca		
0400	0500		USA, WTWW Lebanon TN	5755va	12100va	
0400	0500		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0400	0500		USA, WWRB Manchester TN	3185na		
0400	0500		Zambia, CVC Radio Christian Voice			4965af
0400	0500		Zambia, ZNBC/Radio Two	6165do		
0430	0500	mtwhf	Swaziland, TWR Africa	3200af	4775af	
0430	0500		USA, BBG/Voice of America/African Svc			4930af
			4960af	6080af	11670af	15580af
0435	0445		India, All India Radio/Delhi	4860do		
0455	0500		Nigeria, Voice of Nigeria	15120af		
0459	0500		New Zealand, Radio NZ International			11725pa
0459	0500	DRM	New Zealand, Radio NZ International			11675pa

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

0500	0507	twhfas	Canada, CBC Northern Quebec Svc			9625na
0500	0530		Germany, Deutsche Welle	7430af	9480af	
			11875af			
0500	0530		Japan, Radio Japan NHK World			5975va
			6110na	11970va		
0500	0530		UK, BBC World Service	5975eu		
0500	0530		Vatican City State, Vatican Radio			5965va
			7250eu	9660af	11625af	13765af
0500	0557		China, China Radio International			6020na
			6190na	11710af	11895as	15350as
			15465as	17505va	17540as	17730va
			17855va			
0500	0600		Anguilla, University Network			6090na
0500	0600		Australia, ABC NT Alice Springs			4835do
0500	0600		Australia, ABC NT Katherine	5025do		
0500	0600		Australia, ABC NT Tennant Creek			4910do
0500	0600		Australia, Radio Australia	9660pa	12080pa	
			13630pa	13690pa	15160pa	15240pa
			17750as			
0500	0600		Bahrain, Radio Bahrain	6010me		
0500	0600		Bhutan, Bhutan Broadcasting Svc			6035do
0500	0600		Canada, CFRX Toronto ON	6070na		
0500	0600		Canada, CKZN St Johns NF	6160na		
0500	0600		Canada, CKZU Vancouver BC			6160na
0500	0600		Cuba, Radio Havana Cuba	6000na	6010na	
			6050na	6060na	6150sa	
0500	0600	mtwhf	Equatorial Guinea, Radio Africa 2			15190af
0500	0600	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
0500	0600	mtwhf	France, Radio France Internationale			11995af
			13680af			
0500	0600		Malaysia, RTM Kajang/Traxx FM			7295do
0500	0600		Micronesia, The Cross Radio/Pohnpei			4755 as
0500	0600		New Zealand, Radio NZ International			11725pa
0500	0600	DRM	New Zealand, Radio NZ International			11675pa
0500	0600		Nigeria, Voice of Nigeria	15120af		
0500	0600		Palau, T8WH/ WHRI	17800as		
0500	0600		Russia, Voice of Russia	13775na		
0500	0600	mtwhf	South Africa, Channel Africa	7230af		
0500	0600	mtwhf	Swaziland, TWR Africa	3200af	4775af	
0500	0600		Swaziland, TWR Africa	9500af		
0500	0600	Sat/Sun	Swaziland, TWR Africa	4775af		
0500	0600		Taiwan, Radio Taiwan International			6875na
0500	0600		UK, BBC World Service	3255af	3955eu	
			6005af	6190af	7255af	9410af
			11945af	12095as	15310as	15365as
			15420af	17640as	17790as	
0500	0600		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0500	0600		USA, BBG/Voice of America/African Svc			4930af
			6080af	11670af	155870af	
0500	0600		USA, EWTN/WEWN Irondale, AL			11520af
0500	0600		USA, FBN/WTJC Newport NC			9370na
0500	0600		USA, WHRI Cypress Creek SC			7385va
			9825va	11565va		
0500	0600		USA, WINB Red Lion PA	13570ca		
0500	0600		USA, WRMI Miami FL	9955ca		
0500	0600		USA, WTWW Lebanon TN	5755va	12100va	
0500	0600		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0500	0600		USA, WWRB Manchester TN	3185na		
0500	0600		Zambia, CVC Radio Christian Voice			4965af
0500	0600		Zambia, ZNBC/Radio Two	6165do		
0515	0530	Sat	Greece, Voice of Greece	11645eu		
0530	0550	Sun	Greece, Voice of Greece	11645eu		
0530	0557	DRM	Romania, Radio Romania International			7305eu
0530	0557		Romania, Radio Romania International			9655eu
			17760eu	21500eu		
0530	0600	Sat/Sun	Clandestine, Sudan Radio Service/SRS			13720af
0530	0600		Thailand, Radio Thailand World Svc			17655va

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

0600	0615	Sat/Sun	South Africa, TWR Africa	11640af		
0600	0629		USA, WINB Red Lion PA	13570ca		
0600	0630		Germany, Deutsche Welle	9545af	15275af	
0600	0645	smtwhf	South Africa, TWR Africa	11640af		
0600	0655	mtwhf	South Africa, Channel Africa	15255af		
0600	0658		New Zealand, Radio NZ International			11725pa
0600	0658	DRM	New Zealand, Radio NZ International			11675pa
0600	0700		Anguilla, University Network			6090na
0600	0700		Australia, ABC NT Alice Springs			4835do
0600	0700		Australia, ABC NT Katherine	5025do		
0600	0700		Australia, ABC NT Tennant Creek			4910do
0600	0700		Australia, Radio Australia	9660pa	12080pa	
			13630pa	13690pa	15160pa	15240pa
			15415as	17750as		
0600	0700		Bahrain, Radio Bahrain	6010me		
0600	0700		Canada, CFRX Toronto ON	6070na		
0600	0700		Canada, CFVP Calgary AB	6030na		
0600	0700		Canada, CKZN St Johns NF	6160na		
0600	0700		Canada, CKZU Vancouver BC			6160na
0600	0700		China, China Radio International			11710af
			11870me	11895as	13660as	15140me
			15350as	15465as	17505va	17540as
			17710as			
0600	0700		Cuba, Radio Havana Cuba	6000na	6010na	
			6050na	6060na	6150sa	
0600	0700	mtwhf	Equatorial Guinea, Radio Africa 2			15190af
0600	0700	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
0600	0700	mtwhf	France, Radio France Internationale			11615va
			15160af	17800af		
0600	0700		Malaysia, RTM Kajang/Traxx FM			7295do
0600	0700		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
0600	0700		Micronesia, The Cross Radio/Pohnpei			4755 as
0600	0700		Nigeria, Voice of Nigeria	15120af		
0600	0700		Palau, T8WH/ WHRI	17800as		
0600	0700		Papua New Guinea, Radio Fly			5960do
0600	0700		Russia, Voice of Russia	15405pa		
0600	0700	mtwhf	South Africa, Channel Africa	7230af		
0600	0700		South Africa, CVC 1 Africa Radio			13590af
0600	0700		Swaziland, TWR Africa	9500af		
0600	0700		UK, BBC World Service	5875eu	6005af	
			6190af	7430eu	9410af	9860af
			12015af	12095as	15105af	15310as
			15420af	17640af	17790as	
0600	0700		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0600	0700		USA, BBG/Voice of America/African Svc			6080af
			11670af	15580af		
0600	0700		USA, EWTN/WEWN Irondale, AL			11520af
0600	0700		USA, FBN/WTJC Newport NC			9370na
0600	0700		USA, WHRI Cypress Creek SC			7385va
			9825va	11565va		
0600	0700		USA, WRMI Miami FL	9955ca		
0600	0700		USA, WTWW Lebanon TN	5755va	12100va	
0600	0700		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0600	0700		USA, WWRB Manchester TN	3185na		
0600	0700		USA, WYFR/Family Radio Worldwide			9680na
0600	0700		Zambia, CVC Radio Christian Voice			13590af
0600	0700		Zambia, ZNBC/Radio Two	6165do		
0602	0700		Swaziland, TWR Africa	6120af		
0630	0645		India, All India Radio/Guwahati			7280do
0630	0645		India, All India Radio/Hyderbad			7420do
0630	0645		India, All India Radio/Kurseong			7230do
0630	0645		India, All India Radio/Mumbai			7240do

0630 0645 India, All India Radio/Thiruvananthapuram 7290do
0630 0700 Bulgaria, Radio Bulgaria 9600na 11600na
0630 0700 USA, WINB Red Lion PA 9265ca
0630 0700 Vatican City State, Vatican Radio 11625af 13765af 15570af
0645 0700 Sun Germany, TWR Europe 6105eu
0645 0700 Sun Monaco, TWR Europe 9800eu
0659 0700 New Zealand, Radio NZ International 6170pa
0659 0700 DRM New Zealand, Radio NZ International 7440pa

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

0700 0730 Sun Canada, Bible Voice Broadcasting 5945eu
0700 0745 Sat Canada, Bible Voice Broadcasting 5945eu
0700 0745 USA, WYFR/Family Radio Worldwide 7570eu
0700 0750 mtwhf Germany, TWR Europe 6105eu
0700 0750 smtwhf Monaco, TWR Europe 9800eu
0700 0758 New Zealand, Radio NZ International 6170pa
0700 0758 DRM New Zealand, Radio NZ International 7440pa
0700 0759 USA, WINB Red Lion PA 9265ca
0700 0800 Anguilla, University Network 6090na
0700 0800 Australia, ABC NT Alice Springs 4835do
0700 0800 Australia, ABC NT Katherine 5025do
0700 0800 Australia, ABC NT Tennant Creek 4910do
0700 0800 Australia, Radio Australia 9475as 9660pa 9710pa 11945as 12080pa 13630pa 15160pa
0700 0800 Bahrain, Radio Bahrain 6010me
0700 0800 m/DRM Belgium, TDP Radio 6015eu
0700 0800 Canada, CFRX Toronto ON 6070na
0700 0800 Canada, CFVP Calgary AB 6030na
0700 0800 Canada, CKZN St Johns NF 6160na
0700 0800 Canada, CKZU Vancouver BC 6160na
0700 0800 China, China Radio International 11895as 13660as 15125va 13710eu 15350as 15465as 17490eu 17540as 17710as
0700 0800 mtwhf Equatorial Guinea, Radio Africa 2 15190af
0700 0800 Sat/Sun Equatorial Guinea, Radio East Africa 15190af
0700 0800 mtwhf France, Radio France Internationale 15615af 17605af
0700 0800 Malaysia, RTM Kajang/Traxx FM 7295do
0700 0800 Malaysia, RTM/Voice of Malaysia 6175as 9750as 15295as
0700 0800 Micronesia, The Cross Radio/Pohnpei 4755 as
0700 0800 Palau, T8WH/ WHRI 17800as
0700 0800 Papua New Guinea, Radio Fly 5960do
0700 0800 Russia, Voice of Russia 15405pa
0700 0800 mtwhf South Africa, Channel Africa 7230af
0700 0800 South Africa, CVC 1 Africa Radio 13590af
0700 0800 Swaziland, TWR Africa 6120af 9500af
0700 0800 UK, BBC World Service 5875eu 6190af 11760me 11765af 11830af 12095af 15310as 15400af 15575as 17640af 17790as 17830af
0700 0800 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0700 0800 USA, EWTN/WEWN Irondale, AL 11520af
0700 0800 USA, FBN/WTJC Newport NC 9370na
0700 0800 USA, WHRI Cypress Creek SC 7385va 9825va 11565va
0700 0800 USA, WRMI Miami FL 9955ca
0700 0800 USA, WTWW Lebanon TN 5755va 12100va
0700 0800 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0700 0800 USA, WWRB Manchester TN 3185na
0700 0800 USA, WYFR/Family Radio Worldwide 5950ca
0700 0800 Zambia, CVC Radio Christian Voice 13590af
0700 0800 Zambia, ZNBC/Radio Two 6165do
0715 0750 Sun Germany, TWR Europe 6105eu
0715 0750 Sat Monaco, TWR Europe 9800eu
0730 0745 India, All India Radio/Aizawl 5050do
0730 0745 India, All India Radio/Delhi 6190do 11710do 15185do 15260do
0730 0745 India, All India Radio/Guwahati 7280do
0730 0745 India, All India Radio/Imphal 7335do
0730 0745 India, All India Radio/Jaipur 7325do
0730 0745 India, All India Radio/Kolkata 7210do
0730 0745 India, All India Radio/Kurseong 7230do
0730 0745 India, All India Radio/Shimla 6020do
0730 0800 Australia, HCJB Global Australia 11750pa
0730 0800 India, All India Radio/Chennai 4920do
0759 0800 New Zealand, Radio NZ International 6170pa
0759 0800 DRM New Zealand, Radio NZ International 7440pa

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

0800 0830 Australia, ABC NT Alice Springs 4835do
0800 0830 Australia, ABC NT Katherine 5025do
0800 0830 Australia, ABC NT Tennant Creek 4910do
0800 0830 Australia, HCJB Global Australia 11750pa
0800 0845 USA, WYFR/Family Radio Worldwide 5950ca
0800 0900 Anguilla, University Network 6090na
0800 0900 Australia, Radio Australia 5995pa 9475as 9590pa 9710pa 9580pa 11945as 12080pa 13630pa
0800 0900 Bahrain, Radio Bahrain 6010me
0800 0900 t/DRM Belgium, TDP Radio 6015eu
0800 0900 Bhutan, Bhutan Broadcasting Svc 6035do
0800 0900 Canada, CFRX Toronto ON 6070na
0800 0900 Canada, CFVP Calgary AB 6030na
0800 0900 Canada, CKZN St Johns NF 6160na
0800 0900 Canada, CKZU Vancouver BC 6160na
0800 0900 China, China Radio International 11620as 11895as 13710eu 15350as 15465as 15625va 17490eu 17540as
0800 0900 mtwhf Equatorial Guinea, Radio Africa 2 15190af
0800 0900 Sat/Sun Equatorial Guinea, Radio East Africa 15190af
0800 0900 Sat Italy, IRRS-Shortwave 9510va
0800 0900 Italy, IRRS-Shortwave/Euro Gospel Radio 7290va
0800 0900 Malaysia, RTM Kajang/Traxx FM 7295do
0800 0900 Malaysia, RTM/Voice of Malaysia 6175as 9750as 15295as
0800 0900 Micronesia, The Cross Radio/Pohnpei 4755 as
0800 0900 New Zealand, Radio NZ International 6170pa
0800 0900 DRM New Zealand, Radio NZ International 7440pa
0800 0900 Palau, T8WH/ WHRI 17800as
0800 0900 Papua New Guinea, Radio Fly 5960do
0800 0900 Russia, Voice of Russia 15405pa
0800 0900 mtwhf South Africa, Channel Africa 9625af
0800 0900 South Africa, CVC 1 Africa Radio 13590af
0800 0900 Sun South Africa, SA Radio League 7205af 17570af
0800 0900 South Korea, KBS World Radio 9570as
0800 0900 UK, BBC World Service 6190af 11760me 12095af 15310as 15400af 15575as 17640af 17790as 17830af 21470af
0800 0900 USA, American Forces Network/AFRTS 4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0800 0900 USA, EWTN/WEWN Irondale, AL 11520af
0800 0900 USA, FBN/WTJC Newport NC 9370na
0800 0900 USA, WHRI Cypress Creek SC 7385va 11565va
0800 0900 USA, WINB Red Lion PA 13570ca
0800 0900 USA, WRMI Miami FL 9955ca
0800 0900 USA, WTWW Lebanon TN 5755va 12100va
0800 0900 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0800 0900 USA, WWRB Manchester TN 3185na
0800 0900 Zambia, CVC Radio Christian Voice 13590af
0800 0900 Zambia, ZNBC/Radio Two 6165do
0815 0900 Nepal, Radio Nepal 5005as
0820 0900 mtwhfa Guam, TWR Asia/KTWR 15170as
0830 0845 India, All India Radio/Aizawl 5050do
0830 0845 India, All India Radio/Chennai 4920do
0830 0845 India, All India Radio/Delhi 6190do 11710do 15185do 15260do
0830 0845 India, All India Radio/Hyderbad 7420do
0830 0845 India, All India Radio/Imphal 7335do
0830 0845 India, All India Radio/Itanagar 4990do
0830 0845 India, All India Radio/Kolkata 7210do
0830 0845 India, All India Radio/Shillong 7315do
0830 0845 India, All India Radio/Thiruvananthapuram 7290do
0830 0900 Australia, ABC NT Alice Springs 2310do
0830 0900 Australia, ABC NT Katherine 2485do
0830 0900 Australia, ABC NT Tennant Creek 2325do
0830 0900 Guam, TWR Asia/KTWR 11840as

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

0900 0910 Guam, TWR Asia/KTWR 11840as
0900 0930 Sat/Sun/DRM Bulgaria, BNR Horizont/Home Svc 1 11900eu
0900 0959 Germany, Deutsche Welle 15640as
0900 1000 Anguilla, University Network 6090na
0900 1000 Australia, ABC NT Alice Springs 2310do
0900 1000 Australia, ABC NT Katherine 2485do

0900	1000		Australia, ABC NT Tennant Creek			2325do
0900	1000		Australia, Radio Australia	9475as		9580pa
			9590pa	11945as		
0900	1000		Bahrain, Radio Bahrain	6010me		
0900	1000	w/DRM	Belgium, TDP Radio	6015eu		
0900	1000		Canada, CFRX Toronto ON	6070na		
0900	1000		Canada, CFVP Calgary AB	6030na		
0900	1000		Canada, CKZN St Johns NF	6160na		
0900	1000		Canada, CKZU Vancouver BC			6160na
0900	1000		China, China Radio International			11620as
			13790pa	15210as	15270eu	15350as
			17490eu	17570eu	17750as	
0900	1000		Germany, Deutsche Welle	17820as		
0900	1000	Sun	Greece, Voice of Greece	9420va		15630va
0900	1000		Italy, IRRS-Shortwave/Euro Gospel Radio			
			7290va			
0900	1000		Malaysia, RTM Kajang/Traxx FM			7295do
0900	1000		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
0900	1000		Micronesia, The Cross Radio/Pohnpei			4755 as
0900	1000	DRM	New Zealand, Radio NZ International			7440pa
0900	1000		New Zealand, Radio NZ International			6170pa
0900	1000		Nigeria, Voice of Nigeria	9690af		
0900	1000		Papua New Guinea, Radio Fly			5960do
0900	1000		Russia, Voice of Russia	15170as		
0900	1000	mtwhf	South Africa, Channel Africa	9625af		
0900	1000		South Africa, CVC 1 Africa Radio			13590af
0900	1000		UK, BBC World Service	6190af		6195as
			9740as	11760me	12095af	15310as
			15400af	15575as	17640af	17760as
			17790as	17830af	21470af	21630as
0900	1000		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0900	1000		USA, EWTN/WEWN Irondale, AL			11520af
0900	1000		USA, FBN/WTJC Newport NC			9370na
0900	1000		USA, WHRI Cypress Creek SC			7385va
			9825va	11565va		
0900	1000		USA, WINB Red Lion PA	13570ca		
0900	1000		USA, WRMI Miami FL	9955ca		
0900	1000		USA, WTWW Lebanon TN	5755va		12100va
0900	1000		USA, WWCR Nashville TN	4840na		5890af
			5935af	9985eu		
0900	1000		USA, WWRB Manchester TN	3185na		
0900	1000		USA, WYFR/Family Radio Worldwide			9465as
			9755ca			
0900	1000		Zambia, CVC Radio Christian Voice			13590af
0900	1000		Zambia, ZNBC/Radio Two	6165do		
0930	1000	Sun	Italy, IRRS-Shortwave	9510va		
0930	1000		Saudi Arabia, BSKSA/External Svc			15250af
0959	1000		Netherlands, R Netherlands Worldwide			12065as
			15110as			

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

1000	1030		Japan, Radio Japan NHK World			9605as
			9625pa	9840pa		
1000	1030		Vietnam, Voice of Vietnam/Overseas Svc			
			9840as	12020as		
1000	1057		Netherlands, R Netherlands Worldwide			12065as
			15110as			
1000	1057		North Korea, Voice of Korea		11710ca	11735as
			13650as	15180sa		
1000	1058	DRM	New Zealand, Radio NZ International			7440pa
1000	1058		New Zealand, Radio NZ International			6170pa
1000	1100		Anguilla, University Network			11775na
1000	1100		Australia, ABC NT Alice Springs			2310do
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek			2325do
1000	1100		Australia, Radio Australia	9475as		9580pa
			9590pa	11945as		
1000	1100		Bahrain, Radio Bahrain	6010me		
1000	1100	h/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St Johns NF	6160na		
1000	1100		Canada, CKZU Vancouver BC			6160na
1000	1100		China, China Radio International			6040na
			11610as	11635as	13590as	13620as
			13790na	15190as	15210as	15350as
			17490as			
1000	1100		India, All India Radio/External Svc			7270as
			13695pa	15260as	15410as	17510pa
			17800as	17895pa		
1000	1100		Indonesia, Voice of Indonesia			9526va
1000	1100	Sun	Italy, IRRS-Shortwave	9510va		
1000	1100		Italy, IRRS-Shortwave/Euro Gospel Radio			
			7290va			
1000	1100		Malaysia, RTM Kajang/Traxx FM			7295do
1000	1100		Micronesia, The Cross Radio/Pohnpei			4755as
1000	1100		Nigeria, Voice of Nigeria	9690af		
1000	1100		Russia, Voice of Russia	15170as		
1000	1100		Saudi Arabia, BSKSA/External Svc			15250af
1000	1100	mtwhf	South Africa, Channel Africa	9625af		
1000	1100		South Africa, CVC 1 Africa Radio			13590af
1000	1100		UK, BBC World Service	6190af		6195as
			9740as	11760me	12095af	15310as
			15400af	15575as	17640af	17760as
			17790as	21470af	21660as	
1000	1100	Sat/Sun	UK, BBC World Service	17830af		
1000	1100		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1000	1100		USA, EWTN/WEWN Irondale, AL			9390as
1000	1100		USA, FBN/WTJC Newport NC			9370na
1000	1100		USA, KNLS Anchor Point AK	11870as		
1000	1100		USA, WHRI Cypress Creek SC			7385va
			11565va			
1000	1100		USA, WINB Red Lion PA	13570ca		
1000	1100		USA, WRMI Miami FL	9955ca		
1000	1100		USA, WTWW Lebanon TN	5755va		12100va
1000	1100		USA, WWCR Nashville TN	4840na		5890af
			5935af	9985eu		
1000	1100		USA, WWRB Manchester TN	3185na		
1000	1100		USA, WYFR/Family Radio Worldwide			9465na
1000	1100		Zambia, CVC Radio Christian Voice			13590af
1000	1100		Zambia, ZNBC/Radio Two	6165do		
1030	1100		Iran, IRIB/ VOIRI	17710as	21630as	
1030	1100		Mongolia, Voice of Mongolia	12085as		
1059	1100		New Zealand, Radio NZ International			9655pa
1059	1100	DRM	New Zealand, Radio NZ International			7440pa

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

1100	1105		Pakistan, PBC/Radio Pakistan		15725eu	17720eu
1100	1120	f/DRM	Japan, Radio Japan NHK World			9760eu
1100	1127		Iran, IRIB/ VOIRI	17710as	21630as	
1100	1130	Sat/DRM	South Korea, KBS World Radio			9760eu
1100	1130	fa	UK, BBC World Service	9760eu		
1100	1130		Vietnam, Voice of Vietnam/Overseas Svc			
			7285as			
1100	1145		USA, WYFR/Family Radio Worldwide			9755ca
1100	1157		Romania, Radio Romania International			15210eu
			15430eu	17510af	17670af	
1100	1158	DRM	New Zealand, Radio NZ International			7440pa
1100	1200		Anguilla, University Network			11775na
1100	1200		Australia, ABC NT Alice Springs			2310do
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek			2325do
1100	1200		Australia, Radio Australia	5995pa		6020pa
			9475as	9560pa	9580pa	9590pa
			11945as	12080pa		
1100	1200		Bahrain, Radio Bahrain	6010me		
1100	1200	f/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC Northern Quebec Svc			9625na
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St Johns NF	6160na		
1100	1200		Canada, CKZU Vancouver BC			6160na
1100	1200		China, China Radio International			5955as
			6040as	11650as	11660as	11750na
			11795as	13590as	13645as	13650eu
			13720as	17490eu		
1100	1200	Sun	Italy, IRRS-Shortwave	9510va		
1100	1200		Italy, IRRS-Shortwave/Euro Gospel Radio			
			7290va			
1100	1200		Malaysia, RTM Kajang/Traxx FM			7295do
1100	1200		New Zealand, Radio NZ International			9655pa
1100	1200		Nigeria, Voice of Nigeria	9690af		
1100	1200		Russia, Voice of Russia	12065as		
1100	1200		Saudi Arabia, BSKSA/External Svc			15250af
1100	1200	mtwhf	South Africa, Channel Africa	9625af		
1100	1200		South Africa, CVC 1 Africa Radio			13590af
1100	1200		Taiwan, Radio Taiwan International			7445as
			11715as			
1100	1200		UK, BBC World Service	6140as		6195as
			9740as	11760me	12095af	15285as
			15310as	15400af	15575as	17640as
			17760as	17790as	17830af	21470af
1100	1200		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		

1100	1200		USA, EWTN/WEWN Irondale, AL			9390as
1100	1200		USA, FBN/WTJC Newport NC			9370na
1100	1200		USA, WHRI Cypress Creek SC			7385va
			9410va	11565va		
1100	1200		USA, WINB Red Lion PA	13570ca		
1100	1200		USA, WRMI Miami FL	9955ca		
1100	1200		USA, WWCR Nashville TN	4840na		5890af
			5935af	15825eu		
1100	1200		USA, WWRB Manchester TN	3185na		
1100	1200		USA, WYFR/Family Radio Worldwide			5950na
			15560sa			
1100	1200		Zambia, CVC Radio Christian Voice			13590af
1100	1200		Zambia, ZNBC/Radio Two	6165do		
1130	1200		Vietnam, Voice of Vietnam/Overseas Svc			
			9840as	12020as		
1135	1145		India, All India Radio/Aizawl	5050do		
1135	1145		India, All India Radio/Delhi	9595do		11710do
			15185do			
1135	1145		India, All India Radio/Shillong			4970do

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

1200	1215		Vatican City State, Vatican Radio			13730am
1200	1230		Germany, AWR Europe	17535as		
1200	1230		Saudi Arabia, BSKSA/External Svc			15250af
1200	1245		USA, WYFR/Family Radio Worldwide			5950na
1200	1258		New Zealand, Radio NZ International			9655pa
1200	1259		Poland, Polskie Radio Warsaw			11675eu
			11980eu			
1200	1300		Anguilla, University Network			11775na
1200	1300		Australia, ABC NT Alice Springs			2310do
1200	1300		Australia, ABC NT Katherine	2485do		
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300		Australia, Radio Australia	5995pa		6020pa
			9475as	9560pa	9580pa	9590pa
			11945as			
1200	1300		Bahrain, Radio Bahrain	6010me		
1200	1300	Sat/ DRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC Northern Quebec Svc			9625na
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St Johns NF	6160na		
1200	1300		Canada, CKZU Vancouver BC			6160na
1200	1300		China, China Radio International			5955as
			9460as	9600as	9645as	9730as
			9760pa	11650as	11660as	11690va
			11760pa	11980as	13645as	13650as
			13790eu	17490eu		
1200	1300		Ethiopia, Radio Ethiopia/National Program			
			5990do	7110do	9705do	
1200	1300		Italy, IRRS-Shortwave/Euro Gospel Radio			
			7290va			
1200	1300		Japan, Radio Japan NHK World			6120na
			9695as			
1200	1300		Malaysia, RTM Kajang/Traxx FM			7295do
1200	1300		Nigeria, Voice of Nigeria	9690af		
1200	1300	DRM	Russia, Voice of Russia	9445as		
1200	1300		Russia, Voice of Russia	11500as		
1200	1300		South Africa, CVC 1 Africa Radio			13590af
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		UK, BBC World Service	5875as		6140as
			6190af	6195as	9740as	11750as
			11760me	12095af	15310as	15575as
			17640af	17790af	17830af	21470af
1200	1300		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1200	1300		USA, BBG/Voice of America	7575va		9510va
			12075va	12150va		
1200	1300		USA, EWTN/WEWN Irondale, AL			13580va
1200	1300		USA, FBN/WTJC Newport NC			9370na
1200	1300		USA, KNLS Anchor Point AK	11870as		
1200	1300		USA, WHRI Cypress Creek SC			7385va
			9410va	11565va		
1200	1300		USA, WINB Red Lion PA	13570ca		
1200	1300		USA, WRMI Miami FL	9955ca		
1200	1300		USA, WWCR Nashville TN	7490af		9980af
			13845eu	15825eu		
1200	1300		USA, WWRB Manchester TN	3185va		
1200	1300		Zambia, CVC Radio Christian Voice			13590af
1200	1300		Zambia, ZNBC/Radio Two	6165do		
1215	1300		Egypt, Radio Cairo	17870as		
1230	1245		India, All India Radio/Aizawl	5050do		
1230	1245		India, All India Radio/Chennai			4920do
1230	1245		India, All India Radio/Delhi	4860do		6085do
1230	1245		India, All India Radio/Hyderbad			4800do
1230	1245		India, All India Radio/Jeypore			5040do
1230	1245		India, All India Radio/Kurseong			4895do
1230	1245		India, All India Radio/Port Blair			4760do
1230	1245		India, All India Radio/Radio Kashmir			4950do
1230	1245		India, All India Radio/Shillong			4970do
1230	1245		India, All India Radio/Thiruvananthapuram			
			5010do			
1230	1300		Australia, HCJB Global Australia			15400as
1230	1300		Thailand, Radio Thailand World Svc			9890va
1230	1300		Turkey, Voice of Turkey	15450va		
1230	1300		Vietnam, Voice of Vietnam/Overseas Svc			
			9840as	12020as		
1259	1300		New Zealand, Radio NZ International			6170pa

