

Scanning - Shortwave - Ham Radio - Equipment
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Monitoring Times[®]

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2012 Air Show Special!



In this issue:

- MT Rides "Fat Albert Airlines"
- Must-have Air Show Frequencies
- Refueling the USAF's Thunderbirds
- MT Reviews: WinRADIO G39DDCe

AR5001D Wide Coverage Professional Grade Communications Receiver

The Legend Lives On!



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

Available in both professional and consumer versions, the AR5001D features wide frequency coverage from 40 KHz to 3.15 GHz*, with no interruptions.

Developed to meet the monitoring needs of security professionals and government agencies, the AR5001D can be controlled through a PC running Windows XP or higher. Up to three channels can be monitored simultaneously. Fast Fourier Transform algorithms provide a very fast and high level of signal processing, allowing the receiver to scan through large frequency segments quickly and accurately. AR5001D standard features include storage of up to 2000 frequencies, 45 MHz IF digital signal processing, direct digital sampling, a high performance analog RF front-end, a DDS local oscillator and advanced signal detection capabilities which can detect hidden transmitters. With its popular analog signal meter and large easy-to-read digital spectrum display, the AR5001D is destined to become the choice of federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.

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

- Multimode receives AM, wide and narrow FM, upper and lower sideband and CW
- Up to 2000 alphanumeric memories (50 channels X 40 banks) can be stored
- Analog S-meter
- 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
- An SD memory card port can be used to store recorded audio
- 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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Cover Story 8
A How-To Guide to Monitoring Air Shows
 By Larry Van Horn N5FPW, MT Assistant Editor

In our 13th annual Air Show Special, MT Assistant Editor Larry Van Horn N5FPW delivers the hundreds of frequencies you'll need if you're within receiving distance of any air show in 2012.

From the Blue Angels and Thunderbirds precision flight teams to the U.S. service parachute and search and rescue demonstration teams to the many other military and civilian demo teams from the U.S. and abroad, Larry has the frequencies each use. Now you can bring the excitement you see at the show to your ears.

But wait, there's more! In this month's *Milcom* column, Larry also tells you which scanners work best at the air shows, what features you'll need and which models can cover the military as well as civilian frequencies used at all air shows.

On Our Cover

Photo by Kevin Burke shows U.S.A.F. Thunderbird moments after refueling. Kevin was in the seat next to the boom when this shot was taken with a Cannon XTi camera using a Cannon 18-135 mm zoom lens at 1/500 sec with f-stop 10.

C O N T E N T S

My Ride on a T-Bird Refueling Mission..... 14
 By Kevin Burke

How lucky would you have to be to be asked to take a six hour flight on a KC-135 refueling tanker? Lottery lucky! But, this was no ordinary refueling mission. The thirsty aircraft cueing for fuel were none other than the famous USAF Thunderbirds. Join Kevin on this ride of a lifetime while he jockeys for position on the most favored boom seat. As an aircraft photographer, Kevin says that it's a matter of luck and timing to get the perfect refueling shot. They even gave him a free lunch!



Flying Fat Albert Airlines 16
 By Kevin Burke

How do you top a refueling mission with the Thunderbirds? How about, a thrill-ride on the Blue Angels' "Fat Albert Airlines!" Yes, Kevin's two for two with military flight team spectaculars and he tells all in this harrowing account of a short but memorable flight on a Marine C-130, an unlikely aerobatic aircraft that has some surprising moves.



Radio and the Air Show Experience 17
 By Brian and Jo Marie Topolski

Air show and photo veterans Brian and Jo Marie Topolski share their monitoring tips and insights into some of the best shows on the summer long air show circuit. To get the best out of watching an air show with 800,000 fellow air show fans, you'll need to know when to go, what to take, where to be and where to tune.

And, Brian and Jo Marie show how to fashion an impromptu air-comm cart from a couple of items

you can find inexpensively at your nearby Lowes or Home Depot. They'll show you how to stop lugging your gear around and get more enjoyment out of the show.



R E V I E W S

WiNRADIO G39DDCe
Wide-Frequency-Coverage Receiver..... 69
 By Bob Grove W8JHD

A receiver that tunes from 9 kHz to 3.5 GHz in AM, AMS, CW, LSB, USB, ISB, DSB, FM (narrow and wide stereo) as well as FSK, has an infinite number of stored frequencies at 80,000 channels per second, can get Bob Grove's attention every time. He calls it, "a marriage of a multimode receiver and a spectrum analyzer." Bob puts this software defined radio (SDR) through its paces both on his home bench and on the road. The bottom line? Bob says, "This is the most amazing receiver I've ever encountered."

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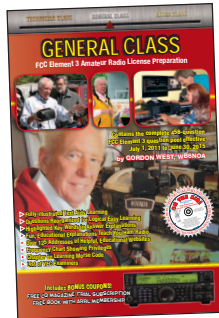
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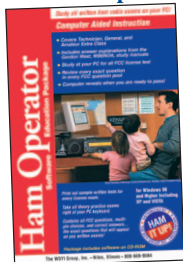
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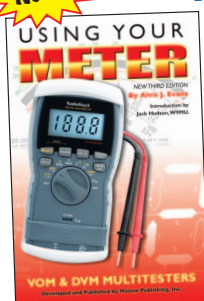


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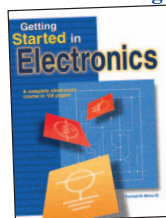
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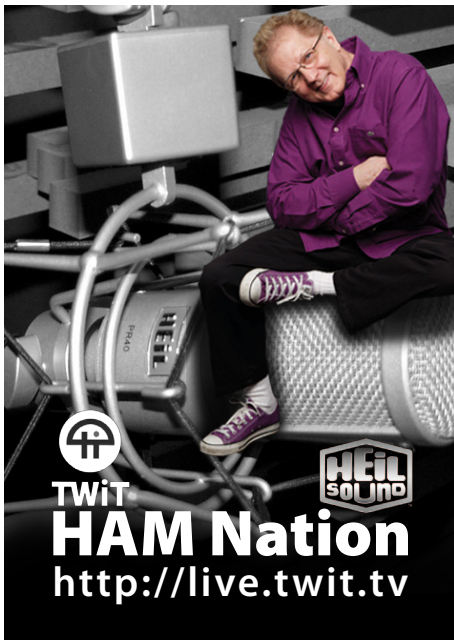
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AMATEUR RADIO/ SHORTWAVE

HAM Nation Archives on iTunes

HAM Nation, the weekly live video webcast about ham radio hosted by Bob Heil K9EID and Gordon West WB6NOA, is live each Tuesday evening at 8:00 pm CT. To watch the live shows via Leo Laport's This Week in Technology network go to: <http://live.twit.tv>. You can catch the episodes you missed by going to <http://twit.tv/hn> or download episodes via iTunes. Episodes include "Smoke and Solder" segments with George Thomas W5JDX. The opening theme music was written by Joe Walsh WB6ACU who was also a guest on the first episode.



Ham Radio: Fountain of Youth

Age is just a matter of perspective, and an article in *The Oregonian* last December is a case in point. An 80 year-old woman had been living in California where she had been a ham for the previous 15 years. She moved to Oregon and gave up her license because she thought she was too old.

Eighteen years later she met up with a group of hams and decided to take the exam and get her ticket back. At 98 she was back on the airwaves. That was four years ago. Now at 102 she's part of the Clackamas Amateur Radio Emergency Service. Other club members at the Milwaukie View Manor where she lives include one of the club's founders who is 97 years old and youngsters in their mid-

80s. According to the article, the YL made a perfect score on her Tech exam and recently upgraded to General.

FCC: KJES off by 21 Hz

According to FCC documents, the agency's High Frequency Direction Finding Center was monitoring religious shortwave broadcaster KJES near Vado, New Mexico and were not mesmerized by the chanting voices of the children of Our Lady's Youth Center. Instead they found the station, licensed to broadcast on 11,715 kHz with a "tolerance of .0015%," was in fact transmitting on 11,714.803 kHz, a full 21 Hz beyond its allowed frequency tolerance.

A Notice of Violation was issued, giving the reclusive station 20 days to fully explain the violation. The infraction was filed August 6 of last summer and published December 14. It must have been a very slow week for the High Frequency Direction Finding Center.

Radio's Dark Side: Cartel Network

A widely circulated *Associated Press* report told of an extensive two-way radio network used by Mexican drug cartels that had stretched the length of Mexico and featured solar powered repeaters, antennas, transmitters and cleverly disguised towers with buried feed lines. Cartel members were said to use the system to alert various drug operators of the movements of Mexican government anti-narcotic squads. According to the article, the network was built in 2006.

The Mexican army took down the network which consisted of 155 repeaters, 167 antennas, 166 power sources, 71 pieces of computer equipment and 1,446 two-way radios. Years earlier, cartel members would break into government frequencies to threaten Mexican soldiers involved in drug interdiction, but the government has since switched to encrypted systems which, according to the article, the cartels have yet to be able to break into.

AM/FM/TV BROADCASTING

FCC OKs Media Ownership Changes

For years, under both Democrat and Republican chairmen, the FCC has been trying to change what it sees as archaic market rules regarding media ownership. In an end-of-year decision, the FCC voted to scrap radio/TV cross-ownership rules (which will lead to even more market consolidation) and loosen newspaper/broadcast cross-ownership rules (it's hard to believe there are any rules left).

According to an article in *Broadcasting & Cable*, a previous attempt to do this was tossed out by a Federal court for lack of sufficient public notice of the plan. This time the Commission is determined not to let this opportunity slip by on a technicality; they're allowing a significant period for comment on the Notice of Proposed Rulemaking (NPRM).

Prometheus "Get Radio!" Effort

The non-profit community radio organization that spearheaded the expansion of the FCC's new Low Power FM (LPFM) rules has initiated a "Get Radio!" mapping project. If you want to know how many new LPFM licenses will be available this year check out this site: <http://prometheusradio.org/content/get-radio-mapping-project>. Prometheus notes that the map shows only the top 200 markets and the possible number of new licenses that each could have. But, many more LPFM licenses may be available outside the 200 top U.S. markets.



PUBLIC SERVICE

Experts Explain P25 Issues

Daryl Jones' public safety technology blog has a paper issued by noted security experts titled, "Why (Secret Agent) Johnny (Still) Can't Encrypt: A Security Analysis of the APCO Project 25 Two-way Radio System" at his website: <http://blog.tcomeng.com>. The 16 page document, issued at the University of Pennsylvania



during a seminar on the subject last summer, concluded that the system is "inherently vulnerable to passive traffic interception and active attack, and so it must rely entirely on cryptographic techniques for its optional security features." The entire document can be read at his web site.

SATELLITE

AirTrans Ditches XM

Cutting corners is the name of the game in the airline industry, and Atlanta-based



AirTran has literally shed some weight by removing the massive painting of pop music icon Elton John and the XM logo from its fuselages as well as all the XM-related receiving gear. According to the *Atlanta Journal-Constitution*, the move comes as AirTran becomes part of Southwest Airlines, and it was not done without thought. The article quoted a company official who said it was an effort to make "a consistent product." AirTran has carried XM aboard its planes since 2005.

African Satellite Mystery

A number of media outlets leaped upon the story of a mysterious orb that apparently fell from space in mid-December, landing in Namibia. There was no mystery of course, it was simply another one of those Composite Overwrapped Pressure Vessels (COPV) used on many satellites to store gases under pressure in space.

It turned out that the return to Earth of the 15 inch "spaceship" was not an isolated occurrence; others have been found across Africa, South America and Asia over the last 20 years and there's no telling how many are lying at the bottom of the world's oceans. Scientists predict an increase in such events as more satellites are launched and others reach the end of their orbital lives.

Russian Satellite Irony

As if to emphasize the point of the story above, *Agence France Presse* (AFP) reported at the end of December the crash of a Russian Meridian communications satellite, debris of which fell over a town in Siberia. One piece fell through the roof of a house that happened to be located on Cosmonaut Street.

Unfortunately, the loss of the Russian satellite was not an isolated incident either. According to the AFP report, the Soyuz -2.1B rocket that failed to launch the satellite is the same type that's used to send multinational crews to the International Space Station.

All irony aside, the loss of the Meridian satellite joins the loss of other Russian satellites including three navigation satellites, a military satellite, a telecommunications satellite, and a probe that had been headed to Mars. One Russian official blamed the downward success spiral on migration of Russian engineering talent to more lucrative industries and countries following the collapse of the former Soviet Union.

LightSquared Dares FCC

In what seems a provocative move, would-be 4G satellite/Internet spectrum seller LightSquared has filed a Petition for Declaratory Ruling (PDR) with the FCC regarding its right to continue the build-out of its Telco-



partnered Internet service, despite claims by the GPS retail industry that the service would interfere with current GPS units. Specifically, the company is seeking a ruling that it was not obligated to pay for any fix that might be required should their service in fact interfere with existing GPS-related satellite devices.

According to the actual FCC PDR, LightSquared told the FCC that, "It recently has become apparent that the commercial GPS industry has manufactured, and sold to unsuspecting consumers, unlicensed and poorly designed GPS receivers that 'listen' for radio signals both in the 'RNSS' frequency band in which the U.S. GPS system is intended to operate, as well as across the adjacent 'MSS' frequency band that is not intended for GPS use, and in which LightSquared is licensed."

LightSquared, as if to make the GPS industry understand its position, stated in their PDR that, "unlicensed commercial GPS receivers simply are not entitled to interference protection from LightSquared's licensed operations in the MSS band. Moreover, the commercial GPS industry is mistaken that LightSquared must bear the financial burden resulting from the failure of the commercial GPS industry, for almost a decade, to account for the deployment of LightSquared's network in the design and manufacture of commercial GPS receivers."

You can almost hear all the lawyers girding their loins for lucrative battle.

FCC ENFORCEMENT

FM Pirates and Taxi Drivers Cited

The usual suspects were the target of routine FM pirate radio busts in the last thirty days. An Olympia, Washington man was issued a Notice of Unlicensed Operation (NOUO) for his pirate FM station on 98.5 MHz at 4,428 microvolts/meter at 436 meters (legal limit under Part 15 rules is 250 microvolts/meter at 3 meters). A woman from Ashland, Oregon who is part owner of the building in Olympia was also sent a NOUO, as was a man in Medford, Oregon, also apparently a part owner of the property. The FCC is going for the trifecta with this one NOUO.

The FCC also issued a Notice of Violation (NOV) to the United Independent Taxi Drivers, Inc. for operating their repeater atop Oak Mountain near Van Nuys, California against rules. Among the violations cited were nearly continuous yakking by various drivers (you're supposed to un-key the mic now and then); a continuous digitally modulated signal was present on the frequency (everyone should try not to interfere with the repeater frequency); during the "extended period" of monitoring, neither the repeater nor the stations using the repeater were ever identified (such stations and repeaters should ID at least every 15 minutes, according to FCC rules governing such repeaters), and the repeater needs to be located at the assigned location on the license (this repeater was somehow nearly one and a half miles away from where it was supposed to be).

Have you checked to see where your repeater is lately?

CBer Cited for CB Interference

FCC field agents investigated a complaint by a CB operator in Clinton, Tennessee of interference from another CB operator in located in Knoxville, Tennessee. According to FCC documents, the Knoxville CBer admitted to FCC agents in a telephone interview to intentionally causing interference to the other operator. The Commission gave the Knoxville op 20 days to explain the issue to their satisfaction. It's always good to know that at least the CB band is interference-free in Knoxville, Tennessee.

FCC Goes Clubbing in S.F.

Notices of Unlicensed Operation (NOUOs) were issued in early December by FCC field agents working the club scene in San Francisco in early November of last year. Clubs known as Déjà vu Centerfolds Club, The Hustler Club and The Gold Club were said to be operating radios in the 450-600 MHz range and found to be interfering with America's Search and Rescue radio system. It's easy to see that such interference might have caused some real confusion if SAR teams had rappelled from helicopters into the clubs.



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

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A How-to Guide to Monitoring Air Shows

The 13th Annual MT Air Show Guide

By Larry Van Horn, MT Assistant Editor



B-52 arrives at Pease Vermont Air National Guard (Photo by Kevin Burke)

If the bits of radio chatter in the adjacent box sound familiar to you, chances are you have monitored the exciting communications transmitted by the U.S. Navy Blue Angels at a military air show in the recent past. And nothing will stir up the milcom monitoring enthusiast's juices more than those two magical words – *Air Show!*

Anyone who has attended one of these events will tell you it is thrilling to watch the close quarter flying of the Blue Angels' delta formation or the hair splitting maneuvers of the Thunderbird opposing solos. But there is a way you can add to the visual experience by monitoring the performing teams' radio communications. With a radio scanner in hand, you will experience a whole new perspective of the show that few attendees will get experience – the sounds from the aircraft cockpit.

Every year, from March through November, millions of people hit the road to watch the excitement and thrills as military and civilian aero teams put their high performance aircraft through their paces to entertain the crowds and perform at air shows all over the world.

To indulge in monitoring the air show experience you need a current and well researched list of frequencies that the various performers may use during their performance. That requirement is the reason this feature is presented every year in March in the pages of *Monitoring Times*.

What started out as an answer to a question by an *MT* reader in my *Milcom* column 13 years ago has now grown into one of the most eagerly anticipated features in this magazine each year,

and with good reason. Not only will I give you the frequencies you need to monitor the air show groups, but you also get my recommended list of radio equipment needed to listen to these events (see this month's *Milcom* column).

So here we are again at the start of another air show circuit. It is time to pack up those radio wagons, charge up the scanner batteries, and get ready for a new season of thrills on your scanner. *Monitoring Times* proudly presents our 13th annual *Milcom Air Show Guide*.

“A little more pull, a little power. Standby boards ---- boards!”

Where do you hear the action?

From time to time, frequencies for air show teams do change, by design or by need, so it's important to know where to search for potential new frequencies.

You should be able to locate most air show activity at the event you are attending by searching in the frequency bands below. If you have a scanner that has the Close Call® or Signal Stalker® functions, that will help speed up the process of determining the active frequencies in use during the show.

| | |
|-----------------|--|
| 118.000-137.000 | 25 kHz search steps (AM) |
| 122.700-123.575 | 25.0 kHz search steps (AM) |
| 138.000-144.000 | 12.5 kHz search steps (AM/Narrowband FM or NBFM) |
| 148.000-150.800 | 12.5 kHz search steps (AM/NBFM) |
| 162.000-174.000 | 12.5 kHz search steps (NBFM) |
| 225.000-380.000 | 25.0 kHz search steps (AM) |
| 380.000-400.000 | 12.5 kHz search steps (NBFM and AM) |
| 406.100-420.000 | 12.5 kHz search steps (NBFM) |

Note: All frequencies in this article are in MHz and the mode is AM unless otherwise indicated.

U.S. Navy Blue Angels

The premier U.S. Navy/Marine Corps military flight demonstration team on the air show circuit is the Blue Angels flying the F/A-18 Hornet aircraft.

The team is based at Forrest Sherman Field, Naval Air Station Pensacola, Florida. However, the squadron does spend January through March each year training pilots and new team members at the Naval Air Facility in El Centro, California.

The Blue Angels are scheduled to fly approximately 69 air shows at 35 air show sites in the continental United States during this, their 66th season. This year also marks the 26th year the team has flown the F/A 18 Hornet. Since its inception in

1946, the Blue Angels have performed in front of more than 474 million fans.

During their performances the Blue Angels exhibit the skills possessed by all naval aviators. These include the graceful aerobatic maneuvers of the four plane diamond formation, in concert with the fast paced, high performance maneuvers of the two solo pilots. At the close of every show, the team illustrates the pinnacle of precision flying, performing maneuvers locked as a unit in the renowned, six jet Delta formation.

The other major piece of flying hardware in the squadron is their C-130T Hercules transport aircraft, affectionately known as “Fat Albert Airlines.” It is the only Marine Corps aircraft permanently assigned to support a Navy squadron and it is flown by an all Marine Corps crew of three pilots and five enlisted personnel. “Fat Albert Airlines” flies more than 140,000 miles during the course of a show season. It carries more than 40 maintenance and support personnel, their gear, and enough spare parts and communication equipment to complete a successful air show.

Blue Angel Aero Frequencies

237.800 Solos when not in the show box (Solo #2) and cross country air/air [Channel 8]
 251.600 Air/Air nationwide and at NAS Pensacola
 255.200 Circle/arrivals discrete and cross country air/air [Channel 17]
 265.000 Diamond formation secondary



KC-135 taking off (Photo by Kevin Burke)

- 275.350 Diamond formation when not in the show box, cross country air/air, and their Pensacola squadron common [Channel 9]
- 284.250 Show box for diamond, solos, delta and cross country air/air [Channel 16]
- 289.800 Air refueling during cross country trips
- 305.500 Fat Albert "Bert" primary, solo aircraft (West Coast), and maintenance officer [Channel 10]
- 305.900 Fat Albert "Bert" – First heard during the 2009 San Francisco Fleet Week, at the 2009 Pensacola homecoming show (no 305.500 MHz comms heard), and the solo aircraft used this frequency during their annual Naval Academy graduation flyover at Annapolis, Maryland.
- 333.300 The Diamond formation was monitored on this frequency during Fleet Week in San Francisco.
- 346.500 "Checklist Freq" – Pre-show checklist, ground start/roll out and maintenance [Channel 18]

Blue Angel Aircraft Radio Preset Plan

| Frequency | Usage |
|----------------|----------------------------------|
| Channels 1-7 | NAS Pensacola (KNPA) frequencies |
| Channels 8-10 | Team frequencies |
| Channels 11-15 | Show site frequencies |
| Channels 16-18 | Team frequencies |
| Channels 19-20 | Unknown usage |

Blue Angel Organization

The Blue Angels' support team is made up of the Events Coordinator, Maintenance Officer, Flight Surgeon, Administrative Officer, Public Affairs Officer, Supply Officer and approximately 110 enlisted Navy and Marine Corps volunteers. Alternating crews of about 45 team members travel to each show site.

The squadron consists of seven distinct departments that are jointly responsible for guaranteeing the team's readiness. A tribute to this dedicated team is the fact that the Blue Angels have never cancelled an air show due a maintenance problem.

Administration – The Administration Department is responsible for executive and official correspondence, squadron records, pay and travel orders. Administration maintains instructions and notices, handles promotions and awards, and controls legal and security concerns.

Aviation Medicine – The Aviation Medicine Department is responsible for the health and wellness of each team member. The medical team performs annual physical examinations and emergency medical procedures, keeps medical and dental readiness up to date, and acts as a liaison for advanced medical care.

Events Coordinator – The Events Coordination Department schedules preseason visits with show site sponsors and secures accommodations and ground support for each demonstration show.

Fat Albert Airlines – As mentioned previously, the all-Marine flight crew assigned to the squadron's Lockheed-Martin C-130 Hercules is responsible for transporting road-crew personnel, supplies and equipment to and from each show site throughout the season.

Maintenance – The Maintenance Department consists of the airframes, avionics, corrosion control, crew chiefs, life support, maintenance control, power plants, quality assurance and video shops. The maintenance team is responsible for all aircraft upkeep.

Public Affairs Office – The Public Affairs Office documents and promotes the Blue Angels. It designs, writes, photographs, edits, publishes and distributes all promotional materials. The

Public Affairs Office also coordinates coverage and interviews with local, national and international media, and manages the VIP rider program.

Supply – The Supply Department researches, procures, stores, and issues spare parts, tools, and uniforms. Supply also researches future squadron logistical needs and initiates contracts for services required to support daily operations.

The Blue Angel ground maintenance crews have their own set of communication frequencies in support of their mission. They carry with them a communications cart "comcart" for their ground maintenance net. The two confirmed frequencies used by this cart are:

- 139.8125 Ground maintenance crews and equipment checks [Bravo] NBFM 67.0 Hz PL tone
- 142.6125 Ground maintenance crews and equipment checks [Alpha] NBFM 67.0 Hz PL tone

In 2007, 141.5625 MHz was reported as an additional comcart frequency. In 2009, I received another report that this frequency was used at a West Coast air show. Since this frequency has been reported sporadically, I believe that it is used only at locations where one of the two regular comcart frequencies listed above are in regular use at an air show site. I am especially interested in reports on this frequency and any P25 activity noted in use.

A new development occurred in 2011 regarding the team's ground communications. It now appears they also have radios that they can use on the new DoD 380-400 MHz trunk radio systems.

At the NAS Jacksonville air show, the ground maintenance team was observed using the Navy Southeast Region 380-400 MHz trunk radio system. Talk group 29529 was being used by aircraft ground handlers and for tower to comm cart communications. Talk group 29530 was confirmed when the team conducted comm checks and used it during the start of their performance. These two talk groups fit perfectly the known talk group plan that has been observed in use here in the southeast United States.

If you attend an air show this year at a base that has one of these new DoD 380-400 MHz trunk radio systems, be sure to program systems in your scanner, and you might be treated to some interesting ground communications on talk groups 29529 and 29530.

U.S. Air Force Thunderbirds

The U.S. Air Force has a flight demonstration team of their own known as the Thunderbirds. This year marks the 59th season that the T-Birds have performed air shows and they will conduct 60 shows in 33 locations, including two shows in Canada.

They will kick-off the 2012 season by performing a flyover for the 54th running of NASCAR's Daytona 500 on February 26.

During each show the team performs formation flying and solo routines. Like the Blue Angels, the four aircraft diamond formation demonstrates the training and precision of Air Force pilots, while the solos highlight the maximum capabilities of the F-16 aircraft. The Thunderbirds recently completed a swap of their older F-16 Block 32 Fighting Falcon for more advanced and powerful F-16 Block 52 aircraft.

A Thunderbirds' aerial demonstration is a mix of formation flying and solo routines. The pilots perform approximately 40 maneuvers in a demonstration. The entire show, including ground and air, runs about one hour. Like the Blue Angels, the T-Bird air show season lasts from March to November, with the winter months used to train new members at their home base at Nellis AFB, Nevada.

The U.S. Air Force Air Demonstration Squadron is an Air Combat Command unit composed of eight pilots (including six demonstration pilots), four support officers, four civilians and approximately 110 enlisted Airmen performing in more than 29 Air Force specialties.

U.S. Air Force Thunderbird Aero Freqs

| Frequency | Usage |
|-----------|--|
| 139.225 | Diamond formation [Victor #] |
| 139.800 | Diamond formation [Victor #] |
| 140.700 | Diamond formation [Victor #] |
| 141.075 | Diamond formation [Victor #] |
| 235.250 | Pre-engine start/solo aircraft on/off show center/linked to PA system [Uniform 1] |
| 235.350 | New frequency: Thunderbirds solo aircraft (5-6) air/air (first noted at the Cheyenne Wyoming air show) |
| 318.850 | Thunderbirds air/ground and air/air training at Nellis AFB |
| 322.950 | Engine starts/solo aircraft (5-6) air/air [Uniform 2] |

Thunderbird Maintenance/Ground Team Frequencies (Mode NBFM)

| | |
|---------|--|
| 216.725 | Announce PA feed - Music and show narration [Channel 55] |
| 216.775 | Announce PA feed - Music and show narration [Channel 56] |
| 216.975 | Team air show frequency feeds/mix air/air simulcast [Channel 60] |
| 413.275 | Ground maintenance – Analog (DCS 431)/P25 NAC293 |
| 413.325 | Ground maintenance – Analog (DCS 503) |
| 413.375 | Ground maintenance – Analog (monitored in Hawaii) |
| 901.500 | Comm cart headset |
| 905.350 | Comm cart headset |

Previously reported frequencies used by the team are listed below. If you hear any of



F-16 landing at Pease Vermont Air National Guard. (Photo by Kevin Burke)



*United States Navy Legacy Flight
(Photo by Brian Topolski)*

these frequencies in 2012, please contact us at our email address listed in the Milcom column masthead.

| | |
|---------|---|
| 143.250 | Pre-engine start |
| 143.700 | Heard at air show in Wyoming, same audio as 235.250 MHz |
| 148.850 | Alternate diamond [Victor 2] |
| 150.150 | Alternate diamond [Victor 2] |

One question that pops up from time to time is, "Who is using the Thunderbird 14 call sign?" This is normally used by an Air Mobility Command transport aircraft carrying the team maintenance/ground crew personnel and their equipment to the various shows. Typically this is one of the huge C-17 transport aircraft operated by the U.S. Air Force Air Mobility Command.

Other U.S. DoD Military Flight Demo Teams

This air show season, we will see a major curtailment of Air Force sponsored single-ship flight demonstration team activity. Shortly before we went to press with this issue, the Air Force Air Combat Command issued the following press release:

"ACC statement about reduction of single-ship demo teams in 2012

"We face significant fiscal constraints and are making tough decisions about the best ways to continue providing combat airpower to war-fighting commanders, which is what we do as the Air Force's primary force provider.

"One decision we've made is to sponsor one single-ship demonstration team for the 2012 air show season, scaling back from the six teams we've historically sponsored – A-10 East & West, F-16 East & West, F-15E and F-22.

"For the 2012 season, we're sponsoring our F-22 demonstration team to perform at up to 20 shows. In addition to the F-22 demonstration team, the Thunderbirds are set to complete a full season . . .

"The opportunity to showcase our aircrew at air shows around the country is important – and we're confident our Thunderbirds, F-22 demonstration team and the Air Force Heritage Flight Foundation will continue highlighting the extraordinary work of all our Airmen."

Even though we may not see many of the Air Force Flight demo teams in 2012, that policy could change at any time, or units could be added to the schedule. So I will still publish below the VHF and UHF frequencies these units have used during their performances in the past couple of years. I have also included frequencies for the other DoD service teams.

US Military Flight Demo Teams

Air Force ACC A-10 Thunderbolt Demonstration Teams:

East Coast Demo Team

| | | | |
|-------------------------------------|---------|---------|---------|
| 23 Wing based at Moody AFB, Georgia | | | |
| 122.475 | 136.575 | 138.150 | 138.275 |
| 138.425 | 138.875 | 139.275 | 139.700 |
| 139.725 | 140.200 | 140.425 | 141.650 |
| 142.600 | 143.000 | 143.150 | 143.600 |
| 143.750 | 226.100 | 227.800 | 227.850 |
| 228.075 | 233.475 | 234.025 | 240.100 |
| 242.150 | 251.200 | 251.975 | 268.100 |
| 271.100 | 275.650 | 275.900 | 283.700 |
| 289.300 | 292.100 | 295.000 | 327.300 |
| 371.200 | 375.650 | 379.500 | 376.025 |
| 384.550 | | | |

West Coast Demo Team

| | | | |
|--|----------|---------|---------|
| 355 Wing based at Davis Monthan AFB, Arizona | | | |
| 136.575 | 139.2875 | 139.600 | 139.625 |
| 139.700 | 139.725 | 141.050 | 141.775 |
| 143.550 | 229.050 | 233.475 | 238.500 |
| 283.700 | 326.775 | 327.700 | 372.175 |
| 384.550 | | | |

Air Force ACC F-15E Strike Eagle Demonstration Team:

East Coast Demo Team

| | | | |
|--|---------|---------|------------------|
| 4 FW Seymour-Johnson AFB, North Carolina | | | |
| 370.025 | 375.925 | 376.025 | (Demo to Safety) |
| 376.100 | 377.850 | 384.550 | |

Air Force ACC F-16CJ Viper Demonstration Teams:

East Coast Demo Team – 20 FW Shaw AFB, South Carolina

| | | | |
|---------|---------|---------|---------|
| 123.150 | 136.475 | 136.575 | 136.675 |
| 138.150 | 138.950 | 139.825 | 139.900 |
| 140.200 | 140.275 | 140.375 | 141.025 |
| 141.150 | 141.175 | 141.550 | 141.650 |
| 141.675 | 141.700 | 141.900 | 141.950 |
| 142.225 | 142.400 | 149.875 | 252.100 |
| 273.700 | 311.200 | 376.025 | 384.550 |

West Coast Demo Team – 388 FW Hill AFB, Utah, Call signs: Viper 1 and Viper 2

| | | | |
|----------|---------|---------|----------|
| 136.475 | 136.575 | 136.675 | 138.150 |
| 138.4375 | 138.750 | 138.950 | 139.1125 |
| 140.450 | 141.150 | 141.650 | 141.950 |
| 142.1125 | 142.600 | 142.700 | 142.900 |

| | | | |
|----------|---------|---------|---------|
| 142.9625 | 143.250 | 143.625 | 143.700 |
| 252.100 | 369.000 | | |
| 376.025 | 376.100 | 384.550 | |

Air Force ACC F-22A Raptor Flight Demonstration Team: East Coast Demo Team – 1 FW Langley AFB, Virginia

| | | | |
|---------|---------|---------|---------|
| 233.225 | 236.550 | 252.775 | 292.700 |
| 308.600 | 375.925 | 376.025 | 384.550 |

Air Force ACC Heritage Flight

| | | | |
|---------|---------|---------|---------|
| 122.475 | 123.150 | 123.475 | 136.475 |
| 136.575 | 136.675 | 375.925 | 376.025 |
| 384.550 | | | |

Air Force AFRC C-130 Dobbins ARB, Georgia

| | | | |
|--------------------------|---------|--|--|
| – Air Drop Demonstration | | | |
| 239.975 | 379.525 | | |

Air Force AMC C-17/C-47 Heritage Flight

| |
|---------|
| 123.150 |
|---------|

Air Force B-2 Bomber Flyover/Static Displays 509 BW Whiteman AFB, Missouri

| | | | |
|---------|---------|---------|---------|
| 233.025 | 257.100 | 260.250 | 265.825 |
| 267.000 | 320.525 | 354.350 | 375.925 |
| 376.025 | 388.850 | | |

Air Force B-52 Bomber Flyers

| |
|---------|
| 376.025 |
|---------|

Air Force Combat Search and Rescue (SAR) Demonstrations

| | | | |
|---------|-------------|---------|-------------|
| 236.000 | [SAR Bravo] | 251.900 | [SAR Alpha] |
| 282.800 | | | |

Army Sky Soldiers Demonstration Team (Army Aviation Heritage Foundation)

| | | | |
|---------|-----------------|---------|---------|
| N149HF | (CV-2B Caribou) | N599HF | (AH-1P) |
| N737HF | (AH-1G) | N992CH | (OH-6A) |
| 123.025 | 123.450 | 234.500 | 242.400 |

Coast Guard Aircraft/SAR Demonstrations

| | | | |
|-------------------|---------|---------|---------|
| (Air frequencies) | | | |
| 237.900 | 282.800 | 326.150 | 345.000 |
| 379.050 | | | |

Coast Guard Aircraft/SAR Demonstrations

| | |
|-------------------------------------|--|
| (VHF marine frequencies, NBFM mode) | |
| 157.050 | Show Control/Show Center Boats [Channel 21] |
| 157.075 | Search and Rescue Demo/Command Post [Channel 81] |
| 157.100 | Show Warning Broadcast [Channel 22] |
| 157.125 | Unknown usage [Channel 82] |
| 157.150 | Show Control/Show Center Boats/HITRON Drug Interdiction Demonstration [Channel 23] |
| 157.175 | Boats to Show Center [Channel 83] |

Maine Corps AV-8B II Flight Demonstration Teams:

East Coast – MCAS Cherry Point, North Carolina 363.300

West Coast – MCAS Yuma, Arizona

Frequency information is needed for the west coast harrier units

Marine Corps Helicopter Demonstrations

| | |
|---------|---------|
| 315.375 | 315.400 |
|---------|---------|

Navy F/A-18C Hornet and Navy F/A-18F Super Hornet Flight Demonstration Teams:

East Coast – VFA-106 NAS Oceana, Virginia

| | |
|---------|---------|
| 237.800 | 349.900 |
|---------|---------|

West Coast – NAS Lemoore, California

Frequency information is needed for the west coast units

Military Parachute Demonstration Teams

One of the fan favorites on the air show circuit is the U.S. Army Golden Knights based out of Fort Bragg, North Carolina. Look for their communications on the often reported frequencies of 122.775, 123.150, 123.400, 123.475 or 123.500 MHz. The team aircraft used during air shows is either the C-31A Friendship or UV-18A Twin Otter.

The Golden Knights aren't the only parachute team that performs around the country. The U.S. Army Special Operations Command has a parachute team known as the Black Daggers. Several frequencies have been uncovered for them during the last few seasons including 123.150, 123.450, 136.000, and 136.500 MHz.

Another performing U.S. Army parachute team is the Silver Wings based out of Fort Benning, Georgia. They were recently heard using 34.650 and 44.900 MHz (NBFM). However, both these frequencies were common landing zone frequencies in the area they were performing in. So if neither of these two frequencies above is heard at the event you are attending, I suggest you initiate a search for them in VHF-low band military frequency subbands.

In addition to the VHF low band frequencies mentioned above, ground and safety personnel associated with this team have also been heard using 467.6125 MHz (FRS Channel 10/GMRS NBFM) for communications. There was also one report that the team was even using an Intra Squad radio frequency of 397.500 MHz.

The famed 101st Airborne Division has a parachute demonstration team known as the Screaming Eagles. They are based out of Fort Campbell, Kentucky and have been reportedly using 44.200 MHz (NBFM).

The U.S. Army has several more teams, but we still do not have frequency information for them. We would appreciate your field reports on the following U.S. Army teams if you catch them performing this air show season.

82nd Airborne All American Free Fall Team
Fort Bragg, North Carolina
Black Knights Parachute Team
US Military Academy, West Point, New York
Green Beret Parachute Team
Fort Bragg, North Carolina

The U.S. Special Operations Command has a parachute demonstration team based out of MacDill AFB in Florida. They have been heard using 122.450, 123.450, and (no, this is not a misprint) 151.625 MHz (NBFM), a nationwide business itinerant frequency.

The U.S. Air Force Academy has a parachute team called the Wings of Blue and it is based at the academy in Colorado. Two frequencies that are reportedly used for air-to-ground jump coordination are 121.950 and 407.500 MHz (NBFM).

And last, but certainly not least: the colorful U.S. Navy Seal Parachute Team, known as the Leap Frogs, are frequent visitors around the country at various sporting/civic events and air shows. This team has been regularly reported on 270.000 and 407.500 MHz (NBFM 131.8-Hz PL tone) over the last several years.

This year this team will conduct several jumps in the San Diego area and monitors in that area are asked to submit any reports of frequencies used by this team to our *MT* email address.

Foreign Military Flight Demonstration Teams

The U.S. military doesn't have an exclusive when it comes to military demonstration teams. Several countries have teams, and some of those teams have even performed here in the United States. I have included a list of the teams that we have received recent reports on below.

Belgium: Swallows – Belgian Air Force Display Team 130.725

Brazil: Esquadilha da Fumaça (The Smoke Squadron) – Brazilian Air Force Air Demonstration Squadron 127.050 130.450 130.550 130.650 132.250

Canada: 15 Wing, Moose Jaw, CT-156 Havard II Trainers, Call sign: Viking # 275.800

Chile: Escuadrilla de Alta Acrobacia Halcones (Falcons High Aerobatics Squad) – Chilean Air Force 136.175

Finland: Midnight Hawks – Finnish AF Academy Demo Team 140.625

France: Patrouille Acrobatique de France – French Air Force Military Flight Team
121.850 123.600 138.450 141.825 (Main formation) 143.100 (Main formation)
143.850 242.650 (Solos) 242.850 (Solos)
243.850 (Team Transport) 263.350 266.175

Ireland: Silver Swallows – Irish Air Corps 130.550

Italy: Frece Tricolori – Italian Military Flight Team 123.475 140.600 263.250 (Displays) 307.800 362.625 387.525 (Displays) 440.450 (NBFM) (Ground Support Team/Commentator)

Jordan: Le Royal Jordanian Falcons – Sponsored by Royal Jordanian Airlines and Air Force 123.500 126.800 456.4625 (NBFM) Ground Crews

Morocco: Marche Verte [Green March] – Royal Moroccan Air Force 135.000 (Ground) 135.500 (Air/Air) 135.925 (Ground) 135.975

Netherlands: Dutch Air Force F-16 142.475 281.800 (Air/Air)

Netherlands: Grasshoppers – Royal Air Force Helicopter Team 281.100

Netherlands: Team Apache 128.450 130.000 135.925 138.325 138.450

Poland: Team Iskry – Polish Air Force Team 123.600

Poland: Team Orlik – Polish Air Force Team Frequency reports are requested

Portugal: Asas de Portugal, Esquadra 103 (Wings of Portugal 103 Squadron) Flight Team (Note: This team was deactivated in 2010 before the start of the air show season. Future activity unknown.)

Slovak Republic: Biele Albatrosy or White Albatroses Display Team – Slovakian Air Force Aerobatic Team (Frequency reports are requested)

Spain: La Patrulla Aguila – Spanish Fixed Military Flight Team 130.300 130.500 241.950 (ex-252.500) 337.975

Spain: La Patrulla Aspa – Spanish Military Helicopter Flight Team 119.000

Spain: PAPEA Military Team 250.240 350.240 310.800

Sweden: Team 60 – Swedish Air Force Aerobatic Team (frequency reports are requested)

Switzerland: Patrouille de Suisse – Swiss Military Flight Team
244.300 266.175 288.850 312.350 359.450 375.450 388.075

Switzerland: Swiss PC-7 Display Team – Swiss Air Force (Frequency reports are requested)

Turkey: Turkish Stars Display Team – Turkish Air Force

141.475 142.325 225.750 235.250 243.450 264.400 279.600

United Kingdom: Army Air Corps Historic Aircraft Flight (AHAF) 380.200

United Kingdom: Battle of Britain Memorial Flight (BBMF) 120.800 122.700 380.200

United Kingdom: Black Cats – Royal Navy Helicopter Display Team 280.475

United Kingdom: Blue Eagles – Royal Army Air Corps Helicopter Flight Team, Call sign: Blue Eagles 44.650 (NBFM) 135.950 135.975 136.975 [VHF-1] 143.600 237.800 252.000 259.600 275.350 284.250 305.500 382.800 [UHF-1]

United Kingdom: Falcons – Royal Air Force Parachute Jump Team
255.1000 (Drop Zone Air/Ground) 256.9000 445.3375 (NBFM) 465.1000 (NBFM)

United Kingdom: Red Arrows – Royal Air Force Flight Team, Call sign: Red #
120.800 242.000 242.050 (Primary) 242.200 243.450 253.450 370.600

United Kingdom: Red Devils – British Army Parachute Team 462.6250 (Ground Support) 462.925 [Ch 3 Ground Support] 464.250 [Ch



Black Diamond Jet Team
(Photo by Brian Topolski)

1 Drop Zone A/G] 464.550 [Ch 2 Drop Zone A/G]

United Kingdom: Royal Navy Historic Flight (Frequency reports are requested)

United Kingdom: The Great War Display Team (GWDT) (Frequency reports are requested)

Canadian Flight and Parachute Demonstration Units

The Royal Canadian Forces flight demonstration team, the 431 Air Demonstration Squadron Snowbirds, is based with the 15 Wing at RCAF Moose Jaw and are regulars on the U.S./Canada air show circuit.

The following frequencies have been recently reported for this popular aerial demonstration team: 123.150 (Solos) 123.325 (Air-to-Air Off Show Center) 227.600 242.600 [13] 243.400 245.500 245.750 272.100 (Primary) [11] 284.900 299.500 333.300 [14] 340.100 MHz. A strange VHF frequency in the nav aids segment of the civilian aircraft band has been used by this team's solo aircraft in recent years -116.000 MHz.

Some additional Snowbird frequencies that have been reported and need further confirmation by field reports include: 227.650 236.800 239.900 240.500 245.000 245.700 266.300 316.500 321.700 378.500 MHz.

The Canadian Forces also has a CF-18 flight demonstration team. A few of years ago Brian "Check your Six" Topolski in Connecticut passed along the frequencies below for this team.

128.975 129.025 130.075 245.500 263.500 263.700 264.600 (East Ops) 274.450 285.975 312.550 (Air/Air) 316.550 323.300 333.300 335.600 340.200 (West Ops) 341.700

The Canadians also have a parachute jump team - the Skyhawks. Frequencies that have been reported for them include 123.000 and 294.700 MHz.



Air Force One lands at Andrews Air Force Base. (Photo by Brian Topolski)

Civilian Air/Parachute Demonstration Teams

At most air shows, the military flight demonstration units aren't the only aerial performers. Civilian organizations, companies, and individuals sponsor a host of aerobatics teams and parachutist teams. A wide variety of civilian aeronautical frequencies are used by these organizations. Load your scanner with the following frequencies and you should be able to catch most of the communications used by the civilian aero acts.

Aircraft (air carrier and private) 122.825 122.875
 Aircraft (air carrier and private)/Aviation support 122.775 123.300 123.500
 Aircraft (air carrier and private)/Flight test 123.125 123.150 123.175 123.200 123.225 123.275 123.325 123.350 123.375 123.400 123.425 123.450 123.475 123.525 123.550 123.575
 MULTICOM 122.850 122.900 122.925
 Private aircraft helicopter 123.025
 Private fixed wing aircraft air/air communications 122.750
 UNICOM 122.700 122.725 122.800 122.950 122.975 123.000 123.050 123.075

Some specific frequencies recently reported to us for select foreign and U.S. civilian demonstration teams are listed below.

Civilian Flight Demonstration Teams and Air Show Companies

Aeroshell Aerobatics Team (AT-6 Texans) 122.775 123.150
 Aerostars CJ-6/YAK-52 Flight Formation Team (UK) 118.700 122.475 122.775 122.950 123.150 123.350 124.450 129.925
 Breitling Jet Team (France) 118.325 127.350 129.050 130.200
 Breitling Wingwalkers (ex-Team Guinot) - AeroSuperBatics Ltd (UK) Call sign: Wingwalk 118.000
 Civilian Air Show Discrete Common 123.150
 Dave Schultz Air Shows 118.700 (Ground Ops) 132.950 (Operations) 135.650 (Airboss) 238.150 (Airboss) 350.300
 Falcon Flight Formation Flying Team 123.150
 Flight for Diabetes (Michael Hunter) 123.425
 Firecat (Rich Perkins) 123.500
 Flying Colors Hang Glider Aerobatic (Dan Buchanan) 123.150 123.300 123.450
 Geico Extra 300 (Tim Weber) 123.150
 Geico Skytypers Team 122.750 122.775 123.425 (Formation) 122.775 123.150 123.425 123.450 (Solos)
 Hamster Biplane (Ed Hamill) 123.150
 Heavy Metal Jet Aerobatics Team 122.475
 Herb and Ditto (T-28 Aircraft) (Herb Baker) 123.450
 Iron Eagles Aerobatic Team 122.925 123.150 123.475
 John Klatt Air shows 123.475
 Julie Clark's (T-34) American Aerobatics 135.925
 Lima Lima Flight Team 123.150 123.175 123.425 123.575
 Manfred Radius Glider Aerobatics Team 123.1500
 Matt Chapman/Michel Mancuso Aerobatics 136.975
 Oreck Vacuum Cleaners Aerobatic Demo (Frank Ryder) 122.825 123.425 123.450
 Otto the Helicopter 123.150 123.300
 Patty Wagstaff Air Shows Inc 122.750 123.475
 Red Bull Air Force 123.450
 Red Eagles Aerobatic Team 122.125 123.150 123.425 123.475
 Ritchie's Pyro 467.6375 (NBFM 233.6 Hz PL)
 Robasaurus - World's First CAR-NIVOROUS Monster Spotter 462.7125 (NBFM DCS464)
 SIAI Marchetti SF260 (Debbie Gary) 123.150
 Showcopters 123.150
 Super Decathlon (Greg Koontz) 123.150
 Swift Magic Aerobatic Team 122.775 122.925
 Team Oracle (Sean Tucker) 122.8750 122.950 123.150 123.450 123.475 133.000
 Team Red 123.350
 Texas T-Cart Aerobatic Aircraft (Randy Henderson) 118.400



VAW-120 Greyhawks (Photo by Brian Topolski)

| | | |
|--|---------|---------|
| The Blades Aerobatic Display Team (UK) | 121.175 | 136.175 |
| The Horseman P-51 Aerobatic Team | 122.925 | 136.675 |
| The Patriots (L39) Jet Team | 127.300 | |
| The Red Star Formation | 127.050 | |
| The Tumbling Bear (Rob Harrison) | 134.700 | |
| Tora Tora Tora Warbirds Team (Commemorative Air Force) | | |
| 122.850 122.875 123.150 123.425 123.450 469.500 (NBFM) | | |
| 469.550 (NBFM) | | |
| Vintage Thunderbird (T-33) Aerobatics (Fowler Cary) | 123.150 | |
| Yakovlevs Team (UK) | 124.450 | 130.900 |

This year's civilian frequency list is dedicated to an air show legend that we lost unexpectedly in 2011 – Greg Poe.

GMRS Frequencies

Several years ago I received several reports that the Golden Knights were using GMRS (General Mobile Radio Service) frequencies 462.6250, 467.5625 and 467.6125 MHz NBFM. In addition to hearing air show demo crews, monitors have found vendors, exhibitors, air show companies, and military ground units using GMRS frequencies. You should make these frequencies part of your scanner load-out prior to the air show. The frequency pair of 462.675/467.675 MHz NBFM is allocated as a national emergency frequency pair for the GMRS service.

| A | B | C |
|---------|---------|----------|
| 462.550 | 467.550 | 462.5625 |
| 462.575 | 467.575 | 462.5875 |
| 462.600 | 467.600 | 462.6125 |
| 462.625 | 467.625 | 462.6375 |
| 462.650 | 467.650 | 462.6625 |
| 462.675 | 467.675 | 462.6875 |
| 462.700 | 467.700 | 462.7125 |
| 462.725 | 467.725 | |

Legend:

- A Base station, mobile relay, fixed station, or mobile station
- B Mobile station, control station, fixed station operating in duplex mode.
- C Interstitial frequencies, base and portable simplex

Family Radio Service and Intra-Squad Radio Frequencies

Ground pyrotechnics personnel from the Tora Tora Tora and Warbirds flight demonstration teams have been monitored at air shows using FRS or Family Radio Service handhelds for communications during shows. In fact, quite a few people and organizations use FRS at air shows. So load up FRS frequencies below (NBFM mode) in your scanner, or better yet, carry a FRS radio to the show. If you are lucky, one of these FRS frequencies might help you make a new milcom monitoring friend or give you a chance to meet one of those high tech radio enthusiasts dragging around one of those fancy radio wagons at the show.

| | | | | | | | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| 462.5625 [Ch 1] | 462.5875 [Ch 2] | 462.6125 [Ch 3] | 462.6375 [Ch 4] | 462.6625 [Ch 5] | 462.6875 [Ch 6] | 462.7125 [Ch 7] | 467.5625 [Ch 8] | 467.5875 [Ch 9] | 467.6125 [Ch 10] | 467.6375 [Ch 11] | 467.6625 [Ch 12] | 467.6875 [Ch 13] | 467.7125 [Ch 14] |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|



Blue Angels in the Air Tonight
(Photo by Brian Topolski)

The government version of the Family Radio Service is known as the Inter-Squad Radio or ISR. There have been numerous reports over the last few years of military units, including the Civil Air Patrol (CAP), using ISR frequencies at air shows. I highly recommend programming these frequencies (NBFM mode) into your scanner and also making them a permanent part of your regular monitoring frequency load out.

In the last year I have confirmed that there are now only 12 ISR frequencies, instead of the 14 that were originally allocated by DoD several years ago. So ISR channels 13/14 (399.925/399.975 MHz) can be removed from your scanner load out.

| | | | | | | | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| 396.875 [Ch 1] | 397.125 [Ch 2] | 397.175 [Ch 3] | 397.375 [Ch 4] | 397.425 [Ch 5] | 397.475 [Ch 6] | 397.550 [Ch 7] | 397.950 [Ch 8] | 398.050 [Ch 9] | 399.425 [Ch 10] | 399.475 [Ch 11] | 399.725 [Ch 12] |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|

U.S. Civil Air Patrol Frequencies

Finally, you should also program U.S. Air Force Civil Air Patrol frequencies in your scanner. We have received field reports of CAP frequencies (repeater and simplex) being used for ground support at several air shows.

The Civil Air Patrol frequency plan has been in transition to their new narrowband allocations / equipment over the last year. At this time, per CAP Headquarters at Maxwell AFB, Alabama, all units should have made the transition to their new frequency assignments and equipment as listed below.

| Repeater out/in | PL Tone | Usage [Channel] |
|-------------------|----------|--|
| 141.5750 Simplex | 127.3 Hz | Command control 1 [CC1] |
| 141.0000 Simplex | 131.8 Hz | Command control 2 [CC2] |
| 149.2750 Simplex | 141.3 Hz | Air/Air [Air 1] |
| 150.5625 Simplex | 151.4 Hz | Air/Air [Air 2] |
| 150.2250 Simplex | 162.2 Hz | Back up guard channel [Guard 1] |
| 139.8750 Simplex | 173.8 Hz | Tactical use (Miscellaneous use) [TAC 1] |
| 148.1250 Simplex | 100.0 Hz | Primary talk-around [PA TA] |
| 148.1500 Simplex | 100.0 Hz | Secondary talk-around [PB TA] |
| 148.1375/143.6250 | 203.5 Hz | Airborne/Tactical repeater |

| | | |
|-------------------|-------------|----------------------------|
| 148.1375/143.6250 | 192.8 Hz | Airborne/Tactical repeater |
| 148.1375/143.6250 | 131.8 Hz | Airborne/Tactical repeater |
| 148.1375/143.6250 | 162.2 Hz | Airborne/Tactical repeater |
| 148.1250/143.5500 | Various PLs | National repeater pair |
| 148.1500/143.7000 | Various PLs | National repeater pair |

There are more frequency designators built around the nationwide repeater pairs mentioned above. That list of nationwide repeater pairs and private line (PL) tones was published in the May 2010 *Milcom* column in *Monitoring Times*.

In Closing

It is always difficult to predict what changes a new air show season will bring, so I strongly encourage readers to watch my *Milcom* Blog, my new Twitter feed (MilcomMP) or the *Monitoring Times* Blog RSS feed on the *MT* home page for any late breaking news or frequency information during the 2012 air show season.

Before I close, I would like to publicly thank the real heroes of this annual air show guide – the hundreds of radio monitors who took the time to share with me what they have heard at the air shows. Without these caring radio hobbyists, there would be no guide. So to each of you, I want to dedicate this latest edition of *MT's Air Show Guide*.

If you have found this guide useful and you would like to help, how about taking a minute or two and pass along what you are hearing this next season? It is important that we get reports from the field since I can't make many shows. We just don't have a budget for that sort of thing.

Even if it is already on our list, pass it along anyway. It all goes in the mix and helps us to compile our next annual guide. You can reach me via my snail mail address at *MT Milcom*, 7540 Highway 64 West, Brasstown, NC 28902 or via e-mail at larryvanhorn@monitoringtimes.com.

So, now it is time once again to break out your scanners, plug in your air show frequencies, crank that volume up, and get ready for the ride of a lifetime. It is an experience you will never forget when you can listen to the sounds from the cockpit at the air show!

"Blue Angels Delta Formation – Stand by **MT** Boards – Boards!"

Radio and the Air Show Experience

By Brian and Jo Marie Topolski
(Photos by the authors)

Air show season will soon be upon us and what an excellent time of year! Sunshine, warm temperatures and air shows in abundance are scheduled from sea to shining sea. If you're ready for the sights, sounds and thrills of pure adrenalin in motion, come with us. Let's take a trip into the wild, blue yonder!

Jet teams, prop planes, WWI and WWII aircraft, parachute jump teams, wing walkers, helicopters, jet powered trucks and static displays – in combination, these components are all designed to thrill, enlighten and inspire. There's something for everyone to enjoy at today's modern air show. This is where we all have the opportunity to learn how the power of flight has changed the face of world history and how our armed forces provide the finest cooperative defense system in the world.

The Black Diamond Jet Team

Who? Yes, you heard right: The Black Diamond Jet Team is the latest sensation on the air show circuit. Formed in 2011, they were

originally known as the Heavy Metal Jet Team. In 2012, they changed their name to Black Diamond because they “wanted a team name that reflected skill, challenge and expertise.” Comprised of seven expert pilots, each with thousands of hours of flight experience in multiple aircraft, the Black Diamond is a seven-plane aerobatic, civilian-owned, jet demonstration team based in Lakeland, Florida.

Last year there were only six jets, but they recently added a seventh for the opposing solo position. Their planes consist of five Aero L-39 Albatross jets along with two MiG 17s, all sporting an impressive arctic camouflage paint scheme. If you love seeing extreme aerobatic and formation flying that'll keep you on the edge of your seat, check out The Black Diamond Jet Team; these guys are awesome!

I first experienced them in Atlantic City, New Jersey during the “Thunder over the Boardwalk” air show in August, 2011. This show featured the United States Air Force Thunderbirds, who are renowned for their amazing flying skills. Traditionally held on a Wednesday, sky conditions were cloudy for the Tuesday practice

show. Rain storms shadowed the area before ultimately moving in and forcing cancellation of all flying activity for the afternoon.

But, on Wednesday it was show time, a picture perfect beach day with bright sunshine and hot summer temperatures. This resulted in the largest air show attendance I had ever seen! The crowd count was estimated at 800,000 people. The performances unfolded flawlessly throughout the day, and you'd never know that practices were cut short the previous day. Admission was free, but if you weren't there early, you were stuck in traffic on the Atlantic City Expressway.

One thing missing last year was the dominating presence of the F-22 Raptor Jet Demonstration Team. With its seemingly other-worldly flying maneuverability, this aircraft is always a crowd pleaser. We did not see it because all F-22 squadrons had to be temporarily shut down pending an investigation of a problem with the oxygen supply system to the pilot. This now being fixed, we welcome them back for the 2012 season!

Getting Geared Up

Let's talk about how we listen at the air show. Something new in my air show radio arsenal is the grab-and-roll comm-cart I call “The Gator Box.” I conceived and built it on the fly in Atlantic City during Thunder over the Boardwalk. I had to think of something in lieu of my main wagon rig, which is too heavy to roll smoothly through thick beach sand. The grab-and-roll is a scaled-down version of the four radio wagon setup that I usually bring with me.

In the grab-and-roll, everything is rack mounted inside a sturdy plastic Gator case, which comes with removable front and rear covers. Gator is a company name that manufactures equipment cases for the music industry. The bottom radio and speakers are bolted to a steel rack mounted shelf.

The top radio is held by heavy-duty Velcro to the lower radio. The two antenna mounts with BNC connections are securely mounted with magnets, each to a galvanized steel washer which is attached by Velcro to the case. The cart is a collapsible/foldable hand truck purchased at any Lowe's or Home Depot store. Everything is secured to the cart using bungee cords.

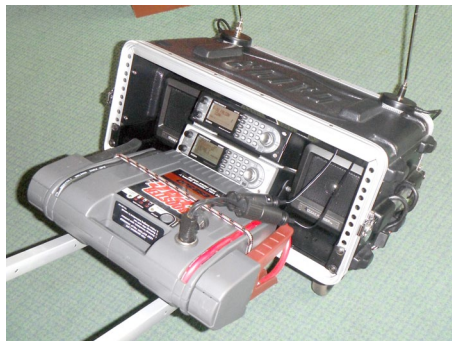
Thunderbirds parked with Comm-cart



It's like a travel suitcase, but the bottom line is that it works most everywhere, but not in sand. It needs larger tires so it can ride higher above the grainy particles that can ultimately wreak havoc on your electronics. Another great feature is the fact that this communication setup has the ability to operate continuously, even while you "walk and roll" down the tarmac. This way, you won't miss a beat if you find that you have to relocate.

When the time comes to put it away, all cables, along with the antennas, can be placed in a ballistic nylon carry pouch and securely stowed in the back of the case.

The radios you see in the Gator Box photo are temporary. On the bottom is the Uniden BCD-996T, on top is the Uniden BCT-15X. The ultimate version for 2012 will be just as you see it, but the radios are being replaced by two matching Uniden BCD-996XT's, each with digital receive capability.



The metal enclosed speakers are Texas Rangers. They project very well and are warm sounding (not tinny) and can take the power of a small amplifier should you decide to add one. Power is derived from a rechargeable 12 volt/900 peak amp battery used in jump-starting cars.

Remember to always keep your rig looking neat and professional. This helps to ease the mind of security personnel when you're going through a checkpoint. It makes it easier for them to inspect your equipment and know exactly what it is you have. As I've mentioned before, plan on being searched. It doesn't always happen, but be prepared.

Carry proper identification such as a drivers license with you at all times! Military bases are usually more intensive than civilian sponsored shows. If you're a licensed ham radio operator,

C-5 Galaxy transport at Andrews Air Force Base, Maryland.



certainly bring along a copy of your license. This credential gives you valid reason for having radios on your person.

