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Times**

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# Air Show 2013!



***In this issue:***

- Tune in to Air Show Action
- ATC Radio: Untangling the Mysteries
- Riding a Stratotanker with the Blue Angels

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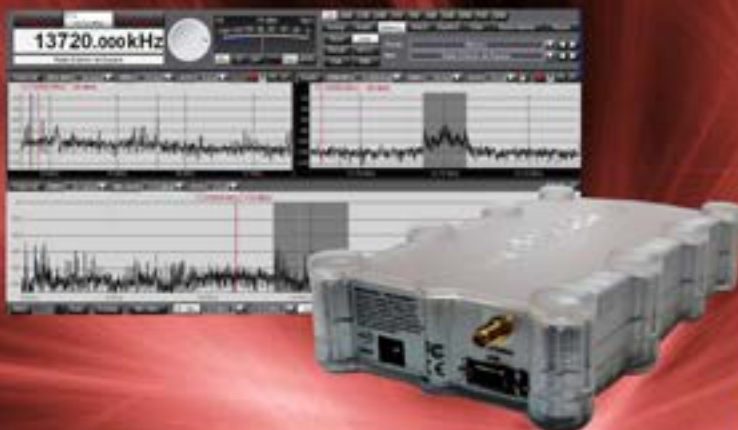
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### WinRadio Excilbur Pro

...towards serious measurement protocols but it is abundantly clear that the Excilbur Pro is better than anything we have hitherto encountered. To be able to connect a full-size 6/7MHz dipole to a receiver on an autumn evening and be able to observe the sideband sets of individual broadcasters down to virtually the receiver's noise floor is – to put it mildly – an unusual position for a reviewer to find himself in! Certainly the Excilbur Pro was not remotely troubled at any time by anything our various antennas could throw at it.

#### CONCLUSION

The Excilbur Pro is the best SDR we have used – in some ways it is the best receiver we have used regardless of the underlying architecture –

[www.wrth.com](http://www.wrth.com)

Overall rating ★★★★★



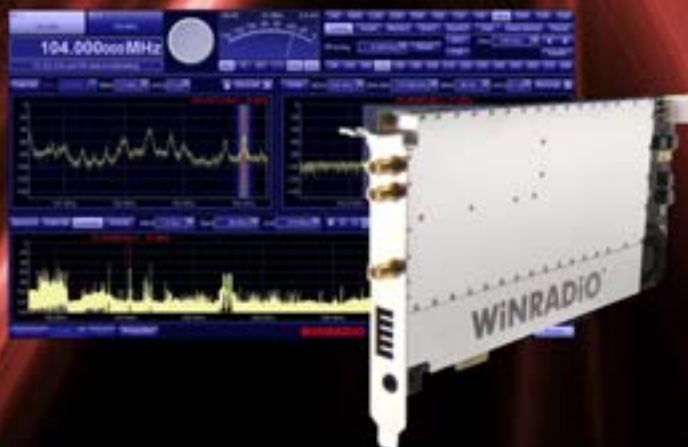
### review

Mike Richards takes a look at the WINRADIO G39DDC Excelsior, a receiver that some might consider the best software defined radio currently available.

If there's one thing that is likely to be at the top of a radio enthusiast's wish list, it's a system that can find signals quickly. The WINRADIO G39DDC Excelsior certainly has the ability to do this and it must be something close to a dream receiver.

#### summary

...y, the WINRADIO G39DDC Excelsior is a stunning receiver and a dream for ...  
...ew, I have only really covered the most interesting aspects of its performan...



### FIRST LOOK

MT Takes a Look at the Latest Tech

By Bob Grove, WB1HD

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.

I ordinarily find something to complain about in my reviews, but trying to find something I don't like about the G39DDC has left me at a loss, and that's a gain for this winner.

\* Yes, this does mean get one for free. Go to this web page for details:

[www.winradio.com/mt](http://www.winradio.com/mt)

WINRADIO by RADIXON: Great receivers ahead of their time.™



## 2013 Air Show Guide.. 8 By Larry Van Horn N5FPW MT Assistant Editor and Milcom Specialist

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.

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, 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 ever experience – pilot audio from the aircraft cockpit.

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.

### On Our Cover

Kevin Burke took this month's cover photo somewhere over the U.S. East Coast through the window of a KC-135 Stratotanker. He used a Canon 60D camera with a Canon 55-250 mm telephoto zoom lens, a 1/200 shutter speed and f8 aperture.

## C O N T E N T S

### Riding a Stratotanker with the Blue Angels..... 10

By Kevin Burke

Last year Kevin Burke caught a ride with a Thunderbirds mid-air re-fueling mission. This year he hitches a ride on a New Hampshire Air National Guard KC-135 Stratotanker for a rendezvous with the Navy's Blue Angels over the skies of Charleston, South Carolina. The famed air demonstration team is on their way from their base at Naval Air Station Pensacola to the annual Boston-Portsmouth Air Show in Massachusetts.

Kevin makes great use of the opportunity and takes some superb photos, one of which is on this month's cover. Kevin also tells how you can monitor air show participants enroute and how he takes those great photos from the ground and in the air.



Photo by Craig Scott

### New York Air Show 2013..... 12

By Brian and Jo Marie Topolski

Two air show and air monitor veterans Brian and Jo Marie Topolski detail their activities at two of the most popular air shows in the U.S. right on the doorstep of the Big Apple. They tell you where to listen and where to set up your listening post for maximum monitoring and photo opportunities. They also had the chance to photograph a bird seldom found in captivity, let alone in the air: the restored B-29 Superfortress bomber "FiFi" during a rare air show visit.



Photo by Brian and Jo Marie Topolski

### Air Traffic Control – Untangling the Mysteries..... 14

By Buddy Sohl KC4WQ

Having spent 25 years in the tower as an Air Traffic Controller, Buddy knows the ins and outs of ATC radio communications. There's an art to issuing concise directions to aircraft coming and going through the airspace of any good sized airport. These comms can sound a bit mysterious to the casual listener. In this article Buddy explains the roles of the many voices you'll hear when you monitor the Air Band where you live.



Photo by Buddy Sohl

## R E V I E W S

### WiNRADIO G33EM Marine Receiver .....56

By Bob Grove W8JHD

Bob takes a close look at a specialty receiver from WiNRADIO, the G33EM marine receiver, designed for marine monitoring applications and loaded with extras, such as factory installed presets for DSC (Digital Selective Calling), NAVTEX, HF FAX, TELEX, and marine distress frequencies that may be modified by the user as desired. As with other WiNRADIO products, this receiver also features a spectrum analyzer and versatile built-in digital recorder.



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

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

**Continuously amazing, the AR6000 professional grade receiver features:**

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

**Add to the capabilities of the AR6000 with:**

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



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**Happy monitoring!**  
**Ken Reitz, Editor**

## Tracking RF Radiation

Richard Johnson K1YZY, Harwich, Massachusetts writes:

"I wish to thank you for the article 'Tracking RF Radiation' (January 2013). I think it was a very fair treatment of the subject. We all need to keep aware of the latest research and findings. Keep up the good work. P.S. I shall stay with 100 watts maximum power on my ham rigs...and keep that cell phone somewhere else."

## Better Audio for your Smartphone. And, it's Portable!

Longtime reader Donald Strumpf, who lives near Philadelphia, Pennsylvania, responds to Ken Reitz's *Beginner's Corner* column in the January issue of *MT* regarding "Wireless Scanning" which looks at various ways to listen to scanners via an off-the-shelf portable/wireless arrangement. Donald found an inexpensive way to listen to better Internet radio audio from his smartphone.

"I already had an Android® smartphone and could listen to Internet radio on it via the TuneIn app (<http://tunein.com/mobile/android>). But the speaker in the smartphone is tiny and sounds tinny. I particularly like classical music and you need a good speaker for listening to that genre. To the rescue was a Memorex MW550 wireless speaker. It works with Bluetooth® as does my smartphone. After pairing the two (real easy), I can listen to the Internet radio stations on the Memorex speaker system and it sounds quite good.

"It works with AC and/or batteries so it's quite portable, and you can use the smartphone like a remote. To save airtime costs, I usually run it on WiFi at home and at my office. Oh, did I forget to mention that I picked up the Memorex off the clearance table at Staples for \$48? It's listed on the Internet for more but with a little looking around I'm sure it can be picked up for less than the listed price (\$70). See link below for details on the Memorex. [www.staples.com/Memorex-MW550-Wireless-Speaker/product\\_954181](http://www.staples.com/Memorex-MW550-Wireless-Speaker/product_954181)

"My desktop didn't have Bluetooth capability so I picked up a small USB device that gave my desktop that ability (\$15 at Micro Center which I got on clearance for \$12). It's an IoGear brand and works well on Microsoft XP. Now I can run the Memorex from the desktop up to 30 feet away



*Memorex MW550 Bluetooth wireless speaker. (Courtesy: Staples.com)*

from each other.

"The main advantage is that I can get more Internet stations on the desktop than I can on the smartphone. The main disadvantage is that I have to walk 30 feet to the desktop to change stations. Again, the smartphone works as a remote and it is usually in my pocket so I can change stations easily with it. By the way, the TuneIn app picks up my local HD stations (as well as great U.S. and international broadcast stations). It's hard to find an inexpensive radio to use at home that picks up HD. TuneIn does include some government frequencies so you can use this combo as a scanner (though very limited). P.S. I liked the Memorex so much that I went back to Staples and got the last one on clearance sale for \$48. Now I have one for my home and one for my office."

## Basket Weave Antenna Dimensions

Roger Bury KC7OM from Lebanon, Oregon writes to VHF/UHF Antenna columnist Kent Britain WA5VJB:

"Do you have the dimensions of the Basket Weave Antenna you mentioned in your *Antenna Topics* article in the January 2013 issue of *Monitoring Times*? I would like to try and build one for an old AM receiver I have."



*Vintage basket weave antenna. (Courtesy: Kent Britain)*

Kent Britain replies:

*I've been looking for one to photograph for well over a year and saw that one at a flea market near Austin, Texas. The owner was kind enough to let me take photos. As with most of these radios, the back was compressed sawdust, so about 12 x 6 inches. I think the politically correct term is now Engineered Lumber. Looks like about 50 turns. About the only way to properly tune it will be to build one and tune in a good strong local station. If the station at 1000 kHz comes out 900 kHz, add a few more turns. If it comes out 1100 kHz or higher, take off some turns. Good luck with your project!*

## UE Smart Radio vs Sangean WFR-28

James writes to Ken Reitz via email:

I read your *Beginner's Corner* article in the January issue of *Monitoring Times* titled, "Product Recommendations Update," and I am trying to decide between buying a Logitech UE Smart Radio and a Sangean WFR-28 Wi-Fi Radio. I was leaning towards the Sangean because it takes regular batteries. Which one would you suggest and why?

*Of course the Sangean model gets the nod on price, but let's look at the features a little closer. The Smart Radio has a built-in charger and includes a battery pack which is good for hundreds of charges, the Sangean has you buying batteries and managing them with a separate charger or using non-reusable batteries: extra expenses not in the purchase price. Even on Amazon the Sangean price is \$120 but with batteries it soars to \$147, just \$33 less than the Smart Radio which includes its own battery pack. Then there's shipping. Unless you're an Amazon Prime customer that'll be extra. No shipping charge for the Smart Radio direct from Logitech. Edge here to the Smart Radio.*

*The Sangean screen is monochrome LCD multi-line text, the Smart Radio has a full color display which can show album art, etc. Edge here to the Smart Radio. Audio is a subjective issue. The Sangean has a single 3 inch speaker, the Smart Radio uses a 3/4" high-definition soft-dome tweeter and 3 inch high-power long-throw, woofer/midrange speaker. The edge here is to the Smart Radio. You'll be surprised at the audio quality. I like that Logitech seems devoted to Squeezebox buyers even though the product is no longer made. That gives me confidence they'll do the same for Smart Radio customers in the future. – Editor*

## Who Cares?

David Librizzi K4IZZ from Piedmont, South Carolina writes:

"I enjoyed the *Beginner's Corner* column in the February *Monitoring Times*. At risk of being 'the grammar police,' I am going to nit-pick on something in the article. On page 27 (under the sub-heading, 'Disappearance of OTA-TV'), there is a paragraph where the author wrote, 'The essential problem is that, by some estimates, only 11 percent of us watch OTA-TV exclusively. That means that 89 percent of Americans **could care less** about whether or not channel 6 teams up with channels 8 and 12 to transmit from one tower.' [my emphasis added]

"I hear that phrase 'could care less' all the time and wonder if those who say it realize that it means exactly the opposite of what they usually intend. If someone 'could care less,' it means that they do care, because they could still care less.

"The correct phrase is 'I couldn't care less,' meaning I could not care any less because my level of caring is already at rock bottom. Anyway, yes, I have a degree of OCD [Obsessive Compulsive Disorder] and too much time on my hands. I'm sure I have set myself up for your obvious reply to my nit-picking... that you really couldn't care less!"

*As someone who spends his days reading and correcting the grammar and punctuation of others until my eyes are weary, I couldn't care more! No wait, I could care more! I'm thrilled that MT readers read what we write so carefully and care enough to write to us about it. I could care less, if you know what I mean, that you're one up on our normally crack proofreading crew, both of whom missed the error. – Editor*





# COMMUNICATIONS

by Ken Reitz KS4ZR

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

## RADIO LIBERTY IN TURMOIL

An article in the *Washington Post* January 3 detailed the controversy around Radio Liberty, the independently operated radio voice active in eastern Europe since the Cold War which is funded through a federal grant overseen by the Broadcasting Board of Governors (BBG). According to the article, Radio Liberty opened a bureau in Moscow after the collapse of the Soviet Union and by 1992 obtained a medium wave license to operate in Moscow. By 2004 it had garnered more than 30 affiliated radio stations across the country which gave it access to Russia's biggest media markets. Thanks to a new Russian law prohibiting foreign ownership of such stations, which went into effect late last year, Radio Liberty was forced to downsize its Russian-based operations.

According to the article, Radio Liberty CEO Steven Korn, who had spent less than eighteen months in that job, resigned effective January 25. Part of the controversy stems from the fact that some of the reporters fired in November of last year have since set up a web site critical of the changes at Radio Liberty ([www.usgbroadcasts.com/bbgwatch](http://www.usgbroadcasts.com/bbgwatch)). The group has asked for a congressional investigation into the closure of the station. Another part of the controversy stems from BBG policy of switching funding to online programming and closing actual broadcast outlets.



## ARRL APPROVES 5 SCHOOL GRANTS

In early January the executive committee of the ARRL's Education and Technology Program (ETP) approved applications from five schools for grants totalling nearly \$7,000.

The schools include **Taft Middle School** (Cedar Rapids, Iowa) which will receive a basic VHF station for its high-altitude balloon program and participation in ARISS (Amateur Radio aboard the International Space Station). **Roosevelt Junior High School** (Roosevelt, Utah) will also receive ARISS equipment. **Mill Springs Academy** (Alpharetta, Georgia) will use funds to promote student licensing and ARISS participation. **Curtis**



**A. Strange Elementary** (Kenosha, Wisconsin) will help students learn about basic electronics, microcontroller programming and the science of radio. At **Delcastle Technical High School** (Wilmington, Delaware) students will learn circuit board soldering and the science of radio.

The League's ETP has helped more than 500 schools and 600 teachers around the U.S. receive support in the form of grants for equipment, curriculum and resources, as well as teacher in-service training through the Teachers Institute on Wireless Technology. Applications for equipment and resource grants are accepted twice each year: May 1 and November 1. For more information and to find out how your local club can participate go here: [www.arrl.org/teachers-institute-on-wireless-technology](http://www.arrl.org/teachers-institute-on-wireless-technology).

## FCC: TELCOS TO BLAME FOR 911 DERECHO OUTAGES

In January the FCC released a comprehensive study of the derecho storm that hit Midwest and mid-Atlantic states last July killing 22 people and causing power outages for millions in the affected areas and resulting in 3.6 million people in six states losing partial or complete access to 911 services, some for a period of several days. The scathing report termed the outages "unacceptable" and noted, "The Bureau found that above and beyond any physical destruction by the derecho, 911 communications were disrupted in large part because of avoidable planning and system failures, including the lack of functional backup power, notably in central offices. Monitoring systems also failed, depriving communications providers of visibility into critical network functions. In most cases, the 911 and other problems could and would have been avoided if providers had followed industry best practices and available guidance."

## 5 GHZ TO BE NEW HOME FOR WIFI

FCC chairman Julius Genachowski thrilled the annual Geek-a-Thon, the January Consumer Electronics Show (CES) in Las Vegas, by announcing that their worries were over with the freeing up of 195 MHz of bandwidth in the 5 GHz band which could provide faster WiFi connectivity. Goofy-haircut hipsters might have been seen dancing with tassel-loafed sales execs while virtual cash registers rang like the trumpets of a new dawn, or at least a new dotcom bubble. Like all FCC proposals, the plan is fraught with issues; not the least of which is that the proposed bandwidth is already in use by federal and non-federal users.

The CES FCC press release noted, "In 2010, the Commission provided for operation of unlicensed devices in the unused spectrum between broadcast TV channels, called white spaces. Unlocking this valuable spectrum is opening the doors for new industries to arise, creating American jobs, and fueling new invest-

ment and innovation. In addition, as part of the effort to implement the world's first incentive auction, the FCC proposed to ensure that a significant amount of low-band unlicensed spectrum recovered from TV broadcasters will be available on a consistent, nationwide basis for the first time." We'll see.

## BATTLE OF OTA-TV NUMBERS

The TV ratings company Nielson, in an article in *TV Technology* online in early January, stated that Over-the-Air TV-only households were now down to nine percent of the total U.S. TV-watching universe. Down, they said, from 16 percent in 2003. But, the number conflicts with data from the National Association of Broadcasters (NAB), the nation's biggest broadcast lobby group, which six months earlier released its own survey showing the OTA-TV-only homes were at almost 18 percent, up nearly 3 percent from the previous year.

Bolstering the NAB survey is an article in the *Wall Street Journal* from one year ago titled, "OTA TV Catches Second Wind, Aided by Web." In that story OTA-TV antenna manufacturer Antennas Direct noted that their sales were soaring; expecting to double their sales from the previous year. The company reported selling 70,000 such antennas in January of last year alone. The WSJ article explained that "cord-cutting" households were saving an average of \$48 per month by switching to OTA-TV and signing up for Netflix.

## PIRATE RADIO STATION JAMS CAR LOCKS

A story that found its way into many news outlets, including the Florida *Sun-Sentinel*, on a slow news day in late December, detailed the distress suffered by jammed key-fob operated door locks on cars, particularly certain Lexus, BMW, Mercedes and Toyota models. Befuddled car owners, who had their cars towed to the dealer found that, once at the dealer, there was no problem. This had gone on for months and south Florida police were stumped.

It turns out that a pirate radio station operating on 104.7 MHz, and playing Caribbean music around the clock, had been installed on the roof of an eight-story bank building in the neighborhood where the jammed locks were occurring, one block from a local police station. Detectives, aided by field agents of the local FCC office in Miami, found the transmitter and antenna concealed under an air conditioning unit. During the four months of the lock jamming mystery, owners of affected vehicles were forced to read their owner's manual and learn how to (gasp!) use their manual key.

# A How-to Guide to Monitoring Air Shows

## 14th Annual MT Air Show Guide

By Larry Van Horn N5FPW, MT Assistant Editor and Milcom Specialist

Photo by Kevin Burke

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. 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: 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 ever experience – pilot audio from the aircraft cockpit.

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 the March issue of *Monitoring Times*.

So, here we are again, at the start of another air show season. It's 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 14th annual Air Show Guide.

### Where do you Hear the Action?

From time to time, frequencies for air show teams do change, by design or 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 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 aka 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)

Photo by Kevin Burke



Note: All frequencies in this article are in Megahertz (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 other major piece of flying hardware in the squadron is their C-130T Hercules transport aircraft, affectionately known as "Fat Albert Airlines."