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

1300	1325		Turkey, Voice of Turkey	15450va		
1300	1330		Egypt, Radio Cairo	17870as		
1300	1330		Japan, Radio Japan NHK World			15735as
			15660al			
1300	1357		North Korea, Voice of Korea	9335na		11710na
			13760eu	15245eu		
1300	1400		Anguilla, University Network			11775na
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, Radio Australia	5995pa		6020pa
			9560pa	9580pa	9590pa	
1300	1400		Bahrain, Radio Bahrain	6010me		
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na		
1300	1400	Sat/Sun	Canada, CBC Northern Quebec Svc			9625na
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St Johns NF	6160na		
1300	1400		Canada, CKZU Vancouver BC			6160na
1300	1400		China, China Radio International			5995as
			9570na	9650na	9730as	9760pa
			9765va	9870as	11660as	11760pa
			11980as	13610eu	13755as	13760eu
			13790eu	15260na		
1300	1400	Sat	Greece, Voice of Greece	15630va		
1300	1400	Sun	Greece, Voice of Greece	9420va		
1300	1400		Indonesia, Voice of Indonesia	9526as		
1300	1400		Italy, IRRS-Shortwave	15610va		
1300	1400		Italy, IRRS-Shortwave/Euro Gospel Radio			
			7290va			
1300	1400		Malaysia, RTM Kajang/Traxx FM			7295do
1300	1400		New Zealand, Radio NZ International			6170pa
1300	1400		Nigeria, Voice of Nigeria	9690af		
1300	1400		Russia, Voice of Russia	12065as		
1300	1400		South Africa, CVC 1 Africa Radio			13590af
1300	1400		South Korea, KBS World Radio			9570as
1300	1400		Tajikistan, Voice of Tajik	7245va		
1300	1400		UK, BBC World Service	5875as		6190af
			6195as	9740as	11760me	12095af
			15310as	15420af	15575as	17790as
			17830af	21470af		
1300	1400		USA, American Forces Network/AFRTS			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1300	1400	Sat/Sun	USA, BBG/Voice of America	7575va		9510va
			12150va			
1300	1400		USA, EWTN/WEWN Irondale, AL			13580va
1300	1400		USA, FBN/WTJC Newport NC			9370na
1300	1400		USA, KJES Vado NM	7555na		
1300	1400		USA, WBCQ Monticello ME	9330usb		
1300	1400		USA, WHRI Cypress Creek SC			7385va
			11565va			
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC			9840af
1300	1400		USA, WINB Red Lion PA	13570ca		
1300	1400		USA, WRMI Miami FL	9955ca		
1300	1400		USA, WWCR Nashville TN	7490af		9980af
			13845eu	15825eu		
1300	1400		USA, WWRB Manchester TN	9385na		
1300	1400		USA, WYFR/Family Radio Worldwide			11560as
			11560ca	12160ca		
1300	1400		Zambia, CVC Radio Christian Voice			13590af
1300	1400		Zambia, ZNBC/Radio Two	6165do		
1330	1345		India, All India Radio/Delhi	6085do		
1330	1400	w	Guam, AWR/KSDA	11880as		
1330	1400		India, All India Radio/External Svc			9690as
			11620as	13710as		
1330	1400		Vietnam, Voice of Vietnam/Overseas Svc			
			9840as	12020as		
1345	1400	Sun	Canada, Bible Voice Broadcasting			17945as
1359	1400		Netherlands, R Netherlands Worldwide			11835as

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

1400	1430	Sun	Germany, Pan American Broadcasting	15205as
1400	1430		Japan, Radio Japan NHK World	11705as
			15735as 21560va 15660al	
1400	1430		Thailand, Radio Thailand World Svc	9575va
1400	1430	Sun	UK, FEBA Radio 12025as	
1400	1457		Netherlands, R Netherlands Worldwide	9800as
			11835as	
1400	1500		Anguilla, University Network	11775na
1400	1500		Australia, ABC NT Alice Springs	2310do
1400	1500		Australia, ABC NT Katherine 2485do	
1400	1500		Australia, ABC NT Tennant Creek	2325do
1400	1500		Australia, Radio Australia 5995pa	6080as
			7240pa 9590pa 11660as	
1400	1500		Bahrain, Radio Bahrain 6010me	
1400	1500	DRM	Belgium, TDP Radio/Disco Palace	6015eu
1400	1500	Sat	Canada, Bible Voice Broadcasting	17945as
1400	1500	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na
1400	1500		Canada, CFRX Toronto ON 6070na	
1400	1500		Canada, CFVP Calgary AB 6030na	
1400	1500		Canada, CKZN St Johns NF 6160na	
1400	1500		Canada, CKZU Vancouver BC	6160na
1400	1500		China, China Radio International	5955as
			9765va 9870as 11665me	11765as
			13710eu 13760eu 11740na	13790eu
			17630af	
1400	1500	Sat/Sun	Equatorial Guinea, Radio East Africa/Malabo	
			15190af	
1400	1500		India, All India Radio/External Svc	9690as
			11620as 13710as	
1400	1500		Italy, IRRS-Shortwave/Euro Gospel Radio	
			7290va	
1400	1500		Libya, LJBC Voice of Africa 17725af	
1400	1500		Malaysia, RTM Kajang/Traxx FM	7295do
1400	1500		New Zealand, Radio NZ International	6170pa
1400	1500		Nigeria, Voice of Nigeria 9690af	
1400	1500		Oman, Radio Sultanate of Oman	15140va
1400	1500	DRM	Russia, Voice of Russia 7225eu	9750eu
1400	1500		Russia, Voice of Russia 4975va	11500as
1400	1500		South Africa, CVC 1 Africa Radio	13590af
1400	1500		UK, BBC World Service 5845as	5875as
			6190af 6195as 7435af	9740as
			12095as 13820as 15310as	17640af
			17830af 21470af	
1400	1500		USA, American Forces Network/AFRTS	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
1400	1500		USA, BBG/Voice of America/African Svc	4930af
			6080af 12080af 15580af	17545af
1400	1500		USA, EWTN/WEWN Irondale, AL	15610va
1400	1500		USA, FBN/WTJC Newport NC	9370na
1400	1500		USA, Overcomer Ministries 9655eu	13810va
1400	1500		USA, WBCQ Monticello ME 9330usb	
1400	1500		USA, WHRI Cypress Creek SC	7385va
			9840va	
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC	9840af
			17510af	
1400	1500		USA, WINB Red Lion PA 13570ca	
1400	1500		USA, WJHR International Milton FL	15550na
1400	1500		USA, WRMI Miami FL 9955ca	
1400	1500		USA, WWCR Nashville TN 7490af	9980af
			13845eu 15825eu	
1400	1500		USA, WWRB Manchester TN 9385na	
1400	1500		USA, WYFR/Family Radio Worldwide	9615as
			11560as	
1400	1500		Zambia, CVC Radio Christian Voice	13590af
1400	1500		Zambia, ZNBC/Radio Two 6165do	
1405	1435	Sat/Sun	Canada, Bible Voice Broadcasting	9345as
1415	1430	mtwhfa	Germany, Pan American Broadcasting	15205as
1415	1500	Sun	Canada, Bible Voice Broadcasting	17945af
1415	1500		Nepal, Radio Nepal 5005as	
1420	1440		India, All India Radio/Itanagar	4990do
1425	1455		Swaziland, TWR Africa 4760af	
1430	1445	Sat	Germany, Pan American Broadcasting	15205as
1430	1445		India, All India Radio/Aizawl 5050do	
1430	1445		India, All India Radio/Delhi 6085do	9575do
			9835do	
1430	1445		India, All India Radio/Jeypore	5040do
1430	1445		India, All India Radio/Mumbai	4840do
1430	1500	mtwhfa	Albania, Radio Tirana 13625na	
1430	1500		China, CNR-11/Xi'an 4905do	4920do
			6010do 6130do	
1430	1500		Guam, AWR/KSDA 9560as	
1430	1500	Sat	India, All India Radio/Gangtok	4835do
1445	1500	smtwhf	Australia, HCJB Global Australia	15340as
1450	1500		India, All India Radio/Itanagar	4990do
1450	1500		India, All India Radio/Kurseong	4895do

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

1500	1515	Sun	Canada, Bible Voice Broadcasting	12035as
1500	1525	tf	Guam, TWR Asia/KTWR 12140as	
1500	1530	Sun	Canada, Bible Voice Broadcasting	17945as
1500	1530		Guam, AWR/KSDA 11720as	
1500	1530		India, All India Radio/Jeypore	5040do
1500	1530		Vietnam, Voice of Vietnam/Overseas Svc	
			7285as 9840as 12020as	
1500	1535	mwhfa	Guam, TWR Asia/KTWR 12140as	
1500	1550		New Zealand, Radio NZ International	6170pa
1500	1557		North Korea, Voice of Korea 9335na	11710na
			13760eu 15245eu	
1500	1558		Libya, LJBC Voice of Africa 17725af	
1500	1600		Anguilla, University Network	11775na
1500	1600		Australia, ABC NT Alice Springs	2310do
1500	1600		Australia, ABC NT Katherine 2485do	
1500	1600		Australia, Radio Australia 5995pa	6080as
			7240pa 9475as 9590pa	11660as
1500	1600		Bahrain, Radio Bahrain 6010me	
1500	1600		Bhutan, Bhutan Broadcasting Svc	6035do
1500	1600	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na
1500	1600		Canada, CFRX Toronto ON 6070na	
1500	1600		Canada, CFVP Calgary AB 6030na	
1500	1600		Canada, CKZN St Johns NF 6160na	
1500	1600		Canada, CKZU Vancouver BC	6160na
1500	1600		Canada, Radio Canada International	11675as
			15125as	
1500	1600		China, China Radio International	5955as
			6095me 7325as 7395as	9720me
			9765va 9800as 9870as	11965eu
			13640eu 13730na 13760eu	17630af
1500	1600	Sat/Sun	Equatorial Guinea, Radio East Africa/Malabo	
			15190af	
1500	1600		Italy, IRRS-Shortwave/Euro Gospel Radio	
			7290va	
1500	1600		Malaysia, RTM Kajang/Traxx FM	7295do
1500	1600		Nigeria, Voice of Nigeria 15120af	
1500	1600	DRM	Russia, Voice of Russia 7225eu	
1500	1600		Russia, Voice of Russia 4975va	9660as
			11985va 12040eu	
1500	1600	mtwhf	South Africa, Channel Africa 9625af	
1500	1600		South Africa, CVC 1 Africa Radio	13590af
1500	1600		Uganda, Dunamis Shortwave 4750af	
1500	1600		UK, BBC World Service 5845as	5875as
			6190af 6195as 7435af	9540as
			9740as 12095as 13820as	15310as
			15400af 15420af 17640af	17830af
			21470af	
1500	1600		USA, American Forces Network/AFRTS	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
1500	1600		USA, BBG/Voice of America 13570va	15530va
1500	1600		USA, BBG/Voice of America/African Svc	4930af
			6080af 12080af 15580af	17895af
1500	1600		USA, BBG/Voice of America/Special English	
			6140af 7465va 9485va	9760va
1500	1600		USA, EWTN/WEWN Irondale, AL	15610va
1500	1600		USA, FBN/WTJC Newport NC	9370na
1500	1600		USA, KNLS Anchor Point AK 9920as	
1500	1600		USA, Overcomer Ministries 9655eu	13810va
			17485af	
1500	1600		USA, WBCQ Monticello ME 9330usb	
1500	1600		USA, WHRI Cypress Creek SC	7385af
1500	1600	Sat/Sun	USA, WHRI Cypress Creek SC	9840af
1500	1600	Sat	USA, WHRI Cypress Creek SC	17510af
1500	1600	Sun	USA, WHRI Cypress Creek SC	15195va
1500	1600		USA, WINB Red Lion PA 13570ca	
1500	1600		USA, WJHR International Milton FL	15550na
1500	1600		USA, WRMI Miami FL 9955na	
1500	1600		USA, WWCR Nashville TN 9980af	12160af
			13845eu 15825eu	
1500	1600		USA, WWRB Manchester TN 9385na	
1500	1600		USA, WYFR/Family Radio Worldwide	11605as
			17580af	
1500	1600		Zambia, CVC Radio Christian Voice	13590af
1500	1600		Zambia, ZNBC/Radio Two 6165do	
1515	1530		Australia, HCJB Global Australia	15340as
1515	1545	Sat	Canada, Bible Voice Broadcasting	13670as
1525	1555	Sat/Sun	Swaziland, TWR Africa 4760af	
1530	1545		India, All India Radio/Aizawl 5050do	
1530	1545		India, All India Radio/Bengaluru	9425do
1530	1545		India, All India Radio/Bhopal 4810do	

1530	1545		India, All India Radio/Chennai	4920do
1530	1545		India, All India Radio/Delhi	5015do
1530	1545		India, All India Radio/External Svc	9910as
1530	1545		India, All India Radio/Guwahati	4940do
1530	1545		India, All India Radio/Hyderbad	4800do
1530	1545		India, All India Radio/Itanagar	4990do
1530	1545		India, All India Radio/Jaipur	4910do
1530	1545		India, All India Radio/Kolkata	4820do
1530	1545		India, All India Radio/Kurseong	4895do
1530	1545		India, All India Radio/Lucknow	4880do
1530	1545		India, All India Radio/Panaji, Goa	9820do
1530	1545		India, All India Radio/Port Blair	4760do
1530	1545		India, All India Radio/Radio Kashmir	4950do
1530	1545		India, All India Radio/Shillong	4970do
1530	1545		India, All India Radio/Shimla	4965do
1530	1545		India, All India Radio/Thiruvananthapuram	5010do
1530	1600	DRM	Belgium, TDP Radio/Disco Palace	15775as
1530	1600	Sun	Canada, Bible Voice Broadcasting	13590me
1530	1600	h	Canada, Bible Voice Broadcasting	13670as
1530	1600		Germany, AWR Europe	15255as
1530	1600		Iran, IRIB/ VOIRI	9600as 11945as
1530	1600		Mongolia, Voice of Mongolia	12015as
1530	1600		Myanmar, Myanma Radio/National Svc	5985do
1545	1600	mtwhfa	Canada, Bible Voice Broadcasting	13590me
1551	1600		New Zealand, Radio NZ International	7440pa
1551	1600	DRM	New Zealand, Radio NZ International	6170pa

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

1600	1605	Sun	Croatia, Croatian Radio	6165eu
1600	1615	tf	Canada, Bible Voice Broadcasting	13590me
1600	1615	mtwhfa	Croatia, Croatian Radio	6165eu
1600	1627		Iran, IRIB/ VOIRI	9600as 11945as
1600	1630		Australia, Radio Australia	9965pa
1600	1630	DRM	Belgium, TDP Radio/Disco Palace	15775as
1600	1630		Guam, AWR/KSDA	11805as 12035as
1600	1630		Myanmar, Myanma Radio/National Svc	5985do
1600	1630		Vietnam, Voice of Vietnam/Overseas Svc	7220me 7280eu 9550me 9730eu
1600	1645	h	Canada, Bible Voice Broadcasting	13590me
1600	1645		USA, WYFR/Family Radio Worldwide	11865na
1600	1657		Germany, Deutsche Welle	6170as
1600	1657		North Korea, Voice of Korea	9990va 11545va
1600	1659		Germany, Deutsche Welle	15410as
1600	1659		USA, WINB Red Lion PA	13570ca
1600	1700		Anguilla, University Network	11775na
1600	1700		Australia, ABC NT Alice Springs	2310do
1600	1700		Australia, ABC NT Katherine	2485do
1600	1700		Australia, Radio Australia	5995pa 6080as 7240pa 9475as 9710pa 11660as
1600	1700		Bahrain, Radio Bahrain	6010me
1600	1700		Bhutan, Bhutan Broadcasting Svc	6035do
1600	1700	Sat/Sun	Canada, Bible Voice Broadcasting	13590me
1600	1700	Sat	Canada, CBC Northern Quebec Svc	9625na
1600	1700		Canada, CFRX Toronto ON	6070na
1600	1700		Canada, CFVP Calgary AB	6030na
1600	1700		Canada, CKZN St Johns NF	6160na
1600	1700		Canada, CKZU Vancouver BC	6160na
1600	1700		China, China Radio International	6060as 7420af 7235as 9570af 11900af 11940eu 11965eu 13760eu
1600	1700		Egypt, Radio Cairo	15345af
1600	1700	Sat/Sun	Equatorial Guinea, Radio East Africa/Malabo	15190af
1600	1700		Ethiopia, Radio Ethiopia	7235va 9560va
1600	1700		Italy, IRRS-Shortwave/Euro Gospel Radio	7290va
1600	1700		Malaysia, RTM Kajang/Traxx FM	7295do
1600	1700	DRM	New Zealand, Radio NZ International	6170pa
1600	1700		New Zealand, Radio NZ International	7440pa
1600	1700		Russia, Voice of Russia	4975va 11985va 12040eu
1600	1700		South Africa, CVC 1 Africa Radio	13590af
1600	1700		South Korea, KBS World Radio	9515eu 9640as
1600	1700		Taiwan, Radio Taiwan International	9435as 15485as
1600	1700		Uganda, Dunamis Shortwave	4750af
1600	1700		UK, BBC World Service	3255af 5845as 5975as 6190af 9495as 12095as 13820as 15400af 15420af 17640af 17795af 17830af 21470af
1600	1700		USA, American Forces Network/AFRTS	4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
1600	1700		USA, BBG/Voice of America/African Svc	4930af 6080af 15580af
1600	1700	mtwhf	USA, BBG/Voice of America/Special English	11890va 12080va 13750va
1600	1700	Sat/Sun	USA, BBG/Voice of America/Special English	11890va 13570va
1600	1700		USA, EWTN/WEWN Irondale, AL	15610va
1600	1700		USA, FBN/WTJC Newport NC	9370na
1600	1700		USA, WBCQ Monticello ME	9330usb
1600	1700		USA, WHRI Cypress Creek SC	7385af 9840af 17520af
1600	1700		USA, WJHR International Milton FL	15550na
1600	1700		USA, WRMI Miami FL	9955na
1600	1700		USA, WWCR Nashville TN	9980af 12160af 13845eu 15825eu
1600	1700		USA, WWRB Manchester TN	9385na
1600	1700		USA, WYFR/Family Radio Worldwide	11850as 17545af 21525af
1600	1700		Zambia, CVC Radio Christian Voice	13590af
1600	1700		Zambia, ZNBC/Radio Two	6165do
1630	1700		Guam, AWR/KSDA	11740as
1630	1700		Palau, T8WH/ WHRI	9930as
1630	1700	m	South Africa, SA Radio League	3230af
1630	1700		Turkey, Voice of Turkey	15520as
1630	1700	mtwhf	USA, BBG/Voice of America	13830af
1630	1700	mtwhf	USA, BBG/Voice of America/Sudan in Focus	9675af 12015af 13830af

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

1700	1720	t	Canada, Bible Voice Broadcasting	13590me
1700	1725		Turkey, Voice of Turkey	15520as
1700	1729	DRM	Romania, Radio Romania International	7350eu
1700	1730	m	South Africa, SA Radio League	3230af
1700	1730		Vietnam, Voice of Vietnam/Overseas Svc	9625eu
1700	1755	mtwhf	South Africa, Channel Africa	9675af
1700	1757	DRM	Romania, Radio Romania International	9535eu
1700	1757		Romania, Radio Romania International	11735eu
1700	1759	DRM	Poland, Polskie Radio Warsaw	7265eu
1700	1759		Poland, Polskie Radio Warsaw	7265eu 9770eu
1700	1800		Anguilla, University Network	11775na
1700	1800		Australia, ABC NT Alice Springs	2310do
1700	1800		Australia, ABC NT Katherine	2485do
1700	1800		Australia, Radio Australia	5995pa 6080as 9475as 9580pa 9710pa 11880pa
1700	1800		Bahrain, Radio Bahrain	6010me
1700	1800	Sat/Sun	Canada, Bible Voice Broadcasting	11960me
1700	1800	Sat	Canada, CBC Northern Quebec Svc	9625na
1700	1800		Canada, CFRX Toronto ON	6070na
1700	1800		Canada, CFVP Calgary AB	6030na
1700	1800		Canada, CKZN St Johns NF	6160na
1700	1800		Canada, CKZU Vancouver BC	6160na
1700	1800		China, China Radio International	6090as 6140as 6145eu 6165me 7235as 7265as 7410as 7420as 11900af 13760af
1700	1800		Egypt, Radio Cairo	15345af
1700	1800	Sat/Sun	Equatorial Guinea, Radio Africa	7190af
1700	1800		Italy, IRRS-Shortwave/Euro Gospel Radio	7290va
1700	1800		Malaysia, RTM Kajang/Traxx FM	7295do
1700	1800		New Zealand, Radio NZ International	7440pa
1700	1800	DRM	New Zealand, Radio NZ International	6170pa
1700	1800		Palau, T8WH/ WHRI	9930as
1700	1800		Russia, Voice of Russia	4975as 11985af 12040eu
1700	1800		South Africa, CVC 1 Africa Radio	4965af 13590af
1700	1800		Swaziland, TWR Africa	3200af
1700	1800	Sat	Swaziland, TWR Africa	3200af
1700	1800		Taiwan, Radio Taiwan International	15690af
1700	1800		UK, BBC World Service	3255af 5845as 5975as 6190af 7405af 7565as 9410af 9495as 12095af 15400af 17795af 17830af
1700	1800		USA, American Forces Network/AFRTS	4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
1700	1800		USA, BBG/Voice of America/African Svc	6080af 12015af 15580af 17895af
1700	1800		USA, EWTN/WEWN Irondale, AL	15610va
1700	1800		USA, FBN/WTJC Newport NC	9370na
1700	1800		USA, WBCQ Monticello ME	9330usb 15420usb
1700	1800		USA, WHRI Cypress Creek SC	7385af 9840af 17520af

1700	1800		USA, WINB Red Lion PA	9265ca
1700	1800		USA, WJHR International Milton FL	15550na
1700	1800		USA, WRMI Miami FL	9955ca
1700	1800		USA, WWCR Nashville TN	9980af 12160af 13845eu 15825eu
1700	1800		USA, WWRB Manchester TN	9385na
1700	1800		USA, WYFR/Family Radio Worldwide	7395af
1700	1800		Zambia, CVC Radio Christian Voice	4965af 13590af
1700	1800		Zambia, ZNBC/Radio Two	6165do
1720	1740	Sat/Sun	USA, BBG/Voice of America/Studio 7	4930af 7210af 12130af
1730	1745		India, All India Radio/Bhopal	4810do
1730	1745		India, All India Radio/Delhi	5015do 7370do 9575do 9835do
1730	1745		India, All India Radio/Guwahati	4940do
1730	1745		India, All India Radio/Hyderbad	4800do
1730	1745		India, All India Radio/Jaipur	4910do
1730	1745		India, All India Radio/Kolkata	4820do
1730	1745		India, All India Radio/Kurseong	4895do
1730	1745		India, All India Radio/Lucknow	4880do
1730	1745		India, All India Radio/Radio Kashmir	4950do
1730	1745		India, All India Radio/Shimla	4965do
1730	1745		India, All India Radio/Thiruvananthapuram	5010do
1730	1800		Bulgaria, Radio Bulgaria	5900eu 7400eu
1730	1800	DRM	Bulgaria, Radio Bulgaria	9700eu
1730	1800	mtwhf	Clandestine, Sudan Radio Service/SRS	9590af
1730	1800	mtwhf	USA, BBG/Voice of America/Studio 7	4930af 7210af 12130af
1730	1800		Vatican City State, Vatican Radio	11625af 13765af 15570af
1740	1745		India, All India Radio/Chennai	4920do
1745	1800	DRM	India, All India Radio/External Svc	9950eu 11580af
1745	1800		India, All India Radio/External Svc	7400af 7410af 7550eu 9415af 9445af 11670eu 11935af
1759	1800		Netherlands, R Netherlands Worldwide	6020af 15495af

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

1800	1815	Sun	Canada, Bible Voice Broadcasting	13590me
1800	1815	Sat	Canada, Bible Voice Broadcasting	11855as
1800	1830		South Africa, AWR Africa	3215af 3345af
1800	1830	w	South Africa, AWR Africa	9755af
1800	1830	mtwhf	USA, BBG/Voice of America/African Svc	6080af 9850af 12015af 15580af
1800	1830	Sat/Sun	USA, BBG/Voice of America/African Svc	4930af 6080af 9850af 12015af 15580af
1800	1835		New Zealand, Radio NZ International	7440pa
1800	1835	DRM	New Zealand, Radio NZ International	6170pa
1800	1845	Sun	Canada, Bible Voice Broadcasting	9430me
1800	1857		Netherlands, R Netherlands Worldwide	6020af 15495af
1800	1857		North Korea, Voice of Korea	13760eu 15425eu
1800	1900		Anguilla, University Network	11775na
1800	1900	mtwhf	Argentina, RAE	15345eu
1800	1900		Australia, ABC NT Alice Springs	2310do
1800	1900		Australia, ABC NT Katherine	2485do
1800	1900		Australia, Radio Australia	6080pa 7240pa 9475as 9580pa 9710pa 11880pa
1800	1900		Bahrain, Radio Bahrain	6010me
1800	1900	Sat	Canada, Bible Voice Broadcasting	9430me
1800	1900	Sun	Canada, Bible Voice Broadcasting	6030eu
1800	1900		Canada, CFRX Toronto ON	6070na
1800	1900		Canada, CFVP Calgary AB	6030na
1800	1900		Canada, CKZN St Johns NF	6160na
1800	1900		Canada, CKZU Vancouver BC	6160na
1800	1900		Canada, Radio Canada International	9530af 11765af 17810af
1800	1900		China, China Radio International	6175eu 9600eu 13760eu
1800	1900	Sat/Sun	Equatorial Guinea, Radio Africa	7190af
1800	1900	DRM	India, All India Radio/External Svc	9950eu 11580af
1800	1900		India, All India Radio/External Svc	7400af 7410af 7550eu 9415af 9445af 11670eu 11935af
1800	1900		Italy, IRRS-Shortwave/Euro Gospel Radio	7290va
1800	1900		Kuwait, Radio Kuwait	15540eu
1800	1900		Malaysia, RTM Kajang/Traxx FM	7295do
1800	1900		Nigeria, Voice of Nigeria	15120af
1800	1900		Palau, T8WH/ WHRI	9930as 9955as
1800	1900		Russia, Voice of Russia	4975me 12040va
1800	1900		South Africa, CVC 1 Africa Radio	4965af 13590af
1800	1900		South Korea, KBS World Radio	7275eu
1800	1900		Swaziland, TWR Africa	9500af
1800	1900		Taiwan, Radio Taiwan International	6155eu
1800	1900		UK, BBC World Service	3255af 7405af 11765va 11810af 12095af 15400af
1800	1900		USA, American Forces Network/AFRTS	4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
1800	1900		USA, EWTN/WEWN Irondale, AL	15610va
1800	1900		USA, FBN/WTJC Newport NC	9370na
1800	1900		USA, KJES Vado NM	15385na
1800	1900		USA, WBCQ Monticello ME	9330usb 15420usb
1800	1900		USA, WHRI Cypress Creek SC	7385af 9840af 17520af
1800	1900		USA, WINB Red Lion PA	9265ca
1800	1900		USA, WJHR International Milton FL	15550na
1800	1900		USA, WRMI Miami FL	9955ca
1800	1900		USA, WWCR Nashville TN	9980af 12160af 13845eu 15825eu
1800	1900		USA, WWRB Manchester TN	9385na
1800	1900		USA, WYFR/Family Radio Worldwide	5905af 7395af 9770af 9925af 13750af
1800	1900		Zambia, CVC Radio Christian Voice	4965af 13590af
1800	1900		Zambia, ZNBC/Radio Two	6165do
1805	1810	Sat	Croatia, Croatian Radio	6165eu
1805	1815	mtwhf	Croatia, Croatian Radio	6165eu
1810	1820	f	USA, BBG/Voice of America/Studio 7	4930af 7210af 12130af
1815	1845	Sat	Canada, Bible Voice Broadcasting	6030eu
1830	1845		Croatia, Croatian Radio	15540na
1830	1845		India, All India Radio/Delhi	5015do
1830	1900		Moldova, (Transnistria) Radio PMR	6240eu
1830	1900		South Africa, AWR Africa	9610af
1830	1900		Turkey, Voice of Turkey	9785eu
1830	1900		UK, BBC World Service	9850as 5875as 5905af 5950as 5950as 5975as 6190af
1830	1900		UK, BBC World Service	9410af
1830	1900		USA, BBG/Voice of America/African Svc	4930af 6080af 9850af 12015af 15580af
1830	1900	mtwhf	USA, BBG/Voice of America/Studio 7	7210af 12130af
1836	1850		New Zealand, Radio NZ International	9615pa
1836	1850	DRM	New Zealand, Radio NZ International	9890pa
1845	1900	mtwhfa	Albania, Radio Tirana	7520na 13735na
1851	1900		New Zealand, Radio NZ International	9615pa
1851	1900	DRM	New Zealand, Radio NZ International	15720pa
1859	1900		Netherlands, R Netherlands Worldwide	7425af 11610af

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

1900	1925		Turkey, Voice of Turkey	9785eu
1900	1930		Germany, Deutsche Welle	6150af 9735af 11795af 17610af
1900	1930		USA, BBG/Voice of America/African Svc	4930af 4940af 6080af 9850af 15580af 17895af
1900	1930		Vietnam, Voice of Vietnam/Overseas Svc	7280eu 9730eu
1900	1945	DRM	India, All India Radio/External Svc	9950eu 11580af
1900	1945		India, All India Radio/External Svc	7400af 7410af 7550eu 9415af 9445af 11670eu 11935af
1900	1950		New Zealand, Radio NZ International	9615pa
1900	1957		Netherlands, R Netherlands Worldwide	7425af 11615af 15195af
1900	1957		North Korea, Voice of Korea	7210af 9975va 11535va 11910af
1900	2000		Anguilla, University Network	11775na
1900	2000		Australia, ABC NT Alice Springs	2310do
1900	2000		Australia, ABC NT Katherine	2485do
1900	2000		Australia, Radio Australia	6080pa 7240pa 9500as 9580pa 9710pa 11880pa
1900	2000		Bahrain, Radio Bahrain	6010me
1900	2000		Canada, CFRX Toronto ON	6070na
1900	2000		Canada, CFVP Calgary AB	6030na
1900	2000		Canada, CKZN St Johns NF	6160na
1900	2000		Canada, CKZU Vancouver BC	6160na
1900	2000		China, China Radio International	7295va 9435af 9440af

1900	2000		Cuba, Radio Havana Cuba	11760sa
1900	2000		Egypt, Radio Cairo	11510af
1900	2000	Sat/Sun	Equatorial Guinea, Radio Africa	7190af
1900	2000		Indonesia, Voice of Indonesia	9526eu
1900	2000		Italy, IRRS-Shortwave/Euro Gospel Radio	7290va
1900	2000		Kuwait, Radio Kuwait	15540eu
1900	2000		Malaysia, RTM Kajang/Traxx FM	7295do
1900	2000		Micronesia, The Cross Radio/Pohnpei	4755as
1900	2000	DRM	New Zealand, Radio NZ International	15720pa
1900	2000		Palau, T8WH/ WHRI	9930as
1900	2000		Russia, Voice of Russia	12040va
1900	2000		South Africa, CVC 1 Africa Radio	4965af
				13590af
1900	2000	mtwhf	Spain, Radio Exterior de Espana	9665eu
				11610af
1900	2000		Swaziland, TWR Africa	3200af
1900	2000	Sat	Swaziland, TWR Africa	3200af
1900	2000		Thailand, Radio Thailand World Svc	7205eu
1900	2000		UK, BBC World Service	3255af 5875as
			5950as 6005af 6190af	9410af
			11810af 12095af 15400af	
1900	2000		USA, American Forces Network/AFRTS	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
1900	2000		USA, BBG/Voice of America/Special English	
			7485va 9630va	
1900	2000		USA, EWTN/WEWN Irondale, AL	15610va
1900	2000		USA, FBN/WTJC Newport NC	9370na
1900	2000		USA, WBCQ Monticello ME 7415usb	9330usb
			15420usb	
1900	2000		USA, WHRI Cypress Creek SC	7385af
			9840af 17520na	
1900	2000		USA, WINB Red Lion PA	9265ca
1900	2000		USA, WJHR International Milton FL	15550na
1900	2000		USA, WRMI Miami FL	9955ca
1900	2000		USA, WWCR Nashville TN	9980af 12160af
			13845eu 15825eu	
1900	2000		USA, WWRB Manchester TN	9385na
1900	2000		USA, WYFR/Family Radio Worldwide	3230af
			6020af 7270af 7395af	9610af
			9775af 18980eu	
1900	2000		Zambia, CVC Radio Christian Voice	4965af
			13590af	
1900	2000		Zambia, ZNBC/Radio Two	6165do
1905	1920	Sat	Mali, ORTM/Radio Mali	9635do
1930	2000	Sat/Sun	Germany, Pan American Broadcasting	9515af
1930	2000		Iran, IRIB/ VOIRI 5940eu 6205eu	9780eu
			9800af	
1930	2000		South Africa, RTE Radio Worldwide	5840af
1930	2000		USA, BBG/Voice of America/African Svc	4930af
			4940af 6080af 15580af	
1945	2000	DRM	Vatican City State, Vatican Radio	9800am
1950	2000		Vatican City State, Vatican Radio	4005va
			5885va 7250va 9645va	
1951	2000		New Zealand, Radio NZ International	11725pa