Photo Opportunities

For my air show photography I use the Nikon D-90 camera with two lenses. Lens number one is a Nikon 18-100 mm zoom. I use this for close-up photos, including people and aircraft on static display. Lens number two is a Sigma 70-300 mm zoom. I use this one for objects that are farther away, such as an aircraft in flight. I select the fastest shutter speed available for jets and other fast movers.

Hints: keep both eyes open while looking into the camera viewfinder. This enables you to see other aircraft coming into photographic view via your peripheral vision. This technique is especially useful when trying to capture two opposing jets in a crisscross maneuver. You don't know where the second one is, if you can't see it. For propeller driven aircraft, I use a slower shutter speed. This helps to blur the propeller and give the viewer a sense that the aircraft is actually flying.

One show definitely worth attending this year is the Boston-Portsmouth Air Show at Pease Air National Guard Base in New Hampshire. For more information go here: www.newengland

airshow.com. It takes place June 30-July 1, 2012 and will feature the United States Navy Blue Angels. Oh, and did I mention the Black Diamond Jet Team will also be there? Don't miss them!

Directly from there, it's off to Boston, Massachusetts for their Independence Day celebration. This year is especially historical because it commemorates the bicentennial of the "Star Spangled Banner" composed by Francis Scott Key during the War of 1812. In addition to fireworks, and an Esplanade concert by the Boston Pops Orchestra, the city of Boston, in coordination with the United States Navy and "Operation Sail" (also referred to as Op Sail), will host numerous tall ships from around the world sailing to and docking in Boston Harbor. Op Sail is a national non-profit organization dedicated to sailing ship training and promoting goodwill among nations. Included in this extravaganza will be a flyover by the Blue Angels over Boston Harbor on the 4th of July, an excellent scanning and photo opportunity! This huge undertaking takes place June 28-July 4, 2012. For information visit: www.bostonharborfest.com.

For this venue, have your scanners and this issue of *MT* ready. Among top monitoring targets are the Blue Angels, Massachusetts State Police (using a Motorola Type II Trunked Radio System), City of Boston Police/Fire and EMS (conventional radio system), City Of Cambridge (Motorola Type III Hybrid Trunked Radio System), United States Coast Guard (conventional system), Civilian Maritime (conventional system), Boston's Logan International Airport Tower (conventional system), and the Massachusetts 104 Fighter Wing F-15 Eagles (they usually do the Boston Esplanade flyover) air/air tactical used: 159.60/159.90/264.85 (all am mode). www.radioreference.com is an excellent source of frequency information for the above named public safety agencies.

And, if you happen to see us at an air show, please come over and say hello. We're always up for a good rag chew and frequency exchange. In the meantime, "keep your head to the sky; see you on the flightline!" Check Six... Good Hunting!



Snow Birds Ascending

Blue Angels' Marine C-130, also known as "Fat Albert" with crew member and flag taxiing.



If I told you that in 2011 I also flew in one of the United States Navy Blue Angels aircraft, you might start to think, "How does this guy pull off these awesome flights?"

Well, luck definitely plays a role in what I have been able to "pull off" in terms of photo opportunities, but I also work at keeping the ball rolling. An interesting article and photos in *Monitoring Times* lets me share the experience and also satisfies the Public Relations people. By allowing me these opportunities I help spread the word about the Thunderbirds and Blue Angels programs they are promoting.

And now, the Rest of the Story

My favorite New England Air Show at Quonset Point Rhode Island was hosting the Blue Angels this past June for their annual air show. In my research before the show, mainly on airshowbuzz.com, I read that there would be seats available for media on Fat Albert, the Marine C-130 transport the Blue Angels bring to every air show during its air show performance. No, this wasn't the dream ride we all wish for in a fighter aircraft, but it was still an incredible experience that I will never forget.

I had been told by other media friends that it was a ride not to pass up, so I sought out the people I needed to talk to in order to make this happen. On Friday, the practice day, it was cloudy and would probably be the best day to go on a flight rather than try to take air show pictures from the ground.

There were five other people going on this flight as passengers. We all had to fill out a medical form which it was scrutinized by the Blue Angels' Flight Surgeon and we were warned, "This will not be an easy ride." We were told there would be positive G forces, negative G forces, even zero G forces (weightlessness). I

Flying Fat Albert Airlines

By Kevin Burke
(Photos courtesy the author)

could see the other passengers appear to disregard the severity of the warning they had just received about the flight they had just signed up for. Had I not discussed the Fat Albert rides with friends, I too probably would have thought this ride was going to be a piece of cake!

Once we got out to the aircraft we met the flight crew and they immediately brought us to the tail of the aircraft and went into their precision flight briefing. The pilot went over every single detail of this flight, including telling us everything that he would be saying over the headset to the other flight crew members. He rifled off flap settings, speeds, and altitudes with such speed that I was struggling to take in all that I was hearing. I do remember hearing him say our high speed pass will be 150 feet above the runway.

I had asked to be in the cockpit and I'm so glad I got that seat (more on that in a bit). On the takeoff roll you could really feel the G's as the pilot pulled back on the yoke during the simulated JATO, or Jet Assisted Take Off. C-130's used to be capable of attaching rocket motors to the fuselage to assist in taking off from short runways. Fat Albert used to wow the air show crowds when lighting the rockets on the take off roll. Unfortunately, these rockets are no longer manufactured, but the Blue Angels now perform a simulated JATO.

My friends had also informed me about the weightlessness on Fat Albert, so I made sure my seatbelt was tightened and then retightened. At the top of the JATO maneuver the pilot pushes

the yoke to nose over the top of the climb. It is that point that we experienced momentary weightlessness, and I saw one of the flight crew float off his feet only holding on by a handrail over the pilots head.

We performed a similar maneuver one more time and did a lot more turning than I expected, even though I have watched Fat Albert many, many times. I could feel the G's making it hard to breathe so I forced myself to breathe fast and deep during the long turns where the G's were constant. Sometimes it seemed we were turning hard from a left turn then an immediate right turn.

I was glad to be in the cockpit so I could look out the windows and see the ground to give my brain some reference as to which way was up. In the back of the C-130 there are only a couple tiny windows and they are up high when you are strapped into the seats so they don't help give your brain a reference point. The ride in back can best be described as what it must feel like to be on the inside of a clothes dryer while it is running! My friend on this flight actually got sick hours after the flight and ended up in the hospital.

I felt like this ride was actually very close to what it would feel like to be in a jet fighter during an air show demo. For as long as I can remember, the air show at Quonset Point State Airport has been my favorite New England air show and I owe the Rhode Island National Guard Public Affairs crew many thanks for the incredible experience.

MT

"Fat Albert" landing at Quonset Point State Airport.



My Ride on a T-Bird Refueling Mission

By Kevin Burke
(All photos courtesy the author)

In August I was lucky enough to get onboard a New Hampshire Air National Guard KC-135 Strato-tanker to photograph the United States Air Force Thunderbirds in their F-16C's while en route to the Boston Portsmouth Air Show at Pease International Trade port in Portsmouth, New Hampshire.

It was a very tense couple of weeks waiting for the official word that I was actually on the list of those approved to fly on this mission. I have been able to get myself on a handful of tanker flights, but for each new 'pending' flight I am like a kid waiting for Christmas day!

Pre-Flight Briefing

On the morning of the flight, a group of about 20 photographers met the Public Affairs people and Air Show coordinators outside the main gate of Pease Air National Guard Base at seven in the morning. After a customary search

of our bags we got an abbreviated flight briefing about the flight and an informative slide-show presentation about the duties of the New Hampshire Air National Guard (NHANG) and the North East Tanker Task Force, the vital link of aerial refueling responsibilities handled by New Hampshire and Maine Air National Guard tanker units providing aerial refueling across the Atlantic Ocean.

The commander of the 157th Air Refueling Wing, Paul "Hutch" Hutchinson talked about how busy the NHANG has been with their eight KC-135's and how they hope to get the new Air Force tanker, the KC-45A.

I really enjoy the briefings. It is an inside look at everything it takes to put a refueling mission together. Usually this is where you can see maps of refueling areas and Military Operating Areas, or MOAs, Air Refueling (AR) Tracks and radio frequencies, etc. For this abbreviated briefing, they actually had a slide listing the

AR track, altitude, and the estimated time to be at each track. We also saw a slide that showed a planned off-load of 60,000 pounds of fuel between the two tankers.

We also learned that Pease can stage up to 27 tankers and they have the only KC-135 simulator in the Northeast. They also have a jet and a crew on short notice alert 365 days a year, 24 hours a day with a four hour response time from notification to launch.

For this flight the group of photographers boarded one tanker, and a group of special guests from the Air Show such as representatives from the Boy Scouts of America boarded the other jet.

Front Row Seat on a KC-135

Using the call signs Pack 61 and 62, we took off around nine in the morning. We were given a boxed lunch (a chicken salad sandwich,

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GROVE



Two T-Birds outside the tanker window during a refueling mission.

cookie and small bag of chips) before we boarded and the flight crew randomly selected me to sit in the cockpit during takeoff. It was nice to be able to see the lead tanker as we headed across the country to meet the Thunderbirds at AR 406, in the area of North Kansas, Southeast Nebraska and Northern Missouri. It was expected to take us about 3 hours to get to this refueling track.

Meanwhile, the Thunderbirds were meeting a different set of refueling tankers to get their first sip of fuel since taking off from their home base, Nellis Air Force Base in Nevada before meeting us for their other two sips of fuel needed to get to New Hampshire.

As soon as it was safe to do so, we were told we could get up and walk around and check out the aircraft. People who had never been on a tanker before were able to lie down in the boom operator's pod at the rear of the jet and ask questions. Some actually moved the boom around with its control stick. I was checking out the condition of the windows on the side of the aircraft. There are only two windows on each side of the aircraft, and it takes a good amount of maneuvering to be able to steady yourself for picture taking while looking out these windows.

When we approached AR 406, Thunderbirds 1 through 4 went to the lead tanker, Pack 61 and Thunderbirds 5, 6 and 7 came to our tanker, Pack 62. I was in line to get the "ideal shot" I was looking for; a Thunderbird F-16 as it approaches from underneath. But there were a lot of us looking for that same shot and those jets sip fuel really quickly. I opted to go for the shots out the side windows because there were quite a few people ahead of me for the two best seats in the house, on either side of the boom operator.

The crew was definitely trying their best to rotate the group through the two spots at the boom. I actually didn't make it to the boom for the first refueling. It took about an hour to fly to our second track (AR 217) which was the Thunderbirds third refueling track and goes from Toledo, Ohio to Pennsylvania.

Monitoring the action in the air was difficult. While I was in the cockpit for takeoff I was given an intercom headset and could hear both tankers talking to the tower and I could hear the tankers talking to each other regarding spacing. But, once at cruising altitude, I left the cockpit and wasn't able to monitor any communications.

On the tanker flights I have been on with a group of photographers, there is just not enough time to keep swapping the headsets while at the boom operator's station.

Riding the Boom

During this refueling track, the Thunderbirds went into a more relaxed formation which put each F-16 too far away to be able to get any pictures. The flight crew went around asking who didn't get to the boom for the first refueling so I felt like chances were good that I still might get some good shots from the boom.

When it was time, I had my plan of action ready. I was in line to get to the boom, but favoring the right side (looking to the rear). For some reason, the way the boom pod is laid out in the KC-135's there is better visibility from the spot on the right of the boom operator. I have photographed from the left of the boom operator, but viewing and photography is better from the right side.

There was already an F-16 on the boom sipping gas when I got into position. I started filming with a little Kodak video camera in my left hand while snapping still images with my digital SLR camera in my right hand. I was waiting for the F-16 to finish getting gas and back off so I could get that photo I was hoping for. I

had brought along my Cannon XT camera using a Cannon 18-135 mm zoom lens and was ready.

During refueling the fighter aircraft are just so close it is unreal. It could be me just being picky with my photos but I *really* wanted to get a shot as the jet was moving away, so I could get the whole F-16 in the photo.

As you can see I did get some good shots, but for the photo I was looking for, I only had about 3 seconds to make it happen and then I was ushered out of the boom pod so the next photographer could get in. For this shot I used a setting of 1/800 second at F10. For the other in-flight pictures I typically used 1/500 to 1/800 sec with F stops from 8 to 10.

After the last refueling the two tankers climbed higher and sped up so we could get to Pease ANG base before the Thunderbirds; otherwise we would have to be put in a holding pattern just outside of the Pease air space while the Thunderbirds did their arrival maneuvers. As it happened, we returned to Pease just before 3:00 pm and were walking down the stairs when the Thunderbirds performed their arrival maneuver, the delta solo break from behind the crowd.

F-16's are capable of carrying many combinations of up to three external fuel tanks. Usually when you see an F-16 in the sky or parked at an air show you will see these fuel tanks, one of which can be placed under the belly and two can be hung under the wings.

On this trip the Thunderbirds elected not to carry the wing tanks, possibly to eliminate the excess equipment they would need to bring with them to store and maneuver around. I have been told by a boom operator that the Thunderbirds will use the external tanks when flying overseas.

The 2012 Boston Portsmouth Air Show, which will be held on June 30 and July 1 this year, has quickly become a first rate annual air show, consistently attracting major jet teams like the Thunderbirds and Blue Angels, and also top notch civilians like Mike Goulian and Sean Tucker. Last year this show also hosted the Heavy Metal jet team, now known as the Black Diamond jet team which will be returning in 2012.

MT



Kevin Burke's three second perfect shot: T-Bird backs away from the refueling boom.

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SCANNING REPORT

THE WORLD ABOVE 30MHZ

Dan Veeneman

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Scanning the Pacific Northwest

Like many decisions about technology, selecting the “best” scanner is always a subjective determination. A number of factors come into play and what’s good for one user might not be so good for another. This month we take a look at possible choices for a new user in the Pacific Northwest.

I live in Tacoma, Washington and want to purchase a scanner. I have done some research and am still confused about the best scanner to purchase. I believe the Tacoma police use a Motorola Type II Smart Zone trunked system. Do I need to purchase a trunk-tracking scanner in order to hear the chatter? I would like to hear Seattle as well. Can you suggest the best scanner at the lowest price point that will give me both?

*Thanks,
Amy in Tacoma*

Tacoma is a city of about 200,000 people located about 30 miles southwest of Seattle. It is part of a larger region bordered on the west by Puget Sound and on the east by the Cascade Mountains, made up of three counties totaling 3.4 million people and 6,000 square miles. Pierce County, where Tacoma is located, covers nearly 1,800 square miles and is home to about 800,000 people. King County, with Seattle as the county seat, holds 1.9 million residents across 2,100 square miles. Snohomish County, north of Seattle, has about 700,000 people in an area of just over 2,000 square miles.



Amy’s confusion is certainly understandable, since there are currently eight primary public safety land mobile radio systems operating in the region:

- King County Emergency Radio Communication System
- Pierce County Government Radio Communications System
- Pierce County FireCom Radio System
- Pierce County Transit Radio System
- Port of Seattle Public Safety Radio System

- Snohomish County Emergency Radio System (SERS)
- Tacoma-Puyallup Public Safety Radio System
- Washington State Patrol Radio System (WSP)

All but one of these systems operates either conventionally – meaning each radio frequency is dedicated to a specific agency and function – or uses a common Motorola trunking technology. Trunking is a method of sharing a common pool of frequencies among all the users of the radio system, and the Motorola technology in use in the Tacoma area is supported by all trunk-tracking scanners.



| System | Band | Transmission Type | Sites | Units |
|-----------------------|---------|--------------------|-------|--------|
| Snohomish County | 800 MHz | Motorola trunked | 21 | 4,300 |
| King County | 800 MHz | Motorola trunked | 26 | 16,200 |
| Port of Seattle | 800 MHz | Motorola trunked | 5 | 2,000 |
| Tacoma-Puyallup | 800 MHz | Motorola trunked | 12 | 3,600 |
| Pierce County FireCom | VHF | conventional | many | |
| Pierce County Gov’t | VHF | conventional | 11 | 2,200 |
| Pierce County Transit | 700 MHz | Project 25 Phase 1 | 6 | |
| WSP (in the Region) | VHF | conventional | 11 | 1,200 |

There are approximately 30,000 radios on these eight systems. In addition, about 10,000 commercial wireless data cards are in use providing mobile data connectivity. Some Snohomish County agencies also access a private data network that carries data at 9,600 bits per second.

For the City of Tacoma, the Tacoma-Puyallup public safety system supports most of the local agency activity. The system carries voice in both analog and encrypted digital formats with Motorola Type II control channels. This means that any scanner capable of trunk tracking Motorola analog systems will follow the action as long as the voice transmissions are analog. Digital voice transmissions appear to be limited to sensitive police operations and are reportedly encrypted, so you’re not missing anything by not having a digital-capable scanner.

The Tacoma-Puyallup system is made up of three subsystems. The primary is Tacoma, simulcasting from six repeater sites on the following frequencies: 866.7875, 866.8125, 866.8375, 866.8625, 867.1625, 867.1875, 867.2125, 867.2375, 867.2625, 867.4625, 867.9500, 867.9875, 868.2500 and 868.3250 MHz.

The Puyallup subsystem can be heard on 868.3500, 868.3750, 868.4000, 868.5000, 868.5750 and 868.6250 MHz.

The McNeil Island subsystem operates on 866.7250, 867.3750, 867.4000, 867.9250,

868.6000 and 868.6250 MHz.

The Tacoma and Puyallup subsystems both operate in *simulcast* (simultaneous broadcast) mode, meaning that the same content is transmitted from each repeater site at the same time. This enables a radio (or a scanner) to pick up system activity without regard to which specific repeater site the signal is coming from.

Tacoma-Puyallup Talkgroups

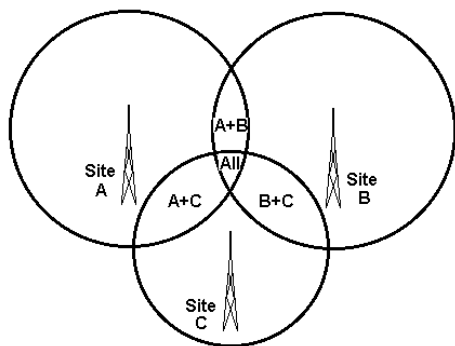
| Decimal | Hex | Description |
|---------|-----|---|
| 272 | 011 | Patch for local law enforcement |
| 1808 | 071 | Tacoma Fire (Operations) |
| 1840 | 073 | Tacoma Fire (Operations) |
| 45808 | B2F | Tacoma Police Tactical (Encrypted) |
| 45840 | B31 | Tacoma Police Tactical (Encrypted) |
| 47824 | BAD | Tacoma Police Tactical (Encrypted) |
| 52080 | CB7 | Tacoma Police (Events North) |
| 52112 | CB9 | Tacoma Police (Events South) |
| 52176 | CBF | Tacoma Police (Dispatch North) |
| 52208 | CBF | Tacoma Police Records |
| 52240 | CC1 | Tacoma Police (Tactical 1 North) |
| 52272 | CC3 | Tacoma Police (Tactical 2 North) |
| 52304 | CC5 | Tacoma Police (Dispatch South) |
| 52368 | CC9 | Tacoma Police SWAT |
| 52400 | CCB | Tacoma Police (Tactical 1 South) |
| 52432 | CCD | Tacoma Police (Tactical 2 South) |
| 52560 | CD5 | Tacoma Police Law Enforcement 1 |
| 52592 | CD7 | Patch to LERN |
| 52624 | CD9 | Patch to LERN |
| 53008 | CF1 | City Public Works |
| 53040 | CF3 | City Public Works |
| 53072 | CF5 | Dome Public Works |
| 53168 | CFB | Tacoma Solid Waste - Garbage Trucks |
| 53200 | CFD | Tacoma Solid Waste - Garbage Trucks |
| 53296 | D03 | Tacoma Water |
| 53360 | D07 | Tacoma Solid Waste - Landfill |
| 53424 | D0B | Tacoma Solid Waste - Garbage Trucks |
| 53520 | D11 | Tacoma Solid Waste - Garbage Trucks |
| 53680 | D1B | Tacoma Maintenance |
| 54096 | D35 | American Medical Response (AMR) Ambulance |
| 54320 | D43 | Rural/Metro Ambulance (Dispatch) |
| 54416 | D49 | Tacoma Fire (Training) |
| 54512 | D4F | Police and Fire Common (Simulcast on 155.370) |
| 54544 | D51 | Tacoma Fire (Alternate) |
| 54576 | D53 | Tacoma Fireground (Channel 5) |
| 54608 | D55 | Tacoma Fireground (Channel 4) |
| 54640 | D57 | Tacoma Fireground (Channel 3) |
| 54672 | D59 | Tacoma Emergency Medical Services (Channel 2) |
| 54704 | D5B | Tacoma Fire (Dispatch) |
| 54736 | D5D | Tacoma Fire (Events) |
| 55120 | D75 | Pierce County Fire Crosslink |

❖ Conventional Frequencies

In addition to trunked systems, many agencies operating in the greater Seattle/Tacoma area make use of conventional frequencies as well. The following frequencies carry analog voice traffic and can be monitored on nearly any scanner manufactured in the past thirty years.

| Frequency | Description |
|-----------|---|
| 45.20 | Comprehensive Emergency Management Network (CEM-Net) F1 |
| 45.36 | Comprehensive Emergency Management Network (CEM-Net) F2 |
| 45.48 | Comprehensive Emergency Management Network (CEM-Net) F3 |
| 151.355 | Pierce County Emergency Management |
| 151.415 | Department of Natural Resources (DNR) Common |
| 153.830 | Washington State fire service mutual aid (Red Net) |
| 153.890 | Pierce County Fire (Dispatch Countywide) |
| 154.160 | Pierce County Fire (Fireground Central) |
| 154.265 | Puyallup Fireground |
| 154.295 | Pierce County Fire (Dispatch Central) |
| 154.325 | Pierce County Fire (Fireground South) |
| 154.355 | Pierce County Fire (Fireground West) |
| 154.385 | Pierce County Fire (Fireground East) |
| 154.950 | Pierce County Sheriff (Dispatch East) |
| 155.160 | Search and Rescue (SAR) |
| 155.190 | King County Mutual Aid Radio System (KCMARS) |
| 155.280 | Hospital Emergency Administrative Radio (HEAR) |
| 155.310 | Pierce County Sheriff (Tactical) |
| 155.340 | Hospital Emergency Administrative Radio (HEAR) |
| 155.370 | Law Enforcement Radio Network (LERN) |
| 155.475 | National Law Enforcement Network (NLEC) |
| 155.610 | Pierce County Sheriff (Administration) |
| 155.640 | Pierce County Sheriff (Dispatch West) |
| 156.090 | Pierce County Sheriff (Records Countywide) |
| 156.135 | On-Scene Command and Coordination Radio Network (OSCCR) |
| 156.240 | Pierce County Fire (Central Response) |
| 460.550 | King County Mutual Aid Radio System (KCMARS) |

**Simulcast
Overlapping Coverage**



The three low-band frequencies, 45.20, 45.36 and 45.48 MHz, provide backup communications between state and local Emergency Operations Centers (EOCs), as well as serving as operational frequencies for some state agencies.

On-Scene Command and Coordination Radio (OSCCR) uses 156.135 MHz as a common radio frequency for use by two or more agencies for mutual aid and for emergencies and disasters. It is managed by the state Emergency Management Division (EMD) and has also been designated as the "Primary On Scene Command Channel" for the State of Washington. EMD also manages the Search and Rescue (SAR) frequency of 155.160 MHz, although it may be difficult to monitor, since its use is limited to



mobile and portable radios which transmit using much lower power than a typical repeater site.

Two VHF frequencies, 155.370 (LERN) and 155.475 (NLEC), are common police frequencies available statewide for use during disasters, emergencies, and operations that require coordination among multiple law enforcement agencies.

The Hospital Emergency Administrative Radio (HEAR) frequencies of 155.280 and 155.340 MHz are used by hospitals to communicate with ambulances while on-scene and enroute.

❖ Seattle

The King County public safety system makes use of more than 140 frequency pairs spread across more than a dozen subsystems. The largest subsystem, covering Seattle proper, uses the following frequencies: 851.1875, 851.4125, 851.9875, 852.1625, 852.6875, 852.9125, 853.4375, 853.6625, 854.1125, 854.1875, 854.3625, 854.4125, 866.2875, 866.3375, 866.4375, 866.6875, 866.7125, 866.8875, 867.2875, 867.7875, 868.1750, 868.4750, 868.6750 and 868.8750 MHz.

Given the large number of frequencies, it may be easier to use a scanner that has a "control channel only" trunking option, where only the control channel frequencies need to be programmed. Such a scanner will use the information from the control channel data stream to figure out the proper voice frequencies.

Each of the Motorola trunked systems have a frequency dedicated to carrying digital instructions between radios and repeater sites. These instructions allow radios to figure out which talkgroups are active and on what frequency each talkgroup conversation is occurring. This frequency is called a *control channel*. Because the channel contains information about every active talkgroup and frequency, a scanner with a "control channel only" feature doesn't always need to have every voice channel explicitly programmed.

The control channels for the King County system are 851.0625, 851.4125, 851.8125, 854.3625, 855.9625, 857.2625, 857.4625, 858.2375, 858.4875, 860.2625, 860.7125, 860.9625, 867.8625, 867.9125, 868.1750, 868.2000, 868.2250, 868.4000, 868.4250, 868.4500, 868.6500, 868.6750, 868.7000, 868.7750, 868.9500 and 868.9750 MHz.

King County System Talkgroups

| Decimal | Hex | Description |
|---------|-----|------------------------------------|
| 1616 | 065 | Seattle Fire (All Call) |
| 1648 | 067 | Seattle Fire (Fire Response 1) |
| 1680 | 069 | Seattle Fire (Fire Response 2) |
| 1712 | 06B | Seattle Fire (Fire Response 3) |
| 1744 | 06D | Seattle Fire (Dispatch) |
| 1776 | 06F | Seattle Fire (Medical Responses 1) |
| 1808 | 071 | Seattle Fire (Medical Responses 2) |
| 1840 | 073 | Seattle Fire (Command Support) |
| 1872 | 075 | Seattle Fire (Command Support) |
| 1904 | 077 | Seattle Fire (Site Dispatch) |
| 1936 | 079 | Seattle Fire (Site Response) |
| 1968 | 07B | Seattle Fire (Ambulance Requests) |
| 2000 | 07D | Seattle Fire (Medic One) |
| 2032 | 07F | Seattle Fire (Trauma Doctor) |
| 2064 | 081 | Seattle Fire (Command Support) |
| 2096 | 083 | Seattle Fire (User-to-User) |
| 2128 | 085 | Seattle Fire (Fireground) |

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| | | |
|-------|-----|--|
| 2160 | 087 | Seattle Fire (Investigations) |
| 2192 | 089 | Seattle Fire (Administration) |
| 2224 | 08B | Airlift Northwest (Medical) |
| 3184 | 0C7 | Seattle Fire Emergency Operations Center |
| 3216 | 0C9 | Seattle Police (All Call) |
| 3248 | 0CB | Seattle Police (Dispatch West) |
| 3280 | 0CD | Seattle Police (Dispatch North) |
| 3312 | 0CF | Seattle Police (Dispatch South) |
| 3344 | 0D1 | Seattle Police (Dispatch East) |
| 3408 | 0D5 | Seattle Police (Records) |
| 3440 | 0D7 | Seattle Police (Tactical 1) |
| 3472 | 0D9 | Seattle Police (Tactical 2) |
| 3504 | 0DB | Seattle Police (Tactical 3) |
| 3536 | 0DD | Seattle Police (Tactical 4) |
| 3568 | 0DF | Seattle Police Event 1 |
| 3600 | 0E1 | Seattle Police Emergencies |
| 3632 | 0E3 | Seattle Police (Tactical East) |
| 3664 | 0E5 | Seattle Police (Tactical South) |
| 3696 | 0E7 | Seattle Police (Tactical North) |
| 3728 | 0E9 | Seattle Police (Tactical West) |
| 3760 | 0EB | Seattle Police Tactical 1 |
| 3792 | 0ED | Seattle Police Tactical 2 |
| 3824 | 0EF | Seattle Police |
| 3856 | 0F1 | Seattle Police |
| 3888 | 0F3 | Seattle Police Command 1 |
| 3920 | 0F5 | Seattle Police Command 2 |
| 3952 | 0F7 | Seattle Police Command 3 |
| 3984 | 0F9 | Seattle Police Command 4 |
| 4016 | 0FB | Seattle Police Command 5 |
| 4048 | 0FD | Seattle Police Harbor Patrol |
| 4080 | 0FF | Seattle Police Narcotics 1 |
| 4112 | 101 | Seattle Police Narcotics 2 |
| 4144 | 103 | Seattle Police Narcotics 3 |
| 4176 | 105 | Seattle Police Narcotics Task Force |
| 4208 | 107 | Seattle Police Vice 1 |
| 4240 | 109 | Seattle Police Vice 2 |
| 4272 | 10B | Seattle Police Criminal Intelligence Service 1 |
| 4304 | 10D | Seattle Police Criminal Intelligence Service 2 |
| 4336 | 10F | Seattle Police Emergency Response Team 1 |
| 4368 | 111 | Seattle Police Emergency Response Team 2 |
| 4464 | 117 | Seattle Police Internal Investigations |
| 23152 | 5A7 | King County Sheriff North (Dispatch) |
| 23184 | 5A9 | King County Sheriff Tactical 2 |
| 23216 | 5AB | King County Sheriff Southeast (Dispatch) |
| 23248 | 5AD | King County Sheriff Tactical 3 |
| 23280 | 5AF | King County Sheriff Southwest (Dispatch) |
| 23312 | 5B1 | King County Sheriff Tactical 4 |
| 23344 | 5B3 | King County Sheriff Northwest (Dispatch) |
| 23376 | 5B5 | King County Sheriff Tactical 5 |
| 23408 | 5B7 | King County Sheriff Special Operations |
| 23440 | 5B9 | King County Sheriff Tactical 6 |
| 23472 | 5BB | King County Sheriff Records |
| 23504 | 5BD | King County Sheriff Tactical 1 |
| 23536 | 5BF | King County Sheriff Tactical 7 |
| 23568 | 5C1 | King County Sheriff Tactical 8 |
| 23600 | 5C3 | King County Sheriff Tactical 9 |
| 23632 | 5C5 | King County Sheriff Tactical 12 |
| 23952 | 5D9 | King County Metro Transit Police (Dispatch) |
| 23984 | 5DB | King County Metro Transit Police (Tactical) |
| 24016 | 5DD | King County Metro Transit |
| 24048 | 5DF | King County Metro Transit |
| 24976 | 619 | King County Sheriff Tactical 14 |
| 25424 | 635 | King County Sheriff Tactical 10 |
| 26608 | 67F | King County Sheriff Tactical 16 |
| 27088 | 69D | King County Sheriff Tactical 18 |
| 27344 | 6AD | King County Sheriff Tactical 30 |
| 30128 | 75B | King County Sheriff Tactical 20 |
| 35824 | 8BF | King County Sheriff (Surveillance) |
| 38448 | 963 | King County Fire (Dispatch) |
| 38480 | 965 | King County Fire 2 |
| 38512 | 967 | Valley Comm Fire (Common 3) |
| 38544 | 969 | Valley Comm Fire (Common 4) |
| 38576 | 96B | KV Fire Operations 1 |
| 38608 | 96D | KV Fire Operations 2 |
| 38640 | 96F | KV Fire Operations 3 |
| 38672 | 971 | Valley Comm Fire Operations 4 |
| 38704 | 973 | Valley Comm Fire Operations 5 |
| 38736 | 975 | Valley Comm Fire Operations 6 |
| 39056 | 989 | King County Fire District 17 Administration |
| 39088 | 98B | King County Fire District 20 Administration |
| 39120 | 98D | King County Fire District 40 Administration |
| 39152 | 98F | King County Fire District 43 Administration |
| 39184 | 991 | King County Fire District 44 Administration |
| 39216 | 993 | King County Fire District 46 Administration |

| | | |
|-------|-----|---|
| 39248 | 995 | King County Fire District 47 Administration |
| 62384 | F3B | King County Fire |
| 62416 | F3D | King County Fire Mutual Aid Zone 1 |
| 62448 | F3F | King County Fire Mutual Aid Zone 2 |
| 62480 | F41 | King County Fire Mutual Aid Zone 3 |
| 62512 | F43 | King County Fire Mutual Aid Zone 4 |
| 62544 | F45 | King County Fire Mutual Aid Zone 5 |
| 62576 | F47 | King County Fire Mutual Aid Pool 1 |
| 62608 | F49 | King County Fire Mutual Aid Pool 2 |
| 62640 | F4B | King County Fire Emergency Operations |
| 62704 | F4F | King County Fire Emergency Operations |
| 62736 | F51 | King County Fire Emergency Operations |

❖ Control Channel Only

The following scanners can properly support control-channel-only. Some older models may also require the programming of a "plan" to allow the scanner to compute the proper frequency.

| Source | Model | Type | Introduced |
|-------------|----------|-------------|------------|
| GRE | PSR-300 | Handheld | 2007 |
| GRE | PSR-400 | Base/Mobile | 2007 |
| GRE | PSR-500 | Handheld | 2007 |
| GRE | PSR-600 | Base/Mobile | 2007 |
| Radio Shack | PRO-93 | Handheld | 2001 |
| Radio Shack | PRO-94 | Handheld | 1999 |
| Radio Shack | PRO-95 | Handheld | 2002 |
| Radio Shack | PRO-96 | Handheld | 2003 |
| Radio Shack | PRO-97 | Handheld | 2005 |
| Radio Shack | PRO-106 | Handheld | 2007 |
| Radio Shack | PRO-107 | Handheld | 2009 |
| Radio Shack | PRO-160 | Base/Mobile | 2008 |
| Radio Shack | PRO-162 | Handheld | 2008 |
| Radio Shack | PRO-163 | Base/Mobile | 2008 |
| Radio Shack | PRO-164 | Handheld | 2009 |
| Radio Shack | PRO-197 | Base/Mobile | 2007 |
| Radio Shack | PRO-433 | Base/Mobile | 2006 |
| Radio Shack | PRO-528 | Handheld | 2006 |
| Radio Shack | PRO-2051 | Base/Mobile | 2005 |
| Radio Shack | PRO-2053 | Base/Mobile | 2001 |
| Radio Shack | PRO-2055 | Base/Mobile | 2005 |
| Radio Shack | PRO-2096 | Base/Mobile | 2005 |
| Uniden | BCT8 | Base/Mobile | 2003 |
| Uniden | BCT15 | Base/Mobile | 2006 |
| Uniden | BCT15X | Base/Mobile | 2009 |
| Uniden | BC246T | Handheld | 2004 |
| Uniden | BC250D | Handheld | 2002 |
| Uniden | BC296D | Handheld | 2003 |
| Uniden | BR330T | Handheld | 2005 |
| Uniden | BC346XT | Handheld | 2009 |
| Uniden | BCD396T | Handheld | 2005 |
| Uniden | BCD396XT | Handheld | 2009 |
| Uniden | BC780XLT | Base/Mobile | 2000 |
| Uniden | BC785D | Base/Mobile | 2002 |
| Uniden | BC796D | Base/Mobile | 2003 |
| Uniden | BC898T | Base/Mobile | 2004 |
| Uniden | BCD996T | Base/Mobile | 2006 |
| Uniden | BCD996XT | Base/Mobile | 2009 |

If you'd like to avoid programming altogether, you could choose one of the newest scanners that comes pre-programmed with nearly all U.S. radio systems and has a simple user interface.

| Source | Model | Type | Year |
|-------------|--------------|-------------|------|
| GRE | PSR-800 | Handheld | 2011 |
| Radio Shack | PRO-18 | Handheld | 2011 |
| Uniden | HomePatrol-1 | Base/Mobile | 2010 |

❖ Unified Regional System

Three counties make up the core of the Seattle-Tacoma area, namely King, Pierce and Snohomish. In 2008 an organization called the Radio Executive Policy Committee (REPC) was formed to design, build and operate a

single voice and data network within this three-county area. The intent of the REPC is to migrate all of the county and local radio users from their current systems to a new network that will provide "state-of-the-art" wireless mission-critical voice and broadband data capabilities for public safety and general government use."

REPC recognizes that most of the public safety systems in the area use a Motorola technology called *SmartZone* and are concerned that over time it will become more difficult to get vendor support for critical hardware and software components. They also anticipate additional users as agencies grow to serve an increasing population.

In 2010, the City of Seattle received a waiver from the Federal Communications Commission (FCC) to operate within the newly allocated 700 MHz Public Safety Broadband (PSBB) spectrum. However, Seattle was unsuccessful in finding federal grant money to build out a broadband system and is now looking for alternatives.

Last year the City, on behalf of the REPC, issued a Request for Information (RFI) seeking information about a possible partnership between the regional governments and private industry to help build, fund and operate a new network. They envision the use of an emerging commercial cellular technology called Long Term Evolution (LTE) to simultaneously support the needs of a minimum of 40,000 public safety users and thousands of commercial users. It will be interesting to see how private industry will respond.

That's all for this month. Please send your questions, comments and updates to me at danveeneman@monitoringtimes.com. More information about scanners, trunking, and other radio-related topics can be found at www.signalharbor.com. Until next month, happy scanning!

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Q. *What makes an HD-2 FM broadcast signal fluctuate in signal strength and then drop out? (Dave McDonald, K4EWC, Clearwater, FL)*

A. Assuming the signal fluctuation is not caused by an erratic antenna system, this is undoubtedly an atmospheric condition, probably solar or weather induced, changing the path or polarization of the received signal.

While our traditional analog signals simply struggle with background noise, letting us hear or see broadcast signals along with the noise, modern digital transmissions are all or none. When the data stream is interrupted or corrupted by low levels or interference, the entire stream drops out.

Q. *The push-to-talk switch on CB radio microphones disconnect the microphone element during the receive function. Why is that necessary? (J.J. Owens, NC)*

A. The common audio circuitry can produce acoustic feedback if the mike is left connected during receive. On a related topic, CBers who enjoy the echo sound of feedback can purchase models that leave the speaker connected for that sound effect.

Q. *Why is there no longer an antenna trimmer on car radios as there was years ago? (Tim Kuryla, Lexington, KY)*

A. I can only speculate among the following possible answers:

1. Older components were not nearly as stable over time as they are now, especially in tube-type radios, so some readjustment was appropriate.
2. Older whips were telescopic, so some adjustments would be necessary to accommodate a car owner's decision to lengthen or shorten the antenna.
3. Modern electronic tuning (varactor diode circuitry) allows one factory adjustment for the vehicle's standard antenna length, and it stays matched as the radio's frequency is changed.
4. Most modern car radios are left operating on FM, so the fixed-length whips are cut for quarter-wave resonance on the FM band for nominal 50 ohm input impedance.
5. And finally, car radios are less expensive to make if you leave mechanical parts off! (This may turn out to be the major reason!)

Q. *I was under the impression that all shortwave broadcasters were to evacuate the 41 meter band, leaving it for amateurs only, but I still hear a few broadcasters. Why are they still here? (Mark Burns, Terre Haute, IN)*

A. By international agreement in 2003 at the World Administrative Radio Conference (WARC) in Geneva, Switzerland, all broadcasters were to evacuate 7100-7200 kHz by March 29, 2009. It would be decided later what would become of broadcasting in the remaining part of the amateur 40 meter band (7200-7300 kHz).

But rule making is one thing, and compliance is another. There are always rogue broadcasters who are more concerned with propagating their propaganda than cooperating with fellow broadcasters. Having fewer competitive stations now on that part of the spectrum is an open invitation for abuse of the ruling.

Q. *What are some inexpensive ways to keep a desktop scanner running in the event of a power outage? (Bill Moore, South Daytona, FL)*

A. Assuming that your desktop scanner is also designed for mobile applications, it should run on 12 VDC.

1. Select a model with the lowest current rating.
2. Lock out all the channels that aren't vital for reception during that period to avoid the extra current required for unnecessary audio.
3. Keep the volume only as loud as necessary.
4. Consider running a temporary DC power cord to your car battery (or cigarette lighter jack).
5. Keep a good size, 12 VDC, rechargeable battery on hand fully charged.
6. Consider an inexpensive uninterruptible power supply plugged in with the scanner plugged into it for these emergencies.
7. Consider a solar panel that can supply the needed current and voltage to run the scanner during the day as well as charge the batteries for nighttime use.

Q. *Why is AC more efficient in long-distance power lines than DC? (Mark Burns, Terre Haute, IN)*

A. It isn't more efficient, it's just easier to convert (transform) to other voltages. AC can be directly transformed to any voltage by a simple turns ratio, while DC must either be dropped in voltage by resistance (very lossy as heat), or fed into a DC/AC converter to step it up (not as

efficient, and more complex and expensive than using a simple transformer).

Q. *What is the basis for radio rack panel height (multiples of 1.75") and width (19") standards? (Dave Williams, K7HMP/4, Stafford, VA)*

A. The original standard was developed around 1890 by George Westinghouse for the railroads to use as a mounting system for railroad signaling relays, thus the common name, relay rack. He later adapted it to the telephone industry to mount their array of relays. Eventually, the Electronic Industries Association (EIA) adopted the system.

Q. *I enjoy monitoring aircraft communications. When someone says, "flight level 380," does that mean that the aircraft is flying at 38000 feet? How high can a commercial airliner fly (safely)? (M.B., IN)*

A. Yes, FL380 is a flight level of 38,000 feet. It's an abbreviated response just like when they say, "Contact (airport name) 121.62" they really mean 121.625 MHz. Larger, higher-performance aircraft can cruise as high as FL51; 51,000 feet (roughly 9.6 miles).

Lower flight levels are more tightly restricted as a safety precaution because of the numbers of aircraft simultaneously on major air routes at those altitudes.

Q. *Won't the change in VHF/UHF land mobile band planning to narrower deviation (6.25 kHz) mean sharper filters with better shape factors for scanners? (J.J. Owens, NC)*

A. Sharper, yes; better shape factor, probably not. The characteristics of FM signals require a stronger interfering signal to override the desired signal ("FM capture"), even when right on frequency, and we're talking about adjacent channel interference. With AM, even a weak signal will produce interference.

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.)



Polytone and Espionage: Some Questions Answered

A recent e-mail from ENIGMA 2000's Paul Beaumont sheds considerable light on the role of the Russian "Polytone" numbers station in communicating with undercover agents in the field.

Paul is a key figure in the authoritative ENIGMA 2000 group. This organization continues the high standards of the original European Numbers Information Gathering and Monitoring Association (ENIGMA), but completely online. Summaries of ENIGMA 2000's excellent observation and analysis are in their newsletters, which are available at www.brogers.dsl.pipex.com/enigma2000/

ENIGMA 2000 has classified the Polytones as XP, where the "X" is their prefix for unknown modes, and the P is the first letter of the name. There are a whole class of Polytones, all presumed to come from Russian intelligence. While the exact modes and tonal schemes have varied considerably, all use strings of brief tone pulses at different audio frequencies to pass messages. Signals are decoded by computer and converted into text usable to agents without extensive radio training.

Good examples of this audio are at a link from the home page of the site just mentioned above. Numbers hobbyists have written programs that can decode these. What you get is similar to messages sent by a Russian Morse code numbers station, and in fact plenty of evidence exists to tie both stations to the same agencies.

The particular Polytone we're interested in is called XPA, and in particular schedule "b" (lower case). This is ENIGMA 2000's designator for a Tuesday-Thursday time slot at 0440, 0500, and 0540 Coordinated Universal Time (UTC).

XPAb uses a sophisticated mode, which was described in the January column. There are 20 possible audio tones, though not all are used. These are sent rapidly in upper sideband (USB), and messages are quite long. Transmitter powers are high, allowing decode on simple (and unobtrusive) consumer receivers.

This is all quite spectacular, in the usual geeky sort of way, to hear for the first time. Frequencies, unfortunately, are not known as of this writing, but the stations turn up regularly in online logs.

❖ Spies and XPA

XPAb has become somewhat famous, or at least notorious, though not by that name. The station is very likely the one that was tuned in by "Heidrun A" when German special forces busted down her door on October 18, 2011. According to Beaumont, who should know, it was the only plausible numbers schedule that was up at the time. Furthermore, all reports of the arrest note a "musical tone" broadcast in progress.

According to affidavits, "Heidrun A" and her husband Andreas go back a long way in their chosen profession. Allegedly, their current assignment involved industrial espionage. Andreas worked in a job related to the German auto industry. However, they were indeed government agents, going back all the way to the old Soviet KGB and its more recent successor, the SVR.

Immediately after this arrest, broadcasts increased greatly in two other Russian teleprinting modes used mostly for diplomatic traffic. Given the rapidly developing international incident in progress, it's not too farfetched to suggest that these were related.

All this intrigue is of interest to Americans for another reason. Everyone remembers the US "Russian spy bust" in June of 2009. It closed down a ring of agents and launched the brief celebrity career of the red-haired, self-styled Mata Hari named Anna Chapman. Chapman has tried to keep this going in Russia, with mixed results, after she and the others were swapped for Americans in custody there. Currently, it appears that she is leading business seminars.

According to interesting evidence cited by Beaumont, Anna and her people were at least loosely affiliated with Heidrun and Andreas A. It is said that Anna's bunch also used Polytone, notably an XPA schedule at 2100 UTC. This was described as a "radiotelegram" in the FBI complaint. For whatever it's worth, "radiotelegram" is the Russian name for the Polytone mode.

Beaumont also reports that this particular XPA schedule left the air fairly soon after the US bust. It will be interesting to see whether XPAb has a similar fate. Right now, it's still on the air, but everyone will be listening to see what happens.

❖ Digital Selective Calling

It might just be conditions, but activity on ship DSC (Digital Selective Calling) seems to have picked up in the parts of the Pacific Ocean that are most audible here. DSC became compulsory for large vessels upon adoption of

the relatively new GMDSS (Global Maritime Distress and Safety System) under international treaties. At first, monitoring used to be kind of a lonely affair, with a few hits now and again. Lately, however, the screen fills up with decodes when the bands are working well.

DSC uses a transmission mode that sounds similar to Simplex Telex Over Radio, Mode B (SITOR-B), but the underlying data protocol is completely different. It comes in short bursts lasting several seconds. The resulting message is rather terse, with station being called, message class, station calling, and any additional information such as position or voice channels being used. In this latter one, note that "J3E" is just the international mode designator for plain old upper sideband (USB).



Each station is identified by its 9-digit Maritime Mobile Service Identity (MMSI), as issued by the relevant regulatory body or its designees at the vessel's country of registry. For ships, the first three digits are the Maritime Identification Digits, a country code, which are then followed by the vessel's serial number.

Coast station MMSIs begin in 0 (individual station) or 00 (group call), followed by the MID and serial number. Ship and shore MMSIs can be looked up online at the International Telecommunications Union (ITU) web site, or a number of commercial sites. It is getting remarkably easy to track ships online by a combination of DSC monitoring and World Wide Web lookup.

Primary long-distance DSC frequencies are: 2187.5, 4207.5, 6312.0, 8414.5, 12577.0, and 16804.5 kilohertz (kHz). Due to channel offsets, dial frequencies will vary. For coastal use, there's also VHF (Very High Frequency) channel 70, on 156.525 megahertz (MHz).

One popular commercial decode program is DSCDecoder. It's from COAA, a Portuguese observatory, at www.coaa.co.uk It does a nice job and allows ITU lookup of the MMSI with a simple mouse click.

DSCDecoder was in daily use here until last week, when the computer was replaced. The decoder doesn't seem to like the new sound card. After this column goes off to Brasstown, troubleshooting will commence. It would be too

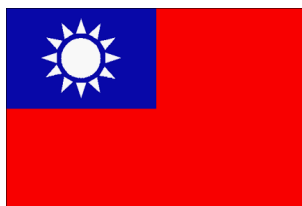


bad to give up such a nice piece of software.

Meanwhile, any number of multimode packages will also do DSC. Typical are SeaTTY, MultiPSK, and of course the ultra-expensive HOKA and Wavecom.

❖ Taiwanese Fishery

Peter Poelstra, a long-time contributor to the *Utility Logs*, was trying to identify a conversation in Chinese that he was hearing on 13173.0 kHz USB. In searching the Web, he turned up a really old frequency list for Taiwanese Fishery Radio. 13173, as it turns out, is possibly BVJ, in Donggang. The list also shows them on 8788 and 12533 kHz USB.



Unfortunately, the document is obviously decades old. Some stations are shown using an international band plan that was replaced around the turn of the century. A few that aren't include: BVK, Suao, 9222 and 17398; BVL, Taichung, 8803 and 10183,3; BVI, Kaohsiung, 12202 and 13302; BVM, Hualien, 4373; BVO, Green Island, 8809; and BVQ, Matsu, 4426 kHz.

In addition, a few use ITU international duplex channels, shore side given first: BVF Kaohsiung, channel 1203 (13083/12236), 1216 (13122/12275), 1614 (17281/16399), and 2226 (22771/22075); BVP, Hsinchu, 404 (4366/4074); and BVW, Penghu, 406 (4372/4080).

While these have undoubtedly changed somewhat over the intervening years, they might still be useful in unraveling some of the Asian-language chatter coming over the bands. Until next month, fair winds and following seas.

ABBREVIATIONS USED IN THIS COLUMN

| | | | |
|---------------|---|--------------|--|
| ALE..... | Automatic Link Establishment | Navtex..... | Navigational Telex |
| AM..... | Amplitude Modulation | RTTY..... | Radio Teletype |
| CAMSLANT..... | Communications Area Master Station, Atlantic | Selcal..... | Selective Calling |
| CAMSPAC..... | Communications Area Master Station, Pacific | SESEF..... | Shipboard Electronics Systems Evaluation Facility |
| CAP..... | US Civil Air Patrol | SITOR..... | Simplex Telex Over Radio, modes A & B |
| COTHEN..... | US Customs Over-The-Horizon Enforcement Network | Tascomm..... | UK Terrestrial Air Sea Communications |
| CW..... | On-off keyed "Continuous Wave" Morse telegraphy | UK..... | United Kingdom |
| DSC..... | Digital Selective Calling | Unid..... | Unidentified |
| E11..... | "Strich" family numbers, says "Oblique" for "/" | US..... | United States |
| FAX..... | Radiofacsimile | USAF..... | US Air Force |
| FEMA..... | US Federal Emergency Management Agency | USCG..... | US Coast Guard |
| FM..... | Frequency Modulation | USS..... | United States Ship |
| G11..... | German version of E11, says "Strich" for "/" | UTC..... | Coordinated Universal Time |
| HFDL..... | High-Frequency Data Link | VC01..... | Rapid-fire "Voice Chip" Chinese numbers |
| LDOC..... | Long-Distance Operational Control | Volmet..... | "Flying Weather;" airport observations & forecasts |
| M18..... | Russian CW "clock," sends local time of day strings | WMD-CST..... | Weapons of Mass Destruction Civil Support Team |
| MARS..... | US Military Auxiliary Radio System | | |
| Meteo..... | Meteorological (weather office), also "Metro" | | |
| NAT..... | North Atlantic air route control, families A-F | | |

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 ().

| | | | |
|--------|---|--------|--|
| 506.3 | WE2XGR/1-Amateur Experimental Group station 1, MA, CW identifier beacon at 0355 (Mario Filippi-NJ). | 4405.0 | TAH, weather in a barely intelligible Turkish and English computer voice, at 1809 (PPA-Netherlands). |
| 1704.0 | OXZ-Lyngby Radio, Denmark, maritime warnings in English, parallel 2586, at 2141 (Michel Lacroix-France). | 4426.0 | NMN-USCG CAMSLANT, gale warnings at 0527 (PPA-Netherlands). |
| 1721.0 | 4QEL-Probable fishing net beacon, CW ID at 0200 (Filippi-NJ). | 4441.0 | Unid-European "Oblique" station (E11), callup 412/38 and message in 38 5-figure groups, at 0900 (Ary Boender-Netherlands). |
| 1726.0 | 4KHD, probable fishing net beacon, CW ID at 0203 (Filippi-NJ). | 4583.0 | DDK2-German Weather Service, Hamburg/Pinneberg Radio, RTTY weather at 0230 (Filippi-NJ). |
| 1728.0 | KW212, probable fishing net beacon, CW ID at 0205 (Filippi-NJ). | 4712.0 | Kazan Radio-Russian airport weather net, radio check with Perm Radio, at 0430 (PPA-Netherlands). |
| 1890.0 | PBK-Dutch Coast Guard, Den Helder, weather in English, at 2142 (Lacroix-France). | 4765.0 | 6DZX-Belgian military net control, working 81PQ, JFY71, and AE76V; then traffic with HFY71 and HE76V, starting at 1055 (ALF-Germany). |
| 2182.0 | SKQJ-Swedish flag side-loading freighter Wilson Star, working Dutch Coast Guard regarding engine failure, went to 2520 ship/ 2824 shore duplex, at 2230 (Patrice Privat-France). | 4836.0 | Unid-Chinese air defense, cut-number CW tracking string with time stamp (UTC+8), also on 5399, at 1458 (PPA-Netherlands). |
| 2187.5 | C4HR2-Cyprus flag high-speed ferry Jonathan Swift, calling Holyhead Coast Guard, UK, DSC at 0537. 235089435-UK flag high-speed ferry Stena Superfast VII (2EZR3), at 0634 (Privat-France). | 4850.0 | RBI-Unknown Russian military, CW and RTTY with RJW2 and RII2, at 0500 (PPA-Netherlands). |
| 2579.0 | Unknown-Sounded like "Zulu Bravo Radio," possibly Bari Radio, IPB, Italy, robot male weather voice at 0040 (Filippi-NJ). | 4951.5 | Unid-Russian air defense, CW null-message strings with UTC+4 time stamps, at 1431 (MPJ-UK). |
| 2598.0 | VCM-Canadian Coast Guard, St. Anthony, NFD, maritime broadcast at 2146 (Lacroix-France). | 5324.0 | Unid-Possible Algerian military, net in French and Arabic with IM, LR, and other phonetic 2-letter stations, at 2005 (ALF-Germany). |
| 2600.0 | IQQ-Mazara del Vallo Radio, Italy, female machine voice with warnings in English and Italian, at 1753 (PPA-Netherlands). | 5390.0 | 53-Algerian Railway, working Al-Djazair (control in Algiers), then 52 working 56, all in French using reset tones, at 0255 (ALF-Germany). |
| 2663.0 | IPC-Crotone Radio, Italy, computer voice with weather in English and Italian, at 0351 (PPA-Netherlands). | 5405.0 | Ashkhabat Center-Ashkhabat Aeradio, Turkmenistan, calling unknown station in Russian, at 0352 (ALF-Germany). |
| 2872.0 | Gander-NAT-C, Canada, selcal AG-HK to bizjet VQ-BHA, a Dassault Falcon 7X, at 0306 (PPA-Netherlands). | 5520.0 | New York-Caribbean air route control, higher altitude clearance for TVS 961 (probably Travel Service/Smart Wings, Czech Republic), at 2340 (Stern-FL). |
| 3413.0 | Shannon Volmet, formatted aviation weather, also on 5505 and 8957, at 0550 (Allan Stern-FL). | 5550.0 | New York-Caribbean air route control, selcal AB-CH and position from Air Transat 156, an A310 reg C-GTSY, sent aircraft to 8918, at 2324 (Stern-FL). |
| 3455.0 | New York-Caribbean air route control, working JetBlue 56 at 2331 (Stern-FL). | 5568.0 | Sphora-Rostov Airport, Russia, working Atlantida (Maikop Airport), in Russian at 0335 (PPA-Netherlands). |
| 3485.0 | Gander Volmet, aviation weather, also on 6604 and 10051, at 0554. New York Volmet, also on 6604, weather at 0648 (Stern-FL). | 5670.0 | Colombo-Southeast Asia air route control, Sri Lanka, selcal JM-AB for Emirates 435, a B777 reg A6-ECF, at 2017 (PPA-Netherlands). |
| 3579.7 | "Pirate Beacon"-Morse identifier of unknown dasher beacon, CW at 1710 (ALF-Germany). | 5680.0 | Kinloss Rescue-UK Royal Air Force Air Rescue Co-ordination Centre, Scotland, working unknown station at 0915 (Lacroix-France). |
| 3803.1 | Unid-Russian intelligence, repeated CW time strings (M18), 4 hours ahead of UTC, sent "2305" at 1905 (PPA-Netherlands). M18, CW time strings, UTC+4 but one minute fast, sent "2318" at 1919 (ALF-Germany). | 5798.5 | D06-Netherlands Army, working D08, ALE at 1140 (ALF-Germany). |
| 4149.0 | WPE Jacksonville-Crowley Marine, FL, position and status check with seagoing tug The Navigator, at 0602 (Stern-FL). | 5881.5 | MAAASF1-US National Guard Army Aviation Support Facility, working R24587, a UH-60A #87-24587, ALE at 0006. MAAASF1, ALE with UH-60A R23711, at 0007 (Bob Wilczynski-MA). |
| 4207.5 | 003669991-USCG Boston, MA, answering DSC call from 316214000, Canadian flag tanker Kometik (VCRT), at 0457 (PPA-Netherlands). | 6340.5 | NMF-USCG Boston, MA, FAX satellite image at 0351 (PPA-Netherlands). |
| 4209.5 | TAH-Istanbul Radio, Turkey, SITOR-B Navtex messages, at 1759 (PPA-Netherlands). | 6345.0 | RIT-Russian Navy Northern Fleet Headquarters, Severomorsk, CW traffic to collective call sign RLO, at 0305 (ALF-Germany). |
| 4376.5 | RBC89-Russian Navy vessel, CW traffic header and message in 5-figure groups, at 1824 (PPA-Netherlands). | 6393.5 | UDK2-Murmansk Radio, Russia, RTTY all-ships coastal warnings, at 0404 (PPA-Netherlands). |