#### Blue Angel Aero Frequencies

237.800	Solos outside the show box (Solo #2) and cross country air/air [Channel 8]
251.600	Air/Air nationwide and at NAS Pensacola – Start and taxi
255.200	Circle/arrivals discrete and cross country air/air [Channel 17]
265.000	Diamond formation secondary
275.350	Diamond formation outside the show box, cross country air/air and their Pensacola squadron common [Channel 9]
284.250	Show box (center) 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" and solos/"Ernie Demo" Blue Angel 9
333.300	Diamond formation/Delta show box (Fleet Week in San Francisco)
346.500	"Checklist Freq" – Pre-show checklist, ground start/roll out and maintenance [Channel 18]

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 include:

139.8125	Ground maintenance crews/equipment checks NBFM 67.0 Hz PL tone
141.6125	Ground maintenance crews/equipment checks NBFM 67.0 Hz PL tone
142.6125	Tower Observer NBFM 67.0 Hz PL tone

We have now had several reports that the Blue Angels have the capability to operate on 380-400 MHz Navy trunk radio systems. In the Southeast Region, the ground maintenance team (aircraft ground handlers) and tower-to-comcart communications have used talk group 29529. Talk group 29530 has been used when the team conducts comm checks and at the start of their performance.

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 these systems in your scanner. 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, based out of Nellis AFB, Virginia, and flying the F-16 Block 52 aircraft during their performances. The U.S. Air Force Thunderbird Air Demonstration Squadron is an Air Combat Command unit.

#### U.S. Air Force Thunderbird Aero Frequencies

<b>VHF High Diamond formation [Victor #]</b>				
139.225	139.800	140.700	141.075	141.175 (new in 2012)
Other possible frequencies to monitor that may pop up include:				
138.250	138.4375	138.550	138.600	138.625
138.750	138.950	139.000	139.600	139.900
140.200	140.500	141.150	141.400	142.600
142.700	142.800	142.900	143.000	143.200
143.250	143.725	143.750		

Frequency	Usage
235.250	Pre-engine start/solo aircraft on/off show center/linked to PA system [Uniform 1]
235.350	Thunderbirds solo aircraft (5-6) air/air
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 Teams 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 (PL tone 141.3 Hz/DCS 431/P25 NAC293)
413.325	Ground maintenance – Analog (DCS 503)
413.375	Ground maintenance – Analog (monitored in Hawaii)
901.500	Comcart headset
905.350	Comcart headset

Photo by Nick Burke



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.

## 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 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 are not the only parachute teams that perform around the country. The U.S. Army Special Operations Command has a parachute team known as the Black Daggers. Frequencies uncovered for them during the last few seasons include 123.150, 123.450, 123.475, 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 in which they were performing.

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 UHF 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 reportedly been using 44.200 (NBFM) and 123.450 MHz.

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 and 123.450 MHz. They have also been heard on V/U LMR frequencies 151.625 and 462.550 MHz (NBFM).

The U.S. Air Force Academy has a parachute team called the Wings of Blue and it is based at the Air Force 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 123.150, 270.000, 407.500, and 461.0375 MHz (NBFM 131.8-Hz PL tone) over the last several years.

## Other U.S. DoD Military Flight Demo Teams

There are other teams of aircraft from DoD that regularly perform at air shows. Some of these

and their frequencies are listed below.

**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 (Callsigns: Viper 1/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 (F-16D/P-51D Callsign – 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 AFB, 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 (Reaper Callsign)**  
 136.975 233.025 257.100 260.250 265.825 267.000  
 320.525 354.350 375.925 376.025 388.850

**Air Force B-52 Bomber Flyovers** 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]

Captain Blaine Jones - Photo by Kevin Burke



**Maine Corps AV-8B II/MV-22 Flight Demonstration Teams (MV-22 Callsign – Team Osprey):**  
**East Coast – MCAS Cherry Point, North Carolina** 357.000  
 363.300  
**West Coast – MCAS Yuma, Arizona**  
 Frequency information is needed

**Marine Corps Helicopter Demonstrations**  
 315.375 315.400

**Navy F/A-18C Hornet and Navy F/A-18F Super Hornet Flight Demonstration Teams - F/A-18F Rhino ## callsign):**  
**East Coast – VFA-106 NAS Oceana, Virginia**  
 237.800 349.900  
**West Coast – NAS Lemoore, California**  
 Frequency information is needed

## 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 and Twitter feed (MilcomMP) for any late breaking news or frequency information during the 2013 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 would like to help, and you have found this guide useful, how about taking a minute or two and pass along what you are hearing this next season? 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!

# Riding a Stratotanker with the Blue Angels

By Kevin Burke

(All photos, unless otherwise noted, are by the author)

In 2012, I was once again offered the incredible experience of photographing the headlining act for the Boston Portsmouth air show, the United States Navy Blue Angels, aboard a New Hampshire Air National Guard KC-135 Stratotanker.\* The Public relations company hired to promote the Air Show held at the Portsmouth International Tradeport, the Herb Gillen Agency, worked in conjunction with the New Hampshire Air National Guard to organize this opportunity.

As I expected from my refueling flights in the past, there were two KC-135s standing by with the necessary hose and drogue baskets already attached to the refueling booms, a procedure that takes about 15 minutes per tanker. This attachment is necessary to refuel United States Navy aircraft. The rate of flow that fuel can be pumped through this hose assembly is a little less than what can be pumped through the refueling boom itself when refueling an Air Force aircraft.

After all passengers were checked for proper identification and our bags were checked, we were shown the mandatory KC-135 safety procedure video. This video is shown because we will be well above 10,000 feet. If pressurization of the aircraft is compromised we will not have enough oxygen to breathe until we descend to around 10,000 feet. Therefore we need to carry an emergency bottle at all times. We were then given a quick briefing of the flight plan which was that all show sponsors would be on one tanker and the media would be on another tanker.

We planned to fly to the Charleston,



Taken from the right side of the boom operator, you can see the 'catcher's mitt.' It's hard to see but there is a flexible hose between the basket and the solid, straight boom. I chose the right position for this shot. People that were on the left side of the boom operator had a different angle; the tanker's boom blocks the cockpit. (Shutter speed 1/200 at f10 aperture)



This photo, taken through one of the tanker's two side windows, shows what must be fuel venting from the tail of Number 5. I noticed differences in these two airframes, mainly the antennas on the bottom. Number 4 is an F/A 18 C model and Number 5 is an F/A 18 A model. I found it amazing that the Blue Angel squadron actually flies a mix of different model numbers. I found by looking through my photos that 1 and 4 are the same (C), 2 and 3 are the same (A) and 5 and 6 are the same (A). (Shutter speed 1/200 at f8 aperture)

South Carolina area at a predetermined time, location, and altitude. The Blue Angels, taking off from their home base, Naval Air Station Pensacola in the Florida Panhandle, would fly to this rendezvous point allowing enough fuel in their jets to get to an emergency landing airfield if something happened to our tankers and we were not able to meet them.

We were told that each tanker will actually carry enough fuel to feed all six jets in case one tanker had any kind of problem that prevented it from taking off in the first place or from

transferring fuel once we got to the refueling areas.

Once I absorbed all of this information, I wanted to share what I had learned so that others could be on the lookout for the action on their scanners as the flight was passing through their area. I sent a text message to the one person I knew who would respond right away and help me pass along the information to a few people along our planned flight path. I knew he would be at home in upstate New York about 100 miles away, probably with his scanners on, so I wanted him to know about the



OK, this is the shot that someone could make a credit card commercial out of, where years and years of taking photos at air shows is mentioned, then experiencing what the military does every day, getting a FREE flight up and down the East Coast, culminating in one of the greatest and most memorable photographs I've ever taken. To me, it's PRICELESS! (Shutter speed 1/200 at f10 aperture)

## HOW TO GET THOSE GREAT AIR SHOW SHOTS

In the spring of 2012 I decided to invest in a new Digital Single-Lens Reflex (DSLR) camera. My reliable Canon Rebel XTi had served me well, but I felt I needed to buy a newer camera with new features that the XTi doesn't have. The camera I chose was the Canon 60D. This camera captures images at 18 megapixels compared to 10 with the XTi. This increase in megapixels will allow me to crop my photos a bit more and still maintain image quality.

Once I decided on the 60D, I looked online for the best deal and found one that included a medium range zoom lens, the Canon 55-250 mm with image stabilization for only \$75 more than the cost of the camera after an instant rebate. This lens sells for over \$150. At the time I didn't see myself needing this lens but I didn't want to pass up a great deal on a lens.

I planned to have this lens and the XTi in my camera bag as a back up system. At the Quonset Point, Rhode Island air show I had my



ten year-old son Nick with me. I thought of that back up system just sitting in my bag unused and said to Nick, "I have another camera in my bag, do you want me to set it up for you so you can try to take some

pictures?" I was pleasantly surprised when he replied, "Yeah, sure!"

I set the camera on the SPORTS or FAST ACTION mode where the camera makes all the decisions of aperture and a fast shutter speed for correct exposure. I don't usually use this mode myself but for this situation I wanted to just set the camera and let him go. I showed him how to zoom and told him to focus on something far away before trying to focus on planes approaching. I showed him how the shutter button, when pressed half way down, starts the focusing and told him, "When the planes are getting close to what you think is a good picture, just start firing away."

Nick had never used my DSLR before that air show. The pictures he took completely amazed me. His photos are proof that anyone can take great photographs at an air show, with hand-me-down gear on their first try.

flight also. Sure enough, right away he replied with, "Will do buddy! Have fun, take care."

After we boarded the aircraft, I went to the boom operators station to decide on which side of the boom operator I wanted to position myself. I know the view is best from the right side of the boom operator, but I needed to lay down in each position to visualize which side will offer the best view, taking into consideration that, with the hose and drogue attachment, the F-18's will not be directly underneath us as it would be with an F-16.

I also had to consider the refueling probe that extends off to the right of an F-18 cockpit when refueling. I decided that I would pass on the opportunity to photograph from the boom operator's left hand side and focus on getting a shot from the right hand side.

The slower fuel pumping rate with the hose and drogue basket attached, combined with the way Navy aircraft connect with a KC-135, worked in favor of the twenty or so people who were waiting for their turn to view this speeding gas station in the air.

With Air Force aircraft, whether a B-1B, C-5 or F-16, the receiver flies up close to the rear of the tanker. The boom operator flies the boom with a joystick and moves it right into the receiver's receptacle. Up to four fuel pumps

can be used and fuel can be pumped at up to 4,000 pounds per minute.

With Navy aircraft, the pilot of the receiving aircraft has to fly his jet with what looks like the butt end of a baseball bat that mechanically extends from its hidden location along the right side of the fuselage. When ready to refuel, this baseball bat is now parallel with and a few feet away from the fuselage. The pilot has to fly that jet so that the butt end goes into the sweet spot of a large catcher's mitt that is at the end of a 10 to 15 foot long hose while both aircraft are traveling at over 200 miles an hour. It took much longer to top off an F-18 Hornet with that slower pumping rate than it would an Air Force F-16 Fighting Falcon, for example. The upside was that we all got plenty of time to photograph from the boom operator's station.

I wasn't able to get my ideal shot of a Blue Angel jet without the boom attached or in the way of the shot, but we did luck out and had all six Blue Angels form underneath us with their white smoke billowing out the back of each jet. The crew on the tanker kept calling out and counting down the remaining time that the Delta formation would continue to stay in that formation. When I was stepping down to get into position for the shot, a crew member said, "30 seconds!" I laid down, took a few

## AIR SHOW MONITORING FROM AFAR

Can't make it to your local air show? You can still catch some action on the radio. For us air show/scanner buffs we all need to be aware of the schedules of the Thunderbirds and Blue Angels. Any show site that puts you in the path of the jets getting to the show, or even returning home from the show afterward, is an opportunity for you to catch some communications.

When the Thunderbirds flew to Brunswick Maine this year for



their air show I was prepared to try to monitor them from my workplace in northeastern Massachusetts. I was outside operating a Bobcat skid steer loader. I had my handheld pro-97 scanner with a diamond RH77CA antenna and headphones. The machine itself is quite noisy but I managed to hear the Thunderbirds talk about visual landmarks. I was also able to catch one of the Thunderbirds call ahead to the number 7 Thunderbird who was already on the ground at Brunswick and give him a new frequency the team will be using on arrival.

I always keep the first few channels in each scanner bank unprogrammed just for moments like this. I quickly entered the new frequency 141.175 into the first channel of the bank I was listening to. I could tell by the way it was read out very slowly that this frequency was brand new. I could also tell it was new to me because my scanner would have indicated if this new frequency was already entered in my scanner.

A couple days later I was at the Brunswick airport standing next to the Thunderbirds comm cart as a Thunderbird team member came over to the comm cart and said, "VICTOR 1 needs to be reprogrammed to 141.175." I considered that to be double confirmation that this was going to be a Thunderbird frequency for a long time. I emailed Larry Van Horn and explained the confirmation. The Thunderbirds used this new frequency all weekend and longer I believe.

shots, and was back up and out of the way so the next person could get down there and get their shot; there was still another 15 seconds left.

When it was obvious that the refueling and photo opportunity was finished, no one was disappointed, there were smiles all around. You couldn't tell if this was a plane full of very satisfied photographers, who had been invited to witness up-close and personal what the New Hampshire Air National Guard does every day, or if it was a plane full of people who had just hit the lottery!

Just a few days after this tanker flight I learned that the friend I had texted to share information about the flight, Don Edwards, had passed away. I had thought of him because he was a true friend who would not only pass the info along, but share in my excitement at that very moment, as only a friend equally enthusiastic about the combination of military aircraft, photography, and scanners would.

As I was flying high on that flight, little did I know that Don would soon be on his own flight to an even greater altitude.

\*See "My Ride on a T-Bird Refueling Mission" by Kevin Burke (pages 17 and 18, MT March 2012)

# Air Show 2013

By Brian and Jo Marie Topolski  
(All photos by the authors)

**W**elcome air show enthusiasts! I hope everyone had a good winter and, now that temperatures are heating up, let's gear up for some air show fun! First stop: New York City and "Fleet Week" celebration. Fleet Week is a combined United States Navy, Marine Corps and Coast Guard tradition. This annual week-long extravaganza takes place during the days preceding Memorial Day weekend and continues through to the following Thursday.



*Intruder thunders into the sky*

This year kicks off on Wednesday, May 22, 2013 with the opening "Parade of Ships." It begins in the morning with numerous military vessels sailing north up the Hudson River and past the *USS Intrepid* museum. This is the perfect opportunity for radio monitoring enthusiasts to tune-in! At this point, you'll witness a sight you don't often see: a recently acquired "fast response" FDNY fireboat, commissioned in 2010, spraying red, white and blue water high into the air as New York City welcomes the ships! How's that for rolling out the red carpet! In 2012, FDNY fireboat comms were up on: 486.1375 MHz NBFM.

The festival will also include various military aircraft overflying the fleet. Expect to be surprised by anything from V-22 Ospreys to F/A-18 Super Hornets! Last year, a squadron of F/A-18s flew in from NAS Oceana and made several passes up and down the river. They communicated air-to-air on 333.3000 AM mode.

I like to base my operation on the Jersey side of the river. In doing so, you are now set-up for a picture postcard view of the event, featuring the "Big Apple," aka New York City, as a beautiful scenic backdrop for photography. This panoramic combination is stunning! Don't forget to keep your eyes peeled for U.S. Coast Guard and NYC police boats and helicopters as they patrol the area ensuring the safety of all involved. From this perspective you'll also see other aircraft that normally transit the air space. These include NYC news and business helicopters buzzing to and from the city. Oh,

and don't forget the flying sightseers, just passing through to get a look-see at the festivities via their civilian aircraft.

This area now becomes one extremely busy and hazardous travel corridor for the next several hours! Be careful not to fall off the edge of your seat and have your cameras and scanners at the ready as you listen to the traffic controllers do their best in juggling all air, land and sea activities! Listening to 118.4500 AM mode in 2012, I heard what sounded like the Air Boss sending out a very strong voice signal. Make sure to have the following programmed in your radio: United States Air Force Thunderbirds, (they'll be close-by in Long Island for an upcoming air show). That creates the possibility of a fly-over. See Larry Van Horn's Milcom column elsewhere in this issue for the latest frequencies for all military and civilian air show teams. Also include Kennedy, LaGuardia and Newark Liberty airports, New Jersey State Police, New York State Police, NYPD, FDNY, U.S. Maritime, and U.S. Coast Guard, using both conventional and Motorola P25 digital.

The following are very active NYC aviation frequencies; note that while monitoring, it's interesting to hear aircraft refer to the Statue of Liberty respectfully as, "The Lady." You'll want to make sure you have these "hot" frequencies tuned in all day so as not to miss any of the action (all AM mode):  
121.5000/243.000 Guard/Emergency  
123.1000 NYPD, Helicopters air/air  
123.0750 NYPD, East River, Wall Street, East 34<sup>th</sup>



*Geico Skytypers*

123.0500 NYPD, Hudson River, New York Harbor, West 30<sup>th</sup>  
123.0250 News Helicopters air/air  
131.9750 Kearney Helicopter-stop

These next frequencies have been used for ships coordination and timing when entering the mouth and sailing up the Hudson:

163.0500 FM P25 digital "USCG Sector Long Island Sound"  
277.8000 AM "Atlantic/Pacific Fleet"

The date for this year's NYC Fleet Week festival is set for Wednesday, May 22, 2013 through Thursday, May 30, 2013. For information go to: [www.fleetweeknewyork.com](http://www.fleetweeknewyork.com) and [www.intrepidmuseum.org](http://www.intrepidmuseum.org).

In addition to *Monitoring Times*, check out [www.radioreference.com](http://www.radioreference.com); [www.n2nov.net](http://www.n2nov.net) and [www.w2lie.net/news.php](http://www.w2lie.net/news.php), great resources to expand your listening pleasure! (Thank you for all you do!)

## On to Jones Beach

Next stop: Jones Beach, New York. There's nothing I enjoy more on a summer day than being outside watching and listening to my favorite aerial artists. But why do it on a hot tarmac? Jones Beach, located in southern Nassau County, Long Island, New York, is a beautiful and natural venue to see an air show. Created by Robert Moses and built during the 1920s, the park features 6.5 miles of pristine Atlantic Ocean coastline, un-acosted by the hectic pace of day-to-day living.

## FIFI...B-29 SUPERFORTRESS

This is "FiFi," a very rare B-29 Superfortress. What makes her so special is the fact that she is the only airworthy B-29 left in the world, certainly "one of a kind." This past summer we got a chance to experience living history firsthand by travelling to Bradley International Airport in Connecticut to meet this "grand old lady." What a wonderful experience this turned out to be. We felt that if we didn't see her today, we may never get another chance.

"FiFi" is owned and maintained by an organization known as the Commemorative Air Force (CAF). Before that, she served as an administrative aircraft until her retirement in 1958. She was then placed in a desert storage area located in China Lake Naval Air Weapons Station in California. There, along with 35 other B-29s, "FiFi" was used as a military gunnery target, all the while enduring years of harsh desert climate. In 1971 a CAF pilot in the National Guard reported seeing a group of what appeared to be B-29 aircraft deteriorating in the California desert. Upon further investigation, the sighting was confirmed; they were indeed B-29's! Thus began the painstaking recovery mission to save what they could of what was left.

After intense negotiation with the U.S. Air Force and Navy, CAF would become the proud, official owner of the B-29 which would later become "FiFi." After determining which one of these birds was in the best workable condition, it took nine grueling weeks of cannibalizing parts together from other B-29's in order to make the plane flyable. Once that was completed, they acquired a one-flight only permit in order to limp the aircraft safely back to the CAF home base in Midland, Texas, where she would undergo more extensive restoration.