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

2000	2015	Sat	Germany, Pan American Broadcasting	9515af
2000	2027		Iran, IRIB/ VOIRI 5940eu 6205eu	9780eu
			9800af	
2000	2030	mtwhfa	Albania, Radio Tirana	7465eu 13735na
2000	2030		Egypt, Radio Cairo	11510af
2000	2030		South Africa, RTE Radio Worldwide	5840af
2000	2030	Sat	Swaziland, TWR Africa	3200af
2000	2030		USA, BBG/Voice of America/African Svc	4930af
			4940af 6080af 15580af	
2000	2030		Vatican City State, Vatican Radio	7365af
			9755af 11625af	
2000	2050		New Zealand, Radio NZ International	11725pa
2000	2050	DRM	New Zealand, Radio NZ International	15720pa
2000	2057		Germany, Deutsche Welle 6150af	11865af
2000	2057		Netherlands, R Netherlands Worldwide	7425af
			11615af	
2000	2059		Germany, Deutsche Welle	11795af
2000	2100		Anguilla, University Network	11775na
2000	2100		Australia, ABC NT Alice Springs	2310do
2000	2100		Australia, ABC NT Katherine	2485do
2000	2100		Australia, ABC NT Tennant Creek	2325do
2000	2100		Australia, Radio Australia 6080pa	7240pa
			9500as 11650pa 11660pa	11880pa
2000	2100		Bahrain, Radio Bahrain 6010me	
2000	2100		Belarus, Radio Station Belarus	7255eu
			7360eu 7390eu	
2000	2100	DRM	Belgium, TDP Radio/Disco Palace	17755am
2000	2100		Canada, CFRX Toronto ON 6070na	
2000	2100		Canada, CFVP Calgary AB 6030na	
2000	2100		Canada, CKZN St Johns NF 6160na	
2000	2100		Canada, CKZU Vancouver BC	6160na
2000	2100		Canada, Radio Canada International	15235af
			15330af 17735af	
2000	2100		China, China Radio International	5960eu
			5985af 7285eu 7415eu	9440af
			9600eu	
2000	2100	Sat/Sun	Equatorial Guinea, Radio Africa	7190af
2000	2100		Kuwait, Radio Kuwait 15540eu	
2000	2100		Malaysia, RTM Kajang/Traxx FM	7295do
2000	2100		Micronesia, The Cross Radio/Pohnpei	4755as
2000	2100		Palau, T8WH/ WHRI	9930as
2000	2100		Russia, Voice of Russia	12040va
2000	2100		South Africa, CVC 1 Africa Radio	4965af
			9505af	
2000	2100		UK, BBC World Service 3255af	6005af
			6190af 9410af 11810af	12095af
			13710af	
2000	2100		USA, American Forces Network/AFRTS	4319usb
			5446usb 5765usb 7812usb	12133usb
			12759usb 13362usb	
2000	2100	mtwhf	USA, BBG/Voice of America 5930va	9480va
2000	2100		USA, EWTN/WEWN Irondale, AL	15610af
2000	2100		USA, FBN/WTJC Newport NC	9370na
2000	2100		USA, WBCQ Monticello ME 7415usb	9330usb
			15420usb	
2000	2100		USA, WHRI Cypress Creek SC	7385na
			15665na	
2000	2100		USA, WINB Red Lion PA 9265ca	
2000	2100		USA, WJHR International Milton FL	15550na
2000	2100		USA, WRMI Miami FL 9955ca	
2000	2100		USA, WWCR Nashville TN 9980af	12160af
			13845eu 15825eu	
2000	2100		USA, WWRB Manchester TN 9385na	
2000	2100		USA, WYFR/Family Radio Worldwide	12060af
			15195af 17725ca	
2000	2100		Zambia, CVC Radio Christian Voice	4965af
			9505af	
2000	2100		Zambia, ZNBC/Radio Two 6165do	
2030	2045		Thailand, Radio Thailand World Svc	9680eu
2030	2057	DRM	Romania, Radio Romania International	9765eu
2030	2057		Romania, Radio Romania International	11880na
			11940na 13800na	
2030	2100		Moldova, (Transnistria) Radio PMR	6240eu
2030	2100		Turkey, Voice of Turkey 7205va	
2030	2100		USA, BBG/Voice of America 7555as	
2030	2100		USA, BBG/Voice of America/African Svc	4930af
			6080af 15580af	
2030	2100	Sat/Sun	USA, BBG/Voice of America/African Svc	4930af
			4940af 6080af 15580af	
2030	2100		Vietnam, Voice of Vietnam/Overseas Svc	
			7220me 7280eu 9550me	9730eu
2045	2100		India, All India Radio/External Svc	7550eu
			9445eu 9910pa 11620pa	11670eu
			11715pa	
2045	2100	DRM	India, All India Radio/External Svc	9950eu
2051	2100	DRM	New Zealand, Radio NZ International	11675pa
2051	2100		New Zealand, Radio NZ International	11725pa

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

2100	2125		Turkey, Voice of Turkey 7205va	
2100	2130		Australia, ABC NT Alice Springs	2310do
2100	2130		Australia, ABC NT Katherine	2485do
2100	2130		Australia, ABC NT Tennant Creek	2325do
2100	2130		Austria, AWR Europe	11955af
2100	2130	Sat	Canada, CBC Northern Quebec Svc	9625na
2100	2130		South Korea, KBS World Radio	3955eu
2100	2150	DRM	New Zealand, Radio NZ International	11675pa
2100	2150		New Zealand, Radio NZ International	11725pa
2100	2157		Germany, Deutsche Welle 9735af	
2100	2157		North Korea, Voice of Korea 13760eu	15245eu
2100	2200		Angola, Angolan National Radio	7217af
2100	2200		Anguilla, University Network	11775na
2100	2200		Australia, Radio Australia 9500as	9660pa
			11660pa 11650pa 11695as	13630pa
			15515pa	
2100	2200		Bahrain, Radio Bahrain 6010me	
2100	2200		Belarus, Radio Station Belarus	7255eu
			7360eu 7390eu	
2100	2200	DRM	Belgium, TDP Radio	17555eu
2100	2200		Bulgaria, Radio Bulgaria 5900eu	7400eu
2100	2200		Canada, CFRX Toronto ON 6070na	
2100	2200		Canada, CFVP Calgary AB 6030na	

2100	2200		Canada, CKZN St Johns NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200		China, China Radio International	5960eu		
			7205af	7285eu	7325af	7415eu
			9500eu			
2100	2200	Sat/Sun	Equatorial Guinea, Radio Africa	7190af		
2100	2200		Germany, Deutsche Welle	11865af	15275af	
			15460af			
2100	2200		India, All India Radio/External Svc	7550eu		
			9445eu	9910pa	11620pa	11715pa
2100	2200	DRM	India, All India Radio/External Svc	9950eu		
2100	2200		Malaysia, RTM Kajang/Traxx FM	7295do		
2100	2200		Micronesia, The Cross Radio/Pohnpei	4755 as		
2100	2200		Palau, T8WH/ WHRI	9930as		
2100	2200		South Africa, CVC 1 Africa Radio	4965af		
			9505af			
2100	2200	Sat/Sun	Spain, Radio Exterior de Espana	9650eu		
2100	2200		Syria, Radio Damascus	9330va	12085va	
2100	2200		UK, BBC World Service	3255af	3915as	
			5875as	5905as	6005af	6190af
			6195as	9410af	9915af	12095af
2100	2200		USA, American Forces Network/AFRTS	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2100	2200		USA, BBG/Voice of America	7555as		
2100	2200		USA, BBG/Voice of America/African Svc	6080af		
			15580af			
2100	2200		USA, EWTN/WEWN Irondale, AL	15610af		
2100	2200		USA, FBN/WTJC Newport NC	9370na		
2100	2200		USA, WBCQ Monticello ME	7415usb	9330usb	
2100	2200		USA, WHRI Cypress Creek SC	7385na		
			13660na			
2100	2200		USA, WINB Red Lion PA	9265ca		
2100	2200		USA, WJHR International Milton FL	15550na		
2100	2200		USA, WRMI Miami FL	9955ca		
2100	2200		USA, WWCR Nashville TN	7465eu	9350af	
			9980af	15825na		
2100	2200		USA, WWRB Manchester TN	3215na		
2100	2200		USA, WYFR/Family Radio Worldwide	7425af		
			12060af			
2100	2200		Zambia, CVC Radio Christian Voice	4965af		
			9505af			
2100	2200		Zambia, ZNBC/Radio Two	6165do		
2115	2200		Egypt, Radio Cairo	6270eu		
2130	2200		Australia, ABC NT Alice Springs	4835do		
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200	mtwhfa	Canada, CBC Northern Quebec Svc	9625na		
2151	2200	DRM	New Zealand, Radio NZ International	17675pa		
2151	2200		New Zealand, Radio NZ International	15720pa		

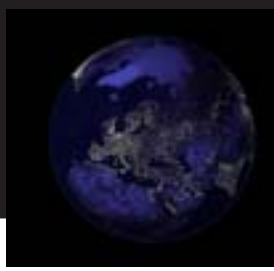
2200 UTC - 6PM EDT / 5PM CDT / 3PM PDT

2200	2205		Zambia, ZNBC/Radio Two	6165do		
2200	2229		USA, WINB Red Lion PA	9265ca		
2200	2230		India, All India Radio/External Svc	7550eu		
			9445eu	9445eu	9910pa	11620pa
			11670eu	11715pa		
2200	2230	DRM	India, All India Radio/External Svc	9950eu		
2200	2230	smtwh	USA, BBG/Voice of America	5895va	7480va	
			7575va	11955va		
2200	2245		Egypt, Radio Cairo	6270eu		
2200	2255		Turkey, Voice of Turkey	9830va		
2200	2257		Romania, Radio Romania International	5960eu		
			7435eu	9790eu	11940eu	
2200	2300		Anguilla, University Network	6090na		
2200	2300		Australia, ABC NT Alice Springs	4835do		
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, Radio Australia	9660pa	9855as	
			13630pa	15230pa	15515pa	15560pa
2200	2300		Bahrain, Radio Bahrain	6010me		
2200	2300	smtwhf	Canada, CBC Northern Quebec Svc	9625na		
2200	2300		Canada, CFRX Toronto ON	6070na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St Johns NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300		China, China Radio International	9590as		
2200	2300	Sat/Sun	Equatorial Guinea, Radio Africa	7190af		
2200	2300		Malaysia, RTM Kajang/Traxx FM	7295do		
2200	2300		Micronesia, The Cross Radio/Pohnpei	4755 as		
2200	2300	DRM	New Zealand, Radio NZ International	17675pa		
2200	2300		New Zealand, Radio NZ International	15720pa		
2200	2300		Palau, T8WH/ WHRI	9930as		
2200	2300		Russia, Voice of Russia	9800va		
2200	2300		UK, BBC World Service	3915as	5875as	
			5905as	5935af	6195as	7490as
			9580as	9915af	12095af	
2200	2300		USA, American Forces Network/AFRTS	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2200	2300		USA, BBG/Voice of America	7555as		
2200	2300		USA, EWTN/WEWN Irondale, AL	15610me		
2200	2300		USA, FBN/WTJC Newport NC	9370na		
2200	2300		USA, WBCQ Monticello ME	7415usb	9330usb	
2200	2300		USA, WHRI Cypress Creek SC	9850na		
			9860na	13620na		
2200	2300		USA, WRMI Miami FL	9955ca		
2200	2300		USA, WWCR Nashville TN	7465eu	9350af	
			9980af	15825na		
2200	2300		USA, WWRB Manchester TN	3215na	5050na	
2200	2300		USA, WYFR/Family Radio Worldwide	15255sa		
			15440ca			
2200	2300		Zambia, CVC Radio Christian Voice	4965af		
2215	2230		Croatia, Croatian Radio	3985eu	9925ca	
2230	2300		China, Xizang PBS/Lhasa	4905do		
2230	2300		Moldova, (Transnistria) Radio PMR	6240eu		
2230	2300		South Africa, AWR Africa	15320as		
2230	2300		USA, BBG/Voice of America/Special English			
			7460af	9570va	11840va	15340va
2230	2300		USA, WINB Red Lion PA	13570ca		
2245	2300		India, All India Radio/External Svc	6055as		
			7305as	11645as	13605as	

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

2300	0000		Anguilla, University Network	6090na		
2300	0000		Australia, ABC NT Alice Springs	4835do		
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, Radio Australia	9660pa	9855va	
			13690pa	15230pa	15415pa	17795pa
2300	0000		Bahrain, Radio Bahrain	6010me		
2300	0000		Bulgaria, Radio Bulgaria	9700na	11700na	
2300	0000	smtwhf	Canada, CBC Northern Quebec Svc	9625na		
2300	0000		Canada, CFRX Toronto ON	6070na		
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St Johns NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		
2300	0000		China, China Radio International	5915as		
			5990ca	6145na	7350eu	7410as
			9610as	11690as	11790as	11840na
2300	0000		Cuba, Radio Havana Cuba	5040ca		
2300	0000		Egypt, Radio Cairo	6270na		
2300	0000		India, All India Radio/External Svc	6055as		
			7305as	11645as	13605as	
2300	0000		Malaysia, RTM Kajang/Traxx FM	7295do		
2300	0000		Micronesia, The Cross Radio/Pohnpei	4755 as		
2300	0000		New Zealand, Radio NZ International	15720pa		
2300	0000	DRM	New Zealand, Radio NZ International	17675pa		
2300	0000		Palau, T8WH/ WHRI	9930as		
2300	0000		Russia, Voice of Russia	9665va	9800va	
2300	0000		UK, BBC World Service	7490as	9580as	
			9740as	9890as	11850as	12010as
2300	0000		USA, American Forces Network/AFRTS	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2300	0000		USA, BBG/Voice of America	5895va	5915va	
			7555va	7575va	11955va	
2300	0000		USA, BBG/Voice of America/Special English			
			7460af	9570va	11840va	15340va
2300	0000		USA, EWTN/WEWN Irondale, AL	15610me		
2300	0000		USA, FBN/WTJC Newport NC	9370na		
2300	0000		USA, WBCQ Monticello ME	7415usb	9330usb	
2300	0000	mtwhfa	USA, WHRI Cypress Creek SC	9850na		
2300	0000	Sun	USA, WHRI Cypress Creek SC	7315na		
			17820va			
2300	0000		USA, WINB Red Lion PA	13570ca		
2300	0000		USA, WRMI Miami FL	9955ca		
2300	0000		USA, WTWW Lebanon TN	5755va	12100va	
2300	0000		USA, WWCR Nashville TN	7465eu	9350af	
			9980af	13845na		
2300	0000		USA, WWRB Manchester TN	3215na	5050na	
2300	0000		USA, WYFR/Family Radio Worldwide	11580sa		
			15440ca			
2300	0000		Zambia, CVC Radio Christian Voice	4965af		
2300	2330	DRM	Vatican City State, Vatican Radio	9755am		
2330	0000		Australia, Radio Australia	17750as		
2330	0000		Vietnam, Voice of Vietnam/Overseas Svc			
			9840as	12020as		
2330	2345		India, All India Radio/Aligarh	9470do		

MTXtra
Shortwave Broadcast Guide



PORTUGUESE

The following language schedule is extracted from our new *MTXtra Shortwave Broadcast Guide* pdf which is a free download to all *MTXpress* subscribers. This new online *Shortwave Broadcast Guide* has more than 9,100 station entries that include all languages being broadcasts via shortwave radio worldwide, sorted by time and updated monthly.

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

0900	1000		Brazil, Educadora/Braganca	4825do	
0900	1000		Brazil, Radio 9 de Julho	9820do	
0900	1000		Brazil, Radio A Nossa Voz	4974do	
0900	1000		Brazil, Radio Alvorada/Londrina		4865do
0900	1000		Brazil, Radio Aparecida	5035do	6135do
			9630do	11855do	
0900	1000		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0900	1000		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0900	1000		Brazil, Radio Brasil 5000	4785do	
0900	1000		Brazil, Radio Brasil Central	4985do	11815do
0900	1000		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0900	1000		Brazil, Radio Capixaba	4935do	
0900	1000		Brazil, Radio Clube do Para	4885do	
0900	1000		Brazil, Radio Congonhas	4775do	
0900	1000		Brazil, Radio Cultura do Para	5045do	
0900	1000		Brazil, Radio Cultura/Sao Paulo		6170do
			9615do		
0900	1000		Brazil, Radio Daqui	4915do	11830do
0900	1000		Brazil, Radio Difusora Acerana		4885do
0900	1000		Brazil, Radio Difusora Caceres		5055do
0900	1000		Brazil, Radio Difusora de Macapa		4915do
0900	1000		Brazil, Radio Difusora Roraima		4875do
0900	1000		Brazil, Radio Difusora/Londrina		4815do
0900	1000		Brazil, Radio Educadora/Guajara Mirim		3375do
0900	1000		Brazil, Radio Educadora/Limeira		2380do
0900	1000		Brazil, Radio Gaucha/Porto Alegre		6020do
0900	1000		Brazil, Radio Gaucha/Rio de Janeiro		11915do
0900	1000		Brazil, Radio Gazeta	9684do	15325do
0900	1000		Brazil, Radio Gazeta Universitaria		5955do
0900	1000		Brazil, Radio Globo	11805do	
0900	1000		Brazil, Radio Guaiba	6000do	11784do
0900	1000		Brazil, Radio Guaruja Paulista		5045do
0900	1000		Brazil, Radio Imaculada Conceicao		4754do
0900	1000		Brazil, Radio Inconfidencia	6010do	15190do
0900	1000		Brazil, Radio Itatiaia	5970do	
0900	1000		Brazil, Radio Jornal A Critica	5055do	
0900	1000		Brazil, Radio Maria	4885do	
0900	1000		Brazil, Radio Marumby	11724do	
0900	1000		Brazil, Radio Meteorologia Paulista		4845do
0900	1000		Brazil, Radio Missoes da Amazonia		4865do
0900	1000		Brazil, Radio Mundial	3325do	
0900	1000		Brazil, Radio Municipal	3375do	
0900	1000		Brazil, Radio Nacional da Amazonia		6180do
			11780do		
0900	1000		Brazil, Radio Novas de Paz	6080do	9515do
0900	1000		Brazil, Radio Novo Tempo	4895do	
0900	1000		Brazil, Radio Record	6150do	9505do
0900	1000		Brazil, Radio Rural	4765do	
0900	1000		Brazil, Radio Senado	5990do	
0900	1000		Brazil, Radio Transmundial	5965do	11735do
0900	1000		Brazil, Radio Voz Misionaria/Camboriu		9665do
0900	1000		Brazil, Radio Voz Misionaria/Florianopolis		
			11749do		
0900	1000		Brazil, Super Radio Deus e Amour/Curitiba		
			6060do	11765do	
0900	1000		Brazil, Super Radio Deus e Amour/Sao Paulo		
			6120do	9585do	
0900	1000		Portugal, RDP Internacional	12020eu	15160af
0900	1000	Sat/Sun	Portugal, RDP Internacional	15160af	
0900	1000	DRM	Portugal, RDP Internacional	11995eu	
0900	1000		USA, WYFR/Family Radio Worldwide		6175sa
			9625sa	11770sa	
0927	1000		Brazil, Radio Alvorada/Parintins		4965do
0930	1000		Brazil, Radio Difusora do Amazonas		4805do
0930	1000		France, Radio France Internationale		6165sa
0930	1000		Japan, Radio Japan NHK World		6145sa
0945	1000		Brazil, Radio Educacao Rural/Coari		5035do

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

1000	1030	Sat/Sun	USA, BBG/Voice of America	17740sa	21590sa
1000	1045		USA, WYFR/Family Radio Worldwide		6175sa
			9605sa	11770sa	
1000	1100		Brazil, Educadora/Braganca	4825do	
1000	1100		Brazil, Radio 9 de Julho	9820do	
1000	1100		Brazil, Radio A Nossa Voz	4974do	
1000	1100		Brazil, Radio Alvorada/Londrina		4865do
1000	1100		Brazil, Radio Aparecida	5035do	6135do
			9630do	11855do	
1000	1100		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
1000	1100		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
1000	1100		Brazil, Radio Brasil 5000	4785do	
1000	1100		Brazil, Radio Brasil Central	4985do	11815do
1000	1100		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
1000	1100		Brazil, Radio Capixaba	4935do	
1000	1100		Brazil, Radio Clube do Para	4885do	
1000	1100		Brazil, Radio Congonhas	4775do	
1000	1100		Brazil, Radio Cultura do Para	5045do	
1000	1100		Brazil, Radio Cultura Ondas Tropicais		4845do
1000	1100		Brazil, Radio Cultura/Sao Paulo		6170do
			9615do		
1000	1100		Brazil, Radio Daqui	4915do	11830do
1000	1100		Brazil, Radio Difusora Acerana		4885do
1000	1100		Brazil, Radio Difusora Caceres		5055do
1000	1100		Brazil, Radio Difusora de Macapa		4915do
1000	1100		Brazil, Radio Difusora do Amazonas		4805do
1000	1100		Brazil, Radio Difusora Roraima		4875do
1000	1100		Brazil, Radio Difusora/Londrina		4815do
1000	1100		Brazil, Radio Educacao Rural/Coari		5035do
1000	1100		Brazil, Radio Educadora 6 de Agosto		3355do
1000	1100		Brazil, Radio Educadora/Guajara Mirim		3375do
1000	1100		Brazil, Radio Educadora/Limeira		2380do
1000	1100		Brazil, Radio Gaucha/Porto Alegre		6020do
1000	1100		Brazil, Radio Gaucha/Rio de Janeiro		11915do
1000	1100		Brazil, Radio Gazeta	9684do	15325do
1000	1100		Brazil, Radio Gazeta Universitaria		5955do
1000	1100		Brazil, Radio Globo	11805do	
1000	1100		Brazil, Radio Guaiba	6000do	11784do
1000	1100		Brazil, Radio Guaruja Paulista		5045do
1000	1100		Brazil, Radio Inconfidencia	6010do	15190do
1000	1100		Brazil, Radio Itatiaia	5970do	
1000	1100		Brazil, Radio Jornal A Critica	5055do	
1000	1100		Brazil, Radio Maria	4885do	
1000	1100		Brazil, Radio Marumby	11724do	
1000	1100		Brazil, Radio Meteorologia Paulista		4845do
1000	1100		Brazil, Radio Missoes da Amazonia		4865do
1000	1100		Brazil, Radio Mundial	3325do	
1000	1100		Brazil, Radio Municipal	3375do	
1000	1100		Brazil, Radio Nacional da Amazonia		6180do
			11780do		
1000	1100		Brazil, Radio Novas de Paz	6080do	9515do
1000	1100		Brazil, Radio Novo Tempo	4895do	
1000	1100		Brazil, Radio Record	6150do	9505do
1000	1100		Brazil, Radio Rio Mar	6160do	9694do
1000	1100		Brazil, Radio Rural	4765do	
1000	1100		Brazil, Radio Senado	5990do	
1000	1100		Brazil, Radio Transmundial	5965do	11735do
1000	1100		Brazil, Radio Voz Misionaria/Camboriu		9665do
1000	1100		Brazil, Radio Voz Misionaria/Florianopolis		
			11749do		
1000	1100		Brazil, Super Radio Deus e Amour/Curitiba		
			6060do	11765do	

1000	1100		Brazil, Super Radio Deus e Amour/Sao Paulo 6120do 9585do		
1000	1100		Portugal, RDP Internacional	15180af	
1000	1100	Sat/Sun	Portugal, RDP Internacional	12020eu	
1030	1100		Brazil, Radio Verdes Florestas	4865do	

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

1100	1200	mtwhf	Argentina, RAE 6060am	11710am	
1100	1200		Brazil, Educadora/Braganca	4825do	
1100	1200		Brazil, Radio 9 de Julho	9820do	
1100	1200		Brazil, Radio A Nossa Voz	4974do	
1100	1200		Brazil, Radio Alvorada/Londrina		4865do
1100	1200		Brazil, Radio Aparecida 9630do	5035do 11855do	6135do
1100	1200		Brazil, Radio Bandeirantes 11925do	6090do	9645do
1100	1200		Brazil, Radio Boa Vontade 11895do	6160do	9550do
1100	1200		Brazil, Radio Brasil 5000	4785do	
1100	1200		Brazil, Radio Brasil Central	4985do	11815do
1100	1200		Brazil, Radio Cancao Nova 9675do	4825do	6105do
1100	1200		Brazil, Radio Capixaba	4935do	
1100	1200		Brazil, Radio Clube do Para	4885do	
1100	1200		Brazil, Radio Congonhas	4775do	
1100	1200		Brazil, Radio Cultura do Para	5045do	
1100	1200		Brazil, Radio Cultura Ondas Tropicais		4845do
1100	1200		Brazil, Radio Cultura/Sao Paulo 9615do		6170do
1100	1200		Brazil, Radio Daqui	4915do	11830do
1100	1200		Brazil, Radio Difusora Acerana		4885do
1100	1200		Brazil, Radio Difusora Caceres		5055do
1100	1200		Brazil, Radio Difusora de Macapa		4915do
1100	1200		Brazil, Radio Difusora do Amazonas		4805do
1100	1200		Brazil, Radio Difusora Roraima		4875do
1100	1200		Brazil, Radio Difusora/Londrina		4815do
1100	1200		Brazil, Radio Educacao Rural/Coari		5035do
1100	1200		Brazil, Radio Educadora 6 de Agosto		3355do
1100	1200		Brazil, Radio Educadora/Guajara Mirim		3375do
1100	1200		Brazil, Radio Educadora/Limeira		2380do
1100	1200		Brazil, Radio Gaucha/Porto Alegre		6020do
1100	1200		Brazil, Radio Gaucha/Rio de Janeiro		11915do
1100	1200		Brazil, Radio Gazeta	9684do	15325do
1100	1200		Brazil, Radio Gazeta Universitaria		5955do
1100	1200		Brazil, Radio Globo	11805do	
1100	1200		Brazil, Radio Guaiba	6000do	11784do
1100	1200		Brazil, Radio Guaruja Paulista		5045do
1100	1200		Brazil, Radio Imaculada Conceicao		4754do
1100	1200		Brazil, Radio Inconfidencia	6010do	15190do
1100	1200		Brazil, Radio Itatiaia	5970do	
1100	1200		Brazil, Radio Jornal A Critica	5055do	
1100	1200		Brazil, Radio Maria	4885do	
1100	1200		Brazil, Radio Marumby	11724do	
1100	1200		Brazil, Radio Meteorologia Paulista		4845do
1100	1200		Brazil, Radio Missoes da Amazonia		4865do
1100	1200		Brazil, Radio Mundial	3325do	
1100	1200		Brazil, Radio Municipal	3375do	
1100	1200		Brazil, Radio Nacional da Amazonia 11780do		6180do
1100	1200		Brazil, Radio Novas de Paz	6080do	9515do
1100	1200		Brazil, Radio Novo Tempo	4895do	
1100	1200		Brazil, Radio Record	6150do	9505do
1100	1200		Brazil, Radio Rio Mar	6160do	9694do
1100	1200		Brazil, Radio Rural	4765do	
1100	1200		Brazil, Radio Senado	5990do	
1100	1200		Brazil, Radio Transmundial	5965do	11735do
1100	1200		Brazil, Radio Verdes Florestas	4865do	
1100	1200		Brazil, Radio Voz Misionaria/Camboriu		9665do
1100	1200		Brazil, Radio Voz Misionaria/Florianopolis 11749do		
1100	1200		Brazil, Super Radio Deus e Amour/Curitiba 6060do 11765do		
1100	1200		Brazil, Super Radio Deus e Amour/Sao Paulo 6120do 9585do		
1100	1200		Portugal, RDP Internacional	12020eu	15180af

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

1200	1230		Brazil, Radio Verdes Florestas	4865do	
1200	1245		USA, WYFR/Family Radio Worldwide		9625sa
1200	1300		Brazil, Educadora/Braganca	4825do	
1200	1300		Brazil, Radio 9 de Julho	9820do	
1200	1300		Brazil, Radio A Nossa Voz	4974do	
1200	1300		Brazil, Radio Alvorada/Londrina		4865do
1200	1300		Brazil, Radio Aparecida 9630do	5035do 11855do	6135do
1200	1300		Brazil, Radio Bandeirantes 11925do	6090do	9645do
1200	1300		Brazil, Radio Boa Vontade 11895do	6160do	9550do
1200	1300		Brazil, Radio Brasil 5000	4785do	
1200	1300		Brazil, Radio Brasil Central	4985do	11815do
1200	1300		Brazil, Radio Cancao Nova 9675do	4825do	6105do
1200	1300		Brazil, Radio Capixaba	4935do	
1200	1300		Brazil, Radio Clube do Para	4885do	
1200	1300		Brazil, Radio Congonhas	4775do	
1200	1300		Brazil, Radio Cultura do Para	5045do	
1200	1300		Brazil, Radio Cultura Ondas Tropicais		4845do
1200	1300		Brazil, Radio Cultura/Sao Paulo 9615do		6170do
1200	1300		Brazil, Radio Daqui	4915do	11830do
1200	1300		Brazil, Radio Difusora Acerana		4885do
1200	1300		Brazil, Radio Difusora Caceres		5055do
1200	1300		Brazil, Radio Difusora de Macapa		4915do
1200	1300		Brazil, Radio Difusora do Amazonas		4805do
1200	1300		Brazil, Radio Difusora Roraima		4875do
1200	1300		Brazil, Radio Difusora/Londrina		4815do
1200	1300		Brazil, Radio Educacao Rural/Coari		5035do
1200	1300		Brazil, Radio Educadora 6 de Agosto		3355do
1200	1300		Brazil, Radio Educadora/Guajara Mirim		3375do
1200	1300		Brazil, Radio Educadora/Limeira		2380do
1200	1300		Brazil, Radio Gaucha/Porto Alegre		6020do
1200	1300		Brazil, Radio Gaucha/Rio de Janeiro		11915do
1200	1300		Brazil, Radio Gazeta	9684do	15325do
1200	1300		Brazil, Radio Gazeta Universitaria		5955do
1200	1300		Brazil, Radio Globo	11805do	
1200	1300		Brazil, Radio Guaiba	6000do	11784do
1200	1300		Brazil, Radio Guaruja Paulista		5045do
1200	1300		Brazil, Radio Imaculada Conceicao		4754do
1200	1300		Brazil, Radio Inconfidencia	6010do	15190do
1200	1300		Brazil, Radio Itatiaia	5970do	
1200	1300		Brazil, Radio Jornal A Critica	5055do	
1200	1300		Brazil, Radio Maria	4885do	
1200	1300		Brazil, Radio Marumby	11724do	
1200	1300		Brazil, Radio Meteorologia Paulista		4845do
1200	1300		Brazil, Radio Missoes da Amazonia		4865do
1200	1300		Brazil, Radio Mundial	3325do	
1200	1300		Brazil, Radio Municipal	3375do	
1200	1300		Brazil, Radio Nacional da Amazonia 11780do		6180do
1200	1300		Brazil, Radio Novas de Paz	6080do	9515do
1200	1300		Brazil, Radio Novo Tempo	4895do	
1200	1300		Brazil, Radio Record	6150do	9505do
1200	1300		Brazil, Radio Rio Mar	6160do	9694do
1200	1300		Brazil, Radio Rural	4765do	
1200	1300		Brazil, Radio Senado	5990do	
1200	1300		Brazil, Radio Transmundial	5965do	11735do
1200	1300		Brazil, Radio Voz Misionaria/Camboriu		9665do
1200	1300		Brazil, Radio Voz Misionaria/Florianopolis 11749do		
1200	1300		Brazil, Super Radio Deus e Amour/Curitiba 6060do 11765do		
1200	1300		Brazil, Super Radio Deus e Amour/Sao Paulo 6120do 9585do		
1200	1300	Sat/Sun	Portugal, RDP Internacional	12020eu	15180af