- 6433.0 Unid-"Strich" station (G11), null-message callup V99/00, then signed "Ende," at 1328 (ALF-Germany).
- 6535.0 Dakar Radio-African air route control, Senegal, working Iberia 6825, at 0503 (Stern-FL).
- 6586.0 New York-Caribbean air route control, selcal check MP-CQ with American 1635, a B767 reg N175AN, at 2303 (Stern-FL).
- 6628.0 Santa Maria Radio-NAT-E, position from Air Transport 236 (ATI/ Air Transport International), requested new altitude at 0532 (Stern-FL).
- 6640.0 New York LDOC, Medlink patch from JetBlue 701 for on-board medical emergency, at 0359 (Stern-FL).
- 6649.0 Atlantico-South American air route control, Recife, Brazil, working airliners at 0512 (Stern-FL).
- 6661.0 Mumbai-India regional air control, selcal AJ-CP for Emirates 653, a B777 reg A6-EMS, at 1943 (PPA-Netherlands).
- 6712.0 ME0211-Middle East Airlines, HFDL position for Shannon, at 0930. CKS414-Kalitta Air freighter, HFDL position for Shannon, at 0933 (Lacroix-France).
- 6754.0 Trenton Military-Canadian Forces Volmet, aviation weather at 0538 (Stern-FL).
- 6772.0 VANDAL3GNET-Probable US Marine Corps, working 3GNET in ALE and a serial data modem, at 2222 (Jack Metcalfe-KY).
- 6804.5 239717000-Greek flag high-speed ferry Superfast VI (SYHS), DSC at 1114 (Privat-France).
- 6910.0 AEA1RD-US Army MARS, Germany, working AEM1AB and AEM1SLCD, at 1108 (ALF-Germany).
- 6911.5 BROOK-FL National Guard Army Aviation Support Facility #2, working UH-60L R26609, ALE at 0024. BROOK, ALE with UH-60L R26609, at 2053 (Wilczynski-MA).
- 6940.5 Bourbon-US military, working Shadow, who also identified as Shadow Warrior, at 1730 (Metcalfe-KY).
- 6992.5 PHAS-Unknown Sea Cadets, working MFJ04, at 1235 (ALF-Germany).
- 7416.0 LFOCBA2011-US military, calling COCBA2011 RIPTIDEBA2011, ALE and serial data, at 1704 (Metcalfe-KY).
- 7532.0 "0"-US military, ALE linking with MASSALE, then secure comm, at 2000 (Metcalfe-KY).
- 7535.0 Determined Warrior Tech Control-US Navy guided missile destroyer USS Cole (DDG-67), testing with Norfolk SESEF, VA, at 2042 (Metcalfe-KY).
- 7591.5 Unid-French Air Force, CW "mission de caloré" test marker, at 1104 (ALF-Germany).
- 7792.0 The Chinese Robot (VC01), fast machine-generated numbers in Chinese, at 0804 (Boender-Hong Kong remote).
- 7906.0 XVS-Ho Chi Minh Ville Radio, Viet Nam, storm warnings in English and Vietnamese, at 1706 (PPA-Netherlands).
- 8047.0 M050IN-MI Army National Guard, Lansing, ALE sounding at 1331 and 1510 (MDMonitor-MD).
- 8050.0 Pastor-Unknown, probably US government, working Pastor8, ALE at 0250. STB-Unknown US government or military, working helo 855732, ALE at 2315 (Wilczynski-MA).
- 8414.5 9HAK9-Maltese flag cargo ship André-michel 1, DSC position for Lyngby Radio, Denmark, at 1500. CNA3727-Moroccan flag container ship Kenza, DSC with Las Palmas, Canary Islands, at 1938 (Lacroix-France).
- 8439.0 PBB-Dutch Navy, Den Helder, RTTY channel availability marker with time stamp every five minutes, at 0305 (Filippi-NJ).
- 8473.0 WLO-ShipCom, AL, wrapping up SITOR-B news from Voice of America, and changing to RTTY, at 0225. WLO, VOA news and back to SITOR-B at 0240 (Filippi-NJ).
- 8834.0 "08"-Johannesburg HFDL ground station, South Africa, uplink to ZS-SXC (South African Airways A340, flight SAA287), at 1815 (PPA-Netherlands).
- 8912.0 R27106-US Army helicopter, COTHEN ALE sounding at 2023 (MDMonitor-MD).
- 8918.0 New York-Caribbean air control, selcal check with Sunwing 420 (Sunwing Airlines, Canada), at 1652. New York, position from Navy LK 01, a P-3C, later on 11330, at 1838 (Stern-FL).
- 8948.0 CO0094-Continental Airlines flight, working HFDL Shannon, Ireland grand station, at 0828 (Lacroix-France).
- 8983.0 CAMSLANT Chesapeake-USCG, VA, repeated calls to Coast Guard 2310 (HC-144A Ocean Sentry), no joy at 0158 (Stern-FL).
- 9025.0 170043-USAF C-5B #87-0043, ALE sounding at 1345 (MDMonitor-MD).
- 9031.0 Ascot 6616-UK Royal Air Force C-17A #ZZ171, selcal check JK-ES with Tascomm, at 1120 (ALF-Germany).
- 9106.0 KGD825-US Environmental Protection Agency, MA, ALE sounding at 1700 (MDMonitor-MD).
- 9129.5 PIAOPS-IL National Guard, Peoria, calling CH285 in ALE; also on 5778.5, 5833.5, 6985.0, and 7361.5; at 1953 (Metcalfe-KY).
- 9295.0 SYRNY-NY Army National Guard, Syracuse, ALE sounding at 2008. BUFNY, Buffalo, ALE sounding at 2054. TRYNY, Troy, sounding at 2057. MVLNY, Morrisonville, ALE sounding at 2119 (MDMonitor-MD).
- 10093.0 "09" HFDL ground station, Barrow, AK, uplink to VQ-BEL, an Aeroflot A330 flight SU572, at 0809 (PPA-Netherlands).
- 10108.8 DDK9-German Weather Service, RTTY identifier and synoptic broadcast for Baltic and other areas, at 0332 (Filippi-NJ). [Legal 30-meter utility; good propagation indicator. -Hugh]
- 10242.0 LNT-USCG CAMSLANT, calling N02 (HC-144A #2302) COTHEN ALE at 1850 (MDMonitor-MD).
- 10914.5 GWPWZ33-Brazilian Navy, Rio de Janeiro, calling GWPWAR, vessel Ary Rongel (H44), at 0447 (PPA-Netherlands).
- 10977.5 MEC-Probable US Marine Corps, ALE with ME1 and ME4, earlier on 7332.5, at 1652 (Metcalfe-KY).
- 11090.0 KVM70-US National Weather Service, Honolulu, HI, FAX tropical surface analysis chart at 1400 (PPA-Netherlands).
- 11232.0 CHR-Canadian Forces, Trenton, ONT, weather for Canforce 2504, at 1236 (PPA-Netherlands).
- 11279.0 Gander Radio-NAT-D, position from Lufthansa 511, at 1530 (Stern-FL).
- 11318.0 "13"-HFDL ground station, Santa Cruz, Bolivia, uplink to N948AC (Avianca A330, flight 85), at 0819 (PPA-Netherlands).
- 11330.0 New York-Caribbean air control, selcal check with Key Air 606, at 1625. New York, giving Continental 147 new primary of 6587 and secondary 8846, at 1912 (Stern-FL).
- 11342.0 New York LDOC, passing weather for Caracas, Venezuela to VEC 201 (Vensecar Internacional freighter), at 1635 (Stern-FL).
- 11345.0 Stockholm LDOC, working medical emergency with a flight 124, at 1534 (Lacroix-France).
- 11396.0 New York-Caribbean air control, position from Iberia 6463, at 1659 (Stern-FL).
- 12087.0 F040LN-FL Army National Guard, St. Augustine, calling I100DN, Boise, ID, ALE at 1513 (MDMonitor-MD).
- 12168.0 T1126-ME Army National Guard 1-126 Aviation, working helo R23571, ALE at 1834. T1126, ALE with UH-60A R23734, at 2045 (Wilczynski-MA).
- 12216.0 FR1FEM-FEMA Region 1, MA, ALE sounding at 1513 (MDMonitor-MD).
- 12222.0 N04-USCG HC-144A #2304, working LNT, USCG CAMSLANT, VA, COTHEN ALE at 1650 (MDMonitor-MD).
- 12431.0 DENARO-Italian Coast Guard Patrol Boat Denaro (P-03), working TARANTO, Italian Financial Police, at 1520 (MPJ-UK).
- 12577.0 LXMC-Luxembourg flag suction dredger Niccolo Machiavelli, DSC position for Roma, at 1320 (Lacroix-France).
- 12823.5 CTP-Portuguese Navy, Oeiras, RTTY Notice to Allied War Ships marker at 1745 (Filippi-NJ).
- 13173.0 BVJ-Probable Donggang Fishery Radio, Taiwan, patch in Chinese at 1237 (PPA-Netherlands).
- 13182.0 XSQ-Guangzhou Radio, short announcement in Chinese, at 1250 (PPA-Netherlands).
- 13191.0 XVG-Hai Phong Radio, Viet Nam, traffic in Vietnamese at 1302 (PPA-Netherlands).
- 13215.0 PLA-USAF, Lajes Field, Azores, calling 221099 (C-17 #02-1099), ALE at 1700 (MDMonitor-MD).
- 13270.0 New York Volmet, aviation weather at 0050 (Robbie Spain, WY).
- 13306.0 New York-NAT-A, flight level - 450 clearance for MT-KFR, a Gulfstream 550 bizjet owned by Tele-Fonika Kable SP, at 2118 (Stern-FL).
- 13927.0 AFA5QW-USAF MARS, morale patch from N130AR (EC-130Q #162312, purchased by National Science Foundation for atmospheric research), at 1854 (Stern-FL).
- 14104.5 Unid-Chinese 64-tone digital mode, sending encrypted messages at 0935 (Eddy Waters-Australia).
- 14285.0 STAT151-Algerian government/military "Station 151," working STAT12, at 1351 (MPJ-UK).
- 14463.0 QA19-Algerian Air Force, ALE text message exchange with CM4 (4th military headquarters), at 1338 (MPJ-UK).
- 14653.0 F040LN-FL Army National Guard, St. Augustine, calling WAC10NG, 10th WMD-CST, WA, ALE at 1852. F040LN, calling WVC35NG, 35th WMD-CST, WV, at 1945 (MDMonitor-MD).
- 15867.0 Z13-USCG Sector Key West, FL, working 503 (HC-130H #1503), COTHEN ALE at 1600 (MDMonitor-MD).
- 16804.5 241007000-Greek flag tanker Eugenie (SVAZ3), requesting DSC safety tests with Capetown, Punta Arenas, Lyngby, USCG Honolulu, Charleville/Wiluna, Callao, USCG Miami, Manaus, Comodoro Rivadavia, and USCG New Orleans, starting at 2029 (Hugh Stegman-CA).
- 17151.2 NMC-USCG CAMSPACc Pt. Reyes, CA, FAX 48-hour surface forecast, at 1317 (Filippi-NJ).
- 17967.0 "15"-HFDL ground station Al Muharraqa, Bahrain, uplink to N419MC (Atlas Air B747 freighter), at 1212 (PPA-Netherlands).
- 18000.0 MAN-Possible Myanmar army, Mandalay, ALE link checks with KKT, Kikaito; parallel on 18500 and 19000, at 1130 (Waters-Australia).
- 18003.0 440189-USAF KC-10 #84-0189, ALE sounding at 1934 (MDMonitor-MD).
- 18560.0 BMF-Taippei Meteo, Taiwan, Chinese text fishery forecast in FAX, at 0924 (PPA-Netherlands).
- 20890.0 503-USCG HC-130H #1503, ALE sounding at 1423 (PPA-Netherlands).
- 21863.0 0001NHQCAP-CAP National Headquarters, AL, ALE sounding at 1810 (MDMonitor-MD).
- 24526.0 FC4FEM004 FEMA Region 4 Communications, probably GA, ALE sounding at 1359 (PPA-Netherlands).
- 24838.5 ABQSEC-COTHEN secondary remote transmitter, NM, ALE sounding at 2230 (MDMonitor-MD).
- 25910.0 Unid-Probable FM program audio of WBAP AM 820, Ft. Worth, TX, at 1740 (Filippi-NJ).
- 25940.0 KOA-Probable FM program audio of KOA AM 850, Denver, CO, at 1738 (Filippi-NJ).
- 28301.5 SP-Unknown fishing buoy locator beacon, CW tone and Morse identifier every 1.5 minutes, also heard beacons BX and LC, at 1229 (ALF-Germany).
- 29770.0 WQAP986-Bushwick Car Service, Brooklyn, NY, dispatch in English and Spanish, FM at 1321 (ALF-Germany).
- 29790.0 WQMA652-Van Pool Transportation, Fitchburg, MA, school bus drivers, FM at 1440 (ALF-Germany).
- 31080.0 WPXA428-Myrtle Avenue Car Service, Brooklyn, NY, Spanish and English dispatch, FM at 1507 (ALF-Germany).
- 31120.0 WPYJ841-Secco of Palmer Inc., MA, school bus drivers, FM at 1425 (ALF-Germany).



Bonobos, the Congo and another Mystery ALE Net

Sometimes you find some really unusual and fascinating services using digital systems on HF. This month is no different, where we cover a network run by Germany's Max Planck Institute (one of the foremost scientific research organizations in the world), another by the Congolese National Police, and (as usual) yet another ALE network that has so far defied positive identification.

❖ Max Planck Institute's HF Network

In the February 2012 edition of this column, I mentioned a mystery PacTOR network on 19241.5 kHz. Having recently acquired PacTOR-III capabilities, this network was one of the first that I tuned into. What I found was a tremendous amount of email forwarding, mostly involving two stations, DRA65 in Germany and 9SD56 in the Congo. Initially, I didn't see any login information and asked the Utility DXers Forum (UDXF) members if they knew the identity of the German station. Unsurprisingly (since the U.S. is one of the few places where such information is in the public domain), there were no answers. Eventually, after a few more days of listening, I saw this:

```
[SCSmail 1.2.0.10]---[9171B08B]---
Welcome DRA65-1 to SCSmail Server!
Welcome at the MPI-EVA in Leipzig/Germany.
Contact: noack@eva.mpg.de
```

Now it was pretty clear that the owner of the network was the Institute's department of Evolutionary Anthropology based in Leipzig. A quick search of their website showed a number of projects studying various primates deep in the jungles of the Democratic People's Republic of Congo. After a few more weeks of listening, I also saw another Congolese callsign, 9SD42, presumably yet another field unit checking in for email.

There was one more station, DEJO02, using the network, yet much less frequently than the Congolese stations. Here's an example of an email picked up by this station:

```
*** 1 new MSG for you Hallo Peter !
Hier ist DEJO02, Emil aus Kelheim / Donau
--Zeit der Eintracht ist vorbei, der Endspurt auf
die Wahlen hat begonnen. Joseph Kabila und
Etienne Tshisekedi haben am Wochenende
jeweils die Hochburgen des Gegners besucht:
Kabila war heute in Mbuji-Mayi, Hauptstadt
der Provinz Kasai-Oriental und Hochburg Tsh-
isekedis; Tshisekedi war in Kindu, Hauptstadt
der Provinz Maniema und Hochburg Kabilas.
Wst-Drcke n.nrt Fus dekl eher Mbuji-Mayi
Schauplatz von Scharmdersisckg-w
enter text for: dejo02
```

In this case, it's a report from another group in the Congo reporting on the outcome of the recent elections there. UDXF listener Michael Marten, saw my logging of this station and in an informative email told me that the callsign DEJO02 is licensed to "Humanitaere Hilfe Afrika" (Humanitarian Help for Africa), an NGO from Germany, founded by Emil Ott many years ago.

He also mentioned that the network is used by many other researchers and by a number of missionaries throughout the world, though I've yet to see any traffic other than from the stations mentioned above. Apparently the network also uses 10132.5 and 15792.5 kHz, though again, I've yet to hear traffic on these channels either. Anyway, certainly a great example of how a laptop, radio, PacTOR modem and software allows colleagues from far-away and remote places to keep in touch using HF.

❖ Congolese National Police

Staying with the African theme, I recently bumped into some ALE on 19490 kHz USB. The 5 figure identifiers like 01003 and 11002 were certainly suggestive of a Codan-based network, so I parked the receiver there and collected a few day's worth of activity. Here are all the identifiers I heard:

```
0100-3, 10
0200-2, 9
0300-2, 3, 4, 11, 16
0400-2, 4, 8, 13, 17, 21, 22, 23, 24
0500-5, 16, 21, 22, 24, 25, 26, 31
0600-2, 5, 9, 13, 14, 16, 17
0700-4, 5, 6, 12, 13, 16, 21, 25
0800-2, 4, 9, 11, 16, 17, 18
0900-2, 3, 4, 6, 8
1001-7
1100-3, 8, 12
1201-0, 16, 19
```

You can clearly see that there are twelve groups of identifiers and up to 30 or so units in each group. I was also lucky enough to be at the radio when two stations linked, but to my surprise the conversation took place on the lower sideband! Anyway, I collected about 10 minutes of audio which sounded like an African dialect mixed with French. The radios confirmed Codan manufacture by the characteristic 1200Hz PTT release tone. See the Resources section for the audio clip.

IRC user "linkz" in Lyon, France kindly transcribed the audio which certainly suggested that the origin was the Police National de Congo (PNC), the country's main police force. He was also able to find some documents on the French senate's website that showed the budgetary ap-

propriations for Codan radio equipment for the PNC.

Since the Congo has 12 administrative districts, it's quite likely that the Codan network structure reflects that organization. I have also since found that Codan 100bd/170 Hz selcals (compatible with CCIR493-3) are also used in place of the ALE, again a setup typical of Codan-based networks. In this case, those captured so far include:

1003, 3002, 4003, 14, 24, 6002, 9003, 11003

In other words, these are the same as the ALE identifiers without the leading zero if there is one. I also searched my database for other instances of these ALE identifiers and am now quite sure that there are at least three other channels in use: 5840, 13501 and 16263 kHz USB. Traffic is quite infrequent and quite weak, but quite a catch!

❖ The KM3 Mystery ALE Network

This network appears to have been building up activity since November 2011. The frequencies so far identified include:

4475, 5510, 5815.5, 7873, 8010, 8060, 8250, 9090, 10876, 11450, 12417, 14922kHz USB

This network looks like it is arranged to allow part NVIS (see MT January 2012 feature article) and part traditional long-haul operation. There is quite frequent operator chatter in Spanish as well as occasional MIL-STD-188-110A 2400bd high-speed modem traffic after the ALE command "FAXDATA CK" is sent. The modem traffic is encrypted and has not revealed any headers of note.

I collected a lot of chatter on the 9090 kHz channel, which my Peruvian colleague was surprised to be able to confirm as coming from either southern Peru or Northern Chile. Most of the chatter involves mentions of roads, trucking, cargo and such, making it a possibility that this is some customs or border guard operation; however, chatter is very disorganized and informal. Here are the identifiers noted so far:

111NO, 3KM, 5KM, BET, BLP, BOZAS, DPA, EIB, EPA, GPM, KM0, KM3, KM5, KN2, MPM, PFA, POD, QAQ

Any information as to the origin will be welcome. Until next time, enjoy your digital DXing.

RESOURCES

Max Planck Institute EVA Department
www.eva.mpg.de/primat
Congolese Police
dl.dropbox.com/u/301213/19490LSB.wav



ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

Kirk A. Kleinschmidt, NT0Z

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One Monitor to Rule Them All

As I write this, the first week of the new year has already brought three unprecedented and auspicious occurrences. For years I've been hoping to see a real California Christmas here in Minnesota, complete with dingy brown landscapes, absolutely no snow and plenty of sunshine. Well, this year I got my wish! Not only did we have a California Christmas, New Years was decidedly San Diego-like, too. If there's a plus side to the specter of global climate change, this is it!

The second holiday miracle is that I didn't get fat (fatter) over the "eating season." Third, despite the lack of snow, Santa still miraculously managed to bring me a gift I'd been imagining for at least as long as the California Christmas: an enormous, billboard-size monitor for my shack PC!

Beyond the practical reality that computers are now radios and radios are now computers (detailed in previous columns), over the past 20 years or so computers have taken ham radio in new directions and to new heights. They're now completely integral to the pursuit of our hobby,

even by casual hams.

Typical shack PCs are used for logging, packet spotting, antenna modeling, circuit design, digital modes, rig control, Internet-connected functions too numerous to mention, testing, measuring, keying, modulating, demodulating, awards tracking, interfacing, translating, compressing, equalizing, recording, license renewal, etc. Heck, PCs can even work each other on the air if we let them!

❖ PCs Front and Center

Like most hams, for the past 30+ years a transceiver always took center stage at my operating position. Because I needed to look at the display and fiddle with the knobs, it made sense. When I added a desktop or a laptop computer for logging or digital-mode operating, it always sat off to the left. I needed my right hand for writing and keying (still can't key with my left hand), but I can type passably with my left, so it works after a fashion.

Now, though, even if my main rig weren't a FLEX-1500 SDR, the PC is moving to center stage. Everything that happens in the shack pretty much revolves around the shack computer. It's absolutely required to run the SDR, but it also handles all the other stuff, too. I can even play solitaire on it when I'm waiting for a DXpedition to take calls from my call sign district!

My latest challenge is to find a reasonable way to move the PC's display to center stage and make the PC the acknowledged Master and Commander of the shack (and not just a handy afterthought). With so much software required for everyday operation (and let's not forget contesting!), keeping track of everything was (is) a real task.

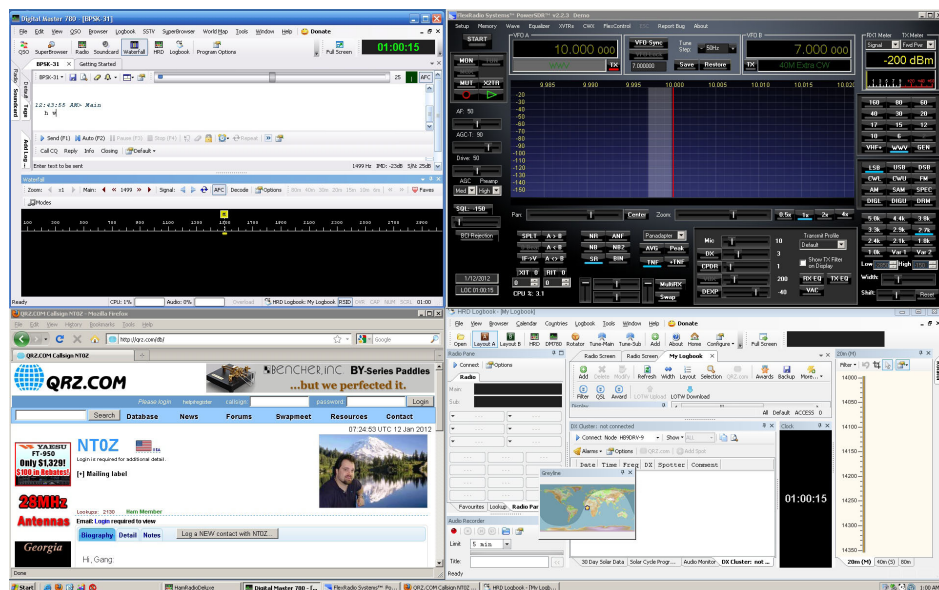
For the past several years I've used two 17-inch LCDs to display as much of the action as possible. As mentioned, they were positioned as "left," "leftier," and "leftest." During extended operating sessions I often get a sore neck from swiveling back and forth! Not cool!

Setting up multiple monitors in various flavors of Windows is pretty straightforward, but dragging program windows between screens, remembering where they are spatially, and efficiently moving the mouse between them as I move back and forth between PowerSDR (radio), DM780 (PSK and RTTY), HRD (logging), N3FJP's AC Log (more logging), Firefox (web browser), plus who knows what else, is tedious at best. In the next five to 20 years, computers will be powerful enough to manage most of these tasks on their own, without the micro-management required today. Until then, we experiment.

In my updated shack, a single, gigantic, hi-resolution monitor will be the center of attention, with the rest of my station hardware organized around it. After all, the FLEX-1500 really doesn't have any front-panel controls other than a power switch. It's a tiny black box that can park just about anywhere. I'll probably have to build a new shelf/console to support the new hardware arrangement. Once that's completed I will see once and for all whether it's better (for me, at least) to use several small monitors or one biggie. Until then, using the monitors in my experiment, let's talk about modern PC monitors with a nod to amateur radio use in the shack.

❖ Monitoring Times

My existing monitors are a pair of 17-inch HP LCDs that I purchased for \$50 each on craigslist. They're non-widescreen TN panels with fluorescent backlights and a 1280 x 1024 max resolution. The new monitor is a 28-inch Hanns.G (a Hannspre brand) that "Santa" bought from



Shown here is a full screen capture of my shack software as displayed on a 28-inch Hanns.G HZ281 LCD computer monitor. On sale, it's about \$250, making it arguably the largest "full HD" monitor that can still accurately display small type. The whopper display sports a healthy 1920 x 1200 widescreen resolution (which also look great on 24-inch LCDs if you have excellent eyesight). The next step up in resolution (2560 x 1600) costs at least \$1100 – nearly a kilobuck more.

Shown here (clockwise from the upper left) are DM780, PowerSDR, HRD's Logbook and a web browser. My challenge is to make all of my ham radio software usable on one center-mounted PC monitor. By selecting only desired features, some PC software can be configured for tiny screen sizes, but most cannot. PowerSDR, for example, could be much more compact, and FlexRadio has been hinting that its SDR software may soon sport a "tiny mode" for use on netbooks and laptops. Until all ham software has "mini modes," I may be forced to add extra monitors or win the lottery to make the jump to 2560 x 1600! See text.

www.newegg.com for \$239 (on sale, or so the card said). The biggie display also has a TN panel with fluorescent backlights, but it sports a healthy 1920 x 1200 widescreen resolution. As you can imagine, there are pluses and minuses for each approach.

Multiple monitor setups are more flexible, with panels that can be positioned here, there and everywhere, as needed. They're also really inexpensive. New 20-inch LCDs cost about \$100 on sale. Craigslist and swap-meet LCDs are in the \$20 to \$60 range, while older CRT monitors are free for the taking. People and businesses will simply give them to you if you'll agree to haul them away!

Multi-monitor installs also require your shack PC to have multiple video cards, dual-head video cards, or both (if you want three or four monitors). This isn't all that difficult with Windows, Linux or OSX, but the video cards have to "play nice" with each other, and newer video cards may require adapters to work with older displays, so some fiddling around may be required.

Single large monitors are one-stop shopping: one display, one video card (and, unfortunately, one point of failure). They're also huge and relatively expensive, although costs have fallen tremendously in the past three years. My first LCD was a 13-inch low-res model that retailed for \$1100 in 2001. At \$250 or so, the massive Hanns.G display costs a lot more than a pile of craigslist monitors, but in the big picture, it's a real bargain.

Being a value-conscious ham (which may be an oxymoron), I carefully chose that model based on screen size and cost. And I can still add extra monitors if necessary, although that would make my shack look like a Wall Street brokerage (PC displays totaling the size of a pool table with a transceiver the size of a house brick!) Don't laugh. It might happen!

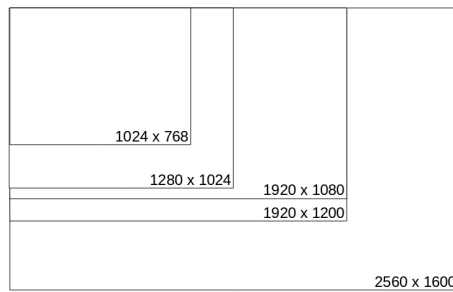
❖ Modern Specs

Modern monitors are mostly widescreen LCDs in sizes ranging from 17 to 24 inches. There are a few that are larger or smaller, but that's the sweet spot. Here are some other considerations:

Aspect ratio. CRT monitors from yesteryear (and some existing LCD models) have aspect ratios of 4:3. That is, the screen is four units wide by three units tall – a mostly-square rectangle. Most modern LCDs have aspect ratios of 16:9 or 16:10 – a pronounced rectangle. Many users prefer 4:3 monitors for word processing and productivity apps (logging?), and widescreen monitors for watching movies. Depending on the screen's resolution, aspect ratio differences can really help or hinder productivity. I will test this extensively during my monitor experiment.

Resolution. Aspect ratio broadly defines the shape of a monitor, while resolution roughly defines how much information it can display. My older HP LCDs have a resolution of 1280 x 1024, which means that, in 17 diagonal inches, the screen's image is 1280 pixels from left-to-right, and 1024 pixels from top-to-bottom. This resolution is shared by most 19-inch LCDs as well, so it's important to note that, in this comparison, no additional information is being displayed on the larger monitor because the number of pixels that make up the image is the same. What's changed is the size of each pixel, which can affect how "sharp" we perceive the image.

If we enlarge a 1280 x 1024 image to fit on



A comparison of PC screen sizes (and pixel dimensions) typically used for amateur radio applications. Although most screen resolutions seem puny compared to 2560 x 1600, remember that screens of that resolution are typically 30 inches that cost more than \$1000 and are as big as a TV! As long as you can use several at once, 17-inch monitors at 1280 x 1024 are the most affordable, costing as little as \$30 each on craigslist or at hamfests.

the screen at a drive-in movie theater, each pixel would be the size of a basketball, making the image appear quite fuzzy unless we're watching from 200 feet away. Similarly, some smart phones cram about the same number of pixels into 4-inch screens, making each pixel too small to see unless you're a 12-year-old kid with a magnifier. Apple calls these screens "retina displays," because the resolution is high enough (and the screen small enough) to produce "dot-less" images (like the retina in the human eye).

My point is that resolution without screen size is essentially meaningless! Don't be fooled. That's why large HDTVs make great gaming displays but poor text displays for PCs. They have the same number of pixels as a 20-inch display, but are two to four times the size. Big pixels = fuzzy text.

Most 4:3 monitors use 1280 x 1024 or 1600 x 1200 pixels (although older CRT types went as low as 800 x 600 or 640 x 480). Widescreen 16:9 monitors typically use 1366 x 768, 1600 x 900 or 1920 x 1080. Widescreen 16:10 monitors typically use 1440 x 900, 1680 x 1050, or 1920 x 1200 pixels.

Because flat-panel TVs use 16:9 displays, the industry has been focusing on this aspect ratio to the potential exclusion of all others. This is unfortunate, because the "extra" 120 pixels in the vertical dimension on modern jumbo screens can be very important for productivity apps, including ham radio apps. (Most large 16:9 monitors have resolutions of 1920 x 1080 pixels, while most large 16:10 models have resolutions of 1920 x 1200 pixels).

Considering resolution, size, aspect ratio, price and industry leanings, the present sweet spot in the market is a 23-24 inch LCD with a resolution of 1920 x 1080 (16:9). It's 16:9 and not 16:10, but with typical sale prices of \$135, that's a heckuva deal.

Really big monitors. My 28-inch monitor is absolutely the largest size panel that can still display small text at a resolution of 1920 x 1200 pixels. Most monitors in the 27-30 inch range sport crazy-high resolutions of 2560 x 1600 and require powerful dual-head video cards to drive them. I want one, of course, but I just don't want to pay for one!

Once \$3000 to \$5000, the most affordable monitor of its type is Dell's beautiful 30-incher, which costs about \$1200 on sale. Dell's 27-incher, with a slightly "diminished" resolution of 2560 x 1440, goes on sale for about \$800, but that's still

a big step above the Hanns.G's \$250 price point.

Contrast ratios. Most published contrast specs for modern LCDs are incorrect or outright fabrications of the marketing department! Other than backlight choices (below), you can safely ignore this when purchasing.

LED vs fluorescent backlights. LCDs don't "make their own light," so they require a "backlight" to produce a visible image. Fluorescent backlights got the ball rolling, but LED backlights are coming on strong. Both work well, but the scuttlebutt suggests that LEDs don't suffer the same failure rates that fluorescents do. But even if the LED backlights last forever, the screens themselves are still the same old LCDs, and they still fail at the same rate. LED backlights may tend to produce a bit more contrast and a bit less RFI, but because there is a ton of other circuitry in modern displays that can get RF-noisy, the jury's still out.

Glossy vs. matte. Glossy screens have a mirror-like reflective surface and are easier to clean. Matte screens are much less reflective but harder to clean. Take your pick.

TN vs IPS vs OLED. Inexpensive LCDs – the kind we're talking about here! – are usually "TN" panels, while expensive LCDs are usually "IPS" panels. Technical details aside, TN panels are easy and inexpensive to manufacture, while IPS panels are difficult and more expensive. IPS panels offer wider viewing angles and better color fidelity. TN panels are "close enough for government work" (and can look quite nice). Next-gen panels of the OLED variety – which make their own light – are hitting the market in higher volume, but are practical only on smart phone-size screens because of costs and manufacturing yields.

Connectors. Most LCDs – even the big ones – still have 15-pin VGA connectors, but the writing is on the wall and there are dark forces in play that want to eliminate them for good in favor of newer all-digital connectors such as DVI, Display Port and HDMI (which were mostly created for the HDTV market but are now common in newer PCs). Most DVI ports on PCs and video cards can also output analog VGA signals through an inexpensive adapter, but the newest DVI ports are all digital (like Display Port and HDMI). Each can offer excellent image quality, but your video sources and your monitors have to "speak" the same languages. Check it out before you buy!

Tidbits. Consider mounting large monitors on articulated arms to get them up off the table. This frees a lot of space underneath that can be used to store logbooks, keyboards, etc.

Some monitors have built-in speakers, but the sound quality is usually tinny, shrill and poor.

Don't touch your LCD with fingers, pens, pointers, etc. Ever! And be sure to cover your mouth when you sneeze or cough (good advice even if no monitors are present!). LCDs should be cleaned only with special LCD cleaning cloths and/or solutions. Don't even think about using household cleaners, or you'll be sorry!

Most modern LCDs don't have built-in signal cables, which means you can use high-quality cables with molded-on RF chokes if necessary to knock down monitor RFI. Use snap-on ferrite chokes if necessary.

Will a PC or a PC display take center stage in your shack? I'm betting that, sooner or later, it will. Good luck to us all...



Free-to-Air Satellite Revisited and AM DX

The *Beginner's Corner* for the previous two issues dealt with a review of the new Manhattan RS1933 Free-to-Air (FTA) satellite receiver and other C and Ku-band satellite TV issues. One reader's comments required some further discussion of the subject.

❖ Return to TVRO

MT reader Mike Hoblinski N6IMF from California wrote, "I enjoyed your article on the Manhattan receiver. I was considering setting up an FTA system to experiment with and just want to get something basic setup to see what it's all about. But, I too always look for more flexibility. I ran across some satellite TV cards that come in both PCI and PVI-e versions. I am sure there are many others like them. My first goal is to get a basic system up and running. The Manhattan looks good because my monitor has extra HDMI port..."

Mike notes, "I am not completely new to satellite TV. I remember as a teenager I saved up the money for a C-band system... [and] my dad was all for putting it in. He even tore out the avocado tree to make way for the dish. He poured the concrete and dug the ditch for the cables too!" Mike noted that he started out with a heavy, multi-piece, ten foot fiberglass dish and eventually upgraded to a twelve foot Paracclipse mesh dish.



DVB-S2 PCI3 Free-to-Air PCI-based FTA satellite TV receiver card (\$100). (Courtesy: Sadoun.com)

PCI-based FTA satellite TV cards are intended to go in an empty card slot in a typical desk top computer. About the only reason to consider such a receiver would be cost; they tend to be a little under \$100 compared with \$150-200 for a good stand-alone FTA receiver.

The difficulty most users have with such re-

ceivers is compatibility issues between the device and their personal computer. To downlink MPEG2 – or harder yet, MPEG4 – HD video via satellite through the card for display on your monitor requires a very robust computer. According to one manufacturer a minimum PC would use Windows XP SP2 (or later) or Vista; Microsoft Direct X9.0C or later; a Pentium 2.4 GHz CPU or higher, 256 MB Ram or more; a VGA card with at least 32 MB memory and DXVA acceleration, in addition to the usual sound card and free PCI slot. Other manufacturers may state lower requirements, but there's no guarantee that it will work for you. And, you'll still need the dish, LNBF and cable to go from the dish to your computer.

Most dealers I checked with online will not offer tech support for such receivers but refer you instead to satellite-TV related forums where many questions go unanswered or are met with additional questions and referrals to other sites to download additional programs to cope with the issues. And, dealers in these receivers offer a very narrow window for returns if they offer returns at all. If you are totally computer savvy it could be a fun way to while away the days delving into the problems and trying to solve them. But, if you'd rather be watching and listening to FTA satellite, it's so much easier (and probably cheaper in the long run) to buy a complete system (most are under \$200).

Another advantage to the complete system is that you won't need to have your computer on just to listen to FTA radio, and you won't be limited to your computer's monitor to watch FTA TV. I can assure you that watching CBC-TV in HD or NASA-HD on a 42 inch Sony TV is awesome. Also, if you get bitten by the FTA bug, you'll want to install a DiSEqC (Digital Satellite Equipment Control) switch (\$8) out at your dish farm to be able to switch from dish to dish.

Mike had one further question: "Have you ever seen anybody use a 90 cm offset or 1 meter dish to receive C-band satellites?" He mentioned that shipping on such a dish seemed expensive.

The reason shipping is high for a 1 meter dish is that it has to be shipped as an oversized package and therefore the higher shipping rate despite the fact that they are actually light weight dishes. Shipping to the West Coast from Ohio will incur a hefty rate even using UPS Ground. You might try to find a supplier nearer where you live.

I have successfully received MPEG2 channels on a dish as small as 48 inches, but the dish was heavy-gauge spun aluminum with a very high degree of surface accuracy. Most Ku-band dishes are very thin steel or aluminum and can be easily bent and are subject to warping, which diminishes

reception capabilities. Others are made with a thin wire mesh embedded in plastic and tend to be more durable.

Ninety centimeters is about 35.5 inches which is quite small for C-band reception. You'll find that there are several difficulties to overcome when trying to pickup digital C-band signals with such a small dish. The first problem is that satellite transponders have varying power output depending on the age of the satellite, amount of traffic on the transponder, and the kind of traffic that's being transmitted. In general, C-band satellites transmit less power than Ku-band satellites (which in turn transmit considerably less power than the DBS satellites used by DirecTV or DISH Network), making it that much harder for C-band reception.

Furthermore, signals falls on the Earth's curved surface at different angles, depending on your location with respect to the position of the satellite in the arc and whether or not the transponder is transmitting a hemispheric (broad) beam or a spot (narrow) beam. C-band satellite frequencies fall in the same band as terrestrially-based point-to-point microwave, which is still used in many parts of the U.S. Ingress from such a source is called terrestrial interference (TI) and can disrupt a digital satellite signal to the point where it is impossible to receive. TI does not disrupt Ku-band signals.



Channel Master 84E 40 inch offset fed Ku-band dish (\$60) (Courtesy: ImpaktProducts.com)

Nonetheless, it may be possible to receive C-band FTA satellite signals on a dish as small as 40 inches, roughly 101.5 cm. I talked with Bill Benner at Impakt Products, a national TVRO supplier based in Ohio (www.impactproducts.com), about small dish C-band reception. They offer the 40 inch Channel Master 84E offset fed dish (\$60) with a special conical C-band scalar ring with offset mount (\$13) and Eagle Aspen C-band LNBF (\$25). I was told that some customers

Conical scalar ring with offset feed mount replaces traditional scalar ring to improve reception on smaller aperture C-band dishes. (Courtesy: ImpaktProducts.com)



have had limited C-band reception with this setup. Apparently, the special conical ring adapter, which replaces the typical scalar ring, helps direct more C-band energy directly into the throat of the feed horn.

Eagle Aspen C-band LNBF (\$25) (Courtesy: ImpaktProducts.com)



You could also use the C/Ku-band feed I tested in last month's issue. Unfortunately, 40 inches is just a tad over the 1 meter maximum allowed under FCC OTARD (Over the Air Reception Devices) rules to escape the wrath of HOA (Home Owners Association) cops, if they bothered to bring along a tape measure (and you just know they would).

❖ Doug's AM Challenge

In Doug Smith's *Broadcast Bandscan* column in February, he noted that both 690 and 940 kHz were currently "unoccupied"; that the full-power stations assigned to those frequencies were not yet on the air. He asked readers to see what kind of low power DX they could find on those frequencies until the new licensees take over. I decided to take up Doug's challenge.

Using my Kenwood TS-140s with 480 foot horizontal loop tuned to 690 kHz during the daytime, I could hear WELD Fisher, West Virginia (3 kW daytime) at a distance of about 90 miles. Just before sundown, I could hear WOKV, Jacksonville, Florida (570 miles) with a strong signal from its non-directional daytime antenna and 50 kW transmitter.

At night, once WOKV reduced power to 25 kW and went directional, sending its signal mostly out to the Atlantic, it was gone. But, switching to the Sangean HDT-1X and tunable loop, I could just hear CMEC, a 50 kW day/night station out of Santa Clara, Cuba. Other than that, 690 was dominated by IBOC hash from WLW's HD-Radio signal on 700.

How strong was WLW's signal? The dial graphic on this page, taken from my Sangean receiver (using the tunable AM loop antenna), shows WLW in full HD reception with call sign and web address showing up in the text display along with the HD logo and signal strength indicator.

I had much better luck on 940 kHz which netted WMAC, Macon, Georgia and WMIX, Mt. Vernon, Illinois. Oddly, both are almost exactly the same distance (just under 500 miles) from my location. I got positive IDs on both (WMAC was airing a University of Georgia Bulldogs men's basketball game and WMIX was airing Christmas music the week before Christmas) as they ebbed and flowed nicely between them.

The interesting thing was that while WMAC has a nighttime power limit of 10 kW, their five

tower beam heads them off in nearly the opposite direction from where I am. WMIX's tower arrangement has their signal equally divided with the eastern lobe of their signal pointed directly at me, but their nighttime power output is only 1.5 kW. Pretty good AM DX!

❖ More AM HD DX Intrigue

In the January issue I wrote a feature about AM radio and the problems with receiving AM-HD signals both locally and as DX. While taking the Doug Smith AM challenge, as mentioned, I got a nice lock on the HD signal from both WLW and WCBS. While both lasted some few minutes, I got a much longer lock throughout the evening on Boston's WBZ-AM 1030 kHz. The photo shows the call sign, HD logo, signal strength and slogan, "WBZ News Radio 1030." I also got a partial lock on WFAN, 660 kHz New York City.

I wrote emails to the Chief Engineers of all three stations and sent each a photo of their station on the Sangean display as seen here. I asked each if they had received similar reports and if so, from what distance and using what equipment.

I received a reply from only one, Mark Manuelian, from WBZ who wrote, "This is very unusual. The selective fading that usually occurs on skywave makes HD DXing difficult. I have had only one other report that far away (December, 2009). I like the Sangean tuner, have a couple of them myself."

Mark attached the email he had received from that reception report which was from the Chief Engineer of a group of FM stations in Michigan. The report noted that the listener had used a Radioscopy HD-100 with a Terk AM-1000 tunable loop antenna and that HD reception lasted only 10 seconds. Over the next few days I continued to monitor the band for AM HD signals and consistently got a lock for several minutes on WBZ.

So, how about it *Beginner's Corner* readers: Got AM HD DX? Let me know, and send pictures!



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PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Alternative Talk Radio

Welcome to another edition of Programming Spotlight. This month we shine the spotlight on a few alternative sources of radio programming and talk radio from around the world. We'll make a quick stop in Greece and then look at youtube as a source of radio programming. Yeah, really!

Lots to cover this month, so let's get to it.

❖ Alternative Programming Sources

There is no doubt that shortwave as a programming source is getting more problematic as the months and years go by. There is still lots of quality programming on shortwave, but much of it has migrated to other platforms. Programming content is what I have always been interested in; therefore, although I like the romance of listening to shortwave, if I can get a quality program via the Internet or AM radio, I am just as happy.

Not so long ago, one could sit on a BBC frequency like 5975 or 6175 kHz for most of the evening, hearing a wide variety of quality programming from London. Today many National Public Radio stations across the United States carry BBC programming for many hours each day. For instance, my local NPR station, WNED 970 in Buffalo, NY carries the BBC World Service from 10pm-5am EST daily. WXXI 1370 in Rochester, NY carries the BBC from midnight to 5am ET every day.



Many NPR stations across the country seem to do this, so check your local listings, if you are looking for an overnight BBC fix. Some stations also carry BBC, CBC and other international programming at other times. While I am no longer the night crawler I once was, when I have to be up late at night, the BBC is a really good companion!

And, while we are on the topic of PBS, I get KCTS as part of my cable package of time shifting stations. Weekdays at 8:30 am Eastern, they carry a 30 minute newscast from NHK in Tokyo.; most interesting, especially after the earthquake/tsunami and subsequent nuclear disaster.

Recently, I rediscovered the World Radio Network online. This is a great source of radio programming from around the world. I first heard it when I attended an ODXA Radio Fest in 1995 or 96, held at the CBC building in Toronto. It was being piped into one of the rooms and I was captivated. That was the early days of the Inter-

net and the idea that one would have access to streaming audio on demand was still a fantasy. I got my WRN fix via the CBC Overnight program for the next few years. When I finally joined the 21st Century here at home and got hooked up to the Internet, I fell in love with the WRN website and the programming on offer. For no apparent reason, I have neglected this resource for the past couple of years. But I have recently been giving them a listen on a regular basis.




Spending an afternoon with WRN takes one around the world more than a few times. I like to leave the North American stream on, while I do other things. In the course of the afternoon, I travel to diverse places like Prague, Sweden, New Zealand, Poland, Korea, Israel, Romania and Australia. Three or four hours spent listening can give one a really good overview of what is going on in the world. The variety and scope of the programming is wonderful.

Other times, it's fun to listen to one of the language feeds, such as Russian or French. I find that it is good practice to listen to these and try to follow along.

Every once in a while you stumble onto a really good program this way, and discover something new. Today, as I write this, I heard a fascinating history program from Prague. The program discussed Gustav Husak, the late Czechoslovak president. It seems his legacy is being re-examined. Shortwave listeners from the era will remember Husak as the party boss, who helped re-establish the control of the Communist Party after the abortive Prague Spring and subsequent Soviet invasion. It was under Husak that dissidents like Vaclav Havel were imprisoned.

He is seen now as almost a tragic figure. He was a reformist who was forced by circumstance to quell the reformist tendencies in his country. He figured that if he did Moscow's bidding, they would give him a free hand to run the country. Ultimately he was wrong. His rule began and ended with reform preceded by Dubcek and succeeded by Havel. This program put the broadcasting output of Radio Prague and much of the history of the Czechoslovakia of the 1970s and 1980s in perspective.

The World Radio Network presents programming like this every day. It is well worth investigating. Listen online at  www.wrn.org or one can try listening to WRMI on 9955 kHz. WRMI rebroadcasts the World Radio Net-

work from 0500-0630 UTC, Tuesday - Saturday; from 0700-0900, 1100-1200, and 1700-2300 UTC Monday - Friday. Between the limitations of my listening location, and the poor signal of WRMI, I have found it a real challenge to try to listen this way. Nevertheless, sometimes it should be doable.

Whether you listen to WRMI on your radio or online at www.wrmi.net, WRMI has an interesting lineup of programs as well. For several hours each day, it relays the World Radio Network. At other times, it carries programming from stations that have otherwise left shortwave, such as Radio Sweden, Radio Slovakia International, Radio Prague; and others like Vatican Radio and many popular DX programs. Listen to these on 9955 kHz at the following times: Radio Sweden at 0230 UTC Tuesday - Thursday; Radio Slovakia International at 0130 UTC Monday - Friday; Radio Prague at 0700 UTC Saturday and Sunday, 1000 UTC Monday- Saturday, and Daily at 1500 UTC. These programs will also pop up in the WRN programming blocks.

❖ Talk is Cheap

Sometimes it is also very interesting, often controversial and occasionally funny. One can find all kinds of talk radio all over the world. It's sometimes interesting to hear talk radio – or talk-back, as it's often known abroad – from distant parts of the globe.

Call-in shows on shortwave were a novelty in the 1980s, a function of the high cost of long-distance telephone calls at the time. Apartheid era Radio RSA used to have an annual call-in show on New Year's Eve which was something of a tradition at the time. HCJB used to have the odd call-in show too. And I recall participating in a one-off call-in show on WRNO in the mid 1980s.

In the late 1980s, Rush Limbaugh revolutionized talk radio for better or worse (one's view dependent on where one sits on the political spectrum). Like him or not, he became a radio phenomenon, spawning dozens of Rush wannabes all across the dial, in much the same way that Art Bell inspired a series of copycats, too.

While Talk Radio is often political, and often biased to the right or to the left, there are other types of talk radio, too.

The aforementioned Art Bell and his successor George Noory have ruled the night time airwaves for many years, discussing the spooky, the scientific, the strange and the weird. Whether they are discussing serious NASA science, or wacky pseudo-scientific subjects, it is often interesting and always entertaining. I find any program

featuring frequent guest Dr Michio Kaku to be fascinating. Any time you are feeling sleepless, you can always find a station somewhere carrying this program overnight. www.coasttocoastam.com/

NPR in the U.S. is home to Talk of the Nation, one of the more cerebral call-in shows on the airwaves. Heard weekdays usually between 2 and 4 pm it is always interesting often looking at subjects not often covered. Recent programs have looked at such topics as John Brown of Harper's Ferry fame, the Arab Spring and its reverberations, political fact checking under fire and Sri Lankan cooking! Check it out on your local NPR radio station. There is a handy station finder at the Talk of the Nation website at www.npr.org/programs/talk-of-the-nation/ And, if you can't listen live, many past programs are archived online.

Canada's long-running national talk show is heard on Sunday afternoons. Heard across the nation on CBC Radio One, Cross Canada Checkup is hosted by the one and only Rex Murphy.

"On occasions in the past, the program has gone to air as Cross-Continent Checkup by involving a radio network in at least one other foreign country, such as National Public Radio in the United States or the CBC's own Radio Canada International, and taking calls from English-speaking callers in all involved countries. In each case, callers generally call a toll-free number in their own country. Checkup, nevertheless, often receives calls from callers outside Canada." (Wikipedia)

As a personal opinion, I have always believed that to be a truly nationwide program in Canada, it should also be heard on Radio-Canada (the French CBC) with simultaneous translation. Would that be too cumbersome? I don't know. But lots of programs on both television and radio in Canada use simultaneous translation from English to French and vice versa.

While the program has been on the air since 1965 (!), Rex Murphy has been the best host by far. A Rhodes Scholar, he is witty, charming, and a master of the English language. His political commentaries on Canadian television are legendary. Check up on Cross Canada Checkup at 4 pm Eastern across the country, 2100 UTC on 9625 kHz, and the CBC Radio One network, online at www.cbc.ca/radio.

Australia has some interesting talkback programming. Over the years I have listened to private broadcasters like 3AW in Melbourne and 6PR in Perth, online. Talk radio is a rough and tumble experience there, but it is also very entertaining. Oddly enough, many of the topics discussed on Australian talkback programs sound like they would be right at home on any station here in Canada or the United States. Either many of the issues that concern North Americans are also of concern to Australians, or the stations employ the same radio consultants.

One thing I found particularly interesting was how regularly Australian politicians will guest on these shows and take calls from citizens. Even the Prime Minister has taken a turn on these shows at times. Aside from election campaigns, it seems to me that Canadian politicians tend to avoid such a program like the plague. However, in Australia it seems to be the norm and is expected

of the leaders. They often get blasted by callers over one decision or another, but it's all part of the game there. You can hear 3AW at www.3aw.com.au and 6PR at www.6pr.com.au

❖ It's All Greek to Me

Greece is a country that has been in the news a lot in recent months, due to the deep financial crisis that nation finds itself in. A nation rich in history and culture, it has long been an easy catch with a shortwave radio. Most evenings, broadcasts boom in on 9420 kHz, featuring a wide, eclectic mix of music.

There is a haunting quality to the Greek music heard here. One can enjoy this frequency for hours, and I often use it as quiet background music when I am working or reading. One might hear traditional Greek music, or smooth jazz or any number of styles and types of music. It's always a treat, assuming the signal is good on a given night.

Just shy of 11 million people live in Greece, with 99% speaking the Greek language. Several million speak it outside of Greece as a first or second language. Greek words have been widely adopted into other languages, including English, such as mathematics, physics, astronomy, democracy, philosophy and athletics. And, of course, Greece gave us the Olympics. Greek is one of the oldest written languages in the world going back some 34 centuries!

Give the Voice of Greece a listen some evening, it's a treat!

❖ Youtube

Youtube, the ubiquitous video website, is more than just music videos, cute animals and funny clips. There are new videos being added all the time with a direct connection to radio. For instance, there are videos showing radio

programs and personalities of the past (and the sometimes rather primitive equipment with which they performed their vocal magic). There are clips of famous and not so famous radio broadcasts of the past and present.

One can spend hours looking through these clips (I have!). Just recently I came across clips of Joe Adamov and Boris Belitsky from Radio Moscow. People often share videos featuring their DX catches, or their shacks. These are always interesting. Talks from the annual Winter SWL Fest find their way here as well.

There are items of historical interest, such as the Hindenburg Disaster in 1937 with Herbert Morrison's legendary radio commentary. www.youtube.com/watch?v=xiAT9xvTVKI

Then there is the chilling video recreation of the last Morse code broadcast from Corregidor in the Philippines before they surrendered to the Japanese in 1942. www.youtube.com/



[watch?v=viCAX8WupTY](http://www.youtube.com/watch?v=viCAX8WupTY)

As noted by Mike Terry on Facebook and elsewhere, someone has posted a fascinating record album from 1961 about Radio Moscow and its broadcasts in English. Entitled Radio Moscow and the Western Hemisphere, it is an interesting flashback to the Cold War era. www.youtube.com/watch?v=ODH1yjmDon8

Still another "video" contained Radio Moscow's coverage of protests on the last anniversary of the Bolshevik Revolution in the USSR, November 7, 1991. This includes the one and only Vasily Strelnikov doing a David Letterman style Top Ten list, about the top ten dreams/nightmares of the Soviet leadership, which is hilarious. You can hear it at www.youtube.com/watch?v=5eSjnILFYwE

Ever wonder what a radio studio looks like? Q, the CBC Radio arts program hosted by Jian Ghomeshi each weekday, has its own YouTube channel, on which you will find dozens if not hundreds of videos of interviews and musical performances that have taken place on the show. It's actually pretty cool to see a radio show in progress, and to see the inner workings of the studio. One can peek behind the curtain, so to speak, and see the wizard at work. As a lifelong fan of radio it's fun to watch these.

How about a blast from the past? Here is a video of DJ Don Shuster at radio station WWWW on Dec 26 1970. It is a glimpse of how radio was made 40 years ago. www.youtube.com/watch?v=biG8jY3CDMg&feature=youtu.be

Poke around YouTube sometime, you never quite know what you might turn up!

NASB

National Association of Shortwave Broadcasters

Representing the privately-owned shortwave stations in the USA

- Find links to all of our members at www.shortwave.org
- Take the NASB Shortwave Listener Survey and get a free subscription to the NASB Newsletter. www.surveymonkey.com/s/6LRVLJ7
- Listen to "The Voice of the NASB" on HCJB's DX Party Line on WRMI's 9955 kHz. Visit www.wrmi.net for schedule
- NASB is a member of the HFCC (High Frequency Coordination Conference) and the DRM (Digital Radio Mondiale) Consortium

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

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ODXA Announces New QSL Manager

Ontario DX Association has been appointed QSL Manager for radio stations CKMX Classic Country AM 1060 kHz and CFVP Shortwave on 6030 kHz. Serving as the QSL Manager is Harold Sellers. QSL reports for either station will be verified for accurate program details. Send E-reports to: QSLCalgary@gmail.com. or to: Harold Sellers, 3211 Centennial Drive, Apt. 23, Vernon, British Columbia V1T 2T8, Canada. In the near future ODXA will permit report submissions at www.odxa.on.ca.

DX Window has announced two new Peruvian stations that hobbyists have been monitoring. **Aroma Café Radio** located in Pichanaki, has been heard on 6059 kHz signing on at 1105 UTC with the Peruvian national anthem and it has been audible to 1230 UTC.

The station has also been heard at 1515, 1850, 2100, 2130-2200 sign-off. Postal address: Av. Marginal, salida a Satipo, Centro Médico Virgen de Guadalupe, Miguel Grau 120 Pichanaki, Chanchamayo, Junín, Peru.

Radio Universal, a new station from Cusco, has been identifying as "Por Radio Universal" monitored on 6088 kHz from 0940-1130 and

2330-0015 UTC. Radio Universal broadcast as OCZ-7C FM 103.3 MHz, OCX-7Q 1150 kHz, and OAZ-7C 6090 kHz. A prepared QSL card and mint stamps could garner a verification sent to: José Santo Chocano G-11 Urb. Santa Mónica, distrito de Wanchaq, Cusco, Peru. Streaming audio at: <http://radiouniversal-cusco.com.pe/>

Bill Plum's DX Stamp Service offers a reliable and affordable service to shortwave and amateur radio operators. Bill's service is the number one source for purchasing mint stamps to enclose within your reception reports and DX supplies. For a current price list, send your email request to Bill at plumdx@msn.com. Monthly specials are posted on the first of each month on my Shortwave Central blog at <http://mt-shortwave.blogspot.com/>



AMATEUR RADIO

République de Guinée, 3XY1D, 24.9 MHz. Full data color photo QSL card of DXpedition participants at the Hotel Mariador Palace, Guinea. Received in 32 days for \$2.00US and nested Euro envelope from Bill Plum's DX Stamp Service. QSL Manager address: DL7UFR Frank Rutter, Box 700242, 10322 Berlin, Germany (Larry Van Horn, NC).

United States, The Mighty Eighth Air Force Museum B-17: City of Savannah, WW2COS, 7.268 MHz. Full data color photo QSL card of B-17 City of Savannah planes and crew. Museum includes the stories of courage, character and patriotism by the men and women of the Eighth Air Force from World War II to the present. Received in two weeks for a SASE to: Mighty Eighth Air Force Museum Radio Club, 7611 Central Avenue, Savannah, GA 31406-6423 USA (Van Horn).

AUSTRALIA

Radio Australia, 6140 kHz via Singapore. Full data Radio Australia in Touch With the World card, signed by Roger Broadbent. Received in seven months for E-report to: broadbent.roger@abc.net.au (Edward Kusalik, Alberta, Canada).

CANADA

CHU Ottawa/Time & Frequency Station 7850 kHz. Classic CHU card unsigned. Received in 36 days for an E-report to: radio.chu@nrc.ca. Station address: Institute for National Measurement Standards, National Research Council of Canada (NRC-INMS), 1200 Montreal Road, Bldg M-36, Ottawa, Ontario, K1A 0R6, Canada (Rudolf Grimm, São Bernardo SP, Brazil).

GERMANY

HCJB via Weenermoor, Germany 3995 kHz. Full data E-QSL/PDF from Horst Rosiak. Received in two days for report to deutsche@andestimme.org (N. Marabello, Italy/playdx).

Ecuador postal address: Radio HCJB, Die Stimme der Anden, Postfach 17-17-691, Quito, Ecuador. Website: www.radiohcbj.org

MADAGASCAR

Deutsche Welle relay via Talata-Volondry, 17800 kHz. Full data Twenty Years of Unity QSL card, with site notation, unsigned. Received in 22 days. Station address: D-53110 Bonn, Germany (Kusalik). Streaming audio www.dw-world.de

MEDIUM WAVE

KCJB, 910 kHz AM. 91 Country. Full data verification letter, signed by Dave Lehner-"Old Geezer." Received in 87 days for a CD report. Station address: 1000 20th Avenue SW, Minot, ND 58701 USA (Patrick Martin, Seaside, OR). Streaming audio link via www.iheart.com/#/live/5076/?autoplay=true

KXEL, 1540 kHz AM. Newstalk 1540. Full data verification letter, signed by Mark Shumacher-Chief Engineer, plus station info and coverage map. Received in 14 days for an AM report and a SASE. Station address: 514 Jefferson Street, Waterloo, IA 50701 USA (Frank Halaburak, Montreal, Canada). Website: www.kxel.com/

WWVA, 1170 kHz AM. The Big One. Full data QSL map/logo card, signed by Jack Rees-Chief Engineer. Received in four months from follow-up report. Station address: 1015 Main Street, Wheeling, WV 26003 USA (Halaburak). Website: www.wwva.com.

PAPUA NEW GUINEA

Radio Fly, 3915, 5960 kHz. Full data (except for incorrect year) Ok Tedi Mining logo card. Accompanying form letter signed by James Kaltobie. Received in 14 days after follow-up email to Mr. Kaltobie. QSL address: Ok Tedi Mining Ltd., P.O. Box 1, Tabubil, Western Province, Papua New Guinea (John Wilkins,

Wheat Ridge, CO). You Tube audio/video link www.youtube.com/watch?v=UNP-thazil E-QSL via Francis Tekei francis.tekei@oktedi.com (Kusalik).

SRI LANKA

Sri Lanka Broadcasting Corporation, 11905 kHz via Trincomalee. Full data QSL card, unsigned. Received in 42 days for an English report and \$2.00US. Station address: P.O. Box 574, Colombo 7, Sri Lanka (Frank Hillton, Charleston, SC). Streaming audio www.slbk.lk/

UTILITY

France, IS-NDB Ajaccio/Campo del Oro, 341 kHz. Full data prepared QSL verified with signature and stamp. Received in 28 days for a utility report and a prepared card. QSL address: Ministère de l'Équipement, des Transports et du Tourisme, Direction Generale de l'Aviation Civile, Direction de l'Aviation Civile Sud Est, Maintenance Régionale Ajaccio, Col d'Aspretto, 20090 Ajaccio, France (Patrick Robic, Austria/UDXF).

Iceland, Iceland Radio, 8891 kHz. Full data prepared QSL card. Received in nine days for a utility report and a prepared QSL card. QSL address: Isavia ohf., Flugturninum Reykjavíkurflugvelli, Reykjavík, Iceland (Robic).

USA

Radio Martí via Greenville, NC 6030 kHz. Full data Greenville antenna scene card, with no mention of Radio Martí. Signed by Chief Engineer. Received in one week. QSL address: Voice of America Transmitting Station, 3913 VOA Site "B" Road, Grimesland, NC 27837-8977 USA (Wendel Craighead, Prairie Village, KS).

WTWW, 5755 kHz. E-QSL in one day for E-report to George McClinton, President/Manager at George@wtww.us. Station address: 1784 West Northfield Blvd., Murfreesboro, TN 37129 USA (Luca Botto Fiora, Italy/playdx).



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 Standard Time) 5, 6, 7 or 8 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

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

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:

| | |
|--------------|------------------------|
| <u>Codes</u> | |
| 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.

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

"MISSING" LANGUAGES?

A **FREE** download to MTXpress subscribers, the online MTXtra Shortwave Guide is 115+ pages of combined language schedules, sorted by time. Print subscribers: add the MTXtra SW Guide to your subscription for only \$11.95. Call **1-800-438-8155** or visit **www.monitoringtimes.com** to learn how.

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Additional Contributors to This Month's Shortwave Guide:

Thank You to ...