Today, "FiFi" is a masterpiece of restorative craftsmanship and is flown all over the country appearing in numerous air shows in an effort to bring World War II history to the nation while maintaining the memory of the sacrifices of the men and women of generations past.

It takes a lot to maintain living history. "FiFi" was recently grounded because of extensive repair work needed on her number two engine. For more information on this plane and the 2013 schedule of its possible appearances this season, go to this web site: <http://commemorativeairforce.org>



to see the now retired NASA Space Shuttle *Enterprise* being transported to New York City and the *USS Intrepid* museum where it will permanently reside on public display. Its trip began at the Kennedy Space Center in Florida, when the shuttle was hoisted and secured to the top of a modified Boeing-747. Their combined weight was approximately 475,000 pounds. They were closely shadowed on their journey by a NASA T-38 jet with a side mounted camera so as to document this history-making flight.

While communicating with air routing traffic

control centers, otherwise known as ARTCC and local airports, the two aircraft maintained both visual and radio contact with each other. They communicated on 235.4000 MHz AM. This enabled them to coordinate and position themselves for the very last dramatic, in-flight photos of space shuttle *Enterprise* against a variety of significant United States landmarks as backdrops. A salute to you, Space Shuttle *Enterprise* for having etched yourself into the creative hearts and minds of future explorers and thus your final resting place in world history, where the inspiration continues. Till next time, keep your head to the sky and we'll see you on the flightline or the beach! Check Six...Good Hunting!

MT



P-51 Mustang and Corsair pass

The architecture of the buildings at this magnificent New York state park is imaginatively based on the Art Deco style of the era. This brings you back in time, thus creating a very relaxed atmosphere. It also includes a boardwalk that stretches as far as the eye can see. This is where I base my comm-cart; aka, "comfort zone." Slightly elevated well above the sandy beach, the boardwalk allows me to navigate my wagon carrying all my monitoring equipment throughout, eliminating the risk of sand getting into my sensitive electronics (flashback to Atlantic City, 2011). Photography angles abound, so stay hydrated and make yourself comfortable with the surf, sand and sky offered up by this extraordinary vista. You might even feel like going for a swim!

An impressive feature of the park, standing sentinel above the beaches, boardwalks and nature's seaside wonders, is a 231-foot water tower. This obelisk becomes show-center for the entire event. Distant, incoming pilots use it as a point of reference.

This year's show will feature the United States Air Force Thunderbirds. Make sure you have your radios programmed with these frequencies so you don't miss one exciting detail of events as they unfold! Thank you to Larry Van Horn at *MT* for providing us with the latest Thunderbirds frequencies! Participating aircraft for this venue are based at and fly-in from several locations: Republic Airport, in Farmingdale, New York; Long Island MacArthur airport in Islip, New York and the Francis S. Gabreski Airport in Westhampton, New York. For information about Jones Beach go to <http://nysparks.com/parks/10/details.aspx>.

An exceptionally memorable highlight for us in 2012 was the once-in-a-lifetime opportunity

T-Birds 5 & 6 get close



# Air Traffic Control – Untangling the Mysteries

By Buddy Sohl KC4WQ  
(All photos courtesy the author)

**T**he movie “Pushing Tin,” released in 1999, was based around air traffic control at the New York Common I. Billy Bob Thornton and John Cusack went head to head as maverick controllers, each trying to best the other in their own way. Air traffic controllers, in the real world, are very similar to these two characters. As a matter of fact, while I watched this movie, back in the day, I was seeing all the different personalities with which I worked daily.

Air traffic control is a very demanding occupation, it’s not for the faint hearted or indecisive. It is not a job that can be performed or taught to just anyone. To reach the level of a good controller, you must be precise, flexible, obstinate, contrary, egocentric and a bit arrogant as well as polite, courteous and possess an extra dose of common sense, all at the same time.

To the outsider, air traffic control can be a puzzling mess of duties and responsibilities. There are tower controllers, terminal controllers, center controllers and some facilities that blend all three.

## Inside the Tower

As a tower controller you have to be a master of many skills. You have to have eagle eyes, an ability to hear three or four conversations at once, catch pilot miscues immediately and stay on top of weather changes at your field and adjacent fields. Some tower controllers have access to radar information and some do not.

The Air Traffic Control (ATC) tower is broken down into different areas of responsibilities. When your pilot wants to leave the airport he has to contact the tower starting at the ATIS (Automatic Terminal Information System). This process has become mostly automated, with a printout appearing in the cockpit or attached to the pilot’s paperwork. ATIS reports are usually given a letter name from Alpha through Zulu and provide the important weather and airport information exclusive to a particular airport.

Airports requiring a VFR (Visual Flight Rules) clearance to depart or if your pilot is seeking IFR (Instrument Flight Rules) clearance, you would next contact clearance delivery. On the initial contact you would inform the controller at clearance delivery of the current ATIS code and receive your clearance.

There are many locations that have automated this function as well and the FAA provides airport information via <http://aeronav.faa.gov> which will help you navigate through the air traffic system.

The next area of ATC responsibility is ground control. As the name suggests, this position is responsible for all the movements on the ground. This is the controller that gets you to the gate after landing or to the runway from parking. He or she is listening to ensure that every clearance issued is read back correctly and the aircraft moving on the ground are doing as instructed. The ground controller’s biggest responsibility is to ensure that aircraft don’t wander onto runways without proper permissions.

Imagine looking out the window, 200 feet above ground level, watching a dozen or more aircraft all moving from one point to another over a four or five square mile area. Now imagine one of those aircraft doesn’t do as instructed and gets in the way of other aircraft. Did you look several moves ahead to make certain you had another plan, in case “Plan A” didn’t work? You can bet the ground controller did.

Once the ground controller gets the aircraft to an agreed upon location, that aircraft is switched over to the local controller. This can be done verbally or, as in a lot of airports, by signage posted around the taxiways. The local controller handles the comings and goings of the airport, landings and departures as well as the traffic flying around the airport proper. In

some of the busier facilities there could be more than one tower controller. The responsibility of the local controller is to ensure the separation of the aircraft as they come and go, keeping the transient aircraft separated from the arrivals and departures.

Some of the things local controllers consider are wake turbulence and watching for aircraft encroaching on the runways. The puzzle is always in motion. Not only is the local controller watching the same four or five square miles as the ground controller, but also the air above, north, south, east and



*Buddy Sohl on the job at KSDF, Louisville International Airport, Kentucky*

west of the airport. And as always, when Plan A doesn’t pan out, the tower controller has to be flexible enough to go to Plan B, C or D, all on the fly.

Approach controls have the densest concentration of aircraft. Every aircraft has the same destination, the airport to which they filed a flight plan. But all cannot arrive at the same time. The old adage of two solids unable to occupy the same space comes into play. This is where the radar approach controller goes to work. Quite often these men and women occupy the same structure as the tower controllers and are likely to work upstairs as well as downstairs, in the radar room.

The radar controllers are responsible for providing radar separation to all aircraft with which they have contact. Each facility is unique in the way airspace is delegated to controllers. Some are just split in half, many are tiered and separated into arrival and departure functions but all have established procedures that expedite the movement of aircraft through the airspace.

## Ins and Outs of ATC

A lot of the movement through an approach control airspace seems arbitrary and mysterious to the non-controller. However, each facility works up policies and procedures to safely move the air traffic in their jurisdiction and to successfully and expeditiously move traffic into adjacent airspaces. This last part is something that even confuses a lot of pilots.

Coordination between facilities is a time consuming affair and the use of verbal communications is quite often a cause of human error, resulting in delays or occasionally loss of minimum separation. Hence, controllers use published routes and altitudes to expedite the flow of traffic to and from different facilities. A note here: the FAA has established minima for separation between different types of airspace and aircraft. Most times, even though this minimum separation was not maintained, safety was not compromised.



*Final scope during the midnight inbound push at SDF*





*Sharon Ballard at the scope.*

One of the most exciting approach control positions is the final controller position. This controller takes the aircraft for the last phase of flight before going to the tower controller. It was also one of the positions most portrayed in "Pushing Tin." The goal of the final controller is to get all the arrivals lined up nose to tail and minimize the amount of airspace used, considering wake turbulence and other separation criteria. For instance, it is more expeditious to put a Learjet ahead of a B-757 due to less required separation.

Some of the largest approach controls are not affiliated with a single control tower but provide approach service to several busy airports. The New York metro area is one such facility, referred to as the Common I. Busy airports such as Newark, LaGuardia, and JFK have thousands of flights daily and all of these aircraft are crisscrossing away from the airports. Controllers have developed procedures to ensure these aircraft can safely traverse this airspace with altitude crossing restrictions and routes, all under the watchful eye of a dedicated and experienced controller.

There's a big sky out there and someone has to keep those high fliers separated. Once the approach controller has completed his responsibilities to a flight, that aircraft is handed off (radar identification and communications transferred) to an enroute facility. These facilities are referred to as centers and the responsibilities of center controllers are varied as well. Some controllers handle all the low altitude traffic between approach controls. Others handle all the high altitude flights.

Controllers are responsible to ensure minimum vertical and lateral separation at speeds approaching 90% of the speed of sound and closure rates in excess of Mach 1. Some center controllers watch the 'big' picture, keeping track of volumes of traffic going in and out of the bigger airports. These men and women are flow controllers and they can make or break a center controllers day.

If a problem or congestion occurs at an airport, the flow controllers start putting restrictions in place. When a flow controller pops into a center controller's ear, things are about to get dicey. Aircraft could be re-routed to new arrival areas or around weather areas. The center controller could be asked to hold aircraft. Needless to say, you can't just ask the airplane to stop, so the pilot will need to fly circles in the air. For the center controller, this blocks up larger areas

of airspace and makes the movement of other aircraft more difficult. The flow controller can even issue departure stops. These ground delays are the last step.

## Tools of the Tower

All of these different facilities have variations on the theme. There are some CERAP's (Center/Radar/Approach Control). There are sections of facilities dedicated to non-radar separation in oceanic sectors; it's difficult to have radar coverage over the open oceans.

There are lots of "toys" that controllers use to track aircraft. As technology improves air traffic control will follow along. The FAA moves slowly here and rightfully so. Utilizing unproven technology can result in serious consequences.

In the late 1980s the enroute centers phased out the use of broadband radar and went exclusively to networked long range radar displays. With more accurate altimeters, high altitude separation, above FL (Flight Level) 290 (29,000 feet) was reduced to 1000 foot increments, rather than the 2000 feet used for decades.

Approach controls have gone to a mosaic style of radar in the last five years. This replaced a digitally enhanced broadband and provides a source of radar coverage when the primary radar site fails or is down for maintenance.

Many VFR towers have a radar display that allows VFR tower controllers an eye extender to help them locate aircraft more quickly. Ground control radar keeps track of vehicles as well as aircraft on the airport surface, enhancing safety three fold. This radar is even selective enough to display people walking on the movement areas.

Flow control has become a major player in air traffic control. Many facilities have a display that allows the facility to track aircraft around the world, literally. Do you want to see all aircraft inbound to your airport? Type it in and up it comes.

Air traffic radar training was at one time limited to only live traffic, real airplanes and real people. As technology gets more sophisticated so does the computerized aspect of training. There are tower mock ups that provide 360 degree real time simulations (almost as good as the real thing). Radar simulations and digitized radar scopes work hand in hand and allow true-to-life training. As an aside, after September 2001, ATC



*George Foster, supervisor, oversees the operation.*

lost one of the best training aids available to controllers with the elimination of the familiarization program. This allowed controllers to jump seat on aircraft to get a pilots eye view of the air traffic system. This put all the information learned through FAA training into a complete package, teaching the controller how his or her instructions affect the operations in the cockpit. The FAA needs to reinstate this program to provide complete controller training.

There are some changes coming for ATC: more use of accurate GPS for position reporting and approaches; on board radar to facilitate separation and spacing; visual approach clearances only when aircraft are established within 30 degrees of the final approach, and faster digital communications to relay flight information between facilities, all of which will help maintain order.

My career as an air traffic controller was an exciting and satisfying 25 years. It seems like yesterday that I walked into an auditorium in Oklahoma City and began my journey through the mysterious world of ATC. I was fortunate to have the opportunity to certify in both enroute and terminal options and to work with some of the finest and most dedicated men and women in the world of aviation.

In my view, the Federal Aviation Administration does not fully appreciate the dedicated workforce that staff the scopes and towers day in and day out. Without the tireless dedication of the frontline controller, aviation in the skies of the U.S. would grind to a halt as would all the commerce that aviation brings.

By the way, back to "Pushing Tin," I always saw myself as a bit more of the John Cusack character with a touch of Billy Bob Thornton thrown in.

## About the Author

*Buddy Sohl KC4WQ became a licensed radio amateur in 1979 and received his Extra Class license in 1981. He is active on 160 meters through 70 cm, primarily on CW and digital modes. He is a life member of ARRL, a Volunteer Examiner and past president of of the Bullitt Amateur Radio Society in Bullitt and Jefferson counties in Kentucky. His last article, "Train Your Replacement: a Decade of Amateur Radio in the Classroom," appeared in the September 2012 issue of Monitoring Times.*



## Monitoring Southeast Louisiana

In December, the Jefferson, St. Bernard and Plaquemines Parishes in southeastern Louisiana announced that they would begin encrypting all police radio transmissions, including routine dispatch activity, at the beginning of 2013. Expressing the now-standard argument that criminals might gain some kind of an advantage by listening in, officials justified their decision as a matter of officer safety and expected the public to be satisfied with a summary of events provided days later by public relations staff on an entry on the crime mapping web service located at [www.crimemapping.com/map/la/neworleans](http://www.crimemapping.com/map/la/neworleans).

Local newsrooms, community anti-crime patrols and neighborhood watch groups all expressed their frustration that government officials expected them to trust the same law enforcement agencies that have proven themselves to be less than truthful in the past.

The announcement came as the New Orleans Police Department was operating under a consent decree with the U.S. Department of Justice, following numerous and continuing complaints of unconstitutional conduct, violations of federal law and use of excessive force. The decree requires the Police Department to overhaul policies and procedures for use of force, training, interrogations, searches, arrests, recruitment and supervision. City officials estimate that implementing these reforms will cost more than \$10 million a year for the next few years.

One of the primary goals of the decree is to restore public confidence in the police department. A key requirement to achieve this goal is to provide sufficient transparency that will allow the community to participate in and track the reform process. Shutting out real-time access to routine police work degrades the transparency so necessary for department accountability.

After some review, a more nuanced response emerged. According to news reports, Orleans and Jefferson Parishes will keep some radio channels "in the clear" while encrypting more sensitive information. The ten New



Orleans Police Department dispatch channels will also remain open, although other channels carrying officer discussions will be encrypted. Jefferson Parish Sheriff's Office dispatch channels will remain in the clear while Plaquemines Parish said it would encrypt all channels. The St. Bernard Sheriff's Office did not announce their policy at press time.

### ❖ Encryption

Officials stated that Motorola provided the encryption software free of charge. This implies that the particular product is called Advanced Digital Privacy (ADP), a proprietary encryption method we reviewed in the August 2012 *Scanning Report*. ADP is not particularly secure from a cryptographic point of view but is enough to put transmissions out of reach for most scanner listeners. More effective encryption methods are available, but Motorola typically charges a per-radio fee for them.

Despite the freebie, the use of ADP could potentially cause a problem for Louisiana. Millions of dollars in federal grant money has been used to build, repair and upgrade the radio system. There are some requirements that come with the money, including guidance to the effect that grant recipients must be compliant with Project 25 (P25) standards, which has a defined encryption protocol spelled out in an official document. That document does not include proprietary methods like ADP.

The use of ADP, since it is not compliant with P25 standards and is not available on hardware from more than one vendor, places the system in conflict with federal grant requirements.

### ❖ Louisiana Wireless Information Network

The parishes considering encryption all operate on the Louisiana Wireless Information Network (LWIN), a fully digital statewide

APCO Project 25 system. In early 2004, the Louisiana State Police began an effort to achieve full interoperability for all emergency services throughout the state. This effort was named Louisiana Totally Interoperable Environment (LATIE) and was intended to replace the older 800 MHz system originally installed in 1996. That older system served about 10,000 users across 70 agencies from 46 repeater sites.

The need for interoperability was proven in the aftermath of Hurricane Katrina, when responders from all over the state and other parts of the country arrived to help but were unable to communicate over local systems, which even if undamaged were incompatible with responder's radio equipment.

After Katrina, FEMA issued a \$15.9 million purchase order to Motorola to repair and augment the infrastructure in the affected area, including the construction and upgrade of 19 repeater sites in southeast Louisiana. An additional \$5 million from FEMA has funded the purchase of 700 MHz radios for St. Bernard and Plaquemines Parishes. This represented the first phase of LATIE. The second phase covered the southwest part of the state, and the third phase brought coverage to the northern parishes. When complete, LATIE would have more than 100 repeater sites and have the capability to reconfigure coverage if one or more sites were damaged or otherwise made inoperative.

The first three sites came on line in the New Orleans area in 2005. A year later, after the complete failure of their EDACS system during Katrina, the City of New Orleans made the decision to replace the system with a 700 MHz P25 system.

In 2007, Orleans Parish and the New Orleans Police Department joined the LATIE system. By 2010 there were 88 repeater sites in operation serving nearly 50,000 users. More than 4,800 talkgroups had been established.

### ❖ Frequencies

The system, as you might expect, is quite large. Managing frequency lists of this size is much easier and less error-prone if you use a pre-assembled file. Most modern scanners, which are necessary to scan a fully digital system like LWIN, typically come with large municipal systems pre-loaded in memory. Check your owner's manual for instructions on how to activate the proper set of frequencies. For owners of easy-to-use models like the Uniden HomePatrol-1, simply entering a zip code in the proper area is enough to get started.



If you're intent on doing it manually, you can use your scanner's "Control Channel Only" feature to cut down on the number of frequencies you need to enter. Rather than programming in every voice frequency, you can get away with just programming the control channel frequencies. Because LWIN is a "pure" digital P25 system, your scanner can figure out all of the proper voice frequencies based only on information carried in the control channel.

Jefferson Parish: 769.10625, 769.70625, 769.95625, 770.70625, 773.08125, 773.53125, 853.47500, 853.52500, 853.57500, 853.85000, 853.90000 and 860.46250 MHz.

Orleans Parish: 774.03125, 774.31875, 774.56875, 774.78125, 796.19375 and 853.80000 MHz.

## ❖ Talkgroups

There are now somewhere in the neighborhood of 50,000 talkgroups on the system. The following is a list of popular talkgroups in the parishes near New Orleans. Updated local listener reports are welcome, to let us know which talkgroups are actually encrypted on a day-to-day basis and which ones remain in the clear.