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

1300	1330		Brazil, Radio Difusora do Amazonas		4805do
1300	1355	Sat/Sun	Portugal, RDP Internacional	12020eu	15180af
1300	1400		Brazil, Educadora/Braganca	4825do	
1300	1400		Brazil, Radio 9 de Julho	9820do	
1300	1400		Brazil, Radio A Nossa Voz	4974do	
1300	1400		Brazil, Radio Alvorada/Londrina		4865do
1300	1400		Brazil, Radio Aparecida 9630do	5035do 11855do	6135do
1300	1400		Brazil, Radio Bandeirantes 11925do	6090do	9645do
1300	1400		Brazil, Radio Boa Vontade 11895do	6160do	9550do
1300	1400		Brazil, Radio Brasil 5000	4785do	
1300	1400		Brazil, Radio Brasil Central	4985do	11815do
1300	1400		Brazil, Radio Cancao Nova 9675do	4825do	6105do
1300	1400		Brazil, Radio Capixaba	4935do	
1300	1400		Brazil, Radio Clube do Para	4885do	
1300	1400		Brazil, Radio Congonhas	4775do	
1300	1400		Brazil, Radio Cultura do Para	5045do	
1300	1400		Brazil, Radio Cultura Ondas Tropicais		4845do

1300	1400	Brazil, Radio Cultura/Sao Paulo		6170do 9615do
1300	1400	Brazil, Radio Daqui	4915do	11830do
1300	1400	Brazil, Radio Difusora Acerana		4885do
1300	1400	Brazil, Radio Difusora Caceres		5055do
1300	1400	Brazil, Radio Difusora de Macapa		4915do
1300	1400	Brazil, Radio Difusora Roraima		4875do
1300	1400	Brazil, Radio Difusora/Londrina		4815do
1300	1400	Brazil, Radio Educacao Rural/Coari		5035do
1300	1400	Brazil, Radio Educadora 6 de Agosto		3355do
1300	1400	Brazil, Radio Educadora/Guajara Mirim		3375do
1300	1400	Brazil, Radio Educadora/Limeira		2380do
1300	1400	Brazil, Radio Gaucha/Porto Alegre		6020do
1300	1400	Brazil, Radio Gaucha/Rio de Janeiro		11915do
1300	1400	Brazil, Radio Gazeta	9684do	15325do
1300	1400	Brazil, Radio Gazeta Universitaria		5955do
1300	1400	Brazil, Radio Globo	11805do	
1300	1400	Brazil, Radio Guaiba	6000do	11784do
1300	1400	Brazil, Radio Guaruja Paulista		5045do
1300	1400	Brazil, Radio Imaculada Conceicao		4754do
1300	1400	Brazil, Radio Inconfidencia	6010do	15190do
1300	1400	Brazil, Radio Itatiaia	5970do	
1300	1400	Brazil, Radio Jornal A Critica	5055do	
1300	1400	Brazil, Radio Maria	4885do	
1300	1400	Brazil, Radio Marumby	11724do	
1300	1400	Brazil, Radio Meteorologia Paulista		4845do
1300	1400	Brazil, Radio Missoes da Amazonia		4865do
1300	1400	Brazil, Radio Mundial	3325do	
1300	1400	Brazil, Radio Nacional da Amazonia		6180do 11780do

MT SHORTWAVE STATION RESOURCE GUIDE

Albania, Radio Tirana ..... **http://rtsh.sil.at/**
Angola, Angolan National Radio ..... **www.rna.ao/**
Anguilla, University Network ..... **www.worldwideuniversitynetwork.com/**
Argentina, RAE ..... **www.radionacional.gov.ar**
Australia, ABC NT Alice Springs ..... **www.abc.net.au/radio/**
Australia, ABC NT Katherine ..... **www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek ..... **www.abc.net.au/radio/**
Australia, HCJB Global Australia ..... **www.hcjb.org/**
Australia, Radio Australia ..... **www.abc.net.au/ra/**
Austria, AWR Europe **www.awr2.org/**
Bahrain, Radio Bahrain ..... **www.radiobahrain.fm/**
Belarus, Radio Station Belarus ..... **www.radiobelarus.tvr.by/eng/**
Belgium, TDP Radio ..... **www.airtime.be/schedule.html**
Belgium, TDP Radio/Disco Palace ..... **www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Svc ..... **www.bbs.com.bt**
Bulgaria, Radio Bulgaria ..... **www.bnr.bg/**
Canada, Bible Voice Broadcasting ..... **www.biblevoice.org/**
Canada, CBC Northern Quebec Svc ..... **www.cbc.ca/north/**
Canada, CFRX Toronto ON ..... **www.cfrb.com**
Canada, CFVP Calgary AB **www.classiccountryam1060.com**
Canada, CKZN St Johns NF ..... **www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC ..... **www.cbc.ca/bc**
Canada, Radio Canada International ..... **www.rcinet.ca/**
China, China Radio International ..... **www.cri.cn/**
Clandestine, Sudan Radio Service/SRS ..... **www.sudanradio.org**
Cuba, Radio Havana Cuba ..... **www.radiohc.cu/**
Egypt, Radio Cairo ..... **www.ertu.org**
Equatorial Guinea, Radio Africa ..... **www.radiopanam.com/**
Equatorial Guinea, Radio Africa 2 ..... **www.radiopanam.com/**
Equatorial Guinea, Radio East Africa ..... **www.radiopanam.com/**
Equatorial Guinea, Radio East Africa/Malabo ..... **www.radiopanam.com/**
Ethiopia, Radio Ethiopia ..... **www.ertagov.com**
Ethiopia, Radio Ethiopia/National Program ..... **www.ertagov.com**
France, Radio France Internationale ..... **http://rfienglish.com**
Germany, AWR Europe **www.awr2.org/**
Germany, Deutsche Welle ..... **www.dw-world.de/**
Germany, Pan American Broadcasting ..... **www.radiopanam.com/**
Germany, TWR Europe ..... **www.twr.org**
Greece, Voice of Greece ..... **www.voiceofgreece.gr/**
Guam, AWR/KSDA **www.awr2.org/**
Guam, TWR Asia/KTWR ..... **http://nea.ktwr.net/**
India, All India Radio/Aizawl ..... **www.allindiaradio.org/**
India, All India Radio/Bengaluru ..... **www.allindiaradio.org/**
India, All India Radio/Bhopal ..... **www.allindiaradio.org/**
India, All India Radio/Chennai ..... **www.allindiaradio.org/**
India, All India Radio/Delhi ..... **www.allindiaradio.org/**
India, All India Radio/External Svc ..... **www.allindiaradio.org/**
India, All India Radio/Gangtok ..... **www.allindiaradio.org/**
India, All India Radio/Gorakhpur ..... **www.allindiaradio.org/**
India, All India Radio/Guwahati ..... **www.allindiaradio.org/**
India, All India Radio/Hyderbad ..... **www.allindiaradio.org/**
India, All India Radio/Imphal ..... **www.allindiaradio.org/**
India, All India Radio/Itanagar ..... **www.allindiaradio.org/**
India, All India Radio/Jaipur ..... **www.allindiaradio.org/**
India, All India Radio/Jeypore ..... **www.allindiaradio.org/**
India, All India Radio/Kolkata ..... **www.allindiaradio.org/**
India, All India Radio/Kurseong ..... **www.allindiaradio.org/**
India, All India Radio/Lucknow ..... **www.allindiaradio.org/**
India, All India Radio/Mumbai ..... **www.allindiaradio.org/**
India, All India Radio/Panaji, Goa ..... **www.allindiaradio.org/**
India, All India Radio/Port Blair ..... **www.allindiaradio.org/**
India, All India Radio/Radio Kashmir ..... **www.allindiaradio.org/**
India, All India Radio/Shillong ..... **www.allindiaradio.org/**
India, All India Radio/Shimla ..... **www.allindiaradio.org/**
India, All India Radio/Thiruvananthapuram ..... **www.allindiaradio.org/**
Indonesia, Voice of Indonesia ..... **www.voi.co.id**
Iran, IRIB/ VOIRI ..... **www.irib.ir/English/**
Italy, IRRS-Shortwave ..... **www.nexus.org**
Italy, IRRS-Shortwave/Euro Gospel Radio ..... **www.egradio.org/**
Japan, Radio Japan NHK World ..... **www.nhk.or.jp/english/**
Kuwait, Radio Kuwait ..... **www.media.gov.kw/**
Malaysia, RTM Kajang/Traxx FM ..... **www.traxxfm.net/index.php**
Malaysia, RTM/Voice of Malaysia ..... **www.rtm.gov.my**
Mali, ORTM/Radio Mali ..... **www.ortm.ml**
Micronesia, The Cross Radio/Pohnpei ..... **www.pmapacific.org/**
Monaco, TWR Europe ..... **www.twr.org/**
Nepal, Radio Nepal ..... **www.radionepal.org/**
Netherlands, R Netherlands Worldwide ..... **www.radionetherlands.nl/**
New Zealand, Radio NZ International ..... **www.rnzi.com**
Nigeria, Voice of Nigeria ..... **www.voiceofnigeria.org**
Oman, Radio Sultanate of Oman ..... **www.oman-tv.gov.om**
Pakistan, PBC/Radio Pakistan ..... **www.radio.gov.pk**
Palau, T8WH/ WHRI ..... **www.whr.org/**
Philippines, PBS/ Radyo Pilipinas ..... **www.pbs.gov.ph/**
Poland, Polskie Radio Warsaw ..... **www.polskieradio.pl**
Romania, Radio Romania International ..... **www.rri.ro/**
Russia, Voice of Russia ..... **http://english.ruvr.ru/**
Saudi Arabia, BSKSA/External Svc ..... **www.saudiradio.net/**
Serbia, International Radio Serbia ..... **www.glassrbije.org**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa ..... **www.channelafrica.org**
South Africa, CVC 1 Africa Radio **www.1africa.tv**
South Africa, RTE Radio Worldwide **www.rte.ie/radio1/**
South Africa, SA Radio League ..... **www.sarl.org.za**
South Africa, TWR Africa ..... **www.twr.org/**
South Korea, KBS World Radio ..... **www.worldkbs.co.kr**
Spain, Radio Exterior de Espana ..... **www.ree.rne.es/**
Sri Lanka, SLBC ..... **www.slbc.lk**
Swaziland, TWR Africa ..... **www.twrafrica.org**
Syria, Radio Damascus ..... **www.rtv.gov.sy/**
Taiwan, Radio Taiwan International ..... **http://english.rti.org.tw/**
Thailand, Radio Thailand World Svc **www.hsk9.org/**
Turkey, Voice of Turkey ..... **www.trt-world.com**
Uganda, Dunamis Shortwave ..... **www.biblevoice.org/stations/east-africa**
UK, BBC World Service ..... **www.bbc.co.uk/worldservice/**
UK, FEBA Radio ..... **www.febaradio.net**
USA, American Forces Network/AFRTS ..... **http://myafn.dodmedia.osd.mil/**
USA, BBG/Voice of America ..... **www.voanews.com/**
USA, BBG/Voice of America/African Svc ..... **www.voanews.com/**
USA, BBG/Voice of America/Special English ..... **www.voanews.com/**
USA, BBG/Voice of America/Studio 7 ..... **www.voanews.com/**
USA, BBG/Voice of America/Sudan in Focus ..... **www.voanews.com/**
USA, EWTN/WEWN Irondale, AL ..... **www.ewtn.com/**
USA, FBN/WTJC Newport NC ..... **www.fbnradio.com/**
USA, KNLS Anchor Point AK ..... **www.knls.org/**
USA, Overcomer Ministries ..... **www.overcomerministry.org/**
USA, WBCQ Monticello ME ..... **www.wbcq.com/**
USA, WHRI Cypress Creek SC ..... **www.whr.org/**
USA, WRMI Miami FL ..... **www.wrmi.net/**
USA, WRMI/Radio Slovakia Intl ..... **www.wrmi.net/**
USA, WRNO New Orleans LA ..... **www.wrnoradio.com**
USA, WTWW Lebanon TN ..... **www.wtww.us/**
USA, WWCR Nashville TN ..... **www.wwcr.com**
USA, WWRB Manchester TN ..... **www.wwrb.org/**
USA, WYFR/Family Radio Worldwide ..... **www.familyradio.com/**
Vatican City State, Vatican Radio ..... **www.vaticanradio.org/**
Vietnam, Voice of Vietnam/Overseas Svc ..... **www.vov.org.vn**
Zambia, CVC Radio Christian Voice ..... **www.voiceafrica.net**
Zambia, ZNBC/Radio Two ..... **www.znbc.co.zm**

MILCOM
MONITORING MILITARY COMMUNICATIONS

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Monitoring the Military on COTHEN

"I don't hear the United States Coast Guard on HF anymore. Where have they moved to?"

This is a common query I hear nearly every day on various newsgroups and blogs. While some of the common frequencies that have been noted for many years are still around (i.e., 5690, 8983, etc.), they are not used as much as had been, because the Coast Guard has joined their mates in the Department of Homeland Security, the US Customs Service, and several other agencies on the COTHEN radio system.

COTHEN (Custom Over the Horizon Enforcement Network) is an HF network that consists of land transmission/reception sites across the continental United States and selected Caribbean locations that are connected by telephone and internet lines. The land lines serve as a backbone, connecting the network sites to one another to provide seamless communications coverage. As of 1989, the network had 19 sites, 89 remote communications consoles (RCC's), and a Technical Service Center (TSC) in Orlando, FL.

For example, a call made from a unit in the Pacific Ocean to a unit on the Atlantic, may be received by a COTHEN site in New Mexico and be sent along the land line to another site located in Florida for transmission to the unit.

COTHEN is an all purpose communications network. COTHEN can receive calls from air, sea, or shore and maintain seamless communications regardless of the origin of the call. Once an asset is connected to the network, the TSC monitors the call and the communications. The signals travel across land lines in order to use a combination of transmission sites to optimize the signal for both the receiver and the sender.

At the sectors, RCCs provide a graphical interface for watch standers that depicts the assets online within the network. The operator can see what assets are engaged in communications within the network and the quality of the links with each asset.

The COTHEN network itself selects the most optimal transmission sites through software. This way the most optimal site manages the radio call. There is a Technical Service Center (TSC) that ensures the optimal sites are used for communications and continuously provides technical support.

COTHEN uses the Automatic Link Establishment (ALE) protocol to select the best transmission frequency from the unit to a COTHEN site and vice versa. ALE is a software based communications protocol that establishes radio links and eliminates human error. This ensures maximum connectivity between assets. The ALE radio frequently sends and receives signals (known as soundings) in order to determine the optimal operating frequencies for that particular radio and location. Based on these soundings, the radio is able to automatically connect or "handshake" with other radios without requiring the user to manage the frequencies.

Through the use of ALE techniques and the COTHEN network, the Coast Guard has been able to optimize its HF communications capabilities. This system is intended to improve high frequency communications specifically between Sectors and their assets, such as aircrafts and cutters.

As mentioned previously, 19 transmission sites span the nation in order to form one unified coverage area. The map included with this column and the station list below identify all of the primary ground stations and their three letter/digit identification that they use on the COTHEN network. This list and map appeared in a 2008 open source study conducted about this system that we found on the internet.

COTHEN NETWORK STATIONS

ID	Coordinates	Station Location
ABQ	35 08′ 39″ N 105 54′ 31″ W	Stanley, NM (E of Albuquerque)
ATL	32 55′ 18″ N 84 39″ 33″ W	Warm Springs, GA (S. of Atlanta)
CDI	34 57′ 30″ N 076 16′ 36″ W	Cedar Island, NC (SE of Raleigh, E of Jacksonville)
CR1-CR8	42 03′ 18″ N 091 63′ 75″ W	Omaha, NE
CDR	42 00′ 26″ N 091 29′ 43″ W	Marion, IA (E of Cedar Rapids)
DEN	39 26′ 26″ N 103 57′ 31″ W	Agate, CO (SE of Denver)
FTM	26 33′ 38″ N 081 25″ 00″ W	Sarasota, FL
KCM	38 36′ 96″ N 093 36′ 35″ W	Kansas City, MO
LUV	40 05′ 21″ N 118 31′ 57″ W	Lovelock, NV (NE of Reno)
MEM	34 36″59″ N 090 04 53″ W	Senatobia, MS (S. of Memphis)
OKO/OKD	34 51′ 46″ N 097 51′ 47″ W	Chichasha, OK (SW of Oklahoma City)
PR1	18 29′ 08″ N 066 37′ 59″ W	Islote, PR (W of San Juan)
RNO	38 52′ 00″ N 119 24′ 38″ W	Simpson, NV (SE of Reno)
RSH	34 49′ 02″ N 078 07 55″ W	Concord, NC (E of Fayetteville)
SAR	27 21′ 15″ N 081 52′ 25″ W	Limestone, FL (E of Sarasota)
SEA	34 58′ 07″ N 078 23′ 32″ W	Clinton, NC (E of Fayetteville)
SS1	42 00′ 26″ N 0 91 29′ 43″ W	Cedar Rapids, IA
VGS	36 35′ 44″ N 114 29′ 27″ W	Longandale, NV (NE of Vegas)

Each of these transmission sites has two antennas: Omni TSI 530 and Directional TSI 540. The omni-directional antenna radiates power uniformly in one plane. These antennas are generally used for air support. Directional antennas radiate more power in one direction than in any other. They are particularly useful for marine support.

Each site transmits 1-kW of power and is connected to one another with 56-k bit phone lines. The connection of the sites by phone line unifies the each site's coverage area so that the network provides one large coverage area rather than 19 individual ones.

❖ COTHEN's Growing Frequency Pool

This part of the COTHEN equation has changed significantly since the Coast Guard has started using the system for flight following and other communications (See *MT Milcom* Feb 2009 for further details).

Original COTHEN Frequencies: 7527.0 8912.0 10242.0 11494.0 13907.0 15867.0 18594.0 20890.0 23214.0 25350.0 kHz ALE/USB. Within the last few years 5732.0 kHz was added to this network.

As we went to press, we found the following 18 frequencies being used by participants the COTHEN network.

4614.5 5250.0 5732.0 5909.5 7527.0 8912.0 10242.0 11494.0 12222.0 13312.0 13907.0 14582.0 15867.0 18594.0 20890.0 23214.0 24838.5 25350.0 kHz ALE/USB.

I am still sifting through some more possible frequencies for COTHEN, so stay tuned to this column for future frequency list releases.

Who are the COTHEN Military Players?

Even though COTHEN is run by the Customs Service, a non-DoD agency, we see more than just the US Coast Guard on this HF radio network. I have seen FEMA ground stations, FEMA auxiliary stations, State EOCs, Department of Agriculture (Animal and Plant Health Inspection EOC), and Department of Justice stations. We believe that some of the tri-graph ALE addresses we see on this system belong to US Navy assets. We have a whole series of ALE addresses that are assigned to the US Army Corps of Engineers.

Table One is a current list of US Coast Guard stations that have been seen/heard/listed on COTHEN and Table Two includes the ALE addresses associated with the Corps of Engineers.

If we have a major natural disaster, such as a hurricane, earthquake, etc., this is one net you want to be part of your listening mix. This month is the peak of hurricane season and, given my monitoring experience in 2005 during hurricane Katrina, this will be one of the important networks that I monitor on HF.

Additional information on COTHEN can be found on *MT* reader Mark Cleary's Low Country Blog at **http://lowcountry-listening-post.blogspot.com/search/label/COTHEN%20ALE%20List**. More information on Coast Guard units, aircraft and cutters can be accessed on Mark's blog at **http://lowcountry-listening-post.blogspot.com/search/label/COTHEN%20ALE%20List**. Also keep an eye out on our Milcom Blog at **http://mt-milcom.blogspot.com** for further updates and information.

And that does it for this edition of *MT*'s *Milcom* column. 'Til next month, 73 and good hunting.

COAST GUARD ASSETS ON COTHEN

GROUND STATIONS

01Z USCG District 1
05Z USCG District 5
07Z USCG District 7 "Miami Ops"

CAM	CAMSPAC Point Reyes, CA
CAMSPAC	CAMSPAC Point Reyes, CA
COLDBAY	Air Facility Cold Bay, AK
CSK	COMMSTA Kodiak, AK
KODIAK1	Kodiak, AK
LNT	CAMSLANT Chesapeake, VA
MP01CG	USCG Unknown
MP02CG	USCG Unknown
NMC	CAMSPAC, Point Reyes, CA
NMH	TISCOM, Alexandria, VA
NMN	CAMSLANT Chesapeake, VA
NOJ	COMMSTA Kodiak, AK
NOJ1	COMMSTA Kodiak, AK

P##	USCG Air Stations
P02	CGAS Clearwater, FL
P03	CGAS Elizabeth City, NC
P08	CGAS New Orleans, LA
P16	CGAS Miami, FL
P18	CGAS Sacramento, CA
P21	ATC Mobile, AL
P23	CGAS Savannah, GA

Other addresses seen but not yet IDed:
P01 P04 P07 P22 P26 P30 P32 P38

PAC	CAMSPAC Point Reyes, CA
STP	Loran Station, Saint Paul Island, AK
TISCOM	USCG Telecommunications and Information Systems Command, Alexandria, VA
UCG	CAMSPAC Point Reyes, CA

Z##	USCG Sector Remote Command Consoles	
Z01	Portland, ME	Sector Northern New England
Z02	Boston, MA	Sector Boston
Z03	Woods Hole, MA	Southeast New England
Z04	New Haven, CT	Sector Long Island
Z05	Staten Island, NY	Sector New York
Z06	Philadelphia, PA	Sector Delaware
Z07	Baltimore, MD	Sector Baltimore
Z08	Portsmouth, VA	Sector Hampton Roads
Z09	Wilmington, NC	Sector North Carolina
Z10	Charleston, SC	Sector Charleston
Z11	Jacksonville, FL	Sector Jacksonville
Z12	Miami, FL	Sector Miami
Z13	Key West, FL	Sector Key West
Z13PRI	Key West, FL	Sector Key West
Z13SEC	Key West, FL	Sector Key West
Z14	St. Petersburg, FL	Sector St. Petersburg
Z15	San Juan, PR	Sector San Juan
Z27	San Francisco, CA	Sector San Francisco
Z28	Los Angeles, CA	Sector Los Angeles
Z29	San Diego, CA	Sector San Diego
Z30	Seattle, WA	Sector Pudget Sound
Z99	Chesapeake, VA	CAMSLANT

Other addresses seen but not yet IDed: Z36 Z58 Z81

AIRCRAFT

ALE Address	Aircraft Type
00#	HC-130Js
5##	HC-130Hs
7##	HC-130Hs
F##	HU-25 Falcons
J##	MH-60J/MH-60T helicopters
K##	MH-65Cs/MH-65Ds
L##	MH-65Cs
N##	HC-144As

COAST GUARD CUTTERS

ALE Address	Cutter Name/Hull Number
AXP	Haddock (WPB 87347)
AYL	Dolphin (WPB 87354)
AYU	Petrel (WPB 87350)
AYV	Fir (WLB 213)
BCU	Sawfish (WPB 87357)
BNW	Sitkinak (WPB 1329)
CBE	Tahoma (WMEC 908)
CPI	Cypress (WLB 210)
CSR	Pea Island (WPB 1347)
CWX	Hudson (WLIC 801)
DCK	Sanibel (WPB 1312)
DIL	Diligence (WMEC 616)
DTS	Dauntless (WMEC 624)
DWA	Morgenthau (WHEC 722)
EDI	Cuttyhunk (WPB 1322)
EPP	Healy (WAGB-20)
ERH	Tybee (WPB 1330)
FFS	Chandeleur (WPB 1319)
FMK	Seneca (WMEC 906)
GBL	Ocracoke (WPB 1307)
GDF	Munro (WHEC 724)
GYS	Key Biscayne (WPB 1339)
HHF	Hollyhock (WLB 214)
HIC	Vigilant (WMEC 617)
HKW	Confidence (WMEC 619)
HNC*	Harriet Lane (WMEC 903)
HSD	Drummond (WPB 1323)
ICB	Forward (WMEC 911)
IGY	Penobscot Bay (WTGB 107)
IKL*	Tampa (WMEC 902)
JHT	Liberty (WPB 1334)
JOM	Sea Otter (WPB 87362)
JOR*	Gallatin (WHEC 721)
KVQ	Nantucket (WPB 1316)
LGV*	Legare (WMEC 912)
LIL	Bainbridge Island (WPB 1343)
MFN	Knight Island (WPB 1348)
MHU	Blacktip (WPB 87326)
MUD	Diligence (WMEC 616)
NAS*	Escanaba (WMEC 907)
NOR	Northland (WMEC 904)
NRT	Active (WMEC 618)
ORW	Jefferson Island (WPB 1340)
OWK	Dependable (WMEC 626)
PAL	Kingfisher (WPB 87322)
PCR	Dallas (WHEC 716)
QSP	Vigorous (WMEC 627)
RDC*	Campbell (WMEC 909)
RKI	Bluefin (WPB 87318)
RKN*	Bear (WMEC 901)
RLT*	Resolute (WMEC 620)
ROS*	Spencer (WMEC 905)
RPM	Legare (WMEC 912)
RTF	Active (WMEC 618)
RUF	Mohawk (WMEC 913)
STF	Steadfast (WMEC 623)
TBZ	Orcas (WPB 1327)
TRK	Adelie (WPB 87333)
UGW	Gannet (WPB 87334)
UHC	Decisive (WMEC 629)
VAI	Valiant (WMEC 621)
VES*	Venturous (WMEC 625)
WHD	Kodiak Island (WPB 1341)
YCQ	Boutwell (WHEC 719)
YWL	Thetis (WMEC 910)

** Indicates that a small boat assigned to this cutter has been observed using the cutter ALE address and add a number one or two to the address. (I.e, RKN1, VES2)*

US ARMY CORP OF ENGINEERS

Voice Call: Charlie ##

C01	Rapid Response Vehicle #1	St. Louis, MO
C02	Rapid Response Vehicle #2	Baltimore, MD
C03	Rapid Response Vehicle #3	Nashville, TN
C04	Rapid Response Vehicle #4	Los Angeles, CA
C05	Rapid Response Vehicle #5	Portland, OR
C06	Rapid Response Vehicle #6	Fort Worth, TX
C08	Rapid Response Vehicle #8	Unknown
C10	Tactical Operations System	Mobile, AL
C11	Emergency Command & Control Vehicle #1	Mobile, AL
C12	Emergency Command & Control Vehicle #2	Mobile, AL
C13	Emergency Command & Control Vehicle #3	Sacramento, CA
C20	Communications Office	Mobile, AL
C21	Tactical Operations Center (TOC)	Mobile, AL
C22	Tactical Operations Center (TOC)	Unknown
C23	Tactical Operations Center (TOC)	Mobile, AL
C24	Tactical Operations Center (TOC)	Honolulu, HI
C26	Emergency Operations Center (EOC)	Chicago, IL
C27	Emergency Operations Center (EOC)	Pittsburgh, PA
C30	Emergency Operations Center (EOC)	Anchorage, AK
C35	Emergency Operations Center (EOC)	Vicksburg, MS
C46	Emergency Operations Center (EOC)	Kansas City, MO
C47	Emergency Operations Center (EOC)	Omaha, NE
C50	Emergency Operations Center (EOC)	Washington, DC
C70	Unknown usage	Mobile, AL
C99	Portable Radio Unit	Unknown

Other addresses seen but not yet IDed:
C02A C03A C05A C08A C09A C10A/B/C C32 C33/A C36 C37 C54 C80

MILCOM EXTRA

MONITORING MILITARY COMMUNICATIONS

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Milcom Bonus Feature

US Customs and Border Protection Air and Marine Branch

The U.S. Customs and Border Protection's (CBP) Office of Air and Marine is the largest aviation and maritime law enforcement organization in the world, utilizing over 700 pilots, operating more than 290 aircraft of 22 different types, including the use of unmanned aircraft systems (UAS). With more than 1,200 federal agents, the 290 aircraft, and 280 marine vessels operating from 80 locations throughout the United States, Customs uses its sophisticated fleets to detect, sort, intercept, track and apprehend criminals in diverse environments at and beyond U.S. borders.

The following is the latest list of aircraft that we have been able to locate in the public domain. We have included for the first time in any list, all of the known HF COTHEN ALE addresses and Mode-S ICAO codes for each aircraft.