ADXC; BCL News; Cumbre DX; DSWCI-DBS 2011; DSWCI-DX Window; DX Asia; DX India; HFCC; Hard-Core DX; JPNpremium; DX Mix News 708-713; BC-DX WWDXC Top News; Nagova DX Circle.

A.J. Janitschek/Radio Free Asia, Washington, DC; Alokesh Gupta, New Delhi, India; Alan Roe, Brenda Constantino/ WYFR; Ehard Goddinjn, Belgium; Elena Osipova/Voice of Russia; Ivo Ivanov, Bulgaria; Rachel Baughn/MT; Rudolph Grimm, São Bernardo, Brazil; Sean Gilbert UK/ WRTH 2012; Victor A. Goonetilleke, Sri Lanka; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE GUIDE

0000 UTC - 7PM EST / 6PM CST / 4PM PST

| | | | | |
|------|------|---|----------|---------|
| 0000 | 0030 | Egypt, R Cairo | 6270na | |
| 0000 | 0030 | USA, BBG/Voice of America | 7560as | |
| 0000 | 0045 | India, All India R/External Svc | 6055as | 7305as |
| | | 11645as | 13605as | |
| 0000 | 0045 | USA, WYFR/Family R Worldwide | | 11720ca |
| 0000 | 0057 | China, China R International | 6005as | 6020na |
| | | 6180as | 7350eu | 7425as |
| | | 9570as | 11650as | 11790as |
| 0000 | 0059 | Canada, R Canada International | | 9880as |
| 0000 | 0100 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9660pa | 12080pa |
| | | 13690va | 15240va | 17715va |
| | | 17795va | | |
| 0000 | 0100 | Bahrain, R 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 | Cuba, R Havana Cuba | 5040ca | |
| 0000 | 0100 | Malaysia, RTM Kajang/Traxx FM | | 7295do |
| 0000 | 0100 | Micronesia, V6MP/Cross R/Pohnpei | | 4755 as |
| 0000 | 0100 | New Zealand, R New Zealand Intl | | 15720pa |
| 0000 | 0100 | New Zealand, R New Zealand Intl | | 17675pa |
| 0000 | 0100 | Russia, Voice of Russia | 7250va | |
| 0000 | 0100 | Spain, R Exterior de Espana | 6055na | |
| 0000 | 0100 | Thailand, R Thailand World Svc | | 13745na |
| 0000 | 0100 | UK, BBC World Service | 6195as | 9410as |
| | | 9740as | 12095as | 13725as |
| 0000 | 0100 | USA, Amer Forces Network/AFRTS | | 4319usb |
| | | 5446usb | 5765usb | 7812usb |
| | | 12759usb | 13362usb | |
| 0000 | 0100 | USA, EWTN/WEWN Irontdale AL | | 11520me |
| 0000 | 0100 | USA, FBN/WTJC Newport NC | | 9370na |
| 0000 | 0100 | USA, WBCQ Monticello ME | 5110am | |
| 0000 | 0100 | USA, WBCQ Monticello ME | 9330am | |
| 0000 | 0100 | USA, WBCQ Monticello ME | 7490am | |
| 0000 | 0100 | USA, WHRI Cypress Creek SC | | 7385ca |
| 0000 | 0100 | USA, WINB Red Lion PA | 9265ca | |
| 0000 | 0100 | USA, WTWW Lebanon TN | 5080am | 5755am |
| | | 12105na | | |
| 0000 | 0100 | USA, WWCR Nashville TN | 3195eu | 5070af |
| | | 9980af | 13845eu | |
| 0000 | 0100 | USA, WWRB Manchester TN | 3185va | 3215na |
| | | 5050va | 5745va | |
| 0000 | 0100 | USA, WYFR/Family R Worldwide | | 6115va |
| | | 6155ca | 7360sa | 7395sa |
| 0000 | 0100 | Zambia, CVC R Christian Voice | | 4965af |
| 0030 | 0100 | Australia, R Australia | 15415va | |
| 0030 | 0100 | Canada, Bible Voice Broadcasting | | 7395as |
| 0030 | 0100 | Palau, T8WH/ WHRI | 15700as | |
| 0030 | 0100 | UK, BBC World Service | 9510as | |
| 0030 | 0100 | USA, BBG/Voice of America | 6170va | 9325va |
| | | 9490va | 9715va | 11695va |
| | | 15185va | 15205va | 15290va |
| 0030 | 0100 | USA, BBG/Voice of America/Special English | | |
| | | 6170va | 9325va | 9490va |
| | | 11695va | 11730va | 12005va |
| | | 15205va | 15290va | |
| 0035 | 0045 | India, All India R/Aizawl | | 5050do |
| 0035 | 0045 | India, All India R/Chennai | | 4920do |
| 0035 | 0045 | India, All India R/Guwahati | | 4940do |
| 0035 | 0045 | India, All India R/Hyderabad | | 4800do |
| 0035 | 0045 | India, All India R/Imphal | | 4775do |
| 0035 | 0045 | India, All India R/Port Blair | | 4760do |
| 0035 | 0045 | India, All India R/Shillong | | 4970do |
| 0035 | 0045 | India, All India R/Shimla | | 4965do |
| 0035 | 0045 | India, All India R/Thiruvananthapuram | | 5010do |

0100 UTC - 8PM EST / 7PM CST / 5PM PST

| | | | | |
|------|------|-----|--|---------|
| 0100 | 0115 | Sat | Canada, Bible Voice Broadcasting | 7395as |
| 0100 | 0130 | | Vietnam, Voice of Vietnam/Overseas Svc | 6175na |
| 0100 | 0156 | | Romania, R Romania Intl | 6145na |
| | | | | 7355na |
| 0100 | 0157 | | China, China R International | 6005na |
| | | | 6075as | 6175as |
| | | | 9420as | 9570na |
| | | | 11885as | 9580na |
| | | | | 11650as |

| | | | | |
|------|------|--------|---|----------|
| 0100 | 0200 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9660pa |
| | | | 13690va | 15240va |
| | | | 17750va | 15415va |
| | | | 17795va | 17715va |
| 0100 | 0200 | | Bahrain, R Bahrain | 6010me |
| 0100 | 0200 | | Canada, CFRX Toronto ON | 6070na |
| 0100 | 0200 | | Canada, CFVP Calgary AB | 6030na |
| 0100 | 0200 | | Canada, CKZN St Johns NF | 6160na |
| 0100 | 0200 | | Canada, CKZU Vancouver BC | |
| | | | | 6160na |
| 0100 | 0200 | | Cuba, R Havana Cuba | 6000na |
| 0100 | 0200 | | Malaysia, RTM Kajang/Traxx FM | 6050na |
| 0100 | 0200 | | Micronesia, V6MP/Cross R/Pohnpei | 7295do |
| 0100 | 0200 | | New Zealand, R New Zealand Intl | 4755 as |
| 0100 | 0200 | | New Zealand, R New Zealand Intl | 15720pa |
| 0100 | 0200 | DRM | New Zealand, R New Zealand Intl | 17675pa |
| 0100 | 0200 | | North Korea, Voice of Korea | 4405as |
| | | | 9345as | 9730as |
| | | | 15180as | 11735as |
| 0100 | 0200 | | Russia, Voice of Russia | 7250va |
| 0100 | 0200 | | Taiwan, R Taiwan Intl | 11875as |
| 0100 | 0200 | | UK, BBC World Service | 5940as |
| | | | 9740as | 5970as |
| | | | 11750as | 12095as |
| | | | 15335as | 17685as |
| 0100 | 0200 | | USA, Amer Forces Network/AFRTS | 4319usb |
| | | | 5446usb | 5765usb |
| | | | 12759usb | 7812usb |
| | | | | 12133usb |
| 0100 | 0200 | | USA, BBG/Voice of America | 9435as |
| 0100 | 0200 | | USA, EWTN/WEWN Irontdale AL | 11705pa |
| 0100 | 0200 | | USA, FBN/WTJC Newport NC | 11520me |
| 0100 | 0200 | mtwhfa | USA, WBCQ Monticello ME | 9370na |
| 0100 | 0200 | | USA, WBCQ Monticello ME | 7490am |
| 0100 | 0200 | twhfa | USA, WBCQ Monticello ME | 9330am |
| 0100 | 0200 | | USA, WHRI Cypress Creek SC | 5920na |
| 0100 | 0200 | | USA, WINB Red Lion PA | 9265ca |
| 0100 | 0200 | | USA, WTWW Lebanon TN | 5080am |
| | | | 12105na | 5755am |
| 0100 | 0200 | | USA, WWCR Nashville TN | 3195eu |
| | | | 5935af | 4840na |
| 0100 | 0200 | | USA, WWRB Manchester TN | 3185va |
| | | | 5050va | 3215na |
| | | | 5745va | |
| 0100 | 0200 | | USA, WYFR/Family R Worldwide | 6115va |
| 0100 | 0200 | | Zambia, CVC R Christian Voice | 4965af |
| 0120 | 0200 | mtwhfa | Sri Lanka, SLBC | 6005as |
| 0130 | 0200 | | Iran, IRIB/VOIRI | 9770as |
| 0130 | 0200 | | Palau, T8WH/ WHRI | 7365eu |
| 0130 | 0200 | Sun | Serbia, International R Serbia | 15700as |
| 0130 | 0200 | twhfa | USA, BBG/Voice of America/Special English | 6190va |
| 0130 | 0200 | twhfa | USA, WRMI/R Slovakia Intl relay | 5960va |
| | | | | 7465va |
| | | | | 9955am |

0200 UTC - 9PM EST / 8PM CST / 6PM PST

| | | | | |
|------|------|-------|--|---------|
| 0200 | 0227 | | Iran, IRIB/VOIRI | 7230eu |
| 0200 | 0230 | | Thailand, R Thailand World Svc | 7365eu |
| 0200 | 0257 | | China, China R International | 11785as |
| 0200 | 0300 | | Anguilla/Caribbean Beacon/Univ Network | 13640as |
| | | | 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, R Australia | 9660pa |
| | | | 13690va | 12080va |
| | | | 17750va | 15415va |
| | | | 17795va | 15515pa |
| 0200 | 0300 | | Bahrain, R Bahrain | 6010me |
| 0200 | 0300 | | Canada, CFRX Toronto ON | 6070na |
| 0200 | 0300 | | Canada, CFVP Calgary AB | 6030na |
| 0200 | 0300 | | Canada, CKZN St Johns NF | 6160na |
| 0200 | 0300 | | Canada, CKZU Vancouver BC | |
| | | | | 6160na |
| 0200 | 0300 | | Cuba, R Havana Cuba | 6000na |
| 0200 | 0300 | | Egypt, R Cairo | 6050na |
| 0200 | 0300 | | Malaysia, RTM Kajang/Traxx FM | |
| 0200 | 0300 | | Micronesia, V6MP/Cross R/Pohnpei | 7295do |
| 0200 | 0300 | | New Zealand, R New Zealand Intl | 4755 as |
| 0200 | 0300 | | New Zealand, R New Zealand Intl | 15720pa |
| 0200 | 0300 | DRM | New Zealand, R New Zealand Intl | 17675pa |
| 0200 | 0300 | | North Korea, Voice of Korea | 3560as |
| | | | 15100as | 13650as |
| 0200 | 0300 | Sun | Palau, T8WH/ WHRI | 17800as |
| 0200 | 0300 | | Philippines, R Pilipinas Overseas | 11880me |
| | | | 15285me | 17700me |
| 0200 | 0300 | | Russia, Voice of Russia | 7250sa |
| 0200 | 0300 | | South Korea, KBS World R | 9580sa |

| | | | | | | |
|------|------|--------|--|----------|---------|----------|
| 0200 | 0300 | mtwhfa | Sri Lanka, SLBC | 6005as | 9770as | 15745as |
| 0200 | 0300 | | Taiwan, R Taiwan Intl | | 5950na | 9680na |
| 0200 | 0300 | | UK, BBC World Service | | 5875me | 5940as |
| | | | 7385af | 12095as | 15310as | |
| 0200 | 0300 | | USA, Amer Forces Network/AFRTS | | | 4319usb |
| | | | 5446usb | 5765usb | 7812usb | 12133usb |
| | | | 12759usb | 13362usb | | |
| 0200 | 0300 | | USA, EWTVN/WEWN Irondale AL | | | 11520me |
| 0200 | 0300 | | USA, FBN/WTJC Newport NC | | | 9370na |
| 0200 | 0300 | mtwhfa | USA, WBCQ Monticello ME | | 7490am | |
| 0200 | 0300 | | USA, WBCQ Monticello ME | | 9330am | |
| 0200 | 0300 | twhfa | USA, WHRI Cypress Creek SC | | | 5920na |
| | | | 7385na | | | |
| 0200 | 0300 | | USA, WINB Red Lion PA | | 9265ca | |
| 0200 | 0300 | | USA, WRNO New Orleans LA | | | 7505am |
| 0200 | 0300 | | USA, WTTW Lebanon TN | | 5080am | 5755am |
| | | | 12105na | | | |
| 0200 | 0300 | | USA, WWCN Nashville TN | | 3215eu | 4840na |
| | | | 5890af | 5935af | | |
| 0200 | 0300 | | USA, WWRB Manchester TN | | 3185va | 5050va |
| | | | 5745va | | | |
| 0200 | 0300 | | USA, WYFR/Family R Worldwide | | | 5985ca |
| | | | 6115ca | 7360ca | | |
| 0200 | 0300 | | Zambia, CVC R Christian Voice | | | 4965af |
| 0215 | 0300 | | Nepal, R Nepal | | 5005as | |
| 0230 | 0257 | | China, China R International | | | 15435as |
| 0230 | 0300 | twhf | Albania, R Tirana | | 7420na | |
| 0230 | 0300 | | Myanmar, Myanma R/Natl Svc | | | 5915do |
| | | | 5920al | | | |
| 0230 | 0300 | | Vietnam, Voice of Vietnam/Overseas Svc | | | 6175na |
| 0245 | 0300 | | Australia, HCJB Global Australia | | | 15400as |
| 0245 | 0300 | | India, All India R/Bhopal | | 7430do | |
| 0245 | 0300 | | India, All India R/Delhi | | 4860do | 6030do |
| | | | 7235do | 11830do | 15135do | |
| 0245 | 0300 | | India, All India R/Gorakhpur | | 3945do | 6030do |
| | | | 7235do | 11830do | 15135do | |
| 0245 | 0300 | | India, All India R/Guwahati | | 4940do | |
| 0245 | 0300 | | India, All India R/Hyderabad | | 7420do | |
| 0245 | 0300 | | India, All India R/Imphal | | 7335do | |
| 0245 | 0300 | | India, All India R/Itanagar | | 4990do | |
| 0245 | 0300 | | India, All India R/Jaipur | | 4910do | |
| 0245 | 0300 | | India, All India R/Kolkata | | 7210do | |
| 0245 | 0300 | | India, All India R/Kurseong | | 4895do | |
| 0245 | 0300 | | India, All India R/Lucknow | | 4880do | |
| 0245 | 0300 | | India, All India R/R Kashmir | | 4760do | |
| 0245 | 0300 | | India, All India R/Shillong | | 4970do | |
| 0245 | 0300 | | India, All India R/Shimla | | 6020do | |
| 0245 | 0300 | | India, All India R/Thiruvananthapuram | | | 7290do |
| 0250 | 0300 | | Vatican City State, Vatican R | | 6040am | 7305am |
| 0300 | 0315 | | Croatia, Voice of Croatia | | 3985am | 7375am |

0300 UTC - 10PM EST / 9PM CST / 7PM PST

| | | | | | | |
|------|------|------|--|---------|---------|---------|
| 0300 | 0315 | | India, All India R/Imphal | | 7335do | |
| 0300 | 0315 | | India, All India R/Itanagar | | 4990do | |
| 0300 | 0315 | | India, All India R/Shillong | | 4970do | |
| 0300 | 0330 | | Egypt, R Cairo | | 9315na | |
| 0300 | 0330 | | Myanmar, Myanma R/Natl Svc | | | 9731do |
| 0300 | 0330 | | Philippines, R Pilipinas Overseas | | | 11880me |
| | | | 15285me | 17700me | | |
| 0300 | 0330 | | Vatican City State, Vatican R | | 9660af | 11625af |
| 0300 | 0355 | | South Africa, Channel Africa | | 6155af | |
| 0300 | 0357 | | China, China R International | | 6190na | 9460as |
| | | | 9690na | 9790na | 13620as | 15120as |
| 0300 | 0359 | | South Africa, Channel Africa | | 3345af | |
| 0300 | 0400 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | | 9660pa | 12080va |
| | | | 13690va | 15240va | 15415va | 15515pa |
| | | | 17750va | 21725as | | |
| 0300 | 0400 | | Bahrain, R Bahrain | | | 6010me |
| 0300 | 0400 | twhf | 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 | | Cuba, R Havana Cuba | | 6000na | 6050na |
| 0300 | 0400 | | Malaysia, RTM Kajang/Traxx FM | | | 7295do |
| 0300 | 0400 | | Micronesia, V6MP/Cross R/Pohnpei | | | 4755 as |
| 0300 | 0400 | | New Zealand, R New Zealand Intl | | | 15720pa |
| 0300 | 0400 | DRM | New Zealand, R New Zealand Intl | | | 17675pa |

| | | | | | | |
|------|------|--------|--|----------|---------|----------|
| 0300 | 0400 | | North Korea, Voice of Korea | | 4405as | 7220as |
| | | | 9345as | 9730as | | |
| 0300 | 0400 | | Oman, R Sultanate of Oman | | | 15355af |
| 0300 | 0400 | Sun | Palau, T8WH/ WHRI | | | 17800as |
| 0300 | 0400 | mtwhf | Palau, T8WH/ WHRI | | | 17800as |
| 0300 | 0400 | | Russia, Voice of Russia | | 7250sa | 12040as |
| 0300 | 0400 | Sat | Sri Lanka, SLBC | | 6005as | 9770as |
| 0300 | 0400 | | Taiwan, R Taiwan Intl | | 6875na | 15320as |
| 0300 | 0400 | | UK, BBC World Service | | 3255af | 5940me |
| | | | 6140af | 6190af | 7255af | 9410as |
| | | | 9460af | 11860af | 12095as | 15310as |
| | | | 17790as | | | |
| 0300 | 0400 | | USA, Amer Forces Network/AFRTS | | | 4319usb |
| | | | 5446usb | 5765usb | 7812usb | 12133usb |
| | | | 12759usb | 13362usb | | |
| 0300 | 0400 | | USA, BBG/Voice of America | | 4930af | 6080af |
| | | | 9885af | 15580af | | |
| 0300 | 0400 | | USA, EWTVN/WEWN Irondale AL | | | 11520me |
| 0300 | 0400 | | USA, FBN/WTJC Newport NC | | | 9370na |
| 0300 | 0400 | mtwhfa | USA, WBCQ Monticello ME | | 7490am | |
| 0300 | 0400 | | USA, WBCQ Monticello ME | | 9330am | |
| 0300 | 0400 | Sat | USA, WHRI Cypress Creek SC | | | 7520va |
| 0300 | 0400 | | USA, WINB Red Lion PA | | 9265ca | |
| 0300 | 0400 | | USA, WRNO New Orleans LA | | | 7505am |
| 0300 | 0400 | | USA, WTTW Lebanon TN | | 5080am | 5755am |
| | | | 12105na | | | |
| 0300 | 0400 | | USA, WWCN Nashville TN | | 3215eu | 4840na |
| | | | 5890af | 5935af | | |
| 0300 | 0400 | | USA, WWRB Manchester TN | | 3185va | 5050va |
| | | | 5745va | | | |
| 0300 | 0400 | | USA, WYFR/Family R Worldwide | | | 6115va |
| | | | 9930ca | 11740ca | | |
| 0300 | 0400 | | Zambia, CVC R Christian Voice | | | 4965af |
| 0330 | 0400 | | Iran, IRIB/VOIRI | | 7200eu | 7365eu |
| 0330 | 0400 | | Vietnam, Voice of Vietnam/Overseas Svc | | | 6175na |
| 0335 | 0345 | | India, All India R/Aizawl | | 5050do | |
| 0335 | 0345 | | India, All India R/Delhi | | 7235do | 11830do |
| | | | 15135do | | | |
| 0335 | 0345 | | India, All India R/Kolkata | | | 7210do |

0400 UTC - 11PM EST / 10PM CST / 8PM PST

| | | | | | | |
|------|------|-------|--|----------|---------|----------|
| 0400 | 0427 | | Iran, IRIB/VOIRI | | 7200eu | 7365eu |
| 0400 | 0430 | | USA, BBG/Voice of America | | 4930af | 4960af |
| | | | 6080af | 9885af | 15580af | |
| 0400 | 0456 | | Romania, R Romania Intl | | 6130na | 7305na |
| | | | 11895as | 15220as | | |
| 0400 | 0457 | | China, China R International | | 6190na | 9460as |
| | | | 13620as | 15120as | 17725as | 17855as |
| 0400 | 0457 | | Germany, Deutsche Welle | | 6180af | 7350af |
| | | | 9855af | | | |
| 0400 | 0458 | | New Zealand, R New Zealand Intl | | | 15720pa |
| 0400 | 0458 | DRM | New Zealand, R New Zealand Intl | | | 17675pa |
| 0400 | 0500 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | | 9660pa | 12080va |
| | | | 13690va | 15240va | 15515pa | 17750va |
| | | | 21725as | | | |
| 0400 | 0500 | | Bahrain, R Bahrain | | | 6010me |
| 0400 | 0500 | twhf | 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 | mtwhf | Cuba, R Havana Cuba | | 6000na | 6050na |
| | | | France, R France International | | | 9805af |
| | | | 11995af | | | |
| 0400 | 0500 | | Malaysia, RTM Kajang/Traxx FM | | | 7295do |
| 0400 | 0500 | | Micronesia, V6MP/Cross R/Pohnpei | | | 4755 as |
| 0400 | 0500 | | Russia, Voice of Russia | | 12040as | |
| 0400 | 0500 | | South Africa, Channel Africa | | 7230af | |
| 0400 | 0500 | Sat | Sri Lanka, SLBC | | 6005as | 9770as |
| 0400 | 0500 | | Turkey, Voice of Turkey | | 7240as | 9655va |
| 0400 | 0500 | | UK, BBC World Service | | 3255af | 6005af |
| | | | 6190af | 7255af | 9410me | 11860af |
| | | | 12035af | 12095af | 15310as | 15360as |
| | | | 17790as | | | |
| 0400 | 0500 | | USA, Amer Forces Network/AFRTS | | | 4319usb |
| | | | 5446usb | 5765usb | 7812usb | 12133usb |
| | | | 12759usb | 13362usb | | |
| 0400 | 0500 | | USA, EWTVN/WEWN Irondale AL | | | 11520me |
| 0400 | 0500 | | USA, FBN/WTJC Newport NC | | | 9370na |

| | | | | | |
|------|------|--------|---------------------------------|---------|--------|
| 0400 | 0500 | mtwhfa | USA, WBCQ Monticello ME | 7490am | |
| 0400 | 0500 | | USA, WBCQ Monticello ME | 9330am | |
| 0400 | 0500 | m | USA, WBCQ Monticello ME | 5110am | |
| 0400 | 0500 | hf | USA, WHRI Cypress Creek SC | 7385na | |
| 0400 | 0500 | Sun | USA, WHRI Cypress Creek SC | 7465eu | |
| 0400 | 0500 | Sat | USA, WHRI Cypress Creek SC | 9640me | |
| 0400 | 0500 | | USA, WRNO New Orleans LA | 7505am | |
| 0400 | 0500 | | USA, WTTW Lebanon TN | 5080am | 5755am |
| | | | 12105na | | |
| 0400 | 0500 | | USA, WWCR Nashville TN | 3215eu | 4840na |
| | | | 5890af | 5935af | |
| 0400 | 0500 | | USA, WWRB Manchester TN | 3185va | 5050va |
| | | | 5745va | | |
| 0400 | 0500 | | Zambia, CVC R Christian Voice | 4965af | |
| 0430 | 0500 | | Australia, R Australia | 15415va | |
| 0430 | 0500 | Sun | Palau, T8WH/ WHRI | 17800as | |
| 0430 | 0500 | | USA, BBG/Voice of America | 4930af | 4960af |
| | | | 9885af | 15580af | |
| 0435 | 0445 | | India, All India R/Delhi | 4860do | |
| 0459 | 0500 | | New Zealand, R New Zealand Intl | 11725pa | |
| 0459 | 0500 | DRM | New Zealand, R New Zealand Intl | 13730pa | |

0500 UTC - 12AM EST / 11PM CST / 9PM PST

| | | | | | |
|------|------|---------|--|----------|----------|
| 0500 | 0507 | twhf | Canada, CBC Northern Quebec Svc | 9625na | |
| 0500 | 0530 | | Germany, Deutsche Welle | 6155af | 9800af |
| | | | 12045af | | |
| 0500 | 0530 | | Japan, R Japan NHK World | 5975va | 6110na |
| | | | 9770va | | |
| 0500 | 0557 | | China, China R International | 5960na | 6190na |
| | | | 7220af | 7295af | 9440af |
| | | | 15350as | 17505va | 17540as |
| | | | 17855as | | 17725as |
| 0500 | 0600 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9660pa | 12080va |
| | | | 13630va | 13690va | 15160va |
| | | | 17750va | 21725va | 15240va |
| 0500 | 0600 | | Bahrain, R 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, R Havana Cuba | 6010na | 6050na |
| | | | 6060ca | 6125ca | |
| 0500 | 0600 | Sat/Sun | Eq Guinea, R East Africa | 15190af | |
| 0500 | 0600 | mtwhf | Eq Guinea, R Africa 2 | 15190af | |
| 0500 | 0600 | mtwhf | France, R France International | 13740af | |
| | | | 17850af | | |
| 0500 | 0600 | | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 0500 | 0600 | | Micronesia, V6MP/Cross R/Pohnpei | 4755 as | |
| 0500 | 0600 | | New Zealand, R New Zealand Intl | 11725pa | |
| 0500 | 0600 | DRM | New Zealand, R New Zealand Intl | 13730pa | |
| 0500 | 0600 | | Nigeria, Voice of Nigeria | 15120af | |
| 0500 | 0600 | | South Africa, Channel Africa | 7230af | |
| 0500 | 0600 | | Swaziland, TWR Africa | 6120af | |
| 0500 | 0600 | | Taiwan, R Taiwan Intl | 6875na | |
| 0500 | 0600 | DRM | UK, BBC World Service | 3955eu | |
| 0500 | 0600 | | UK, BBC World Service | 3255af | 3955eu |
| | | | 6005af | 6190af | 7255af |
| | | | 12095af | 15310as | 15360as |
| | | | 15420af | 17640af | 17790as |
| 0500 | 0600 | Sat/Sun | UK, BBC World Service | 15420af | |
| 0500 | 0600 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12759usb | 13362usb | 12133usb |
| 0500 | 0600 | | USA, BBG/Voice of America | 4930af | 6080af |
| | | | 9885af | 15580af | |
| 0500 | 0600 | | USA, EWTN/WEWN Irondale AL | 11520me | |
| 0500 | 0600 | | USA, FBN/WTJC Newport NC | 9370na | |
| 0500 | 0600 | | USA, WBCQ Monticello ME | 9330am | |
| 0500 | 0600 | Sun | USA, WHRI Cypress Creek SC | 11565pa | |
| 0500 | 0600 | | USA, WTTW Lebanon TN | 5080am | 5755am |
| | | | 12105na | | |
| 0500 | 0600 | | USA, WWCR Nashville TN | 3215eu | 4840na |
| | | | 5890af | 5935af | |
| 0500 | 0600 | | USA, WWRB Manchester TN | 3185va | 5050va |
| | | | 5745va | | |

| | | | | | |
|------|------|---------|----------------------------------|---------|--|
| 0500 | 0600 | | Zambia, CVC R Christian Voice | 6065af | |
| 0530 | 0600 | | Australia, R Australia | 15415va | |
| 0530 | 0600 | Sat/Sun | Clandestine, SRS/Sudan R Service | 13720af | |
| 0530 | 0600 | Sun | Palau, T8WH/ WHRI | 17800as | |
| 0530 | 0600 | | Thailand, R Thailand World Svc | 12015eu | |

0600 UTC - 1AM EST / 12AM CST / 10PM PST

| | | | | | |
|------|------|---------|--|----------|----------|
| 0600 | 0630 | | Australia, R Australia | 15290as | |
| 0600 | 0630 | | Germany, Deutsche Welle | 12045af | 15440af |
| | | | 17800af | | |
| 0600 | 0630 | | Vatican City State, Vatican R | 3975eu | 6075eu |
| | | | 7250eu | | |
| 0600 | 0650 | DRM | New Zealand, R New Zealand Intl | 13730pa | |
| 0600 | 0655 | | South Africa, Channel Africa | 15255af | |
| 0600 | 0657 | | China, China R International | 6115na | 11750af |
| | | | 11770as | 11880as | 13645as |
| | | | 15350as | 15465as | 17505va |
| | | | 17710as | | 17540as |
| 0600 | 0659 | | South Africa, Channel Africa | 7230af | |
| 0600 | 0700 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9660pa | 12080va |
| | | | 13630va | 13690va | 15160va |
| | | | 15415va | 17750va | 21725va |
| 0600 | 0700 | | Bahrain, R Bahrain | 6010me | |
| 0600 | 0700 | | Canada, CFRX Toronto ON | 6070na | |
| 0600 | 0700 | | Canada, CFPV Calgary AB | 6030na | |
| 0600 | 0700 | | Canada, CKZN St Johns NF | 6160na | |
| 0600 | 0700 | | Canada, CKZU Vancouver BC | 6160na | |
| 0600 | 0700 | | Cuba, R Havana Cuba | 6010na | 6050na |
| | | | 6060ca | 6125ca | |
| 0600 | 0700 | Sat/Sun | Eq Guinea, R East Africa | 15190af | |
| 0600 | 0700 | mtwhf | Eq Guinea, R Africa 2 | 15190af | |
| 0600 | 0700 | mtwhf | France, R France International | 11615af | |
| 0600 | 0700 | | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 0600 | 0700 | | Malaysia, RTM/Voice of Malaysia | 6175as | |
| | | | 9750as | 15295as | |
| 0600 | 0700 | | Micronesia, V6MP/Cross R/Pohnpei | 4755 as | |
| 0600 | 0700 | | New Zealand, R New Zealand Intl | 11725pa | |
| 0600 | 0700 | | Nigeria, Voice of Nigeria | 15120af | |
| 0600 | 0700 | Sun | Palau, T8WH/ WHRI | 17800as | |
| 0600 | 0700 | | Papua New Guinea, R Fly | 5960do | |
| 0600 | 0700 | | Russia, Voice of Russia | 17805pa | 21805pa |
| 0600 | 0700 | DRM | Russia, Voice of Russia | 11635eu | |
| 0600 | 0700 | | South Africa, CVC 1 Africa R | 13590af | |
| 0600 | 0700 | | Swaziland, TWR Africa | 6120af | |
| 0600 | 0700 | | UK, BBC World Service | 3955eu | 6005af |
| | | | 6190af | 9410af | 11760me |
| | | | 12095af | 15310as | 15400af |
| | | | 17640af | 17790as | 15420af |
| 0600 | 0700 | DRM | UK, BBC World Service | 3955eu | |
| 0600 | 0700 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12759usb | 13362usb | 12133usb |
| 0600 | 0700 | | USA, BBG/Voice of America | 6080af | 9885af |
| | | | 15580af | | |
| 0600 | 0700 | | USA, EWTN/WEWN Irondale AL | 11520af | |
| 0600 | 0700 | | USA, FBN/WTJC Newport NC | 9370na | |
| 0600 | 0700 | | USA, WBCQ Monticello ME | 9330am | |
| 0600 | 0700 | Sat | USA, WHRI Cypress Creek SC | 9615me | |
| 0600 | 0700 | | USA, WTTW Lebanon TN | 5080am | 5755am |
| | | | 12105na | | |
| 0600 | 0700 | | USA, WWCR Nashville TN | 3215eu | 4840na |
| | | | 5890af | 5935af | |
| 0600 | 0700 | | USA, WWRB Manchester TN | 3185va | 5050va |
| | | | 5745va | | |
| 0600 | 0700 | | Zambia, CVC R Christian Voice | 6065af | |
| | | | 17695af | | |
| 0630 | 0645 | | India, All India R/Guwahati | 7280do | |
| 0630 | 0645 | | India, All India R/Hyderabad | 7420do | |
| 0630 | 0645 | | India, All India R/Kurseong | 7230do | |
| 0630 | 0645 | | India, All India R/Mumbai | 7240do | |
| 0630 | 0645 | | India, All India R/Thiruvananthapuram | 7290do | |
| 0630 | 0656 | DRM | Romania, R Romania Intl | 9600eu | |
| 0630 | 0656 | | Romania, R Romania Intl | 7310eu | 17780eu |
| | | | 21600eu | | |
| 0630 | 0700 | | Vatican City State, Vatican R | 7360af | 9660af |
| | | | 11625af | | |
| 0651 | 0700 | DRM | New Zealand, R New Zealand Intl | 13730pa | |

0700 UTC - 2AM EST / 1AM CST / 11PM PST

| | | | | | |
|------|------|--|----------|---------|----------|
| 0700 | 0757 | China, China R International | 11785eu | 11880as | |
| | | 13645as | 15125va | 15350as | 15465as |
| | | 17540as | 17490eu | 17710as | |
| 0700 | 0758 | New Zealand, R New Zealand Intl | | 11725pa | |
| 0700 | 0758 | DRM New Zealand, R New Zealand Intl | | 13730pa | |
| 0700 | 0800 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9475as | 9660pa | |
| | | 9710as | 11945as | 12080va | 13630va |
| | | 15160va | 15240va | 21725va | |
| 0700 | 0800 | Bahrain, R 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 | Sat/Sun Eqt Guinea, R East Africa | 15190af | | |
| 0700 | 0800 | mtwhf Eqt Guinea, R Africa 2 | 15190af | | |
| 0700 | 0800 | mtwhf France, R France International | | 15615af | |
| 0700 | 0800 | Malaysia, RTM Kajang/Traxx FM | | 7295do | |
| 0700 | 0800 | Malaysia, RTM/Voice of Malaysia | | 6175as | |
| | | 9750as | 15295as | | |
| 0700 | 0800 | Micronesia, V6MP/Cross R/Pohnpei | | 4755 as | |
| 0700 | 0800 | Papua New Guinea, R Fly | 5960do | | |
| 0700 | 0800 | Russia, Voice of Russia | 17805va | 21805va | |
| 0700 | 0800 | DRM Russia, Voice of Russia | | 11635eu | |
| 0700 | 0800 | South Africa, CVC 1 Africa R | 13590af | | |
| 0700 | 0800 | Swaziland, TWR Africa | 6120af | | |
| 0700 | 0800 | UK, BBC World Service | 3955eu | 5875eu | |
| | | 6190af | 11760me | 11770af | 12095af |
| | | 13820af | 15310as | 15400af | 15575me |
| | | 17640af | 17790as | 17830af | |
| 0700 | 0800 | DRM UK, BBC World Service | | 5875eu | |
| 0700 | 0800 | USA, Amer 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, WBCQ Monticello ME | 9330am | | |
| 0700 | 0800 | Sun USA, WHRI Cypress Creek SC | | 11565pa | |
| 0700 | 0800 | USA, WTWW Lebanon TN | 5080am | 5755am | |
| | | 12105na | | | |
| 0700 | 0800 | USA, WWCR Nashville TN | 3215eu | 4840na | |
| | | 5890af | 5935af | | |
| 0700 | 0800 | USA, WWRB Manchester TN | 3185va | | |
| 0700 | 0800 | Zambia, CVC R Christian Voice | | 6065af | |
| | | 17695af | | | |
| 0730 | 0745 | India, All India R/Aizawl | 5050do | | |
| 0730 | 0745 | India, All India R/Delhi | 6190do | 11710do | |
| | | 15185do | 15260do | | |
| 0730 | 0745 | India, All India R/Guwahati | 7280do | | |
| 0730 | 0745 | India, All India R/Imphal | 7335do | | |
| 0730 | 0745 | India, All India R/Jaipur | 7325do | | |
| 0730 | 0745 | India, All India R/Kolkata | 7210do | | |
| 0730 | 0745 | India, All India R/Kurseong | 7230do | | |
| 0730 | 0745 | India, All India R/Shimla | 6020do | | |
| 0730 | 0800 | Australia, HCJB Global Australia | | 11750pa | |
| 0730 | 0800 | India, All India R/Chennai | 4920do | | |
| 0759 | 0800 | New Zealand, R New Zealand Intl | | 9765pa | |
| 0759 | 0800 | DRM New Zealand, R New Zealand Intl | | 9870pa | |

0800 UTC - 3AM EST / 2AM CST / 12AM PST

| | | | | | |
|------|------|--|---------|---------|---------|
| 0800 | 0830 | Australia, ABC NT Alice Springs | | 4835do | |
| 0800 | 0830 | Australia, ABC NT Katherine | 5025do | | |
| 0800 | 0830 | Australia, ABC NT Tennant Creek | | 4910do | |
| 0800 | 0830 | Australia, HCJB Global Australia | | 11750pa | |
| 0800 | 0830 | Sun Canada, Bible Voice Broadcasting | | 7250eu | |
| 0800 | 0845 | Sat Canada, Bible Voice Broadcasting | | 7220eu | |
| 0800 | 0850 | Austria, TWR Europe | 7310eu | | |
| 0800 | 0850 | Germany, TWR Europe | 6105eu | | |
| 0800 | 0857 | China, China R International | 9415as | 11785eu | |
| | | 11880eu | 13350as | 15465as | 15625va |
| | | 17490eu | 17540as | | |
| 0800 | 0900 | Anguilla/Caribbean Beacon/Univ Network | | | |
| | | 6090na | | | |
| 0800 | 0900 | Australia, R Australia | 5995va | 9475as | |
| | | 9580pa | 9590pa | 9710as | 11945as |
| | | 12080va | 13630va | | |

| | | | | | |
|------|------|--|----------|---------|----------|
| 0800 | 0900 | Bahrain, R 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 | Sat/Sun Eqt Guinea, R East Africa | 15190af | | |
| 0800 | 0900 | mtwhf Eqt Guinea, R Africa 2 | 15190af | | |
| 0800 | 0900 | Malaysia, RTM Kajang/Traxx FM | | 7295do | |
| 0800 | 0900 | Malaysia, RTM/Voice of Malaysia | | 6175as | |
| | | 9750as | 15295as | | |
| 0800 | 0900 | Micronesia, V6MP/Cross R/Pohnpei | | 4755 as | |
| 0800 | 0900 | New Zealand, R New Zealand Intl | | 9765pa | |
| 0800 | 0900 | DRM New Zealand, R New Zealand Intl | | 9870pa | |
| 0800 | 0900 | mtwhf Palau, T8WH/ WHRI | | 9930as | |
| 0800 | 0900 | Sun Palau, T8WH/ WHRI | | 9930as | |
| 0800 | 0900 | Papua New Guinea, R Fly | 5960do | | |
| 0800 | 0900 | Russia, Voice of Russia | 17805va | 21805va | |
| 0800 | 0900 | DRM Russia, Voice of Russia | | 7325eu | 11635eu |
| 0800 | 0900 | South Africa, Channel Africa | 9625af | | |
| 0800 | 0900 | South Africa, CVC 1 Africa R | 13590af | | |
| 0800 | 0900 | Sun South Africa, South African R League | | 7205af | |
| | | 17760af | | | |
| 0800 | 0900 | South Korea, KBS World R | 9570as | | |
| 0800 | 0900 | UK, BBC World Service | 5760eu | 5875eu | |
| | | 6190af | 11760me | 12095af | 15310as |
| | | 15400af | 15575me | 17640af | 17790as |
| | | 17830af | 21470af | | |
| 0800 | 0900 | DRM UK, BBC World Service | | 5790eu | 5875eu |
| 0800 | 0900 | USA, Amer 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, WBCQ Monticello ME | 9330am | | |
| 0800 | 0900 | smtwhf USA, WHRI Cypress Creek SC | | 11565pa | |
| 0800 | 0900 | USA, WTWW Lebanon TN | 5080am | 5755am | |
| | | 12105na | | | |
| 0800 | 0900 | USA, WWCR Nashville TN | 3215eu | 4840na | |
| | | 5890af | 5935af | | |
| 0800 | 0900 | USA, WWRB Manchester TN | 3185va | | |
| 0800 | 0900 | Zambia, CVC R Christian Voice | | 6065af | |
| | | 17695af | | | |
| 0815 | 0900 | Nepal, R Nepal | 5005as | | |
| 0820 | 0900 | smtwhf Guam, TWR Asia/KTWR | | 15170as | |
| 0830 | 0845 | India, All India R/Aizawl | 5050do | | |
| 0830 | 0845 | India, All India R/Chennai | 4920do | | |
| 0830 | 0845 | India, All India R/Delhi | 6190do | 11710do | |
| | | 15185do | 15260do | | |
| 0830 | 0845 | India, All India R/Hyderabad | 7420do | | |
| 0830 | 0845 | India, All India R/Imphal | 7335do | | |
| 0830 | 0845 | India, All India R/Itanagar | 4990do | | |
| 0830 | 0845 | India, All India R/Kolkata | 7210do | | |
| 0830 | 0845 | India, All India R/Shillong | 7315do | | |
| 0830 | 0845 | India, All India R/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 | mtwhfa Guam, TWR Asia/KTWR | | 11840pa | |

0900 UTC - 4AM EST / 3AM CST / 1AM PST

| | | | | | |
|------|------|--|---------|---------|---------|
| 0900 | 0910 | mtwhfa Guam, TWR Asia/KTWR | | 11840as | |
| 0900 | 0930 | mtwhf Palau, T8WH/ WHRI | | 9930as | |
| 0900 | 0930 | Sun Palau, T8WH/ WHRI | | 9930as | |
| 0900 | 0957 | China, China R International | 9415as | 15210pa | |
| | | 15270eu | 15350as | 17490eu | 17570eu |
| | | 17690pa | 17750as | | |
| 0900 | 1000 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9475as | 9580pa | |
| | | 9590pa | 11945as | 12080va | |
| 0900 | 1000 | Bahrain, R 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 | 3rd Sun Germany, XVRB Radio | | 6045va | |
| 0900 | 1000 | Sat Italy, IRRS-Shortwave | | 9510va | |

| | | | | |
|------|------|---|----------|---------|
| 0900 | 1000 | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 0900 | 1000 | Malaysia, RTM/Voice of Malaysia 9750as 15295as | 6175as | |
| 0900 | 1000 | Micronesia, V6MP/Cross R/Pohnpei | 4755 as | |
| 0900 | 1000 | DRM New Zealand, R New Zealand Intl | 9870pa | |
| 0900 | 1000 | New Zealand, R New Zealand Intl | 9765pa | |
| 0900 | 1000 | Nigeria, Voice of Nigeria | 9690af | |
| 0900 | 1000 | Sat Palau, T8WH/ WHRI | 9930as | 15700as |
| 0900 | 1000 | Papua New Guinea, R Fly | 5960do | |
| 0900 | 1000 | Russia, Voice of Russia | 7205as | 17805va |
| | | 21805va | | |
| 0900 | 1000 | DRM Russia, Voice of Russia | 7325eu | 11635eu |
| 0900 | 1000 | South Africa, Channel Africa | 9625af | |
| 0900 | 1000 | South Africa, CVC 1 Africa R | 13590af | |
| 0900 | 1000 | UK, BBC World Service | 6190af | 6195as |
| | | 9740as 11760me 11895as | 12095af | |
| | | 15285as 15310as 15400af | 15575me | |
| | | 17760as 17790as 17830af | 21470af | |
| 0900 | 1000 | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | 5446usb 5765usb 7812usb | 12133usb | |
| | | 12759usb 13362usb | | |
| 0900 | 1000 | USA, EWTN/WEWN Irondale AL | 9390as | |
| 0900 | 1000 | USA, FBN/WTJC Newport NC | 9370na | |
| 0900 | 1000 | USA, WBCQ Monticello ME | 9330am | |
| 0900 | 1000 | Sun USA, WHRI Cypress Creek SC | 11565pa | |
| 0900 | 1000 | USA, WTWW Lebanon TN | 5080am | 5755am |
| | | 12105na | | |
| 0900 | 1000 | USA, WWCN Nashville TN | 3215eu | 4890na |
| | | 5890af 5935af | | |
| 0900 | 1000 | USA, WWRB Manchester TN | 3185va | |
| 0900 | 1000 | USA, WYFR/Family R Worldwide | 9465as | |
| 0900 | 1000 | Zambia, CVC R Christian Voice | 6065af | |
| | | 17695af | | |
| 0905 | 0910 | Pakistan, PBC/R Pakistan | 15725eu | 17700eu |
| 0915 | 0930 | mtwhf Palau, T8WH/ WHRI | 9930as | |
| 0930 | 1000 | w Palau, T8WH/ WHRI | 9930as | |
| 0945 | 1000 | m Palau, T8WH/ WHRI | 9930as | |
| 0945 | 1000 | hf Palau, T8WH/ WHRI | 9930as | |
| 0945 | 1000 | mtwhf Palau, T8WH/ WHRI | 15700as | |

1000 UTC - 5AM EST / 4AM CST / 2AM PST

| | | | | |
|------|------|--|---------|---------|
| 1000 | 1030 | Japan, R Japan NHK World | 9605as | 9625pa |
| | | 9840pa | | |
| 1000 | 1030 | Vietnam, Voice of Vietnam/Overseas Svc | 9840as | |
| | | 12020as | | |
| 1000 | 1057 | China, China R International | 5955as | 7215as |
| | | 11640as 13590as 13720as | 15190as | |
| | | 15210pa 15350as 17490eu | 17690as | |
| 1000 | 1057 | Netherlands, R Netherlands Worldwide | 12065as | |
| 1000 | 1058 | New Zealand, R New Zealand Intl | 9765pa | |
| 1000 | 1100 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9580pa | 9590pa |
| | | 11945as 12080va | | |
| 1000 | 1100 | Bahrain, R 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 | India, All India R/External Svc | 7270as | 13710va |
| | | 15020as 15235as 17510pa | 17800as | |
| | | 17895pa | | |
| 1000 | 1100 | Indonesia, Voice of Indonesia | 9525va | |
| 1000 | 1100 | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1000 | 1100 | Micronesia, V6MP/Cross R/Pohnpei | 4755as | |
| 1000 | 1100 | DRM New Zealand, R New Zealand Intl | 9870pa | |
| 1000 | 1100 | Nigeria, Voice of Nigeria | 9690af | |
| 1000 | 1100 | North Korea, Voice of Korea | 6185as | 6285sa |
| | | 9335sa 9850as | | |
| 1000 | 1100 | fa Palau, T8WH/ WHRI | 9930as | |
| 1000 | 1100 | Russia, Voice of Russia | 7205as | |
| 1000 | 1100 | South Africa, Channel Africa | 9625af | |
| 1000 | 1100 | South Africa, CVC 1 Africa R | 13590af | |
| 1000 | 1100 | UK, BBC World Service | 6190af | 6195as |
| | | 9740as 11760me 11895as | 12095af | |
| | | 15285as 15310as 15575me | 17640af | |
| | | 17760as 17790as 21470af | | |
| 1000 | 1100 | Sat/Sun UK, BBC World Service | 15400af | 17830af |

| | | | | |
|------|------|---|----------|---------|
| 1000 | 1100 | USA, Amer 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 | 9615as | |
| 1000 | 1100 | USA, WBCQ Monticello ME | 9330am | |
| 1000 | 1100 | Sun USA, WHRI Cypress Creek SC | 11565pa | |
| 1000 | 1100 | USA, WTWW Lebanon TN | 5080am | 5755am |
| | | 12105na | | |
| 1000 | 1100 | USA, WWCN Nashville TN | 4840na | 5890af |
| | | 5935af 7465eu | | |
| 1000 | 1100 | USA, WWRB Manchester TN | 3185va | |
| 1000 | 1100 | USA, WYFR/Family R Worldwide | 9465as | |
| 1000 | 1100 | Zambia, CVC R Christian Voice | 6065af | |
| | | 17695af | | |
| 1015 | 1100 | Sun Palau, T8WH/ WHRI | 9930as | |
| 1030 | 1030 | mtwhf USA, WRMI/R Prague relay | 9955am | |
| 1030 | 1100 | Iran, IRIB/VOIRI | 21575va | 21695va |
| 1030 | 1100 | Sun Italy, IRRS-Shortwave | 9510va | |
| 1030 | 1100 | Sun Italy, IRRS-Shortwave/Euro Gospel R | 9510eu | |
| 1030 | 1100 | Mongolia, Voice of Mongolia | 12085as | |
| 1030 | 1100 | mtwhf Palau, T8WH/ WHRI | 9930as | |
| 1059 | 1100 | New Zealand, R New Zealand Intl | 15720pa | |

1100 UTC - 6AM EST / 5AM CST / 3AM PST

| | | | | |
|------|------|---|----------|---------|
| 1100 | 1105 | Pakistan, PBC/R Pakistan | 15725eu | 17700eu |
| 1100 | 1127 | Iran, IRIB/VOIRI | 21575va | 21695va |
| 1100 | 1130 | f/ DRM Japan, R Japan NHK World | 9760eu | |
| 1100 | 1130 | Sat/DRM South Korea, KBS World R | 9760eu | |
| 1100 | 1130 | UK, BBC World Service | 15400af | |
| 1100 | 1130 | Vietnam, Voice of Vietnam/Overseas Svc | 7285as | |
| 1100 | 1157 | China, China R International | 5955as | 5960na |
| | | 9570as 11650as 11795as | 13645as | |
| | | 13665eu 13590as 13720as | 15110as | |
| | | 17490eu | | |
| 1100 | 1158 | DRM New Zealand, R New Zealand Intl | 9870pa | |
| 1100 | 1200 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 5995va | 6020va |
| | | 6140as 9475as 9560as | 9580pa | |
| | | 9590pa 11945as | | |
| 1100 | 1200 | DRM Australia, R Australia | 12080pa | |
| 1100 | 1200 | Bahrain, R 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 | Sun Italy, IRRS-Shortwave | 9510va | |
| 1100 | 1200 | Sun Italy, IRRS-Shortwave/Euro Gospel R | 9510eu | |
| 1100 | 1200 | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1100 | 1200 | New Zealand, R New Zealand Intl | 15720pa | |
| 1100 | 1200 | Nigeria, Voice of Nigeria | 9690af | |
| 1100 | 1200 | DRM Russia, Voice of Russia | 12000as | |
| 1100 | 1200 | Russia, Voice of Russia | 7205as | 7260as |
| | | 7350as 9560as 9670as | | |
| 1100 | 1200 | Saudi Arabia, BSKSA/External Svc | 15250af | |
| 1100 | 1200 | South Africa, Channel Africa | 9625af | |
| 1100 | 1200 | South Africa, CVC 1 Africa R | 13590af | |
| 1100 | 1200 | Taiwan, R Taiwan Intl | 7445as | 11715as |
| 1100 | 1200 | UK, BBC World Service | 6190af | 6195as |
| | | 9740as 11760me 11895as | 12095af | |
| | | 15285as 15575me 17640af | 17790as | |
| | | 17830as 21470af | | |
| 1100 | 1200 | USA, Amer 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, WBCQ Monticello ME | 9330am | |
| 1100 | 1200 | Sat/Sun USA, WHRI Cypress Creek SC | 7315ca | |
| 1100 | 1200 | USA, WTWW Lebanon TN | 5755am | 9990am |
| | | 12105na | | |
| 1100 | 1200 | USA, WWCN Nashville TN | 4840na | 5890af |
| | | 5935af 7465eu | | |
| 1100 | 1200 | USA, WWRB Manchester TN | 3185va | |
| 1100 | 1200 | USA, WYFR/Family R Worldwide | 9310as | |
| | | 13795as | | |

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|------|--------|--|---------|---------|
| 1100 | 1200 | Zambia, CVC R Christian Voice | 6065af | |
| | | 17695af | | |
| 1130 | 1200 f | Vatican City State, Vatican R | 15595as | 17590as |
| 1130 | 1200 | Vietnam, Voice of Vietnam/Overseas Svc | 9840as | |
| | | 12020as | | |
| 1135 | 1145 | India, All India R/Aizawl | 5050do | |
| 1135 | 1145 | India, All India R/Delhi | 9595do | 11710do |
| | | 15185do | | |
| 1135 | 1145 | India, All India R/Shillong | 4970do | |

1200 UTC - 7AM EST / 6AM CST / 4AM PST

| | | | | |
|------|------|--|-------------------------------------|----------|
| 1200 | 1230 | Germany, AWR Europe | 17510as | |
| 1200 | 1230 | Japan, R Japan NHK World | 6120na | 9695as |
| 1200 | 1230 | Saudi Arabia, BSKSA/External Svc | 15250af | |
| 1200 | 1256 | Romania, R Romania Intl | 15430eu | 15460eu |
| | | 17530af | 17765af | |
| 1200 | 1257 | China, China R International | 5955as | 7250as |
| | | 9460as | 9660as | 9645as |
| | | 9760 oa | 11650as | 11690as |
| | | 12015as | 13665eu | 13790eu |
| | | 17490eu | | 13980as |
| 1200 | 1258 | New Zealand, R New Zealand Intl | 15720pa | |
| 1200 | 1300 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 6020va | 6140as |
| | | 9475as | 9560as | 9580pa |
| | | | | 9590pa |
| 1200 | 1300 | DRM | Australia, R Australia | 5995va |
| 1200 | 1300 | | Bahrain, R 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 | | Ethiopia, R Ethiopia/Natl Pgm | 9705do |
| 1200 | 1300 | Sun | Italy, IRRS-Shortwave/Euro Gospel R | 9510eu |
| 1200 | 1300 | | Malaysia, RTM Kajang/Traxx FM | 7295do |
| 1200 | 1300 | | Nigeria, Voice of Nigeria | 9690af |
| 1200 | 1300 | Sat/Sun | Palau, T8WH/ WHRI | 9930as |
| 1200 | 1300 | DRM | Russia, Voice of Russia | 7325eu |
| | | | 12000as | 7340as |
| 1200 | 1300 | | Russia, Voice of Russia | 7350as |
| | | | 11660as | 9560as |
| 1200 | 1300 | | South Africa, CVC 1 Africa R | 13590af |
| 1200 | 1300 | | South Korea, KBS World R | 9650na |
| 1200 | 1300 | | UK, BBC World Service | 5875as |
| | | | 6195as | 9740as |
| | | | 15310as | 11760me |
| | | | 21470af | 11895as |
| | | | | 17830as |
| 1200 | 1300 | | USA, Amer Forces Network/AFRTS | 4319usb |
| | | | 5446usb | 5765usb |
| | | | 12759usb | 7812usb |
| | | | | 12133usb |
| 1200 | 1300 | | USA, BBG/Voice of America | 7575as |
| | | | 11700pa | 11750pa |
| | | | | 12150va |
| 1200 | 1300 | | USA, EWTN/WEWN Irondale AL | 14610eu |
| 1200 | 1300 | | USA, FBN/WTJC Newport NC | 9370na |
| 1200 | 1300 | | USA, KNLS Anchor Point AK | 9615as |
| 1200 | 1300 | | USA, WBCQ Monticello ME | 9330am |
| 1200 | 1300 | smtwhf | USA, WHRI Cypress Creek SC | 7385na |
| 1200 | 1300 | | USA, WTWW Lebanon TN | 5755am |
| | | | 12105na | 9990am |
| 1200 | 1300 | | USA, WWCN Nashville TN | 4890na |
| | | | 9980af | 5935af |
| | | | | 15825eu |
| 1200 | 1300 | | USA, WWRB Manchester TN | 9395na |
| 1200 | 1300 | | USA, WYFR/Family R Worldwide | 9310as |
| | | | 17520as | 17880as |
| 1200 | 1300 | | Zambia, CVC R Christian Voice | 6065af |
| | | | 17695af | |
| 1215 | 1300 | Egypt, R Cairo | 17870as | |
| 1230 | 1245 | India, All India R/Aizawl | 5050do | |
| 1230 | 1245 | India, All India R/Chennai | 4920do | |
| 1230 | 1245 | India, All India R/Delhi | 4860do | 6085do |
| 1230 | 1245 | India, All India R/Hyderabad | 4800do | |
| 1230 | 1245 | India, All India R/Jeyapore | 5040do | |
| 1230 | 1245 | India, All India R/Kurseong | 4895do | |
| 1230 | 1245 | India, All India R/Port Blair | 4760do | |
| 1230 | 1245 | India, All India R/R Kashmir | 4950do | |

| | | | | |
|------|------|--|--------|--|
| 1230 | 1245 | India, All India R/Shillong | 4970do | |
| 1230 | 1245 | India, All India R/Thiruvananthapuram | 5010do | |
| 1230 | 1300 | Thailand, R Thailand World Svc | 9720va | |
| 1230 | 1300 | Vietnam, Voice of Vietnam/Overseas Svc | 9840as | |
| | | 12020as | | |

1300 UTC - 8AM EST / 7AM CST / 5AM PST

| | | | | |
|------|------|--|--|----------|
| 1300 | 1330 | Egypt, R Cairo | 17870as | |
| 1300 | 1330 | Japan, R Japan NHK World | 11730as | |
| 1300 | 1357 | China, China R International | 5995as | 7300as |
| | | 9570na | 9655as | 9730as |
| | | 9870as | 11760pa | 11885na |
| | | | 11980as | 13670eu |
| | | | | 13790eu |
| | | | | 15230na |
| 1300 | 1400 | Anguilla/Caribbean Beacon/Univ Network | | |
| | | 11775na | | |
| 1300 | 1400 | Australia, ABC NT Alice Springs | | 2310do |
| 1300 | 1400 | Australia, ABC NT Katherine | 2485do | |
| 1300 | 1400 | DRM | Australia, R Australia | 5995va |
| 1300 | 1400 | | Bahrain, R 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 | | Indonesia, Voice of Indonesia | 9525va |
| 1300 | 1400 | | Italy, IRRS-Shortwave | 15190va |
| 1300 | 1400 | | Italy, IRRS-Shortwave/Overcomer Ministry | 15190pa |
| 1300 | 1400 | | Malaysia, RTM Kajang/Traxx FM | 7295do |
| 1300 | 1400 | | New Zealand, R New Zealand Intl | 5950pa |
| 1300 | 1400 | | Nigeria, Voice of Nigeria | 9690af |
| 1300 | 1400 | | North Korea, Voice of Korea | 3560as |
| | | | 9335na | 11710na |
| | | | | 12015eu |
| 1300 | 1400 | Sat/Sun | Palau, T8WH/ WHRI | 9930as |
| 1300 | 1400 | DRM | Russia, Voice of Russia | 7325eu |
| | | | 9675eu | 7340as |
| 1300 | 1400 | | Russia, Voice of Russia | 7205as |
| | | | 9560as | 7260as |
| 1300 | 1400 | | South Africa, CVC 1 Africa R | 13590af |
| 1300 | 1400 | | South Korea, KBS World R | 9570do |
| 1300 | 1400 | | Tajikistan, Voice of Tajik | 7245va |
| 1300 | 1400 | | UK, BBC World Service | 5875as |
| | | | 6195as | 9410as |
| | | | 11890as | 12095af |
| | | | 15575me | 17640af |
| | | | | 17830as |
| | | | | 21470af |
| 1300 | 1400 | | USA, Amer Forces Network/AFRTS | 4319usb |
| | | | 5446usb | 5765usb |
| | | | 12759usb | 7812usb |
| | | | | 12133usb |
| 1300 | 1400 | Sat/Sun | USA, BBG/Voice of America | 7575as |
| | | | 11700va | 12150va |
| 1300 | 1400 | | USA, EWTN/WEWN Irondale AL | 15610eu |
| 1300 | 1400 | | USA, FBN/WTJC Newport NC | 9370na |
| 1300 | 1400 | | USA, WBCQ Monticello ME | 9330am |
| 1300 | 1400 | Sun | USA, WHRI Cypress Creek SC | 9840na |
| 1300 | 1400 | | USA, WTWW Lebanon TN | 9480na |
| | | | 12105na | 9990am |
| 1300 | 1400 | | USA, WWCN Nashville TN | 7490af |
| | | | 13845eu | 15825eu |
| 1300 | 1400 | | USA, WWRB Manchester TN | 9395na |
| 1300 | 1400 | | USA, WYFR/Family R Worldwide | 5835as |
| | | | 9310as | 9390as |
| | | | | 11520as |
| 1300 | 1400 | | Zambia, CVC R Christian Voice | 6065af |
| | | | 17695af | |
| 1330 | 1345 | India, All India R/Delhi | 6085do | |
| 1330 | 1400 | India, All India R/External Svc | 9690as | 11620as |
| | | 13710as | | |
| 1330 | 1400 | Turkey, Voice of Turkey | 12035va | |
| 1330 | 1400 | Vietnam, Voice of Vietnam/Overseas Svc | 9840as | |
| | | 12020as | | |