Dec	Hex	Description
5020	139C	State Police Troop B (Dispatch)
5021	139D	State Police Troop B (Dispatch)
5022	139E	State Police Troop B
5024	13A0	State Police Troop B (Car-to-Car)
5026	13A2	State Police Troop B (Narcotics)
5030	13A6	State Police Troop B
5031	13A7	State Police Troop B
5032	13A8	State Police Troop B
5033	13A9	State Police Troop B
5034	13AA	State Police Troop B
5035	13AB	State Police Troop B
5036	13AC	State Police Troop B
5180	143C	State Police Headquarters
5191	1447	State Police (Transportation and Environmental Safety)
5193	1449	State Police (Executive Security)
5197	144D	State Police (Hazardous Materials)
5198	144E	State Police (Hazardous Materials)
5199	144F	State Police (Emergency Operations Center)
5200	1450	State Police (Emergency Operations Center)
5201	1451	State Police (Intelligence)
5216	1460	Louisiana Air National Guard
5217	1461	Louisiana Air National Guard
5218	1462	Louisiana Air National Guard
5219	1463	Louisiana Air National Guard
5220	1464	Louisiana Air National Guard
5221	1465	Louisiana Air National Guard
5222	1466	Louisiana Air National Guard
5223	1467	Louisiana Air National Guard
5224	1468	Louisiana Air National Guard
5225	1469	Louisiana Air National Guard
5226	146A	Louisiana Air National Guard
6851	1AC3	Acadian Emergency Medical Services (Dispatch)
6852	1AC4	Acadian Emergency Medical Services (Administration)
6853	1AC5	Acadian Emergency Medical Services (Air Operations)
6854	1AC6	Acadian Emergency Medical Services (Operations)
6855	1AC7	Acadian Emergency Medical Services (Operations)
7000	1B58	National Guard Logistics
7001	1B59	National Guard Task Force 1
7002	1B5A	National Guard Task Force 2
7003	1B5B	National Guard Task Force 3
7004	1B5C	National Guard 255th Air Control Squadron
7005	1B5D	National Guard Task Force 4
7006	1B5E	National Guard Task Force 5
7007	1B5F	National Guard State Aviation Command
7008	1B60	National Guard Task Force 6

7010	1B62	National Guard State Headquarters
7016	1B68	National Guard Camps
7018	1B6A	National Guard Camp Minden
26500	6784	Orleans Parish Sheriff (Dispatch)
26501	6785	Orleans Parish Sheriff Channel 2
26502	6786	Orleans Parish Sheriff Channel 3
26503	6787	Orleans Parish Sheriff Channel 4
27503	6B6F	Plaquemines Parish Sheriff (Dispatch)
27504	6B70	Plaquemines Parish Sheriff (Tactical)
27510	6B76	Plaquemines Parish Sheriff
27549	6B9D	Plaquemines Parish Port Authority
27550	6B9E	Plaquemines Parish Health Department
27618	6BE2	Jefferson Parish Sheriff (Dispatch District 1)
27619	6BE3	Jefferson Parish Sheriff (Dispatch District 2)
27620	6BE4	Jefferson Parish Sheriff (Dispatch District 3)
27621	6BE5	Jefferson Parish Sheriff (Dispatch District 4)
27622	6BE6	Jefferson Parish Sheriff Special Events 1
27623	6BE7	Jefferson Parish Sheriff Special Events 2
27624	6BE8	Jefferson Parish Sheriff Special Events 3
27625	6BE9	Jefferson Parish Sheriff Special Events 4
27626	6BEA	Land Air Sea Emergency Rescue (LASER) Marine
27627	6BEB	Jefferson Parish Sheriff Traffic 1
27628	6BEC	Jefferson Parish Sheriff Traffic 2
27631	6BEF	Special Weapons and Tactics
27632	6BF0	Jefferson Parish Sheriff (District 1 Talk)
27633	6BF1	Jefferson Parish Sheriff (District 2 Talk)
27634	6BF2	Jefferson Parish Sheriff (District 3 Talk)
27635	6BF3	Jefferson Parish Sheriff (District 4 Talk)
27636	6BF4	Jefferson Parish Sheriff (Departmental Talk 1)
27637	6BF5	Jefferson Parish Sheriff (Departmental Talk 2)
27638	6BF6	Jefferson Parish Sheriff (Reserves)
27639	6BF7	West Bank Street Crimes Unit
27640	6BF8	East Bank Street Crimes Unit
27641	6BF9	Land Air Sea Emergency Rescue (LASER) Canine
27646	6BFE	Jefferson Parish Sheriff Records
27666	6C12	Jefferson Parish Sheriff Juvenile Assessment Center
27669	6C15	Jefferson Parish Sheriff Narcotics (West Bank Unit)
27693	6C2D	Jefferson Parish Correctional Center
27694	6C2E	Jefferson Parish Correctional Center
27976	6D48	West Jefferson Emergency Medical Services (Dispatch)
27977	6D49	West Jefferson Emergency Medical Services (Tactical 1)
27978	6D4A	West Jefferson Emergency Medical Services (Security)
27979	6D4B	West Jefferson Emergency Medical Services (Maintenance)
27980	6D4C	Westwego Emergency Medical Services (Dispatch)
27981	6D4D	West Jefferson Emergency Medical Services (Dispatch Alternate)
27982	6D4E	West Jefferson Emergency Medical Services (Supervisor)
27983	6D4F	West Jefferson Emergency Medical Services (Tactical 2)
27984	6D50	West Jefferson Emergency Medical Services (Emergency Room)
27985	6D51	West Jefferson Emergency Medical Services (Emergency Room)
27986	6D52	West Jefferson Emergency Medical Services (Security)
27987	6D53	West Jefferson Emergency Medical Services (Maintenance)
27988	6D54	West Jefferson Emergency Medical Services (Operations 1)
27989	6D55	West Jefferson Emergency Medical Services (Operations 2)
27990	6D56	West Jefferson Emergency Medical Services (Operations 3)
27991	6D57	West Jefferson Emergency Medical Services (Operations 4)
28026	6D7A	East Jefferson Emergency Medical Services (Dispatch)
28027	6D7B	East Jefferson Emergency Medical Services (Tactical 1)
28028	6D7C	East Jefferson Emergency Medical Services (Dispatch Alternate)
28034	6D82	East Jefferson Emergency Medical Services (Tactical 2)

28036	6D84	East Jefferson Emergency Medical Services (Operations 1)
28037	6D85	East Jefferson Emergency Medical Services (Operations 2)
28038	6D86	Jefferson Parish Mobility Impaired Transit System
28126	6DDE	Jefferson Parish Fire District 1 (Tactical)
28127	6DDF	Jefferson Parish Fire (Hazardous Materials)
28128	6DE0	Jefferson Parish Fire District 2 (Tactical)
28129	6DE1	Jefferson Parish Fire District 3 (Tactical)
28130	6DE2	Jefferson Parish Fire District 4 (Tactical)
28131	6DE3	Jefferson Parish Fire District 5 (Tactical)
28132	6DE4	Jefferson Parish Fire District 6 (Tactical)
28133	6DE5	Jefferson Parish Fire District 7 (Tactical)
28134	6DE6	Jefferson Parish Fire District 8 (Tactical)
28135	6DE7	Jefferson Parish Fire District 9 (Tactical)
28139	6DEB	Jefferson Parish Fire District 1 (Dispatch)
28140	6DEC	Jefferson Parish Fire District 1 (Tactical 2)
28141	6DED	Jefferson Parish Fire District 1 (Tactical 3)
28142	6DEE	Jefferson Parish Fire District 1 (Private)
28143	6DEF	Jefferson Parish Fire District 1 (Chief)
28144	6DFO	Jefferson Parish Fire Alarms (Dispatch)
28145	6DF1	Jefferson Parish Fire District 2 (Dispatch)
28146	6DF2	Jefferson Parish Fire District 2 (Tactical 2)
28147	6DF3	Jefferson Parish Fire District 2 (Tactical 3)
28148	6DF4	Jefferson Parish Fire District 2 (Talk)
28149	6DF5	Jefferson Parish Fire District 2 (Private)
28150	6DF6	Jefferson Parish Fire District 2 (Chief)
28151	6DF7	Jefferson Parish Fire District 3 (Dispatch)
28152	6DF8	Jefferson Parish Fire District 3 (Tactical 2)
28153	6DF9	Jefferson Parish Fire District 3 (Tactical 3)
28154	6DFA	Jefferson Parish Fire District 3 (Talk)
28155	6DFB	Jefferson Parish Fire District 3 (Private)
28156	6DFC	Jefferson Parish Fire District 3 (Chief)
28157	6DFD	Jefferson Parish Fire District 4 (Dispatch)
28158	6DFE	Jefferson Parish Fire District 4 (Tactical 2)
28159	6DFF	Jefferson Parish Fire District 4 (Tactical 3)
28160	6E00	Jefferson Parish Fire District 4 (Talk)
28161	6E01	Jefferson Parish Fire District 4 (Private)
28162	6E02	Jefferson Parish Fire District 4 (Chief)
28163	6E03	Jefferson Parish Fire District 5 (Dispatch)
28164	6E04	Jefferson Parish Fire District 5 (Tactical 2)
28165	6E05	Jefferson Parish Fire District 5 (Tactical 3)
28166	6E06	Jefferson Parish Fire District 5 (Talk)
28167	6E07	Jefferson Parish Fire District 5 (Private)
28168	6E08	Jefferson Parish Fire District 5 (Chief)
28169	6E09	Jefferson Parish Fire District 6 (Dispatch)
28170	6E0A	Jefferson Parish Fire District 6 (Tactical 2)
28171	6E0B	Jefferson Parish Fire District 6 (Officer)
28172	6E0C	Jefferson Parish Fire District 6 (Tactical 3)
28173	6E0D	Jefferson Parish Fire District 6 (Private)
28174	6E0E	Jefferson Parish Fire District 6 (Chief)
28175	6E0F	Jefferson Parish Fire District 7 (Dispatch)
28178	6E12	Jefferson Parish Fire District 7 (Tactical 4)
28184	6E18	Jefferson Parish Fire District 7 (Chief)
28187	6E1B	Jefferson Parish Fire District 8 (Dispatch)
28188	6E1C	Jefferson Parish Fire District 8 (Tactical 2)
28189	6E1D	Jefferson Parish Fire District 8 (Tactical 3)
28190	6E1E	Jefferson Parish Fire District 8 (Private)
28199	6E27	Jefferson Parish Fire District 9 (Dispatch)
28200	6E28	Jefferson Parish Fire District 9 (Tactical 2)
28201	6E29	Jefferson Parish Fire District 9 (Tactical 3)
28202	6E2A	Jefferson Parish Fire District 9 (Talk)
28203	6E2B	Jefferson Parish Fire District 9 (Private)
28204	6E2C	Jefferson Parish Fire District 9 (Chief)
28237	6E4D	Jefferson Parish Fire District 5 (Officer)
28238	6E4E	Jefferson Parish Fire District 6 (Chief 2)
28239	6E4F	Jefferson Parish Fire District 5 (Chief 2)
28241	6E51	Jefferson Parish Fire District 1 (Talk)
28373	6ED5	Jefferson Parish Fire District 7 (Tactical 1)

28374	6ED6	Jefferson Parish Fire District 8 (Tactical 1)	29295	726F	New Orleans Police District 7 Talk
28400	6EFO	Jefferson Parish Fire District 7 (Dispatch)	29296	7270	New Orleans Police District 8 Talk
28529	6F71	St. Bernard Parish Sheriff (Dispatch 1)	29338	729A	New Orleans Police All City 1
28530	6F72	St. Bernard Parish Sheriff (Dispatch 2)	29339	729B	New Orleans Police All City 2
28576	6FA0	St. Bernard Parish Fire (Dispatch)	29420	72EC	New Orleans Police Special 1
28577	6FA1	St. Bernard Parish Fireground 1	29421	72ED	New Orleans Police Special 2
28578	6FA2	St. Bernard Parish Fireground 2	29422	72EE	New Orleans Police Special 3
28579	6FA3	St. Bernard Parish Fireground 3	29423	72EF	New Orleans Police Special 4
28580	6FA4	St. Bernard Parish Fireground 4	29424	72FO	New Orleans Police Special 5
28581	6FA5	St. Bernard Parish Fireground 5	29425	72F1	New Orleans Police Special 6
28856	70B8	Plaquemines Parish Sheriff	29551	736F	New Orleans Fire Fireground 2A
28858	70BA	Plaquemines Parish Sheriff	29552	7370	New Orleans Fire Fireground 3A
28901	70E5	Plaquemines Parish Fire (Dispatch North)	29553	7371	New Orleans Fire Fireground 4A
28902	70E6	Plaquemines Parish Fire (Dispatch South)	29554	7372	New Orleans Fire Fireground 5A
28916	70F4	Plaquemines Parish Emergency Medical Services (Dispatch)	29555	7373	New Orleans Fire Fireground 6A
28917	70F5	Plaquemines Parish Emergency Medical Services	29556	7374	New Orleans Fire Fireground 8A
28923	70FB	Plaquemines Parish Port Authority	29557	7375	New Orleans Fire Fireground 9A
28924	70FC	Plaquemines Parish Emergency Operations Center	29558	7376	New Orleans Fire Fireground 10A
28934	7106	Plaquemines Parish Ferry	29559	7377	New Orleans Fire Fireground 11A
28935	7107	Plaquemines Parish Animal Control	29560	7378	New Orleans Fire Fireground 12A
29176	71F8	New Orleans International Airport (Emergency)	29561	7379	New Orleans Fire Operations
29177	71F9	New Orleans International Airport (Police Dispatch)	29562	737A	New Orleans Fire Dispatch
29178	71FA	New Orleans International Airport (Fire Dispatch)	29563	737B	New Orleans Fireground 2
29179	71FB	New Orleans International Airport (Fire Department)	29564	737C	New Orleans Fireground 3
29180	71FC	New Orleans International Airport (Fireground)	29565	737D	New Orleans Fireground 4
29257	7249	New Orleans Police Duty Desk	29566	737E	New Orleans Fireground 5
29259	724B	New Orleans Police Supervisors	29567	737F	New Orleans Fireground 6
29273	7259	New Orleans Police Dispatch 1	29568	7380	New Orleans Fire (Information)
29274	725A	New Orleans Police Dispatch 2	29569	7381	New Orleans Fireground 8
29275	725B	New Orleans Police Dispatch 3	29570	7382	New Orleans Fireground 9
29276	725C	New Orleans Police Dispatch 4	29571	7383	New Orleans Fireground 10
29277	725D	New Orleans Police Dispatch 5	29572	7384	New Orleans Fire (Tactical)
29278	725E	New Orleans Police Dispatch 6	29573	7385	New Orleans Fire Hazardous Materials
29279	725F	New Orleans Police Dispatch 7	29574	7386	New Orleans Fire Command
29280	7260	New Orleans Police Dispatch 8	29577	7389	New Orleans Fire Supervisors
29284	7264	New Orleans Police Traffic Operations 1	29700	7404	New Orleans Emergency Medical Services (Dispatch)
29285	7265	New Orleans Police Traffic Operations 2	29703	7407	New Orleans Emergency Medical Services
29287	7267	New Orleans Police Dispatch 9	29719	7417	New Orleans Emergency Medical Services
29288	7268	New Orleans Police Dispatch 10	29800	7468	New Orleans Harbor Police (Dispatch)
29289	7269	New Orleans Police District 1 Talk	29801	7469	New Orleans Harbor Police
29290	726A	New Orleans Police District 2 Talk	29802	746A	New Orleans Harbor Police
29291	726B	New Orleans Police District 3 Talk			
29292	726C	New Orleans Police District 4 Talk			
29293	726D	New Orleans Police District 5 Talk			
29294	726E	New Orleans Police District 6 Talk			

That's all for this month. More information is available on my website at [www.signalharbor.com](http://www.signalharbor.com), including detailed explanations of trunking and digital scanners. Please send your questions, comments and reception reports to me at [danveeneman@monitoringtimes.com](mailto:danveeneman@monitoringtimes.com). Until next time, happy scanning!

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**Q.** I understand why a balun transformer can help impedance matching, for example a 4:1 balun for matching 72 ohm coax to a 300 ohm dipole, but why would anyone use a 1:1 balun? (J.M., Indiana)

**A.** A balun (balanced to unbalanced) transformer not only matches impedances, but also allows an unbalanced line like coax to be connected to a balanced antenna like a dipole. This helps uneven currents to appear on the coax shield which would result in unwanted radiation causing distortion of the antenna pattern and/or exposure of RF power to the near-field environment.

**Q.** Somewhere you said that a very long wire antenna offers no real advantage over a shorter one because of the additional noise that would be picked up by the longer antenna. Is this true in the 200-400 kHz aviation beacon band? I've read about very long Beverage antennas are effective for beacon DXing. Don't they pick up more noise too? (Van Wilshire, email)

**A.** The Beverage has large signal and noise capture because of its length, but its pattern (directivity) is sharper than that of a long random wire so it picks up less interference and noise. Its impedance is much better matched, thus reducing line loss, and its low mounting reduces environmental noise pickup and favors direct groundwave pickup. This is true anywhere in the effective groundwave spectrum which certainly includes the LF beacon band.

**Q.** I know that radio waves in free space travel at the speed of light, but how fast do electrons flow in a wire?

**A.** It depends upon the current, but let's assume we're talking about a 100 watt light bulb (1 amp). In direct current (DC) the electrons actually do move along the wire, but at a snail's pace – about 2 feet per hour. In household alternating current (AC), they never leave home, but simply vibrate back and forth 60 times per second (60 Hz).

It's the wave of electromagnetic energy that travels along the wire at nearly the speed of light, just as with radio frequency energy moving along the coaxial cable and antenna elements in radio frequency (RF) systems.

**Q.** Is there a cure for the flutter I get on receiving 800 MHz signals with my mobile scanner?

**A.** I'm sure you get this mostly when you are driving through built-up areas due to out-of-phase, signal-cancelling reflections from buildings or even hillsides. Reader Tony Conte HP1KL had the same problem, but improved reception with dual-diversity antennas.

Tony mounted one whip on his right fender and the other on his rear deck (he drives a Toyota RAV-4). His best results were with unequal lengths of coax and those two, non-symmetrical, antenna mounting positions. Both cables are connected to the pair side of a standard TV-style splitter. The third port is connected to his scanner by a short jumper cable.

**Q.** I'd like to put up a broadband LF/HF receive-only antenna. I presently have a 75' random wire up about 30 feet and have been considering the WinRADIO WR-LWA-0130 long wire antenna adapter. What is the recommended length of wire to go with it? My limited knowledge tells me that a "long wire" means one wavelength or longer, while "random wire" is about any length. (Lee KJ4KUT)

**A.** Yes, your definitions of long wire and random wire are correct. As you've probably already figured out, a random wire can have a wide range of feed-point impedances depending on wire length, frequency, and height above ground.

Since 40-60 feet is a good average for a random wire antenna, at least 25 feet high, that transformer should work just fine on your present antenna! Fortunately, reasonable impedance mismatches don't matter much for receiving at LF/HF with large antenna apertures and minimal coax loss, but they do matter at VHF and UHF with the shorter elements wasting signals in the coax.

**Q.** Are D-STAR and WIRES the same thing? (Bill, email)

**A.** No. D-STAR (Digital Smart Technology for Amateur Radio), developed by the JARL (Japanese Amateur Radio League), was adopted by ICOM for interlinking VHF/UHF repeaters and Internet communications as well. It employs 128 kbps data and 4.8 kbps voice digitization to

improve signal handling efficiency.

WIRES II (Wide-Coverage Repeater Enhancement System) is Yaesu/Vertex's computer/transceiver interface for utilizing DTMF tones to network other WIRES users interlinked by the Internet.

There are quite a few other platforms that have been introduced for interlinking amateur radio communications including IRLP, Echo-link, AllStar, and ILINK.

**Q.** As a lead-acid battery charges, the current gradually decreases. Is that because the battery's resistance is going up? (Mark, IN)

**A.** No, it's because the increasing voltage of the battery actually opposes the voltage of the charger, and once they are the same, no current exchange takes place. A voltage must sense a potential difference in order for it to flow.

If you place a conductor across the terminals of a battery, it senses a potential difference between its positive and negative terminals and current flows because its negative electrons are attracted to the positive terminal. If it sees an identical voltage attached across its terminals, there is no potential difference to cause a current flow.

**Q.** Since my primary listening is in the VHF and UHF air bands, is there any advantage to my getting an extra-wideband discone antenna, or is a simple, inexpensive discone going to work just as well? (Chris, email)

**A.** Discones were developed during WWII for ground-to-air communications, so they are an excellent choice. They all behave about the same on the VHF/UHF air bands, so choose one that fits your fancy, you don't have to worry about extended frequency models. I'd recommend either the WinRADIO AX-71C: <http://www.grove-ent.com/wrax71c.html> or the Diamond D130J: <http://www.grove-ent.com/ANT9.html> You can leave the top vertical element off since it's for the 30-50 MHz band.