Aircraft Serial No	Home Base	Aircraft Type	Mode-S ICAO24	ALE Address
77-22718	Grand Forks AB, ND	UH-60A Blackhawk		A18
78-22982	Grand Forks AB, ND	UH-60A Blackhawk		A82
78-23010	Miami AMB, FL	UH-60A Blackhawk		A10
79-23297	Tucson AB, AZ	UH-60A Blackhawk		A97
79-23299	Tucson AB, AZ	UH-60A Blackhawk		A99
79-23320	San Diego AMB, CA	UH-60A Blackhawk		A20
79-23321	Miami AMB, FL	UH-60A Blackhawk		A32
79-23344	Tucson AB, AZ	UH-60A Blackhawk		A44
79-23350	Caribbean AMB	UH-60A Blackhawk		A50
80-23423	Tucson AB, AZ	UH-60A Blackhawk		A23
80-23465	Caribbean AMB	UH-60A Blackhawk		A65
82-23670	Caribbean AMB	UH-60A Blackhawk		A70
82-23747	El Paso AU, TX	UH-60A Blackhawk		A47
82-23927	Unknown Base	UH-60A Blackhawk		
86-24548	Tucson AB, AZ	UH-60A Blackhawk		A48
87-24641	Miami AMB, FL	UH-60L Blackhawk		A41
07-27170	Unknown Base	UH-60M Blackhawk		
N100PW	San Diego AMB, CA	UH-1H Iroquis	A0060E	
N1200N	Great Lakes AMB, IL	Cessna 550	A05617	I00
N12549	STB Oklahoma City, OK	Cessna 550	A0694B	I49
N1254X	Bellingham AMB, WA	Cessna 550	A0693F	I54
N1255K	Grand Forks AB, ND	Cessna 550	A06956	I55
N1257B	Miami AMB, FL	Cessna 550	A06994	I57
N1260M	Unknown Base	Cessna 182P	A06C60	
N139HS	Great Lakes AMB, IL	Agusta AB-139	A09D60	A39
N140HS	Great Lakes AMB, IL	Agusta AB-139	A0A370	A40
N142CS	Corpus Christi AMB, TX	P-3B AEW&C	A0AA61	D42
N143CS	Corpus Christi AMB, TX	P-3B AEW&C	A0AE18	D43
N144CS	Corpus Christi AMB, TX	P-3B AEW&C	A0B1CF	D44
N145CS	Jacksonville AMB, FL	P-3B AEW&C	A0B586	D45
N146CB	Unknown Base	Eurocopter EC-120B	A0B92E	
N146CS	Jacksonville AMB, FL	P-3B AEW&C	A0B93D	D46
N147CS	Jacksonville AMB, FL	P-3B AEW&C	A0BCF4	D47
N148CS	Corpus Christi AMB, TX	P-3B AEW&C	A0C0AB	D48
N149CS	Corpus Christi AMB, TX	P-3B AEW&C	A0C462	D49
N15390	Corpus Christi AMB, TX	P-3A	A0D900	D90
N1546	Caribbean AMB	Beech King Air 200	A0DC35	M46
N1547	Pensacola AU, FL	Beech King Air 200	A0DC58	T47
N1549	Miami AMB. FL	Beech King Air 200	A0DC9E	M49
N1551	Miami AMB. FL	Beech King Air 200	A0DF3D	M51
N1553	Miami AMB. FL	Beech King Air 200	A0DF83	M53
N1554	STB Oklahoma City, OK	Beech King Air 200	A0DFA6	T54
N1558	Miami AMB. FL	Beech King Air 200	A0E032	T58
N1559	San Diego AMB, CA	Beech King Air 200	A0E055	T59
N1560	New Orleans AMB, LA	Beech King Air 200	A0E2D1	T60
N16295	Corpus Christi AMB, TX	P-3A	A0FCCD	D95
N16370	Corpus Christi AMB, TX	P-3A	A10039	D70
N1650X	Tucson AB, AZ	Cessna T210L	A106AF	
N172AE	Bellingham AMB, WA	Eurocopter AS-350-B3	A120A0	
N178CB	Unknown Base	Eurocopter EC-120B	A13719	
N179CB	Tucson AB, AZ	Eurocopter EC-120B	A13AD0	
N17WW	Unknown Base	Hughes OH-6A	A118DD	
N18314	Corpus Christi AMB, TX	P-3A	A14E69	D14
N183AE	Jacksonville AMB, FL	Eurocopter AS-350-B3	A14BD6	
N183CB	Unknown Base	Eurocopter EC-120B	A14C05	
N186AE	Unknown Base	Eurocopter AS-350-B3	A156FB	A86
N187AE	Plattsburgh AB, NY	Eurocopter AS-350-B3	A15AB2	
N192BP	San Diego AMB, CA	UH-1H Iroquis	A16FC0	
N192CB	Unknown Base	Eurocopter EC-120B	A16FCD	
N194BP	Unknown Base	UH-1H Iroquis	A1772E	
N194CB	Unknown Base	Eurocopter EC-120B	A1773B	
N197CB	Unknown Base	Eurocopter EC-120B	A18260	
N201TU	Tucson AB, AZ	Eurocopter AS-350-B3	A19776	
N202TU	Tucson AB, AZ	Eurocopter AS-350-B3	A19B2D	
N203TU	Unknown Base	Eurocopter AS-350-B3	A19EE4	
N204TU	Great Lakes AMB, IL	Eurocopter AS-350-B3	A1A29B	
N205TU	Unknown Base	Eurocopter AS-350-B3	A1A652	
N2265S	Plattsburgh AB, NY	Cessna T210L	A1FA63	
N2306D	Jacksonville AMB, FL	Cessna T210N	A20BAE	
N230CB	Unknown Base	Eurocopter EC-120B	A208B4	
N241CB	Great Lakes AMB, IL	Eurocopter EC-120B	A233EA	
N2423S	El Paso AU, TX	Cessna T210L	A23A3F	
N2431K	Unknown Base	Cessna T210M	A23DA9	
N243DR	El Paso AU, TX	Cessna TU206G	A23B7F	
N2531K	San Angelo AU, TX	Cessna 550	A26528	I31
N26494	Southern US	Cessna 550	A29189	I94
N26496	New Orleans AMB, LA	Cessna 550	A2918B	I96
N265CB	Unknown Base	Eurocopter EC-120B	A291C4	
N26621	Houston AMB, TX	Cessna 550	A297FF	I21
N2663Y	Texas	Cessna 550	A2981F	I63
N26JK	Unknown Base	Hughes OH-6A	A27D76	
N2734K	Houston AMB, TX	Cessna 550	A2B48F	I34
N2946F	Unknown Base	Bell 204	A30786	
N3262M	Tucson AB, AZ	Cessna 550	A38744	I62
N338BP	Unknown Base	Eurocopter EC-120B	A3B3AE	
N3538R	Unknown Base	Cessna T206H	A3F372	
N3543B	Tucson AB, AZ	Cessna T206H	A3F66C	
N35442	Holton AMB, ME	Cessna T206H	A3F6A8	
N371HS	Unknown Base	Eurocopter EC-120B	A43842	
N37201	San Diego AMB, CA	Cessna 550	A43DAB	I01
N372HS	Unknown Base	Eurocopter EC-120B	A43BF9	
N373HS	Unknown Base	Eurocopter EC-120B	A43FB0	
N374HS	Unknown Base	Eurocopter EC-120B	A44367	
N375HS	Unknown Base	Eurocopter EC-120B	A4471E	
N376HS	Unknown Base	Eurocopter EC-120B	A44AD5	
N377HS	Unknown Base	Eurocopter EC-120B	A44E8C	
N378HS	Unknown Base	Eurocopter EC-120B	A45243	
N37929	Unknown Base	Hughes OH-6A	A457FA	
N3925A	Unknown Base	Eurocopter EC-120B	A48D3F	
N3926A	Unknown Base	Eurocopter EC-120B	A48D62	
N3930A	Unknown Base	Eurocopter AS-350-B3	A49047	
N3931A	Unknown Base	Eurocopter AS-350-B3	A4906A	
N3933A	Unknown Base	Eurocopter AS-350-B3	A490B0	
N3934A	Unknown Base	Eurocopter AS-350-B3	A490D3	
N3935A	Unknown Base	Eurocopter AS-350-B3	A490F6	
N3937A	San Antonio AU, TX	Eurocopter AS-350-B3	A4913C	
N3940A	Unknown Base	Eurocopter AS-350-B3	A493FE	

N4035W	Unknown Base	Eurocopter AS-350-B2	A4BAE2	
N4043L	Unknown Base	Eurocopter AS-350-B2	A4BE49	
N4048L	Unknown Base	Eurocopter AS-350-B2	A4BEF8	
N4055L	San Diego AMB, CA	Eurocopter AS-350-B2	A4C246	
N4059W	San Diego AMB, CA	Eurocopter AS-350-B2	A4C2DC	
N4068W	Miami AMB, FL	Eurocopter AS-350-B2	A4C670	
N423SK	Corpus Christi AMB, TX	P-3B LW	A5085E	D23
N43SA	Ronald Reagan Intl, DC	Cessna 550	A52256	I43
N448AE	Unknown Base	Eurocopter AS-350-B2	A5685A	
N455AE	Unknown Base	Eurocopter AS-350-B2	A584B4	
N4604U	Unknown Base	Cessna TU206G	A59C92	
N4614N	Tucson AB, AZ	Cessna 550	A5A043	I14
N4812E	Unknown Base	Cessna 182R	A5EEF3	
N4869N	Grand Forks AB, ND	Cessna 182Q	A60283	
N4885N	Unknown Base	Cessna 182Q	A60965	
N497PC	Bellingham AMB, WA	Pilatus PC-12-45	A62B61	
N51216	Unknown Base	Cessna T206H	A66B77	
N51824	Unknown Base	Cessna T206H	A681E2	
N51844	Unknown Base	Hughes OH-6A	A68228	
N5187Y	Unknown Base	Hughes OH-6A	A6828B	
N5202Y	Caribbean AMB	Eurocopter AS-350-B2	A68BA3	
N5204G	Miami AMB, FL	Eurocopter AS-350-B2	A68BD9	
N5204J	Bellingham AMB, WA	Eurocopter AS-350-B2	A68BDB	
N5204P	Unknown Base	Eurocopter AS-350-B2	A68BE0	
N5204X	Caribbean AMB	Eurocopter AS-350-B2	A68BE8	
N5204Y	Unknown Base	Eurocopter AS-350-B2	A68BE9	
N5219E	Unknown Base	Cessna T206H	A6903D	
N5247S	Atlanta, GA	McDonnell Douglas MD-369E	A69B28	
N5314J	Bellingham AMB, WA	Cessna 550	A6B711	I4J
N5315X	El Paso AU, TX	Cessna TU206G	A6B741	
N5408G	Bellingham AMB, WA	Cessna 550	A6DB63	I08
N5416U	STB Oklahoma City, OK	Cessna T210N	A6DEE0	
N541PB	Plattsburgh AB, NY	Pilatus PC-12-45	A6DCEA	
N5424X	San Angelo AU, TX	Cessna TU206G	A6E254	
N5475A	Unknown Base	Hughes OH-6A	A6F4F5	
N5515Y	Unknown Base	Cessna T210N	A70640	
N578AE	Jacksonville AMB, FL	Eurocopter AS-350-B3	A76C26	
N586RE	Unknown Base	Cessna 550	A78DAE	I86
N59063	Unknown Base	Cessna 210L	A7A0AD	
N593PC	Great Falls AB, MT	Pilatus PC-12-45	A7A9D4	
N6001L	Houston AMB, TX	Cessna 550	A7C9C5	I1L
N602BP	San Diego AMB, CA	McDonnell Douglas 600N	A7CED4	
N602MB	San Angelo AU, TX	Cessna TU206G	A7CFC2	
N603BP	Unknown Base	McDonnell Douglas 600N	A7D28B	
N604BP	San Diego AMB, CA	McDonnell Douglas 600N	A7D642	
N605BP	Unknown Base	McDonnell Douglas 600N	A7D9F9	
N606BP	San Diego AMB, CA	McDonnell Douglas 600N	A7DDB0	
N607BP	Unknown Base	McDonnell Douglas 600N	A7E167	
N60838	Bellingham AMB, WA	Cessna TU206F	A7E7D9	
N6084W	Unknown Base	Eurocopter AS-350-B2	A7E7F0	
N6087C	California	Eurocopter AS-350-B2	A7E847	
N6088B	Unknown Base	Eurocopter AS-350-B2	A7E869	
N6093K	Unknown Base	Eurocopter AS-350-B2	A7EB79	
N6095U	Unknown Base	Eurocopter AS-350-B2	A7EBC8	
N6098U	San Antonio AU, TX	Eurocopter AS-350-B2	A7EC31	
N6103X	San Antonio AU, TX	Eurocopter AS-350-B2	A7F195	
N611BP	Unknown Base	McDonnell Douglas 600N	A7F29C	
N613BP	Unknown Base	McDonnell Douglas 600N	A7FA0A	
N61865	Unknown Base	Hughes OH-6A	A80FBE	
N6187C	Unknown Base	Hughes OH-6A	A80FC6	
N6188C	Unknown Base	Hughes OH-6A	A80FE9	
N6188D	Unknown Base	Hughes OH-6A	A80FEA	
N6188H	Unknown Base	Hughes OH-6A	A80FEE	
N6229F	Unknown Base	Cessna 182P	A82144	
N6265B	Unknown Base	Cessna 210M	A82F90	
N6298E	Unknown Base	Cessna 182R	A83B21	
N6506R	San Antonio AB, TX	Cessna U206C	A88FF4	
N6506V	Miami AMB, FL	Cessna T210M	A88FF8	
N6507B	Jacksonville AMB, FL	Beech King Air 200	A89009	T07
N65085	Houston AMB, TX	Cessna 210M	A89048	
N6508U	Atlanta, GA	Hughes 369E	A8903D	
N65093	San Diego AMB, CA	Cessna T210M	A89069	
N6621A	Unknown Base	Cessna T210N	A8BE23	
N6637G	San Diego AMB, CA	Cessna 550	A8C2B2	I37
N6637N	Unknown Base	Hughes OH-6A	A8C2B8	
N6640K	Tucson AB, AZ	Hughes OH-6A	A8C577	
N674TC	Miami AMB, FL	Cessna T206H	A8EC40	
N6763L	Great Falls AB, MT	Cessna 550	A8F4CE	I3L
N6775C	Albuquerque AB, NM	Cessna 550	A8F8C3	I75
N6776T	San Diego AMB, CA	Cessna 550	A8F8F5	I76
N7069A	Caribbean AMB	Beech King Air 200	A96E6C	M69
N7074G	Unknown Base	Beech King Air 200	A9717A	T74
N7166M	Jacksonville AMB, FL	Hughes 369E	A9958D	
N72469	Unknown Base	UH-1H Iroquis	A9B5B4	
N72470	Caribbean AMB	Beech King Air 200	A9B5CE	M70
N72472	Florida	Beech King Air 200/C-12C	A9B5D0	T72
N72476	New Orleans AMB, LA	Beech King Air 200	A9B5D4	T76
N7247C	Unknown Base	UH-1H Iroquis	A9B5B8	
N7247J	Unknown Base	UH-1H Iroquis	A9B5BE	
N7247R	San Diego AMB, CA	UH-1H Iroquis	A9B5C5	
N7247Y	New Orleans AMB, LA	Beech King Air 200	A9B5CC	T7Y
N732JF	Unknown Base	Cessna T210L	A9D347	
N748AM	Unknown Base	Eurocopter AS-350-B3	AA104E	
N751AM	Plattsburgh AB, NY	Eurocopter AS-350-B3	AA1DCC	
N752AM	Plattsburgh AB, NY	Eurocopter AS-350-B3	AA2183	
N752CC	San Angelo AMB, TX	Cessna 550	AA21AC	I52
N753AM	Unknown Base	Eurocopter AS-350-B3	AA253A	
N753CC	STB Oklahoma City, OK	Cessna 550	AA2563	I53
N754AM	Unknown Base	Eurocopter AS-350-B3	AA28F1	
N755AM	Unknown Base	Eurocopter AS-350-B3	AA2CA8	
N759AM	Unknown Base	Eurocopter AS-350-B3	AA3B84	
N7681U	Abuquerque AMB, NM	Cessna T210R	AA61CE	
N783MC	STB Oklahoma City, OK	Beech King Air 200	AA9CC1	T83
N785MC	Unknown Base	Beech King Air 200	AAA42F	
N796AM	Unknown Base	Eurocopter AS-350-B3	AACE5B	
N797CW	Unknown Base	Cessna 550	AAD24D	I97
N801MR	Caribbean AMB	DHC-8-202	AAE6B7	D01
N802MR	Caribbean AMB	DHC-8-202	AAEA6E	D02
N803MR	Caribbean AMB	DHC-8-202	AAEE25	D03
N805MR	Unknown Base	DHC-8-202	AAF593	D05
N806MR	Unknown Base	DHC-8-300	AAF94A	D06
N807AM	Unknown Base	Eurocopter AS-350-B3	AAFBEA	
N807MR	Unknown Base	DHC-8-315	AAFD01	D07
N808MR	Unknown Base	DHC-8-315	AB00B8	D08
N810AM	Unknown Base	Eurocopter AS-350-B3	AB0968	
N8142G	Houston AMB, TX	Cessna 210K	AB1ADD	
N8388F	Unknown Base	Hughes 369HS	AB7988	
N839SA	Unknown Base	Cessna T206H	AB7B5A	
N840BP	Unknown Base	Eurocopter AS-350-B2	AB8000	
N841BP	Unknown Base	Eurocopter AS-350-B2	AB83B7	
N842BP	Unknown Base	Eurocopter AS-350-B2	AB876E	A42
N843BP	Unknown Base	Eurocopter AS-350-B2	AB8B25	
N844BP	Unknown Base	Eurocopter AS-350-B3	AB8EDC	
N845BP	Unknown Base	Eurocopter AS-350-B3	AB9293	
N846BP	Unknown Base	Eurocopter AS-350-B3	AB964A	
N847BP	Unknown Base	Eurocopter AS-350-B3	AB9A01	
N848BP	Unknown Base	Eurocopter AS-350-B3	AB9DB8	
N849BP	Unknown Base	Eurocopter AS-350-B3	ABA16F	
N850BP	Unknown Base	Eurocopter AS-350-B3	ABA77F	
N852BP	Unknown Base	Eurocopter AS-350-B3	ABAEED	
N853BP	Unknown Base	Eurocopter AS-350-B3	ABB2A4	
N854BP	Unknown Base	Eurocopter AS-350-B3	ABB65B	
N855BP	Unknown Base	Eurocopter AS-350-B3	ABBA12	
N856BP	Unknown Base	Eurocopter AS-350-B3	ABBDC9	
N896WD	Unknown Base	Eurocopter AS-350-B2	AC5D96	
N9085U	Jacksonville AMB, FL	Piper PA-42-720R	AC8FFE	T85
N909IJ	Jacksonville AMB, FL	Piper PA-42-720R	AC931F	T91
N9116Q	Jacksonville AMB, FL	Piper PA-42-720R	AC9D9B	T16
N9140Y	San Diego AMB, CA	Hughes 396E	ACA7F6	
N9142B	Jacksonville AMB, FL	Piper PA-42-720R	ACA827	T42
N91620	San Diego AMB, CA	Hughes 396E	ACAFAC	
N9204U	San Diego AMB, CA	Hughes 396E	ACC121	
N9204Y	Unknown Base	Hughes 396E	ACC125	
N9214X	Unknown Base	UH-1H Iroquis	ACC4DB	
N9215Z	San Diego AMB, CA	UH-1H Iroquis	ACC500	
N9279A	Jacksonville AMB, FL	Piper PA-42-720R	ACDBBF	T9A
N93285	San Diego AMB, CA	Cessna T210L	ACF0A5	
N9403Y	San Diego AMB, CA	Cessna T210N	AD1000	
N94590	Unknown Base	Cessna 182Q	AD2367	
N96474	Unknown Base	Cessna 182Q	AD6E6C	
N9769N	Grand Forks AFB, ND	Cessna U206A	AD9D8F	
N9724P	Unknown Base	Piper PA-18-150	AD8E05	

US Customs Air and Marine Branch

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The Federal Integrated Wireless Network

Over the history of my tenure at the *Fed Files* one topic that has been a special interest of mine is the Federal Integrated Wireless Network, or IWN. The project has interested me for a number of reasons, including the fact that it has been growing in my own back yard. And I believe that many in the federal government plan on it being the future of federal law-enforcement communications systems

The federal trunked radio system started out as a Justice Department "pilot project" in the Pacific Northwest, running along Interstate 5 in the state of Washington. The original project had 15 P-25VHF trunked radio sites. But after the early testing proved that additional sites were needed to provide the desired service coverage for users, the number of sites in Oregon and Washington has now topped 50.

Originally the project was planned to support primarily Justice Department agencies, but soon after the pilot project began, the Treasury Department signed on as a potential user of the system. Later on, the Department of Homeland Security also joined in the project, and has ended up being a heavy user of the IWN along the US/Canadian border in Washington State.

After the initial phase of the IWN became operational, there was much speculation as to where the next area of the country that new IWN sites would appear. Some official documents seemed to indicate that the Southwest US border areas might be the next area to be built. Listeners reported several IWN trunked sites on the air in Sault Ste. Marie, Michigan and the Washington DC areas and potential testing of IWN digital coverage in the southeastern Arizona area.

In the fall of 2010, many listeners in the Maryland and Virginia areas surrounding Washington, DC noted some new VHF P-25 trunked radio sites appearing on the air. About the same time these signals appeared on the airwaves, the Justice Department budget documents came on line and described the addition of new IWN radio sites in the National Capitol Region (NCR) or the Washington DC area. You can check out the budget documents here:

www.justice.gov/jmd/2011justification/pdf/fy11-lewc-justification.pdf

These new sites were noted to be using a different trunked "System ID" than the original IWN trunked sites. The original IWN trunked sites have indicated a system ID of "715," while these new sites are showing an ID of "010." Some on-line sources have indicated that these new sites may use an ID of "011," but I did not find that to be true of the 14 sites I monitored. These new sites are apparently what are referred to as an "overlay" of the IWN network. It is a separate cluster of trunked sites that make up a unique trunked system, but it can be networked to other IWN system sites across the country.

Here is a listing of what is currently active in the IWN National Capitol Region Overlay System. In some cases, only the control channel was active and voice channels had not yet been identified. And some site locations have not yet been determined:

170.6625 170.9375	Site 101
169.6000 170.8750 171.2750	Site 201 – Independent Hill, VA
170.6250 170.9125	Site 301 – Bull Run VA
169.1875 171.7750	Site 401 – FBI Headquarters, Washington DC
169.6000 171.2750 172.6250	Site 501 – Greenbelt, MD
167.5875 168.2625 168.8250	Site 601
170.8125 171.6250	Site 701 – Fairfax VA
168.2875 168.4875 168.6875 168.8500	Site 801
169.9125	Site 901
168.7625 168.8875 168.9750 171.4375	Site 1001 – Dulles Airport

171.9875 172.6125	Site 1101 – Gaithersburg, MD
172.0125 172.1875 172.2875 172.6375	Site 1201
168.7375	Site 1301
168.7375 173.9000	Site 1401

In addition to these new sites, there are still some sites from the original IWN deployment, System 715, on the air:

170.9250 171.4375	Site 0124	Fairfax, VA
168.2625 168.8875 169.6625 173.5500	Site 0160	Washington DC

Recent reports in communications trade publications seem to indicate that the NCR IWN system had been accepted in early 2011 and that users were expected to receive their radios shortly. I monitored various sites of the IWN NCR over a period of a week in June of this year and actually heard very little traffic. In fact, my logs from PRO96COM showed no radio affiliations on the trunked sites while I was monitoring.

It's not completely clear how this new trunked radio network will be utilized by the many federal agencies in the Washington DC area. A web page provided by the IWN primary contractor, General Dynamics, appears to show that Justice Department agencies will remain the primary user of this newest portion of the IWN:

www.gdc4s.com/content/detail.cfm?item=35d5dd21-6319-4a2e-b382-0940b3306da7

❖ Mt Baker Snoqualmie National Forest Radio System

Continuing the *Fed Files* tour of federally managed lands in the Pacific Northwest, in this issue I will focus on the Mt. Baker-Snoqualmie National Forest in Washington State. The MBS National Forest runs mostly north and south along the western slopes of the Cascade Mountain range, all the way from the Canadian border to the north side of Mount Rainier National Park, which was detailed in the May 2011 *Monitoring Times*.

The MBS National Forest covers 7 counties in Washington and covers almost 1.8 million acres of land. There are 4 district offices in the forest, with the headquarters located in Everett. The Mt. Baker-Snoqualmie National Forest web site has much more information on the forest and its features, **http://fs.usda.gov/mbs**

As with many other large national forests, the MBSNF has several radio networks covering the various ranger districts. Each district has multiple repeaters transmitting and receiving on the same set of frequencies, but with different input CTCSS tones. And there are simplex tactical channels available for localized usage. Here is the most current radio channel plan I have for the MBS National Forest:

	Repeater Out	Repeater In
SEDRO WOOLLEY DISTRICT		
Leonards Ridge	169.9250, 146.2 pl	164.1250, 146.2 pl
West Church (Glacier)	169.9250, 146.2 pl	164.1250, 156.7 pl
Panorama Dome	169.9250, 146.2 pl	164.1250, 167.9 pl
Lookout	169.9250, 146.2 pl	164.1250, 103.5 pl
DARRINGTON DISTRICT		
North Mountain	170.5250, 146.2 pl	162.6125, 146.2 pl
Green Mountain (Verlot)	170.5250, 146.2 pl	162.6125, 103.5 pl
Round Lake (Lost Creek)	170.5250, 146.2 pl	162.6125, 131.8 pl
Miners Ridge	170.5250, 146.2 pl	162.6125, 100.0 pl
Mt Dickerman (Barlow)	170.5250, 146.2 pl	162.6125, 141.3 pl
SKYKOMISH DISTRICT		
Sobieski Mountain	169.5750, 146.2 pl	162.6125, 156.7 pl
Frog	169.5750, 146.2 pl	162.6125, 167.9 pl
NORTH BEND DISTRICT		
Rattlesnake (North Bend)	169.9000, 146.2 pl	164.1500, 146.2 pl
Grass Mt (Enumclaw)	169.9000, 146.2 pl	164.1500, 156.7 pl
Granite Mountain	169.9000, 146.2 pl	164.1500, 100.0 pl
Bessemer	169.9000, 146.2 pl	164.1500, 131.8 pl
Mt Phelps	169.9000, 146.2 pl	164.1500, 203.5 pl
Ravens Roast	169.9000, 146.2 pl	164.1500, 103.5 pl
Tolmie Peak	169.9000, 146.2 pl	164.1500, 167.9 pl
Sun Top	169.9000, 146.2 pl	164.1500, 114.8 pl
TAC-All Forest Personnel	170.1250, CSQ	170.1250, 146.2 pl
AVIATION - Air Guard	168.6250, 110.9 pl	168.6250, 110.9 pl
National Flight Following	168.6500, 110.9 pl	168.6500, 110.9 pl
MBS Air to Ground	167.3000, CSQ	167.3000, CSQ

❖ Umatilla National Forest

Continuing our tour of Pacific Northwest forests, we arrive at the Umatilla National Forest in North Central Oregon. The Umatilla National Forest takes its name from the Umatilla Indian word meaning "water rippling over sand." The Lewis and Clark expedition passed through the area in 1805 on the nearby Columbia River.

The Umatilla National Forest straddles both Oregon and Washington, covering ten counties and nearly 1.4 million acres of land. The US Forest Service Region 6 is responsible for managing the operations at Umatilla National Forest and the forest headquarters is located in Pendleton, Oregon. The Umatilla National Forest web page has much more information if you are interested, **http://fs.usda.gov/umatilla**

As with other forest service systems, there are multiple repeaters with different input CTCSS tones. In this case, I believe the repeater outputs carry no CTCSS tones. Here is the most recent listing I have been able to compile of frequencies used in the Umatilla National Forest:

	Repeater Out	Repeater In
WALLA WALLA DISTRICT		
Black Mountain North	171.7875	163.3750, 110.9 pl
Spout Springs	171.7875	163.3750, 114.8 pl
Bone Springs	171.7875	163.3750, 123.0 pl
Lookout Mountain	171.7875	163.3750, 131.8 pl
Table Rock	171.7875	163.3750, 103.5 pl
Madison Butte	171.7875	163.3750, 136.5 pl
Tamarack Mountain	171.7875	163.3750, 156.7 pl
HEPNER DISTRICT		
Black Mountain South	162.9625	163.3750, 141.3 pl
Tamarack Mountain	162.9625	163.3750, 156.7 pl
Madison Butte	162.9625	163.3750, 136.5 pl
POMEROY DISTRICT		
Tallow Flat	164.8250	169.0000, 156.7 pl
Cottonwood	164.8250	169.0000, 131.8 pl
Robertson Field	164.8250	169.0000, 123.0 pl
Wenatchee/Saddle Butte	164.8250	169.0000, 146.2 pl
Diamond Peak	164.8250	169.0000, 151.4 pl
Oregon Butte	164.8250	169.0000, 167.9 pl
NORTH FORK DISTRICT		
Tower Mountain	164.1250	169.0000, 141.3 pl
Desolation	164.1250	169.0000, 103.5 pl
Bone Point	164.1250	169.0000, 162.2 pl
TAC – All forest personnel		
South Simplex	164.1250, CSQ	164.1250, CSQ
North Simplex	164.8250, CSQ	164.8250, CSQ
Project	164.9625, CSQ	164.9625, CSQ
AVIATION - Air Guard	168.6250, 110.9 pl	168.6250, 110.9 pl
National Flight Following	168.6500, 110.9 pl	168.6500, 110.9 pl
Air-To-Ground	167.9500, CSQ	167.9500, CSQ
Air-To-Ground "Delta"	167.3750, CSQ	167.3750, CSQ

In addition to the US Forest Service channels in the radios of the Umatilla National Forest, they also maintain some additional channels to communicate with nearby federally managed properties:

US Fish & Wildlife, Columbia Wildlife Refuge	164.7750	164.2500, 127.3 pl
Wallowa-Whitman National Forest		
Mount Emily	164.8000	168.1500, 167.9 pl
Mount Fanny	164.8000	168.1500, 151.4 pl
Johnson Rock	164.8000	168.1500, 103.5 pl
Malheur National Forest		
Dixie	172.4000	169.5750, 131.8 pl
Long Creek	172.4000	169.5750, 146.2 pl

Unfortunately, the information I have on Umatilla NF is somewhat dated. I have not seen any updated information more current than about 2006, but listeners have confirmed that many of these frequencies are currently in use. If you have any updated information on the Umatilla National Forest, or any federal managed parks or forests, please send them along to *The Fed Files*!

❖ Mt. Hood & GPNF UHF Links Update

In the March 2011 *Fed Files*, I mentioned the Columbia Cascade Communications Center and how it handles the communications for both Gifford Pinchot National Forest and Mount Hood National Forest. Over the last two years, there have been a number of radio system upgrades that have included some new P-25 digital UHF radio links used to control the various VHF radio repeaters, which are still analog. These UHF links have been somewhat of a mystery as to how they are used and which VHF channels they are connected with.

I heard from a source in the Vancouver, Washington area, site of the Columbia Cascade Communications Center, who was able to monitor the UHF channels and was able to make some headway as to how they are used.

My source reported, "Great time to catch them when they do the morning weather forecast around 10 - 11am. One day I took an early lunch and parked across the street from the Columbia combined dispatch in Orchards to make sure I got all the links and see if they were transmitting on VHF at all; they weren't."

From his on-site monitoring trips, my source was able to determine the following:

417.9875, N68F is linked to the Mitchell Peak 172.2250, 123.0 pl repeater, Gifford Pinchot NF Central Net.
415.5750, N4CE is linked to the Burley Mountain 171.4250, 123.0 pl repeater, Gifford Pinchot North Net.
415.5250, N788 is linked to the Mt. Defiance 172.3250,123.0 pl repeater, Gifford Pinchot Central Net.
418.1875, N47C is linked to Mt. Defiance 169.9500, 127.3 pl repeater for the Columbia River Gorge.
419.7875, N4F9 is linked to the 169.9250, 114.8 pl repeater for Mt Hood East Net.
415.425 N656 is linked to the 170.5250, 162.2 pl repeater for Mt Hood West Net.
415.3875 N47C is linked to the 170.5250, 114.8 pl repeater for the Mt. Hood West Net, Zig Zag Ranger District.
419.7875 N47C is linked with the 169.9250, 114.8 pl repeater for Mt. Hood East Net.

My source also reported, "Another weird thing is that during the weather broadcast I also heard two downlinks active (406.3875, N555 and 406.4250, N555) with the weather. They are definitely coming from the hilltops; not dispatch, though. The only thing I can think of is that those two UHF links are set up as a repeater rather than just a straight link controlling the VHF base stations. No idea why."

Thanks to my source for his diligent research. If anyone else has had experience with other national forests and their radio systems, I'd like to hear from you!

I can't believe we're headed into fall already, but *The Fed Files* will be back in November with more federal monitoring action!

BOATS, PLANES, AND TRAINS

TRAINS

Ernest Robl
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Passenger *vs.* Freight and More Signals

In listening to your scanner, it's good to be aware of fundamental differences between passenger trains and freight trains, other than the obvious one of what the trains do. One difference is that on a modern freight train, the engineer, who operates the engine, and the conductor, who is in charge of paperwork and the total operation of the train, both ride in the engine cab (of the lead engine, when there are multiple engines). On most short-distance passenger trains, the engineer is alone in the engine cab, while the conductor rides back in the train with the passengers.

This has several safety implications – and implications for what you will hear from these trains. For example, safety rules prohibit the engineer from copying orders while the train is in motion. These orders can range from track warrant authority, to slow orders, or other special instructions that need to be issued once the train has left its point of origin. (Slow orders or other instructions that are already in effect when the crew comes on duty are issued – usually via fax – at that location and signed for there.)