1400 UTC - 9AM EST / 8AM CST / 6AM PST

| | | | | |
|------|------|-----|------------------------------------|---------|
| 1400 | 1415 | Sun | Germany, Pan American Broadcasting | 15205as |
| 1400 | 1430 | | Japan, R Japan NHK World | 5955as |
| | | | 21560af | 11695as |
| 1400 | 1430 | | Serbia, International R Serbia | 9635eu |
| 1400 | 1430 | | Thailand, R Thailand World Svc | 9725va |
| 1400 | 1430 | | Turkey, Voice of Turkey | 12035va |

| | | | | |
|------|------|--|--|----------|
| 1400 | 1457 | China, China R International | 5955as | 7300as |
| | | 9460as | 9700eu | 9765eu |
| | | 11665as | 13675na | 13740na |
| | | 17630af | | |
| 1400 | 1457 | Netherlands, R Netherlands Worldwide | 12080as | |
| 1400 | 1500 | Anguilla/Caribbean Beacon/Univ 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, R Australia | 5995va | 6080as |
| | | 7240pa | 9590pa | 11660as |
| 1400 | 1500 | Bahrain, R Bahrain | | 6010me |
| 1400 | 1500 | Sun | Canada, Bible Voice Broadcasting | 15470as |
| 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 | Sat/Sun | Eqt Guinea, R East Africa/Malabo | 15190af |
| 1400 | 1500 | | India, All India R/External Svc | 9690as |
| | | | 13710as | 11620as |
| 1400 | 1500 | | Italy, IRRS-Shortwave/Overcomer Ministry | |
| | | | 15190va | |
| 1400 | 1500 | | Malaysia, RTM Kajang/Traxx FM | 7295do |
| 1400 | 1500 | | New Zealand, R New Zealand Intl | 5950pa |
| 1400 | 1500 | | Nigeria, Voice of Nigeria | 9690af |
| 1400 | 1500 | | Oman, R Sultanate of Oman | 15140va |
| 1400 | 1500 | Sat | Palau, T8WH/ WHRI | 9930as |
| 1400 | 1500 | DRM | Russia, Voice of Russia | 7340as |
| 1400 | 1500 | | Russia, Voice of Russia | 4975va |
| | | | 7310as | 11660as |
| 1400 | 1500 | | South Africa, CVC 1 Africa R | 13590af |
| 1400 | 1500 | | UK, BBC World Service | 5845as |
| | | | 5975as | 6190af |
| | | | 6195as | 9410as |
| | | | 9740as | 11760me |
| | | | 11890as | 12095af |
| | | | 15420af | 17640af |
| | | | 17830as | |
| 1400 | 1500 | | USA, Amer Forces Network/AFRTS | 4319usb |
| | | | 5446usb | 5765usb |
| | | | 7812usb | 12133usb |
| | | | 12759usb | 13362usb |
| 1400 | 1500 | | USA, BBG/Voice of America | 6080af |
| | | | 17650af | 17715af |
| 1400 | 1500 | mtwhf | USA, BBG/Voice of America | 7575as |
| | | | 12150va | 9760as |
| 1400 | 1500 | | USA, EWTN/WEWN Irondale AL | 15610eu |
| 1400 | 1500 | | USA, FBN/WTJC Newport NC | 9370na |
| 1400 | 1500 | | USA, WBCQ Monticello ME | 9330am |
| 1400 | 1500 | Sun | USA, WHRI Cypress Creek SC | 21600af |
| 1400 | 1500 | Sat | USA, WHRI Cypress Creek SC | 9680na |
| 1400 | 1500 | | USA, WJHR Intl Milton FL | 15550na |
| 1400 | 1500 | | USA, WTWW Lebanon TN | 9480na |
| | | | 12105na | 9990am |
| 1400 | 1500 | | USA, WWRB Nashville TN | 7490af |
| | | | 13845eu | 15825eu |
| 1400 | 1500 | | USA, WWRB Manchester TN | 9395na |
| 1400 | 1500 | | USA, WYFR/Family R Worldwide | 5835as |
| | | | 9365as | 11540as |
| | | | 11560as | |
| 1400 | 1500 | | Zambia, CVC R Christian Voice | 6065af |
| | | | 17695af | |
| 1405 | 1435 | Sun | Canada, Bible Voice Broadcasting | 9390as |
| 1415 | 1430 | mtwhfa | Germany, Pan American Broadcasting | 15205as |
| 1415 | 1500 | | Nepal, R Nepal | 5005as |
| 1420 | 1440 | | India, All India R/Itanagar | 4990do |
| 1430 | 1445 | Sun | Germany, Pan American Broadcasting | 15205as |
| 1430 | 1445 | | India, All India R/Aizawl | 5050do |
| 1430 | 1445 | | India, All India R/Delhi | 6085do |
| | | | 9835do | 9575do |
| 1430 | 1445 | | India, All India R/Jeyapore | 5040do |
| 1430 | 1445 | | India, All India R/Mumbai | 4840do |
| 1430 | 1500 | | Australia, R Australia | 9475as |
| 1430 | 1500 | Sat | Canada, Bible Voice Broadcasting | 15470af |
| 1430 | 1500 | Sat | India, All India R/Gangtok | 4835do |
| 1445 | 1500 | | Australia, HCJB Global Australia | 15340as |
| 1450 | 1500 | | India, All India R/Itanagar | 4990do |
| 1450 | 1500 | | India, All India R/Kurseong | 4895do |

1500 UTC - 10AM EST / 9AM CST / 7AM PST

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| 1500 | 1515 | Sun | Canada, Bible Voice Broadcasting | 13740as |
| 1500 | 1525 | Sun | China, Haixa zhi Sheng/VO Strait | 4940do |
| | | | 9505do | |
| 1500 | 1525 | mh | Guam, TWR Asia/KTWR | 15200as |
| 1500 | 1530 | | Australia, HCJB Global Australia | 15340as |
| 1500 | 1530 | | Clandestine, SRS/Sudan R Service | 17745af |

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|------|------|---------|---|----------|
| 1500 | 1530 | | India, All India R/Jeyapore | 5040do |
| 1500 | 1530 | | USA, WRMI/R Prague relay | 9955am |
| 1500 | 1530 | | Vietnam, Voice of Vietnam/Overseas Svc | 7285as |
| | | | 9840as | 12020as |
| 1500 | 1535 | twas | Guam, TWR Asia/KTWR | 15200as |
| 1500 | 1550 | | New Zealand, R New Zealand Intl | 5950pa |
| 1500 | 1557 | | China, China R International | 5955as |
| | | | 7325as | 7405as |
| | | | 9435eu | 9525eu |
| | | | 9720va | 9785as |
| | | | 9870as | 13740na |
| | | | 17630af | |
| 1500 | 1559 | | Canada, R Canada International | 9635as |
| | | | 11975as | |
| 1500 | 1559 | | South Africa, Channel Africa | 9625af |
| 1500 | 1600 | | Anguilla/Caribbean Beacon/Univ Network | |
| | | | 11775na | |
| 1500 | 1600 | | Australia, ABC NT Alice Springs | 2310do |
| 1500 | 1600 | | Australia, ABC NT Katherine | 2485do |
| 1500 | 1600 | | Australia, R Australia | 5995va |
| | | | 7240pa | 9475as |
| | | | 9590pa | 11660as |
| 1500 | 1600 | | Bahrain, R 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 | Sat/Sun | Eqt Guinea, R East Africa/Malabo | 15190af |
| 1500 | 1600 | | Malaysia, RTM Kajang/Traxx FM | 7295do |
| 1500 | 1600 | | Nigeria, Voice of Nigeria | 15120af |
| 1500 | 1600 | | North Korea, Voice of Korea | 3560as |
| | | | 9335na | 11710na |
| | | | 12015eu | |
| 1500 | 1600 | DRM | Russia, Voice of Russia | 7340as |
| 1500 | 1600 | | Russia, Voice of Russia | 4975va |
| | | | 9660as | 9880as |
| 1500 | 1600 | | South Africa, CVC 1 Africa R | 13590af |
| 1500 | 1600 | | Uganda, Dunamis Shortwave | 4750do |
| 1500 | 1600 | | UK, BBC World Service | 5875as |
| | | | 6195as | 9410as |
| | | | 9490af | 9505as |
| | | | 11830me | 12095af |
| | | | 15400af | 15420af |
| | | | 17640af | 17830as |
| 1500 | 1600 | DRM | UK, BBC World Service | 5845as |
| 1500 | 1600 | | USA, Amer Forces Network/AFRTS | 4319usb |
| | | | 5446usb | 5765usb |
| | | | 7812usb | 12133usb |
| | | | 12759usb | 13362usb |
| 1500 | 1600 | | USA, BBG/Voice of America | 4930af |
| | | | 7575as | 9930pa |
| | | | 11840va | 12150va |
| | | | 13570va | 15580af |
| | | | 17715af | 17895af |
| 1500 | 1600 | | USA, BBG/Voice of America/Special English | |
| | | | 6140va | 7465va |
| | | | 7520va | 9760va |
| | | | 9945va | |
| 1500 | 1600 | | USA, EWTN/WEWN Irondale AL | 15610eu |
| 1500 | 1600 | | USA, FBN/WTJC Newport NC | 9370na |
| 1500 | 1600 | | USA, KNLS Anchor Point AK | 9655as |
| 1500 | 1600 | | USA, WBCQ Monticello ME | 9330am |
| 1500 | 1600 | Sat | USA, WBCQ Monticello ME | 15420am |
| 1500 | 1600 | Sun | USA, WHRI Cypress Creek SC | 17570va |
| 1500 | 1600 | Sat | USA, WHRI Cypress Creek SC | 21630af |
| 1500 | 1600 | | USA, WINB Red Lion PA | 13570ca |
| 1500 | 1600 | | USA, WJHR Intl Milton FL | 15550na |
| 1500 | 1600 | | USA, WTWW Lebanon TN | 9480na |
| | | | 12105na | 9990am |
| 1500 | 1600 | | USA, WWRB Nashville TN | 7490af |
| | | | 13845eu | 15825eu |
| 1500 | 1600 | | USA, WWRB Manchester TN | 9395na |
| 1500 | 1600 | | USA, WYFR/Family R Worldwide | 6280as |
| | | | 11610as | 11995as |
| | | | 21840af | |
| 1500 | 1600 | | Zambia, CVC R Christian Voice | 6065af |
| | | | 17695af | |
| 1515 | 1530 | Sat | Canada, Bible Voice Broadcasting | 13670as |
| 1530 | 1545 | | India, All India R/Aizawl | 5050do |
| 1530 | 1545 | | India, All India R/Bengaluru | 9425do |
| 1530 | 1545 | | India, All India R/Bhopal | 4810do |
| 1530 | 1545 | | India, All India R/Chennai | 4920do |
| 1530 | 1545 | | India, All India R/Delhi | 5015do |
| 1530 | 1545 | | India, All India R/Guwahati | 4940do |
| 1530 | 1545 | | India, All India R/Hyderabad | 4800do |
| 1530 | 1545 | | India, All India R/Itanagar | 4990do |
| 1530 | 1545 | | India, All India R/Jaipur | 4910do |
| 1530 | 1545 | | India, All India R/Kolkata | 4820do |
| 1530 | 1545 | | India, All India R/Kurseong | 4895do |
| 1530 | 1545 | | India, All India R/Lucknow | 4880do |
| 1530 | 1545 | | India, All India R/Panaji (Goa) | 9820do |

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| 1530 | 1545 | India, All India R/Port Blair | 4760do | |
| 1530 | 1545 | India, All India R/R Kashmir | 4950do | |
| 1530 | 1545 | India, All India R/Shillong | 4970do | |
| 1530 | 1545 | India, All India R/Shimla | 4965do | |
| 1530 | 1545 | India, All India R/Thiruvananthapuram | 5010do | |
| 1530 | 1550 | DRM Vatican City State, Vatican R | 15180as | |
| 1530 | 1550 | Sat/DRM Vatican City State, Vatican R | 15190as | |
| 1530 | 1600 | Afghanistan, R Afghanistan | 7200as | |
| 1530 | 1600 | DRM Belgium, TDP Radio/Disco Palace | 12115as | |
| 1530 | 1600 | h Canada, Bible Voice Broadcasting | 13670as | |
| 1530 | 1600 | smtwa Germany, AWR Europe | 15255as | |
| 1530 | 1600 | Iran, IRIB/VOIRI | 13785as 15525as | |
| 1530 | 1600 | Mongolia, Voice of Mongolia | 12085as | |
| 1530 | 1600 | Myanmar, Myanma R/Natl Svc | 5985do | |
| 1530 | 1600 | Sat Vatican City State, Vatican R | 7585as 11850as | |
| 1551 | 1600 | New Zealand, R New Zealand Intl | 7440pa | |
| 1551 | 1600 | DRM New Zealand, R New Zealand Intl | 5950pa | |

1600 UTC - 11AM EST / 10AM CST / 8AM PST

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| 1600 | 1627 | Iran, IRIB/VOIRI | 13785as 15525as | |
| 1600 | 1630 | Australia, R Australia | 9580as | |
| 1600 | 1630 | DRM Belgium, TDP Radio/Disco Palace | 12115as | |
| 1600 | 1630 | Guam, AWR/KSDA | 11690as 11935as | |
| 1600 | 1630 | 15215as | | |
| 1600 | 1630 | Myanmar, Myanma R/Natl Svc | 5985do | |
| 1600 | 1630 | Vietnam, Voice of Vietnam/Overseas Svc | 7220me 7280eu 9550me 9730eu | |
| 1600 | 1650 | DRM New Zealand, R New Zealand Intl | 5950pa | |
| 1600 | 1650 | New Zealand, R New Zealand Intl | 7440pa | |
| 1600 | 1657 | China, China R International | 6060as 7235as | |
| | | 7255eu 7420af 7435af 9435eu | | |
| 1600 | 1700 | Anguilla/Caribbean Beacon/Univ Network | 11775na | |
| 1600 | 1700 | Australia, ABC NT Alice Springs | 2310do | |
| 1600 | 1700 | Australia, ABC NT Katherine | 2485do | |
| 1600 | 1700 | Australia, R Australia | 5995va 6080as | |
| | | 7240pa 9475as 9710as 11660as | | |
| 1600 | 1700 | Bahrain, R Bahrain | 6010me | |
| 1600 | 1700 | Sat Canada, CBC Northern Quebec Svc | 9625na | |
| 1600 | 1700 | Canada, CFRX Toronto ON | 6070na | |
| 1600 | 1700 | Canada, CFPV Calgary AB | 6030na | |
| 1600 | 1700 | Canada, CKZN St Johns NF | 6160na | |
| 1600 | 1700 | Canada, CKZU Vancouver BC | 6160na | |
| 1600 | 1700 | Egypt, R Cairo | 15345af | |
| 1600 | 1700 | Sat/Sun Eqt Guinea, R East Africa/Malabo | 15190af | |
| 1600 | 1700 | Ethiopia, R Ethiopia | 7235va 9560va | |
| 1600 | 1700 | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1600 | 1700 | North Korea, Voice of Korea | 9990me 11545af | |
| 1600 | 1700 | DRM Russia, Voice of Russia | 6180as | |
| 1600 | 1700 | Russia, Voice of Russia | 4975va 7270me | |
| | | 9470me | | |
| 1600 | 1700 | South Africa, CVC 1 Africa R | 13590af | |
| 1600 | 1700 | South Korea, KBS World R | 9515eu 9640as | |
| 1600 | 1700 | Taiwan, R Taiwan Intl | 9440as 12055as | |
| 1600 | 1700 | Uganda, Dunamis Shortwave | 4750do | |
| 1600 | 1700 | UK, BBC World Service | 3255af 5875as | |
| | | 5975as 6190af 9410as 9505as | | |
| | | 11830me 12095af 13790af 15400af | | |
| | | 15420af 17640af 17830as | | |
| 1600 | 1700 | DRM UK, BBC World Service | 5845as | |
| 1600 | 1700 | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | 5446usb 5765usb 7812usb 12133usb | | |
| | | 12759usb 13362usb | | |
| 1600 | 1700 | USA, BBG/Voice of America | 4930af 6080af | |
| | | 15580af 17895af | | |
| 1600 | 1700 | USA, BBG/Voice of America/Special English | | |
| | | 13600va 15470va | | |
| 1600 | 1700 | USA, EWTN/WEWN Irondale AL | 15610eu | |
| 1600 | 1700 | USA, FBN/WTJC Newport NC | 9370na | |
| 1600 | 1700 | USA, WBCQ Monticello ME | 9330am | |
| 1600 | 1700 | Sat USA, WBCQ Monticello ME | 15420am | |
| 1600 | 1700 | Sun USA, WHRI Cypress Creek SC | 9840na | |
| 1600 | 1700 | USA, WHRI Cypress Creek SC | 11630af | |
| 1600 | 1700 | USA, WINB Red Lion PA | 13570ca | |
| 1600 | 1700 | USA, WJHR Intl Milton FL | 15550na | |
| 1600 | 1700 | USA, WTWW Lebanon TN | 9480na 9990am | |
| | | 12105na | | |
| 1600 | 1700 | USA, WWCN Nashville TN | 9980af 12160af | |

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|------|------|---|-----------------|--|
| | | | 13845eu 15825eu | |
| 1600 | 1700 | USA, WWRB Manchester TN | 9395na | |
| 1600 | 1700 | USA, WYFR/Family R Worldwide | 11740as | |
| | | 17545af | | |
| 1600 | 1700 | Zambia, CVC R Christian Voice | 6065af | |
| | | 17695af | | |
| 1630 | 1700 | Sun Canada, Bible Voice Broadcasting | 9460me | |
| 1630 | 1700 | mtwhf USA, BBG/Voice of America | 9790af 13635af | |
| 1645 | 1700 | mtwhfa Canada, Bible Voice Broadcasting | 9460me | |
| 1651 | 1700 | DRM New Zealand, R New Zealand Intl | 9890pa | |
| 1651 | 1700 | smtwhf New Zealand, R New Zealand Intl | 9765pa | |
| 1658 | 1700 | Sat New Zealand, R New Zealand Intl | 9765pa | |

1700 UTC - 12PM EST / 11AM CST / 9AM PST

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| 1700 | 1710 | Pakistan, PBC/R Pakistan | 7530eu 9470eu | |
| 1700 | 1715 | f Canada, Bible Voice Broadcasting | 9460me | |
| 1700 | 1720 | th Canada, Bible Voice Broadcasting | 9460me | |
| 1700 | 1750 | DRM New Zealand, R New Zealand Intl | 9890pa | |
| 1700 | 1750 | smtwhf New Zealand, R New Zealand Intl | 9765pa | |
| 1700 | 1755 | South Africa, Channel Africa | 15235af | |
| 1700 | 1757 | China, China R International | 6090as 6100eu | |
| | | 6140as 7205eu 7255eu 7410as | | |
| | | 7420as 7425as 9570af 9600as | | |
| | | 13685af | | |
| 1700 | 1800 | Anguilla/Caribbean Beacon/Univ Network | 11775na | |
| 1700 | 1800 | Australia, ABC NT Alice Springs | 2310do | |
| 1700 | 1800 | Australia, ABC NT Katherine | 2485do | |
| 1700 | 1800 | Australia, R Australia | 5995va 6080as | |
| | | 9475as 9580pa 9710as 11880pa | | |
| 1700 | 1800 | Bahrain, R Bahrain | 6010me | |
| 1700 | 1800 | Sat/Sun Canada, Bible Voice Broadcasting | 9460me | |
| 1700 | 1800 | Sat Canada, CBC Northern Quebec Svc | 9625na | |
| 1700 | 1800 | Canada, CFRX Toronto ON | 6070na | |
| 1700 | 1800 | Canada, CFPV Calgary AB | 6030na | |
| 1700 | 1800 | Canada, CKZN St Johns NF | 6160na | |
| 1700 | 1800 | Canada, CKZU Vancouver BC | 6160na | |
| 1700 | 1800 | Egypt, R Cairo | 15345af | |
| 1700 | 1800 | Sat/Sun Eqt Guinea, R Africa | 7190af | |
| 1700 | 1800 | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1700 | 1800 | DRM Russia, Voice of Russia | 7300eu | |
| 1700 | 1800 | Russia, Voice of Russia | 4975va 7240as | |
| | | 7270va 7330eu 9880as | | |
| 1700 | 1800 | South Africa, CVC 1 Africa R | 4965af 13590af | |
| 1700 | 1800 | Swaziland, TWR Africa | 3200af | |
| 1700 | 1800 | Taiwan, R Taiwan Intl | 15690af | |
| 1700 | 1800 | UK, BBC World Service | 5875as 5975as | |
| | | 6190af 7600as 9505as 12095af | | |
| | | 13790af 15400af 15420af 17640af | | |
| | | 17830af | | |
| 1700 | 1800 | DRM UK, BBC World Service | 5845as | |
| 1700 | 1800 | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | 5446usb 5765usb 7812usb 12133usb | | |
| | | 12759usb 13362usb | | |
| 1700 | 1800 | USA, BBG/Voice of America | 15580af 17895af | |
| 1700 | 1800 | USA, EWTN/WEWN Irondale AL | 15610eu | |
| 1700 | 1800 | USA, FBN/WTJC Newport NC | 9370na | |
| 1700 | 1800 | USA, WBCQ Monticello ME | 9330am | |
| 1700 | 1800 | Sat USA, WBCQ Monticello ME | 15420am | |
| 1700 | 1800 | USA, WHRI Cypress Creek SC | 9840na | |
| 1700 | 1800 | Sun USA, WHRI Cypress Creek SC | 11630af | |
| 1700 | 1800 | USA, WINB Red Lion PA | 13570ca | |
| 1700 | 1800 | USA, WJHR Intl Milton FL | 15550na | |
| 1700 | 1800 | USA, WTWW Lebanon TN | 9480na 9990am | |
| | | 12105na | | |
| 1700 | 1800 | USA, WWCN Nashville TN | 9980af 12160af | |
| | | 13845eu 15825eu | | |
| 1700 | 1800 | USA, WWRB Manchester TN | 9395na | |
| 1700 | 1800 | USA, WYFR/Family R Worldwide | 7385af | |
| | | 7395af 17540af 17545af | | |
| 1700 | 1800 | Zambia, CVC R Christian Voice | 4965af | |
| 1730 | 1745 | h Canada, Bible Voice Broadcasting | 9460me | |
| 1730 | 1745 | India, All India R/Bhopal | 4810do | |
| 1730 | 1745 | India, All India R/Delhi | 5015do 7370do | |
| | | 9575do 9835do | | |
| 1730 | 1745 | India, All India R/Guwahati | 4940do | |
| 1730 | 1745 | India, All India R/Hyderabad | 4800do | |
| 1730 | 1745 | India, All India R/Jaipur | 4910do | |
| 1730 | 1745 | India, All India R/Kolkata | 4820do | |
| 1730 | 1745 | India, All India R/Kurseong | 4895do | |

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| 1730 | 1745 | | India, All India R/Lucknow | 4880do | |
| 1730 | 1745 | | India, All India R/R Kashmir | 4950do | |
| 1730 | 1745 | | India, All India R/Shimla | 4965do | |
| 1730 | 1745 | | India, All India R/Thiruvananthapuram | 5010do | |
| 1730 | 1800 | mtwhf | Clandestine, SRS/Sudan R Service | 9840af | |
| 1730 | 1800 | m | South Africa, South African R League | 4895af | |
| 1730 | 1800 | | Turkey, Voice of Turkey | 11735as | |
| 1730 | 1800 | | Vatican City State, Vatican R | 9755af | 11625af |
| | | | 13765af | | |
| 1740 | 1745 | | India, All India R/Chennai | 4920do | |
| 1745 | 1800 | Sat | Canada, Bible Voice Broadcasting | 13810af | |
| 1745 | 1800 | DRM | India, All India R/External Svc | 9950eu | |
| 1745 | 1800 | | India, All India R/External Svc | 7400af | 7410af |
| | | | 7550eu | 9415af | 9445af |
| | | | 11935af | | 11670eu |
| 1751 | 1800 | DRM | New Zealand, R New Zealand Intl | 11675pa | |
| 1751 | 1800 | | New Zealand, R New Zealand Intl | 11725pa | |
| 1758 | 1800 | DRM | New Zealand, R New Zealand Intl | 11675pa | |
| 1758 | 1800 | Sat | New Zealand, R New Zealand Intl | 11725pa | |

1800 UTC - 1PM EST / 12PM CST / 10AM PST

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|------|------|---------|--|----------|----------|
| 1800 | 1815 | Sat | Canada, Bible Voice Broadcasting | 7365as | |
| 1800 | 1830 | w | Austria, AWR Europe | 11690af | |
| 1800 | 1830 | † | Canada, Bible Voice Broadcasting | 9460me | |
| 1800 | 1830 | DRM | Romania, R Romania Intl | 5875eu | |
| 1800 | 1830 | | South Africa, AWR Africa | 3215af | 3345af |
| 1800 | 1830 | m | South Africa, South African R League | 3230af | |
| 1800 | 1830 | | Turkey, Voice of Turkey | 11735as | |
| 1800 | 1830 | | UK, BBC World Service | 5975as | 7600as |
| | | | 9505as | | |
| 1800 | 1830 | | USA, BBG/Voice of America | 4930af | 6080af |
| | | | 13635af | 15580af | |
| 1800 | 1830 | | Vietnam, Voice of Vietnam/Overseas Svc | 5955eu | |
| 1800 | 1850 | DRM | New Zealand, R New Zealand Intl | 11675pa | |
| 1800 | 1856 | DRM | Romania, R Romania Intl | 9745eu | |
| 1800 | 1856 | | Romania, R Romania Intl | 11955eu | |
| 1800 | 1857 | | China, China R International | 6100eu | 6165as |
| | | | 7405eu | 13685af | |
| 1800 | 1859 | | Canada, R Canada International | 9740va | |
| | | | 9770af | 11845af | 15365af |
| | | | 17790af | | |
| 1800 | 1900 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | 6080as | 7240pa |
| | | | 9475as | 9580pa | 9710as |
| | | | | | 11880pa |
| 1800 | 1900 | | Bahrain, R Bahrain | 6010me | |
| 1800 | 1900 | Sun | Canada, Bible Voice Broadcasting | 6110me | |
| | | | 9460me | | |
| 1800 | 1900 | Sat | Canada, Bible Voice Broadcasting | 6110me | |
| 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 | Sat/Sun | Eq Guinea, R Africa | 7190af | |
| 1800 | 1900 | DRM | India, All India R/External Svc | 9950eu | |
| 1800 | 1900 | | India, All India R/External Svc | 7400af | 7410af |
| | | | 7550eu | 9415af | 9445af |
| | | | 11935af | | 11670eu |
| 1800 | 1900 | | Kuwait, R Kuwait | 15540eu | |
| 1800 | 1900 | | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1800 | 1900 | | Netherlands, R Netherlands Worldwide | 11655af | |
| 1800 | 1900 | | New Zealand, R New Zealand Intl | 11725pa | |
| 1800 | 1900 | | Nigeria, Voice of Nigeria | 15120af | |
| 1800 | 1900 | | North Korea, Voice of Korea | 3560as | 7570eu |
| | | | 12015eu | | |
| 1800 | 1900 | | Poland, Polskie R Warsaw | 3955eu | |
| 1800 | 1900 | DRM | Russia, Voice of Russia | 6145eu | 7300eu |
| 1800 | 1900 | | Russia, Voice of Russia | 7270va | 7330eu |
| | | | 11985va | 12060eu | |
| 1800 | 1900 | | South Africa, CVC 1 Africa R | 4965af | 13590af |
| 1800 | 1900 | | South Korea, KBS World R | 7275eu | |
| 1800 | 1900 | | Taiwan, R Taiwan Intl | 3965eu | |
| 1800 | 1900 | | UK, BBC World Service | 3255af | 5945as |
| | | | 6190af | 9430af | 11810af |
| | | | | | 15400af |
| 1800 | 1900 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12759usb | 13362usb | 12133usb |

| | | | | | |
|------|------|---------|-------------------------------------|---------|---------|
| 1800 | 1900 | | USA, EWTN/WEWN Irondale AL | 15610af | |
| 1800 | 1900 | | USA, FBN/WTJC Newport NC | 9370na | |
| 1800 | 1900 | | USA, WBCQ Monticello ME | 9330am | |
| 1800 | 1900 | fas | USA, WHRI Cypress Creek SC | 21630af | |
| 1800 | 1900 | Sat/Sun | USA, WHRI Cypress Creek SC | 9840na | |
| 1800 | 1900 | | USA, WINB Red Lion PA | 13570ca | |
| 1800 | 1900 | | USA, WJHR Intl Milton FL | 15550na | |
| 1800 | 1900 | | USA, WTWW Lebanon TN | 9480na | 9990am |
| | | | 12105na | | |
| 1800 | 1900 | | USA, WWCN Nashville TN | 9980af | 12160af |
| | | | 13845eu | 15825eu | |
| 1800 | 1900 | | USA, WWRB Manchester TN | 9395na | |
| 1800 | 1900 | | USA, WYFR/Family R Worldwide | 5890af | |
| | | | 7385af | 7395af | 9895af |
| | | | 12140af | 13750af | 11665af |
| 1800 | 1900 | | Zambia, CVC R Christian Voice | 4965af | |
| | | | 17695af | | |
| 1830 | 1845 | | India, All India R/Delhi | 5015do | |
| 1830 | 1900 | Sun | Italy, IRRS-Shortwave/Euro Gospel R | 7290eu | |
| 1830 | 1900 | | South Africa, AWR Africa | 11830af | |
| 1830 | 1900 | | UK, BBC World Service | 9410af | |
| 1830 | 1900 | | USA, BBG/Voice of America | 4930af | 6080af |
| | | | 13635af | 15580af | |
| 1851 | 1900 | DRM | New Zealand, R New Zealand Intl | 15720pa | |
| 1858 | 1900 | Sat/DRM | New Zealand, R New Zealand Intl | 15720pa | |

1900 UTC - 2PM EST / 1PM CST / 11AM PST

| | | | | | |
|------|------|---------|--|---------|----------|
| 1900 | 1915 | Sun | Canada, Bible Voice Broadcasting | 9460me | |
| 1900 | 1928 | | Germany, Deutsche Welle | 12045af | |
| 1900 | 1930 | | Germany, Deutsche Welle | 9735af | 12070af |
| 1900 | 1930 | | Vietnam, Voice of Vietnam/Overseas Svc | 7280eu | |
| | | | 9730eu | | |
| 1900 | 1945 | DRM | India, All India R/External Svc | 9950eu | |
| 1900 | 1945 | | India, All India R/External Svc | 7400af | 7410af |
| | | | 7550eu | 9415af | 9445af |
| | | | 11935af | | 11670eu |
| 1900 | 1950 | DRM | New Zealand, R New Zealand Intl | 15720pa | |
| 1900 | 1957 | | China, China R International | 7295as | 7435 `af |
| | | | 9440as | | |
| 1900 | 1957 | | Netherlands, R Netherlands Worldwide | 11655af | |
| 1900 | 1959 | | Netherlands, R Netherlands Worldwide | 11615af | |
| 1900 | 2000 | | Anguilla/Caribbean Beacon/Univ Network | | |
| | | | 11775na | | |
| 1900 | 2000 | | Australia, ABC NT Alice Springs | 2310do | |
| 1900 | 2000 | | Australia, ABC NT Katherine | 2485do | |
| 1900 | 2000 | | Australia, R Australia | 6080as | 7240pa |
| | | | 9500as | 9580pa | 9710as |
| | | | | | 11880pa |
| 1900 | 2000 | | Bahrain, R Bahrain | 6010me | |
| 1900 | 2000 | Sat | Canada, Bible Voice Broadcasting | 9470me | |
| 1900 | 2000 | Sun | Canada, Bible Voice Broadcasting | 6030eu | |
| 1900 | 2000 | | Canada, CFRX Toronto ON | 6070na | |
| 1900 | 2000 | | Canada, CFVP Calgary AB | 6030na | |
| 1900 | 2000 | | Canada, CKZN St Johns NF | 6160na | |
| 1900 | 2000 | | Canada, CKZU Vancouver BC | 6160na | |
| 1900 | 2000 | Sat/Sun | Eq Guinea, R Africa | 7190af | |
| 1900 | 2000 | | Indonesia, Voice of Indonesia | 9525va | |
| 1900 | 2000 | fas | Italy, IRRS-Shortwave/Overcomer Ministry | 7290va | |
| | | | 7290eu | | |
| 1900 | 2000 | | Kuwait, R Kuwait | 15540eu | |
| 1900 | 2000 | | Malaysia, RTM Kajang/Traxx FM | 7295do | |
| 1900 | 2000 | | Micronesia, V6MP/Cross R/Pohnpei | 4755as | |
| 1900 | 2000 | | Netherlands, R Netherlands Worldwide | 7425af | |
| 1900 | 2000 | | New Zealand, R New Zealand Intl | 11725pa | |
| 1900 | 2000 | | North Korea, Voice of Korea | 7210af | 9975me |
| | | | 11535af | 11910af | |
| 1900 | 2000 | DRM | Russia, Voice of Russia | 6040eu | |
| 1900 | 2000 | | Russia, Voice of Russia | 7330eu | |
| 1900 | 2000 | | South Africa, CVC 1 Africa R | 4965af | 13590af |
| 1900 | 2000 | mtwhf | Spain, R Exterior de Espana | 9605af | 9665eu |
| 1900 | 2000 | | Swaziland, TWR Africa | 3200af | |
| 1900 | 2000 | | Thailand, R Thailand World Svc | 9680eu | |
| 1900 | 2000 | | UK, BBC World Service | 3255af | 5945as |
| | | | 6005af | 9410af | 9430af |
| | | | 15400af | | 11810af |
| 1900 | 2000 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12133usb | | 12133usb |

| | | | | | |
|------|------|---|------------------------------------|---------|---------|
| | | 12759usb | 13362usb | | |
| 1900 | 2000 | USA, BBG/Voice of America | 4930af | 4940af | |
| | | 6080af | 7480va | 9590va | 15580af |
| 1900 | 2000 | USA, BBG/Voice of America/Special English | | | |
| | | 7480va | 9590va | | |
| 1900 | 2000 | USA, EWTN/WEWN Irondale AL | | 15610af | |
| 1900 | 2000 | USA, FBN/WTJC Newport NC | | 9370na | |
| 1900 | 2000 | USA, WBCQ Monticello ME | 9330am | | |
| 1900 | 2000 | USA, WHRI Cypress Creek SC | | 9840na | |
| 1900 | 2000 | USA, WINB Red Lion PA | 13570ca | | |
| 1900 | 2000 | USA, WJHR Intl Milton FL | 15550na | | |
| 1900 | 2000 | USA, WTTW Lebanon TN | 9480na | 9990am | |
| | | 12105na | | | |
| 1900 | 2000 | USA, WWCR Nashville TN | 9980af | 12160af | |
| | | 13845eu | 15825eu | | |
| 1900 | 2000 | USA, WWRB Manchester TN | 9395na | | |
| 1900 | 2000 | USA, WYFR/Family R Worldwide | | 3230af | |
| | | 5850af | 6020af | 7395af | 9610af |
| | | 9705af | 9885af | 9925af | |
| | | 18980eu | | | |
| 1900 | 2000 | Zambia, CVC R Christian Voice | | 4965af | |
| | | 13590af | | | |
| 1905 | 1920 | Sat | Mali, ORTM/R Mali | 9635do | |
| 1915 | 1945 | Sat | Canada, Bible Voice Broadcasting | 6030eu | |
| 1915 | 1945 | Sun | Canada, Bible Voice Broadcasting | 9470me | |
| 1930 | 2000 | Sat/Sun | Germany, Pan American Broadcasting | 6040af | |
| 1930 | 2000 | | Iran, IRIB/VOIRI | 6010eu | 6115eu |
| | | | 13670af | 15450af | |
| 1930 | 2000 | | Serbia, International R Serbia | 6100eu | |
| 1930 | 2000 | | South Africa, RTE R Worldwide | 5820af | |
| 1930 | 2000 | | Turkey, Voice of Turkey | 6050va | |
| 1951 | 2000 | DRM | New Zealand, R New Zealand Intl | 17675pa | |
| 1958 | 2000 | Sat/DRM | New Zealand, R New Zealand Intl | 17675pa | |

2000 UTC - 3PM EST / 2PM CST / 12PM PST

| | | | | | | |
|------|------|---------|--|---------|---------|--------|
| 2000 | 2027 | | Iran, IRIB/VOIRI | 6010eu | 6115eu | 7320eu |
| | | | 13670af | 15450af | | |
| 2000 | 2030 | Sat | Germany, Pan American Broadcasting | 6040af | | |
| 2000 | 2030 | | South Africa, RTE R Worldwide | 5840af | | |
| 2000 | 2030 | | Swaziland, TWR Africa | 3200af | | |
| 2000 | 2030 | | Turkey, Voice of Turkey | 6050va | | |
| 2000 | 2030 | | Vatican City State, Vatican R | 7365af | 9755af | |
| | | | 11625af | | | |
| 2000 | 2050 | DRM | New Zealand, R New Zealand Intl | 17675pa | | |
| 2000 | 2057 | | China, China R International | 5960eu | 5985af | |
| | | | 7285eu | 7295as | 7415eu | 9440as |
| | | | 9600eu | 11640af | 13630af | |
| 2000 | 2057 | | Netherlands, R Netherlands Worldwide | 7425af | | |
| | | | 11615af | | | |
| 2000 | 2100 | | Anguilla/Caribbean Beacon/Univ 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, R Australia | 9500as | 11650as | |
| | | | 11660pa | 11880pa | | |
| 2000 | 2100 | mtwhf | Australia, R Australia | 7240pa | | |
| 2000 | 2100 | Sat/Sun | Australia, R Australia | 6080as | 7240pa | |
| | | | 12080va | | | |
| 2000 | 2100 | | Bahrain, R Bahrain | 6010me | | |
| 2000 | 2100 | | Belarus, R Station Belarus | 6155eu | 7360eu | |
| | | | 7390eu | | | |
| 2000 | 2100 | DRM | Belgium, TDP Radio/Disco Palace | 17755na | | |
| 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 | f | Clandestine, JSR/Shiokaze/Sea Breeze | 5965as | | |
| | | | 5910al | 6110al | | |
| 2000 | 2100 | | Cuba, R Havana Cuba | 11760ca | | |
| 2000 | 2100 | Sat/Sun | Eq Guinea, R Africa | 7190af | | |
| 2000 | 2100 | | Germany, Deutsche Welle | 9655af | 9735af | |
| | | | 12070af | | | |
| 2000 | 2100 | | Kuwait, R Kuwait | 15540eu | | |
| 2000 | 2100 | | Malaysia, RTM Kajang/Traxx FM | 7295do | | |
| 2000 | 2100 | | Micronesia, V6MP/Cross R/Pohnpei | 4755as | | |
| 2000 | 2100 | | New Zealand, R New Zealand Intl | 11725pa | | |

| | | | | | | |
|------|------|---------|--|----------|---------|----------|
| 2000 | 2100 | DRM | Russia, Voice of Russia | 6040eu | | |
| 2000 | 2100 | | Russia, Voice of Russia | 7330eu | | |
| 2000 | 2100 | | South Africa, CVC 1 Africa R | 4965af | 9505af | |
| 2000 | 2100 | | UK, BBC World Service | 3255af | 6005af | |
| | | | 6190af | 9410af | 9430af | 11810af |
| | | | 15400af | | | |
| 2000 | 2100 | | USA, Amer Forces Network/AFRTS | 4319usb | | |
| | | | 5446usb | 5765usb | 7812usb | 12133usb |
| | | | 12759usb | 13362usb | | |
| 2000 | 2100 | mtwhf | USA, BBG/Voice of America | 7470va | 9480va | |
| | | | 9490va | | | |
| 2000 | 2100 | | USA, EWTN/WEWN Irondale AL | 15610af | | |
| 2000 | 2100 | | USA, FBN/WTJC Newport NC | 9370na | | |
| 2000 | 2100 | | USA, WBCQ Monticello ME | 9330am | 15420am | |
| 2000 | 2100 | smtwhf | USA, WBCQ Monticello ME | 7490am | | |
| 2000 | 2100 | Sun | USA, WHRI Cypress Creek SC | 9895va | | |
| 2000 | 2100 | Sat | USA, WHRI Cypress Creek SC | 17520af | | |
| 2000 | 2100 | | USA, WINB Red Lion PA | 13570ca | | |
| 2000 | 2100 | | USA, WJHR Intl Milton FL | 15550na | | |
| 2000 | 2100 | | USA, WTTW Lebanon TN | 9480na | 9990am | |
| | | | 12105na | | | |
| 2000 | 2100 | | USA, WWCR Nashville TN | 9980af | 12160af | |
| | | | 13845eu | 15825eu | | |
| 2000 | 2100 | | USA, WWRB Manchester TN | 9395na | | |
| 2000 | 2100 | | USA, WYFR/Family R Worldwide | 6020af | | |
| | | | 9925af | 15195af | 15520af | |
| 2000 | 2100 | | Zambia, CVC R Christian Voice | 4965af | | |
| | | | 13590af | | | |
| 2030 | 2045 | | Thailand, R Thailand World Svc | 9535eu | | |
| 2030 | 2100 | | USA, BBG/Voice of America | 4930af | 6080af | |
| | | | 7560as | 15580af | | |
| 2030 | 2100 | Sat/Sun | USA, BBG/Voice of America | 4940af | | |
| 2030 | 2100 | | Vietnam, Voice of Vietnam/Overseas Svc | 7270me | 7280eu | 9550me |
| | | | 9730eu | | | |
| 2045 | 2100 | | India, All India R/External Svc | 7550eu | 9445eu | |
| | | | 11670eu | 11715pa | | |
| 2045 | 2100 | DRM | India, All India R/External Svc | 9950eu | | |
| 2045 | 2100 | DRM | Vatican City State, Vatican R | 9800am | | |
| 2050 | 2100 | | Vatican City State, Vatican R | 3975eu | 6075eu | |
| | | | 7250eu | | | |
| 2051 | 2100 | DRM | New Zealand, R New Zealand Intl | 15720pa | | |

2100 UTC - 4PM EST / 3PM CST / 1PM PST

| | | | | | | |
|------|------|---------|--|---------|---------|---------|
| 2100 | 2127 | | China, China R International | 11640af | 13630af | |
| 2100 | 2130 | mtwhfa | Albania, R Tirana | 7530na | | |
| 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 | 9830af | | |
| 2100 | 2130 | Sat | Canada, CBC Northern Quebec Svc | 9625na | | |
| 2100 | 2150 | | New Zealand, R New Zealand Intl | 11725pa | | |
| 2100 | 2150 | DRM | New Zealand, R New Zealand Intl | 15720pa | | |
| 2100 | 2157 | | China, China R International | 5960eu | 5690eu | |
| | | | 7205af | 7285eu | 7405af | 7415eu |
| | | | 9600eu | | | |
| 2100 | 2200 | | Angola, Angolan National R | 7217af | | |
| 2100 | 2200 | | Anguilla/Caribbean Beacon/Univ Network | | | |
| | | | 11775na | | | |
| 2100 | 2200 | | Australia, R Australia | 9500as | 9660pa | |
| | | | 11650as | 11660pa | 11695va | 12080va |
| | | | 13630va | 15515va | | |
| 2100 | 2200 | | Bahrain, R Bahrain | 6010me | | |
| 2100 | 2200 | | Belarus, R Station Belarus | 6155eu | 7360eu | |
| | | | 7390eu | | | |
| 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 | Sat/Sun | Eq Guinea, R Africa | 7190af | | |
| 2100 | 2200 | | Germany, Deutsche Welle | 12070af | | |
| 2100 | 2200 | | India, All India R/External Svc | 7550eu | 9445eu | |
| | | | 11670pa | 11715pa | | |
| 2100 | 2200 | DRM | India, All India R/External Svc | 9950eu | | |
| 2100 | 2200 | | Malaysia, RTM Kajang/Traxx FM | 7295do | | |
| 2100 | 2200 | | Micronesia, V6MP/Cross R/Pohnpei | 4755 as | | |
| 2100 | 2200 | | North Korea, Voice of Korea | 3560as | 7570eu | |
| | | | 12015eu | | | |

| | | | | | |
|------|------|---|----------|---------|----------|
| 2100 | 2200 | Russia, Voice of Russia | 7300eu | | |
| 2100 | 2200 | South Africa, CVC 1 Africa R | 4965af | 9505af | |
| 2100 | 2200 | Syria, R Damascus | 9330va | | |
| 2100 | 2200 | UK, BBC World Service | 3255af | 3915as | |
| | | 5875as | 5905af | 5955af | 5965as |
| | | 6190af | 6195as | 9410af | 9915af |
| | | 12095af | | | |
| 2100 | 2200 | USA, Amer Forces Network/AFRTS | 4319usb | | |
| | | 5446usb | 5765usb | 7812usb | 12133usb |
| | | 12759usb | 13362usb | | |
| 2100 | 2200 | USA, BBG/Voice of America | 6080af | 15580af | |
| 2100 | 2200 | USA, EWTN/WEWN Irondale AL | | 15610af | |
| 2100 | 2200 | USA, FBN/WTJC Newport NC | | 9370na | |
| 2100 | 2200 | USA, WBCQ Monticello ME | 9330am | 15420am | |
| 2100 | 2200 | USA, WBCQ Monticello ME | 7490am | | |
| 2100 | 2200 | USA, WHRI Cypress Creek SC | | 9490va | |
| 2100 | 2200 | USA, WINB Red Lion PA | 13570ca | | |
| 2100 | 2200 | USA, WJHR Intl Milton FL | 15550na | | |
| 2100 | 2200 | USA, WTVW Lebanon TN | 9480na | 9990am | |
| | | 12105na | | | |
| 2100 | 2200 | USA, WWCN Nashville TN | 7465eu | 9350af | |
| | | 9980af | 13845eu | | |
| 2100 | 2200 | USA, WWRB Manchester TN | 3215na | 9395na | |
| 2100 | 2200 | USA, WYFR/Family R Worldwide | | 7425af | |
| | | 9925af | 15195af | | |
| 2100 | 2200 | Zambia, CVC R Christian Voice | | 4965af | |
| | | 13590af | | | |
| 2115 | 2200 | Egypt, R Cairo | 6270eu | | |
| 2130 | 2156 | Romania, R Romania Intl | 6030na | 7310na | |
| | | 7380na | 9435na | | |
| 2130 | 2200 | Australia, ABC NT Alice Springs | | 4835do | |
| 2130 | 2200 | Australia, ABC NT Katherine | 5025do | | |
| 2130 | 2200 | Canada, CBC Northern Quebec Svc | | 9625na | |
| 2130 | 2200 | Turkey, Voice of Turkey | 9610va | | |
| 2151 | 2200 | New Zealand, R New Zealand Intl | | 15720pa | |
| 2151 | 2200 | DRM New Zealand, R New Zealand Intl | | 17675pa | |
| 2158 | 2200 | Sat New Zealand, R New Zealand Intl | | 15720pa | |
| 2158 | 2200 | Sat/DRM New Zealand, R New Zealand Intl | | 17675pa | |

2200 UTC - 5PM EST / 4PM CST / 2PM PST

| | | | | | |
|------|------|---------|--|----------|---------|
| 2200 | 2215 | † | USA, WBCQ Monticello ME | 7490am | |
| 2200 | 2230 | | India, All India R/External Svc | 7550eu | 9445eu |
| | | | 11670pa | 11715pa | |
| 2200 | 2230 | | Serbia, International R Serbia | 6100eu | |
| 2200 | 2230 | | South Korea, KBS World R | 3955eu | |
| 2200 | 2230 | | Turkey, Voice of Turkey | 9610va | |
| 2200 | 2245 | | Egypt, R Cairo | 6270eu | |
| 2200 | 2257 | | China, China R International | 5915as | |
| 2200 | 2300 | | Anguilla/Caribbean Beacon/Univ Network | | 6090na |
| 2200 | 2300 | | Australia, ABC NT Alice Springs | | 4835do |
| 2200 | 2300 | | Australia, ABC NT Katherine | 5025do | |
| 2200 | 2300 | | Australia, R Australia | 9855as | 11550as |
| | | | 12080va | 13630va | 15230va |
| | | | 15515va | | 15240va |
| 2200 | 2300 | fa | Australia, R Australia | 9660pa | |
| 2200 | 2300 | | Bahrain, R Bahrain | 6010me | |
| 2200 | 2300 | smtwhf | Canada, CBC Northern Quebec Svc | | 9625na |
| 2200 | 2300 | | Canada, CFRX Toronto ON | 6070na | |
| 2200 | 2300 | | Canada, CFPV Calgary AB | 6030na | |
| 2200 | 2300 | | Canada, CKZN St Johns NF | 6160na | |
| 2200 | 2300 | | Canada, CKZU Vancouver BC | | 6160na |
| 2200 | 2300 | Sat/Sun | Eqt Guinea, R Africa | 7190af | |
| 2200 | 2300 | DRM | India, All India R/External Svc | 11645as | |
| 2200 | 2300 | | Malaysia, RTM Kajang/Traxx FM | | 7295do |
| 2200 | 2300 | | Micronesia, V6MP/Cross R/Pohnpei | | 4755 as |
| 2200 | 2300 | | New Zealand, R New Zealand Intl | | 15720pa |
| 2200 | 2300 | DRM | New Zealand, R New Zealand Intl | | 17675pa |
| 2200 | 2300 | | Russia, Voice of Russia | 7250va | 11830na |
| 2200 | 2300 | Sat/Sun | Spain, R Exterior de Espana | 6125eu | |
| 2200 | 2300 | | UK, BBC World Service | 3915as | 5875as |
| | | | 5890as | 5965as | 6190af |
| | | | 7490as | 9915af | 12095af |
| 2200 | 2300 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12759usb | 13362usb | |
| 2200 | 2300 | smtwh | USA, BBG/Voice of America | 5840as | 7365as |
| | | | 7425pa | 7570va | 11860va |

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|------|------|-------|---|---------|---------|
| 2200 | 2300 | | USA, EWTN/WEWN Irondale AL | | 15610af |
| 2200 | 2300 | | USA, FBN/WTJC Newport NC | | 9370na |
| 2200 | 2300 | smwhf | USA, WBCQ Monticello ME | 7490am | |
| 2200 | 2300 | | USA, WBCQ Monticello ME | 9330am | |
| 2200 | 2300 | Sat | USA, WHRI Cypress Creek SC | | 9490va |
| 2200 | 2300 | f | USA, WHRI Cypress Creek SC | | 15180na |
| 2200 | 2300 | Sat | USA, WHRI Cypress Creek SC | | 9505va |
| 2200 | 2300 | | USA, WINB Red Lion PA | 9265ca | |
| 2200 | 2300 | | USA, WTVW Lebanon TN | 9480na | 9990am |
| | | | 12105na | | |
| 2200 | 2300 | | USA, WWCN Nashville TN | 7465eu | 9350af |
| | | | 9980af | 13845eu | |
| 2200 | 2300 | | USA, WWRB Manchester TN | 3215na | 5050va |
| | | | 5745va | 9395na | |
| 2230 | 2300 | | Guam, AWR/KSDA | | 15320as |
| 2230 | 2300 | fa | Palau, T8WH/ WHRI | | 9930as |
| 2230 | 2300 | | USA, BBG/Voice of America | 7545as | 9570pa |
| 2230 | 2300 | | USA, BBG/Voice of America/Special English | | |
| | | | 5810va | 7545va | 9570va |
| 2245 | 2300 | | India, All India R/External Svc | 6055as | 7305as |
| | | | 13605as | | |

2300 UTC - 6PM EST / 5PM CST / 3PM PST

| | | | | | |
|------|------|--------|--|----------|---------|
| 2300 | 0000 | | Anguilla/Caribbean Beacon/Univ Network | | |
| | | | 6090na | | |
| 2300 | 0000 | | Australia, ABC NT Alice Springs | | 4835do |
| 2300 | 0000 | | Australia, ABC NT Katherine | 5025do | |
| 2300 | 0000 | | Australia, R Australia | 9855as | 9660pa |
| | | | 12080va | 13690va | 15230va |
| | | | 17795pa | | 15515pa |
| 2300 | 0000 | | Bahrain, R Bahrain | 6010me | |
| 2300 | 0000 | smtwhf | Canada, CBC Northern Quebec Svc | | 9625na |
| 2300 | 0000 | | Canada, CFRX Toronto ON | 6070na | |
| 2300 | 0000 | | Canada, CFPV Calgary AB | 6030na | |
| 2300 | 0000 | | Canada, CKZN St Johns NF | 6160na | |
| 2300 | 0000 | | Canada, CKZU Vancouver BC | | 6160na |
| 2300 | 0000 | | Egypt, R Cairo | 6270na | |
| 2300 | 0000 | | India, All India R/External Svc | 6055as | 7305as |
| | | | 13605as | | |
| 2300 | 0000 | | Malaysia, RTM Kajang/Traxx FM | | 7295do |
| 2300 | 0000 | | Micronesia, V6MP/Cross R/Pohnpei | | 4755 as |
| 2300 | 0000 | | New Zealand, R New Zealand Intl | | 15720pa |
| 2300 | 0000 | DRM | New Zealand, R New Zealand Intl | | 17675pa |
| 2300 | 0000 | | Russia, Voice of Russia | 7250va | 7290va |
| 2300 | 0000 | | Turkey, Voice of Turkey | 5960va | |
| 2300 | 0000 | | UK, BBC World Service | 3915as | 5875as |
| | | | 5980as | 6195as | 7490as |
| | | | 11955as | | |
| 2300 | 0000 | | USA, Amer Forces Network/AFRTS | 4319usb | |
| | | | 5446usb | 5765usb | 7812usb |
| | | | 12759usb | 13362usb | |
| 2300 | 0000 | | USA, BBG/Voice of America | 5840as | 5895as |
| | | | 7365as | 7460as | 7480pa |
| | | | 9490va | 11840va | 11860va |
| 2300 | 0000 | | USA, EWTN/WEWN Irondale AL | | 15610af |
| 2300 | 0000 | | USA, FBN/WTJC Newport NC | | 9370na |
| 2300 | 0000 | smtwhf | USA, WBCQ Monticello ME | 7490am | |
| 2300 | 0000 | | USA, WBCQ Monticello ME | 9330am | |
| 2300 | 0000 | Sat | USA, WHRI Cypress Creek SC | | 9505va |
| 2300 | 0000 | smtwhf | USA, WHRI Cypress Creek SC | | 7385ca |
| 2300 | 0000 | | USA, WINB Red Lion PA | 9265ca | |
| 2300 | 0000 | | USA, WTVW Lebanon TN | 9480na | 9990am |
| | | | 12105na | | |
| 2300 | 0000 | | USA, WWCN Nashville TN | 3195eu | 5070af |
| | | | 9980af | 13845eu | |
| 2300 | 0000 | | USA, WWRB Manchester TN | 3215na | 5050va |
| | | | 5745va | 9395na | |
| 2300 | 0000 | | USA, WYFR/Family R Worldwide | | 9430af |
| | | | 15400af | | |
| 2300 | 2330 | | Australia, R Australia | | 15240as |
| 2300 | 2330 | DRM | Vatican City State, Vatican R | | 7370am |
| 2300 | 2356 | | Romania, R Romania Intl | 6015eu | 7220eu |
| | | | 7300eu | 9530eu | |
| 2300 | 2357 | | China, China R International | 5915as | 5990me |
| | | | 6040na | 6145as | 7350eu |
| | | | 9535as | 11790as | 11970va |
| 2315 | 0000 | | USA, WYFR/Family R Worldwide | | 6115va |
| 2315 | 2330 | | Croatia, Voice of Croatia | 3985ca | 7375eu |
| 2330 | 0000 | | Australia, R Australia | | 15415va |
| 2330 | 0000 | | Vietnam, Voice of Vietnam/Overseas Svc | 9840as | |
| | | | 12020as | | |
| 2330 | 2345 | | India, All India R/Aligarh | | 9470do |



MTXTRA

Shortwave Broadcast Guide

SPANISH

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.