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.)



## In the Air Means On the Air

**A**hh, spring time, and just about everyone's fancy turns to thoughts of, well, aircraft. The busy skies become even busier.

Patrice Privat, a long-time listener in France, has been keeping track of his A380 hits. As most know, the A380 is the latest superjumbo from Airbus, and new ones continue to roll out to customers every day. Everyone's going to see one of these giant airliners eventually, and when they do they'll be as amazed as this editor was last fall.

As of press time, he had 58 different A380s. This is pretty good, seeing as it is probably somewhere between about one third and one half of those currently in service.



Big airplanes are most common on long, international flights. The automated digital radio system known as High-Frequency Data Link (HF DL) is a good means of picking up their position checks over the oceans.

Despite shifting technology, HF DL is still very busy worldwide. It has a distinctive sound on the radio, with a 1440-kilohertz reference tone followed a precision-timed period of phase-shift-keyed hiss. This is tuned in upper-sideband (USB) mode.

Aero fans have a number of options for the automatic decoding of HF DL and logging of new aircraft thus turned up. Several free programs by or for plane spotters are available. These are typically fed by an external decoder such as Charles Brain's PC-HF DL, or Patrick Lindecker's MultiPSK. Both of these are low-cost shareware downloads, which U.S. listeners can easily purchase over international PayPal.

HF DL prowling is a form of hunting. Due to shortwave radio's continuously changing propagation, frequencies change every few hours. Once again, one must think like the tiger to catch the tiger.

The best place to get started is with an HF DL System Table. This changes about once a year, and the latest one is always on this column's web site.

One thinks like the tiger by finding a ground station with a reliable signal. This is usually not all that hard. Then one decodes the "squitters" they transmit every 32 seconds. Any HF DL program can do this.

Each squitter contains the frequencies currently in use at that ground station, plus those

of two others. Since there are 15 stations, it takes a few minutes to rotate through them all. The practice here is to keep a list of all these frequencies at the different times of day, then go hunting from that.

Those who have trouble with this method can just program in a lot of frequencies from the overall System Table, which has hundreds, and fish around. Either way, it shouldn't take long before they are collecting airplanes themselves.

### HM01 Update

A month and a half after its discovery, the Cuban hybrid mode (designated HM01 by ENIGMA 2000) is apparently here to stay. As we go to press, it is part of the daily schedule of "numbers" broadcasts from Cuban intelligence. In fact, it appears to have replaced some schedules in the older modes.

The best times to listen are 0500 to 1100, and 2100 to 2400/0000. These times, of course, are in Coordinated Universal Time (UTC).

The most commonly used transmitter is always strong here in California, though the technical quality of the amplitude modulation (AM) signal is poor even by Cuban standards. Modulation is often weak, and hum is always bad. Transmissions rarely start right on the hour, and if they get behind, the carrier will unceremoniously cut off in mid-message when it's time to change frequencies.

While tentative HM01 schedules have been drawn up, personal listening shows these to be still in flux as this column goes to press in January. It's better to just check known frequencies for that time of day.

In the 2100-0000 period, these are 10715, 10735, 11530, 11635, 16180, 17480, 17540,

and 17580 kilohertz (kHz), all AM. The best frequencies in the 0500-1100 period are 5800, 5855, 6165, 9065, 9155, 9240, 9330, 10345, 12180, and 13435 kHz, again all AM.

The typical HM01 broadcast lasts around 25 minutes. A typical hour will have two of these, with an interlude of dead air in between. The exact timing depends on the data bursts, which vary slightly in length. These bursts sound like a busy, buzzing hiss with multiple sine-wave tones at beginning and end.

While they usually start near the top of the hour, the quarters and half have been heard. Sometimes frequencies are broadcast in parallel, but they can come on and off at different times. It's just strange.

### The HM01 Format

After some testing, HM01 has settled down into a predictable format, though there's no way to know if it's permanent. It goes something like this:

On the hour, or soon after, a carrier comes up. Sometimes it switches off again for a brief moment, before coming back to stay. A few seconds after this, the traditional machine "female" begins a preamble of six groups. Recently, all groups have been ending in the figure "1." The whole six-group preamble is repeated for just under two minutes.

Following this, there is a special long tuning tone, then the beginning of a cyclic, segmented transmission alternating voice and data. The voice will say the first of the six groups, and then a small file will be sent digitally. The voice will say the second, then digital again, and so on.

Usually this whole sequence is repeated five times, giving a total of 30 data bursts, each with its voice announcement. This generally ends sometime between the hour plus 24 and 30 minutes. After the aforementioned dead carrier, it starts over.

### Cracking HM01

So what is all the buzzing about? Let's see what is known.

As previously noted in this column, what's being heard is an old, arcane ham radio mode called Redundant Digital File Transfer (RDFT). It came out of work done in the early 2000s by Barry Sanderson, KB9VAK. He presented programs at the Dayton Hamvention, and won a technical excellence award one year.

At the time, it was pretty advanced stuff. RDFT uses eight-carrier Orthogonal Frequency Division Multiplex (OFDM). Each carrier is independently modulated by Differential Phase Shift Keying (DPSK). For highly technical reasons, the implementation is a bit quirky, and this gives the waveform some rather odd characteristics.



Cuban herald (Public domain)

A Brazilian ham, PY4ZBZ, put a much more user-friendly wrapper around Sanderson's early software, thereby adapting it to image transfer. The result was an obscure freeware package called DIGTRX. Even in this application, however, RDFT quickly lost out to a special ham adaptation of Digital Radio Mondiale (DRM).

The newest DIGTRX version seems to be 3.11, from 2005. It's still available around the Internet. Those lucky few who can keep it from crashing under Windows XP, let alone anything newer, will find that HM01 quickly fills their data folders with many little binary files.

These files are HM01's payload. They are not images, but remember that RDFT can transfer anything that can be converted into ones and zeroes.

One would expect Cuba to do things its own way, and indeed the files are a bit weird. For quite some time now, they've been named with series of number digits and the extension ".txt." This extension would indicate, both to people and machines, that they are text files. Opening

one in Notepad, however, produces gibberish, because they really are binaries.

The best way to look at them is in hex dumps. The result is still heavily encrypted data, though some people have found repeating bit strings that might or might not be some kind of headers.

And so that's what HM01 really is. It's a series of file transfers, repeated for more redundancy, with each one announced using a traditional 5-figure group said by the traditional Cuban "female" machine voice.

Attempts are being made by technically inclined people in this hobby to create a simpler and more modern RDFT decoder. Since the mode is in total disuse outside Cuba, and since little good documentation exists, it's no easy task. Sanderson himself left little behind on the Internet, and his ham radio license now shows as expired.

It is clear that HM01 is actually a pretty slick piece of engineering. Everyone is waiting to see what other new ideas might come from down there south of Florida.

## ABBREVIATIONS USED IN THIS COLUMN

AFB.....Air Force Base	Meteo.....Meteorological; weather office
ALE.....Automatic Link Establishment	MFA.....Ministry of Foreign Affairs
AM.....Amplitude Modulation	MX.....Generic for Russian single-letter beacons/markers
Camslant.....Communications Area Master Station, Atlantic	NAT.....North Atlantic oceanic air control, families A-F
CAP.....U.S. Civil Air Patrol	Navtex.....Navigational Telex
COTHEN.....Customs Over-The-Horizon Enforcement Network	NDB.....Non-Directional Beacon (Aero).
CW.....On-off keyed "Continuous Wave" Morse telegraphy	NOAA.....U.S. National Oceanic and Atmospheric Administration
DSC.....Digital Selective Calling	RDFT.....Redundant Digital File Transfer
E11.....English "Strich" family, null-message format	RTTY.....Radio Teletype
E11a.....E11 with group count and message	S28.....Russian voice messages on "UVB-76"
FAX.....Radiofacsimile	Selcal.....Selective Calling
FEMA.....U.S. Federal Emergency Management Agency	Sitor.....Simplex Telex Over Radio, modes A & B
HFDL.....High-Frequency Data Link	TACAMO.....TAke Charge And Move Out
HFGCS.....High-Frequency Global Communications System	UK.....United Kingdom
HM01.....Cuban "Hybrid Mode" using voice & digital	Unid.....Unidentified
ID.....Station identification	U.S.....United States
LDOC.....Long-Distance Operational Control	USAF.....U.S. Air Force
M01-1.....Numbers in 2-tone Morse, identifier "197"	USCG.....U.S. Coast Guard
M18.....Russian intelligence CW pseudo-time station	V13.....Taiwan music and numbers in Standard Chinese
MARS.....U.S. Military Auxiliary Radio System	Volmet.....Scheduled, formatted, aviation weather broadcasts

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

490.0	TFA-Grindavik Radio, Iceland, Sitor-B Navtex weather in Icelandic, at 2140. "L"-DDH49, Pinneberg, Germany, Sitor-B Navtex weather in German, at 2150 (PPA-Netherlands).	3330.0	CHU-Canadian National Research Council time signals, Ottawa, announcement in reduced-carrier upper sideband, also on 14670, at 2052 (PPA-Netherlands).
504.0	"NEED"-Unknown radio beacon, on for months, CW ID at 0335 (Mario Filippi-NJ).	3413.0	Shannon Volmet, voice synthesized female with weather for European airports, at 0126 (Filippi-NJ).
523.0	JJH-NDB, Fulton County Airport, Johnstown, NY, CW ID at 0151 (Filippi-NJ).	3803.1	The Clock-Russian time string station (M18), sending the time of day (UTC +7) continuously, CW at 2248 (MPJ-UK).
1700.0	WPSH468-Manville Department of Emergency Management, NJ, AM traveler's information station with contact information from voice-synthesized "female," then repeating local NOAA weather broadcast, at 2030 (Filippi-NJ).	4207.5	004122100-Shanghai Radio, China, answering DSC call from 266338000, Swedish flag roll-on/roll-off passenger ship <i>Figaro</i> (SMIO), at 2231 (PPA-Netherlands).
1890.0	Unid-Dutch Coast Guard, Den Helder, maritime safety broadcast at 1955 (PPA-Netherlands).	4212.0	XSQ-Guangzhou Radio, China, CW ID in Sitor-A marker, at 1850 (PPA-Netherlands).
2142.5	ZLST-German Customs control post, Cuxhaven, ALE and data with ZHID, Customs Boat <i>Hiddensee</i> (DLVK), also on 2673, at 0003 (MPJ-UK).	4215.0	XSG-Shanghai Radio, China, Sitor-B traffic list, at 1850 (PPA-Netherlands).
2177.0	002570500-Florø Radio, Norway, DSC call to 538001679, drilling rig <i>Transocean Arctic</i> (V7DO6), at 2008 (PPA-Netherlands).	4331.0	4XZ-Israeli Navy, CW markers and numbered messages in 5-letter groups, simulkeyed on 4593 and 6607, at 0248 (Filippi-NJ).
2187.5	LAGR5-Norwegian flag chemical tanker <i>Kristin Knutsen</i> , DSC call to PHOO, Dutch cargo ship <i>Sylvia</i> , at 2210. (MPJ-UK).	4405.0	TAH-Istanbul Radio, Turkey weather in Turkish and English, at 1812 (PPA-Netherlands).
2579.0	IPB-Bari Radio, Italy, voice-synthesized female with navigation warnings in Italian, at 0310 (PPA-Netherlands).	4490.0	197-Unknown agency, hand sent 2-tone-Morse (M01-1), speeding up and making errors, at 2000 (MPJ-UK).
2598.0	VCP-Canadian Coast Guard, Placentia, weather in a live male voice, at 0111 (Filippi-NJ).	4537.5	NDSW03-German Water Police boat 3 (DJ3238), ALE and data with NDSWSPOL, police in Oldenburg, at 2156 (MPJ-UK).
2618.5	GYA-UK Royal Navy, Northwood, grainy FAX surface analysis chart, at 0403 (Filippi-NJ).	4583.0	DDK2-German Weather Service (DWD), Pinneberg, RTTY weather in text and code groups; similar on 7646, 10100.8, and 11039; at 0400 (Filippi-NJ).
2624.0	IQX-Trieste Radio, Italy, voice-synthesized female with Adriatic weather in Italian, at 0454 (PPA-Netherlands).	4610.0	GYA, FAX surface analysis chart at 0408 (Filippi-NJ).
2642.0	ICB-Genova Radio, Italy, voice-synthesized female with gale warnings in Italian, at 0452 (PPA-Netherlands).	4618.0	BP26-German Federal Police boat <i>Eschwege</i> , calling BPLEZS (Cuxhaven), also on 5258, ALE at 1906 (PPA-Netherlands).
2656.0	IPA-Ancona Radio, Italy, Adriatic weather in Italian, at 0451 (PPA-Netherlands).	4625.0	MDZHB-Russian military, strategic group call sign for Russian voice messages (S28) on The Buzzer, sending "62 504 PILAV 47," then a shout and "Stop" in Russian, but continued "95 53 31," at 1315 (Ary Boender-Estonia remote).
2719.0	IZN-Porto Torres Radio, voice-synthesized female with weather in Italian, at 2033 (PPA-Netherlands).	4675.0	Bodo-NAT-D, Norway, working Emirates 226, a B777 reg A6-EGB, at 0746 (PPA-Netherlands).
2748.0	YQI-Constanta Radio, Romania, navigation warnings at 1939 (PPA-Netherlands).	4894.0	RGR35-Russian Navy vessel, working RIT, Severomorsk, CW at 1853 (PPA-Netherlands).
2749.0	Unid-Canadian Coast Guard, male and female voices with bulletins in French, at 0050 and 1701 (Filippi-NJ).	4979.0	RAL2-Russian Navy aircraft, CW radio check with RMW2, at 2132 (PPA-Netherlands).
2860.0	4XZ-Israeli Navy, Haifa, CW marker at 1943 (PPA-Netherlands).	5119.0	Unid-Polish military, female giving numbers in Polish, then ALE (no copy), at 0814 (Michel Lacroix-France).
2872.0	Shanwick-NAT-C, selcal GM-DE for MM62244, an Italian Air Force Falcon 900, at 0623 (PPA-Netherlands).	5195.0	DRA5-Deutscher Amateur-Radio Club, Germany, CW propagation beacon at 0820 (Lacroix-France).
3310.0	UTT-Odessa Radio, Ukraine, weather and ID in Russian, at 2048 (PPA-Netherlands).	5320.0	197-M01-1, CW callup 197 316 30 and message, at 1800 (MPJ-UK).

5500.0 New York-Caribbean air traffic control, working various aircraft at 2300. Galvin 237-Galvin Flying Services, given 3455 kHz secondary, at 2318 (Mark Morgan-OH).

5622.0 014-HFDL ground station, Krasnoyarsk, Russia, working G1A878, a Garuda Indonesia A330 reg PK-GPH, at 1958 (PPA-Netherlands).

5652.0 004-HFDL ground station, Riverhead, NY, working VS010K, a Virgin Atlantic A340 reg G-VEIL ("Queen of the Skies"), at 0718 (PPA-Netherlands).

5680.0 Rescue 131-UK Sea King helicopter, working Kinloss Rescue, Scotland, at 1808 (Lacroix-France).

5732.0 718-USCG HC-130H #1718, working LNT, Camslant Chesapeake, VA on COTHEN, at 0427 (PPA-Netherlands).

5755.0 VMW-Australian Bureau of Meteorology, Wiluna, FAX 48-hour wave forecast chart, at 1315 (Rich Ray-IL).

5807.0 ZKFL-New Zealand MetService, Wellington, FAX 48-hour surface forecast chart, at 1303 (Ray-IL).

5810.0 197-M01-1, CW callup 197 131 30 and message, at 1500 (MPJ-UK).

6330.0 BB3-Israeli Air Force, calling AAA (control), at 1917 (PPA-Netherlands).

6340.5 NMF-USCG, Boston, MA, FAX broadcast schedule at 1422 (Filippi-NJ).

6379.0 4XZ, CW message number 705, at 2139 (Lacroix-France).

6390.1 AQP-Pakistan Navy, CW marker at 2144 (Lacroix-France).

6405.0 Amba-Samara Airport, Russia, radio checks with Torba (Saratov Airport) and Brashka (Chelyabinsk Airport), at 0430 (PPA-Netherlands).

6501.0 NMN-USCG Camslant, ending "Iron Mike" weather at 0416 (PPA-Netherlands).

6532.0 G-VWIN-Virgin Atlantic A330 "Lady Luck," flight VS0601, HFDL log-on with Shannon, at 2125 (MPJ-UK). IYE740-Yemenia Yemen Airways A320 reg 70-AFA, HFDL position for Shannon, at 2213 (Patrice Privat-France).

6535.0 Dakar-African air route control, Senegal, selcal BJ-KM for Speedbird 248, a British Airways B777 reg G-YMMD, at 0600 (PPA-Netherlands).

6604.0 Gander-Gander Volmet, weather report for Quebec, also on 10051, at 2258 (Morgan-OH).

6640.0 New York-Aeronautical Radio, Inc. LDOC, selcal check with Delta 104, at 0515 (Allan Stern-FL).

6661.0 004-HFDL ground station, Riverhead, NY, uplink to VP-BUN, an Aeroflot A319, flight SU1001, at 0744 (PPA-Netherlands).

6676.0 HSD-Bangkok Volmet, with station ID at 1814 (Lacroix-France).

6933.0 KPZL-Pirate "KPZL Puzzle Radio," repeating CW loop with ID, "puzzle this," coded message in 15 5-letter groups, and "happy new year," at 2317 (Hugh Stegman-CA).

7527.0 CDI-COTHEN Remote Transmitter, Cedar Island, NC, calling TSC, COTHEN Technical Service Center, FL, ALE at 0820 (Privat-France).

7654.0 New Star Radio Station (V13), Program 4, Chinese music and coded messages at 0800 (Boender-Hong Kong remote).

7688.0 V13, Chinese music and messages at 0500, 0600, and 1300 (Boender-Hong Kong).

7795.0 JMH2-Japan Meteorological Agency, Tokyo, FAX 36-hour forecast chart, at 1256 (Ray-IL).

7880.0 DDK3-DWD, Pinneberg, FAX North Atlantic ice chart at 2105 (Ray-IL).

8106.9 SVJ4-Athens Meteo, Greece, FAX wind chart at 0850 (Lacroix-France).

8116.0 197-M01-1, CW callup 197 251 30, at 2000 (MPJ-UK).

8140.0 BMF-Taiwan Central Weather Bureau, Taipei, FAX satellite image at 1326 (Ray-IL).

8360.0 Unid-Possible Russian military, bad hand sending of coded CW messages, at 0118 (Filippi-NJ). [This activity has been on this frequency for many years. -Hugh]

8423.0 SVO-Olympia Radio, Pirgos, Greece, CW marker at 0039 (Filippi-NJ).

8435.0 XSQ, watery-sounding CW marker at 1338 (Filippi-NJ).

8467.5 JSC-Kyodo News, Japan, noisy FAX newspaper with interference, at 1626 (Lacroix-France).

8473.0 WLO-ShipCom, AL, "RY" test tape and ID in RTTY and Sitor-B, then Gulf weather, at 0111 (Filippi-NJ).

8495.1 "A"-Russian Navy CW cluster beacon (MX), Astrakhan, single-letter ID at 0127 (Filippi-NJ).

8503.9 NMG-USCG, New Orleans, LA, FAX tropical surface analysis at 0025 (Filippi-NJ).

8550.0 CTP-Portuguese Navy, Oeiras, RTTY test loop at 0431 (Filippi-NJ).

8805.0 ASKAR64-Polish Army, calling IGEIIT37, ALE at 1435 (Lacroix-France).

8819.0 Tashkent Volmet, aviation weather in Russian, at 1355 (Lacroix-France).

8879.0 A9C-AJ-Gulf Air (Bahrain) A320, flight 053, answered selcal CS-FJ from unknown ground station, at 1745 (Privat-France).