However, all orders to trains have to be acknowledged by both the conductor and engineer. With freight trains, that's no problem, even if the train is moving. The conductor, in the engine cab, copies the orders and repeats them back in the presence of the engineer.

For passenger trains, the dispatcher will wait to issue new orders at a location where the train is stopped. (In an emergency, the dispatcher will ask the train to stop to copy orders.) At that location the conductor comes up to the engine cab and the procedure is the same as for freight trains.

Safety rules also require trains to call signals on the radio on most signaled lines. "Clear [green signal] at [location]." This has two important functions. First, it contributes to the situational awareness and alertness of the crew. And second, it lets other trains and railroad employees in the area know what is moving in their area.

Again, there's a difference between freight and passenger trains. On a freight, with both crew members in the engine, only one crew member needs to call the signal on the radio. The other simply acknowledges that signal indication verbally.

Though it doesn't happen often, and Norfolk Southern (NS) dispatchers do make every effort to give priority to passenger trains, Amtrak trains sometimes face delays from what Amtrak calls "freight train interference." Here the west/south-bound Amtrak "Carolinian," train 79, waits on the connecting track at Selma, N.C., (where the train transitions from CSX to NS) for an eastbound NS coal train to clear. The Amtrak train is being held by an absolute signal obscured behind the Amtrak engine in this view. In this case, equipment problems had slowed down the coal train, getting it to Selma later than expected.

On a passenger train with only one crewmember in the cab, only the engineer can see the signal. He calls it on the radio. The conductor, back in the train, repeats it back on his radio. Unless you are close, you may only hear one end of the conversation, as the engine radio is more powerful than the hand-held unit used by the conductor. (Some long-distance Amtrak trains do have two crew members in the cab – an engineer and an assistant engineer. On some trains that normally have only one person in the cab, a second person may be assigned temporarily. This may include a trainee engineer or trainee conductor learning a particular route.)

I've mentioned before that accidents or incidents often result in new procedures. I've noticed one of these on recent Amtrak trips, where I heard the conductor acknowledging signals.

If the signal is clear, or a variation of clear, such as "Diverging Clear" (train has authority to proceed through the curving route of a switch), the conductor simply repeats the indication back. But, if the indication is "Approach," (yellow signal indicating that the next signal is red), then I've heard the conductor respond with, "Approach at [location]. In accordance with the rules, prepare to stop at the next signal."

Again, it's simply a formal reminder that the engineer may need to stop at the next signal.

❖ Absolute and Intermediate Signals

This leads us naturally into further discussion of the types of signals encountered by trains in territory under centralized traffic control (CTC), where signals and routes are remotely controlled from a distant dispatching center. We've touched on some of these aspects before, but they're worth looking at again for a better understanding of railroad operations.

On a CTC-operated line, there are control points – locations where there are either switches or where one track crosses another. These locations have absolute signals. These signals, when displaying stop or dark (burned out bulb or other electrical failure), cannot be passed by trains without instructions from the dispatcher. Permission to pass a stop signal follows specific procedures, where the permission is copied by the train and read back to the dispatcher before going into effect.

But, on CTC lines there are also intermediate signals. On a single track line, sidings may be as much as ten or more miles apart. Opera-

tionally, it does not make sense for that entire ten miles to be a single block, which can only be occupied by one train at a time, particularly when one train is following another in the same direction.

So the distance is divided into multiple blocks, governed by these intermediate signals, which both function as automatic block signals (reacting to track occupancy ahead) and as a slave to the next absolute signal. In other words, if an absolute signal displays stop, the preceding intermediate signal displays approach (yellow or amber), meaning that the train must be prepared to stop.

Intermediate signals, unless there are instructions to the contrary, are usually "permissive." That means that trains can pass them at low speed even when displaying stop or dark. Trains can operate at restricted speed (a speed low enough to stop short of any obstruction or problem) until they reach the next active signal.

This is based on the fact that the train had the authority to enter the track segment from an absolute signal at a previous control point, and, that therefore, there cannot be any opposing movement in the segment. There may be trains following each other in the same direction. But, let's say that a train is proceeding on a clear intermediate signal when it then encounters a dark intermediate signal.

Railroad rules specify that any dark signal must be regarded as displaying the most restrictive aspect. If an absolute signal, capable of displaying only three aspects – clear (green), approach (yellow/amber), or stop (red) – is dark, it must be regarded as displaying stop. If a signal has two heads, for displaying more complex indications, and one of the heads is dark, that head must be regarded as displaying red. So, for example, if you have a dark head over a head displaying green, that signal would be regarded as displaying red over green ("Diverging route clear" on many railroads). And the trains would be governed accordingly.

Dark signals must, of course, be immediately reported to dispatchers. But it may take hours for a signal maintainer to be contacted and to reach the signal.

You can also get a false red signal. Remember that railroad signal systems are set up to "fail safe" – fail in such a mode that the safest possible action is taken.

Why would you get a false or unexpected red signal? That could come from several possible causes. One of these is that the signal has lost communication with the next signal or block. If the signal doesn't know what the status of the next block is, it has to display the most restrictive indication, which is red.

An actual break in the track would also interrupt the track circuit which detects occupancy and would also trigger a red signal. That's one of the reasons why, if a train passes a red intermediate signal, it has to operate at a slow enough speed to be able to stop short of any obstruction or break in the track.

Earlier this year, while returning to my hometown of Durham, N.C., from Charlotte, N.C., on an evening Amtrak train, the train did actually encounter a dark intermediate signal in a rural area following a strong thunderstorm.

An Amtrak conductor checks the platform at Selma while waiting for departure of train 79, the west/south-bound Carolinian.

On my scanner, I heard the engineer call the dark signal to alert the conductor and immediately felt a reduction in speed. The engineer then toned the dispatcher to report the dark signal. He called the dispatcher again to report that he had reached the next signal, and that it was functioning properly – at which point the train resumed its normal speed.

❖ Special Signal Types

There are two special types of signals to which you may also hear reference while listening to your scanner: "Hold-out signals" and "Non-automatic block approach signals." A hold-out signal is a designated absolute signal out on the mainline at a location where there are no switches or cross-tracks that would otherwise require an absolute signal. Rather than simply being an automatic block signal, a hold-out signal is controlled directly by the dispatcher.

It would typically be found a couple of miles out from a major yard or junction, where, in some circumstances, a dispatcher may want to hold a train to keep it from proceeding further. If the yard is congested with switching activity, it may be simpler to hold an approaching train away from the yard for a time.

A non-automatic block approach signal comes just prior to the start of CTC control of a line. Let's say a line runs from A to H. Only the segment from D to H is signaled with CTC. Therefore A to D is "dark" territory controlled by track warrants.

A train operating from A to H would receive a track warrant to proceed from A to D. When it arrives at D, it is then be governed by signal indication. The only problem is that the signal at D may only be visible just before arriving at D. Therefore, the train would otherwise have to slow down, expecting that signal to be a stop indication. For a long, heavy freight train, that means a delay as the train slows down and then accelerates back up to normal speed, even if the signal at D is clear.

The way to solve that problem is to set up a non-automatic block approach signal at C. That signal is identified as such in employee timetables and has a special identifying plate on the signal mast. As the name implies, this signal does not provide information about the occupancy of the block ahead and does not provide movement authority. Remember, the train has a track warrant that governs movement from A to D.

But this signal does give an indication as to what the first absolute signal at the beginning of the CTC segment is showing. If the non-automatic block approach signal is clear, it indicates that the train will be able to proceed past the first signal at D. If it shows "approach" (yellow/amber) then the train needs to expect a red signal. This signal would not normally display a stop indication, as movement between C and D is still governed by track warrant.

Non-automatic block approach signals are also used when a dark (non-signaled) line crosses a signaled line. On the dark line, a non-automatic block approach signal precedes the absolute signal that guards the crossing of the two railroad lines.

❖ PTC Update

Major railroads – with some support from the U.S. Dept. of Transportation – are mounting a campaign to scale back and/or delay the mandate for massive numbers of Positive Train Control (PTC) installations of most mainlines. Not only is the huge cost a daunting factor, but the initial requirement apparently took little considerations of other factors, including the large number of programmers needed to handle the dispatching end of these installations, as well as the need for radio spectrum for all the data communications needed. In the meantime, all of the major railroads in the U.S. are still testing implementation on a few of their lines.

GLOBALNET

Exploring the World of Internet Radio and Television

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You *Can* Take it with You: Internet radio's great mobile push

A few months ago, I touched on how smartphone use is on the rise, especially for Internet radio use. However, there is a large portion of Internet Radio users who don't have smartphones, but who still want to take their Internet radio experience with them on the go.

The awareness of other available options hit me as I was shopping around for a new automobile. There are an increasing number of vehicles that now offer in-car Internet apps and other Web-enhanced features. So, in addition to a smartphone, there are other options available for the person who wants to stay connected no matter where they are.

❖ The Ever Smarter Phone

First, however, a conversation about mobile Internet and Internet radio is not complete without touching on smartphones. The quantum leap that cellular technology has experienced in the last 10 years has taken the smartphone from an extravagant and superfluous accessory for Wall Street high rollers to an everyday necessity for the masses.

I remember my first smartphone, a bulky Treo 600 I purchased to help me stay organized when I was selling radio advertising at Clear Channel Radio. At the time, the Treo promised a fully connected world where you could access the Internet anywhere you could get cell service.

The reality was that the Internet available was a stripped down, nearly useless format that was anything but "the world in your hands."

The release of the iPhone changed that. Finally, the Internet bore a greater resemblance to the computer experience. The big game changer, though, was Apple's use of Apps.

For those in the Internet radio industry, this was revolutionary. Finally, there was a venue for bringing Internet radio and other streaming content into the pockets and hands of every person with a cell phone.

So big was the App craze that other developers had no choice but to get on board. Brands such as Android and Blackberry started their own App stores, opening the door for a focused Web experience for those who wanted it.

But what does a smartphone do for someone wanting a truly mobile Internet radio experience? First, there are the Internet radio apps, like Pandora, TuneIn, Wunderadio, and iHeartRadio. These apps connect to a cell phone signal and stream audio through the app; you don't have to type in a browser address.

TuneIn, for example, has a database of radio station streams from around the world. Finding your favorite station is easy, as their database is searchable from the app, as well as organized by genre or location. Formerly known as RadioTime, the TuneIn database is increasingly being used in WiFi radios and Internet radio apps, so learning to use it here will serve you well for using other Internet radio products.

❖ Audio Anywhere

Once you have your chosen internet radio app, what can you do with it, where can you take it? The most obvious use is listening to streaming audio through the smartphone speakers or a pair of headphones. But there are other uses as well.

I wrote last month how I was using Pandora on my iPhone, paired with an external speaker to listen to streaming music at the beach or poolside. I have been finding this to be an increasingly effective replacement for the portable radio. In the 1980s we had cassette tape boom boxes; then came portable CD player radios in the 1990s. Now we have a smartphone attached to a docking station or speakers.

The nice thing about this option is that it allows you to use any media source or app you have on your smartphone. I have used this speaker with my amateur radio EchoLink app, listening to local and international emergency responder communications through various scanner apps, even watching my favorite episodes of The Office on my Netflix app, all while on the go.

Most smartphones, if not all, should offer a Bluetooth connection for pairing a Bluetooth headset. This comes in handy when pairing a smartphone in a vehicle, as well. If the smartphone is equipped with the A2DP profile (Advanced Audio Distribution Profile), then you might be able to stream any audio from your smartphone to a Bluetooth receiver in your vehicle (nav system, in-car Bluetooth, etc.)

As an example: my new Kia Sorento has built-in Bluetooth capability. With my iPhone paired to the Bluetooth receiver in the car stereo, I can stream any audio source through my vehicle's speakers. Now, I can listen to radio stations across the globe, my custom-created Pandora stations, EchoLink (a nice replacement for my old 2-meter radio) – all wirelessly connected through Bluetooth (as long as I have a cellular signal).

My Sorento and many other cars also have a direct hard-wired iPod docking cable port. Through this I can also play audio from my smartphone through the auxiliary input on my car stereo. This allows me to charge my phone while listening to audio.

The broad number of entertainment and information services makes a smartphone almost a necessity for the person who wants to stay connected while mobile. In addition to Internet radio apps, there are apps for those with a Sirius/XM satellite radio subscription to take their favorite radio channels on-the-go, navigation apps for those not wanting to spend extra money on a portable navigation device, streaming video apps like Netflix, HBO Go, Showtime, and TVu that are beginning to break customers away from the tether of a satellite or cable connection.

❖ Freedom within Limits

It sounds like the smartphone is the perfect solution, right? Well, almost.

Having a smartphone means you will be required to sign up for a data plan with your cell provider. These used to be unlimited data plans that allowed you to stream as much as you wanted to (well, up to 5GB worth of streaming, in most cases).

Because of the strain all of this data use is putting on cellular networks, many providers are now capping data usage or throttling down the speed of the Internet connection for those who exceed a certain amount of usage.

For most users, this doesn't change much. The majority of people who stream audio or use their Internet connection on their phone for checking email or updating their Facebook status will fall well below the cap. But if you are using your smartphone for streaming video or extended streaming audio sessions, you might want to shop around for the carrier with the most cost effective data plan for you.

So, if all you want is to take the Internet with you wherever you go, especially Internet radio and other streaming media, the smartphone is a great all-in-one choice. But it is definitely not the only option out there.

❖ The Tablet: Technology Full-circle

Thousands of years ago, the human race was carving images into tablets to convey or record information. In a case of Fred Flinstone meets George Jetson, today's modern man is doing the same thing, with a little less chiseling.

Once again, Apple was the frontrunner in the tablet wars, releasing to much fanfare the iPad. Now, tablets are popping up everywhere, and they are a great option for taking the Internet

on the go. Just like smartphones, tablets often use a combination of Internet browser and apps to give users access to information and entertainment.

The advantage of tablets as opposed to a smartphone is size, but it can also be a drawback. The larger screen of the tablets puts them in a comfortable spot between phone and laptop, but the size makes them less portable compared to the ease of sliding a phone in your pocket or purse. The larger size does, however, open the door for apps that are not normally offered on smartphones, due to their smaller screens.

When considering a tablet purchase, it really comes down to what you want to use the tablet for, what are the features and things that are important to you, and what are you looking to spend, because tablets can be a bigger investment.

With these devices, you will usually have to make a choice: do you want a WiFi only option that can only connect to the Internet when you have access to a WiFi signal? Or, do you want to get one that can access a cell phone signal to get on the Internet just about anywhere?

For most tablets, the cell connection option comes with an extra monthly fee, like the smartphone data plan. These usually also have data usage caps, and can require a contract commitment (usually 2 years), although some tablet providers are allowing users to do a month-to-month option.

If you prefer the WiFi only option, this doesn't mean you are chained to Starbucks or your home network; there are still a few options for providing yourself a portable WiFi connection that won't break the bank.

❖ MiFi, YourFi, we all want WiFi

The portable WiFi hotspot is starting to become an increasingly popular option. Now, there are products that give you WiFi in your pocket, in your car, even coming from your phone itself.

I have discussed in this column previously some of the in-car WiFi options like AutoNet Mobile, that use a router mounted in your vehicle to convert a cell phone signal into a WiFi hotspot in your car. With this, you can connect to the Internet on your tablets, smartphones (to save on data usage), portable gaming devices, laptop or any other device that uses the Internet. This isn't the least expensive option, though, with the equipment and monthly fees being a bit pricey. But for those who spend a lot of time in their vehicles and have a need to be connected at all times, this is a viable option.

In addition, there has been a surge in the popularity of MiFi devices. These are small, roughly credit card-sized devices that operate much like AutoNet. It converts a cell signal to a WiFi hotspot, usually allowing up to five devices to be connected at once. The speeds aren't blazing yet, and there are reports of spotty service coverage. But for those looking for a basic way to take a WiFi hotspot with them, MiFi might be something to look into. There is usually an equipment charge and a monthly service fee, which either requires a contract, or some providers are allowing users to do a month-to-month option.

Finally, portable WiFi may be even available directly from a smartphone. Many of the HTC and other Android model smartphones, as well as the iPhone, have the ability to turn on a WiFi hotspot from the phone. This can be a bit of a drain on battery life, but like the MiFi, it gives users up to five Wifi connections, which can be encrypted.

Check with your service provider; some carriers charge an extra fee for turning on the WiFi hotspot feature, as they see it as tethering (which usually carries an extra charge).

All of these portable WiFi options can provide a mobile, constant Internet connection for those prepared to pay for it. Again, as with shopping for phones or tablets, evaluate your needs and decide what option is best for you before shelling out hundreds of dollars.

❖ Baby, you can Drive my Internet...

Finally, many automakers are actually putting OEM Internet connectivity in their new vehicles. In addition, many aftermarket products are becoming available which offer some form of Internet connectivity for those with older cars.

In both cases, services range from Internet-assisted Nav Systems, to app-based functionality with Pandora and other apps, to full-on Wi-Fi connectivity through the in-dash head unit.

If something more permanent is what you are looking for, next time you are shopping for a car, see what options are available to you. If you have an older car, checking a reputable source like Crutchfield for a good, aftermarket option will help you to stay on the cutting edge of in-vehicle technology.

It all boils down to two major things to consider, no matter which option or combination of options you choose to go with: need and budget. Having the latest technology or gadget is useless if you can't afford it or it doesn't do what you need it to.

GLOBALNET LINKS

AutoNet Mobile - **www.autonetmobile.com/**

Crutchfield - **www.crutchfield.com/S-myUriYWxsbF/**

Novatel Wireless MiFi - **www.novatelwireless.com/index.php?option=com_content&view=category&layout=blog&id=19&Itemid=12**

BELOW 500 kHz

DXING THE BASEMENT BAND

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Longwave Happenings

On July 3rd 2011, the staff at Radio SAQ in Grimeton, Sweden activated the last remaining (and operational) Alexanderson alternator with a CW transmission on 17.2 kHz to celebrate Alexanderson Day. Transmission times were at 0900 and 1200 UTC.

Below is a preliminary list of reception reports as received by the station, which shows 24 countries and 225 listeners – an excellent turnout for this annual event. The report notes that some 72 listeners were listening to SAQ via a WebSdr receiver located in Delft, the Netherlands, run by PA3WEG/Wouter Weggelaar. My thanks to Lars Kalland, SM6NM for supplying this information.

Transmissions from the Alexanderson alternator are infrequent and are typically preceded by short lead-time announcements. For the latest activities of this historic station, be sure to check their website at **www.alexander.n.se/startsida_e.htm**.

SAQ (17.2 KHZ) RECEPTION BY COUNTRY

Country	Reports
Austria	2
Belgium	12
Czech Rep.	14
Denmark	8
Faroe Islands	1
Finland	4
France	14
Germany	71
Great Britain	18
Greece	2
Iceland	1
Italy	15
Netherlands	21
Norway	3
Poland	5
Portugal	1
Russia	2
Slovak Rep.	1
Slovenia	1
Spain	3
Sweden	19
Switzerland	3
Ukraine	1
United States	3
TOTAL	225

❖ Remote Listening

Did you ever dream of setting up your monitoring station at a prime radio-quiet location, such as a weekend cottage, and still be able to listen to it from home? An article written by A. Maitand Bottoms, AA4HS, titled *Internet Remote LF Receiver*, can help you do just that. Originally appearing in the September-October 2002 edition of the *AMRAD Newsletter*, the article is now available online at the AMRAD website (**www.amrad.org**).

The scheme uses readily available software to link a remote receiver over the Internet. This could be an interesting solution for the noise-challenged DXers among us. The article gives a website where controller packages for some popular receivers may be downloaded. For more information on AMRAD and their LF activities, visit **www.amrad.org**.

❖ New LW Station

Via Ken Reitz at the *Monitoring Times* desk comes word of a new addition to the longwave dial: Danmarks Radio (DR) on 243 kHz. The Danish public-service broadcaster has announced operations on this frequency with a 50 kW transmitter. The broadcasts take the place of some programming formerly transmitted on 1062 kHz mediumwave. For more information, check the link at **www.radioworld.com/article/denmark-goes-long/23744**

❖ Mailbag

Daniel, VE4PBX writes: "While enroute to a job site out of town (Rivers, MB) I inadvertently found a beacon: YBR! I can't seem to find any info on it and I was wondering if you can help me."

Hi Daniel, and congratulations on locating an NDB in person! The World Aeronautical Database shows a VORTAC navigation aid at 113.8 MHz VHF with the ID of YBR, but does not list a longwave NDB with those letters. Did you see "YBR" listed on signage at the station? If so, this may have been indicating the *airfield* the beacon is associated with (Brandon Municipal/CYBR) rather than the beacon's actual on-air ID.

The NDB listed for Brandon Municipal is **BR**, operating at **233 kHz**, which is located 4.7 nautical miles from the airfield. You may want to try listening for it the next time you are near the station. A car's AM radio may be able to receive the 3rd harmonic of the station at 699/700 kHz if you are within a few hundred feet of the antenna. Please keep us updated on the identity of this station.

Kriss Larson, KR6ISS (CA), writes: "Just got back from a vacation in Ireland – three and one half weeks, and 3800 kilometers traveled in the rental car. Between the scenery and castles, I did get to some radio installations, including Ireland's longwave broadcast station NW of Dublin at 252 kHz; several radiobeacons, both of Ireland's NAVTEX coast stations at Valencia and Malin Head. I even got a station tour at Malin Head from the personnel there.

"I finished the trip with three days on the Isle of Man between Ireland and Britain, did a longwave radio scan at the north end of the island next to a lighthouse built by Robert Lewis Stevenson's grandfather (building lighthouses was the family business).

"I'll send that log when I get it formatted up. Britain is still running its LORAN transmitter at Skelton – I thought everybody had shut down globally. The static levels in Europe are amazingly lower in summer than in North America – makes longwave broadcasting practical. "

Thanks for the update, Kriss, and welcome back to the States. Europe has always had a strong allegiance to longwave, and it's good to know several of the stations you mentioned are alive and well. Loggings and photos from your travels are always welcome. I am surprised to hear that LORAN is still active anywhere. I welcome input from other readers, especially those in Europe, about why these stations continue to operate.

Readers wishing to know more about Kriss can check his callsign listing on **www.qrz.com**. He describes himself as possibly the world's only "radio beacon tourist!"

Rowland Hamly (MN) wrote to *Below 500 kHz* with a question regarding availability of my CD and books on Longwave Radio. Rowland, I have produced three items related to longwave: A beacon directory called the *BeaconFinder II*, a narrated audio recording (CD or cassette) titled *The Sounds of Longwave*, and a published book (softcover) under the title of *Listening to Longwave*.

The first two items are available directly from me, and an advertisement for them appears at the back of this magazine. *Listening to Longwave* may be ordered from Universal Radio, Inc., 6830 Americana Parkway, Reynoldsburg, OH 43068-4113 (Tel. 1-800-431-3939). An online link to this book is available at (**http://tinyurl.com/LW-Radio**).

Listening to Longwave was a long-term project completed with Fred Osterman, President of Universal Radio, Inc. It had been a long time since a new book on hobby monitoring of longwave was available, so the time was right for a new release. The book is actually an update of an earlier tome called *The World Below 500*

kHz by L. Peter Carron. It contains dozens of new pages, charts, pictures and diagrams, as well as information on new operating modes.

❖ Loggings

Our loggings this month are courtesy of **Richard D. Palmer**, W7KAM (MO). He uses an ICOM R-75 receiver and a Clifton Z1501 active antenna, with the base up 25 feet with a 10 foot whip. A Timewave DSP599zx is used for audio processing.

Richard writes: "I logged 138 beacons logged this month, 54 less than last month. One storm after another drove me up to the higher bands, and as a result, not much time was spent listening for NDB's this month. Three beacons were heard for the first time this year bringing the year's total to 702."

TABLE 2. SELECTED NDB LOGGINGS

kHz	ID	ST/PR/ITU	CITY
200	HXF	WI	Hartford
200	UAB	BC	Anahim Lake
201	BV	OK	Bartleville
201	GL	QC	La Grande Riviere
203	DMZ	TN	Dickson
205	CQA	OH	Celina
206	IIB	IA	Independence
206	QI	NS	Yarmouth
207	YNE	MB	Norway House
208	YSK	NU	Sanikiluaq
212	DBX	KS	Washington
212	UC	TN	Union City
218	AL	IL	Alton
230	RDK	IA	Red Oak
230	VG	AB	Vermilion
239	HKF	OH	Middletown
245	FS	SD	Sioux Falls
248	GGI	IA	Grinnell
248	HZP	IN	Indianapolis
248	UL	QC	Montreal
251	AM	TX	Amarillo
253	GB	MN	Marshall
254	RA	SD	Rapid City
257	JYR	NE	York
257	XE	SK	Saskatoon
260	AP	CO	Denver
260	BVQ	KY	Glasgow
269	SWT	NE	Seward
275	GUY	OK	Guymon
283	PT	ON	Pelee Island
284	PQN	MN	Pipestone
302	QW	SK	North Battleford
341	PRG	IL	Paris
344	BKU	MT	Baker
388	CFJ	IN	Crawfordsville
410	GDV	MT	Glendive
414	ATS	NM	Artesia
414	EGT	KS	Wellington
414	MSD	LA	Mansfield
526	OJ	KS	Olathe

Note: A complete list of ITU codes is available at: www.wordiq.com/definition/ITU_letter_codes

❖ Homebrew Projects

Looking for some longwave projects to keep you busy this fall? The **SWL Homebuilder** website has a page devoted to NDB Information and Circuits. You can find it at: **www.qrp.pops.net/ndb_more.asp**. This site has some excellent information on building low-pass filters to eliminate AM broadcast interference on longwave. I've had a number of readers ask about these filters over the years, and these ones appear to be easy to build. Each has a response chart showing just where the cutoff frequencies are, and how steep the curves are.

❖ Restoring Old Rigs

A few years ago, I did a talk at the Kulpsville, PA SWL Festival on buying and restoring old receivers. I later gave a similar presentation to the Rochester Amateur Radio Association. This latest version can be accessed online, in a slide show format. If you like old and classic receivers, this program might interest you. Check it out at **http://tinyurl.com/32d8rqf**.

❖ Natural Radio

From time to time, I receive inquiries from readers who would like to explore natural radio at the rock bottom of the radio spectrum. The scarcity and expense of commercially available equipment leads many to explore homebrewing options for this gear.

The March and April 2006 issues of *Below 500 kHz* carried a two-part article on constructing the BBB-4 "Bare Bones Basic" receiver, originally designed by Stephen McGreevy, a pioneer in Natural Radio listening and recording. The BBB-4 is a very capable unit that can be used to get your feet wet in Natural Radio and it can even serve intermediate listeners quite well. For information on article reprints, see **http://monitoringtimes.com/html/reprints.html**. These installments will give you the information you need to build one of these simple, but effective units.

A simple, but effective natural radio receiver built from plans in the March/April 2006 issues of this column (reprints available).

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
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Firing up the BC-1206-C

❖ A Bit of Background

Back in the July issue, we introduced a new project, the World War II-era BC-1206-C Beacon Receiver. This was a smaller-than-a-shoebox aircraft receiver designed to pick up not only beacons, but also weather and other informational broadcasts by control towers. The lightweight 195-420 kHz receiver was designed for (among other things) easy, temporary installation in warplanes being flown from a factory to their point of embarkation for a war zone.

One of the most interesting things about a BC-1206-C is the fact that all of its circuits operate directly from the aircraft's 28-volt power. That includes not only the tube heaters, but also all plate and bias circuits. There is no dynamotor or vibrator supply to provide the usual couple of hundred volts found in those circuits.

Four standard Loktal 12-volt-heater receiving tubes are used in the receiver, and these are connected in series-parallel for 28-volt operation. A fifth tube, the 28D7 output amplifier, has a 28-volt heater for direct connection to the 28-volt line. It's also specifically designed to operate with 28 volts on its plate and screen.

This set happened to come to me new in its original box. A careful examination of the chassis showed no obvious signs of corrosion or deterioration. The paper capacitors were typical 250-volt units as found in the consumer receivers of the era. I would have normally replaced all of them on sight. But, since there was no voltage in the radio higher than 32, I thought that it would be perfectly safe to leave them alone – at least for starters.

❖ Needed: A Power Source

And so the "restoration" of this particular radio was going to boil down to providing a 28-volt d.c. supply to run it. I decided to put together a little variable voltage supply using the versatile LM-317 voltage regulator. Connect it to an appropriate d.c. source and a few external components and the '317 will provide a regulated voltage adjustable from zero up to 30 volts or so – with the upper amount depending the d.c. input voltage. The current rating is 1.5 amps, which is just fine for the 0.75 ampere draw of the BC-1206-C.

I used a Radio Shack 24-volt transformer and 4-amp bridge rectifier with 1000 uf of filtering to provide the d.c. input to the LM-317 and put the whole thing in a little aluminum minibox that I happened to have on hand. It turned out to be a cute little unit, if I do say so myself, and supplied 26 volts at full output – which I thought would be quite adequate to run this 28-volt radio.

❖ Firing it Up

Firing up the radio on a short basement antenna, I found that above certain positions of the volume control I was hearing a loud, raspy, buzz-saw type noise across the entire tuning range. The volume of the noise would change when I connected and disconnected the antenna or touched a finger to the antenna terminal, so I assumed that the receiver was working, but picking up environmental disturbances.

I'm not an experienced VLF listener, but had heard that such things as light dimmers, TV horizontal oscillators, mercury yard lighting, and data transmissions over power lines caused serious reception problems at these frequencies. So I decided to ignore the interference for the time being and proceed with the alignment.

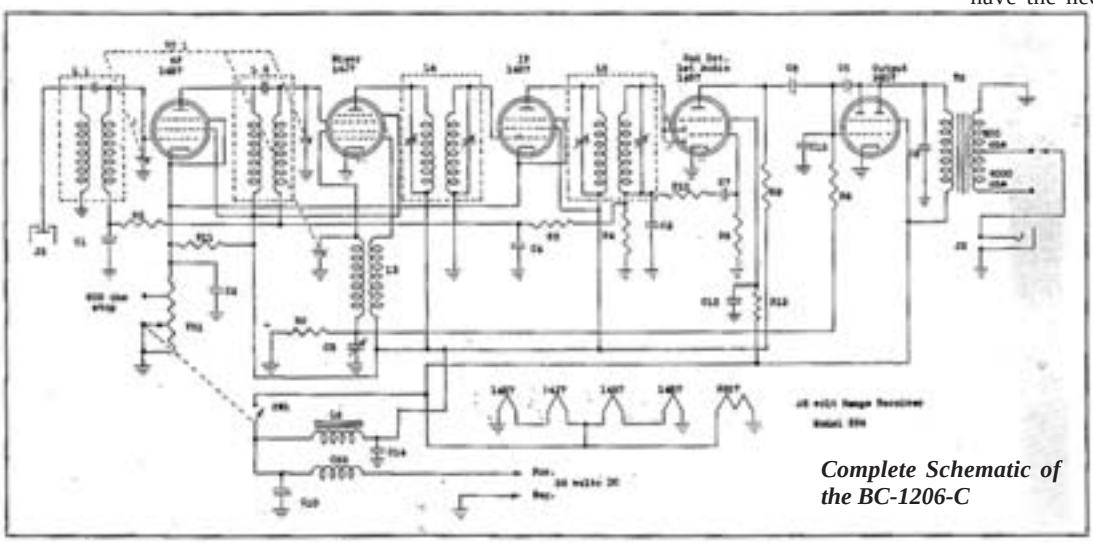
The two i.f. transformer cans look quite similar to those in consumer receivers of the period.