0600 UTC - 1AM EST / 12AM CST / 10PM PST

| | | | |
|-----------|---|---------|--------|
| 0600 0627 | Iran, IRIB/ VOIRI 13710eu | 15330sa | |
| 0600 0657 | China, China Radio International | 15135eu | |
| 0600 0700 | Colombia, La Voz de tu Conciencia | 6010do | |
| 0600 0700 | Colombia, La Voz del Guaviare | 6035do | |
| 0600 0700 | Colombia, Marfil Estereo | 5910do | |
| 0600 0700 | Cuba, Radio Rebelde | 5025na | |
| 0600 0700 | Ecuador, Radio Quito | 4919do | |
| 0600 0700 | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 0600 0700 | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 0600 0700 | Mexico, Radio Educacion | 6185do | |
| 0600 0700 | Mexico, Radio Mil Onda Corta | 6010do | |
| 0600 0700 | Mexico, Radio Transcontinental de America | 4800do | |
| 0600 0700 | Peru, Radio Victoria | 6019do | 9720do |
| 0600 0700 | Peru, Radio Vision 4790do | | |
| 0600 0700 | South Korea, KBS World Radio | 6045eu | |
| 0600 0700 | Spain, Radio Exterior de Espana | 9780eu | |
| 0600 0700 | Spain, Radio Exterior de Espana | 5965sa | |
| 0600 0700 | DRM | 12035eu | |
| 0600 0700 | USA, BBG/Radio Marti | 6030ca | 7405ca |
| 0600 0700 | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 11870sa | |
| 0600 0700 | USA, WYFR/Family Radio Worldwide | 5985na | |
| | | 9505ca | 9715na |
| 0630 0700 | USA, WRMI/Radio Prague relay | | 9955am |

0700 UTC - 2AM EST / 1AM CST / 11PM PST

| | | | |
|-----------|---|---------------------------------|--------|
| 0700 0730 | Bulgaria, Radio Bulgaria | 7300eu | 9800eu |
| 0700 0745 | USA, WYFR/Family Radio Worldwide | 9355eu | |
| | | 9680na | |
| 0700 0757 | China, China Radio International | 15135eu | |
| 0700 0800 | Colombia, La Voz de tu Conciencia | 6010do | |
| 0700 0800 | Colombia, Marfil Estereo | 5910do | |
| 0700 0800 | Cuba, Radio Rebelde | 5025na | |
| 0700 0800 | Ecuador, Radio Quito | 4919do | |
| 0700 0800 | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 0700 0800 | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 0700 0800 | Mexico, Radio Educacion | 6185do | |
| 0700 0800 | Mexico, Radio Mil Onda Corta | 6010do | |
| 0700 0800 | Mexico, Radio Transcontinental de America | 4800do | |
| 0700 0800 | Peru, Radio Victoria | 6019do | 9720do |
| 0700 0800 | Peru, Radio Vision 4790do | | |
| 0700 0800 | DRM | Spain, Radio Exterior de Espana | 9780eu |
| 0700 0800 | Spain, Radio Exterior de Espana | 5965sa | |
| | | 12035eu | |
| 0700 0800 | USA, BBG/Radio Marti | 5980ca | 6030ca |
| 0700 0800 | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 11870sa | |
| 0700 0800 | USA, WYFR/Family Radio Worldwide | 5850ca | |
| | | 9715na | |

0800 UTC - 3AM EST / 2AM CST / 12AM PST

| | | | | |
|-----------|----|-----------------------------------|--------|--------|
| 0800 0900 | fa | Bolivia, Radio Fides | 6155do | 9625do |
| 0800 0900 | | Colombia, La Voz de tu Conciencia | 6010do | |
| 0800 0900 | | Colombia, Marfil Estereo | 5910do | |
| 0800 0900 | | Cuba, Radio Rebelde | 5025na | |
| 0800 0900 | | Ecuador, Radio Quito | 4919do | |

| | | | | |
|-----------|------|---|---------|---------|
| 0800 0900 | | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 0800 0900 | | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 0800 0900 | | Mexico, Radio Educacion | 6185do | |
| 0800 0900 | | Mexico, Radio Mil Onda Corta | 6010do | |
| 0800 0900 | | Mexico, Radio Transcontinental de America | 4800do | |
| 0800 0900 | | Peru, Radio JPI del Peru | 3360do | |
| 0800 0900 | | Peru, Radio Victoria | 6019do | 9720do |
| 0800 0900 | | Peru, Radio Vision 4790do | | |
| 0800 0900 | DRM | Spain, Radio Exterior de Espana | 9780eu | |
| 0800 0900 | | Spain, Radio Exterior de Espana | 12035eu | |
| 0800 0900 | | Spain, Radio Exterior de Espana | 13720eu | |
| 0800 0900 | twhf | USA, BBG/Radio Marti | 5980ca | 6030ca |
| 0800 0900 | | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 11870sa | | |
| 0800 0900 | | USA, WYFR/Family Radio Worldwide | 5850ca | |
| | | 9505ca | 9715na | 11855ca |
| 0830 0900 | | Bolivia, Radio Casachun Coca | | 6075do |

0900 UTC - 4AM EST / 3AM CST / 1AM PST

| | | | | |
|-----------|--|--|---------|---------|
| 0900 0945 | | USA, WYFR/Family Radio Worldwide | 5850ca | |
| | | 9505ca | | |
| 0900 1000 | | Bolivia, Radio Casachun Coca | 6075do | |
| 0900 1000 | | Bolivia, Radio Fides | 6155do | 9625do |
| 0900 1000 | | Bolivia, Radio Logos | 4865do | |
| 0900 1000 | | Bolivia, Radio Loyola | 5996do | |
| 0900 1000 | | Bolivia, Radio Mosoj Chaski | 3310do | |
| 0900 1000 | | Bolivia, Radio San Gabriel | 6080do | |
| 0900 1000 | | Bolivia, Radio Santa Ana | 4451do | |
| 0900 1000 | | Colombia, La Voz de tu Conciencia | 6010do | |
| 0900 1000 | | Colombia, Marfil Estereo | 5910do | |
| 0900 1000 | | Cuba, Radio Rebelde | 5025na | |
| 0900 1000 | | Dominican Republic, Radio Amanecer Intl | 6025do | |
| 0900 1000 | | Dominican Republic, Radio Cristal Intl | 5009do | |
| 0900 1000 | | Ecuador, La Voz del Napo | 3280do | |
| 0900 1000 | | Ecuador, Radio Quito | 4919do | |
| 0900 1000 | | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 0900 1000 | | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 0900 1000 | | Mexico, Radio Educacion | 6185do | |
| 0900 1000 | | Mexico, Radio Mil Onda Corta | 6010do | |
| 0900 1000 | | Mexico, Radio Transcontinental de America | 4800do | |
| 0900 1000 | | Peru, Ondas del Huallaga | 3329do | |
| 0900 1000 | | Peru, Radio JPI del Peru | 3360do | |
| 0900 1000 | | Peru, Radio Victoria | 6019do | 9720do |
| 0900 1000 | | Peru, Radio Vision 4790do | | |
| 0900 1000 | | Spain, Radio Exterior de Espana | 13720eu | |
| | | 15585eu | 21610eu | |
| 0900 1000 | | USA, BBG/Radio Marti | 5980ca | 6030ca |
| | | 9805ca | | |
| 0900 1000 | | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 11870sa | | |
| 0900 1000 | | USA, WYFR/Family Radio Worldwide | 5950na | |
| | | 9715na | 9550sa | 11855sa |
| 0900 1000 | | Venezuela, Radio Nacional de Venezuela | 6180am | |
| 0930 1000 | | Bolivia, Radio Illimani/Radio Patria Nueva | 6025do | |
| 0930 1000 | | Bolivia, Yatun Ayllu Yura/Radio Yura | 4717do | |
| 0930 1000 | | Peru, Radio Cusco6195do | | |
| 0930 1000 | | USA, WRMI/Radio Prague relay | | 9955am |
| 0945 1000 | | Bolivia, Radio Pio XII | 5952do | |
| 0950 1000 | | Peru, Radio Manantial | 4986do | |

1000 UTC - 5AM EST / 4AM CST / 2AM PST

| | | | | |
|------|------|--|---------|--------|
| 1000 | 1030 | France, Radio France Internationale | 7375ca | |
| | | 9825ca | | |
| 1000 | 1030 | Japan, Radio Japan NHK World | 6120ca | |
| | | 6195sa | | |
| 1000 | 1100 | Bolivia, Radio Casachun Coca | 6075do | |
| 1000 | 1100 | Bolivia, Radio Eco 4409do | | |
| 1000 | 1100 | Bolivia, Radio Fides | 6155do | 9625do |
| 1000 | 1100 | Bolivia, Radio Illimani/Radio Patria Nueva | 6025do | |
| 1000 | 1100 | Bolivia, Radio Logos | 4865do | 6165do |
| 1000 | 1100 | Bolivia, Radio Loyola | 5996do | |
| 1000 | 1100 | Bolivia, Radio Mosoj Chaski | 3310do | |
| 1000 | 1100 | Bolivia, Radio Nacional | 5965do | |
| 1000 | 1100 | Bolivia, Radio Pio XII | 5952do | |
| 1000 | 1100 | Bolivia, Radio San Gabriel | 6080do | |
| 1000 | 1100 | Bolivia, Radio Santa Ana | 4451do | |
| 1000 | 1100 | Bolivia, Radio Tacana | 4782do | |
| 1000 | 1100 | Bolivia, Radio Virgen de Remedios | 4835do | |
| 1000 | 1100 | Bolivia, Yatun Ayllu Yura/Radio Yura | 4717do | |
| 1000 | 1100 | Colombia, La Voz de tu Conciencia | 6010do | |
| 1000 | 1100 | Colombia, La Voz del Guaviare | 6035do | |
| 1000 | 1100 | Colombia, Marfil Estereo | 5910do | |
| 1000 | 1100 | Cuba, Radio Rebelde | 5025na | |
| 1000 | 1100 | Dominican Republic, Radio Amanecer Intl | 6025do | |
| 1000 | 1100 | Dominican Republic, Radio Cristal Intl | 5009do | |
| 1000 | 1100 | Ecuador, La Voz del Napo | 3280do | |
| 1000 | 1100 | Ecuador, Radio Quito | 4919do | |
| 1000 | 1100 | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 1000 | 1100 | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 1000 | 1100 | Mexico, Radio Educacion | 6185do | |
| 1000 | 1100 | Mexico, Radio Mil Onda Corta | 6010do | |
| 1000 | 1100 | Mexico, Radio Transcontinental de America | 4800do | |
| 1000 | 1100 | Peru, La Voz de la Selva | 4824do | |
| 1000 | 1100 | Peru, Ondas del Huallaga | 3329do | |
| 1000 | 1100 | Peru, Radio Altura 5014do | | |
| 1000 | 1100 | Peru, Radio Cusco 6195do | | |
| 1000 | 1100 | Peru, Radio JPI del Peru | 3360do | |
| 1000 | 1100 | Peru, Radio Libertad | 5039do | |
| 1000 | 1100 | Peru, Radio Manantial | 4986do | |
| 1000 | 1100 | Peru, Radio Maranon | 4835do | |
| 1000 | 1100 | Peru, Radio Ondas del Suroiente | 5120do | |
| 1000 | 1100 | Peru, Radio Santa Rosa | 6047do | |
| 1000 | 1100 | Peru, Radio Tawantinsuyo | 6174do | |
| 1000 | 1100 | Peru, Radio Victoria | 6019do | 9720do |
| 1000 | 1100 | Peru, Radio Vision 4790do | | |
| 1000 | 1100 | Spain, Radio Exterior de Espana | 13720eu | |
| | | 15585eu | 21610eu | |
| 1000 | 1100 | USA, BBG/Radio Marti | 5980ca | 6030ca |
| | | 9805ca | | |
| 1000 | 1100 | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 12050sa | | |
| 1000 | 1100 | USA, WYFR/Family Radio Worldwide | 6085ca | |
| | | 9550sa | 9715ca | |
| 1000 | 1100 | Venezuela, Radio Amazonas | 4940do | |
| 1000 | 1100 | Venezuela, Radio Nacional de Venezuela | 6180am | |
| 1015 | 1100 | Bolivia, Radio Loyola | 5996do | |
| 1030 | 1000 | USA, WRMI/Radio Slovakia Intl relay | 9955ca | |
| 1030 | 1100 | Bolivia, Radio Cultural Juan XXIII | 6055do | |
| 1030 | 1100 | Bolivia, Radio San Miguel | 4700do | |
| 1030 | 1100 | Peru, Radio Quillabamba | 5025do | |
| 1030 | 1100 | Peru, Radio Sicuani | 4826do | |
| 1045 | 1100 | Peru, La Voz de las Huarinjas | 5059do | |
| 1045 | 1100 | Peru, Radio Bethel 5921do | | |
| 1050 | 1100 | Peru, Radio Genesis | 4850do | |

1100 UTC - 6AM EST / 5AM CST / 3AM PST

| | | | | |
|------|------|--------------------------------------|--------|---------|
| 1100 | 1127 | Netherlands, R Netherlands Worldwide | 6165am | |
| 1100 | 1130 | Ecuador, HCJB Global Voice/Quito | 6050sa | |
| 1100 | 1130 | Ecuador, La Voz del Napo | 3280do | |
| 1100 | 1130 | Peru, Radio Genesis | 4850do | |
| 1100 | 1145 | USA, WYFR/Family Radio Worldwide | 5985na | |
| | | 9355sa | 9715na | 11855sa |
| 1100 | 1200 | Bolivia, Radio Casachun Coca | 6075do | |
| 1100 | 1200 | Bolivia, Radio Cultural Juan XXIII | 6055do | |
| 1100 | 1200 | Bolivia, Radio Eco 4409do | | |

| | | | | |
|------|------|--|---------|---------|
| 1100 | 1200 | Bolivia, Radio Fides | 6155do | 9625do |
| 1100 | 1200 | Bolivia, Radio Illimani/Radio Patria Nueva | 6025do | |
| 1100 | 1200 | Bolivia, Radio Lipez | 4796do | |
| 1100 | 1200 | Bolivia, Radio Logos | 4865do | 6165do |
| 1100 | 1200 | Bolivia, Radio Loyola | 5996do | |
| 1100 | 1200 | Bolivia, Radio Mosoj Chaski | 3310do | |
| 1100 | 1200 | Bolivia, Radio Nacional | 5965do | |
| 1100 | 1200 | Bolivia, Radio Pio XII | 5952do | |
| 1100 | 1200 | Bolivia, Radio San Gabriel | 6080do | |
| 1100 | 1200 | Bolivia, Radio San Jose | 5580do | |
| 1100 | 1200 | Bolivia, Radio San Miguel | 4700do | |
| 1100 | 1200 | Bolivia, Radio Santa Ana | 4451do | |
| 1100 | 1200 | Bolivia, Radio Santa Cruz | 6135do | |
| 1100 | 1200 | Bolivia, Radio Tacana | 4782do | |
| 1100 | 1200 | Bolivia, Radio Virgen de Remedios | 4835do | |
| 1100 | 1200 | Bolivia, Yatun Ayllu Yura/Radio Yura | 4717do | |
| 1100 | 1200 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1100 | 1200 | Colombia, La Voz de tu Conciencia | 6010do | |
| 1100 | 1200 | Colombia, La Voz del Guaviare | 6035do | |
| 1100 | 1200 | Colombia, Marfil Estereo | 5910do | |
| 1100 | 1200 | Cuba, Radio Rebelde | 5025na | |
| 1100 | 1200 | Dominican Republic, Radio Cristal Intl | 5009do | |
| 1100 | 1200 | Ecuador, HCJB Global Voice/Quito | 6050ca | |
| 1100 | 1200 | Ecuador, Radio El Buen Pastor | 4815do | |
| 1100 | 1200 | Ecuador, Radio Quito | 4919do | |
| 1100 | 1200 | Equatorial Guinea, Radio Nacional/Bata | 5005do | |
| 1100 | 1200 | Equatorial Guinea, Radio Nacional/Malabo | 6250do | |
| 1100 | 1200 | Honduras, HRMI/ Radio Misiones Intl | 3340do | |
| 1100 | 1200 | Honduras, Radio Luz y Vida | 3250do | |
| 1100 | 1200 | Mexico, Radio Educacion | 6185do | |
| 1100 | 1200 | Mexico, Radio Mil Onda Corta | 6010do | |
| 1100 | 1200 | Mexico, Radio Transcontinental de America | 4800do | |
| 1100 | 1200 | Peru, La Voz de la Selva | 4824do | |
| 1100 | 1200 | Peru, La Voz de las Huarinjas | 5059do | |
| 1100 | 1200 | Peru, Ondas del Huallaga | 3329do | |
| 1100 | 1200 | Peru, Radio Altura 5014do | | |
| 1100 | 1200 | Peru, Radio Bethel 5921do | | |
| 1100 | 1200 | Peru, Radio Cusco 6195do | | |
| 1100 | 1200 | Peru, Radio Huanta 2000 | 4747do | |
| 1100 | 1200 | Peru, Radio JPI del Peru | 3360do | |
| 1100 | 1200 | Peru, Radio Libertad | 5039do | |
| 1100 | 1200 | Peru, Radio Madre de Dios | 4950do | |
| 1100 | 1200 | Peru, Radio Manantial | 4986do | |
| 1100 | 1200 | Peru, Radio Ondas del Suroiente | 5120do | |
| 1100 | 1200 | Peru, Radio Quillabamba | 5025do | |
| 1100 | 1200 | Peru, Radio Santa Rosa | 6047do | |
| 1100 | 1200 | Peru, Radio Sicuani | 4826do | |
| 1100 | 1200 | Peru, Radio Tarma 4775do | | |
| 1100 | 1200 | Peru, Radio Tawantinsuyo | 6174do | |
| 1100 | 1200 | Peru, Radio Victoria | 6019do | 9720do |
| 1100 | 1200 | Peru, Radio Vision 4790do | | |
| 1100 | 1200 | South Korea, KBS World Radio | 11795sa | |
| 1100 | 1200 | Spain, Radio Exterior de Espana | 13720eu | |
| | | 15585eu | 21610eu | |
| 1100 | 1200 | USA, BBG/Radio Marti | 5980ca | 6030ca |
| | | 9805ca | | |
| 1100 | 1200 | USA, EWTN/WEWN Irondale, AL | 7555ca | |
| | | 12050sa | | |
| 1100 | 1200 | USA, WYFR/Family Radio Worldwide | 6085ca | |
| | | 9605sa | 11970sa | |
| 1100 | 1200 | Venezuela, Radio Amazonas | 4940do | |
| 1100 | 1200 | Venezuela, Radio Nacional de Venezuela | 6180am | |
| 1120 | 1200 | Peru, Radio La Hora | 4857do | |
| 1130 | 1157 | Netherlands, R Netherlands Worldwide | 6165sa | |
| 1130 | 1200 | Vatican City State, Vatican Radio | 21680am | |

1200 UTC - 7AM EST / 6AM CST / 4AM PST

| | | | | |
|------|------|--|---------|--------|
| 1200 | 1227 | Netherlands, R Netherlands Worldwide | 6165sa | |
| | | 9810ca | | |
| 1200 | 1230 | France, Radio France Internationale | 15515ca | |
| 1200 | 1258 | Clandestine, Voice of Resistance | 6070sa | |
| 1200 | 1300 | Argentina, RAE | 11710am | |
| 1200 | 1300 | Bolivia, Radio Cultural Juan XXIII | 6055do | |
| 1200 | 1300 | Bolivia, Radio Eco 4409do | | |
| 1200 | 1300 | Bolivia, Radio Fides | 6155do | 9625do |
| 1200 | 1300 | Bolivia, Radio Illimani/Radio Patria Nueva | 6025do | |
| 1200 | 1300 | Bolivia, Radio Lipez | 4796do | |

| | | | | |
|------|------|---|---------|---------|
| 1200 | 1300 | Bolivia, Radio Logos | 4865do | 6165do |
| 1200 | 1300 | Bolivia, Radio Loyola | 5996do | |
| 1200 | 1300 | Bolivia, Radio Mosoj Chaski | 3310do | |
| 1200 | 1300 | Bolivia, Radio Nacional | 5965do | |
| 1200 | 1300 | Bolivia, Radio Pio XII | 5952do | |
| 1200 | 1300 | Bolivia, Radio San Gabriel | 6080do | |
| 1200 | 1300 | Bolivia, Radio San Jose | 5580do | |
| 1200 | 1300 | Bolivia, Radio San Miguel | 4700do | |
| 1200 | 1300 | Bolivia, Radio Santa Ana | 4451do | |
| 1200 | 1300 | Bolivia, Radio Santa Cruz | 6135do | |
| 1200 | 1300 | Bolivia, Radio Tacana | 4782do | |
| 1200 | 1300 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1200 | 1300 | Colombia, La Voz de tu Conciencia | | 6010do |
| 1200 | 1300 | Colombia, La Voz del Guaviare | | 6035do |
| 1200 | 1300 | Colombia, Marfil Estereo | 5910do | |
| 1200 | 1300 | Cuba, Radio Havana Cuba | 6010na | 6140na |
| 1200 | 1300 | | 6150va | 9540ca |
| | | | 11690ca | 11760va |
| | | | 11840na | 15230sa |
| | | | 15380sa | 15670sa |
| 1200 | 1300 | Cuba, Radio Rebelde | 5025na | |
| 1200 | 1300 | Dominican Republic, Radio Amanecer Intl | | 6025do |
| 1200 | 1300 | Ecuador, HCJB Global Voice/Quito | | 6050sa |
| 1200 | 1300 | Ecuador, Radio El Buen Pastor | 4815do | |
| 1200 | 1300 | Ecuador, Radio Quito | 4919do | |
| 1200 | 1300 | Equatorial Guinea, Radio Nacional/Bata | | 5005do |
| 1200 | 1300 | Equatorial Guinea, Radio Nacional/Malabo | | 6250do |
| 1200 | 1300 | Honduras, HRMI/ Radio Misiones Intl | 3340do | |
| 1200 | 1300 | Honduras, Radio Luz y Vida | 3250do | |
| 1200 | 1300 | Mexico, Radio Mil Onda Corta | | 6010do |
| 1200 | 1300 | Mexico, Radio Transcontinental de America | | 4800do |
| 1200 | 1300 | Peru, La Voz de la Selva | 4824do | |
| 1200 | 1300 | Peru, La Voz de las Huarinjas | 5059do | |
| 1200 | 1300 | Peru, Ondas del Huallaga | 3329do | |
| 1200 | 1300 | Peru, Radio Altura | 5014do | |
| 1200 | 1300 | Peru, Radio Bethel | 5921do | |
| 1200 | 1300 | Peru, Radio Cusco | 6195do | |
| 1200 | 1300 | Peru, Radio Huanta | 2000 | 4747do |
| 1200 | 1300 | Peru, Radio JPI del Peru | | 3360do |
| 1200 | 1300 | Peru, Radio La Hora | | 4857do |
| 1200 | 1300 | Peru, Radio Libertad | | 5039do |
| 1200 | 1300 | Peru, Radio Madre de Dios | | 4950do |
| 1200 | 1300 | Peru, Radio Manantial | | 4986do |
| 1200 | 1300 | Peru, Radio Maranon | | 4835do |
| 1200 | 1300 | Peru, Radio Ondas del Suroiente | | 5120do |
| 1200 | 1300 | Peru, Radio Quillabamba | | 5025do |
| 1200 | 1300 | Peru, Radio Santa Rosa | | 6047do |
| 1200 | 1300 | Peru, Radio Sicuani | | 4826do |
| 1200 | 1300 | Peru, Radio Tarma | 4775do | |
| 1200 | 1300 | Peru, Radio Tawantinsuyo | | 6174do |
| 1200 | 1300 | Peru, Radio Victoria | | 6019do |
| 1200 | 1300 | Peru, Radio Vision | 4790do | 9720do |
| 1200 | 1300 | Spain, Radio Exterior de Espana | | 9765ca |
| | | | 11815sa | 15170na |
| 1200 | 1300 | Spain, Radio Exterior de Espana | | 15125sa |
| 1200 | 1300 | Spain, Radio Exterior de Espana | | 9765ca |
| | | | 15170na | |
| 1200 | 1300 | Spain, Radio Exterior de Espana | | 11910as |
| | | | 13720eu | 15585eu |
| | | | 21610eu | |
| 1200 | 1300 | USA, BBG/Radio Marti | | 6030ca |
| | | | 9805ca | 7405ca |
| 1200 | 1300 | USA, EWTN/WEWN Irondale, AL | | 7555ca |
| | | | 12050sa | |
| 1200 | 1300 | USA, WYFR/Family Radio Worldwide | | 6085ca |
| | | | 7730sa | 9605sa |
| | | | 11970sa | 13800sa |
| | | | 15130na | 15770sa |
| 1200 | 1300 | Venezuela, Radio Amazonas | | 4940do |
| 1200 | 1300 | Venezuela, Radio Nacional de Venezuela | | 11705am |
| 1230 | 1300 | Antarctica, Radio Nacional LRA36 | | 15476va |

1300 UTC - 8AM EST / 7AM CST / 5AM PST

| | | | | |
|------|------|------------------------------------|---------|---------|
| 1300 | 1325 | Peru, Radio Huanta 2000 | 4747do | |
| 1300 | 1345 | USA, WYFR/Family Radio Worldwide | | 7730sa |
| | | | 9605sa | |
| 1300 | 1400 | Antarctica, Radio Nacional LRA36 | | 15476va |
| 1300 | 1400 | Argentina, RAE | 11710am | |
| 1300 | 1400 | Bolivia, Radio Cultural Juan XXIII | | 6055do |
| 1300 | 1400 | Bolivia, Radio Eco | 4409do | |
| 1300 | 1400 | Bolivia, Radio Fides | 6155do | 9625do |

| | | | | |
|------|------|--|---------|---------|
| 1300 | 1400 | Bolivia, Radio Illimani/Radio Patria Nueva | | 6025do |
| 1300 | 1400 | Bolivia, Radio Lipez | 4796do | |
| 1300 | 1400 | Bolivia, Radio Logos | 4865do | 6165do |
| 1300 | 1400 | Bolivia, Radio Loyola | 5996do | |
| 1300 | 1400 | Bolivia, Radio Nacional | 5965do | |
| 1300 | 1400 | Bolivia, Radio Pio XII | 5952do | |
| 1300 | 1400 | Bolivia, Radio Pio XII | 5952do | |
| 1300 | 1400 | Bolivia, Radio San Gabriel | 6080do | |
| 1300 | 1400 | Bolivia, Radio San Jose | 5580do | |
| 1300 | 1400 | Bolivia, Radio San Miguel | 4700do | |
| 1300 | 1400 | Bolivia, Radio Santa Ana | 4451do | |
| 1300 | 1400 | Bolivia, Radio Santa Cruz | 6135do | |
| 1300 | 1400 | Bolivia, Radio Tacana | 4782do | |
| 1300 | 1400 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1300 | 1400 | Colombia, La Voz de tu Conciencia | | 6010do |
| 1300 | 1400 | Colombia, La Voz del Guaviare | | 6035do |
| 1300 | 1400 | Colombia, Marfil Estereo | 5910do | |
| 1300 | 1400 | Cuba, Radio Havana Cuba | 9540ca | 9850na |
| 1300 | 1400 | | 11690ca | 11750ca |
| | | | 11760va | 11840na |
| | | | 13750sa | 15230sa |
| | | | 15380sa | 15670sa |
| 1300 | 1400 | Cuba, Radio Rebelde | 5025na | |
| 1300 | 1400 | Dominican Republic, Radio Amanecer Intl | | 6025do |
| 1300 | 1400 | Ecuador, HCJB Global Voice/Quito | | 6050sa |
| 1300 | 1400 | Ecuador, La Voz del Napo | 3280do | |
| 1300 | 1400 | Ecuador, Radio El Buen Pastor | 4815do | |
| 1300 | 1400 | Ecuador, Radio Quito | 4919do | |
| 1300 | 1400 | Equatorial Guinea, Radio Nacional/Bata | | 5005do |
| 1300 | 1400 | Equatorial Guinea, Radio Nacional/Malabo | | 6250do |
| 1300 | 1400 | Honduras, HRMI/ Radio Misiones Intl | 3340do | |
| 1300 | 1400 | Honduras, Radio Luz y Vida | 3250do | |
| 1300 | 1400 | Mexico, Radio Mil Onda Corta | | 6010do |
| 1300 | 1400 | Mexico, Radio Transcontinental de America | | 4800do |
| 1300 | 1400 | Mexico, Radio Universidad | 6045do | |
| 1300 | 1400 | Peru, Ondas del Huallaga | 3329do | |
| 1300 | 1400 | Peru, Radio Altura | 5014do | |
| 1300 | 1400 | Peru, Radio Bethel | 5921do | |
| 1300 | 1400 | Peru, Radio Cusco | 6195do | |
| 1300 | 1400 | Peru, Radio La Hora | | 4857do |
| 1300 | 1400 | Peru, Radio Libertad | | 5039do |
| 1300 | 1400 | Peru, Radio Madre de Dios | | 4950do |
| 1300 | 1400 | Peru, Radio Manantial | | 4986do |
| 1300 | 1400 | Peru, Radio Ondas del Suroiente | | 5120do |
| 1300 | 1400 | Peru, Radio Quillabamba | | 5025do |
| 1300 | 1400 | Peru, Radio Santa Rosa | | 6047do |
| 1300 | 1400 | Peru, Radio Sicuani | | 4826do |
| 1300 | 1400 | Peru, Radio Tarma | 4775do | |
| 1300 | 1400 | Peru, Radio Tawantinsuyo | | 6174do |
| 1300 | 1400 | Peru, Radio Victoria | | 6019do |
| 1300 | 1400 | Peru, Radio Vision | 4790do | 9720do |
| 1300 | 1400 | Spain, Radio Exterior de Espana | | 9765ca |
| | | | 11815sa | 15170na |
| | | | 17595na | |
| 1300 | 1400 | Spain, Radio Exterior de Espana | | 15125sa |
| 1300 | 1400 | Spain, Radio Exterior de Espana | | 13720eu |
| | | | 17595sa | |
| 1300 | 1400 | Spain, Radio Exterior de Espana | | 9765ca |
| | | | 15170na | |
| 1300 | 1400 | Spain, Radio Exterior de Espana | | 11910as |
| | | | 15585eu | 21610eu |
| 1300 | 1400 | USA, BBG/Radio Marti | 7405ca | 11845ca |
| | | | 13820ca | |
| 1300 | 1400 | USA, BBG/Voice of America | 9885ca | 13750sa |
| | | | 15590sa | |
| 1300 | 1400 | USA, EWTN/WEWN Irondale, AL | | 11550ca |
| | | | 12050sa | |
| 1300 | 1400 | USA, WYFR/Family Radio Worldwide | | 6085ca |
| | | | 13800sa | 15130na |
| | | | 15770sa | |
| 1300 | 1400 | Venezuela, Radio Amazonas | | 4940do |

1400 UTC - 9AM EST / 8AM CST / 6AM PST

| | | | | |
|------|------|--|--------|---------|
| 1400 | 1430 | France, Radio France Internationale | | 17690ca |
| 1400 | 1500 | Antarctica, Radio Nacional LRA36 | | 15476va |
| 1400 | 1500 | Bolivia, Radio Cultural Juan XXIII | | 6055do |
| 1400 | 1500 | Bolivia, Radio Eco | 4409do | |
| 1400 | 1500 | Bolivia, Radio Fides | 6155do | 9625do |
| 1400 | 1500 | Bolivia, Radio Illimani/Radio Patria Nueva | | 6025do |
| 1400 | 1500 | Bolivia, Radio Lipez | 4796do | |
| 1400 | 1500 | Bolivia, Radio Logos | 4865do | 6165do |

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|------|------|---|---------|---------|
| 1400 | 1500 | Bolivia, Radio Loyola | 5996do | |
| 1400 | 1500 | Bolivia, Radio Nacional | 5965do | |
| 1400 | 1500 | Bolivia, Radio San Gabriel | 6080do | |
| 1400 | 1500 | Bolivia, Radio San Jose | 5580do | |
| 1400 | 1500 | Bolivia, Radio San Miguel | 4700do | |
| 1400 | 1500 | Bolivia, Radio Santa Ana | 4451do | |
| 1400 | 1500 | Bolivia, Radio Santa Cruz | 6135do | |
| 1400 | 1500 | Bolivia, Radio Tacana | 4782do | |
| 1400 | 1500 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1400 | 1500 | Colombia, La Voz de tu Conciencia | | 6010do |
| 1400 | 1500 | Colombia, La Voz del Guaviare | | 6035do |
| 1400 | 1500 | Colombia, Marfil Estereo | 5910do | |
| 1400 | 1500 | Sun Cuba, Radio Havana Cuba | 11690ca | 13680ca |
| | | | 13750sa | 15370sa |
| | | | 17750sa | |
| 1400 | 1500 | Cuba, Radio Havana Cuba | 9540ca | 9850na |
| | | | 11690ca | 11750ca |
| | | | 11780na | 11840na |
| | | | 13780na | 15230sa |
| | | | 15380sa | 15670sa |
| 1400 | 1500 | Cuba, Radio Rebelde | 5025na | |
| 1400 | 1500 | Dominican Republic, Radio Amanecer Intl | | 6025do |
| 1400 | 1500 | Ecuador, HCJB Global Voice/Quito | | 6050sa |
| 1400 | 1500 | Ecuador, Radio El Buen Pastor | 4815do | |
| 1400 | 1500 | Ecuador, Radio Quito | 4919do | |
| 1400 | 1500 | Equatorial Guinea, Radio Nacional/Bata | | 5005do |
| 1400 | 1500 | Equatorial Guinea, Radio Nacional/Malabo | | 6250do |
| 1400 | 1500 | Honduras, HRMI/ Radio Misiones Intl | | 3340do |
| 1400 | 1500 | Honduras, Radio Luz y Vida | 3250do | |
| 1400 | 1500 | Mexico, Radio Mil Onda Corta | | 6010do |
| 1400 | 1500 | Mexico, Radio Transcontinental de America | | 4800do |
| 1400 | 1500 | Mexico, Radio Universidad | 6045do | |
| 1400 | 1500 | Peru, La Voz de las Huarinjas | 5059do | |
| 1400 | 1500 | Peru, Radio Altura 5014do | | |
| 1400 | 1500 | Peru, Radio Bethel 5921do | | |
| 1400 | 1500 | Peru, Radio Cusco 6195do | | |
| 1400 | 1500 | Peru, Radio del Pacifico | 9675do | 4974al |
| 1400 | 1500 | Peru, Radio La Hora | 4857do | |
| 1400 | 1500 | Peru, Radio Manantial | 4986do | |
| 1400 | 1500 | Peru, Radio Maranon | 4835do | |
| 1400 | 1500 | Peru, Radio Ondas del Suroiente | | 5120do |
| 1400 | 1500 | Peru, Radio Quillabamba | 5025do | |
| 1400 | 1500 | Peru, Radio Santa Rosa | 6047do | |
| 1400 | 1500 | Peru, Radio Sicuani | 4826do | |
| 1400 | 1500 | Peru, Radio Tawantinsuyo | 6174do | |
| 1400 | 1500 | Peru, Radio Victoria | 6019do | 9720do |
| 1400 | 1500 | Peru, Radio Vision 4790do | | |
| 1400 | 1500 | mtwhf Spain, Radio Exterior de Espana | | 9765ca |
| | | | 11815sa | 15170na |
| | | | 15170na | 17595na |
| 1400 | 1500 | Sat Spain, Radio Exterior de Espana | | 15125sa |
| 1400 | 1500 | Sat/Sun Spain, Radio Exterior de Espana | | 17595sa |
| 1400 | 1500 | Sun Spain, Radio Exterior de Espana | | 9765ca |
| | | | 15170na | |
| 1400 | 1500 | Spain, Radio Exterior de Espana | | 15585eu |
| | | | 21610eu | |
| 1400 | 1500 | USA, BBG/Radio Marti | 11845ca | 11930ca |
| | | | 13820ca | |
| 1400 | 1500 | USA, EWTN/WEWN Irondale, AL | | 11550ca |
| | | | 12050sa | |
| 1400 | 1500 | USA, KJES Vado NM | 11715na | |
| 1400 | 1500 | USA, WYFR/Family Radio Worldwide | 6085ca | |
| | | | 11670ca | 11865na |
| | | | 11970sa | 13800sa |
| | | | 15130na | |
| 1400 | 1500 | Vatican City State, Vatican Radio | | 7250eu |
| | | | 9645eu | 11740eu |
| 1400 | 1500 | Venezuela, Radio Amazonas | 4940do | |

1500 UTC - 10AM EST / 9AM CST / 7AM PST

| | | | | |
|------|------|--|---------|---------|
| 1500 | 1530 | Serbia, International Radio Serbia | 9635eu | |
| 1500 | 1545 | USA, WYFR/Family Radio Worldwide | 11670ca | |
| | | | 11970sa | 13800sa |
| | | | 17555sa | |
| 1500 | 1600 | Bolivia, Radio Cultural Juan XXIII | | 6055do |
| 1500 | 1600 | Bolivia, Radio Eco 4409do | | |
| 1500 | 1600 | Bolivia, Radio Fides | 6155do | 9625do |
| 1500 | 1600 | Bolivia, Radio Illimani/Radio Patria Nueva | | 6025do |
| | | | 6025do | |
| 1500 | 1600 | Bolivia, Radio Lipetz | 4796do | |
| 1500 | 1600 | Bolivia, Radio Logos | 4865do | 6165do |
| 1500 | 1600 | Bolivia, Radio Loyola | 5996do | |
| 1500 | 1600 | Bolivia, Radio Nacional | 5965do | |
| 1500 | 1600 | Bolivia, Radio San Jose | 5580do | |
| 1500 | 1600 | Bolivia, Radio San Gabriel | 6080do | |
| 1500 | 1600 | Bolivia, Radio San Jose | 5580do | |

| | | | | |
|------|------|---|---------|---------|
| 1500 | 1600 | Bolivia, Radio San Miguel | 4700do | |
| 1500 | 1600 | Bolivia, Radio Santa Ana | 4451do | |
| 1500 | 1600 | Bolivia, Radio Santa Cruz | 6135do | |
| 1500 | 1600 | Bolivia, Radio Tacana | 4782do | |
| 1500 | 1600 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1500 | 1600 | Colombia, La Voz de tu Conciencia | | 6010do |
| 1500 | 1600 | Colombia, La Voz del Guaviare | | 6035do |
| 1500 | 1600 | Colombia, Marfil Estereo | 5910do | |
| 1500 | 1600 | Sun Cuba, Radio Havana Cuba | 11690ca | 13680ca |
| | | | 13750sa | 15370sa |
| | | | 17750sa | |
| 1500 | 1600 | Cuba, Radio Havana Cuba | 9540ca | 9850na |
| | | | 11690ca | 11750ca |
| | | | 13780na | 15230sa |
| | | | 15380sa | 15670sa |
| 1500 | 1600 | Cuba, Radio Rebelde | 5025na | |
| 1500 | 1600 | Dominican Republic, Radio Amanecer Intl | | 6025do |
| 1500 | 1600 | Ecuador, Radio El Buen Pastor | 4815do | |
| 1500 | 1600 | Ecuador, Radio Quito | 4919do | |
| 1500 | 1600 | Equatorial Guinea, Radio Nacional/Bata | | 5005do |
| 1500 | 1600 | Equatorial Guinea, Radio Nacional/Malabo | | 6250do |
| 1500 | 1600 | Honduras, HRMI/ Radio Misiones Intl | | 3340do |
| 1500 | 1600 | Honduras, Radio Luz y Vida | 3250do | |
| 1500 | 1600 | Mexico, Radio Mil Onda Corta | | 6010do |
| 1500 | 1600 | Mexico, Radio Transcontinental de America | | 4800do |
| 1500 | 1600 | Mexico, Radio Universidad | 6045do | |
| 1500 | 1600 | Peru, La Voz de las Huarinjas | 5059do | |
| 1500 | 1600 | Peru, Ondas del Huallaga | | 3329do |
| 1500 | 1600 | Peru, Radio Altura 5014do | | |
| 1500 | 1600 | Peru, Radio Bethel 5921do | | |
| 1500 | 1600 | Peru, Radio Cusco 6195do | | |
| 1500 | 1600 | Peru, Radio del Pacifico | 9675do | 4974al |
| 1500 | 1600 | Peru, Radio La Hora | 4857do | |
| 1500 | 1600 | Peru, Radio Manantial | 4986do | |
| 1500 | 1600 | Peru, Radio Maranon | 4835do | |
| 1500 | 1600 | Peru, Radio Ondas del Suroiente | | 5120do |
| 1500 | 1600 | Peru, Radio Quillabamba | 5025do | |
| 1500 | 1600 | Peru, Radio Santa Rosa | 6047do | |
| 1500 | 1600 | Peru, Radio Sicuani | 4826do | |
| 1500 | 1600 | Peru, Radio Tawantinsuyo | 6174do | |
| 1500 | 1600 | Peru, Radio Victoria | 6019do | 9720do |
| 1500 | 1600 | Peru, Radio Vision 4790do | | |
| 1500 | 1600 | ma Spain, Radio Exterior de Espana | | 15385af |
| 1500 | 1600 | mtwhf Spain, Radio Exterior de Espana | | 17595sa |
| 1500 | 1600 | Sat Spain, Radio Exterior de Espana | | 15125sa |
| 1500 | 1600 | Sat/Sun Spain, Radio Exterior de Espana | | 17595sa |
| 1500 | 1600 | Sun Spain, Radio Exterior de Espana | | 9765ca |
| | | | 17755af | 17850na |
| 1500 | 1600 | Spain, Radio Exterior de Espana | | 15585eu |
| | | | 21610eu | |
| 1500 | 1600 | USA, BBG/Radio Marti | 11845ca | 11930ca |
| | | | 13820ca | |
| 1500 | 1600 | USA, EWTN/WEWN Irondale, AL | | 11550ca |
| | | | 12050sa | |
| 1500 | 1600 | USA, KJES Vado NM | 11715na | |
| 1500 | 1600 | USA, WYFR/Family Radio Worldwide | 6085ca | |
| | | | 13695na | 15130na |
| 1500 | 1600 | Venezuela, Radio Amazonas | 4940do | |
| 1500 | 1600 | Venezuela, Radio Nacional de Venezuela | | 11680am |

1600 UTC - 11AM EST / 10AM CST / 8AM PST

| | | | | |
|------|------|--|---------|---------|
| 1600 | 1630 | France, Radio France Internationale | 17690as | |
| 1600 | 1700 | Bolivia, Radio Cultural Juan XXIII | | 6055do |
| 1600 | 1700 | Bolivia, Radio Eco 4409do | | |
| 1600 | 1700 | Bolivia, Radio Fides | 6155do | 9625do |
| 1600 | 1700 | Bolivia, Radio Illimani/Radio Patria Nueva | | 6025do |
| | | | 6025do | |
| 1600 | 1700 | Bolivia, Radio Lipetz | 4796do | |
| 1600 | 1700 | Bolivia, Radio Logos | 4865do | 6165do |
| 1600 | 1700 | Bolivia, Radio Loyola | 5996do | |
| 1600 | 1700 | Bolivia, Radio Nacional | 5965do | |
| 1600 | 1700 | Bolivia, Radio San Jose | 5580do | |
| 1600 | 1700 | Bolivia, Radio San Miguel | 4700do | |
| 1600 | 1700 | Bolivia, Radio Santa Ana | 4451do | |
| 1600 | 1700 | Bolivia, Radio Santa Cruz | 6135do | |
| 1600 | 1700 | Bolivia, Radio Tacana | 4782do | |
| 1600 | 1700 | Chile, CVC Voz Crista | 9635sa | 17680sa |
| 1600 | 1700 | Colombia, La Voz de tu Conciencia | | 6010do |
| 1600 | 1700 | Colombia, La Voz del Guaviare | | 6035do |
| 1600 | 1700 | Colombia, Marfil Estereo | 5910do | |

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|---------------|---|---------|---------|
| 1600 1700 Sun | Cuba, Radio Havana Cuba | 11690ca | 13680ca |
| | 13750sas | 15370sa | 17750sa |
| 1600 1700 | Cuba, Radio Rebelde | 5025na | |
| 1600 1700 | Dominican Republic, Radio Amanecer Intl | | |
| | 6025do | | |
| 1600 1700 | Ecuador, Radio Quito | 4919do | |
| 1600 1700 | Equatorial Guinea, Radio Nacional/Bata | | |
| | 5005do | | |
| 1600 1700 | Equatorial Guinea, Radio Nacional/Malabo | | |
| | 6250do | | |
| 1600 1700 | Honduras, HRMI/ Radio Misiones Intl | 3340do | |
| 1600 1700 | Mexico, Radio Mil Onda Corta | 6010do | |
| 1600 1700 | Mexico, Radio Transcontinental de America | | |
| | 4800do | | |

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|-----------|--------------------------------|--------|--------|
| 1600 1700 | Mexico, Radio Universidad | 6045do | |
| 1600 1700 | Peru, La Voz de las Huarinjas | 5059do | |
| 1600 1700 | Peru, Ondas del Huallaga | 3329do | |
| 1600 1700 | Peru, Radio Altura | 5014do | |
| 1600 1700 | Peru, Radio Bethel | 5921do | |
| 1600 1700 | Peru, Radio Cusco | 6195do | |
| 1600 1700 | Peru, Radio del Pacifico | 9675do | 4974a1 |
| 1600 1700 | Peru, Radio La Hora | 4857do | |
| 1600 1700 | Peru, Radio Manantial | 4986do | |
| 1600 1700 | Peru, Radio Maranon | 4835do | |
| 1600 1700 | Peru, Radio Ondas del Suriente | | 5120do |
| 1600 1700 | Peru, Radio Quillabamba | 5025do | |
| 1600 1700 | Peru, Radio Santa Rosa | 6047do | |
| 1600 1700 | Peru, Radio Sicuani | 4826do | |

MT SHORTWAVE STATION RESOURCE GUIDE

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| Afghanistan, R Afghanistan | www.rta.org.af |
| Albania, R Tirana | http://rtsh.sil.at/ |
| Angola, Angolan National R | www.rna.ao/ |
| Anguilla/Caribbean Beacon/Univ 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.au |
| Australia, R Australia | www.abc.net.au/ra/ |
| Austria, AWR Europe | www.awr2.org/ |
| Austria, TWR Europe | www.twr.org |
| Bahrain, R Bahrain | www.radiobahrain.fm/ |
| Belarus, R 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 |
| 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.classiccountrysam1060.com |
| Canada, CKZN St Johns NF | www.cbc.ca/listen/index.html |
| Canada, CKZU Vancouver BC | www.cbc.ca/bc |
| Canada, R Canada International | www.rcinet.ca/ |
| China, China R International | www.cri.cn |
| China, Haixa zhi Sheng/VO Strait | www.vos.com.cn |
| Clandestine, JSR/Shiokaze/Sea Breeze | www.chosa-kai.jp |
| Clandestine, SRS/Sudan R Service | www.sudanradio.org |
| Croatia, Voice of Croatia | www.hrt.hr/ |
| Cuba, R Havana Cuba | www.radiohc.cu/ |
| Egypt, R Cairo | www.ertu.org |
| Eq Guinea, R Africa | www.radiopanam.com/ |
| Eq Guinea, R East Africa | www.radiopanam.com/ |
| Eq Guinea, R East Africa/Malabo | www.radiopanam.com/ |
| Eq Guinea, R Africa 2 | www.radiopanam.com/ |
| Ethiopia, R Ethiopia | www.erta.gov.com |
| Ethiopia, R Ethiopia/Natl Pgm | www.erta.gov.com |
| France, R France International | 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 |
| Guam, AWR/KSDA | www.awr2.org/ |
| Guam, TWR Asia/KTWR | http://nea.ktwr.net/ |
| India, All India R/Aizawl | www.allindiaradio.org/ |
| India, All India R/Aligarh | www.allindiaradio.org/ |
| India, All India R/Bengaluru | www.allindiaradio.org/ |
| India, All India R/Bhopal | www.allindiaradio.org/ |
| India, All India R/Chennai | www.allindiaradio.org/ |
| India, All India R/Delhi | www.allindiaradio.org/ |
| India, All India R/External Svc | www.allindiaradio.org/ |
| India, All India R/Gangtok | www.allindiaradio.org/ |
| India, All India R/Gorakhpur | www.allindiaradio.org/ |
| India, All India R/Guwahati | www.allindiaradio.org/ |
| India, All India R/Hyderabad | www.allindiaradio.org/ |
| India, All India R/Imphal | www.allindiaradio.org/ |
| India, All India R/Itanagar | www.allindiaradio.org/ |
| India, All India R/Jaipur | www.allindiaradio.org/ |
| India, All India R/Jeyppore | www.allindiaradio.org/ |
| India, All India R/Kolkata | www.allindiaradio.org/ |
| India, All India R/Kurseong | www.allindiaradio.org/ |
| India, All India R/Lucknow | www.allindiaradio.org/ |
| India, All India R/Mumbai | www.allindiaradio.org/ |
| India, All India R/Panaji (Goa) | www.allindiaradio.org/ |
| India, All India R/Port Blair | www.allindiaradio.org/ |

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| India, All India R/R Kashmir | www.allindiaradio.org/ |
| India, All India R/Shillong | www.allindiaradio.org/ |
| India, All India R/Shimla | www.allindiaradio.org/ |
| India, All India R/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 R | www.nexus.org |
| Italy, IRRS-Shortwave/Overcomer Ministry | www.nexus.org |
| Japan, R Japan NHK World | www.nhk.or.jp/english/ |
| Kuwait, R 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/R Mali | www.ortm.ml |
| Micronesia, V6MP/Cross R/Pohnpei | www.pmapacific.org/ |
| Nepal, R Nepal | www.radionepal.org/ |
| Netherlands, R Netherlands Worldwide | www.radionetherlands.nl/ |
| New Zealand, R New Zealand Intl | www.rnz.co.nz |
| Nigeria, Voice of Nigeria | www.voiceofnigeria.org |
| North Korea, Voice of Korea | www.vok.rep.kp |
| Oman, R Sultanate of Oman | www.oman-tv.gov.om |
| Pakistan, PBC/R Pakistan | www.radio.gov.pk |
| Palau, T8WH/ WHRI | www.whr.org/ |
| Philippines, R Pilipinas Overseas | www.pbs.gov.ph/ |
| Poland, Polskie R Warsaw | www.polskieradio.pl |
| Romania, R Romania Intl | www.rri.ro/ |
| Russia, Voice of Russia | http://english.ruvr.ru/ |
| Saudi Arabia, BSKSA/External Svc | www.saudiradio.net/ |
| Serbia, International R Serbia | www.glassrbije.org |
| South Africa, AWR Africa | www.awr2.org/ |
| South Africa, Channel Africa | www.channelafrica.org |
| South Africa, CVC 1 Africa R | www.1africa.tv |
| South Africa, RTE R Worldwide | www.rte.ie/radio1/ |
| South Africa, South African R League | www.sarl.org.za |
| South Korea, KBS World R | www.worldkbs.co.kr |
| Spain, R Exterior de Espana | www.ree.rne.es/ |
| Sri Lanka, SLBC | www.slbc.lk |
| Swaziland, TWR Africa | www.twrafrica.org |
| Syria, R Damascus | www.rtv.gov.sy/ |
| Taiwan, R Taiwan Intl | http://english.rti.org.tw/ |
| Thailand, R 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/ |
| USA, Amer Forces Network/AFRTS | http://myafn.dodmedia.osd.mil/ |
| USA, BBG/Voice of America | www.voanews.com |
| USA, BBG/Voice of America/Special English | 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, WBCQ Monticello ME | www.wbcq.com/ |
| USA, WHRI Cypress Creek SC | www.whr.org/ |
| USA, WINB Red Lion PA | www.winb.com |
| USA, WRMI/R Prague relay | www.wrmi.net/ |
| USA, WRMI/R Slovakia Intl relay | www.wrmi.net/ |
| USA, WRNO New Orleans LA | www.wrnoradio.com |
| USA, WTWW Lebanon TN | www.wtww.us/ |
| USA, WWCR Nashville TN | www.wwcr.com |
| USA, WWRB Manchester TN | www.wwrb.org/ |
| USA, WYFR/Family R Worldwide | www.familyradio.com/ |
| Vatican City State, Vatican R | www.vaticanradio.org/ |
| Vietnam, Voice of Vietnam/Overseas Svc | www.vov.org.vn |
| Vatican City State, Vatican R | www.vaticanradio.org/ |
| Zambia, CVC R Christian Voice | www.voiceafrica.net |



Monitoring the Air Show Experience

Equipment and Tips

Now that you've read this month's cover story and you know who are the crack military flight demonstration teams and where to find the frequencies they use for air-ground coordination and other communications (all found in that article), let's turn to another important consideration for successful monitoring: the equipment required to monitor air show communications.

I am frequently asked which scanner I recommend for air show monitoring. While I don't have a favorite, I have prepared the list of receivers and scanners that meet all the requirements as outlined below.

Most of the scanners sold in the marketplace today are suited for air show monitoring. On the other hand, most of the older scanners on the used market are not suitable for air show monitoring. There are certain requirements your air show radio has to meet in order to successfully monitor the two major military aerial demonstration teams – the Blues and T-Birds.

If you are going to a Thunderbird team event, then you will need a scanner that can monitor the 138-150 MHz military land mobile band in the "AM mode." Most of the older



Uniden scanners cannot be used for air show monitoring due to their lack of independent transmission mode selection.

In addition to the civilian aircraft band (118-137 MHz), you will also need a scanner that has the 225-400 MHz military aeronautical band in it. Most of the action (especially the Blues) will be heard in this military UHF portion of the spectrum.

Adding these two criteria to the mix, the list of possible radios again narrows down our choice for air show scanners even further. Table one is our list of scanners that meet all of the criteria for monitoring all the military flight demonstration teams at air shows worldwide.

Another area of air show monitoring that has become increasingly popular the last couple years is tuning in to the land mobile radio systems at the military bases that sponsor these shows and open houses. Most of the smaller bases, including National Guard bases, still use either simplex or repeater systems for their internal communications. In most cases these are analog narrowband FM mode communications. Some bases have moved over to the APCO P25 digital mode, so if you want to monitor them, you will have to have a scanner capable of decoding the APCO P25 digital stream.

Many of the major military bases have moved most, if not all, of their land mobile communications to trunk radio systems. The major bands for these trunk radio systems are 138-150.8 MHz (excluding the two meter ham band), 406-420 MHz and the new DoD 380-400 MHz LMR subband.

While some of the legacy trunk systems still use analog communications and the 406-420 MHz band, these are rapidly disappearing and being replaced by digital trunked systems in the 138-150.8 and 380-400 MHz bands.

So, in order to monitor these trunk radio systems, our list below gets a bit thinner. Scanners suitable for this task have been marked with an asterisk.

❖ Tips for enjoying a great day at the air show

If you want to have a great time at the air show, you should plan ahead and get some stuff together to take to the event. Here are some suggestions from my personal list from which I gather things to take with me to the air show.

TABLE ONE: MILITARY AIR SHOW CAPABLE RECEIVERS

Digital trunk radio system capable scanners are marked with an asterisk.

Handhelds

| | |
|-------------|--|
| Alinco | DJ-X3, DJ-X7T, DJ-X11T, DJ-X30, DJ-X2000T |
| AOR | AR-8200 MK III, AR-Mini U |
| GRE | PSR-310, PSR-500*, PSR-700, PSR-800* |
| Icom | IC R-5 Sport, IC R-6, IC R-20, IC-RX7 |
| MFJ | MFJ-8322 |
| Radio Shack | Pro-106*, Pro-107, Pro-164 |
| Uniden | BC-246T, BC-346XT, BCD-396XT*, HomePatrol-1* |
| Yaesu | VR-500 |

Base/Mobile Units

| | |
|-------------|--------------------|
| AOR | AR-8600 Mk IIB |
| GRE | PSR-410, PSR-600* |
| Radio Shack | Pro-163, Pro-197* |
| Uniden | BCT-15X, BCD996XT* |
| Yaesu | VR-5000 |

Computer Receivers

| | |
|----------|--|
| Icom | PCR-1500, IC-R1500, PCR-2500, IC-R2500, R-9500 |
| WinRadio | WR-G305e, WR-G305i, WR-G305e/PD, WR-G305i/PD, WR-G315e, WR-G315i, WR-3150e, WR-3150i-DSP, WR-3500e, WR-3500i-DSP, WR-3700e, WR-3700i-DSP |

Discontinued radios/scanners that are capable of air show monitoring (per requirements listed above)

| | |
|-------------|--|
| Alinco | DJ-X2T, DJ-X10T |
| AOR | AR-16B, AR-1000, AR-1500, AR-2515, AR-2700, AR-3000AB, AR-5000+3B, AR-7000B, AR-8000, AR-8200B, AR-8600B |
| Icom | IC-R1, IC-R2, IC-R3, R10, R100, R7000, R7100, PCR-100, PCR-1000, PCR-1500 |
| Kenwood | RZ-1 |
| Radio Shack | Pro-2004, Pro-2005, Pro-2006, Pro-43 |
| Uniden | BCT-15, BC-296, BR-330T, BC-796, BCD-396T*, BCD996T* |
| WinRadio | WR-1000i/e, WR-1500i/e, WR-3000i-DSP, WR-3100i-DSP |
| Yaesu | VR-120, VR-120D |

Hats - Wearing a hat can make a lot of difference to your comfort level while at the show. Ball caps are okay, but you will have to watch out for sunburn on your lower face and neck if you wear one. Many people prefer to wear hats with wide brims for better protection.

Sunglasses - Polarized lenses are especially good for shows that take place near the water, since they reduce glare.

Sun Screen - Speaking of the sun, you obviously want to attend an event with good weather (clear skies and no clouds). This means you'll probably be in the sun a lot. Even if it is on a cloudy or hazy day, beware. You may get more sun than you think. The higher the sun screen SPF the better, and be sure to also take lip balm.

Something to sit on - Take something to use as a drop sheet if you are going to be on the ground. You can lean on your backpack for some support. If allowed, you may consider carrying a lawn or camping chair. Keep in mind that you'll be looking up at an angle for most of the show, so a chair that is somewhat reclined may be more comfortable.

Water - You will probably be at the show for several hours and you really don't want to get dehydrated. Refreshments are normally available at these shows, but your own supply of water may come in handy. Alcohol may make your dehydration worse, so if you do visit the "beer tent" then drink in moderation. Don't rely on soda pop to prevent dehydration.

Snacks - Most air shows have food concessions (hamburgers, hot dogs, etc.), but you might want bring along some lighter snacks in case you need a quick fix and don't want to stand in a long line.

Moist towelettes/wet wipes - Air shows normally have outdoor bathroom facilities and having a way to freshen up afterwards is a good idea.

Notebook and pen - If you are a collector of aircraft serial numbers, radio frequencies, etc. then a notebook and pen are a must. You may also see something you want to make a note about, like website addresses at displays or radio frequencies that you discover.

Binoculars - Low and medium power binoculars tend to work well for checking out distant details. I won't carry higher power binoculars as they are very difficult to use for aircraft in flight.

Camera - Air shows by their nature are very colorful and photogenic events. Many air shows have disposable cameras and film for sale, but you'll probably be happier if you bring along your own. I highly recommend a digital camera, an extra set of batteries, and a couple of extra memory cards since you will probably shoot a lot of pictures. If you bring a video camera, be sure to pack an extra tape or memory card and batteries.

Earplugs - Jets make a lot of noise and/or you may find yourself next to an overly loud speaker system used by the air show announcer.

Scanner - I know it is silly to remind you of this, but be sure to bring along the scanner and our air show guide and extra batteries. You might actually enjoy listening to the air show pilots and demonstration teams.

Small backpack - Yes, security will want to check your backpack before allowing you in to the show, but it is really handy to have some storage space to carry around all the stuff I have mentioned above around the show.

❖ Do's and Don'ts

I have attended a lot of air shows over the years and have developed a list of do's and don'ts you should consider when planning to attend these events.

Do come early and leave late. If you do, you will avoid most of the pedestrian and vehicle traffic headaches. Most air shows have static displays of aircraft and other displays, so before and after the show will afford you some time to look around.

Do find out where you can get medical aid or seek assistance if you need it. If you are in a group and you get separated, where will you meet? If you have children with you, make sure they know how to get help if they get lost.

Do consider where you are going to sit. Most people insist on getting as close to "front and center" as they can. While this is fine, you might be just as happy sitting farther back or at the end of the viewing area where it may be less crowded.

Do stay aware of your surroundings. There are often vehicles or machinery moving around in the public areas such as around the static displays.

Do ask questions. Often there are aircraft owners or representatives at the static displays. Most people are very proud of their airplanes and they'll be happy to answer your questions.

Do appreciate all the aircraft, not just the fastest and the loudest.

Do wear comfortable shoes. You may cover several miles before the day is done

Don't touch the aircraft. Many aircraft in static displays have bits and pieces that can be damaged, broken, or bent. You could get hurt if you don't know what you're doing. Never touch an aircraft unless someone in authority invites you to do so. Never move a propeller, and keep clear of "props" at all times.

Don't smoke around the aircraft. Planes in a static display sometimes vent fuel as the plane heats up in the sun. Some fabric-covered aircraft have coatings that are highly flammable.

Don't litter, as your trash could become a physical hazard to the aircraft (FOD, foreign object damage). Clean up your viewing area once you are done.

Finally, check out the air show website prior to the event to learn about the show hours for the public, any security restrictions (no scanners, backpacks, or coolers, etc), directions in and out of the show, schedules and much more.

On my *Milcom* blog (address in the resource guide), I have posted current schedules for all the major teams and any known websites associated with the air show events they are performing at.

Until next time, 73 and good hunting.

AIR SHOW RESOURCE GUIDE

Milcom Blog <http://mt-milcom.blogspot.com>

Milcom Twitter Feed [MilcomMP](#)

Monitoring Times 2011 Air Show Guide

<http://tinyurl.com/86vjytq>

Canadian Forces Snowbirds 2012-2013 Schedule

<http://tinyurl.com/89kk3k8>

US Air Force Thunderbirds 2012 Schedule

<http://tinyurl.com/84rtev7>

US Army Golden Knights 2012 Schedule

<http://tinyurl.com/8829sgb>

US Navy Blue Angels 2012-2013 Schedule

<http://tinyurl.com/7evlo7g>

US Navy Blue Angels Practice Schedule Schedule

<http://tinyurl.com/7pfqqsp>

Official Websites:

Air Combat Command Aerial Events

www.acc.af.mil/aerialevents/

Blue Angels www.blueangels.navy.mil/index.htm

Golden Knights www.usarec.army.mil/hq/goldenknights/

Leap Frogs www.leapfrogs.navy.mil/

Navy Office of Community Outreach www.navy.mil/navco/

Snowbirds www.snowbirds.dnd.ca/v2/index-eng.asp

Thunderbirds www.airforce.com/thunderbirds

Twitter Feeds:

Air Combat Command Aerial Events

<http://twitter.com/#!/aerialevents>

Blue Angels <http://twitter.com/#!/BlueAngels>

Golden Knights <http://twitter.com/#!/ArmyGK>

Thunderbirds <http://twitter.com/#!/USAFThunderbird>

Facebook Pages:

Air Combat Command Aerial Events

www.facebook.com/aerialevents

Blue Angels www.facebook.com/pages/Blue-Angels/34985920343

Golden Knights www.facebook.com/usarmygoldenknights

Leap Frogs www.facebook.com/leapfrogs

Skyhawks www.facebook.com/group.php?gid=112105354592

Snowbirds www.facebook.com/pages/The-Canadian-Forces-Snowbirds/23613917381

Thunderbirds www.facebook.com/pages/US-Air-Force-Thunderbirds/267550469245



Searching the Good Search

In the January *Fed Files* column, I shared some of my scanning experiences on the road when I travel for work. I'm pretty well infected with the radio bug, so having at least one scanner with me all the time is standard operating procedure. But besides *scanning* known frequencies, I also find it rewarding to *search* for new, active frequencies as well.

Some folks posting in scanning forums or chat rooms often ask for lists of active federal frequencies in their area. Often they add the comment that they only want "confirmed" or "known, good, active" federal channels. The problem is that even with scanning a list of known federal channels in our area, how do you know you're not missing something new?

Since most of the interesting federal agencies operate nationwide, there's no telling when some task force or special operations division might set up camp in your listening area. Also, things are always changing in the radio spectrum. Besides the move to digital, the re-channeling of both the VHF and UHF federal land-mobile bands are requiring some agencies to change frequencies. You may have been listening to federal agency XYZ on their frequency for years, but one day they may not be there any more. Where do you look?