8894.0 011-HFDL ground station, Albrook, Panama, uplink to N19141, a United Airlines B757, at 0441 (PPA-Netherlands).

8903.0 Naha-Central/West Pacific air route control, Japan, working AAR602, an Asiana Airlines B777 reg HL7596, at 0758 (PPA-Netherlands).

8933.0 New York-LDOC, selcal BC-AR for JetBlue 706, an A320 reg N509JB, at 0120 (Stern-FL).

8942.0 LAA305-Lybian Airlines, HFDL position (off Tunisia) for Shannon, at 1904. AFR006-Air France A380 reg F-HPJD, HFDL position (North Atlantic) for Shannon, at 2005 (Privat-France).

8948.0 G-VBUC-Virgin Atlantic A340 "Lady Bird," flight VS0603, HFDL position for Canarias (Canary Islands), at 2124 (MPJ-UK).

8971.0 Fiddle-U.S. Navy Tactical Service Center, FL, clear and secure with P-3Cs Tiger 711 and 713, at 1747 (MDMonitor-MD).

8977.0 QTR075-Qatar Airways Boeing 787 Dreamliner, reg A7-BCB, HFDL position for Reykjavik, at 1021 (Privat-France). G-VNYC-Virgin Atlantic A330 "Uptown Girl," flight VS0026, HFDL log-on with Reykjavik, at 1755 (MPJ-UK).

8992.0 CTM1037-French Air Force A310, reg F-RADB "Republique Francaise," working ground station in French, at 0956 (Lacroix-France).

9031.0 Inclusive-U.S. military, setting up data comms with Obedient, at 1959 (Jack Metcalfe-KY).

10000.0 "Italable"-Bootleg Italian time station, music and announcements at 50 seconds after each minute, at 1035 (Lacroix-France).

10087.0 014-Krasnoyarsk HFDL, working SU1743, an Aeroflot A330 reg VQ-BPK, at 0737 (PPA-Netherlands).

10145.0 CM2-Algerian military 2nd regional command center, Oran, calling BSF in ALE, similar on 12167, at 0807 (PPA-Netherlands).

10366.0 RAP-Saudi Arabian Airfield Status Net, calling JAP, ALE at 1502 (MPJ-UK).

10388.0 RFH61-Russian Navy vessel, working RIW (Moscow headquarters), CW at 0824 (PPA-Netherlands).

10543.0 RCV-Russian Navy, Sevastopol, Ukraine, calling vessel RBE86 with traffic, at 0846 (PPA-Netherlands).

11089.0 KVM-70-NOAA, HI, FAX infrared satellite image at 0049, then schedule at 0102 (Filippi-NJ).

11175.0 Yokota-Ascension-USAF HFGCS, Ascension Island, patching to Sigonella Duty Office, Italy, for Brickyard, a P-3C, who reports that it diverted and is now safely on the ground, at 0425 (Stern-FL). Sigonella-USAF HFGCS, Italy, SKYKING message at 1138. Act Wise (sounds like)-US military, patch via Puerto Rico with no answer, then working Dark Star (likely E-3C back end), at 2004 (Morgan-OH). Obedient-U.S. Navy E-6B TACAMO, patch via Andrews HFGCS, at 1900 (MDMonitor-MD).

11220.0 Offutt-USAF HFGCS, NE, patch to Little Rock AFB Command Post for Reach 635, an Air Mobility Command transport which is returning to base due to a leak, at 2204 (Stern-FL).

11342.0 New York-LDOC, patch to Medlink for United 568 regarding a sick passenger, at 1735. New York, radio check with N298W, a Falcon 900 bizjet on the ground, at 1820 (Stern-FL).

11384.0 ETH706-Ethiopian Airlines B787 Dreamliner, reg ET-AOQ, HFDL position for Shannon, at 1246 (Privat-France).

11387.0 Karachi Volmet, Pakistan, aviation weather at 1448 (Lacroix-France).

12222.0 N08-USCG HC-144A #2308, COTHEN ALE sounding at 1021 (PPA-Netherlands).

12263.0 KCCK-U.S. flag oil tanker *Houston*, position and radio check with unknown station, at 1537 (Metcalfe-KY).

12362.0 VMW-Wiluna Meteo, Australia, bulletins at 1357 (Lacroix-France).

12365.0 VMC-Charleville Meteo, Australia, weather at 1545 (Lacroix-France).

12412.5 NOJ-USCG, Kodiak, AK, FAX 48-hour wind/wave forecast chart, at 2240 (Ray-IL).

12577.0 25000609-Irish flag cargo vessel *Arklow Ruler* (EIXQ), DSC with Lyngby at 1250 (Privat-France). SVLN-Greek flag oil tanker *Minerva Helen*, DSC safety tests with USCG Boston and Madrid Rescue Coordination Center, Spain, at 1628 (MPJ-UK).

12789.9 NMN-USCG, VA, FAX schedules and cyclone forecast explanation, at 1430 (Filippi-NJ).

12840.5 PBB-Dutch Navy, Den Helder, RTTY channel availability marker, at 1557 (Lacroix-France).

12843.0 HLO-Seoul Radio, Korea, CW marker at 0106 (Filippi-NJ).

12856.0 XSG, weather in English at 0918 (PPA-Netherlands).

12935.0 HLG-Seoul Radio, Korea, CW marker at 0822 (PPA-Netherlands).

13101.0 KLB-ShipCom, WA, parallel broadcast of voice-synthesized weather, also on WLO using 13110 and 13152, at 1807 (Filippi-NJ).

13300.0 Kenyan 116-Kenya Airways B767 reg 5Y-KYW, position for Nairobi, at 1048 (Lacroix-France).

13303.0 G-VWKC-Virgin Atlantic A340 "Miss Behavin," flight VS0009, HFDL log-on with Canarias, at 1729. G-VATL-Virgin Atlantic A340 "Miss Kitty," flight VS011B, HFDL position for Canarias, at 1730 (MPJ-UK).

13446.0 FC1FEM-FEMA Region One communications (WGY901), MA, ALE sounding at 1550 (Lacroix-France).

13882.5 DDK6-Hamburg Meteo, FAX surface chart at 1600 (Ray-IL).

13927.0 AFA5QW-USAF MARS, IN, patch to Beale AFB Ops, CA, for Piñon 71, a U-2 at 70,000 feet declaring an inflight emergency and returning to base, at 2130 (Stern-FL).

13988.5 JMH4-Tokyo Meteo, FAX 96-hour surface chart, at 0020 (Ray-IL).

13993.0 AFA1FF-USAF MARS, MA, Transcon Net with AFA5CD, IN, at 1720 (Stern-FL).

14000.0 Unid-Voice-synthesized weather, received on several radios, cut abruptly at 1542 (Metcalfe-KY). [Oops. -Hugh]

14410.0 Unid-"Stritch" family (E11a), callup 954/40, at 1110 (Boender-Netherlands).

14600.0 SPT424-Polish military, working SNB813, ALE at 1224 (MPJ-UK).

14609.5 OEY61-Austrian Army, part of UN Syrian force, working OEY20, also on 17103.2 and 18223.5, ALE at 1136 (MPJ-UK).

14925.0 HK12-Finnish MFA, Helsinki, working ANK, Ankara embassy, Turkey, at 1256 (MPJ-UK).

15632.0 E11a, callup 716/30 at 1155. E11, null-message callup 228/00, at 1540 (MPJ-UK).

16123.0 Puerto Rico-USAF HFGCS, came from 11220 for a patch with Razor 83, at 1459 (Stern-FL).

16180.0 Unid-New Cuban AM "Hybrid" (HM01), alternating standard "female" voice with RDFT data waveform, in progress at 2140 (Stegman-CA).

16341.7 Unid-Probably Egyptian MFA, Cairo, ARQ selcal to KKXD, unknown embassy, at 1423 (MPJ-UK).

16809.0 WLO-ShipCom, CW ID in Sitor-A marker, at 1748 (Filippi-NJ).

17093.6 AQP7-Pakistan Navy, Karachi, CW marker at 0934 (PPA-Netherlands).

17103.2 XSG, CW weather and traffic list at 0918 (PPA-Netherlands).

17916.0 SDJ-Stockholm LDOC, selcal check PR-EF with D-AGEU, a Germana B737, at 0911 (PPA-Netherlands).

28182.0 VYOSNO-Amateur ten-meter CW beacon, Iqaluit, Canada, giving grid-square location as FP53RS, at 1726 (Filippi-NJ).





## Another Mystery ALE Network

This month we take a look at an oddball ALE (Automatic Link Establishment) network, a detailed run-down of the Pakistani Navy's HF digital activities and an update on Chilean Army traffic.

This network is a little different from a few oddballs covered in past editions of this column. In many ALE networks, particularly those based on Codan-manufactured equipment carrying data and voice, we see two distinct but related sets of identifiers: one used for sounding and triggering voice traffic, the other is usually for modem traffic. An example of this would be the Mauritanian Gendarmerie network featured here in July 2011 where ALE and voice IDs cover 1001 to 1014 and data IDs cover 901001 to 914001. In this case, there is a clear one-to-one relationship between the two sets of identifiers even though the two "networks" never interact with each other.

A recently discovered network certainly shares the concept of two distinct sets of identifiers at work on each channel that never interact, but the one-to-one mapping between the two sets is missing. In this case, we have the following identifiers in use:

1536, 2536, 3536, 6536, 9356, 17536  
101, 102, 103, 110, 111, 117, 120, 153, 315,  
334, 420

Channels being used include: 6992, 7627, 8100, 11490, 12500, 14560 and 17878 kHz USB. To date, neither voice nor data traffic has been received. Take a listen and see if you can help!

### ❖ Pakistani Naval HF Operations

Pakistan operates a modest naval fleet comprising 11 frigates, 8 submarines, 8 missile boats, 3 mine hunters and a variety of support and training ships from fleet headquarters in the southern port of Karachi. The administrative headquarters is located in Islamabad and there are 6 other bases dotted around the country's coastline. You can hear these ships and bases quite easily during most times of day and night, with a variety of communication modes in use.

Morse Code: You can hear AQP (Islamabad) with a variety of weather and navigation reports or with the idle marker of "VVV VVV VVV DE AQP2/4/6" on 2458.5, 6390, 6391, 6393, 6394, 8490, 8491 and 13011 kHz.

MIL-188-141A ALE, 2400 bd Rohde & Schwartz modem, the STANAG 4285 2400 bd modem and voice have been heard on 2487, 3590, 4348, 4514, 5646, 7630, 8143, 10962, 12876, 13580 and 18665 kHz USB. ALE identifiers in use include:

AHSAN = Ahsan Shore Unit  
BABUR = Frigate "Babur"  
BADR = Frigate "Badr"  
COMSCHOOL1 = Nval Communications School, Bahadur  
KHAIBAR = Frigate "Khaibar"  
KW = "Karachi Wireless" Fleet HQ, Karachi  
MADADGAR = Tanker "Madadgar"  
MOAWIN = Auxiliary "Moawin"  
NASR = Auxiliary "Nasr"  
NATHIAGALI = Naval Base, Nathia Gali  
NRS = Naval Radio Station, Islamabad  
SJAHAN = Frigate "Shah Jahan"  
SULTAN = Frigate "Tippu Sultan"  
TARIQ = Frigate "Tariq"  
ZULFIQAR1 = Frigate "Zulfiqar"

Modem traffic is triggered by the UUF (User Unique Function) ALE code of "124 0 5" so if you see such an exchange between stations, you'll hear data soon. Listeners have also copied a variety of text strings sent using ALE's AMD or "text message" function, such as these: BNBCPIM, HFDKABNI, HNDKBBPM, JFJILLPDJMDK, IFDNNLODLMDKANFK and MFPFDGOBLNDKANPL, though their meaning has not been determined.

PacTOR-II modem ARQ (Automatic Repeat Request) traffic has been heard on 8282 kHz USB and PacTOR-II in FEC (Forward Error Correction) mode on 10404, 10512, 12220, 12424, 13067, 14850, 16602, 18244, 19888, 20820 and 22635 kHz USB.

PacTOR call signs are ARL for Karachi, together with the official four letter IMO call signs of the warships. Traffic is usually encrypted using an off-line five letter group system as this example depicts:

ZCZC  
QLOFR MQUIM DDMAA EIINQ EJNSW KXOTE  
UVNCQ DYJFD UDVTQ QFWRB  
CYGBS FGKZP KNIMN MOOKD KGWVVB HFXXD  
ELZWI OLGCB SXARK PMXTR  
IIBXP LOHSZ JUSFT OKYEX ECVVS BGTHF SSJWI  
KYVZB QVZEL OKPYH  
LSDLP GZNTM MUUZE WMWEQ OPMXE  
POOWM HGGJM UYXGU ARRZD GIXS  
ETWLC TYCPO  
NNNN

Note that PacTOR modem traffic is centered at 1700 Hz above the USB (carrier) frequencies quoted above.

### ❖ Chilean Army

A number of units of the Chilean Army had been heard building up their ALE activity a few years ago. Back then, channels included 6920, 7527, 7755, 7922, 8125, 9075 and 10530 kHz USB. However, these have been quiet since early 2010. Note the close spacing or clustering of channels, probably indicating a short-range NVIS (Near Vertical Incidence Skywave) HF network arrangement (see Resources). Former

ALE identifiers were "BASE" followed by the nickname of the unit. For example, "BASELO-SANGELES" for the 17th Reinforced Regiment aka "Los Angeles."

In November of 2012, the network appeared again, this time with a different pool of channels and some slightly modified identifiers. So far, the following frequencies have been heard: 7500, 10320, 11200, 11300, 11350, 11380 and 11450 kHz USB. Doubtless there will be more to be found close by the 7 and 10 MHz channels if the NVIS theory is correct. Sounding times are quite lengthy at around 30 seconds per channel and the system scans from lower to higher frequencies, making it relatively easy to find new channels once one frequency has been identified.

Here are the new identifiers heard at the time of writing:

JEFKOM	Army HQ, Santiago
RA2MATURANA	2nd Artillery Regiment, "Maturana", Valdivia
RCBLHUSARES	3rd Cavalry Regiment, "Husares", Valdivia
RI12SANGRA	12th Infantry Regiment, "Sangra", Valdivia
RR3YUNGAY	3rd Reinforced Regiment, "Yungay", Santiago
RR7CHACABUCO	7th Reinforced Regiment, "Chacabuco", Valdivia
RI23COPIAPO	23rd Infantry, "Copiapo", Copiapo

### ❖ A Tale of THOR

For many months, a fellow monitor on IRC (Internet Relay Chat) and I had been hearing a very weak multi-tone FSK (MFSK) signal centered on 11111.8 kHz. Many times, we also heard voices speaking Arabic after the MFSK but the data defied decoding. Quite by accident a few months ago, I happened upon the free Fldigi decoder software (see Resources) which handles many different types of amateur radio data modes. Fldigi's excellent webpages also contain audio clips of these modes for identification.

There I found a little-used MFSK mode called THOR which matched what we had been hearing on 11111.8 kHz. Quite to my surprise, the data happened to be between two US Navy MARS (Military Affiliate Radio Service) stations in California, far away from any Arabic connection. Sometimes, you just have to persevere with often surprising results! Until next time, enjoy your digital HF DX.

### Resources

NVIS Radio - [http://en.wikipedia.org/wiki/Near\\_Vertical\\_Incidence\\_Skywave](http://en.wikipedia.org/wiki/Near_Vertical_Incidence_Skywave)  
Fldigi Software - <http://www.w1hkj.com/Fldigi.html>

## Hilltopping: Outdoor DX Fun at ‘Towering’ Heights!

In my day, most ops found their way to amateur radio via shortwave listening or broadcast band DXing. All roads lead to Rome, however, and there are countless paths to our favorite hobby. Considering this month’s topic, the path taken by a particular fellow ham is especially interesting. Even before getting his ticket he was crazy about RF, and his backyard sported a 48-foot tower and three high-gain Yagis! None of the antennas were cut for the ham bands in particular because they were *TV antennas*. My friend was a crazed, enthusiastic TV DXer, analog and then digital! I was used to ham radio and big-dish satellite antenna farms, but this was my first encounter with an advanced TV DXer. I guess I shouldn’t have been surprised!

The parallels between the two pursuits are many. Hams seek DX contacts on VHF/UHF via any and all standard or exotic propagation modes, and TV DXers do the same, looking for elusive digital TV signals, also on VHF/UHF. (Since 2009 all TV signals in the US are digital, but super band openings can bring analog TV DX to some parts of the country.)

His “TV antenna and tower progression” sounds very familiar. The first DX antenna to be erected was a large “fringe area” log-periodic beam and an inexpensive rotator mounted at a meager 20 feet above ground.

It wasn’t very effective! Next came a roof-mounted mast, which the big antenna liked even better, but things didn’t really improve until the “old school” aluminum was replaced with dedicated VHF/UHF Yagis perched atop the Rohn tower. With a mast-mounted preamp, signals in a 100-mile radius are ho-hum, with stations from all across the country going into the log during tropo sessions or other band openings.

How much antenna gain is enough? How tall is too tall for a backyard tower? Predictably, whether ham or TV DXer, the quest for ever-higher towers and ever more gain continues unabated! During one “fantasy antenna discussion” I mentioned the practical tower-height restrictions that came with living close to a major airport and the financial restrictions that came with purchasing land for and erecting “broadcast or military height” towers. As a passive-aggressive condo dweller I felt it especially necessary to rain on his parade!

I countered his backyard tower daydreams with a reality that can equalize the playing field for every ham, regardless of real estate or budget—hilltopping! If you can’t bring the tower to your shack, bring your shack to the “tower.” To prove my point we attached a trailer to his car and loaded up receivers, power inverters, preamps and several antennas, including a huge, home-brew Gray-Hoverman stacked array. Shown in the photo, the GH looks like a bed spring the size of a pool table. It may be the most awesome TV antenna ever designed, and you can build one for yourself (see photo caption).

We checked signals at several locations around town: the top of a downtown parking ramp, the top of the tallest hill in town, and the parking lot of my out-of-town condo (which is 20 feet shy in elevation of the highest point in the county, which isn’t all that impressive compared to real hills and mountains). Each of our test “hilltops” was 75 to 350 feet higher than the top of my friend’s tower, and the strength of the faraway signals was proof positive that HAAT (height above average terrain) is a VHF DXer’s best friend. Hill-toppers have known this bedrock truth for decades.



*Just tell the neighbors it’s a UFO detector! The 6- and 2-meter beams atop ACOTA’s tower look completely normal, as does the open-wire feed line running up the right-hand side. But what about the giant bedspring in the middle? Once used in a hilltopping experiment (see text), this two-bay Gray-Hoverman array (with screen reflector) sports up to 18 dB gain on UHF TV channels, with equally fantastic front-to-back and beamwidth performance. Released to the public under the GPL open-source license, these beauties can also be designed for single frequencies. They would probably make awesome UHF scanner antennas. To build one for your station, see [www.digitalhome.ca/ota/superantenna](http://www.digitalhome.ca/ota/superantenna). (Photo courtesy of Kevin Adler, ACOTA.)*



*David Palmer, KB5WIA, of Fairfield, California, works the ARRL September VHF Contest from atop Brokeoff Mountain in Lassen National Park. Located in grid square CN90, at the Northern end of California’s Central Valley, at 9,200 feet in elevation, the peaks are a lot taller than any backyard tower! The trade-off? A three-hour hike to get there! David’s “standard hilltop” station includes a Yaesu FT-817ND all-mode transceiver (1.8-432 MHz, 5 W), an Elk dual-band log-periodic antenna for 2 meters and 70cm, and an M2 HO-Loop antenna for 6 meters. It’s all powered by a K2 Energy LiFePO4 battery pack and two 20-W PowerFilm solar panels. You can see more of David’s hilltopping and satellite excursions at <http://kb5wia.blogspot.com>, and [www.qrz.com/db/KB5WIA](http://www.qrz.com/db/KB5WIA). (Photo by Melanie Palmer and courtesy of David Palmer KB5WIA.)*

to the nearest hilltop. Heck, even hand-helds work in some East and West Coast ham-dense areas.