❖ I.F. Alignment

For the intermediate frequency alignment, a 135 kHz modulated signal was introduced into the signal grid of the 14J7 oscillator-mixer through a 100 pF capacitor. I was able to acquire a usable test signal in the receiver at a volume setting below the point where the buzz saw interference would have been a problem, so the alignment proceeded normally. I used my VTVM (vacuum tube volt-meter), set on a low a.c. scale and connected across the headset output, as a signal strength indicator. A VTVM is very helpful when using audio output to measure signal strength. VOMs (volt-ohm meters) don't have the necessary sensitivity and generally require an earsplitting volume setting to show a usable reading.

The BC-1206-C i.f. transformers look very much like those in an inexpensive consumer radio of the period, the difference being that they are tuned to 135 kHz instead of the usual 455 kHz. The method of adjustment is also similar, with the usual two trimmer screws at the top of each can.

This was one of those very satisfying i.f. adjustments; the tuned circuits were so out of line that small trimmer adjustments resulted in huge increases in gain, so the strength of the test signal had to be continually and



Complete Schematic of the BC-1206-C

drastically reduced to keep the VTVM from going off scale. This was hardly surprising for a radio that has been untouched since (according to the date on the packaging) 1944.

❖ Antenna, Oscillator and R.F. Alignment

For the remaining adjustment trimmers (antenna, radio frequency and oscillator) and the oscillator padder, the test signal is injected directly into the antenna jack in series with a 100 pF capacitor. The three trimmers are conveniently located atop the three-gang main tuning capacitor and the padder is accessible through a port in the side of the chassis.

The (left to right) oscillator, r.f. and antenna trimmers sit atop the tuning capacitor frame.

To adjust the three trimmers, the signal generator and receiver are set to 400 kHz (near the top of the receiver's tuning range).

The padder is adjusted with the generator and receiver set to 210 kHz, which is near the bottom of the receiver's tuning range. The reason for adjusting an oscillator trimmer near the top of the range and an oscillator padder near the bottom is to help maintain accurate dial calibration across the entire band.

These adjustments produced an effect almost as dramatic as those of the i.f. transformers. But, curiously, in almost every case the required peak was obtained with the adjustment screw turned in almost to the end of its travel.

❖ Still - That Infernal Buzz-Saw!

With the receiver now re-aligned to factory specs, I disconnected the signal generator and reconnected the short basement antenna. Once more I could hear nothing but that infernal buzz-saw effect all across the band. So, in search of better reception, I picked up the receiver and power supply and took them out to my radio shack in the attic of our garden shed.

My vertical hf ham antenna wasn't much help here, but I also had a 50-foot exterior wire for use in testing. Connecting the '1206 to that didn't change things much – same buzz saw all across the band. Still inclined to blame environmental noise for the effect, I set my alarm one night and made my way out to the shack at four in the morning when there would be less human activity. But I might as well have stayed in bed. The effect was unchanged.

Now I was beginning to suspect my power supply. If you've ever seen a schematic of an LM-317, you know what a complex device it is. Perhaps it was generating hash of some sort while doing its work? The next morning I disconnected the LM-317 from the bridge rectifier and filter so that I could run the receiver directly from the latter. I wired a 100-ohm bleeder resistor across the bridge output to stabilize the voltage, which ended up at about 25.

Connecting this regulator-less power supply to the receiver, I put on the phones, clicked on the power, and listened. Unfortunately, the same buzz-saw noise could still be heard all across the band. The set didn't act right even when powered only by a classic bridge rectifier circuit.

Operating the set from an improvised battery pack improved reception somewhat (see text).

❖ The Answer: Battery Power?

By now I was almost out of ideas, but I did want to find out if the problem was being caused in some way by the power supply. The little radio had, after all, been designed to run directly off the plane's battery. Its unusual 28-volt circuit might be sensitive to the impedance of the power source, which I imagine would be quite different for a battery than for a rectifier and regulator supply.

To test this theory I would have to organize a source of battery power, and I spent some time on line to determine the most economical way of putting together some batteries to deliver the 28 volts at three-quarters of an amp for a reasonable length of time. It looked like my best bet would be to series-connect five common six-volt lantern batteries. These would run me about 25 bucks, but I really wanted to know the answer.

So, off in our hundred-degree heat I went to a local home center that happened to have the best price on some Ray-O-Vacs. I set up six of them (one extra just in case) in a beer shell, cut some short jumpers, and wired them in series – soldering to the battery's spring connectors.

With the radio connected to my test antenna, I connected the set to five batteries and turned it on, noting that the voltage dropped to just about 28 under load. In a minute or so, when the set warmed up, I had an answer. The across-the-band buzzing was still there – but now seemed to appear at a higher setting of the volume control – making listening possible at settings where it had not been possible before.

I could hear atmospheric noise, which was a good sign, and I could hear odd signals, some that sounded like teletype, all across the dial. But, though I hate to disappoint those who have read this far to learn about the outcome, not one Morse code beacon transmission could I hear!

And so, gentle readers, I seem to have inflicted upon you a restoration project that didn't involve a restoration (I didn't do any work at all on the receiver) and had an outcome that wasn't an outcome (no identifiable signals received).

❖ Suggestions, Anyone?

However, maybe we are not quite through with this project. I'd enjoy hearing from some of you experienced long-wave listeners with suggestions about the buzz-saw noise and what beacons I might reasonably expect to hear on this receiver from my Chicago area location. I'd also like to hear from any technical gurus with ideas about the source of that noise and what it might take to make it go away!

For my part, I'm going to dig out a BC-453 command receiver (190-550 kHz) that I restored for this column several years ago and fire it up. It is definitely a much better set than the BC-1206-C, and as I recall, I was able to hear several beacons on it using my basement antenna. Of course there are fewer beacons operating now.

In a recent internet browsing session I came across an Air Force Technical order, Dated May, 1951, covering "Replacement of Range Receiver BC-1206 with Radio Receiver BC-453-B in all F-51D and TF-51D aircraft which are equipped with Radio Set SCR-522." The reason given for the replacement was "To increase flight safety by providing for greater ease of tuning and more dependable reception of beacon signals over a greater distance."

Elsewhere on the 'net, in a Yahoo group message thread, I read: "The BC-1206 is a fun little receiver. But its sensitivity is somewhat lacking for anything other than listening to reasonably strong NDBs. Its selectivity is not great either, it's basically got AM receiver bandwidth which is too wide for serious NDB hunting."

Next month I'll report on any suggestions I might receive from readers as well as anything I might find out through my own further investigation.

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

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Six Antennas for 300 MHz

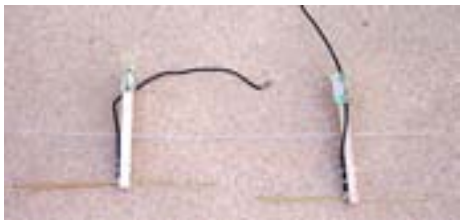
300 MHz Yagis

Some of the most difficult and yet most rewarding monitoring can be found in the 300 MHz band. 300 MHz to 400 MHz is home to many specialized military systems, and yet, except for a few discone antennas, a 300 MHz antenna is a rare find. This month we present a family of six 300 MHz Yagis for long distance monitoring.

These antennas come in two species, those requiring 50 Ohm feeds and those with 75 Ohm feeds. You will note that the 75 Ohm versions have a wider spacing between elements.

There are three very good reasons for designing around 75 Ohms. First is bandwidth: At the higher impedance we can get a bit more bandwidth, or frequency span, out of these antennas. The next is loss in the coax. For a given diameter, 75 Ohm coax has less loss per foot than 50 Ohm coax. And the last reason is that it's just plain cheaper. Old runs of RG-6 from satellite TV systems or end runs from cable TV installations are often found a flea markets and garage sales. Beware of versions using Aluminum foil shields. You need at least some Copper braid for soldering the coax to the antenna.

However, I know many of you want to keep all your systems 50 Ohms, so we have a family of these as well. All six versions of the antenna are designed for elements using .125 in or 1/8th inch rod material



50 Ohm on the left, 75 Ohm on the right

base copper wire, and brass/copper hobby tubing have all been used.

❖ The Driven Element

In technical papers I refer to this family of Yagis as "Controlled Impedance" Yagis. The wood and wire versions we affectionately call "Cheap Yagis."

In most cases a Yagi design would be developed, then various shorting bars, gama rods, series capacitors, etc. are used to get the driven element to match to the coax impedance. In the case of this family of cheap Yagis, the J driven element has about a 150 Ohm impedance when all by itself. By bringing in the other elements, I can load the driven element down to 75 Ohms in case you want to use RG-6 or RG-59 coax. And, by bringing in the other elements even closer the driven element, it can be loaded down to 50 Ohms.

The structure and spacing of the Yagi elements themselves is what creates the impedance matching. You can easily see how the 75 Ohm version is wider spaced than the 50 Ohm model. From a design perspective, this is a bit more challenging to juggle gain, pattern, front-to-back ratio, bandwidth, and impedance to come up with a good antenna. But that's my job. In the end we have a very easy to build and very functional antenna, where the structure of the Yagi itself is doing the impedance matching.

All six versions use the same driven element dimensions as shown in Figure 1. The width of the loop in the J is not a critical dimension: 1" give or take will work.

The coax braid goes to the top element near the middle, the coax center conductor goes near the inside tip of the J. You want to keep the opened sections of the coax as short as practical. Electrically, the driven element length begins where the coax center and shield split. Just solder the coax per Figure 1 and you're OK. If you have 300 MHz test equipment, and want to trim for that perfect SWR, the tip of the J can be adjusted for best performance.

I have held the coax in place with a couple of tie-wraps. But solid wire, bread ties, and even duct tape have also been used to hold the coax to the boom.

After you have all the elements centered up, a drop of glue can hold them in place.

If you have square wood or doweling for the boom, the mounting U-Bolt can be easily drilled for vertical or horizontal polarization. The antennas are end mounted to limit the effects of the mast. 3 or 4 inches of spacing between the reflector element and the mast is enough to keep the antenna from being detuned.

❖ Construction

Wood is the easiest boom material to use, but most any non-metallic material will work. If you need to mount your antenna outside for long periods of time, a coating of spar varnish, wood preservative, clean spray paint, or just plain old house paint will help them last for years. 3/4" square or 1/2" x 3/4" hardwood works best, but cheaper wood and even wood dowels have been used. A bit of RTV or some other kind of sealer on the coax at the driven element is also a good idea.

Nearly 20 years ago I mounted several similar antennas in my attic and they still work fine. Plastic water pipe can be used, but I am not a fan of PVC antennas.

The driven element works a lot better if you use something you can solder to. My favorite is silicon bronze welding rod. #8 or #10 bare copper wire can also be used. For the reflector and director elements, the cheapest wire to use is Radio Shack or Home Depot aluminum ground wire. A 40-foot roll of their 1/8" diameter wire will cost you less than 10 bucks. But welding rod, aluminum rod, aluminum welding rod,

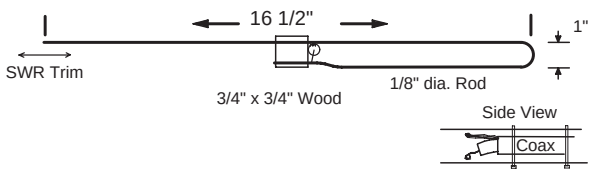
Dimensions 50 Ohm

		Reflector	Driven	D1	D2	D3
2 Element	Element Length	18.0	See Fig1			
	Distance from Reflector	0	4.0			
3 Element	Element Length	18.25	See Fig1	15.0		
	Distance from Reflector	0	4.0	11.0		
5 Element	Element Length	18.5	See Fig1	15.5	15.25	15.25
	Distance from Reflector	0	4.0	10.0	16.5	25.5

Dimensions 75 Ohm

		Reflector	Driven	D1	D2	D3
2 Element	Element Length	18.0	See Fig1			
	Distance from Reflector	0	5.5			
3 Element	Element Length	18.0	See Fig1	15.0		
	Distance from Reflector	0	5.5	11.0		
5 Element	Element Length	18.25	See Fig1	15.0	14.5	14.5
	Distance from Reflector	0	5.0	12.0	1.7	27.0

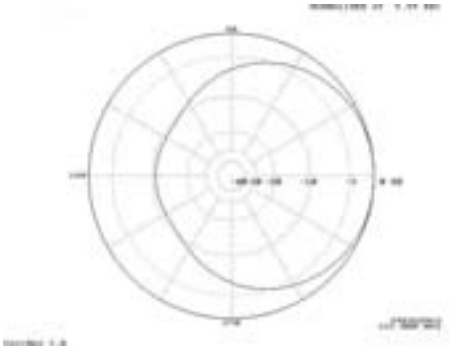
325 MHz Driven Element

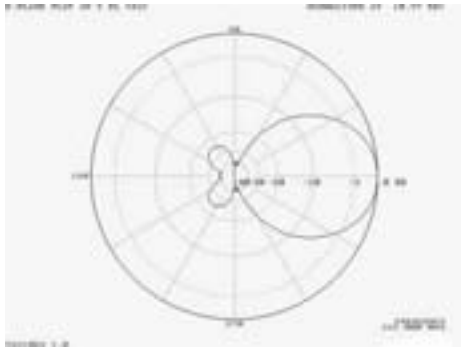


❖ Antenna Patterns

In Plot 1 (next page), I show the vertical polarization pattern for the 2-element version. Gain is in the 5 to 6 dBi range. Even off the back, the antenna has as much gain as many simple scanner antennas.

Plot 2 (next page) is the 3-element version, and again it is a vertical polarized antenna. Gain is now in the 6 to 7 dBi range, but note how much less signal is going out the back of the antenna. Now the antenna is really favors a particular direction.





In Plot 3 we are looking at the 5-element Yagi. Gain is now up to 9 dBi and we have a pretty directional antenna. These are all factors to consider when deciding which version to build. Do you need more gain or wider coverage?

❖ Frequency Range

The 2-element versions work pretty well from 300-370 MHz. The 3-element is falling fast at 300 and 360 MHz, and the 5-elements work best from 300 to 350 MHz.

If you are more interested in the 350-400 MHz portion of the band, just multiply all the lengths and spacings by .93. As an example, the reflector on the 2-element versions would now be 18.0 x .93 or 16.75". Don't get too carried away on the last decimal place; these antennas are designed to be tolerant of construction variance.

These antennas are quick, easy, and cheap. So the next time you are camping just outside Area 51, and the guys wearing Black Kevlar confiscate all your radio equipment, at least you didn't have much money in the antennas.

❖ Polarization of monitoring antennas

Most mobile systems are vertically polarized. Many fixed systems are horizontally polarized. At the National Bureau of Standards (before they became NIST), I saw a collection of monitoring antennas mounted at a 45 deg antenna like the one shown here. This really works out quite well when you don't know the polarization of the system you are monitoring.

An antenna mounted at 45 degrees loses about 1/2 of an S-unit when listening to vertically polarized signals. And a 45 deg mounted antenna loses about 1/2 of an S-unit when listening to horizontally polarized signals. But, it is picking up both polarizations equally well. Keep this trick in mind when searching for unknown signals.

❖ Future Topics

What's your interest for future topics? Here are some options: I can work up a 406 MHz Yagi for the new Digital ELT beacons. For the public service sectors, I can work up 150, 460, and 800 MHz beam antennas. For the digital side of the hobby, there are 915, 2400, and even some 5700 MHz antenna prototypes strewn around my work bench. For the amateur radio community, I have a collection of ham antennas available as downloads from my website. (See **www.wa5vjb.com** in the Reference section.) Let me know!

The quickest way to contact me is at *kent-britain@monitoringtimes.com* or snail mail to the QRZ.COM address for WA5VJB. We welcome and will quickly get back to you on most any antenna questions. Now, time to start thinking about the new antennas you want to get in the air before the roof gets covered in ice and snow.

SKY SURFING

RADIO FROM THE OUTER REACHES

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Sudden Ionosphere Disturbances

If you're interested in detecting the Sun's influence on the Earth's ionosphere, a popular technique is to monitor remote VLF (Very Low Frequency) high-powered transmitters. It's highly likely you have heard about the technique, but here's a quick review for those who haven't.

Solar flares generate intense X-ray and ultraviolet radiation, and when that energy hits our ionosphere it causes disturbances. One of these effects is to allow a sudden increase in VLF propagation by improving the ability to 'duct' the VLF waves. The lower 'D' layer is the principle actor in this play. The 'D' layer resides about 50 to 90 km above the Earth. The distant VLF signals are enhanced and can be detected with a variety of receivers, some as simple as a tuned circuit and antenna that is fed into a sound card on a PC. Appropriate software logs the signals.

I found a number of organizations that support this activity through the usual web search. Here are a few that provide great background information:

www.aavso.org/solar-sids AAVSO (American Association of Variable Star Observers) has an article on the SIDs monitoring concept and numerous links to the various aspects of monitoring the phenomena.

http://sid.stanford.edu/ There are numerous VLF Stations that can be used to monitor for SIDs. One is the Cutler Naval Station, call sign NAA. It is one of the highest powered stations. Lists abound on the web.

Here are some links to VLF receiver projects:

www.ukaranet.org.uk/beginnerprojects/speclab_install_use.htm This link gives shows how to install and run Spectrum Lab as a VLF Receiver.

www.backyardastronomy.net/sid_receiver.html This link has details on SID reception.

❖ RAS 40 kHz VLF Radio Telescope

I recently ordered the Radio Astronomy Supplies RAS 40 KHz VLF Radio Telescope. It comes as a turn-key system. Details can be found at: **http://www.radioastronomy-supplies.com/radio_astronomy_supplies.php?cat=CAT&id=1&name=RADIO TELESCOPE SYSTEMS**

Hopefully I'll be able to have it operation shortly and will review the receiver in my next column.

❖ An Inexpensive VLF Receiver

Here's a 'cheap-as-you-can-get' way to monitor VLF signals for SIDs using the ever-popular, free software, 'Spectrum Lab' by DL4YHF. Using the software configured for VLF detection, you simply plug an antenna into your sound card audio input jack as described in an article at **www.qsl.net/dl4yhf/vlf_rcvr.html**.

Keep in mind that attaching a long wire antenna can be dangerous when tied directly to your PC. Diodes and tuned circuits are recommended in the article. The reference highlights ways to protect your setup.

❖ Another possible way to measure SID?

While digging deeper into the SID topic, I found numerous references to using the GPS satellites in a way that can detect changes to the ionosphere. Since changes in the ionosphere affect the propagation of the GPS signals, those changes affect the accuracy of the calculated position.

One way GPS's accuracy has been improved is to use a fixed station that calculates its own GPS location and then compares it to its actual geographic coordinates that have been determined by survey. The error or difference, sent via radio or suitable techniques, is applied to the present calculated reading to obtain a high degree of accuracy. The need for the corrections is mainly due to the reflection or refraction of the 1500 MHz signals from the GPS satellites while traveling to ground or aircraft GPS receivers. Aviation uses a technique called WAAS (Wide Area Augmentation System) to implement the corrections.

Some years ago, scientists found they could measure changes in the ionosphere, using modified GPS receivers, as a useful way to measure something called TEC (Total Electron Content) in the ionosphere. I suspect one can detect significant SID activity using a GPS receiver that doesn't use WAAS or any error correction.

As a check, I hooked up my Delorme Earthmate GPS BT-20 to my laptop using the Bluetooth connection as a serial port. I then launched 'Spectrum Lab' which has a GPS function that should let you log the readings, though I haven't made that work, yet.

You can see the errors in the GPS path as the direction and velocity change. The GPS isn't moving, so shouldn't the vectors indirectly indicate the changes in the ionosphere? Perhaps a log of the data could be plotted and correlated with other VLF SID events.

Let me know if you know of a practical way to use GPS for Solar disturbance detection. I found a software GPS logger that logs the data which includes coordinates, altitude, etc. into one hour files. I graphed an hour's worth of data and do see changes, but haven't seen a correlation with possible SIDS, yet.

❖ A Dual Jove Receiver Simple Interferometer

In an earlier column I noted the use of the Radio Jove receiver which was designed to receive Jupiter's radio noise at approximately 20 MHz. I ran across a reference that describes how college students in Australia had developed a 'Simple Interferometer' using two Radio Jove receivers and spaced antennas. The receivers were modified so one receiver's local oscillator is fed into the other receiver to provide a common LO (Local Oscillator). A correlator runs on a Linux system. The end result is a somewhat sinusoidal output over time. The peak can be timed and help define the position of a source. Check out **www.fringes.org** for more details and free software.

❖ Radar shoots down UFOs during WWII??

OK, readers. Allow me to digress a bit. Having lived in Roswell, New Mexico for 43 years, I thought we had heard it all regarding the local favorite subject of UFOs (Unidentified Flying Objects). Recently, in the May 29, 2011 edition of the *Roswell Daily Record*, a lady took out a half page advertisement about untold aspects of the UFO story. In the article, she claims Alamogordo, in 1947, was using a type of advanced radar to shoot down more than '50' UFOs. Not only tracking them, but shooting them down, too! She also claims the US hid them under quickly constructed buildings.

Radar can certainly generate high peak powers, but what would it take to shoot a UFO down? WWII radars often had pulsed peak powers of 100-200 kW. Those supporters of the alleged Roswell (really near Corona) UFO crash in 1947 note the 'indestructible' nature of UFO material. Then to be brought down by a WWII radar – bummer. The original claim was started by Frank Skully in his 1950 book, *Behind the Flying Saucers*.

As a parting thought, Roswell has a habit of publishing startling claims like these shortly before the July UFO days. Helps pass the hot, dry summer (108 F today and no rain for 8 months). And winds. And fires.

❖ Visiting NRAO's EVLA - Part 1

The following VLA photos are courtesy of Hank Newton (He has the better camera).

One of the benefits of writing for *Monitoring Times* is the potential for a reader's response that leads you to another story. I had mentioned in one column that I would like to re-revisit the VLA (Very Large Array) 50 miles west of Socorro, New Mexico. The original visit was in the '70s. I received that invite by an electronics engineer, Hank Newton, who works for the NRAO (National Radio Astronomy Observatory). I accepted, and he arranged a personal tour for my wife and me. We drove to Socorro from Roswell, a 3 hour trip. That evening, Hank gave us a tour of the labs where he has been involved in the building of the electronics for the new ALMA (Atacama Large Millimeter/Sub-millimeter Array) in Chile.

The next morning we made the trip out to the VLA, now called EVLA (Enhanced Very Large Array), with Hank Newton and Dave Finley, the Public Information Officer. Upon arrival, my wife noticed a slight misspelling on the RF sign. Catch it? Of course I complied and shut off my cell phone. There wasn't any ATT coverage out there anyway.

Dave disappeared into the control center before we continued on the tour. When he returned he had a key in hand and marched us towards Dish 5. It was not in use at that moment. Suddenly it began to move and turned nearly 360 degrees azimuth and the dish moved upward, pointing nearly straight up. After it stopped, he led us inside the gate. At that point, I didn't know we would get the inside tour.

Above, the 25 meter dish and supporting structure weighs 230 tons and can be moved with special railway equipment. There are four different dish spacings used, called A, B, C, D which are moved about every four months. During our visit in mid-May, they were in the widely spaced D mode. There have been some changes to the schedule now that the system runs in the EVLA (Expanded Very Large Array) mode. The different spacing of the dishes allows researchers to opt for various system sensitivities and resolutions of the combined dish data.

Some of the facts Dave noted about the dish was the special paint which helps the thermal properties of the dish's surface; it costs approximately $200 a gallon! The black band in the picture above is the gear-driven elevation track. Behind it you can see the steel counter weights.

Above, Dave Finley (left) educates me on the operation of the dish. Behind us, you can see the steel counter weights.

We began our climb up into the dish. I had mentioned the VLA is now called EVLA (Expanded Very Large Array). Interestingly, various sources alternately use the term 'Expanded' or 'Enhanced.'

One of the recent major changes made to the VLA was to convert from analog signal handling via waveguides to converting the signals to digital signals at each dish; they are then conveyed to the correlators (very fast processors) in the control room using fiber optics. This and other improvements have vastly improved the performance of the array. One of NRAO's brochures notes the enhanced (upgraded) VLA is designed to be 100 times faster, more frequency agile, and 50 times improved in resolution. These changes were completed in the last two years. The EVLA array is designed to operate over numerous bands. The dishes can operate on any frequency between 1.0 and 50 GHz, with up to 8 GHz bandwidth per polarization. Check out **www.nrao.edu** for more details.

But, guess what? They've hung 74 MHz wire dipoles up near the reflector. There's some interesting science to do in that frequency band. The system should allow a resolution of 24.5 (arcsec) and a sensitivity of 20-0.2 (mjy) millijanskys. The unit jansky is equal to 10^(-26) watts per square meter per hertz, a pretty weak signal.

Here is the highest point on the dish, the secondary reflector. 'Signals,' or noise, from space are reflected off of the dish back up to the steerable reflector above the main dish and back down into one of several selected horn 'antennas' that are located below the surface of the dish. It's a similar scheme as the Schmidt-Cassegrain optical scope configuration. No, we didn't climb up the ladder – Dave said that takes a course how to use the safety cable.

Above is a view of a couple of the horns. Note one of the boxes is labeled 'RF/IF BOX'. At this point, the IF (Intermediate Frequency) is converted to digital signals and sent on into a shielded room near the control room where the 'correlator' or computer processing system handles the incoming data for all of the dishes simultaneously. The data is sent to the VLA's center in Socorro, NM some 50 miles away via fiber optics.

More on the EVLA, Part 2, in the December column.

❖ Radio Astronomy in the Movies

While browsing Netflix after the visit to Socorro, I decided to watch the 1984 movie, *2010: The Year We Make Contact*. It opened with the lead actor, Roy Scheider, wiping a part on a dish at the VLA near Socorro, NM. Dave Finley confirmed it was a dish bearing. You have to wonder why the 'array director' who goes on the trip back to Jupiter gets to wipe bearings on the dishes. There are some greasy parts on the dish, especially the gears. Guess someone had to do it. Dave also made a brief appearance the movie as a 'background actor'. Watch for his hardhat.

Thanks for checking in and happy sky surfing. Stan.

Mode-S and the Message Squitters

By Larry Van Horn, N5FPW
MT Assistant/Technical Editor

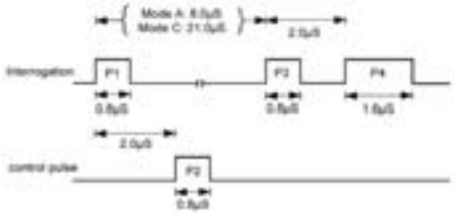
In the last couple of *MT On The Bench* columns, I have presented information about various aviation IFF (Identification Friend or Foe) modes and newer systems being implemented by aeronautical organizations/governments worldwide.

Specifically, in my last column, I introduced Mode-S. If you want to understand the future of our air traffic control system and your ability to monitor it, you will need a general understanding of some of the specific messages/information being transmitted from ground stations and aircraft that are utilizing Mode-S.

To remind readers, Mode S operates on the principle that interrogations are directed to a specific aircraft using that aircraft's unique address. This results in a single reply from that specific aircraft being addressed, with the range to that aircraft determined by the time it takes to receive the reply. The radar monopulse beam provides an accurate bearing measurement to the replying aircraft.

Of course, in order to interrogate an aircraft, its address must be known. To meet this requirement, the ground interrogator also broadcasts All-Call interrogations, which are in two forms.

In one form, the Mode A/C/S All-Call looks like a conventional Mode A or C interrogation at first, and a transponder will start the reply process on receipt of pulse P3 (see figure 1). However, a Mode S transponder will abort this procedure upon the detection of pulse P4, and instead respond with a short Mode S reply containing its 24 bit address. This form of All-Call interrogation is not used much anymore, because it continues to request replies from aircraft already known, creating unnecessary interference.



The alternative form of All-Call uses short Mode S interrogation a with a 16.125µs data block. This can include an indication of the interrogator transmitting the All-Call with the request that, if the aircraft has already replied to this interrogator then do not reply again as aircraft is already known and a reply is unnecessary.

❖ So what are Squitters?

A definition of squitter is a reply format that is transmitted without being interrogated.

The squitter has its origins in distance-measuring equipment (DME) transmissions. The DME ground station would broadcast unsolicited replies or squitters. When the airborne DME interrogator was in range, the squitter would be seen and the DME interrogator would then transmit a range interrogation and receive range replies from the DME ground station. This served to limit unnecessary transmissions over the air and optimized DME ground station-handling capability.

Traffic Alert and Collision Avoidance System 2 (TCAS 2) uses Mode S squitters in a similar fashion: the TCAS just listens for the DF11 squitters (see UF/DF11 below), which contain the sending aircraft's discrete address, thereby reducing the need to interrogate over the air. The discrete address, once obtained, is placed on the TCAS 2 processor's roll call of addresses for ongoing tracking.

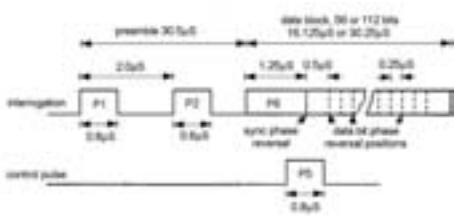
Mode S technology has two types of squitter: a short (56 bit) DF11 acquisition squitter and the extended (112 bit) DF17 squitter.

These "unsolicited replies" are used to provide TCAS 2-equipped aircraft with the discrete address of the squittering aircraft, so the TCAS 2 system may acquire and track the squittering aircraft using Mode S formats UF/DF0 and UF/DF16.

❖ What are UF and DF Messages?

The functional components of the mode S signal consist of the uplink format (UF) and downlink format (DF). Mode-S interrogations or UF is a specific interrogation originating from a Secondary Surveillance Radar (SSR) or from another aircraft asking specific, addressable information about the aircraft being interrogated. DF is the reply from that interrogated aircraft to a UF interrogation.

Mode-S interrogations can take three forms (see figure 2). The first form, known as surveillance, is a short form and it is used for position update. UF numbers 0, 4, 5, 11 and 16 make up the basic surveillance messaging. Basic surveillance messages are comprised of the airframe address, parity bits and a 56-bit data word known as "short" interrogations and replies.



The first five binary bits, known as the uplink field (UF) in the data block, indicate the type of interrogation. The final 24 bits in each case is combined aircraft address and parity. Not all permutations have yet been allocated, but those that have are explained below.

UF0 (Binary 00000) is a short air-to-air surveillance for TCAS/ACAS.
UF4 (Binary 00100) is a short surveillance ground station request for altitude similar to the UF0 request, but initialized by the ground station.
UF5 (Binary 00101) is a short surveillance ground station request for the aircraft identity (mode A identifty).
UF11 (Binary 01011) or the Mode S only All-Call request the aircraft's mode S address.
UF16 (Binary 10000) is a long, air-to-air surveillance for TCAS/ACAS message and is the long form of a UF0.

The second form, known as Comm-A (Communications Type A), is a long form of messages UF4/5 and contains 56 data bits.

UF20 (Binary 10100) is the long form of UF4 and this Comm-A message includes an altitude request sent to aircraft.
UF21 (Binary 10101) is the long form of UF5 and this Comm-A message includes a Mode A identity request to aircraft.