It pays to do a search of the bands when you can. I understand that some listeners are not fortunate enough to have a whole raft of computer controlled scanners logging everything in the airwaves, but once in a while, dedicate a few hours just to search through a segment of the federal radio spectrum and see what's there. You may be surprised to come across something you have not heard before.

For some examples of things found while searching, I can offer you additional personal testimony in this month's column.

❖ NOAA Office of Marine Fisheries

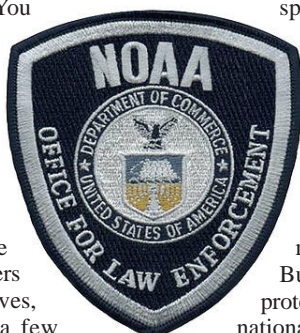
While many scanner enthusiasts associate the National Oceanographic and Atmospheric Administration (NOAA) with the weather broadcasts we find in the federal frequency bands, did you know they have a law enforcement branch?

On a recent trip to the Atlantic City, NJ area, I was not only searching the federal land-mobile bands, but I had my near-field signal-capturing

feature turned on. Uniden calls theirs "Close Call," while the GRE/Radio Shack call theirs "Signal Stalker" or "Spectrum Sweeper."

These features give the listener the ability to quickly sample the radio spectrum for strong radio signals that may be coming from nearby. This feature has been one of the most productive tools for searching out previously unknown channels that I have ever had access to. I use it almost any time I am out and about with a handheld radio, and even while situated at my hotel room "command post."

While traveling around the Atlantic City area, I came across some activities related to federal enforcement of fishing and the commercial sales of fish. It appeared to be some simplex surveillance activity on 163.2250 MHz, 100.0 pl. I knew that the National Marine Fisheries Service had authority over this activity, but I had not heard communications regarding this type of enforcement before, and after catching this traffic, I decided to explore their activities more deeply.



The National Oceanic and Atmospheric Administration Office of Law Enforcement (NOAA OLE) is the federal law enforcement division of the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration. NOAA OLE was established in 1930 as the "Division of Law Enforcement, U.S. Fish Commission and Bureau." It is responsible for the protection and conservation of most of national marine life. Additional detailed information about the OLE can be found here: www.nmfs.noaa.gov/ole/ole_about.html

Here are frequencies assigned for use by the NOAA OLE:

162.0500, 162.1000, 163.0750, 163.2250, 164.0250, 164.0750, 165.2375 (CBP NET 1), 165.4375, 165.4625, 165.4875, 165.5125, 165.5375, 165.5625, 165.5875, 165.6125, 165.6375, 165.6625, 165.7000, 166.0250, 166.0500, 166.1250, 166.1500, 166.4375 (Input to 165.2375 MHz), 169.0750, 172.0500, 172.1000,

Something to note in the above list of NOAA channels: You will see frequencies in the list that are some of the same frequencies used by Customs and Border Protection (CBP). The NOAA OLE is a subscriber agency to the Customs and Border Protection nationwide VHF radio system, dispatched out of the CBP National Law Enforcement Communications Center (NLECC) in Orlando, FL.

❖ Fed Files Wonderland – DC

In the January *Fed Files* column, I talked about one of my most recent trips to New York City and the wealth of federal radio traffic in the area. This month we will take a look at Washington, D.C., the scanner wonderland of federal monitoring.

When it comes to monitoring federal radio traffic, Washington, D.C. is *the* place to be. Almost every agency in the federal government has some sort of radio communications channels allocated to their use. Nearly every available frequency in the federal NTIA and IRAC assignments has some sort of activity on them in this region. No doubt almost all of the federal radio spectrum is allocated and utilized in some way in the District of Columbia and the surrounding areas.

Not only are the federal VHF and UHF land-mobile bands jumping with activity, but the military land-mobile and VHF/UHF aircraft bands are busy as well. It pays to have multiple scanners with you when in the Washington area!

On my most recent trip to D.C., I was able to monitor some activity while I was at work with my handheld radios, as well as having a radio search and log activity from my hotel room. I was on a lower floor of the hotel, so I wasn't able to catch any long-distant traffic, but there was still plenty to be heard.

One interesting tip: if you can, it pays to get up and listen early in the morning. As the government offices open each day, the morning shift will often do radio checks and sometimes actually identify what agency, building or office they are after finishing their roll calls.

Here is what I was able to log during my three days in D.C. These logs represent searching over only a few days in the Washington D.C. area. Obviously, searching over many days or weeks would reveal many more active federal channels. I was able to identify some frequencies by prior logs, some by listening, and some are still unknown but definitely in use:

- 162.0500, N201
- 162.0500, N00F
- 162.0625, N201
- 162.0625, N00F
- 162.0750, N201 – US Secret Service Uniformed Division, F1
- 162.2125, D023
- 162.2500, 173.8 – US Capitol Police F4
- 162.3125, N211
- 162.6000, N012
- 162.6125, 127.3 – US Capitol Police F5
- 162.8250, N076
- 162.9500, N095
- 162.9875, N010 – Possible IWN NCR input
- 163.0000, N010 – Possible IWN NCR input



163.0000, N013
 163.3125, N202
 163.3500, 146.2 – Department of the Treasury
 163.7250, N073 – DHS ICE
 163.9000, N010 – Possible IWN NCR input
 164.1750, N011
 164.4000, N001 – USSS PAPA
 164.4375, N212
 164.6250, 173.8 – US Capitol Police (?)
 164.6500, N001 – USSS TANGO
 164.8875, N001 – USSS OSCAR
 164.9375, 203.5
 165.1875, 156.7
 165.2125, N001 – USSS MIKE
 165.2375, N100 – CBP NET 1
 165.2875, N650 – BATFE NET 1
 165.3750, N001 – USSS CHARLIE
 165.4125, 210.7
 165.5375, 146.2 – US Capitol Police F2
 165.6000, N010 – Possible IWN NCR input
 165.6875, N001 – USSS WDC Field Office
 165.7875, N001 – USSS BAKER
 165.9250, 127.3
 166.2000, N212
 166.3250, N518
 166.3250, N546 – Department of the Interior
 166.4500, 167.9
 166.4625, N001 – DHS Common
 166.5125, N001 – WHCA ALPHA
 166.7000, N001 – WHCA
 166.7250, 127.3 – Park Police F1
 166.8500, 127.3 – Park Police F4
 166.9250, 127.3 – Park Police F2
 167.0125, N001 – USSS Executive Protection
 167.0375, N001 – USSS Executive Protection
 167.0750, 127.3 – Park Police F3
 167.2125, N167 – FBI
 167.4125, N167 – FBI
 168.4875, 167.9
 167.5125, N167 – FBI
 167.5500, N010 – IWN NCR Trunked System
 167.9500, 167.9 – FBI
 168.1250, N167 – FBI
 168.1750, N293
 168.2250, 151.4
 168.2625, N71F – IWN (System 715) Trunked System, Site 160
 168.2875, N010 – IWN NCR Trunked System, Site 801
 168.4250, N293 – National Parks Service, National Capitol Parks East
 168.4250, 162.2
 168.4875, N010 – IWN NCR Trunked System, Site 801
 168.5875, N100
 168.6875, N010 – IWN NCR Trunked System, Site 801
 168.8500, N010 – IWN NCR Trunked System, Site 801
 168.8875, N293
 168.9250, N167 – FBI
 168.9375, N078
 168.9750, N010 – IWN NCR Trunked System, Site 1001
 169.1875, N010 – IWN NCR Trunked System, Site 401
 169.2250, 110.9 – US Capitol Police F1
 169.7750, N4C5 – National Parks Service, George Washington Parkway

169.9375, N201
 170.0000, N001
 170.0000, N003
 170.0000, N004
 170.1000, 103.5
 170.1750, 156.7 – US Capitol Police F3
 170.4375, N202
 170.7500, N293
 171.2375, 254.1
 171.3625, N293 – Department of Transportation
 171.4000, N012
 171.4375, N010 – IWN NCR Trunked System, Site 1001
 171.7625, N211
 171.7750, N010 – IWN NCR Trunked System, Site 401
 171.9875, N010 – IWN NCR Trunked System, Site 1101
 172.0250, 165.5
 172.1125, N010 – IWN NCR Trunked System
 172.2625, N069
 172.4125, N001
 172.4375, N4C5 – National Parks Service
 172.4750, N4C5 – National Parks Service, National Mall and Memorial Parks
 172.5875, N077 – Unknown agency
 172.6125, N010 – IWN NCR Trunked System, Site 1101
 172.6375, N010 – IWN NCR Trunked System
 172.9000, N001 – TSA @ Reagan National Airport
 172.9000, N013 – TSA @ Reagan National Airport
 173.0000, N293 – Unknown agency
 173.5250, 167.9 – US Capitol Police
 173.5500, N71F – IWN Trunked System, Site 160
 173.6375, N293 – US Supreme Court
 173.6500, N293
 173.7375, N293
 173.7375, N864
 173.8750, 94.8 pl – US Capitol Police
 173.9000, N011
 406.3875, D723 – US Capitol, public tours
 406.4250, N12C – US Department of Agriculture, Headquarters Security
 407.1375, N482
 407.4625, N421
 407.6000, N0F0 – US State Department, Bureau of Diplomatic Security
 407.6000, NC0C
 407.6625, N421
 407.7750, N482 – US Postal Inspection Service
 407.8250, N1F2
 407.8625, N0F0 – US State Department, Bureau of Diplomatic Security
 407.8625, NC0C -
 408.2000, N201 – Federal Protective Service
 408.2750, N167
 408.3500, N167
 408.6000, N0F0 – US State Department, Bureau of Diplomatic Security

409.0375, N0F0 – US State Department, Bureau of Diplomatic Security
 409.0625, N421
 409.5125, D073 – Government Printing Office
 409.7125, N0F0 – US State Department, Bureau of Diplomatic Security
 409.8500, D226
 410.8250, D631
 413.7125, N167 – FBI Uniformed Security
 415.9000, 123.0
 417.2000, N201 – Federal Protective Service
 417.8875, N295 – US Mint Police
 418.6750, N156 – DEA F4
 418.7500, N156 – DEA F3
 419.1500, 167.9 – US Information Agency
 419.4875, D624

As with my logs from my New York City trips, I will post these frequencies on the *Fed Files* blog page and solicit updates to folks who monitor these things regularly and who might be able to identify some of these federal users.

The channels labeled as “IWN” are part of the federal Integrated Wireless Network (IWN) trunked radio system, which we took a closer look at in the October 2011 *Fed Files* column. At that time I lamented that I was hardly hearing any traffic nor was I seeing any radios affiliated to the trunked sites I was monitoring from the north side of the D.C. area near Bethesda. However, this trip was more productive, and I actually heard some users on the IWN system.

I was able to log many transmissions on talk group 13030, which according to some listeners is the security patrol for the BATFE Headquarters in Washington. The traffic I heard was definitely characteristic of outside security operations. Also interesting was that I could hear this same talk group active on both the “new” IWN NCR (National Capitol Region) sites as well as the “old” IWN site in Washington. I also heard some clear radio traffic on talk group 21099, with many radio tests and reception reports being passed along.

I will be utilizing some of the techniques and tools for searching out federal activity in the next few weeks as I head to Super Bowl XLVI in Indianapolis. A full report of what was found there will be featured in the next *Fed Files*.

And, the political campaign season is cranking up quickly, so we will also review what to watch and listen for on the road to the political conventions in the late summer and the election in the fall. See you in May!





Infrastructure Inspection and Office Car Specials

Railroads live and die by their infrastructure. In North America, they have to build and maintain that infrastructure themselves. Major flaws in that infrastructure can lead to expensive and potentially deadly problems.

And, unlike road carriers, which have many options of rerouting their freight around problematic sections of highways, railroads have very few options. Detours can be long and circuitous because railroads have a limited number of routes. Some detours may be over a competitor's tracks, for which that competitor needs to be compensated.

Little wonder then, that next to messages relating to basic operations, much of what you will hear on your scanner relates to track inspection and maintenance. At the same time, railroads are often quite anxious to show off their well-maintained infrastructure to current and potential customers.

In this issue, we'll look at several aspects of this focus on infrastructure.

❖ Track Inspection

In a previous column focusing on hi-rail vehicles – highway trucks or SUVs that have retractable flanged wheels that also allow them to run on track – we've seen that among the many uses of these vehicles is track inspection.

So, on a daily basis (seven days a week) on busier lines, you'll hear track employees calling dispatchers to request "track and time." Depending on the railroad and the reporting relationships, these employees may be called roadmasters, track supervisors, or simply track inspectors.

In most cases, dispatchers will grant "work between" authority, allowing the track inspectors to go back and forth within their limits as needed.

Track inspection takes place in all kinds of weather. In fact, the worse the weather, the more likely track inspectors are to be out in full force. In the latter case, they are looking for washed out ballast, water over the tracks due to flash flooding, debris (such as downed trees) obstructing the tracks, and a range of other problems.

But, visual inspection of track can only go so far. Track takes a tremendous pounding from trains weighing many hundreds of tons. Over time, that not only leads to external wear of track, but also to possible internal fractures.

In a recent conversation, a railroad

official pointed out to me that mainline railroad track is among the most expensive and most critical (in terms of adherence to precise specifications for its contents) of all steel produced. This official even lamented the fact that very few American steel mills were willing to produce rail to meet the tight specifications his railroad set.

Rails on busy mainlines are typically changed out somewhere between five and ten years, while on lesser-used lines with light traffic, rails can last much, much longer. Rails usually have their production date molded into them, and on lightly used spur tracks you may even spot rails that are close to a century old.

But, these are averages. Any piece of rail can fail much sooner than that. And, if that happens on a welded section of mainline track, the flaw is cut out with carbide saws and a new section of rail, perhaps 10-12 feet in length is welded in its place.

The problem, of course, is finding these flaws before they become serious enough to lead to a rail break and a derailment.

❖ Sperry Trucks

For this, railroads use a variety of high-tech measuring equipment. For basic track measurements, such as ensuring correct track gauge and proper elevation of the outer rail in curves, railroads typically have their own measuring equipment, often housed in a fully-instrumented passenger car that is pulled by a regular diesel or electric locomotive. (On the scanner, you may hear references to the operation of a "track geometry train.")

Detection of internal rail flaws, however, is work that is handled with very specialized equipment. While a few large railroads, such as Union Pacific, have their own self-propelled detector cars that use ultrasound or magnetic sensors to

test rails, most other railroads, including some of the largest in North America, contract this out to a company called Sperry Rail Services (SRS).

For much of the 20th century, Sperry used rebuilt self-propelled diesel rail cars that had once carried passengers and freight on branch lines. These cars not only carried the appropriate instrumentation, but also had a living space for the crew, which slept and ate on them between detection runs.

Today, Sperry primarily uses specially configured hi-rail trucks. This offers a number of advantages. When the trucks are not actually scanning rails for possible flaws, the crews simply retract the flanged guide wheels and the scanning gear, which also rides on small flanged wheels, and the truck can leave the rails at any grade crossing. The company no longer has to worry about provisioning the crew and maintaining sleeping quarters.

The trucks use standard diesel engines that can be serviced by truck dealers anywhere in the country. (The engines on the self-propelled diesel rail cars ultimately reached the point where they were difficult to maintain, and replacement parts were all but impossible to find.)

At the end of the day of work, the Sperry crew, even if far from its home base, simply dives the truck to a motel for an overnight lay-over.

So, on most major lines, you will hear on your scanner references to a "Sperry truck" or "Sperry movement" perhaps once or twice a year.

The crew of the Sperry truck doesn't actually get authority to occupy and run on the host railroad's tracks. Rather, the authority is given to the roadmaster or track supervisor, who rides with the Sperry crew.

When scanning, the truck not only records



Front and rear views of Sperry Rail Services truck 983 at Huddleston, Va. The scanning equipment for detecting rail flaws is between the two highway tires. These trucks are set up so that they can operate in reverse while on the rails.



A minimal office car special, consisting of a Norfolk Southern engine and NS car 32, "Research." NS train 995-17 was en route from Roanoke, Va., to Raleigh, N.C., where, after a layover, the research car was added to an Operation Lifesaver special train. The old passenger car carries a variety of instrumentation for recording the performance of a variety of rolling stock.

the track conditions electronically, it also marks the locations of rail flaws with spray paint. Depending on how critical the flaws are, they may either be fixed immediately or within a few days.

A couple of years ago, I was checking out a Norfolk Southern (NS) line in central Virginia, when a radio transmission alerted me to a Sperry truck out on the line. That truck was actually accompanied by a fleet of six NS hi-rail trucks capable of making immediate repairs. One of the larger trucks had a small crane and carried replacement rail sections. Another carried welding gear for welding these sections into place.

When the fleet of trucks went into a siding for a lunch break and to let freight traffic go by, the NS crew was quite friendly and willing to talk about what they were doing.

❖ "OCS headed your way"

Major freight railroads and even some smaller lines, all of whom haven't been in the passenger rail business for decades – other than hosting Amtrak trains – nevertheless own and operate some passenger cars.

As already noted, some of these cars have been equipped with instrumentation and are used for recording everything from locomotive performance to track geometry. But the other passenger cars can cover a wide range of configurations from fairly plain coaches to well-appointed cars used by railroad executives as both their home and office while touring the railroad.

An important role of these passenger car fleets is showing off the railroad to non-railroaders, ranging from potential freight customers to state and local officials and even law enforcement officers. In past columns, I've mentioned Operation Lifesaver trains, dedicated to promoting grade crossing safety and preventing trespassing on railroad rights of way. Many major railroads operate such trains on various parts of their systems once or twice a year.

But it's usually the inspection trips by top railroad executives that get the most attention, particularly from front-line railroaders. On these trips, often timed to follow major track or other improvements on a particular route, officials from the home office are accompanied by local railroad managers who are expected to answer questions about operations in their area.

On freight railroads, the small passenger car fleets are usually referred to collectively as "office cars" to distinguish them from passenger cars used in revenue service. And trains handling

these cars are designated as "office car specials" or just OCS. So you may hear the dispatcher telling a freight crew that, "You've got an OCS headed your way," warning to the crew to look extra sharp and make sure they are complying with all work rules.

❖ Background Sources

In a previous column, I promised to mention sources that I use to keep up to date on railroad developments. Two of these are the *Destination Freedom* newsletter, published by the National Corridors Initiative, Inc., (NCII) a passenger rail advocacy group, and the *Transportation Nation* Web site. *Transportation Nation* (TN) is published by a consortium of public radio stations, and though it covers much more than rail, a substantial portion of the content relates to passenger rail.

As with all news sources, it's important to keep in mind the point of view of their publishers and producers. Both of these sources have a strong pro passenger rail and transit stance – but in both cases the content is professionally prepared and edited. Though both sometimes include news related to freight railroads, the items are typically provided because they have some relationship to passenger transportation.

Destination Freedom is published weekly, with breaks for major holidays. New issue are posted to the NCII Web site late Sunday night (Eastern Time). To access the newsletter, go the NCII home page at www.nationalcorridors.org and (depending on screen and browser size) scroll down slightly. The links to the most recent newsletters are on the left-hand side. Though the site contains lots of useful information and commentary, I usually find it a bit wordy. So, I don't always read every article all the way through, though I do tend to look at all the articles.

Transportation Nation is at <http://transportationnation.org>. It's updated on an ongoing basis. Rather than checking this site regularly, I go to it when I hear a brief item about breaking transportation news – for which I'm not likely to find information elsewhere. *TN* frequently has details and/or a link to a site with even more information.

❖ EOT and DPU Frequencies

In an on-line discussion, California railfan David Ferreira recently provided pointers as to how he gets advance warnings of trains

in areas where there isn't a lot of voice radio traffic. He kindly gave me permission to quote him here:

"Since I am on UP [Union Pacific] Rosville sub Donner [Pass], and they have little ATCS, here are some suggestions that work for me. I have an older 200 channel scanner, the first 5 groups of 20 have all the AAR channels plus EOT and DPU frequencies, good when I travel far away and am unsure of what's used in an area.

"The Last bank of 20 has local frequencies, plus EOT and DPU. Since UP crews are not always talking on the radio, and every train has EOT or DPU I get a 5-10 min. warning something is coming. I highly recommend adding the following – EOT [frequencies] 452.9375, 457.9375, DPU 452.925, 452.950, 457.925, 457.950."

EOT stands for the "end of train" telemetry devices that report brake line pressure and other data to the head locomotive. DPU stands for "distributed power unit" – remote controlled locomotives in the back of the train that are operated by the crew in front. All long distance trains will have either an EOT or DPU on the rear. Having a DPU engine on the rear deletes the need for an EOT, as the remote locomotive also transmits data back to the front.

For EOT and DPU transmissions, all you will hear on your scanners are brief chirps of data. But these should let you know that a train is approaching.



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Cutting the Cable – Streaming Video

I talk a lot in this column about streaming Internet radio and the technology and devices that are bringing it to the forefront of the daily lives of people. But, one topic I haven't spent a great deal of time on yet is streaming video.

I must admit, this was due partly to ignorance. I simply was not as educated in this realm as I was with streaming radio and audio content. I have devoted, though, a considerable amount of time in recent months to "catching up" in this area, so expect to see more space devoted to streaming video in coming columns.

I thought that a great way to get us started in this area of streaming content was with a brief primer on who the big players are in the streaming video world, what the technology is that's bringing it to the forefront, and some of the key considerations for future development.

One of the more attractive elements of streaming video is that with the right selection, one could theoretically reduce or even eliminate the need for a monthly cable television bill. That is the goal I set out when doing my research – to drop my cable bill down to the most basic monthly package available and supplement it with streaming video.

Currently, I have been paying \$100 per month just for my cable package with Uverse, which includes all premium movie channels and a ton of HD. My hope is that I will be able to drop to a lower package, add in streaming services, and save some money, without losing too much in content.

The two main things you should be considering when looking to adopt streaming services is which ones have the content you want in combination with a device that uses that service in a way that is helpful to you.

❖ Who has the Streams?

There are a number of different sources for streaming video out there, but who has what you are looking for? To be totally sure, you will have to engage in quite a bit of trial and error to find the source(s) that work best for you.

As an analogy, I had a friend who had to try every new snack food as soon as it was released. Whether it was a new type of cracker, cookie or chips, he had to give it a shot. His reasoning was, "you never know when you are going to find your new favorite."

I have been approaching streaming services in much the same way. I haven't been afraid to try new services, as even those that require a

paid subscription usually offer a free-trial period. With treasure hunting mindset in place, I made my way into the great video beyond.

❖ Netflix

I started with the big gun, Netflix. Usually, the first or biggest in an industry is going to be the best. They have the most resources to figure out the best methods for an interface, offer the widest selection of material and have the most reliable product among their competitors. For the most part, I have found Netflix to follow this model.

Netflix offers a 30-day free trial to their streaming service, which is among the longest I have found of the streaming providers that require a paid subscription. Once the trial period is complete, you can anticipate \$7.99 per month for unlimited, commercial-free streaming.

The selection is pretty good, actually. If you are a fan of '80s sitcoms such as *Cheers*, *Cosby Show* and even '90s shows like *Frasier* and *Roseanne*, you will love reminiscing while watching these episodes on Netflix. As far as movies go, don't expect to see something that was recently in theaters, but older movies are in abundance. This depends on the contracts Netflix has with different studios. (Their contract with Starz just ended last month, stripping all 'Starz' movies from their streaming titles.)

Netflix just recently added the Jeff Bridges movie *True Grit* to their streaming titles, as an example. The rest of their titles are rounded out by obscure b-movies and lesser known releases.

All-in-all, I am a big fan of Netflix. I will dive into the technology for accessing streaming video later, but as a sneak peek, I am able to stream my Netflix account through Apple TV, my

Roku device, iPhone, Xbox, Kindle Fire or my laptop. With all of these options, Netflix was an easy decision for me to add as a video content provider.

As I expand my technology, Netflix makes an easy adopter for most new devices. Smart TVs, app-enabled Blu-Ray players and most smartphones and tablets all will implement Netflix. It really is probably the easiest and most effective way to get into streaming video.

❖ Hulu

I didn't want to stop there, though, and continued my search for streaming content. After seeing mostly older television programs on Netflix, I decided to try Hulu Plus, which offered more recent broadcasts of most of the shows I like to watch, in addition to much of the older stuff like Netflix offers.

Hulu Plus offers a 1-week free trial to test out their service, after which it is \$7.99 per month. One drawback I noticed immediately is that Hulu Plus inserts advertising into their content. They say this is in an effort to keep subscription prices low to offset the high licensing costs of current-season TV episodes. After using it for the full week, I noticed something else.



Since keeping a basic cable package to be able to watch local news, sports and channels like Discovery and Science is a necessity, and since I have a DVR to record new episodes, I don't really have much of a use for Hulu Plus. With my DVR, I can fast-forward through commercials, which I cannot on Hulu Plus, and I can set up my DVR to record the new episodes and watch them at my convenience.

Others who don't have a cable subscription of any kind will likely find Hulu Plus to be a fantastic and necessary streaming service, but people like me who will be keeping basic cable and a DVR, likely won't see much benefit in adding this \$8 fee each month.

❖ One

I am just starting to get my feet wet with One service (thanks to the addition of a Kindle Fire after the holidays) is Amazon Prime. Their



instant video service comes with an Amazon Prime membership, which runs \$79 a year (roughly \$6.58 a month). There are a growing number of movies and television shows available through Amazon Prime. Currently, the only places I can watch this content is either through my Roku device (plugged in to the TV in the bedroom) or on my Kindle Fire. There isn't native support for Amazon Instant Video on my iOS devices.

So far, though, I have been impressed with Amazon Prime as a video source. Adding in other functionality for my Kindle Fire, such as book borrowing, free 2-day shipping on Amazon orders makes it an even more attractive option. The only thing missing would be some sort of streaming music service, similar to a Pandora or Spotify. If I hear rumors that something like this is in the works for Amazon Prime, I will of course provide updates when available.

❖ Other services

There are additional streaming services available or coming online in coming months. One currently available that I frequently use is Crackle. I am able to stream Crackle through Roku or my iPhone, and while it doesn't have the number of shows or movies that a Netflix or Hulu Plus might have, it does have a good niche, with shows distributed by Sony. You won't find all of the episodes for a series here, but there are a handful from various seasons available. The movie selection is limited, but growing. Like with Hulu Plus, there is a brief commercial that comes in every 15-30minutes or so, but it isn't as distracting or as long as those on Hulu Plus.



Some other options to consider are some of the cable provider specific services such as Comcast's Xfinity On-Demand, Verizon FiOS (in addition, Verizon will be launching a Netflix-styled streaming video source this year that will be available in areas not serviced by FiOS currently), Uverse's streaming video through an iPhone app, and more.

I personally envision myself downgrading my cable package and adding a combination of Amazon Prime and Netflix. Combined with my ability to rent new releases through my Uverse subscription or through iTunes on AppleTV, this should give me adequate access to all of the programming I should ever want.

❖ Devices to consider

This really depends on what you want to watch and where you want to watch it. Do you

want something that will give you content at home? Do you want HD? Do you want to be on the go?

For home entertainment systems, you have several options. Probably the easiest would be to purchase a **SmartTV or app-enabled Blu-Ray player**, to give you access to Netflix, Hulu Plus, Amazon Prime, etc. These devices connect to your home WiFi network and use apps to provide you the streaming content.

If you don't have a new TV purchase in your budget, you can opt for the next best thing, a set-top-box such as **AppleTV or Roku**.



Each has their merits and limitations, but both are powerful options for accessing your streaming video. If you just want a basic streaming device that gives you access to the most content and apps, Roku is a great choice. I picked up the Roku LT for my bedroom where I am not running an HDTV and it only set me back around \$55. It works great to give me basic Netflix or Amazon Prime access. For those that are HD-minded, Roku does offer devices that stream in up to 1080p for about \$100.

For roughly the same price as the high-end Roku, you can also opt for AppleTV. While it doesn't have all of the apps that a Roku device will (it does have Netflix, YouTube and a few others), it does offer AirPlay. With this, I can stream my music or video from my laptop, iMac or any iOS device. This makes it a perfect complement to my main home theater system in my living room. For those looking at high-end HD, keep in mind the AppleTV maxes out at 720p.

❖ Mobile Devices

If you are thinking about taking your video on the go, you have a ton of choices.

First, you can go the smartphone route. With this, you can access your streaming video anywhere you can get a cell phone signal. Make sure you have a hearty data plan (I recommend unlimited or the highest you can afford) because streaming video does eat up the gigabytes. If you have access at work or at home to a WiFi network, that should help ease the burden on your cell's data plan.

You can also look at a tablet. There are some that are WiFi-only, like the Kindle Fire I recently acquired. You can also look at tablets that access cellular networks, but remember those will incur additional data plan fees.

If you would rather go the personal WiFi-hotspot route, you can look at a MiFi device. These are basically portable and personal WiFi routers that convert a cell phone 3G signal into a



WiFi signal. From this, you can provide a WiFi Internet connection to several devices (usually up to five at once). Check with your cell provider to see what they offer and how much their plans run. They typically run about what an unlimited data plan will run, but don't always incur a specific contract period (one year, two year, etc..).

Personally, I love my Kindle Fire and iPhone combination. With this, I can use my Kindle Fire when at home or at work and on a WiFi network to stream music, videos, etc. Then, with my iPhone, I can access the same content when I don't have a WiFi connection.

It really all will depend on what features you hold to be most important. Hopefully, though, this column will give you a starting point to begin your research.

GLOBALNET LINKS

Verizon Launching Streaming Service - www.tomsguide.com/us/Verizon-Netflix-HBO-Starz-Video-Streaming,news-13419.html

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Bits & Pieces

❖ A Modest LF Shack

Readers sometimes ask what I use for DXing the longwave band. It may be surprising to some just how basic my setup is, but here is a quick rundown for those who may be curious! Since antennas are by far the most important tool for listening, I'll describe them first.

I use three types of antennas at my western NY location as follows: 1) An L-400B Active Antenna by LF Engineering Co. (www.lfengineering.com), 2) a homebrew broadband shielded loop described at <http://members.shaw.ca/ve7sl/burhans.html>, and 3) a wire antenna about 150-feet long and 30 feet above ground. This last antenna is my "general purpose" receiving wire, which I use across the VLF/LF/MF/HF spectrum. In addition, I sometimes use a Q-Stick Plus+ ferrite bar antenna positioned atop my Sony 2010 portable receiver for traveling or for temporary set-ups. More information on the Q-Stick is available online at <http://dxtools.com/QStick.htm>.

For my main receiver, I use a Drake R8 (non-A version), which my wife gave me as a present in the summer of 1992. It's one of the few brand new radios I have ever owned, and I still love it. This set covers down to 100 kHz, and if I need to go lower, I use an LF Engineering L-101 converter ahead of it, which takes me down to 5 kHz. (For anything below that I break out a homebrew "BBB-4" natural radio receiver, but that's a topic for another column.)

Also for LF work, I have a vintage National RBL-5 regenerative receiver that I use from time to time. This 1943 Navy set is fun to operate and covers 15 to 600 kHz. Using it takes some getting used to, as it does not have all of the niceties of a modern set, such as a noise blanker, notch filter, or even an S-meter. However, the "fun factor" is what keeps me coming back to this set time and again.

Another rig I use occasionally for LF is a Collins R-390 (non-A version) with the above-mentioned LF converter placed ahead of it, as the R-390 only goes down to 500 kHz on its own. It is a very nice set from the mid-1950s, and it still holds its own against most of today's radios. It has mechanical digital tuning accurate to 200 Hz when properly calibrated with the built-in crystal oscillator. It is also my main receiver for ham communication when using AM or CW with separate transmitters on the bench.

❖ Farewell to BeaconFinder II

Since 1998, I have published the *BeaconFinder* directory of longwave stations, with an emphasis on non-directional beacons (NDBs). Recently, I have decided to discontinue this publication, as much of the information is now available online from various sources, many of which we've covered here in the column. Keeping the guide up to date has also become a challenge from the standpoint of time and access to a once-readily available FAA database. Moreover, the number of active longwave beacons has fallen, and this trend is likely to continue.

I would like to thank each and every one of you who ordered the *BeaconFinder* over the years. It was a bigger success than I ever imagined, and you made that possible. Remaining copies will be available while they last, but after that the book will be history. I still think there is a place for a printed guide, as it offers a place to make notes and doesn't require having a PC running to use. However, the times are changing, and online resources are now the preferred way that most people get frequency and location data for longwave beacons. Why fight the trend?

Thanks again for a great run, and my CD recording, *VLF RADIO!* will continue to be available as described on page 76. It offers an audio tour of what you can hear from 0 to 535 kHz, including some "extinct" stations like GWEN and OMEGA.

❖ Basement Band Loggings

Rowland Hamly sent the logs below from his International Falls, MN location. He used a JRC NRD-545 and Icom R-75 receiver for these intercepts. His antenna is an L-400B active antenna by LF Engineering Co.

Selected NDB Logs from MN

| kHz | ID | Location |
|-----|-----|--------------------|
| 218 | RL | Red Lake, ON |
| 223 | YYW | Armstrong, ON |
| 230 | ZUC | Ignace, ON |
| 233 | CQM | Cook, MN |
| 248 | KZ | Buttonville, ON |
| 251 | BR | Brainerd, MN |
| 272 | GP | Grand Rapids, MN |
| 276 | YEL | Elliot Lake, ON |
| 326 | YQK | Kenora, ON |
| 328 | YTL | Big Trout Lake, ON |
| 330 | PWC | Pine River, MN |
| 334 | YER | Fort Severn, ON |
| 335 | YLD | Chapleau, ON |

| | | |
|-----|-----|-------------------|
| 345 | FOZ | Big Fork, MN |
| 346 | YXL | Sioux Lookout, ON |
| 353 | IN | Intl Falls, MN |
| 360 | SW | Warroad, MN |
| 376 | YAG | Fort Frances, ON |
| 382 | YPL | Pickle Lake, ON |
| 385 | SCG | Crane Lake, MN |
| 393 | XVG | Longville, ON |
| 413 | YHD | Dryden, ON |
| 417 | IY | Charles City, IA |
| 429 | POH | Pocahontas, IA |

We also have a list of loggings from Mario Filippi, N2HUN (NJ) made during December. In addition to the logs shown in the list, he also reported hearing a 2-way contact between WE2XGR/6 and WB2XSH/6 at 500 kHz, and hearing Arabic music – weakly – at 170 kHz.

Mario points out that Iowa is the farthest location he has received stateside. All loggings were made on a Yaesu FRG-7 receiver with a Palomar VLF converter. His antenna is a 43-foot vertical from S9 Antennas with 53 ground radials.

Selected NDB Logs from NJ

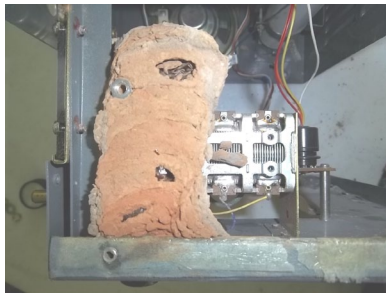
| kHz | ID | Location |
|-----|-----|--------------------------|
| 198 | DIW | Dixon, NC |
| 212 | SJ | Saint John, NB |
| 224 | MO | Moosonee, ON |
| 233 | QN | Nakina, ON |
| 236 | OW | Ottawa, ON |
| 243 | YVB | Bonaventure, QC |
| 244 | DG | Chute des Passes, QC |
| 248 | FRT | Spartanburg-Fairmont, SC |
| 248 | UL | Montreal, QC |
| 257 | YXR | Earlton, ON |
| 260 | UFX | Lourdes-de-Joliette, QC |
| 273 | ZV | Sept-Iles, QC |
| 284 | RQY | Randolph City, WV |
| 289 | YLQ | La Tuque, QC |
| 407 | IL | Wilmington, OH |
| 407 | ZHU | St. Hubert, QC |
| 408 | SN | St. Catharines, ON |
| 409 | YTA | Petawawa, ON |
| 414 | 3U | Gatineau, ON |
| 417 | HHG | Huntington, IN |
| 419 | RYS | Grosse Ile, MI |
| 423 | PCW | Port Clinton, OH |
| 423 | SIF | Reidsville, NC |
| 432 | IZN | Lincolnton, NC |
| 434 | SLB | Storm Lake, IA |
| 526 | ZLS | Stella Maris, Bahamas |

❖ Mailbag

Besides sending loggings, Mario Filippi, N2HUN (NJ), also sent an interesting letter describing his restoration of a Coastal Navigator RDF unit. What he found inside the set is an interesting story in its own right. The radio seemed to be in good shape cosmetically from

the outside, but the Marine Band was dead, so he opened the case to investigate. Inside, he found a large wasp nest made of clay. He says it took a small hammer, screwdriver, and needle-nose pliers to break up the nest, and luckily no wasps were still alive!

Here are pictures of the chassis when the set was first opened, showing the massive nest, and then another shot taken after he cleaned things up, with the set ready for rewiring and troubleshooting.



Mario Filippi's Coastal Navigator chassis, with wasp nest still in place!



Coastal Navigator chassis cleaned and ready for checkout.

❖ Hifer Beacons

When we discuss beacons in this column, it generally pertains to non-directional navigation beacons operating in the 190-535 kHz range. We also touch on some experimental beacons within this range, Lowfer and otherwise. Far lesser known are the other places in the radio spectrum where license-free beacons are allowed to operate. For example, there are operations at the low and high ends of the AM broadcast band by "Medfers," and there are "Hifer" transmissions occurring between about 13.553 and 13.567 MHz. This is just below the 20 meter ham band.

The Hifer band can yield some very interesting results due to skip conditions. On a mid-January morning at about 10 a.m. local time, I was able to hear beacons GNK (Madison, WI) and SZX (Macomb, IL) at weak, but readable levels here in NY.

Hifers typically use less than 5 milliwatts of power into a simple antenna and they are often heard at surprising distances. A list of active stations for this, and other "alternative" experimental beacons, can be found at the site maintained by John H. Davis at www.lwca.org/sitepage/part15/index.htm. Good luck, and if you hear any of these micro-power beacons, be sure to let the operator know!

In addition to Hifers, you may want to check the 10 meter amateur band for beacon activity, especially now that the band is open most days with the increase in sunspot activity. The frequencies between 28.1 and 28.3 MHz are especially fertile ground for beacons, and one resource for identifying them can be found at www.qsl.net/wj50/bcn.htm. If things are really hopping, be sure to check out the 6 meter (50 MHz) band as well. A website for 6-meter beacons can be found at www.keele.ac.uk/depts/por/50.htm.

❖ A New Project

We recently wrapped up the restoration of a AquaGuide RDF-304 receiver in this column. I've since connected an AC adapter to power it, rather than having to use the internal batteries, while retaining the ability to use batteries for portable work. This was a fun set to restore, and even more fun to use, but I've been looking for something new to work on. I think I have found the perfect candidate: A Bendix Navigator 420 direction finding receiver.

The Bendix is a compact solid state portable receiver covering the LF, AM Broadcast, and Marine Bands. It includes a rotatable ferrite antenna on top, an S-meter, and a sensitivity control. It even has a BFO for Consolan reception, a specialized type of navigation aid. I was fortunate to find this set at the 2010 Antique Wireless Association Convention in Rochester, NY last August for \$10, and it included an original manual, which is a rare find in itself. I've seen sets similar to these carrying the name "Nova" on the front and I suspect these were all made by the same manufacturer and then private labeled by a number of companies.

Some of the sets in this family have additional bands, such

as VHF, Aviation, and even CB, but they all retain the same basic appearance. This is the first one I have seen with the Bendix name on it, however. Looking closer at the rear panel, the name Nova does appear in small print, so this would seem to confirm that they all share the same lineage.

Next time we'll open it up and do an assessment on what is needed to put this radio back in top condition.

At first glance, it does not appear to have any physical damage, although there is a white "cocoon" behind the dial scale at the lower right side. Hopefully this, and any remnants from it, can be removed from behind the dial. Having the manual should be a real plus if repairs are required, as it contains a schematic diagram, albeit a small one. The manual also explains all of the features and intended uses for the set.



Our next LF restoration project: a Bendix Navigator 420 RDF receiver

❖ NASWA Winter SWL Fest

I hope to see many at you at the 25th Annual Winter SWL Fest at Plymouth Meeting, PA (near Philadelphia) on March 1-3. This annual gathering of radio enthusiasts has something for all corners of the hobby from DC to daylight. It is also a great time to reunite with friends from the radio hobby and make new ones. For complete information on this event, visit the event's website at www.swlfest.com/.

That's it for this month. 73, and best LW DX!

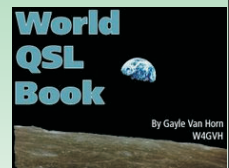
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Bob Grove - December 2008 *What's New Column*, *Monitoring Times* magazine

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Buttoning up the Meissner “Utility” Broadcast Set

Last month, having finished the recapping of our Meissner receiver, I was finally able to fire it up and verify that it was indeed receiving signals throughout the broadcast band. I wanted to be sure of that before attempting an alignment, because the set has some features that make it look like a factory prototype, possibly for a special frequency range. Among these are that it is equipped with Meissner adjustable oscillator and r.f. coils – normally only used for matching unobtainable replacement parts – instead of the fixed coils ordinarily used in this receiver.

Now that I knew I was still dealing with a broadcast band receiver, I felt free to proceed with the alignment, which went smoothly. By the end of the session, I felt that I was satisfied with the results of the restoration except for one issue: a sticking dial drive that was resisting all attempts to free it up.

❖ A Lucky Dial Drive Fix

This month’s session began with an attack on the tuning dial problem. Once that was solved, and the tuning eye reconnected, the Meissner could be reinstalled in its cabinet. I had tried to deal with the dial, which would always have to be “helped” over a certain spot during tuning, with WD-40 lubricant carefully sprayed on the tuning capacitor bearings and on the bearings of a couple of the pulleys. But nothing seemed to work.

Not being sure where in the drive system binding was occurring, it looked like I would have no choice but to disassemble the system to try to isolate the problem. That would re-

quire removing the front panel and, of course, unstringing the drive. Since my Meissner manual for the set doesn’t have a dial stringing diagram, I would have to make my own before disassembly. That’s where I got lucky.

The wraps of dial cord around the main drive pulley were so close together that I couldn’t be sure of how many there were and which ones passed through the hole in the pulley to connect with the tensioning spring. To help me work all this out, I resorted to using a fine jeweler’s screwdriver to wedge the wraps apart so I could distinguish between them. Once I finished my diagram, I decided to operate the dial drive one last time before disassembling it. And I’m glad I did because, to my surprise, it now operated smoothly throughout its entire range! Apparently the binding had been happening someplace where the cord passed over the pulley.

❖ Re-Invigorating the Tuning Eye

The tuning eye had been disconnected throughout all of the testing and realignment procedures because it couldn’t be mounted on its bracket with the set out of the cabinet. It wasn’t necessary for the operation of the radio, so I had kept it unplugged to protect it from damage as I moved the chassis around. Now I reconnected it to check its operation, and I was a little disappointed.

The eye was responding all right, but the closings were only partial, even with very strong signals. There were two possible causes. The most obvious was that a type 6E5 had

been substituted for the 6G5 called for in the documentation. The other was the 1-megohm resistor that is commonly part of the tuning eye circuit and hidden within the tube socket. The latter is known to substantially increase in value over time and reduce the sensitivity of the indication.

I checked the resistor first and it was spot on. There was no problem there, so I looked through my supply of indicator tubes and found one marked “6G5/6H5.” That one was much livelier in its response and was nice and bright besides. A winner!

With the last problem solved, I could now return the set to its cabinet and button it up. I’ve never been able understand why there had to be so many subtly different varieties of tuning eye.

❖ Output Transformer Specs

As those who have been following this restoration know, our radio does not have a built-in speaker or an output transformer. The speaker is an accessory, and is specified as a dynamic type having a 1500-2000 ohm field and an output transformer to match a single 6V6 in class A. The day has long passed when one could purchase a dynamic speaker off the shelf and, as has been previously discussed, we used the recommended series-connected choke and resistor to substitute for the field coil, which left us free to use a common PM speaker instead of the dynamic one.

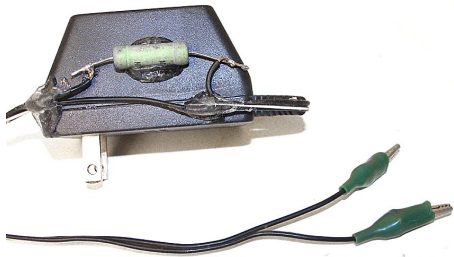
Up to this point, just for testing, we’ve been using an output transformer of unknown specs. Luckily it has worked well enough, but the sound does have a bit of an edge that makes me wonder just how close of a match we might have. The Meissner documentation says we need a transformer, rated at least 5 watts, to match the impedance of a 6V6 tube in class A. What impedance is that? We need to refer to a tube manual to find out, and the spec we want to look at is the load resistance (NOT the plate resistance).

My RCA manual gives the load resistance of a 6V6 in class A at three different voltages: 180, 250 and 315. According to the schematic, the plate voltage on our 6V6 is 250, which corresponds to a load resistance of 5,000 ohms. So what we want is a transformer that will match the typical impedance (3.2 ohms) of the small PM speaker to the 6V6’s 5,000 ohms.

Like dynamic speakers, specific imped-



The Meissner’s sticking dial drive resisted all correction attempts, then got fixed by luck (see text).



The "wall wart" handy dandy transformer tester. It's definitely not pretty, but it does the job!

ance output transformers are rare to find new. Generally one must resort to a "universal" transformer that can be set up for various impedance combinations. One well-known supplier of parts for vintage radios lists a 5-watt universal transformer that can be set up for the impedance combination we want at over \$33.00.

Like many of us, I have a junk box that contains several unmarked output transformers, and while some are the small size used in a.c.-d.c. sets, a few look big enough to handle 5 watts. The question is, how can I tell if the transformer I am using, or any of these alternatives, is the right size?

❖ Finding the Required Turns Ratio

It's important to keep in mind that an output transformer does not have an inherent load. It is strictly a device to couple the output tube and the speaker voice coil. Without a speaker connected to its secondary, it will not present a load to the output tube connected to its primary. And the size of the load, or impedance, presented at the primary depends on two things: the impedance of the voice coil connected to the secondary and the *turns ratio* of the primary and secondary windings.

As the term implies, the turns ratio of a transformer is the ratio between its primary and secondary turns. For example, if the primary has 50 times as many turns as the secondary, then the turns ratio is 50 to 1. Now the impedance of a speaker voice coil connected to the secondary of a transformer is reflected back to the primary of the transformer as the square of the turns ratio.

$$Z_{\text{tube}} = Z_{\text{v.c.}} \times (\text{TR})^2$$

The required turns ratio is the first thing we need to know in evaluating an unmarked output transformer. And since we know the impedance of the voice coil (3.2 ohms for most small speakers) and the desired impedance to be reflected to the primary (5000 ohms), we can calculate the turns ratio with a simple rearrangement of the above formula:

$$\text{TR} = (Z_{\text{tube}}/Z_{\text{v.c.}})^{1/2}$$

So the turns ratio we need is the square root of [5000/3.2=1563] or between 39 and 40 (my calculator doesn't do square roots, but that's close enough for our purposes).

❖ Identifying an Unmarked Transformer

It's very easy to find the turns ratio of the primary and secondary of a transformer experimentally because the turns ratio is the same as the ratio of the voltages in the primary and secondary. So determining the turns ratio is as simple as applying a voltage to one of these windings and measuring the resulting voltage in the other.

In a newsletter article authored by Tony Jacobi some years ago, he suggested using a 12-volt transformer as a voltage source and applying the voltage to the primary winding. A 1k resistor is inserted in series with the voltage source and the winding. The purpose of the resistor is to limit current flow in case the unknown winding being energized is shorted or has an unexpectedly low number of turns.

Once the primary is energized, the voltage at the secondary can be measured and the ratio of primary to secondary voltages, which is the same as the turns ratio, can be calculated. Tony recommended that a VTVM or DVM be used to do the measuring because these instruments can indicate the small voltages more accurately.

Like most of us who dabble in radio and electronics, I have a growing collection of "wall warts" salvaged from defunct or obsolete electronic gear. And I really didn't have to search too long to find one with a nominal 12 v.a.c. output. It delivered 14 volts no load and was rated at a little over 800 mA, which I thought would be more than adequate for the purpose. So that unit became the basis for a little transformer tester.

I used a glob of adhesive to mount a 1k resistor to the side of the wall transformer and routed the output cord past it with more adhesive. Since it was zip cord, I could easily cut one of the leads, then strip the free ends and solder them to the leads of the resistor. This effectively put the resistor in series with the output cord. Cutting off the barrel plug from the end of the cord and substituting a pair of small alligator clips completed my little tester. These would be clipped to the primary leads of the unknown transformer.

Disconnecting the output transformer I had been using with the Meissner from both the radio and the voice coil, I fired up my handy dandy transformer tester and attached its clip leads to the primary. Using a DVM, I measured exactly 12 volts across the primary and 0.5 volts across the secondary. Dividing the primary voltage by the secondary voltage gave me a turns ratio of 24. Assuming a speaker impedance of 3.2 ohms to be connected across the secondary, the load impedance reflected back to the primary would be 3.2 X (24)², or 3.2 X 576, or 1843.

This isn't even half of the 5000-ohm load impedance we really need for the Meissner's 6V6 output tube, and could certainly account for the slight edge noticeable in the radio's audio quality. It could also account for the fact that the set's tone control seems to have only a limited effect.

Checking my tube manual, I found that the load impedance required for a type 50L6, the typical audio output tube in an "All American

Five" a.c.-d.c. receiver, is 2,000 at the 110 plate volts usual in such sets. Thus it's a good guess that the transformer I've been using in the Meissner was salvaged from such a radio. None of the other salvaged transformers in my collection are even that close.

Just to verify my methods, I ran a test on the only marked output transformer I seem to have in the junk box. It's a small military unit intended to match a 600-ohm receiver output to an 8-ohm speaker. According to my voltage measurements and calculations, an 8-ohm speaker would reflect a load impedance back to the receiver of about 750 ohms. Close enough, considering the possible inaccuracies in the inexpensive little DVM I've been using as a temporary replacement for my defective original.

Now that I've tried out Tony's method, I would say that a DVM is a must for measuring the small voltages and fractions of voltages that one encounters at the secondaries of the transformers. But I find that the tests are very quick to do, as are the simple calculations required. It is certainly a very useful technique.


As it happens I have no transformer in my collection that even comes close to the 5,000 ohm-to-3.2 ohm unit needed for the Meissner. So I will have to look elsewhere. New transformers are expensive but, as Tony points out, transformers marked for one purpose can be used for others, provided that the primary to secondary impedance ratios are identical. For example, a transformer intended to match a 50L6 (2,000 ohms nominal plate load) to a 3.2-ohm speaker will also match a 6V6 (5,000 ohms nominal plate load) to an 8-ohm speaker because their impedance ratios, and therefore their turns ratios, are equal.

As I browse through surplus catalogues for a transformer, I can take advantage of this knowledge to give myself a wider choice of possibilities. I could also take advantage of a good buy in an 8-ohm speaker and use the transformer I already have!

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What's My Line? Understanding Transmission Lines

I've often harped on the idea that a good antenna is crucial to the successful operation of one's station. An effective antenna can make an inexpensive radio into a winning performer; a top-of-the-line radio is useless with a poor antenna. Yet there's an even more important and basic link in this equation – the transmission line that connects that comfy indoor station to our (hopefully) effective antenna.

We spend a lot of thought, and money, on getting good radios and putting up good antennas, perhaps without understanding transmission lines as well as we should. This month, let's attempt to look a little more closely at this all-important link in the radio chain.

❖ Balanced vs Unbalanced Feeds

All transmission lines fall into one of two general categories, which we call *unbalanced* and *balanced*. If we ignore for the moment special cases like a single wire feeding a longwire or other random antenna, then what we really mean by *unbalanced* is coaxial cable. *Balanced* refers to ladder line, TwinLead, window line, zip cord – which are not shielded like coax is and which have two obviously equal conductors separated by more or less distance and by more or less insulating material, which we call *dielectric*. These factors of spacing and dielectric are also crucial aspects of the functioning of coaxial cable.

The biggest and most obvious difference between these two configurations is the one that divides them into unbalanced and balanced – coaxial cable has an insulated inner conductor surrounded by a *shield* of woven wire. This outer, shield conductor is always connected solidly to ground at the radio end of the run. Conversely, balanced line has two identical conductors that are not shielded, and neither of which is connected to ground at the radio end. What are the relative advantages and disadvantages of each?

❖ The Miracle of Coax

Coaxial cable's greatest edge, probably, is that it can be run almost *anywhere*. Since it is a shielded cable, it can be run right along metal structures such as towers and metal buildings, taped to other coax cables in groups with no interference between them, even run underground under the right conditions. These features were a tremendous boon to amateurs

in the immediate aftermath of World War II, when huge amounts of military surplus coax came on the market.

Up until then, operators had generally used single-wire or homemade ladder-line feeders, with all the attendant liabilities: the shock hazard from exposed conductors, the unintended radiation from these unshielded feedlines when imbalances in antennas were encountered, the tendency of ladder line to twist in the wind and short out, the need to carefully space or stand-off these feeders from any and all metal surfaces.

Coaxial cable was a godsend of convenience and neat appearance – provided you were feeding a *resonant* antenna with it. Its shielded nature was a huge plus when television first arrived in American homes and TVI (television interference) became a big issue.

Another major part of coax's legacy is that antenna inputs on radios steadily became standardized as 50 ohm unbalanced – a perfect match to the vast majority of coax cables on the market. Nowadays, of course, this is all but universal on receivers, transceivers, tuners, and all other modern radio equipment.

Of course, there is an inevitable downside to all of this. Coaxial cable's big Achilles heel is that it must operate in an *impedance matched* environment. With the center conduc-

tor encased in a substantial plastic jacket and completely surrounded by the outer shield, which is also encased in a jacket, a length of coax is actually a quite efficient capacitor. As long as the antenna load, the coax itself, and the radio's antenna connection are all substantially the same impedance, or nearly so, there is an efficient and unimpeded flow of power.

Introduce much mismatch, though, and the resulting SWR begins to generate power loss in the cable. As little as 2 to 1 SWR, and certainly 3 to 1 or more, results in unacceptable power loss in the cable – indeed, at high enough power levels and bad enough mismatch, the resulting voltage peaks can punch holes right through the coax jacket. This is why, once coax became so prevalent in the post-World War Two era, hams became *very* attentive to the concept of making a coax-fed antenna resonant – that is to say, making dipoles *exactly* a half-wave long at the desired frequency, and making verticals *exactly* a quarter-wave long.

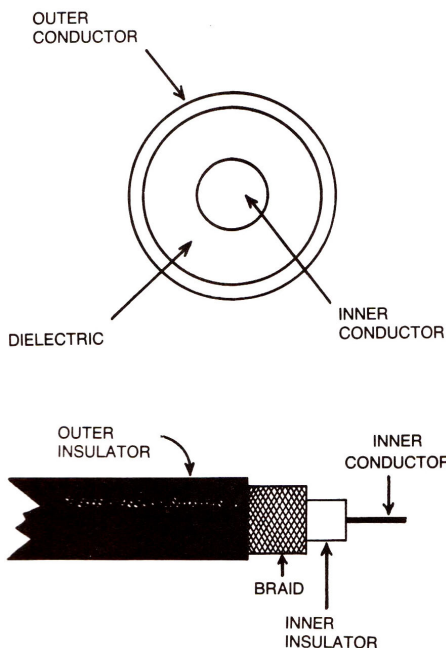
Generally this resulted in antenna feed-point impedances ranging roughly from 30 to 70 ohms – an acceptable match to nominally 50 ohm coaxial cable. Ingenious matching networks at the antenna were developed to bring Yagis, quads, and other antennas into line with this desired impedance range.

Incidentally, this concept of keeping the match between cable and antenna carefully controlled also resulted in the development of SWR bridges and forward and reflected reading wattmeters to allow operators to keep an eye on this whole process – tools which remain indispensable to us to this day. By the way, forward and reflected power measurement refers to the direction of power flow in the coaxial cable – *forward* being from the rig to the antenna, and *reflected* being the power “bounced back” down the line by mismatch and resulting higher SWR.

Ideally, we would like to see an SWR of 1 to 1, which theoretically means maximum forward and zero reflected power. When all-solid-state rigs were developed and perfected, they were provided with “fold-back” circuitry, which automatically restricts the power output when higher than 1 to 1 SWR levels are sensed. This prevents the embarrassing spectacle of blowing up the rig's output transistors!

❖ Achieving Balance

Balanced line is a completely different animal. Care must be exercised in the routing and supporting of a balanced line. Even if it is an insulated line, like TwinLead or window line,



End-on and lateral schematic drawings of coaxial cable construction.



A typical example of manufactured "window line."

it must be spaced away from metal surfaces like window frames, roof flashing, and the like, since it is not shielded, and these conductive surfaces would present grave issues of interaction with the fields surrounding the balanced line. True ladder line, which is bare conductors with wood or plastic spacers, needs even more care, since the line can twist in the wind and short to itself. Also, since the impedance of the line and arrangement of the conductors differs so much from the coax-oriented systems that all our equipment has, it is necessary to "adapt" the balanced line, usually with some sort of *balun* arrangement, which is often an integral aspect of an antenna tuner.

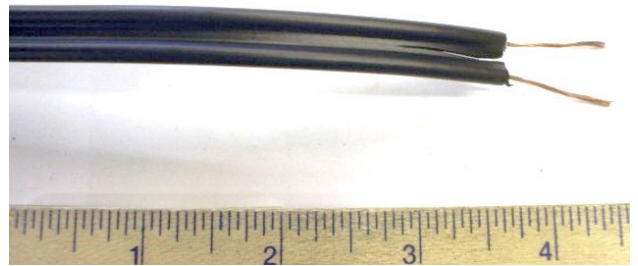
As you might have guessed, though, there's a huge upside to balanced line. The two conductors are well separated, compared to coax, and one is not surrounded by the other. Also, there is far less dielectric between the two, so a much smaller capacitor is formed, and a considerably higher characteristic impedance results. (There are limits to this, of course: TwinLead, for example, has the conductors comparatively close together, and an essentially solid dielectric between the two, making TwinLead less efficient than ladder or window lines.)

What this means in operational terms is

that *antenna resonance and SWR issues become largely meaningless*. This is because the balanced line is essentially lossless due to its tiny capacitance and minimal interaction between conductors, especially compared to coaxial cable. And a moment's thought will show that, if the line is essentially lossless, then SWR on the line really doesn't matter, as long as we insert a tuner or other matching arrangement between the line and the rig's 50 ohm output.

Adjusting the tuner for lowest SWR in this scenario is really just adjusting the rig side of the circuit to 50 ohms – it doesn't much matter what the SWR is on the balanced line, or for that matter at the antenna. The rig sees 50 ohms, and it's happy. The balanced line doesn't care what it sees, and transfers power efficiently over a wide range of conditions. Thus the whole issue of making an antenna a carefully "resonant" length becomes unimportant.

This is a great boon to stealth operators and people with limited real estate, who need only put up the longest and highest dipole, loop, longwire or other arrangement they can manage, and the ladder line and tuner will get them on multiple bands with a single antenna. A good rule of thumb for dipoles operated this way is that, if the dipole is at least a quarter-wavelength long at the lowest desired frequency, balanced line and a tuner will get the operator on every HF band above that frequency. In other words,



One version of TwinLead, a smaller balanced line of about 300 ohms impedance.

if all you can manage is a 35 foot long dipole, you're still able to operate 40, 30, 20, 17, 15, 12, and 10 meters. (The right tuner will permit 6 meter operation as well.) Just try *that* with a single, trapless dipole fed with coax!

I hope that this brief overview gives you some sense of the difference between these two transmission line concepts. If I had the math skills, I would produce for you a reasoned and scholarly explanation of these concepts; nevertheless, forty-odd years of operating experience has shown me that they are indeed valid notions. If you want to learn more about the technical aspects of this subject, I encourage you to study one of the fine texts covering this topic, such as Joseph J. Carr's *Practical Antenna Handbook*, or the Transmission Lines chapter of ARRL's *The Radio Amateur's Handbook*.

That's all for this month, my friends. Join me here in the May issue, and we'll explore further the world of antennas. Until then, happy operating!