How far will your signals carry? Well, how high is your picnic area? The greater the hilltop's height above average terrain (HAAT), within the bounds of safety and reason, of course, the better! Without enhanced propagation, a 10-W signal that usually works out to say, 30 miles, may now cover 100 to 400 miles! Welcome to hilltopping! And with tropo or E-skip, make that 100 to 2000 miles!

If you're wondering why hilltop ham signals seem to work so much better than digital TV signals, remember that TV signals are wideband (several megahertz wide) and serve customers who mostly have poor antennas and even worse receivers. That's why a TV station's effective radiated power is between 20 kW and a megawatt or so! Your narrowband ham rig, even if it's not state of the art, offers a much better power density (10 W spread out over 3 kHz versus 50 kW spread out over 6 MHz).

## ❖ Hills or Mountains—It's All Good

If your home station lacks a world-class tower or is stuck in an RF rut, whether at HF, VHF or UHF, take a portable version of your station to an accessible location that towers above the average terrain. Hilltopping is good, but mountaintopping is even better. And if there aren't any hills nearby, what about tall buildings or tall parking ramps? Any lofty location that you can get to safely, and with permission, could produce amazing results, especially during contests or other organized on-air events. If your home station antenna is 20 feet above average terrain, a site that's 300 feet above average terrain will make a *huge* difference.

Hilltops or mountaintops with scenic overlooks, wayside rests or commercial parking lots can make excellent portable operating sites. Do your best to stay out of other people's way, and make sure you're not trespassing or breaking other laws. If you're on private property, get permission (in advance, if possible). Don't let Hilltopping Fever turn you into a "bad ambassador." And make sure you don't leave garbage or antenna parts laying around. Frustratingly, some popular hilltops get really crowded during VHF/UHF contests, so play nice with the other kids!

Some of the best elevated superspots may require hiking, biking or four-wheelers. Your extra efforts will be rewarded with excellent RF performance, scenic beauty and little or no RF interference. Bring extra batteries and leave the heavy transceivers at home! Google Maps makes it easy to find suitable high spots in your neck of the woods.

## ❖ Gear Up

Modern DC-to-daylight mini-rigs are the easiest way to start your hilltopping adventures. These handy little rigs cover HF through 50, 144 or 432 MHz, weigh only one to five pounds, run



*To facilitate my own hilltopping efforts this year, Santa dropped an Elecraft KX3 HF+6 transceiver kit down my chimney (he usually ignores me completely)! The challenge now is to find the time to assemble and test the little high-performance, trail-friendly rig before the season gets underway. This is one of the main PCBs. For the rest, see [www.elecraft.com](http://www.elecraft.com). (Courtesy: Author)*

on batteries and put out 5-10 W (or 50-100 W with suitable power sources). Candidates include Yaesu's FT-817, FT-857, and FT-897; ICOM's IC-7000, IC-706, IC-703; or Elecraft's KX3 (which presently lacks 144- and 432-MHz coverage but offers chart-topping, "home-station" performance, even in the field). Many other rigs will get the job done (as long as you can provide power), even hand-helds if FM is on your agenda.

For VHF/UHF, small beam antennas are the most popular. Two or three elements on 6 meters and a half-dozen elements on 2 meters will work wonders. Make sure you bring along a mast (or convertible hiking stick) that can be conveniently mounted at your operating position, even if it's just tall enough to get the antennas 6 to 20 feet above the ground. "Armstrong" rotation is just fine—there's no need to get carried away just yet.

At VHF and above, be sure to use the correct antenna polarization when switching from FM to SSB/CW, or you'll suffer a whopping 20 to 30 dB signal loss! FM signals are almost always vertically polarized, so your Yagi will have to be oriented so its elements are parallel to the mast (straight up and down). In that configuration, make sure your mast is wood or fiberglass—not aluminum or steel—or you'll destroy its pattern and gain! SSB and CW signals are almost always horizontally polarized, so your Yagi will have to be oriented so that its elements are perpendicular to the mast (side to side).

Your vehicle battery can usually handle low-power rigs, but to be safe, consider bringing along a second, fully charged battery (or a small portable generator) so you won't need to be rescued. This is a must if you're using an amplifier. Not all hilltoppers run low power!

## ❖ Elevated Activities

No matter what the occasion, hilltopping is a great way to combine radio with outdoor activities, but if you want to work and hear

dozens or even hundreds of stations across a weekend afternoon, or you want to *be the DX* for a change, try hilltopping during one of the large VHF+ contests (and Field Day) held throughout the spring, summer and fall. Every station you hear will be trying hard to work you! Because these events are now so well-attended, from the right hilltop you can work VUCC and many/most states and provinces on 6 meters in a single weekend if propagation is decent.

Feel free to "officially" participate in the contest, or simply work stations casually, hunting for prefixes, grids, states, etc. Don't be intimidated if you're a contest beginner. VHF contesting tends to be a bit friendlier than the hard-core HF stuff. Read the contest rules, listen to a few QSOs before you jump in to learn the required "contest exchange," and get in there! Most VHF+ contests are simple, requiring only call signs, signal reports and locations, usually grid squares.

Some parts of the country (New England and Southern California) have large ham populations and mountain peaks aplenty, but even if your region is less populated with VHFers, hilltops are great "propagation equalizers."

Be sure to set up and test *your entire portable station* before driving to *any* hilltop. The idea isn't to work other stations, it's to make sure you have *everything* you need to ensure a successful outing. Forgetting something important and having to improvise workarounds or drive back to pick up one small tidbit or another isn't a great way to start your adventure.

You may never be able to erect a monster-size tower in your backyard, but nothing's stopping you from enjoying the great outdoors, finding an elevated perch and experiencing amateur radio's "natural high!"

### Hill-Topper-Friendly VHF+ Contests in 2013

June 8 .....	ARRL June VHF QSO Party
June 22 .....	ARRL Field Day
July 20 .....	CQ WW VHF Contest
August 3 .....	ARRL August UHF Contest
September 14...	ARRL September VHF QSO Party



## Exporting U.S. Culture via Shortwave and Whatever Happened to Audio Fidelity?

**R**ecently an *MT* reader wrote to ask if there were any American shortwave broadcasters, other than the religious ones, that might give a global audience a more thorough look at U.S. music and culture.

The answer is, "Yes!" The VOA still has an active schedule of programming worldwide in many languages beamed to all regions of the globe. And, they do a good job of representing American culture, in addition to stating official U.S. policy, to the rest of the world.

### ❖ A Taxpayer's Bargain

Until the first of this year VOA was prohibited by law from making their programming available directly to Americans so it was always a bit harder for U.S. citizens to hear their own "Voice." That changed as the National Defense Authorization Act was signed into law January 2 by President Obama. According to a VOA news release, "The legislation will not change the focus of the agency's broadcasts, which are aimed exclusively at international audiences. The new rules will only affect programs broadcast after July 1, 2013." The new rules effectively repeal what was known as the Smith-Mundt Act of 1948, prohibiting domestic distribution of government generated news and programming.



VOA via FTA satellite receiver. (Courtesy: Author)

Presiding Governor Michael Lynton, of the Broadcasting Board of Governors (BBG), the federal agency tasked with overseeing all official U.S. international broadcasting, is quoted by VOA as saying that the new law will allow "greater transparency as more people in this country come to know what U.S. International broadcasting is about."

It's true that most Americans have no idea that their own VOA provides some of the best programming heard on the shortwave bands. Some may see this as the collapse of the federal government's mandate not to beam propaganda directly at U.S. citizens in an effort to promote specific foreign policies and influence public opinion on such policies. However, it's more

accurately a reflection of reality. Throughout the Cold War all shortwave listeners tuned in to VOA broadcasts, as well as Radio Moscow, BBC World Service and dozens of others. There was simply no technical way to keep Americans from listening, if they wished. That's even more true today, thanks to WiFi radio, online streaming, Free-to-Air (FTA) satellite and the use of smartphones.

As this is being written, I'm listening to VOA on 17.530 MHz, beamed to Africa, and they have a S7 signal here on the east coast (off the back of their antenna). Here is their program lineup: [www.VOAnews.com/programindex.aspx](http://www.VOAnews.com/programindex.aspx). If you spend any time looking at it you'll see it's covers a wide range of musical interests (including country, classic rock, hip-hop and jazz) as well as talk shows covering topics as diverse as health, sports, science and, of course, news (which is unbiased, and differentiated from editorials stating official U.S. foreign policy).

So, folks in Africa who have even a modest shortwave radio have a good chance of picking up VOA and hearing a much different message from the usual religious-based shortwave broadcasters. Incidentally, while writing this, the 17.530 frequency just signed off, but I found their 12.150 MHz signal even better: S9 plus 10 to 20 dB over. I'd have to say that U.S. taxpayers are really getting their money's worth in VOA broadcasts.

The common belief is that VOA is mostly on-line, but as you can see from the shortwave guide in *MT*, VOA can be heard on many shortwave frequencies and bands. The Edward R. Murrow Transmitting Station at Greenville, North Carolina does most of the heavy lifting with their 500 kW transmitter, so their presence on the band is very much felt world-wide. For a look at this amazing installation read the April 2012 *MT* cover story, "VOA's Edward R. Murrow Transmitting Station" by Thomas Witherspoon K4SWL and take a look at the amazing antenna and transmitter facilities.

### ❖ Your Turn to be an International Broadcaster

Allen Weiner's WBCQ ([www.wbcq.com](http://www.wbcq.com)) and Jeff White's WMRI ([www.wrmi.net](http://www.wrmi.net)) do a good job of providing a diverse program lineup for the rest of the world to tune into. But, it's difficult for private shortwave broadcasters to make it financially without the help of paid religious broadcasters, hence the dominance of religion on U.S.-based non-governmental broadcast stations. Such stations are also hampered by considerably lower power and less extensive antenna systems than VOA.

Have you ever thought about being a radio personality? Do you want to have your own show broadcast live via shortwave to the entire planet? Allen and Jeff have already done all the paperwork and fundraising; they're on the air!

Now it's easier than ever to be a commercial shortwave broadcaster playing your favorite music for WBCQ and WRMI listeners. Contact each station about rates. They're typically about \$1 per minute depending on how much time you buy and what timeslot you want. You can start out with a weekly 60 minute show as one blues fan did with WRMI when he established Blues Radio International last year ([www.bluesradiointernational.net](http://www.bluesradiointernational.net)). The show is broadcast Sundays on 9955 kHz at 0200 UTC and streamed live via the WRMI website. New shows are replayed Thursday evenings at 0230 UTC on the same frequency. Archived editions of the program are found on the Blues Radio International web site. And, Blues Radio International will QSL via their on-line report:



[www.bluesradiointernational.net/contact.html](http://www.bluesradiointernational.net/contact.html). Click on "verify my shortwave report" in the "Reason for Contacting BRI."

WBCQ's 5110 kHz frequency is the place for some strange shortwave programming every day of the week; click here for the 5110 schedule: <http://schedule.wbcq.com/main.php?fn=sked&freq=5110>

Don't have the bucks to spring for a weekly one-hour show? Consider teaming up



with friends who share your interests. Divided among six friends your cost would be only \$10 per week for the broadcast. You might also give [www.kickstarter.com](http://www.kickstarter.com) a try. That's a "crowd-funding" web site where individuals or groups seek funding from random supporters to do various projects. Last year a group wanting to start a low-power FM station in Raleigh, North Carolina sought \$10,000 to do so. They found 222 backers and received over \$12,000 in pledges for their cause.

WWCR ([www.wwcr.com/index.html](http://www.wwcr.com/index.html)) also sells airtime. According to their web site: "We are currently revising and reorganizing our information in relation to the topic of 'Buying Airtime.' Please contact our Sales Manager, Rick Shelton, for details regarding the purchase of airtime on WWCR. Rick can be reached by calling 1-800-238-5576 or by at [rickwwcr@hotmail.com](mailto:rickwwcr@hotmail.com)."

## ❖ Whatever Happened to Audio Fidelity?

Most of us grew up at a time when radio stations, radio manufacturers and recording companies prided themselves in what was called high fidelity audio. FM broadcasters brought full-fidelity stereo broadcasting into homes. Expensive "hi-fi systems" sold in specialty stores and via mail order catalogs.

The advent of Compact Discs in the 1980s brought what appears to have been the peak of the search for audio fidelity. Anyone who had ever struggled with vinyl records, with scratches and warping, or who had fumbled with reel-to-reel and cassette tapes thrilled at the sound of the nearly perfect audio recordings.

Then, there came a need for such audio to be portable and, while portable CD players were made and sold by the millions, consumers were unhappy with them. The players couldn't be any smaller than the case it would take to hold a spinning CD; listeners had to change CDs in order to hear something different, and, worst of all, CDs were expensive.

Next came a series of attempts to get the size of the CD down. Mini-CDs and players were produced and that helped, but, it wasn't until the advent of the MP3 player, more specifically the wildly popular iPod, that spelled doom for the CD and any hope of going back to high-fidelity audio. There was another component to the popularity of MP3 players: "free" file-sharing of pirated recordings quickly filled these players. Young people were more than willing to sacrifice audio-fidelity for unlimited free music.

Breakthroughs in audio compression and data storage led to new audio products at such a speed that players selling for hundreds of dollars just a few years earlier were consigned to landfills as consumers sought greater capacity and convenience in portable audio devices.

## ❖ Digital Broadcasting by the Numbers

WVTF is probably the largest FM radio station in Virginia. A service of Virginia Tech,

and based out of Roanoke, Virginia, the station maintains nine translator/repeaters covering a huge portion of central, western and southern Virginia, all of which are also broadcasting in HD-Radio and most of which broadcast secondary channels. It has also provided a Radio Reading Service since 1981. In a recent interview, WVTF's chief engineer, Paxton Durham N4MGQ, took the time to answer my questions about the audio quality of digital compression.

**MT:** I understand that compact discs offer audio at a rate of something like 1,400 kb/s. When I listen to WVTF on a WiFi radio, according to the display on the radio, I'm hearing the station at 96 kb/s. It seems that stations use a wide range of bit rates for streaming. For example, the Voice of America has the lowest rate I've found (20 kb/s), Capital Public Radio (Sacramento) uses 128 kb/s, which seems typical of many public radio stations. CBC Radio 2 uses 135 kb/s; Jazz Wyoming, from Wyoming Public Radio, uses 256 kb/s (the highest I've found among non-commercial broadcasters). Why such variations in streaming quality?

**Paxton Durham:** The world of coding streams is wide open with no standards in place. Stations do control the bandwidth. In our case, we have the "fat" stream which will range from 64 kbps to 96 kbps and a "dialup" stream which will be only 32 kbps or so. The vast number of people do not have Internet service to support fatter streams. There is also a consideration of the bandwidth the server has available. Bandwidth is money and I'm not sure that anyone makes a nickel on their stream, so each station will choose what they want to send.

**MT:** Is there a limit to the number of listeners that any one station can accommodate?

**PD:** There is a limit to how many connections a station can have, but with more server horsepower and additional bandwidth, this can be as large as the station feels is necessary.

**MT:** How does online streaming audio compare with HD-Radio (IBOC) FM bitrates?

**PD:** The streaming bitrates are higher than HD but HD is not using MP3 and is a more efficient codec for bit-limited service. If you have only one HD, the bit rate is 96 kbps. If you add more stations, that 96 gets chopped up however the stations chooses. You could have HD 1 at 48 and then two other HDs at 24 each, for example. I have done that and it isn't all that bad. There is some aliasing [an audio effect as a result of digital processing] going on mostly on female voices.

**MT:** I can tell the difference between VOA and WVTF audio quality, but can people differentiate the difference between 96 kb/s and 256 kb/s?

**PD:** Probably not, depending on what they are listening on. Most people use computer speakers or a smart phone speaker or headphones. If they listen in their car they may hear it, but after the car is moving, I doubt it. You have to remember, we now have two generations that think an iPod sounds good and have never heard high quality audio.

**MT:** As far as can be determined, which comes closest to reproducing CD audio quality: HD-FM or analog FM?

**PD:** The "CD" quality statement, I believe, comes from the frequency response which is the same. There is still coding in HD that is not on the CD. I tell people the thing they will notice in HD is not fidelity but noise. I think my analog audio sounded closer to the CD than HD even with the 15 kHz limit.

**MT:** Years ago FM radio stations were trying to get the best possible audio to the antenna, but in the digital age, it seems that we're going backwards in audio reproduction.

**PD:** I do long for the days when the best audio you could get in your home was a good FM station. CD made it possible for the listener to have high quality on a personal basis. Then iPods came with very tight compression and tiny headphones which did to audio what cell phones did to telephone audio...turned it into crap!

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## The Beijing Hour vs BBC Newsday

**M**arch can mean only one thing: Spring is just around the corner! As we "march forth" into a new month and a new season we'll shine the Programming Spotlight on two of the more important news programs on shortwave and some significant anniversaries.

Recently I decided to compare the content of two of the main news programs heard on shortwave; **China Radio International's Beijing Hour** and the **BBC World Service's Newsday**. I listen to the *Beijing Hour* quite often and find it both informative and professional. Most episodes are presented by native English speakers, principally Rebecca Hume who speaks with a British accent with a regional flavour (not cockney but a hint of perhaps Liverpool). News coverage is quite thorough and comprehensive.



In a January broadcast, stories covered a diverse range of topics including a Sino-Japanese border dispute; American diplomacy in Afghanistan and rallies in support of Hugo Chavez in Venezuela on the day he would have been sworn in again. Gunplay in California was also mentioned. Chinese news included the prospects for post-graduate employment in China. Beijing weather was nice but pretty unimportant to a listener in North America.

In depth coverage was given to the Japanese government's new stimulus package and other business issues. The message is: China is open for business, but also that the Chinese economy is not all roses. Ford is building cars in China, but Honda is cutting jobs in Britain. Sports and Entertainment were also covered, including tennis, NFL news (!) and Oscar nominations. I wonder what Chairman Mao would think. Hume is an excellent presenter and I like her sign off: "I hope you can join us later so we can take a look at the world together." All in all, it is a unique perspective on the day's affairs. Check out *The Beijing Hour* at 0100 UTC on 6020 kHz.

Like the *Beijing Hour*, **BBC World Service's Newsday** is a comprehensive look at the day's news from around the world from London and Johannesburg. This program also led with the Japanese stimulus package, and many of the same stories covered by Beijing appeared in the BBC newscast. U.S. gun control issues also appeared

in this broadcast following a school shooting in California. The revolt in Syria came in for special coverage as well.

Sports focused on African soccer games and oddly car sales were featured in this broadcast too. In this case they talked about the boost in sales of luxury cars. UN Security Council concerns about rebel gains in Mali were also covered.

*Newsday* can be heard at 0305-0330 UTC, 0500-0600 UTC, 0605-0700 UTC and 0700-0830 UTC. Try 7435 kHz at 0300, 15400 kHz at 0500 and 9410 at 0600 UTC.

The BBC program is slightly more even-handed, but both programs have merit. Listening to them together gives one a good sense of what is happening in the world.

**Deutsche Welle's Inside Europe** is one other program that should be mentioned. It can be heard via Rwanda at 2000 and 2100 UTC on 9655 kHz. It is a comprehensive look at European events. Topics are as varied as Gerard Depardieu's adoption of Russian citizenship, asylum seekers in Vienna and the sound of a glass harp. News, business and culture are all covered in this very interesting one hour program. And of course it can also be heard on the **DW** website. Check it out!