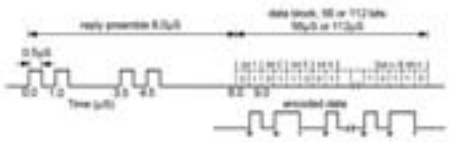
The third form, known as Comm-C (Communications Type C), is also a long form message and can contain up to 16 interrogations strung together for a total transmit string of up to 1280 bits. This UF24 (Binary 11000) message is also known as uplink extended length messaging (UELM), and uses the Comm-C (Communications Type C) capability of an aircraft transponder, if equipped.

An aircraft transponder must be of a certain type to accept a UELM message. Because UELM operates over UF24, this allows for long data messages to be sent from the ground station to the aircraft. UF24 works similar to any other interrogation with one exception: The UELM message is capable of up to 16-bit to 80-bit message segments for this extended message.

❖ Mode-S Reply or DF Messages

Similar to the Mode-S interrogation, in Mode-S reply the first five bits, known as the downlink field (DF) in the data block, indicate the type of reply. The final 24 bits in each case

is combined aircraft address and parity. Eleven permutations have been allocated. Also similar to the Mode-S interrogation, Mode-S reply (see figure 3), can take three forms.



The first form, known as surveillance, is a short form and it is used for position update. DF numbers 0, 4, 5, 11 and 16 make up the basic surveillance messaging. Basic surveillance messages are comprised of the airframe address, parity bits and a 56-bit data word known as "short" interrogations and replies.

DF0 (Binary 00000) is a short air-air surveillance (TCAS) message. The DF0 reply to UF0 from the aircraft will include the Mode-C altitude as well as the Mode-S address.

DF4 (Binary 00100) is a surveillance and altitude reply message. The DF4 reply to UF4 from the aircraft is verified against the Mode-C altitude and the Mode-S address for validity.

DF5 (Binary 00101) is a surveillance Mode-A identity reply message. The DF5 reply to UF5 is the airframe's identification and is compared to the Mode-A 4096 code for validity. An ID field within DF5 is a 24-bit word that contains the Mode-A identification of the aircraft.

DF11 (Binary 01011) is an all-call reply message containing aircraft address. When sent it will reply with the airframe address (squitter address) as well as the capability (CA) field, parity/interrogator identifier (PI) field, the interrogator identifier (II) and a surveillance identifier (SI).

DF16 (Binary 10000 is a long air-air surveillance (TCAS) message. Where the DF0 message is 56 bits long, DF16 is 112 bits long. The DF16 reply will have in it the Mode C altitude, as well as the mode S address.

The second form, known as Comm-B (Communications Type B), is a long form of the DF4/5 messages.

DF20 (Binary 10100) where DF4 is 56 bits long, the DF20 Comm-B message is 112 bits long. The DF20 reply is generated from a Comm-A altitude request. The DF20 reply also contains a 56-bit message field for transferring downlinked aircraft parameters (DAPS). A transponder that does not have an active subsystem that will accept Comm-A data will not reply to a UF20 interrogation.

DF21 (Binary 10101) where DF5 is 56 bits long, the DF21 message is 112 bits long. The DF21 reply is generated from a Comm-A identity request. The DF21 reply also contains a 56-bit message field for transferring downlinked aircraft parameters (DAPS). These parameters are compared to the DF11 reply for validity. A transponder that does not have an active subsystem that will accept Comm-A data will not reply to a UF21 interrogation.

An aircraft transponder equipped to transmit Comm-B replies is fitted with 256 data registers each has 56 bits. The contents of these registers are filled and maintained from on-board data sources. If the ground system requires this data, then it requests it by a surveillance or Comm-A interrogation. Below is a list of the registers and information they contain as currently allocated by the ICAO. A reduced number are required for current operational use and other registers are intended for use with TCAS and ADS-B. The BDS numbers below are in hexadecimal notation.

Register	*Data*
BDS 6,0	Magnetic heading
BDS 6,0	Indicated airspeed
BDS 6,0	Mach number
BDS 6,0	Vertical rate
BDS 5,0	Roll angle
BDS 5,0	Track angle rate
BDS 5,0	True track angle
BDS 5,0	Ground speed
BDS 4,0	Selected vertical intent

The third form, known as Comm-D (Communications Type D), is also a long form message and can contain up to 16 interrogations strung together for a total transmit string of up to 1280 bits. This DF24 (Binary 11000) message is also known as downlink extended length messaging (DELM), and uses the Comm-D (Communications Type D) capability of an aircraft transponder, if equipped. Because DELM operates over DF24, which allows for long data messages to be sent from the airframe to the ground station.

DF24 works similar to other interrogations with one exception: The DELM message is capable of up to 16-bit to 80-bit message segments for this extended message. The working component of DELM is the Comm-D message (MD) field.

❖ Three Extended Mode-S Squitters

Three other Mode-S message permutations have been developed.

DF17 (Binary 10001) is also known as an extended squitter or Automatic Dependent Surveillance-Broadcast (ADS-B). DF17 supports position, height, speed, heading, vertical rate, SSR codes (A/C) and Flight ID. Flight ID has its origins in the International Civil Aeronautics Organization (ICAO). The flight ID is an eight-character identification that is entered by the pilot on the flight deck. The flight ID may contain the company-assigned number for that particular flight. If the company-assigned number is not available or not used, the flight ID then becomes the aircraft tail number. The flight ID supplements the unique 24-bit aircraft discrete address and is used by ATC for monitoring purposes. More on ADS-B below.

DF18 (Binary 10010) is also an extended squitter and is reserved for non aircraft type transmissions such as ground vehicles and is known as TIS-B.

DF19 (Binary 10011) is an extended squitter reserved for military use.

❖ What is ADS-B?

As previously discussed, DF17 is the integral and working portion of the automatic dependent surveillance broadcast (ADS-B) system.

Breaking down the meaning of the terms in this acronym:

Automatic – there is no interrogation needed to start the data or squitter coming from the transponder.

Dependent – as it relies on onboard navigation and broadcast equipment to provide information to other ADS-B users.

Surveillance – it is a means of automatic surveillance and traffic coordination.

Some of the benefits of ADS-B technology are better use of airspace, improved aircraft-on-ground surveillance and better safety for traffic avoidance and conflict management.

ADS-B is a surveillance technology for tracking aircraft as part of the Next Generation Air Transportation System (NextGen) being developed by the FAA here in the United States. The United States will require the majority of aircraft operating within its airspace to be equipped with some form of ADS-B by January 1, 2020.

I will have more on ADS-B and how you can monitor these communications in our next *Monitoring Times On The Bench* column.

MFJ-886 Pocket-size Frequency Counter

By Bob Grove, W8JHD

Frequency counters have come a long way since their original 19-inch rack-mounted arrays of nixie tubes. The hand-held MFJ-886 is an excellent example of modern, compact convenience with outstanding performance throughout the 1-3000 MHz range.

Housed in an all-metal case measuring 3.15 H x 2.7 W x 1.22 D inches, the MFJ-886 is affixed with a BNC connector to accept either its included whip or test-cable jumpers for equipment measurements.

❖ Buttons and Switches

The counter is very easy to use with a minimum of choices required of the user. When the POWER switch is activated, it will briefly display all of its icons, bargraph segments, and numeric characters as a test. Other legends briefly appear as well which aren't accessible on this instrument, suggesting that the LCD module is used on other instruments besides the MFJ-886.

The RANGE switch activates the proper frequency swath desired, 1-300 or 300-3000 MHz. A HOLD button may be pressed at any time the instrument is on and sampling, allowing a fixed display of the measurement.

The GATE button may be progressively pushed through sampling periods of 0.0625, 0.25, 1, and 4 seconds. The fastest time acquires and displays the closest kilohertz, while the slowest period allows frequency acquisition to 1 Hz for measurements below 300 MHz, and the nearest 10 Hz for measurements up to 3 GHz.

❖ Uses for the MFJ-886

Obviously, the primary use for a portable frequency counter is to determine the actual output frequency of a nearby transmitting device. Scanners with near-field detectors like Uniden's Close Call™ and GRE's Spectrum Sweeper are not frequency counters. They read out only the closest FCC-authorized channel frequency of a detected transmitter, not the actual transmitted frequency.

Citizen Band, Family Radio Service, Multi-Use Radio Service (MURS), General Mobile Radio Service (GMRS), commercial, and amateur transceivers are also often off frequency from what they should be, but hopefully within the variance allowed by FCC rules and regulations. The frequency counter will immediately let you know if that is the case.

With the ease of hiding wireless security cameras and especially wireless microphones and surreptitious listening devices, those who are

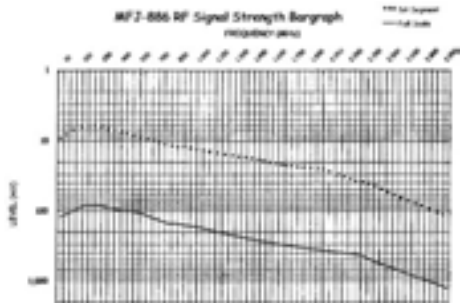
The MFJ-886 in action, showing the 10 digit frequency display and the LCD bargraph at full deflection.

vulnerable to surveillance can use a frequency counter to detect the presence of an emitting source by sweeping the room, watching the display lock its reading onto one frequency as a location is approached.

As a test-bench accessory, the 886 makes a handy piece of equipment to test oscillators in receivers, transmitters, RF remote controls, and other devices which generate or emit a radio signal as part of its normal operation.

Looking for the source of interference to reception in an office, factory, or even your home? Try approaching various electronic accessories with the frequency counter, watching for a stable signal to read out as you grow closer to the offending emitter.

And don't overlook the handy LCD signal-strength bargraph. It may not give you absolute measurements of field intensity, but it does do a credible job of allowing comparative readings



Relative response graph related to frequency, showing minimum input levels in millivolts for first segment to display, and levels to produce full deflection.

Input Sensitivity (Typical)	
Amplifier	50 ohm
Impedance	50 ohm, VSWR<2:1
Range	1 MHz - 3 GHz
Sensitivity	<0.8 mV @ 100 MHz <7 mV @ 300 MHz <6 mV @ 1 GHz <100 mV @ 2.4 GHz
Maximum Input	15 dBm

Frequency Display Resolution			
Range	Gate Time	LSD	Sample Display
300 MHz	0.0625 Sec	10 Hz	300.00000 MHz
	0.25 Sec	1 Hz	300.000000 MHz
	1 Sec	1 Hz	300.000000 MHz
	4 Sec	0.1 Hz	300.000000 MHz
3 GHz	0.0625 Sec	1000 Hz	3000.000 MHz
	0.25 Sec	100 Hz	3000.0000 MHz
	1 Sec	10 Hz	3000.00000 MHz
	4 Sec	10 Hz	3000.00000 MHz

A quick look at specifications.

for optimizing antenna adjustments, transmitter output, and homing in on unsuspected or hidden transmitting devices.

Other uses will come to mind for your own applications.

❖ Power Supply Options

The MFJ frequency counter is powered most conveniently by its internal 6 VDC NiCd battery. A top-mounted jack accommodates an external source of 9-12 VDC for recharging the NiCd or for powering the unit during extended use. An AC/DC wall adapter is included for such applications.

The 886 is capable of operating continuously for approximately 6 hours before the battery needs recharging. The battery automatically starts taking a charge when an external source of power is supplied, and it is completely recharged within 12-16 hours.

❖ Whip Antenna

The 886 comes equipped with a (nominal 50 ohm) BNC base, sturdy, telescoping whip, compressible to 5-inches in length and extensible to 23-inches. A removable pocket clip provides convenient shirt-pocket conveyance of the whip when not attached to the counter.

Adjustability of the length of the sectional whip permits optimal response for weak signals. Compressing the whip reduces strong signal overload while making critical transmitter measurements or adjustments.

The transmitter distance table accompanying this article gives a relative indication of maximum distances for making frequency measurements and taking relative signal strengths with the whip properly adjusted. Another table

Transmitter	Typ. Distance in Meters
Cordless Phone	0.3
Analog Cellular Phone	3-20
CB Radio	2-8
VHF 2-way radio	3-30
UHF 2-way radio	3-30

Typical distances from various common signal sources to produce a stable frequency readout.

shows the range of RF signal strengths which produce minimum and maximum excursions on the LCD bargraph

❖ Counter Sensitivity

A built-in 10-16 dB (depending on frequency range) preamplifier results in a sensitive frequency counter. It responds to signals in the 1-100 mV range in the 1-3000 MHz spectrum respectively. Maximum input to avoid overloading is 15 dBm.

With the whip pulled to its maximum length, the display on my review unit locked on to the carrier of a local FM broadcaster several miles away licensed on 102.7 MHz. According to my 886, however, they were actually on 102.6986062 MHz! Close enough.

Naturally, some household exploring was in order. With modern, digital cell phones constantly switching frequency, I didn't expect a steady reading, but the counter did show 832 MHz consistently. That would be expected from a cell phone transmitting in the allocated 824-849 MHz spectrum.

❖ Counter Accuracy

We were very impressed with the initial frequency accuracy right out of the box. With a signal generator adjusted to zero-beat with 15 MHz standards station WWV, the counter was within a 1- to 2-Hertz of dead-on.

For stalwart perfectionists who have zero tolerance for frequency error, an external hole provides access for razor-sharp adjustment of the time-base oscillator. In normal room temperatures, a stability of better than one part per million (1 ppm) may be expected. The calibration trimmer allows about 10 ppm adjustment range.

Naturally an invitation like that can't be ignored. I decided to see if I could improve the accuracy even further. Armed with a 10 MHz crystal test oscillator, a receiver tuned to 10 MHz WWV in the AM (not SSB) mode, and a two-port TV-style signal splitter to be used in reverse as a signal combiner, I was ready to test the accuracy of my crystal oscillator.

With a shortwave antenna attached to one splitter port and the oscillator to the other, I fed the combined signals into the receiver from the remaining single output port. Switching on the oscillator, I heard the distinct sound of flutter and a slightly altered pitch on the WWV reference tone which told me that my test oscillator was off-tuned.

A readjustment of the oscillator's trimmer gave me that familiar zero beat; switching the oscillator on and off made no difference in the WWV signal, so I now had an accurate signal source.

Attaching the now-accurate 10 MHz test oscillator to the MFJ-886, I saw that the frequency counter read 9.999982 MHz. Pretty darned close, but a touch of the calibration trimmer with a teensy jeweler's-style screwdriver put the MFJ-886 smack dab on 10.000000 MHz. Now that's accuracy!

❖ The Bottom Line

The MFJ-886 is hard to beat for compact convenience, accuracy, ease of operation, and low cost. The MFJ-886 is available for $114.95 plus shipping from Grove Enterprises (1-800-438-8155; **www.grove-ent.com**) and is available from other *MT* advertisers as well.

MFJ-266 Antenna Analyzer

In the early days of radio, tests and measurement instruments were separate. There were voltmeters, field strength meters, tube testers, ohmmeters, and myriad other dedicated testers.

As the science grew, multiple functions became more popular. Volt-ohm-milliameters (VOMs or multimeters) allowed multiple measurements, and many other combinations were offered as well to the service and repair market.

With modern solid-state electronics, compactness allows considerable sophistication to be built into small enclosures. The new MFJ-266 is one of these electronic marvels.

Housed in a 3-3/4 H x 2 W x 6 D inches metal case and weighing two pounds with batteries, it's a bit of a stretch to call it "handheld," but it certainly is portable and can be laid on one hand while making a measurement (See photo).

Powered by eight AA cells (not included), a separate front-panel jack allows connection to an optional 12 volt power supply for extended use. A type N to UHF (SO-239) adapter is included for PL-259 antenna cables, and a DC cord for connection to an external power source is provided as well.

While modestly called an "antenna analyzer," this multi-function instrument has a host of capabilities. Let's take a look at the functions and features the 266 offers.

❖ Antenna Analysis

With antennas, Voltage Standing Wave Ratio (VSWR) is always the biggest concern. Of minor consequence for receiving, it is a major consideration when transmitting, since a high reading means lossy power transfer, power reduction in transmitters, and possible circuit damage from high voltage due to impedance mismatch.

The 266 employs a stimulus-generator-driven bridge circuit which functions as a network analyzer. In this mode, the LCD displays the frequency for the measurement (MHz), the complex impedance (Z=R+JX), impedance (10-500 ohms), and the SWR (1:1 to 9.9:1).

❖ RF Measurements

A built-in frequency counter allows accurate measurements of a signal source from 1-500 MHz with resolution to 1 kHz in the fast gate mode, and 100 Hz in the slow gate mode.

The counter mode also enables a relative field-strength meter which provides a reading in millivolts (mV). This is handy for testing for local RF radiation which can interfere with accurate VSWR measurements, or even serve as a surreptitious transmitter ("bug") detector.

❖ Component Checker

The 266 can also be used to check inductances. I was able to test RF chokes in values from a fraction of a microhenry (µH) up to roughly 70 µH.

A capacitance check showed a range up to about 3000 picofarads (pF) or .003 microfarads (µF) depending on the quality of the capacitor. In both the inductance and capacitance modes, I found it best to use the lowest frequency selection (1.5 MHz).

❖ Signal Generator

Since the instrument must generate an RF signal to measure VSWR, that signal is also present at the type-N RF connector. An FM-modulated, +2 dBm output level is available throughout the 1.5-60 MHz HF range. At VHF and UHF it's no longer modulated, and the carrier it produces is quite unstable.

Frequency instability can be expected from a free-running oscillator such as this, which decreases in stability the higher the frequency, but in a pinch, it does work as an RF signal generator. And after all, the instrument is not designed to be a signal generator, so this function is just a bonus!

Depending upon factory alignment, there will be differences in actual frequency limits for band coverage. In my test unit, I was able to produce a relatively constant output (within about 2-4 dB) from 1.5-63 HF, 84-191 VHF, and 250-514 MHz UHF.

There was also a second harmonic about 24 dB lower than the fundamental signal, allowing extension of the UHF range from 500-1028 MHz.

❖ The Bottom Line

While not a laboratory-precision unit, the MFJ-266 offers a lot of analysis for the money. The frequency capability allows antenna design and testing for amateur, two-way, FM and TV broadcast, military and civilian air bands, and marine radio services in the HF, VHF and UHF services.

The MFJ-266 is available for $349.95 plus shipping from MFJ Enterprises, 300 Industrial Park Rd., Starkville, MS 39759; phone (800) 647-1800 or visit their website at **www.mfjenterprises.com**.

What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

HomePatrol-1 – The New Extreme Version

Late last month, Uniden released two long awaited updates to its HomePatrol Sentinel software plus a surprise upgrade to their popular HomePatrol-1 scanner that was released last fall. The updates are available at no charge to HP-1 owners and the upgrade will be a one-time charge of $99.99.

If you're a HomePatrol-1 owner, the HomePatrol Sentinel software has been an essential tool to keep your scanner's database up to date, your HP-1 favorites lists, and for backing up your HomePatrol-1's settings. With this new HomePatrol Sentinel software update, Uniden added some requested features and functionality that have been in demand since the original release of the unit last year. These new features include:

- Complete programmability for new or existing systems. Create or edit any system in a favorites list to personalize alpha tags, apply some of the newly available settings, or set up systems that have not yet made it into the main database at the RadioReference website. In other words, you can finally do your own thing with HP-1 and are not dependent on an outside database for your frequency programming.
- New channel settings that let the user customize the following:
  - Per-channel delay of 10, 5, 2, 0, -5, or -10 seconds. The negative settings are used to force scanning to resume after the set time elapses, even if a transmission continues.
  - A new per-channel alert that can be used to get your attention when a particularly important channel you are interested in becomes active.
  - Per-channel attenuation to help avoid interference from other in-band transmissions and a per-channel volume offset to help balance the audio level amongst channels.
  - New service tags for racing officials, racing teams, and eight tags you can customize.
  - CTCSS/DCS or NAC search to capture unknown subtones on frequencies. You won't have to watch the screen and record that information anymore. Sentinel does it for you.
- ID search mode for trunked systems so you can monitor channels, even if they are not yet in the RadioReference database. This will enable you to discover new talkgroups on trunk systems that you monitor and you are not a slave to what is available in the online database.
- Unit ID programming so you can alpha tag individual radio IDs and see specifically who is transmitting.
- The ability to add channels to a favorites list automatically based on your location, a range, and the service types you are interested in.
- The ability to enable up to 256 favorites lists for scanning along with the frequencies you get from the main database.
- Up until now you have been limited to a single circle to define the location of a agency, department or radio site. With this new software there is support for defining location using up to 32 rectangles per department or site, which gives the user some interesting capability to turn systems on or off depending on your particular situation.
- Tools for reviewing the results of discovery sessions or activity logs. This new feature is used in conjunction with the new upgrade mentioned below.
- An export feature that allows you to easily share Favorites lists with other HomePatrol users, as well as a companion import feature, so you can use their Favorites lists as well.
- A KML file export feature that lets you export information and geographic points you have compiled for viewing using the Google Earth program on your computer or Smart Device,
- Automatic update notification for the HomePatrol Sentinel software will now let you know when a new version of the software is available.

Firmware Update Required

To take advantage of the capability of the new Sentinel software, the HomePatrol-1 scanner will require a firmware update that is also free. These additional features address all of the major requests that Uniden has received since the initial release of HP-1.

Some of these features will slightly change the way information is displayed on HomePatrol-1's main operation screen. For example, HP-1 will now display the name of the Favorites list below the system name, so that you can more easily identify which system you are monitoring, and it will display the alpha tag for unit IDs along with channel alpha tags when you are using that particular feature.

HomePatrol-1 Extreme Pay Upgrade

Uniden has added some new features to a "pay" firmware upgrade that is now available for your HP-1. These new features include:

- Complete front-panel programmability that lets you edit existing systems in Favorites lists, or create new systems from scratch. You'll no longer be tied solely to the information provided in the RadioReference database when you are out and about, away from your PC.

- A new feature to let you program a limit search between two frequencies.
- Trunking system discovery – A new feature that makes it much easier to discover new channels on a trunked radio system. The HP-1 continuously monitors the selected system and compares received channel grants to the known channels for your area. When a new talk group is discovered, it records up to 4 minutes of audio for later review to aid you in identifying the agency using the channel.
- Conventional discovery – Similar to trunk discovery, this feature helps you find active frequencies in your area that haven't made it into the database. When a frequency has activity, the HP-1 compares the frequency and subtone settings (CTCSS/DCS/NAC) to known channels in your area. If the information is not in the database, the HomePatrol-1 records up to 4 minutes of audio so you can later review and identify the agency using the frequency.
- Trunked activity logging (includes log file for detailed review).
- Trunked system load/reception status tool.
- Current trunked system activity.
- LCN Finder: Helps determine the logical channel numbers for EDACS and LTR trunked systems.
- Trunked LCN Monitor: Records activity on EDACS and LTR trunk LCNs over time.

- Talk group converter to switch between decimal and hex channel representation.
- Band Scope: Plots a graph of radio signal strength indication (RSSI) versus frequencies for a range of frequencies.
- RF Power Plot: Plots a graph of RSSI *vs.* time for a single frequency to help locate transmission sources, monitor antenna performance, and track down interference issues.

You can learn more about these new updates/upgrades on YouTube at **http://youtu.be/iEG-ZodmoeY?hd=1** or on the Uniden HomePatrol website**www.HomePatrol.com**.

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

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Uniden's HomePatrol-1 is a revolutionary touchscreen receiver that lets you instantly listen to police, fire, ambulance, military, weather reports & more.* Visit **www.HomePatrol.com** to learn more.

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Product is not to scale. *Some services not available in all areas. Operation is covered by patents including 5,784,388, 5,956,648, 6,192,223, 6,519,472, 6,941,120.

to the editors

editor@monitoringtimes.com

Tell Us about You

This month we invite you to tell us about you and your equipment in our survey on page 5. It's just a few questions, but knowing what equipment you use and what you listen to will help us serve you better in *Monitoring Times*.

In return, if you are a subscriber (print or digital), you'll get an extra month on your subscription just for filling out the survey. All surveys – whether submitted by subscribers or single-issue purchasers – will be eligible for the grand prize drawing, so don't miss out on your chance to win a $100 gift certificate from Grove Enterprises!

That's how much we value our subscribers and newsstand readers, so get in on the deal by sending in or emailing your survey today! The side benefit is that you'll also ensure we continue to provide the information *you* most need in each issue of *MT*.

More Museums

Doug Robertson wrote about this addition to our Radio Museum list:

"In the Donalson Aviation Museum hanger at the Santa Paula (California) Airport, the entire second floor is devoted to a Radio Museum, with hundreds of radios from the earliest days. Dale Donalson has assembled an incredible collection of phonographs, console models, the RCA Victor 'His Master's Voice' Victrola, the original Crosley Bluebird Art Deco radio, early shortwave radios, early televisions, small Bakelite plastic radios, Zenith Transoceanic radios, clock radios, the earliest portable radios, and an amazing collection of novelty radios throughout history that may bemuse, befuddle or astound you! There are so many radios here you may find an identical one or two from your own past!

"The museum hanger is open for the radio exhibit when the Aviation Museum is open each first Sunday of the month from 10 am to 3 pm, weather permitting. Admission is entirely free. Budget some extra time for this museum, for it is compellingly fascinating. I can't count the number of times I have been in the Radio Museum. Radio was a hobby in my youth and I built and repaired radios and early TVs for a time in my late teens."

Phone: 805-525-1109
Address: In Hanger 5 of the Aviation Museum Hangers (www.amszp.org)
Directions: At Santa Paula Airport at end of 8th Street. Take Highway 126 marked airport turnoff ramp.
Read more: http://members.virtualtourist.com/m/946db/b876a/4/#1326238#ixzz1NwSlWs43

Steve Goulart AC2AS sent information on one of the most ambitious museums we've seen. Historic Camp Evans in Wall, NJ has a stellar history in radio communications, from Edwin Armstrong to the first Tiros weather satellite photos. Check out the web sites below or visit in person for the full story.

"I would like to add the InfoAge Science History Learning Center to the list (**http://infoage.org** or **http://campevans.org**). We host a number of displays and museums related to radio and electronics. Eventual plans see us becoming a regional science learning center serving the NJ shore area and New Jersey's WW2 Living Memorial.

"InfoAge currently supports a group of museums and displays developed and operated by our member clubs and organizations. Current Museums include The Radio Technology Museum and National Broadcaster's Hall of Fame featuring antique radio and TV (New Jersey Antique Radio Club), The Vintage Computer Museum (Mid-Atlantic Retro Computer Hobbyist), and The New Jersey Shipwreck Museum (New Jersey Historical Divers Association).

"Other smaller displays include an early moon bounce system built by a NJ amateur hosted by the Ocean Monmouth Amateur Radio Club at our Diana/Tiros site, WW2 electronics and Radar, WW2 communications, Electronic Warfare, our Apollo Command Module Computer display and the Fallout Shelter Theater in our basement fallout shelter.

"InfoAge is a historic 37 acre site on the Shark River in Wall, NJ originally occupied by the Belmar Station of the Marconi Wireless Telegraphy Co of America. This was the receiver site of the New York to London system built in 1914. Five of the original Marconi buildings remain."

"InfoAge is currently open Sundays from 1 to 5 p.m. and by appointment (contact *steve@infoage.org*). We are working to expand these hours. InfoAge hosts an number of events each year including antique radio auctions, hamfests, a car show, a shipwreck symposium, Vintage Computer Fair East, WW2 symposiums and a large haunted house; watch our calendar for details."

Robert Arnold Coburn (SK)

Monitoring Times has learned that one of the legends of scanner publication industry passed away last February. Robert Arnold Coburn, formerly of Londonderry, New Hampshire, died at The Villages in Florida on February 20, 2011.

He was born on August 26, 1941 in Springfield, Massachusetts. He came to New Hampshire in 1968 to become a full professor in the Department of Business Administration at Franklin Pierce College in Rindge, where he taught for 35 years.

Robert's interest in monitoring started in the early 1960s, when he was first licensed as W1JJO. He was a life member of the ARRL, member of the old Radio Communications Monitoring Association (RCMA) and Northeast Scanning News, the Ohio Scanner Club and a participant in the New Hampshire statewide notification system.

His many interests led to work in law enforcement, as well as writing and publishing his "Official Scanner Guide" books. His statewide scanner guides published in the late '80s and early '90s for Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont were considered some of the best and most comprehensive publications of that era.

Nationally, Robert is best known for his Maritime and Aeronautical Frequency Directories. I still have copies of both in my reference library.

He is survived by his wife of 47 years, Barbara; two daughters, Karen Kilgore of Londonderry and Jean Kadegis of Abilene, Texas, and six grandchildren.

– Larry Van Horn, MT Staff

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

Uniden HomePatrol-1 Digital Radio Scanner

Simple Programming - Simply enter your zip code or city, and HomePatrol-1 selects the channels in use in your area.

TrunkTracker IV (Motorola APCO 25 Digital, Motorola, EDACS, LTR) - Lets you monitor all of the major types of communications systems used by public safety, local government, amateur radio operators, and more.

S.A.M.E. Emergency/Weather Alert - Allows you to specify the area that you need to hear any alerts that may be Weather, Civil, Biological, Nuclear, or National in nature.

Covers US and Canada - The built-in database includes all known channels in use in the United States and Canada. (Some services not available in all areas.)

Quick Record and Playback - Lets you record sessions for later playback or archiving.

Instant Replay - Lets you replay the most recent reception with a single tap.

3.5" Daylight Viewable Display

Free Radio System Updates - Radio System database is updated weekly.

No Subscription Needed.

Touchscreen Operation - Makes it easy to control what you are hearing.

HomePatrol Sentinel PC Software Included - Lets you update the HomePatrol-1's database, update firmware, and more easily manage favorites lists and other settings in your HomePatrol-1.

HomePatrol-1 lets you quickly hear the communications systems used by Public Safety, Aircraft, Military, Weather Spotters and more. Simply enter your US Zip code or Canadian Postal Code and HomePatrol-1 does the rest. Whether it is across town or across the street, HomePatrol-1 keeps you informed.

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Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

ANTENNA TOPICS
www.wa5vjb.com - by Kent Britain

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

UTILITY WORLD
http://mt-utility.blogspot.com/- by Hugh Stegman
www.ominous-valve.com/uteworld.html

Stock Exchange

Got something you'd like to sell? Can't find something you've been searching for? *MT* is THE way to buy or sell all of your radio equipment! It's inexpensive and is seen by tens of thousands of fellow hobbyists! Call today to get your listing in the next issue!

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Ads for Stock Exchange must be received 45 days prior to publication date. All ads must be paid in advance to Monitoring Times.
Ad copy must be typed for legibility.

1-3/4" SQUARE DISPLAY AD:

$50 per issue if camera-ready copy or, $85 if copy to be typeset. Photo-reduction $5 additional charge. For more information on commercial ads, contact Judy Grove at 828-837-9200 or judy@grove-ent.com.

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

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

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- Up to 2000 alphanumeric memories (50 channels X 40 banks) can be stored
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- Fast Fourier Transform algorithms
- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all of the receiver's functions
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- Analog composite video output connector
- CTCSS and DCS squelch operation
- Two selectable Type N antenna input ports
- Adjustable analog 45 MHz IF output with 15 MHz bandwidth
- Triple-conversion receiver exhibits excellent sensitivity
- Powered by 12 volts DC (AC Adapter included), it can be operated as a base or mobile unit
- Professional (government) version is equipped with a standard voice-inversion monitoring feature

Add to the capabilities of the AR5001D with options:

- Optional APCO-25 decoder
- Optional LAN interface unit enables control via the internet
- Optional I/Q output port allows capture of up to 1 MHz onto a computer hard drive or external storage device
- Optional AR-I/Q Windows software facilitates the easy storage and playback of transmissions captured within the selected spectrum in conventional modes, or, signals can be subjected to further analysis
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