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Adventures in Amateur Detection

This month I would like to explore several advanced projects for amateur radio astronomers: Have fun digging into the references. As we all have learned, the Web is loaded with information and software goodies that relate to amateur radio astronomy. You most likely have discovered some of the same links I have listed below, if you have been exploring the hobby.

One link I highly recommend you check out is SARA (Society of Amateur Radio Astronomers) at www.radio-astronomy.org/. They have been in existence since 1981 and hold conferences and offer publications that will make your participation in radio astronomy enjoyable. I recently ordered the last three years of the conference proceedings on CDs. They're loaded with a wealth of information. Each CD is \$20 each. The proceedings can also be ordered in paper form.

❖ Are There Pulsars In Your Future?

Pulsars (**Pulsating Stars**) were first detected in 1967 by a student, Jocelyn Bell Burnell, and Professor Antony Hewish. The repetitive nature of the signal was lightly considered a possible alien source of the transmission. However, they knew they were looking for pulsing objects that had been predicted by scientists back in the 1930s. The emissions are from neutron stars that form narrow rotating beams of high energy. From Earth, the beam acts like a light house's sweeping beam of light and appears to pulse.

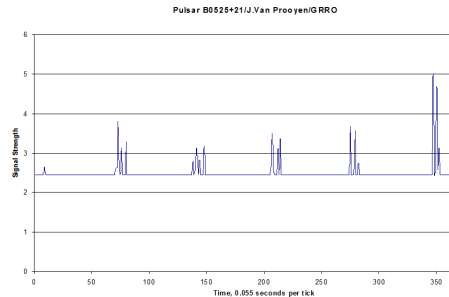
Some pulse as often as 30 times a second. Others can pulse at slower rates, even as slow as 4 seconds. A recent reference mentions a pulsar has been discovered that generates pulses at a 1 millisecond rate (a thousand times a second). Over a long time, most pulsars do slow down, though it takes careful study to note the difference.

One of the early detection problems was due to the long integration times used by radio telescopes, which prevented them from detecting short bursts of noise. With more sensitive big scopes and techniques, hundreds of pulsars have now been detected and cataloged. Which leads to the question: Can an amateur radio astronomer detect pulsars? A Web search shows several have.

I contacted Jeffery M. Lichtman at RAS (Radio Astronomy Supplies), who was the first editor of this column. They sell a 408 MHz receiver that has been used in detecting pulsars. He directed me to Jim Van Prooyen who has extensive experience in working with pulsar detection.

The key to detecting pulsars with modest equipment is using software that samples the sig-

nals at the known pulsar's rate. Below: a chart of Pulsar B02525+21 shows one of his pulsar detections. Note the designation B02525+21 indicates 1950 coordinates (the B), and 25.25 degrees right ascension and +21 degrees north declination.



What kind of equipment would be needed to detect pulsars? Jim Van Pooyen noted he decided on using RAS's 406.7 Radio Telescope for the back end. He uses the 3 meter dish antenna shown below.



Picture courtesy James Van Pooyen

The received signal's logged data is processed with software to recover the weak pulses. The pulsar's pulses are usually brief and the average signal level is very low.

I recently read an account of a couple of amateurs who used RFSpace's SDR-14 receiver to detect pulsars using a 20 ft. dish. Here's a link describing their efforts: www.moetronix.com/pulsar/index.htm

For further information on amateur possibilities, check out these web sites:

<http://radiosky.com/rspplsr.html> - Document on possible detection using timing.
[www.radioastronomysupplies.com/radio_astronomy_supplies.php?cat=CAT&id=1&name=RADIO TELESCOPE SYSTEMS - A 408 MHz Rcvr](http://www.radioastronomysupplies.com/radio_astronomy_supplies.php?cat=CAT&id=1&name=RADIO%20TELESCOPE%20SYSTEMS%20-%20A%20408%20MHz%20Rcvr)

If you are interested in building a 408 MHz Yagi antenna suitable for this work, check out SARA (Society of Amateur Radio Astronomers)

for construction and design details.

www.bambi.net/sara/AntConst.pdf

www.bambi.net/sara/AntDesg.pdf

❖ Cosmic Ray Telescope

Are you ready for a particle telescope? In case you haven't heard of Cosmic Ray Telescopes, several educational organizations have built a variety of them. *Scientific American* published an article on how to build one in 2001. Some folks have used two low cost Geiger counters tied together to detect the cosmic rays.

The technique to capture the presence of these particles is to use material that scintillates or gives off or emits a photon when it's struck by a charged particle. Electrons are excited to a higher level in the plastic scintillator. When they return to their natural state, a photon of light is generated. The photon is reflected from the scintillator out into a PMT (photo multiplier tube). The photo-voltaic effect causes an electron to be emitted from the PMT's metal plate when struck by the photon from the scintillator. The PMT multiplies the effect of the electron striking the tube's anodes in stages. This allows a stronger current to flow making electronic detection easier.

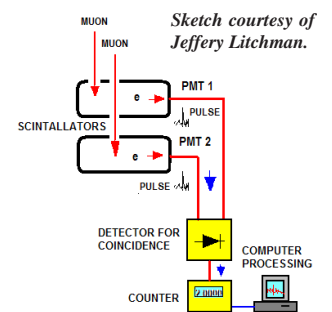
To reduce the problem of detecting random events, the approach is to use coincidence detection, using two or more scintillators, since a random event usually affects only one scintillator. When detection occurs at the same time in two or more scintillators, you probably have a real cosmic ray event.

Below is a sketch of the basic telescope. The scintillators and PMTs are covered and sealed from stray light to reduce random 'noise.'

Here are a couple of links that can help get you started.

You'll find complete documentation on how to construct the detector, and parts lists, etc. This is probably a project for the advanced amateur or assisted by experienced builders.

<http://cosmic.lbl.gov/>
www.pas.rochester.edu/~pavone/particle-www/telescopes/background/How%20the%20Muons%20Telescopes%20Work.htm



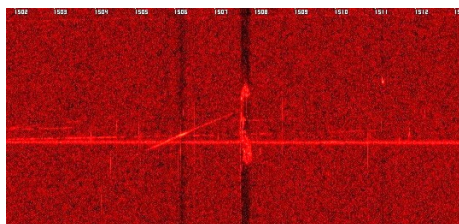
❖ Meteor Shower/Solar apps for iPhone/Android

I read an article in the Science section in a recent *New York Times* and noted a reference to a *Meteor Shower Guide* for \$0.99 from iTunes. This app has the year's meteor showers listed, and what's great is that it converts the peak times to your time zone and shows the current Moon's phase.

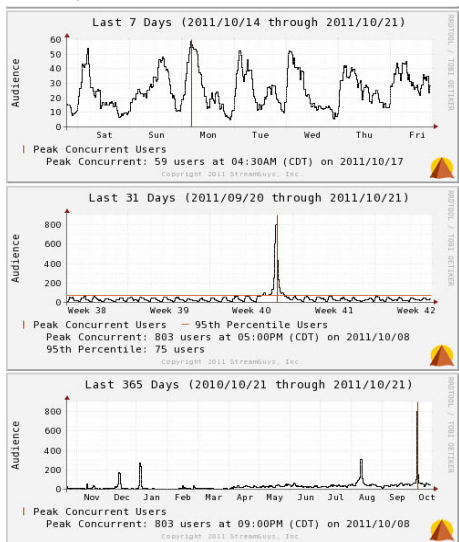
If you're into radio detection of meteors, this simplifies knowing when the shower is expected to peak. I used it for the October 8, 2011 Draconids shower. I have continuously monitored the NAVSPASUR radar system for years. During the Draconids, I found the activity peaked about the same time as the Guide. The meteor guide automatically updates with the next year's shower list.

As a reminder, the 217 MHz radar echoes are broadcast 24/7 and can be heard by checking in at www.SpaceWeatherRadio.com. It's free unless you're on a monitored data plan. I send the broadcast out to SpaceWeatherRadio as a 15 kb/s digital audio stream.

Here's a significant 'ping' or echo that occurred during the peak of the Draconid meteor shower on October 8, 2011, shortly after 3:07 p.m. MDT. The Doppler shift for most meteors is the sharp vertical traces. It was probably a 'messy' echo(s). I suspect it was a breakup of a bigger one.



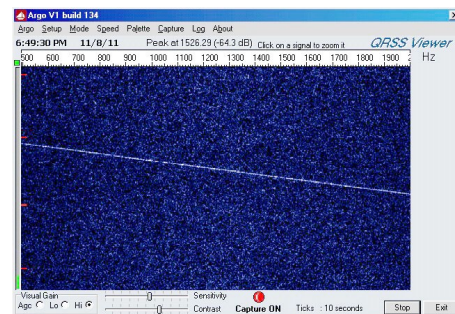
Here's a chart of the listener numbers for various periods of times. The Draconids occurred during the daytime this year in North America. The peak listeners were greater than other meteor showers over the last year which was due to fact they were day-time. We're also seeing a higher base-line of listener counts with peaks in the mornings since March.



I noted a big spike in listeners when the recent asteroid 2005 YU55 passed by Earth at 6:28

p.m. E.T., November 8, 2011-I read a newspaper article that noted astronomers were hoping to radar map the 1300 foot object. I doubt it passed over West Texas to be in position for NAVSPASUR radar detection on my receiver. I saw no traces on my R_Meteor logs at the advertised time.

However, Carl Lyster, RAS's Design Engineer, was able to bag asteroid YU55 using NAVSPASUR. His receiver was tuned to 216.989 MHz. He is located in Knoxville, TN. He used Argo V1 software, see below, which is free. It was developed for Low Frequency work. What's neat about this software is its ability to save the screen to JPEGs in 60 second intervals. I now use it to monitor the audio on 216.989.



Trace of echo from 2005 YU55 Asteroid: by Carl Lyster

One way you can log the 'pings' or the echo's Doppler shift on your PC is to hook up an audio cable from your earphone jack over to the microphone jack. A small audio/microphone isolation transformer would be best. Go to <http://spaceweatherradio.com> and start the monitor. With an audio spectrum program running, like Argo V1, you can easily display the audio feed's spectrum.

I found a free *Meteor Shower Counter* app on iTunes, written by Dr. Tony Philips. Used to log visual meteors, you can share the counts with organizations that track them, such as IMO (International Meteor Organization) and the AMS (American Meteor Society).

Dr. Philips also offers a free *3D Sun* app which keeps you up-to-date on current space weather conditions on your iPhone/iPad. The app displays the current Sun's image with sunspots, if any. Below the image you'll find the current the Sunspot Number, Solar Wind Speed, X-ray Solar Flares, and Planetary K Index.

The numbers are worth checking out since they represent the Sun's activity. Radio transmission, satellites, power grids, etc. are often affected when the numbers get high. There's a great 3D rotating image of the Sun at selectable wavelengths in angstroms (A) which is equal to 1/100,000,000 of a centimeter. Check the app out and be the first to know when to duck inside and ground the antennas when the next big blast of solar activity drifts by our little planet.

❖ Name That Array

In my most recent column, I wrapped up my visit to the VLA (Very Large Array) near Socorro, New Mexico. Shortly after that, I happened across an article on my iPad's BBC News app. It mentioned there's a contest to rename the VLA system to something more encompassing. The article was by Jason Palmer. He noted the link to offer your

choice of names at: www.namethearray.org. I picked "Radio Universe VLA." Oh, well. The contest is probably over by the time this hits the stands. I'll keep you posted on the winner(s).

❖ Some Radio Astronomy Reading

If you're wondering what radio astronomy is all about and looking for a good introduction, check out www.nrao.edu/index.php/learn/radioastronomy.

Also, you might want to check out the book, *'The Invisible Universe: The Story of Radio Astronomy,'* 2nd ed., by Gerrit L. Verschuur. I found it to be an excellent overview of the field of radio astronomy, in mostly layman's terms. Got mine through Amazon.com. SARA also does book reviews on various radio astronomy books.

❖ GPS Service Degradation on demand

Occasionally I get an FAA flight advisory via e-mail that indicates there will be GPS 'Testing' in the Alamogordo, NM area. Pilots are expected to be aware of possible 'unreliable or unavailability' of GPS signals during the testing times. The area affecting reception can be out to 300 NM (Nautical Miles) at Flight Level 250 (25,000 feet) and out to 173 NM at 50 feet above the ground. The tests apparently last a few days.

What's been intriguing is why they clobber the GPS signals and call it testing. I have suspected it's a form of counter measures to test the ability to mess up the GPS accuracy in a given area for tactical reasons. None of the pilots I know were aware of the 'real' reason, other than that it has affected their GPSs in the past.

A quick search of the somewhat trusty Web brings up a link that discusses what's going on. It's has been called a JAMFEST. Yes, they are testing *jamming techniques* and training personnel on how to deal with the resulting GPS degradation. Here's a link to one the earlier exercises that discusses the operation at White Sands: www.insidegnss.com/node/714.

❖ Radio Jove Update

There is a group of dedicated Jupiter (RADIO JOVE) listeners who have been actively reporting their Jupiter recordings using the Radio Jove receiver. You can join the mail list and get all of the details at: <http://radiojove.gsfc.nasa.gov/>. They just released their bi-annual newsletter on the web. You can find it at: <http://radiojove.gsfc.nasa.gov/library/newsletters/2011Nov/>

❖ Radio Astronomy at the Movies

I ran across an interesting web article by Eric Schulman, National Radio Astronomy Observatory in Charlottesville, Virginia, who details the fact that movies that feature an astronomer are successful as opposed those that don't. He has graphs to "prove" it. Apparently the article was published in *Annals of Improbable Research*, Vol. 5, No. 3, pg. 10. Here's the link: <http://mysite.verizon.net/~vze3fs8i/air/airmov.html>

Keep Listening up!

The Tinkerer's Best Friend The Portable Power Station

By Mario Filippi

❖ A Little Background

A few years ago I embarked on a new facet of the monitoring hobby: Ku band Free To Air (FTA) satellite reception. Anyone with modest means can set up one of these systems and travel the world from the couch or easy chair. Basically this requires a dish, LNB, FTA receiver, RG/6 coax, and some electronic elbow grease. Harnessing an FTA satellite (or "bird" as we FTA hobbyists refer to it) initially requires a certain amount of time and effort adjusting certain parameters such as dish angle (elevation), azimuth, and skew.

Most satellite systems require a good southern exposure with unobstructed views so that the dish (much like a rifle sight) can be pointed at the satellite's beam. There's the rub, as most folks like trees, shrubs, sheds, etc., on their property, all which can interfere with reception. Even a neighbor's house or landscaping can be an impediment to your reception of great birds such as Galaxy 19 that provide dozens of TV and radio stations from across the globe.

So, one must experiment with different locations at a site to find that "sweet spot" in which satisfactory reception of desired satellites can be had. Prior to finding the sweet spot in my backyard at least a dozen different locations were tried, all with different results. For example, to receive Hispasat (30°W), just moving the dish about five feet to the west made the difference between a staring blank screen and being able to enjoy Cubavision programs.

Now to the purpose of this article: a good source of AC power is needed to set up and adjust a satellite system. AC power is required to power the LNB and FTA receiver. If you are setting up a motorized system, then the H-H motor needs "juice" in addition. Granted, most homes have an outside AC receptacle, which is convenient, but if the dish is being set up far from the source, then running an extension cord is necessary. In my armamentarium I have a 90 foot extension cord which can always be counted on to morph into a hopelessly tangled mess every time it's unraveled. It's a nightmare to use.

❖ Power Station to the Rescue

Enter the portable power station, which rescues us electronics tinkerers who need power for random projects around the home and in the field. A portable power station can be of enormous help when performing routine electronic procedures at remote locations. So, a few years

ago I purchased a 400 watt power station that was the answer to dilemma faced every time I lugged the satellite dish and assorted components to a new site on the property.

Initially my search was for a no-frills rechargeable power supply with a minimum of two AC outlets to power components needed for routine setup and fine tuning of satellite systems. After initially purchasing one from an Internet industrial supply house, this one arrived with many more bells and whistles imaginable, all which have exceeded my expectations and needs.

This power station, manufactured by Vector Products, Inc.; weighs in at 25 pounds; is 21 inches long by 15 inches high and 12 inches deep, and comes in an eye-catching sport yellow plastic case. The unit is surrounded by hefty tubular armor, allowing it to fend off any roughhousing associated with outdoor projects. There are two protective clear plastic panels that protect the front controls from the elements and unfriendly objects.

In addition to providing AC power, the unit has a 12 volt/5A DC cigarette-lighter-style outlet and a USB port providing 5 volts DC @ 500mA. When the unit runs out of sufficient power, a green LED will begin to blink, indicating a recharge is in order.

For my purposes an overnight charge in a wall outlet is sufficient. The unit can be also recharged by plugging the supplied charging cord into your car's 12 volt outlet. A handy battery level status LED array is provided to check when full charge is attained.

This particular model provides more than enough power to run an LNB, FTA receiver, portable TV, and H-H motor several hours. It will run out of juice a lot later than me, as several hours in the great outdoors adjusting a dish is fun, but I'd rather be inside watching from the comforts of the couch. It can also be used to power tools such as drills, saws, pumps, even a low wattage soldering iron, but these will drain the unit faster.

Now for the other niceties provided by this unit. It has an AM /FM radio which functions adequately and provides entertainment when taking a breather from outdoor radio chores. Headphones can be plugged into the handy jack. If Mother Nature threatens to dampen your FTA



frolics, then tune into the weather as all 7 NOAA channels are included, along with an alert feature for severe weather.

Oh, and in case you nap a little too long in between jobs, it has a built in clock with an alarm! Lastly, if your pursuit of that elusive "bird" takes you beyond the hours of dusk then a built-in LED area light will assist you in finding your way back to the shack.

Below is a typical use of the power station when tweaking a motorized Ku-band FTA system. This is one of my 36 inch Fortec Star dishes, used to receive Telstar (15°W) and Hispasat (30°W). The receiver is a Fortec Star Dynamic, H-H motor is a Sadoun Powertech DG-280, the LNB is a Chaparral universal, and a Radio Shack satellite meter. The small flat screen is an Accurian, plugged into the power station's DC outlet. Recent high winds had caused a shift in the dish's position so I had to do some adjustments.

In conclusion, my portable power station has been a constant companion and valued time-saver while performing all sorts of jobs requiring electrical power. They come in a variety of shapes, sizes, and features and some are even carried by big box stores, so shop around and try one out. As a ham, OTA, scanner and FTA enthusiast, this piece of equipment unquestionably occupies a high position on the totem pole of importance for me.



WiNRADIO G39DDCe Wide-Frequency-Coverage Receiver

By Bob Grove, W8JHD

With the global success of its predecessor, the G31DDCe 9 kHz-50 MHz receiver (*MT First Look Review* November 2010), this newly-released, 9 kHz-3500 MHz, double-receiver descendant was inevitable. Using the new WiNRADIO G39DDC software defined receiver (SDR), you can monitor two different stations within the same 16 MHz span of spectrum, independently or mixed, or listen to one while recording the other.

Still packaged in a compact brick size like its predecessor, but now with heat fins to dissipate the power required for signal processing, the new G39DDCe “*Excelsior*” is a remarkable receiving laboratory.

The G39 is also available as an internal PCI express plug-in card, the G39DDCi. The only difference between the two models is that the 2 MHz span of the secondary spectrum display of the external model, limited by the USB interface, is a wider 4 MHz on the card.

Computer requirements to host the operation of the G39 are a Windows XP, Vista, or 7 OS with 2 GB of RAM and a 2 GHz computer processing unit (CPU). Slower CPU speeds affect selectivity and bandwidth. The display is configured for standard SVGA, and 20 MB of hard-drive free space is required.

Receiver Overview

The G39 is a marriage of a multimode receiver and a spectrum analyzer. As a receiver it is capable of demodulating AM, AMS, CW, LSB, USB, ISB, DSB, FMN, FMW (stereo), FSK, and DRM (with an optional software license purchase).

Tuning and slewing speeds can be adjusted to select 1, 10, 100 Hz, 1, 3.125, 5, 6.25, 10, 12.5, 25, 50, or 100 kHz steps. You can even jump rapidly in 10 MHz increments by using the arrow keys on the spectrum display.

The signal strength meter may be selected to show S units, microvolts (uV), or dBm.

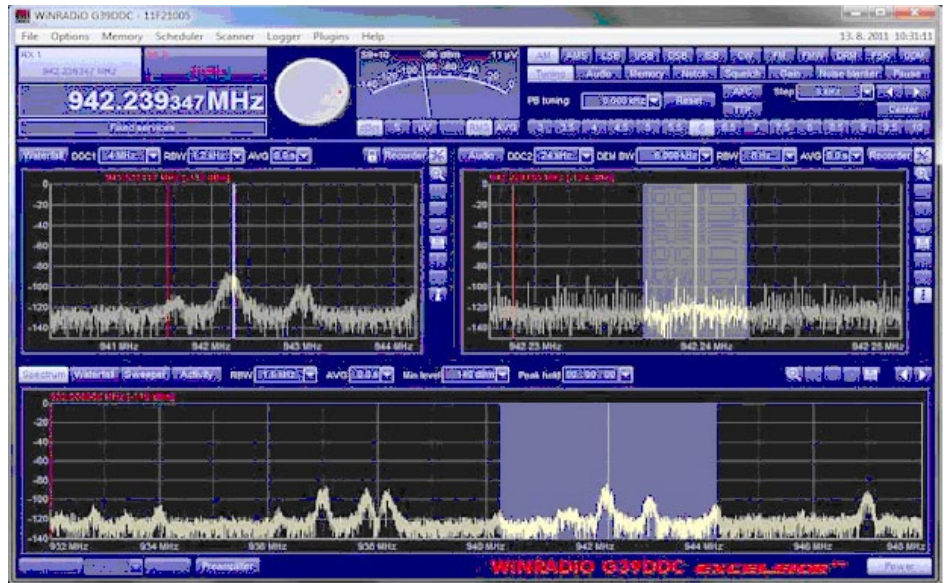


Figure 2 - Screen Shot 1

As you can see from the accompanying illustration (Figure 2), the receiver’s virtual control panel is a busy place! Daunting at first, it gradually makes sense and, after a while, actually become intuitive. A full operating manual disc is included. Read it!

Handily, the entire display may be custom-sized vertically or horizontally to fit the requirements of the computer screen. The three spectrum displays are interlinked. The main display at the bottom is always a span of 16 MHz, chosen anywhere in the receivable spectrum, and it’s in real time.

You say you’d like to see the entire receivable spectrum at once? Choose the sweeper mode and select the number of 16 MHz swaths you’d like stitched together, up to the full 3500 MHz, all on screen in one continuous, rapidly swept swath of 1 GHz per second!

The upper two, smaller displays are finely-tunable span segments of the main display. My preference is to set the left-hand segment digital downconverter (DDC1) to display a 1 or 2 MHz span, and the right-hand segment (DDC2) to about 20 kHz (it can be as wide as 320 kHz).

That arrangement allows me to click my cursor on a signal spike on the main display, quickly sharpen it with a click on the DDC1, then examine the modulation envelope of the carrier in detail on the right-hand display. The shaded area surrounding the cursor on the

main display in Figure 2 is the span chosen for DDC1.

An audio button over DDC2 switches that display to a real-time audio spectrum analyzer. Spectrum markers may be placed on the display to indicate frequencies of interest, set reference points, and calculate differential frequencies.

Even better, the displays can be shown as a waterfall spectrum as shown in Figure 3.

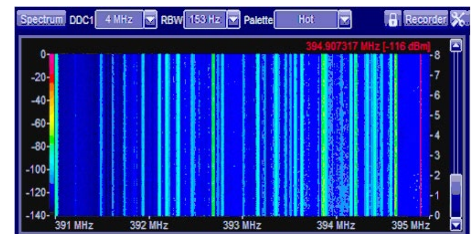


Figure 3 - Screen Shot 2

The waterfall display is speed-adjustable as it scrolls upward from the bottom, revealing signal presence on the spectrum over time. This allows the user to refer back to any active frequency, even after the signal is absent, in order to mark it for later reference or determine its frequency.

The spectrum display may be recorded at any time as a BMP image file for archival retrieval. A variety of colors for the display may be selected from a palette to suit the user’s preference. On a personal note, I found that watching the soothing scroll of colors can be

G39DDCE SPECIFICATIONS

Receiver type

Dual DDC software-defined receiver with up-converter superheterodyne front end

Frequency range

9 kHz to 3500 MHz

Tuning resolution

1 Hz

Mode

AM, AMS, CW, LSB, USB, ISB, DSB, FMN, FMW (stereo), FSK, UDM (user-definable mode), DRM (optional, license fee required)

Image Rejection

85 dB (< 50 MHz)
65 dB (50 - 500 MHz)
85 dB (> 500 MHz)

IP3 (Third order intermodulation)

+6 dBm typ. (< 50 MHz) @ 5 kHz spacing
+2 dBm typ. (> 50 MHz) @ 10 kHz spacing (preamp off)

SFDR (Dynamic Range)

91 dB typ. (< 50 MHz)
88 dB typ. (> 50 MHz) (preamp off)
87 dB typ. (> 50 MHz) (preamp on)

Noise figure

14 dB typ. (< 50 MHz)
14 dB typ. (> 50 MHz) preamp off
5 dB typ. (> 50 MHz) preamp on

MDS

-130 dBm / 500 Hz typ. (< 50 MHz)
-130 dBm / 500 Hz typ. (> 50 MHz) preamp off
-139 dBm / 500 Hz typ. (> 50 MHz) preamp on

Internal spur reduction

Below -95 dBm, typ. less than -115 dBm of equiv. antenna input

RSSI accuracy (S meter)

2 dB

RSSI sensitivity

-140 dBm

Processing and recording bandwidth

20 kHz - 4 MHz (selectable in 24 steps)

Demodulator processing bandwidth

20 kHz - 320 kHz (selectable in 13 steps)

Demodulation bandwidth (selectivity)

1 Hz - 320 kHz (continuously variable in 1 Hz steps within current demodulator processing bandwidth)

Spectrum analyzer

16 MHz wide real-time spectrum, 1.5 kHz resolution bandwidth (RBW)

ADC

16 bit, 100 MSPS

Search speed

Up to 1 GHz/s

Scanning speed

Up to 80,000 ch/s (12.5 kHz channel separation)

Sensitivity

AM: 30% mod., 10 dB S+N/N
SSB, CW: 10 dB S+N/N
FM: 3 kHz dev., 12 dB SINAD
FMW: 50 kHz dev., 12 dB SINAD (Signal to noise and distortion)

Mode

< 50 MHz
> 50 MHz (preamp off)
> 50 MHz (preamp on)

AM

-105 dBm, (1.3 μ V)
-105 dBm, (1.3 μ V)
-113 dBm, (0.5 μ V)

SSB

-118 dBm, (0.3 μ V)
-118 dBm, (0.3 μ V)
-125 dBm, (0.13 μ V)

CW

-125 dBm, (0.13 μ V)
-125 dBm, (0.13 μ V)
-132 dBm, (0.06 μ V)

FM

-114 dBm, (0.45 μ V)
-115 dBm, (0.4 μ V)
-122 dBm, (0.2 μ V)

FMW

not specified
-108 dBm, (0.9 μ V)
-115 dBm, (0.4 μ V)

Intermediate frequencies

IF1: 3910 MHz (BW=30 MHz)
IF2: 70 MHz (BW=16 MHz)

Tuning accuracy

0.5 ppm @ 25 °C

Tuning stability vs. temperature

0.5 ppm (0 to 50° C)

Antenna input

50 ohm (SMA connector)

Output

Digitized IF signal over USB interface

Interface

USB 2.0 High speed

Power supply

12 V DC @ 1.5 A max.

Operating temperature

0°C to 50°C

Dimensions

Length: 166 mm (6.5")
Width: 97 mm (3.8")
Height: 59 mm (2.3")

Weight

805 g (28.4 oz)

Specifications are subject to change without notice due to continuous product development and improvement.

addictive!

As shown in Figure 4 (next column), the RF signals are initially preselected in bands, then up-converted by approximately 4 GHz or higher, then down-converted again for processing. Note that there are actually two receivers and a spectrum analyzer in the architecture. The final 70 MHz down conversion allows the signals to be processed digitally.

❖ Let's Listen

The starting frequency is typed on the computer's keyboard, followed by a k, m, or g

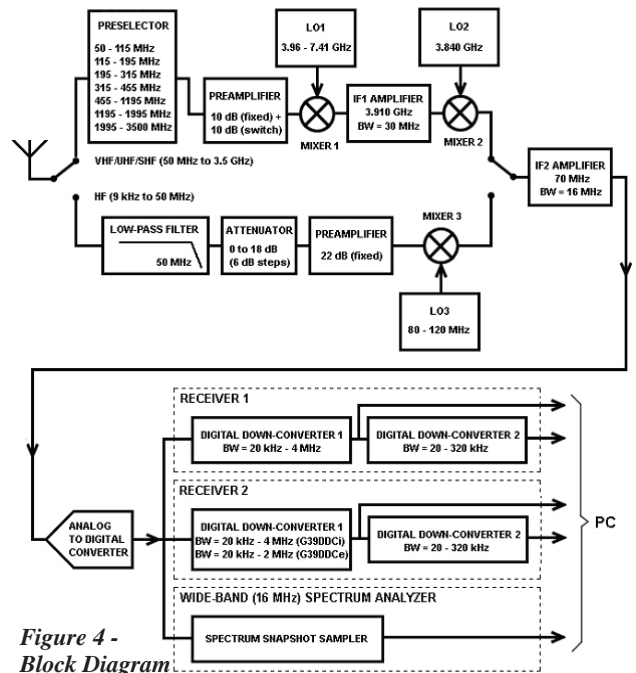


Figure 4 - Block Diagram

to indicate kilohertz, megahertz, or gigahertz. The virtual tuning knob can tune across the spectrum in 1, 10, 100, or 1000 Hz steps, as can the computer keyboard arrows, by pressing the Shift, Alt, and Ctrl computer keyboard keys. The modulation mode is cursor-selected from the modulation mode toolbar (Figure 5).



Figure 5 - Modulation Bar

DRM (Digital Radio Mondiale), a digital mode occasionally used by some shortwave broadcasters, is a licensed internal application that requires the additional purchase of a software key to open it. UDM is a user defined mode which may be configured independently along with other custom characteristics.

Although the bandwidth may be adjusted continuously, it is often more convenient merely to pushbutton-select a common selectivity as allowed by another bar. Additional audio bandwidth tapering is accomplished by an audio bandpass filter, allowing upper and lower roll-off skirts to be selected (Figure 6).



Figure 6 - Audio Filter Bar

Much of the receiver's computer power goes into selectivity/bandwidth filtering. With older, less powerful computers, the response time may slow down or even freeze. An analytical box (Figure 7, next page) is provided to assist the user in choosing the most practical settings for his computer.

Even a software defined receiver (SDR) like the G39 can suffer the indignities of strong signal overload. This is especially likely when using long shortwave antennas which have large capture areas to maximize signal strengths.

If overload occurs, the S meter will display "ADC CLP" (analog-to-digital converter clipping). In such a circumstance, the user

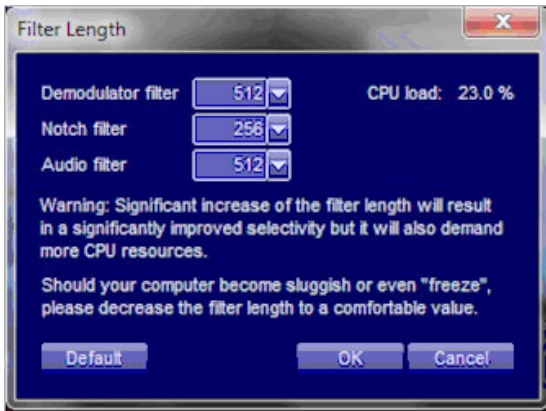


Figure 7 - Filter Length

may select either the attenuator button, or the Auto button which automatically chooses the optimum level. This feature is for under-50 MHz reception where such overload is most likely to occur.

An RF notch filter can be invoked to remove strong-signal interference; it not only removes the center frequencies, but its width is adjustable to remove the sidebands as needed.

A selectable preamplifier may be enabled for VHF and above, providing an additional 10 dB of gain. I found this to be especially useful on weak signal reception, both for raising the audible content of the modulation above the noise floor as well as for increasing the spectrum display spikes.

❖ Digital Selectivity

Digitization of the signal allows considerable flexibility in reception. Referring once again to the spectrum display on the virtual panel (Figure 8, below), you will note a grey area encompassing the signal spike envelope. That's its adjustable bandwidth.

Simply dragging the cursor across the area allows customization of the detection window, narrowing it or moving its center (as in IF shift) to suppress adjacent channel interference. Of course you can also change the bandwidth by selecting from a large drop-down list.

Want to stay right on center frequency? The G39 has spectrum centering, AFC (automatic frequency control), and tune-to-peak control, all of which sharply define the signal's center. Automatic gain control (AGC) is present in six

speeds and continuously-adjustable attack and decay times.

The effective noise blanker allows two different approaches, short-time DDC averaging and ADC input threshold, allowing the presence of random spikes in the digital stream to be replaced with zeroes.

❖ Five Different Squelch Choices

A level squelch permits the user to choose at which point above the background noise a signal can be heard.

Noise squelch provides a custom point at which noise in the signal mutes the audio, particularly useful in weak FM.

Voice squelch detects the presence of voice-frequencies to open the audio.

CTCSS is the familiar tone squelch used by traditional public safety agencies.

DCS is the newer digital squelch system.

❖ Memory

Memory channels can be scanned, selectively skipped (locked out), or manually stepped through. The memory mode is highly flexible, allowing most any storage and access capability one could want.

An infinite (limited by your computer's hard drive) number of frequencies can be stored for later recall, along with mode, call sign, description, bandwidth, squelch settings, audio filter choices, and a hotkey. The memory function is under the Store frequency pop-up and its template for filling in the information. The channels can be scanned in a conventional manner, pausing or stopping on a busy channel, then resuming when the signal disappears, or after a delay.

Many other memory functions are offered as well.

❖ The Antenna Dilemma

The presence of only one antenna connection (an SMA in this case) would seem to pose a problem on an extremely-wide-frequency-coverage receiver. I know of no 9 kHz-3500 MHz antenna available, and antenna switches and RF combiners (multicouplers) that operate

from "DC to daylight" are difficult to find. Even WiNRADiO has no antennas for that wide of frequency coverage.

On the other hand, suppose WiNRADiO had supplied more antenna connectors for different frequency ranges. What would those ranges be? I'd have a hard time deciding whether a cutoff for shortwave should include 30-50 MHz as many receivers now have. And what about all those VHF/UHF bands? Perhaps it was a good idea to allow the end user to decide how to feed signals to this receiver based upon his needs.

❖ Mobile Operation

With the small size of the G39 and the ready availability of lightweight portable computers, the temptation to "go mobile" with the system is persuasive. But the mandate to operate the receiver from 12 VDC within one volt must be observed to avoid damaging the circuitry.

The cigarette lighter jack may be used for 12 volt power *only if the engine is not running*, but if it is, then regulation is necessary to avoid damage from those 16-volt surges from the alternator.

I would recommend using an inexpensive 12VDC/120VAC inverter plugged into the cigarette lighter jack, and the supplied WiNRADiO AC power supply plugged into that.

With the small package of electronics on my front seat and a mag-mount whip on the roof of my car, I decided to see if I could hear the 1 milliwatt VHF telemetry tracking transmitters on the legs of a pair of whooping cranes than had nested nearby.

I was able to get to within about 500 feet or so and, sure enough, the G39's spectrum display came alive with the pulse emissions, and the familiar "chirp chirp" was heard from the speaker!

❖ The Bottom Line

This is the most amazing receiver I've ever encountered. It employs the latest proven SDR architecture, operates well beyond the spectral range that most of us would ever think of trying to hear, and demodulates all conventional modes.

Its three integral spectrum displays are extraordinarily useful, allowing spectral chunks from a few kilohertz up to 3.5 gigahertz to be examined in detail simultaneously.

Competitive receivers and spectrum analyzers with similar features sell typically in the ten thousand dollar range and more. The G39DDCe is available for under five thousand dollars.

This is a receiver we expect to see adopted eagerly by government, military, and professional users for SIGINT, signals surveillance, laboratory R&D, test bench applications, and other analytical applications.

I ordinarily find something to complain about in my reviews, but trying to find something I don't like about the G39DDCe has left me at a loss, and that's a gain for this winner.

The WiNRADiO G39DDCe is available to US and Canadian clients from Grove Enterprises. (See ad in this issue for contact details.)

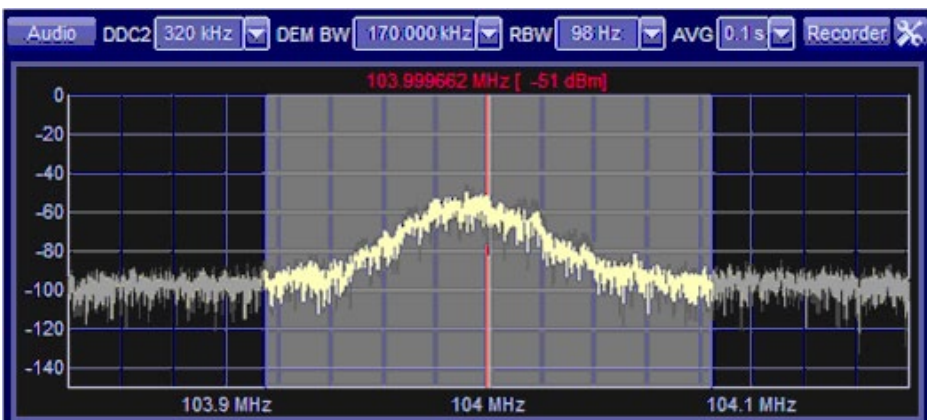


Figure 8 - Screen Shot 3

tion brings readers up to date on terrestrial TV stations and accompanying radio programs also broadcast on those systems.

Finally, there is an extensive reference section that includes global transmitting sites, radio clubs, standard time and frequency transmission schedules, and selected Internet Resources.

The *World Radio TV Handbook* continues to set the gold standard in broadcast reference information. It remains the very best, most authoritative, and comprehensive reference book in the broadcast world. Quite simply, there is no rival. It is an exceptional annual guide that should be in every radio hobbyist's listening post.

The *2012 World Radio and TV Handbook* (BOK03-12) is available from Grove Enterprises www.grove-ent.com for \$29.95 plus S/H. To place an order, call 1-800-438-8155, email order@grove-ent.com, or mail Grove Enterprises, 7540 Highway 64 West, Brasstown, NC 28902 USA. – Gayle Van Horn, W4GVH

Klingenfuss 2012 Shortwave Frequency Guide

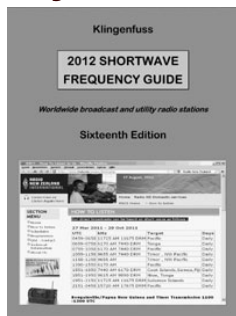
The 16th Edition of the *2012 Shortwave Frequency Guide* – one of several annual radio reference books and CDs available from Klingenfuss Publications – has recently been released.

This year's 408-page book starts out with a general overview of radio observations by Joerg Klingenfuss (author/publisher), followed by a section devoted to monitoring utility stations. This chapter will be of special interest to utility listeners and includes a basic explanation of the various aspects of utility monitoring and a by-frequency listing of stations with call signs, station name, mode and details.

The heart of this book and its primary focus is on shortwave broadcast stations, frequencies, and schedules. The *2012 Shortwave Frequency Guide* covers the latest 2012 schedules for all clandestine, domestic, and international broadcast stations worldwide, which is derived from the *Klingenfuss 2012 Super Frequency List on CD*.

In the broadcast by frequency section there is some introductory material and a segment devoted to Digital Radio Mondiale (DRM) that includes a comprehensive list of DRM schedules. It also includes a brief look to the future of shortwave and the continuing debate over its decline. The by-frequency list starts at 2310 kHz and goes to 26060 kHz. Each frequency listing includes the station name, location, start and end times of each broadcast, language, target area, and selected remarks.

If focusing on a particular country of interest is useful to you, then the by-country section of the book, labeled the "Alphabetical List of Broadcast Radio Stations" in the Table of Contents, will be of particular interest.



Frequency information for international broadcast stations, clandestine, and domestic stations are accurate at time of publication and does include seasonal frequency adjustments. Klingenfuss uses a volunteer staff of radio listeners and broadcasters worldwide who contribute information to this publication and keep it information accurate and up-to-date.

The easy-to read book is a real asset in the radio shack, regardless of whether you monitor the utility bands or enjoy transmissions from shortwave broadcast stations. The *2012 Shortwave Frequency Guide* is an excellent annual publication for the beginner or experienced radio hobbyist who wants a complete HF spectrum reference book (utility plus broadcast station listings). This is a basic no-frills radio reference guide and it will definitely complement your monitoring time at the dials.

To order the *2012 Klingenfuss Shortwave Frequency Guide* book, go to the Klingenfuss website at www.klingenfuss.org or order from U.S. source Universal Radio at www.universal-radio.com. From Universal, it is book number # 5799 selling for \$49.95 plus shipping and handling. You can also order from Universal via phone 1-800-431-3939 or Fax at 1-614-866-2339 (Universal Radio, Inc., 6830 Americana Parkway, Reynoldsburg, OH 43068-4113 USA). – Gayle Van Horn, W4GVH

Upgrades for Legendary AR8200D

Security professionals, government agencies and monitoring enthusiasts will welcome the new digital upgrade to AOR's legendary AR8200D handheld receiver. In addition to its many standard operating modes, this new version includes APCO 25, USB connectors and a micro SD memory chip for audio recording. The 8200D offers frequency coverage from 500 kHz to 3 GHz*, 1,000 alphanumeric memory channels, two VFOs, 40 search banks and all mode reception. No optional CTCSS slot card is required. The special government version, AR8200D, also includes voice inversion capabilities and continuous unblocked frequency coverage.

Existing owners of US versions of the AR8200 MkIII can purchase upgrade service for their units directly from AOR USA, Inc. The upgrade fee for an existing AR8200 MkIII unit includes adding the capabilities of the new D model, and the receiver will be thoroughly tested and certified to its new specs before being returned. The upgrade fee includes parts, labor and return shipping via UPS ground for continental US addresses only.

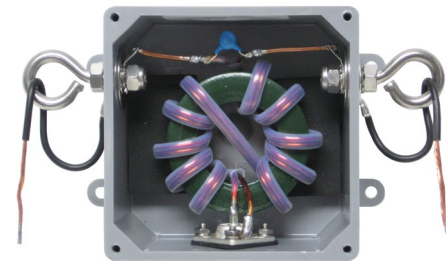
You can get more information on this and all of the other fine AOR products from their website at www.aorusa.com.

* Cellular blocked for US consumer version.



Comtek W2FMI Series Baluns

DX Engineering has announced the release of the Comtek W2FMI Series baluns that are engineered to provide an efficient match between unbalanced coax and balanced antennas. They're inspired by designs from antenna expert Jerry Sevick W2MFI, with modern improvements by DX Engineering's balun R&D department.



Comtek current baluns force equal current to flow through your antenna and prevent high values of common mode feedline current – eliminating pattern distortion, unpredictable performance, RFI, and noise pickup from nearby sources like TV sets and computers.

Typical insertion loss is less than 0.2 dB, with power handling ranging from 3 kW continuous to 5 kW+ intermittent from 1.8 to 54 MHz, with reduced power ratings at 54 MHz.

Comtek Baluns are sealed in a weatherproof 4 x 4 x 2 inch NEMA box. They're constructed with durable stainless steel hardware, including 1/4 inch studs, star washers for lasting electrical connections, and large fender washers which distribute fastener loading to preserve case integrity. SO-239 connectors are silver plated, with Teflon® insulation.

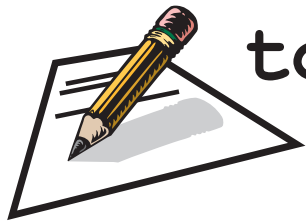
The baluns are available in 1:1 and 4:1 versions, with several different configurations: side studs, top studs, side eyebolts, plus side and top eyebolts. An optional DXE-BMB-4P bracket lets you mount the balun on a boom or pipe.

Priced from \$49.95 to \$69.95, you can get more information or order one by visiting www.dxengineering.com calling 800-777-0703 or writing DX Engineering at PO Box 1491, Akron, OH 44309-1491.



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.



Can't Get Enough Oldies?

Retired broadcaster, Gerald Gaule has re-launched a 24/7 Old Time Radio/Nostalgic service that is heard on the web and locally in the Albany, Oregon area, on AM 1700. SRN/Syncopated Radio Network plays a wide variety of music from 1898-1950 (jazz, ragtime, popular, standards and more), plus Old Time Radio Broadcasts from 1929-62, *The CBS Radio Mystery Theatre* from 1974-82. The station is available through AM 1700, Destiny Media and webcast over Live365.com.

AM 1700 is an FCC Approved Part-15 Microbroadcaster that operates with less than one-tenth of a watt and serves a portion of SW Albany and follows strict FCC Rules and Regulations, and was built with former broadcasting engineers and friends after several months of research.

SRN has over 14,000 songs and over 12,000 OTR archives and is non-commercial and has no sports or news, just music and Old Time Music and Nostalgia and is self-supported. All music royalties and such is paid though by registering my part-15 station to BMI, and most recordings are public domain.

According to Gerald, "I am not here to compete with any local station, I just wanted to be a programming alternative and be a good broadcast provider, plus I wanted to share my passion and collection that goes back to 1898 to 1950."

"I would like to help anyone build a micro-broadcaster and if they choose re-broadcast SRN Radio at no cost."

To tune in go to: AM 1700 locally in Albany (Limited Range) due to FCC Rules or listen at www.live365.com/stations/kivcradio For more station information please visit www.qrz.com and type in Gerald's callsign KE7GGV.

AM Radio Companion

"In 1962 my neighbor friend Harry Perry sold me a Motorola portable AM radio he had received as a performance bonus gift as Parts Manager for a Chicago Oldsmobile dealer. He had no use for it, so I paid an asked token \$10 for it. I was in the last year of Grad School at the time at Northwestern University living in Evanston, IL.

"That little, but deluxe, radio has been a faithful companion for the news every morning during my shave and shower for the last 50 years without ever any breakdown. It takes four C cells which I replace once a year on my birthday. It has lived with me in Illinois, Minnesota and in California homes, as well as been taken on some of my travels. The little radio with leather handle is very heavy for its size, and built like the proverbial 'tank.'

"In an attractive gray genuine top grain cowhide case with reversible padded snap cover, this small transistor radio uses an early exclusive printed circuit design that Motorola of Chicago called a 'PLAcir' plated circuit chassis. The radio's model number is X31A-1, serial No. 76120. It utilizes a five inch ferrite rod antenna with 1 and 1/4 inch litz wire winding and an external screw



capacitive-coupled CD antenna connector for the Civil Defense emergency frequency, which also is marked on the slide rule vertical tuning dial.

"There is a three-gang air variable tuning capacitor. The PLAcir chassis is 2 inch by 3 and 1/4 inch, taking up less than half the case's interior. Number of transistors is unknown, as some little cans might be capacitors, and the chassis board is deeply embedded in the case. The three inch speaker is labeled Motorola Golden Voice. There is an earphone connector on the left side of the case. A novel feature is the spring-loaded push to test knob on the upper left front that is the battery tester. Providing an added load, if the speaker volume drops when depressed, it is time to change the batteries.

"Motorola Inc. was then located at 9401 W. Grand Ave. in Franklin Park, IL, a suburb of Chicago. They were noted for some of the first automobile radio design installations, if not the first, leading to their name. Nineteen U.S. patent numbers are cited on the radio's interior label. Now, Motorola has moved on, splitting into two different companies making different electronic products.

"I now listen to KNX, a 50,000 watt Los Angeles all-news station at 1070 kHz with this radio. I have to wonder how many 50 year old radios are in

daily use? My old Motorola has been a real winner!

"Thank you for a wonderful publication and a Happy New Year to all at *Monitoring Times*."

Doug Robertson

What's That Station?

"Sirs, I have experienced over the past 30 years – as an AM DXer in Missouri and here in Washington, DC – a Spanish language news program (?) on several frequencies at the same time with a time signal beep at the top of every minute and then a complicated computer-like beep blitz of maybe one half second afterward. This usually occurs behind American AM broadcast stations at night which may be on reduced power, such as 570kc here in Washington, DC.

"I am a broadcast engineer at the Voice Of America.

"I have never been able to find out what I am hearing. Could you PLEASE tell me?

David Magness P.

"This is probably one of the most common AM broadcast questions we get and over the years it has been addressed several times in the pages of *MT*. You are hearing a Cuban domestic AM broadcast station from their all news network known as Radio Reloj (Radio Time). This network is the eldest non-stop information channel in the world. These stations transmit news, time pips in the background, and a Morse code ID (RR)/voice ID each minute. There are several of these stations scattered throughout the AM broadcast spectrum.

"You can learn more at http://en.wikipedia.org/wiki/Radio_Reloj

Larry Van Horn N5FPW, MT Technical Editor

"I got a kick out of hearing this on *FM* via sporadic-E a couple of years ago!

"Radio Reloj owns a national network with 22 transmitters in medium wave and others in FM with 16 frequencies. The 570 station is from Villa Clara (30 kW). Here is Radio Reloj's broadcasting network in AM:

| Location | Frequency(kHz) | Power (kW) |
|---------------------------------|----------------|------------|
| Pinar del Rio | 790 | 30 |
| Ciudad de La Habana | 950 | 10 |
| Ciudad de La Habana (Emergente) | 760 | 1 |
| Isla de la Juventud | 850 | 1 |
| Bolondrón, Matanzas | 910 | 5 |
| Central España, Matanzas | 940 | 10 |
| La Jaiña, Matanzas | 930 | 1 |
| Villa Clara | 570 | 30 |
| Cienfuegos | 960 | 1 |
| Sancti Spiritus | 870 | 1 |
| Trinidad | 610 | 1 |
| Ciego de Ávila | 930 | 10 |
| Camagüey | 1270 | 10 |
| Las Tunas | 1010 | 5 |
| Holguín | 940 | 10 |
| Moa, Holguín | 920 | 1 |
| Bayamo, Granma | 980 | 1 |
| Caney de las Mercedes, Granma | 760 | 10 |
| Mayarí Arriba, Santiago de Cuba | 950 | 1 |

| | | |
|---------------------|-----|----|
| Santiago de Cuba | 930 | 1 |
| Baracoa, Guantánamo | 860 | 1 |
| Guantánamo | 960 | 10 |

“Here’s a version of Radio Reloj history from their web site:

On July the 1st 1947, at 6:00 am, from a room located in the roof of the old CMQ building, on the corner of Monte and Prado St., in Havana, Radio Reloj broadcasting station began to go on the air. In that small and inadequate building, become a studio, there were a table, a microphone, metronome and two chairs.

How broadcasts are done today:

The human voice, live, is present during the Radio Reloj’s 24 hours broadcast. The speaker of this plant has a 4 hours stay in the broadcasting station; three of them before the microphone, in that time he reads more than 15 thousand words.

After one hour of reading the news, the speaker rests for half an hour; next he/she returns to the cabin for another hour and rests for 30 minutes again. After this, he/she completes his/her last hour before the microphone.

Speakers in Radio Reloj work in pairs, so they assume two positions: Speaker 1 and Speaker 2. In a sheet for two speakers, Speaker 1 reads first and third paragraphs, while Speaker 2 reads the second one and the fourth one, and has the responsibility to say what time it is.

In order to be able to rest half an hour, a third Speaker replaces the speaker who’s resting temporarily. That is a rotating system per hours; that is to say, in one hour a speaker occupies position 1 and the next one he/she changes for position 2.

When the news, commentaries or interviews are written in a sheet for one speaker, the minute is read by only one speaker completely.

“Everything you need to know about Radio Reloj is here (they also have an ‘English’ translation site: www.radioreloj.cu/)

Doug Smith W9WI, BC Bandscan Editor

Who is Killing AM Radio?

In the latest MT issue, Ken Reitz (KS4ZR) wrote a story entitled “Who is Killing AM Radio.

In his story, I was very surprised to see that he failed to even mention two Giant AMers doing extremely well in the USA. Those stations are the 50 thousand Watt Aircastle known as WSM AM 650 Nashville TN as well as AM-740 Zoomer Radio from Toronto Canada, which gets into 30+ states and also is a music AM station. 50kW

Obviously, Ken isn’t as fluent on AM stations as we think.. Have him do his homework first.

Steve W4ARZ

Don’t sell me short, Steve. As an avid AM band DXer for over 40 years I still spend a lot of time listening to AM. As for WSM, I still have their QSL card from 1966. While a country music DJ for a small AM station in south Georgia in 1969-70, my role model was the legendary WSM announcer Ralph Emery. And, I too enjoy the old time radio and music of yesteryear on CFZN.

But, you’ve inadvertently made my point: There are AM success stories in every market and you name two of the few big market AM stations still playing mostly music. I’m very

happy they’re there: they break the dreary monotony of having to listen to the same syndicated chat shows that dominate the band.

One case in point is WLAC-AM (I have their QSL from 1965) which was also another big signal out of Nashville that in the 1960s played the best Rhythm and Blues on the band, but is now just another talker. Another case is WWVA, Wheeling, West Virginia, another big signal that early on rivaled WSM for country music supremacy on the band, but, like WLAC and hundreds, if not thousands, more like it, is now just another talker.

The facts still speak for themselves: many of the 4,700 plus AM radio stations in the U.S. are not doing as well as either WSM and CFZN. They are struggling for all the reasons mentioned in the article.

While the economy continues to lag, those AM stations that have sister FM and TV co-ownership will do better. Those stations that can piggyback their AM signal on an FM HD signal will do better. Those that are part of a winner-take-all market monopoly thanks to media market consolidation will do better, as losses are shouldered by the stronger stations in the market. Those that can wrangle an FM translator will also do better.

But, there’s no hiding from the fact that AM broadcasting gimmicks such as AM stereo and AM HD are not helping, nor is our increasingly noisy environment or ever-growing competition for our ears that leaves AM with an ever-decreasing audience.

Ken Reitz, KS4ZR, MT Features Editor

Baby Boomer Radio

In reference to A Baby Boomer’s Radio Reflections by Eric Beheim: “Eric, I enjoyed your article in the December 2011 issue of MT, and it prompted me to research your King Kong RCA cathedral radio. It is actually a model # R-8, an 8 tube set, AC only, AM only. The schematic is on pages 2-13 through 2-15 in Riders volume #2, under RCA. It was born in 1931 into 1932. It should be a real great playing set judging by its schematic. Just thought I’d drop a line with the info in case you were interested.”

Irv Sanders K3IUY

Irv, thank you for writing and for taking the time to look up the model number of my grandparents’ RCA radio. The fact that it was AM only probably explains why they bought the PHILCO console model in 1940: my grandfather wanted to follow the war news from Europe via shortwave.

Thanks again, and I’m glad you enjoyed the article.

Eric Beheim

Air Show Addenda

The hardest frequencies to find or get are the frequencies for the USMC Helicopter demo which they do every year in Eisenhower Park.

Would be great if in next March issue you list the info for that as well

Steve Takacs

Thanks for your email on the MT Airshow Guide. As I have written numerous times in the guide, I will only list proven comms or freqs that have been confirmed and monitored by our MT readers at airshows. The USMC demo freqs that

I had in previous editions (see below) have either changed (the assignments have and are in a state of flux these days in the 225-400 MHz band) or could not be confirmed at other venues. Consequently, they were taken out.

What makes the MT Airshow Guide the best info available is that I will not keep any freqs that do not show up in other areas of the country or whose assignment cannot be verified in my sources. ... We want you to hear something when you get to the show, not just scan a list of all the frequencies that have been used in the last 30 years. You can get those sort of lists at many places on the internet, but not in the pages of MT.

When you wrote us in 2009 you observed, “I only heard the Marines on 237.400 this year.” This frequency is a US Army only nationwide frequency. Marines are no longer authorized to use it.

You added, “I heard them two years ago on 315.400 MHz and/or 315.375 MHz in AM mode.” 315.400 could be still be in use (assigned to the 2 MAW Wing Common Tactical and Training Operations at MCAS New River), but I have had no recent reports on it, and by the rules that I have set up for the guide, it has to be removed due to inactivity.

Both 315.375 and 315.400 are now part of an apparent new wideband subband, and all of the regular voice activity on these freqs is being flushed out and moved to other segments of the 225-380 MHz band.

As I said to you then, “the freq they (USMC demo) use will probably depend on the group doing the demo and what freqs they are authorized. Without knowing the group doing the demo, it would be impossible to speculate on the freqs that may be in use at a given airshow. Your best bet until I can get something solid is to put the scanner in search or use close call. Search ranges can be found in my yearly airshow guide.

I wish I could be of more help, but these smaller military demo teams can be a nightmare to document and follow. Most readers aren’t interested in them, so the flow of reports we receive are not as great as the ones we receive on the major airshow groups. If I get something solid, I promise that it will list be listed in the guide.

Thanks for your email and good hunting,
Larry Van Horn, N5FPW

Want to see what Kevin Burke saw on his ride on Fat Albert as described on page 16? You can check out Kevin’s video – including the weightless crewman – on line at:

www.youtube.com/watch?v=JUnusENLq-A

He noted that “A local tv crew got a better seat and a better video...” (and a harder time with disorientation). Check it out at:

www2.turto10.com/lifestyles/2011/jun/21/cockpit-view-50049-vi-29769/

*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*

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Many thanks...from a lapsed subscriber. Its good to be back (my name was actually in an issue about a year ago...). Like many other users, I download the .pdf version of the Mag into iPad and open it with iBooks. Works nicely.

Craig

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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

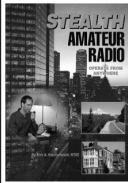
MILCOM
<http://mt-milcom.blogspot.com/> - by Larry Van Horn

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

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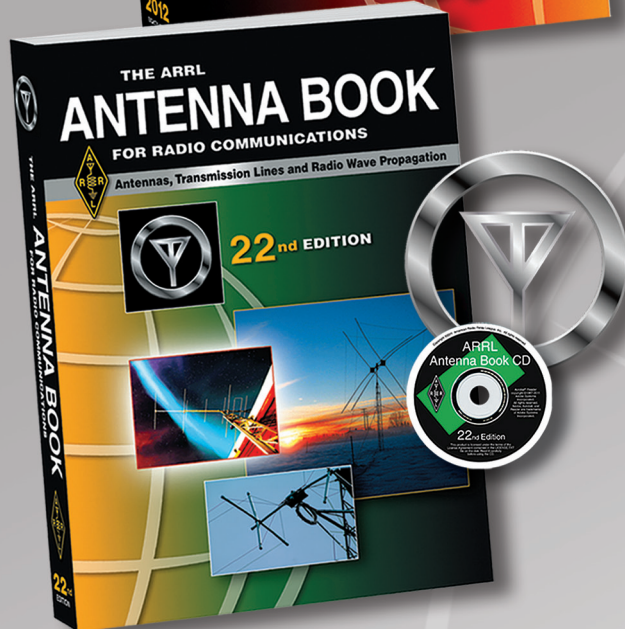
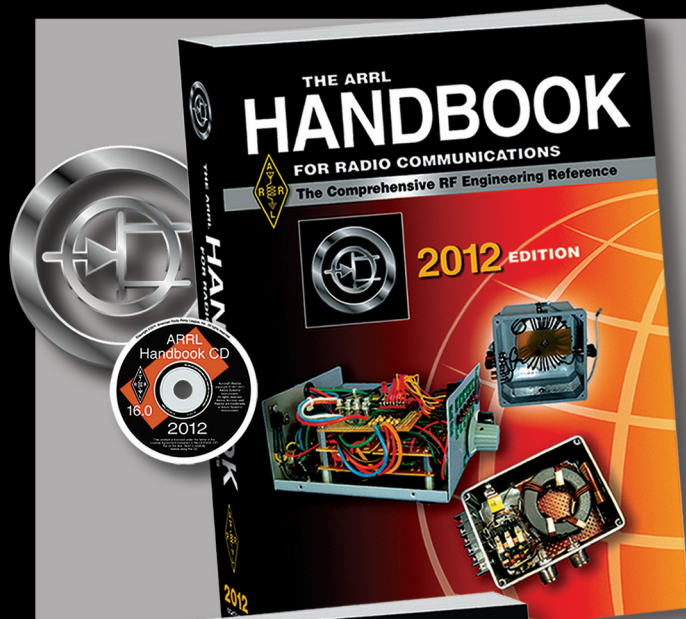
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*Shipping and Handling charges apply. Sales Tax is required for orders shipped to CT, VA, and Canada. Prices and product availability are subject to change without notice.



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