### ❖ PCJ Media Happenings

Keith Perron's **PCJ Media** is one shortwave (and yes, Internet) entity that is expanding its operations. Keith restarted the *Happy Station* program four years ago. As many may remember, the *Happy Station* program was a long-running **Radio Netherlands** program for well over 60 years. In this humble editor's opinion, the combination of music, entertainment, listener interaction and a truly delightful host (I was a fan during Tom Meijer's 20+ years as host) made it a must hear program week after week. It was the kind of program that drew one to **Radio Netherlands** and made it one of the more popular stations on the shortwave bands.

Several years ago, **Radio Netherlands** changed focus to news, reports and documentaries. While these were very interesting and informative, **Radio Netherlands** lost some of its personality. One assumed at the time that the *Happy Station* was one of those programs that sadly would never return.

But four years ago, Keith began an improbable experiment. As many stations and programs disappeared or migrated to the internet, Keith started a new shortwave venture. The first program introduced on his **PCJ Media** service (and still the "jewel in the crown") was the reborn *Happy Station* program.

Keith brings the same *joie de vivre* to the program that legendary hosts like Tom Meijer and Eddie Startz brought to the table. It is a thoroughly enjoyable program.

In March, **PCJ Media** (which itself is a tribute to the original Dutch call letters) will be celebrating three special anniversaries. First, this March marks the fourth anniversary of the return of the *Happy Station Show*. Secondly, it is Keith's fourth anniversary as host of the show. This puts him in third place in terms of length of service as host of the show, although he has a way to go before catching up to Tom Meijer and Eddie Startz (over 40 years).

Finally, it is also the fourth anniversary of the founding of **PCJ Media**. In honour of these special milestones, there will be a special edition of *Happy Station* in March (date TBA as of this writing). Keith notes: "One lucky person will have a chance to win a package of *Happy Station Show* promotional items. These are all new and include a 45rpm record of Tom Meijer. Stay tuned for details." (*PCJ Media Facebook Page*)

Speaking of anniversaries at **PCJ Media**, in late January, *Media Network Plus* aired its 100<sup>th</sup> edition. Congratulations to Keith and all the team at PCJ Media. While the *Happy Station* program is a podcast, *Media Network Plus* can be heard via **WRMI** in Miami. *Media Network Plus* takes up the baton of the **Radio Netherlands Media Network** program of the 1980s and 1990s. *Media Network Plus* is co-hosted by Paulette MacQuarrie and Keith Perron and can be heard on UTC Saturdays (55 minute monthly edition) at 0100 UTC and on UTC Sundays at 1830 (weekly edition). Both broadcasts are on 9955 kHz.

It is fascinating to hear these programs, not only for their content but their ambiance. A recent edition opened with an introduction by both the original **Radio Netherlands** announcer, and by former **Swiss Radio International** presenter Bob Zanotti. It is a fast paced look at media news from around the world. And, as he did on **Radio Netherlands Media Network**, veteran DXer Victor Goonetilleke continues to contribute to the program. For long time listeners it is a blast from the past. For new listeners, it continues to be an informative program about media issues around the world. Something for everyone!

The **Mighty KBC** is another station that has been testing new frequencies and broadcasting to multiple target areas. In mid-January, they were heard by Niagara Falls DXer Dave Jeffrey via transmitters in Bulgaria on 9450 kHz from 0000-0158 UTC Sundays. Programming consisted of classic rock and roll in a program called *The Giant Jukebox* hosted by Eric van Willigen.

Finally, The **Voice of Russia** killed its North America service on January 1, but one may still be able to hear them, as broadcasts to Latin America in English continue. Try 7290 kHz between 0000 and 0400 UTC and 9395 kHz between 2200 and 0000 UTC. Highlights include *Russian Business Report* weekdays at 2300 UTC and *Music and Musicians* weekdays at 0300 UTC.



## Why use a Prepared QSL Card ?

As the hobby and QSLing trends have changed, so have tactics for verifying. The use of prepared cards has evolved into a popular and successful technique.

As the name implies, this is a QSL card that you prepare and enclose with your reception report for the station to fill in and return to you.

There are blank spaces on the card for the station to complete that include time, frequency and date of your reception. Or you can add that data so the station can sign or rubber stamp it. Your name and return address should be on the card with an "Airmail" notation, in case they use the card as a postal card.

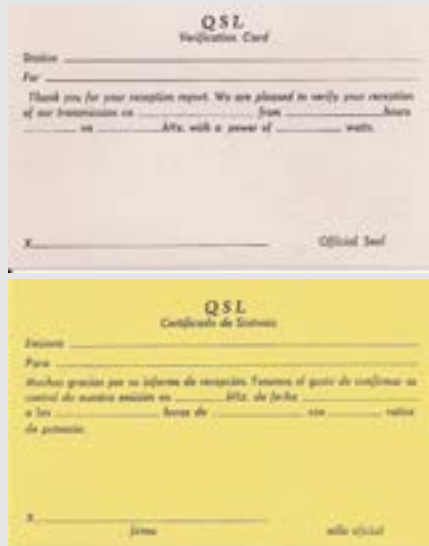
So why prepare a card, when the station likely has its own? Most international broadcasters have their own cards, while those in third world countries may not. Budget cuts or restrictions may result in slashing the QSL budget, while others may not understand the concept of verifications. With a brief and simple explanation, most stations will respond and return your card as verified.

Prepared cards may take many forms, such as an ordinary postcard type stock, commercially printed cards, or individually created cards with graphics corresponding to the country. My personal method for making a prepared QSL is to design a card using my PC's graphics program, using decorative fonts and colors. Try some Web surfing to find the country's flag, map, national symbol or

landmark to place on the card. A great start is the Central Intelligence Agency site at [www.cia.gov/](http://www.cia.gov/) or an image search at [www.google.com](http://www.google.com).

Designing multilingual cards is just as easy. Cut and paste your text and use an on-line translation service such as [www.bing.com/translator/](http://www.bing.com/translator/).

More QSL tips and tricks are available in my new e-book available from Amazon.com at <http://tinyurl.com/acfsjav>.



GVH's Prepared QSL cards

### AMATEUR RADIO

Czech Republic-OK1KSL-RadioClub Slany, 14 MHz-RTTY. Full data color Czech Republic crest card, signed by QSL Manager. Received in 45 days via ARRL. (Larry Van Horn, NC)

Czech-Republic-OK1DRQ/OK4RQ/OL8M, 14 MHz-RTTY. Full data color globe card with *Three Calls-One Operator* logo, signed by Pavel Pok. Address: Sokolovská 59, 323 12 Plzeň, Czech Republic. Received in 45 days via ARRL. (Van Horn)

Norway-LM9LA4OY, 14 MHz-RTTY. Full data color 40th Anniversary club station card, unsigned. Received in 45 days via ARRL. (Van Horn)

### BELARUS

Radio Belarus, 6155 kHz. Full data station QSL card, unsigned. Received in 75 days for an English report and mint stamp. Station address: Cyrvonaja Street 4, 220807 Minsk, Belarus. (Sam Wright, Biloxi, MS) Streaming/on-demand audio [www.radiobelarus.tvr.by](http://www.radiobelarus.tvr.by)

### BRAZIL

Radio 9 de Julho 9820 kHz. Full data electronic verification letter from José Renato Ferreira, Director. Received in 15 days for an e-report to: [radio@radio9dejulho.com.br](mailto:radio@radio9dejulho.com.br). Station address: Rua Manoel de Arão 85, Freguesia do Ó, 02730-030 São Paulo, Brasil. (Artur Fernández Llorella, Spain/HCDX) Streaming audio [www.radio9julho.com.br/](http://www.radio9julho.com.br/)

### CLANDESTINE

Radio Tamazuj, 15400 kHz. Full data QSL, unsigned. Received in three weeks for e-report to [radiotamazuj@yahoo.com](mailto:radiotamazuj@yahoo.com). Copy of report to postal address: Witte Kruislaan 55, 1217 AM Hilversum, Netherlands. (Llorella) QSL for 11650 kHz, received in 30 days for e-report. (Christian Ghibaudo/playdx)

Radio Biafra London, 11870 kHz, via Wertachtal, Germany. Full data e-verification letter. Received in two days for report sent to: [contact@radiobiafralondon.com](mailto:contact@radiobiafralondon.com) (Frank Hillton, Charleston, SC).

### ECUADOR

HCJB, 6050 kHz for Mt. Pinchincha site. Received QSL cards for June and December 2011 reception reports in 437 and 276 days. Enclosed a personal note apologizing for delay, and card for 11920 kHz via Germany. CDs and mint stamps enclosed with each report. Station address: HCJB Global Voice, Casilla 17-17-691, Quito, Ecuador. (Bruce Portzer/HCDX) Streaming audio [www.radiohcbj.org](http://www.radiohcbj.org)

### FRENCH GUIANA

Radio Japan/NHK World relay, 11740 kHz. Full data QSL card, unsigned. Transmitter site was listed as "West Guiana." Received in 15 days for e-report to [nhkworld@nhk.jp](mailto:nhkworld@nhk.jp). Station address: 2-1, Jinnan 2-chome, Shibuya-ku, Tokyo 150-8001 Japan. (Portzer) Streaming audio [www.nhk.or.jp/nhkworld](http://www.nhk.or.jp/nhkworld)

### MEDIUM WAVE

WDIC 1430 kHz AM, *Real Country*. No-data verification letter, signed by Betty L. Fleming. Received in 11 days for an AM report and mint postage. Station address: 2298 Ross Ridge, Clintwood, VA 24228 USA. (David Jones, TN/NRC DX News) Email: [wdic@wdicradio.com](mailto:wdic@wdicradio.com) Streaming audio [www.wdicradio.com/](http://www.wdicradio.com/)

WHKT 1650 kHz AM. *Conservative Talk Radio*. No data email response with apology for delay from Rodney Suiter, Operations, at [rodney@1650whkt.com](mailto:rodney@1650whkt.com). Received in 174 days for an AM report and \$1.00. Email reports to [info@whkt.com](mailto:info@whkt.com). Station address: 2202 Jolliff Road, Chesapeake, VA 23321 (Al Muick, PA/playdx) Streaming audio [www.1650whkt.com](http://www.1650whkt.com).

### RUSSIA

Voice of Russia, 12060 kHz via St. Petersburg. Full data QSL card, calendars and pennant. Received in 50 days for report with audio CD for Arabic service, plus one IRC. QSL address: Mikhail Timofeev, Saint Petersburg Regional Centre, 3 Akademika Pavlova St, Saint Petersburg 197922, Russia. (Porter) Streaming audio [www.english.ruvr.ru/](http://www.english.ruvr.ru/)

### SRI LANKA

Adventist World Radio relay via Trincomalee, 15320 kHz. Full data card *AWR Returns to Sri Lanka* card, signed by Dr. Adrian Peterson. Additional postcards, calendar and note enclosed. Received in 32 days. QSL address: 12501 Old Columbia Pike, Silver Spring, MD 20904-6600. (Ed Kusalik, Alberta, Canada) Streaming/on-demand audio [www.awr.org](http://www.awr.org)

### UTILITY

Croatia-SAL Non Directional Beacon, Sali, 421kHz. Partial data verification letter, signed by Ervin Mrkic-Pestic, Head of ATC Zadar. Received in 22 days for a utility report. Station address: Croatia Control Ltd., Podružnica Zadar, p.p. 297, N.Nodila b.b., 23000 Zadar Zračna luka, Croatia. Patrick Robic, Austria/UDXF)

Italy-PRU Non Directional Beacon, Perugia 398 kHz. Full data prepared card stamped as verified, signed by Stefano Mancuso. Received in 58 days for a utility report. QSL address: ENAV S.p.A., C.A.A.V., Strada del Aeroporto snc, 06080 San Egidio, Italy. (Robic)

Taiwan-BMF Taipei Meteo, Central Weather Bureau, 13900 kHz. Full data card and letter signed by Ming Dean Cheng, Director of Weather Forecast Center. Received in 258 days for a utility report. QSL address: Central Weather Bureau, MOTC, 64 Gongyuan Road, Taipei 10048, Taiwan. (Robic)

Ukraine-BB Non Directional Beacon, Bibrka, 432 kHz. Full data prepared card stamped as verified. Received in 23 days for a utility report. QSL address: Ukraina State Air Traffic Service Enterprise (UKSATSE) Airport Boryspil, Kyiv region 08307, Ukraine (Robic).



## 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.).

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

### FIND THE STATION YOU WANT TO HEAR

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

If a broadcast is not daily, the days of 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 condi-

tions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and MT readers to make the Shortwave Guide up-to-date as of one week before print deadline.

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

#### Target Areas

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

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

### MT MONITORING TEAM

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### Additional Contributors to This Month's Shortwave Guide:

*Thank You to ...*

AOKI; BCL News; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News; British DX Club; WWDX Club/Top News. Alokesh Gupta, New Delhi, India; Tom Taylor, UK; Ashik Eqbal Tokon, Rajshahi, Bangladesh; Cladius Dedio/AWR; Brenda Constantino/WYFR; Dan Elyea/WYFR; Ron Cesarek; Victor Goonetilleke, Sri Lanka; Tom Solomon/WYFR; Georgi Bancova/Balkan DX; Ivo Ivanov, Bulgaria; Michael Puetz/MB; Sean Gilbert UK/WRTH 2013; Wolfgang Bueschel, Stuttgart, Germany.

### SHORTWAVE BROADCAST BANDS

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

#### Notes

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

### "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](http://www.monitoringtimes.com) to learn how.



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

0000 0030	Egypt, R Cairo	9965am	11510al
0000 0030	USA, BBG/VO America	7560as	
0000 0030 twhfa	USA, WHRI Cypress Creek SC	9895ca	
0000 0030 sm	USA, WHRI Cypress Creek SC	7335ca	
0000 0045	India, AIR/External Svc	9690as	9705as
	11710as	13605as	
0000 0045 DRM	India, AIR/External Svc	11645as	
0000 0057	China, China R International	6005eu	
	6020as	6180eu	7350as 7415as
	9425as	9570as	11650as 11790as
	11885as		
0000 0100	Anguilla, University Network	6090na	
0000 0100	Australia, ABC/R Australia	9660pa	12080pa
	15240pa	15415pa	17795pa 19000pa
	21740pa		
0000 0100	Australia, NT VL8A Alice Springs	4835do	
0000 0100	Australia, NT VL8K Katherine	5025do	
0000 0100	Australia, NT VL8T Tennant Creek	4910do	
0000 0100	Bahrain, R Bahrain	6010me	
0000 0100	Canada, CFRX Toronto ON	6070do	
0000 0100	Canada, CFVP Calgary AB	6030do	
0000 0100	Canada, CKZN St Johns NF	6160do	
0000 0100	Canada, CKZU Vancouver BC	6160do	
0000 0100 Sun	Germany, Mighty KBC Radio	9450eu	
0000 0100	Germany, R 6150	6070eu	
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 DRM	New Zealand, R New Zealand Intl	17675pa	
0000 0100	Palau, T8WH/World Harvest R	17650as	
0000 0100	Russia, VO Russia	7290ca	
0000 0100	Thailand, R Thailand World Svc	13745na	
0000 0100	UK, BBC World Service	5970as	6195as
	7360as	9410as	9740as 11750as
	12095as	13725as	15335as 15755as
0000 0100	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0000 0100	USA, Overcomer Ministry	3185na	
0000 0100	USA, WBCQ Monticello ME	5110am	7490am
	9330am		
0000 0100	USA, WEWN/EWTN Irontdale AL	11520af	
0000 0100	USA, WHRI Cypress Creek SC	5920eu	
0000 0100	USA, WINB Red Lion PA	9265ca	
0000 0100	USA, WRNO New Orleans LA	7505na	
0000 0100	USA, WTTW Lebanon TN	5830na	
0000 0100	USA, WWCR Nashville TN	3195eu	5070af
	7520af	13845af	
0000 0100	USA, WWRB Manchester TN	3185na	
	3215na		
0000 0100	USA, WYFR/Family R	6115na	
0030 0100	Australia, ABC/R Australia	17750as	
0030 0100	USA, WHRI Cypress Creek SC	7335ca	
0030 0100 mtwhf	USA, WRMI/R Slovakia Intl relay	9955am	

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

0100	Cuba, R Havana Cuba	5040ca	6000na
	6165na		
0100 0115 Sat/Sun	Canada, Bible Voice Broadcasting	7395as	
0100 0130	Vietnam, VO Vietnam/Overseas Svc	9640na	
0100 0156	Romania, R Romania Intl	6145na	7325na
0100 0157	China, China R International	6020as	
	6075eu	6175eu	7350as 9410as
	9420na	9570na	9580as 11650as
	11885as		
0100 0200	Anguilla, University Network	6090na	
0100 0200	Australia, ABC/R Australia	9660pa	12080pa
	15160pa	15240pa	15415as 17750pa
	17795pa	19000pa	
0100 0200	Australia, NT VL8A Alice Springs	4835do	
0100 0200	Australia, NT VL8K Katherine	5025do	
0100 0200	Australia, NT VL8T Tennant Creek	4910do	
0100 0200	Bahrain, R Bahrain	6010me	
0100 0200	Canada, CFRX Toronto ON	6070do	
0100 0200	Canada, CFVP Calgary AB	6030do	
0100 0200	Canada, CKZN St Johns NF	6160do	

0100 0200	Canada, CKZU Vancouver BC	6160do	
0100 0200 Sun	Germany, Mighty KBC Radio	9450eu	
0100 0200	Germany, R 6150	6070eu	
0100 0200	Malaysia, RTM Kajang/Traxx FM	7295do	
0100 0200	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0100 0200	New Zealand, R New Zealand Intl	15720pa	
0100 0200 DRM	New Zealand, R New Zealand Intl	17675pa	
0100 0200	Palau, T8WH/World Harvest R	17650as	
0100 0200	Russia, VO Russia	7290ca	
0100 0200	South Korea, KBS World R	9690as	
0100 0200	Taiwan, R Taiwan Intl	11875as	
0100 0200	UK, BBC World Service	5940eu	5970as
	9740as	11750as	12095as 15310as
	15335as	15755as	17685as
0100 0200	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0100 0200	USA, BBG/VO America	9435va	11705va
	15155va		
0100 0200	USA, KJES Vado NM	7555na	
0100 0200	USA, Overcomer Ministry	3185na	
0100 0200 mtwhf	USA, Overcomer Ministry	7490na	
0100 0200	USA, WBCQ Monticello ME	5110am	7490am
	9330am		
0100 0200	USA, WEWN/EWTN Irontdale AL	11520af	
0100 0200	USA, WHRI Cypress Creek SC	5920eu	
0100 0200 m	USA, WHRI Cypress Creek SC	9605ca	
0100 0200 twhf	USA, WHRI Cypress Creek SC	7315sa	
0100 0200	USA, WINB Red Lion PA	9265ca	
0100 0200	USA, WRNO New Orleans LA	7505na	
0100 0200	USA, WWCR Nashville TN	3195eu	4840na
	5935af	7520af	
0100 0200	USA, WWRB Manchester TN	3185na	
	3215na		
0100 0200	USA, WYFR/Family R	6115na	
0115 0120 mtwhf	Kyrgyzstan, Kyrgyz Radiosu	4010do	
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as 15745as
0130 0200 twhfa	Serbia, International R Serbia	6190va	
0140 0159	Vatican City State, Vatican R	7410as	9560as

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

0200 0230	Thailand, R Thailand World Svc	13745na	
0200 0230	USA, KJES Vado NM	7555na	
0200 0257	China, China R International	11785as	
	13640as		
0200 0300	Anguilla, University Network	6090na	
0200 0300 twhfa	Argentina, RAE	11710am	
0200 0300	Australia, ABC/R Australia	9660pa	12080pa
	15160pa	15240pa	15415as 17750pa
	17795pa	19000pa	
0200 0300	Australia, NT VL8A Alice Springs	4835do	
0200 0300	Australia, NT VL8K Katherine	5025do	
0200 0300	Australia, NT VL8T Tennant Creek	4910do	
0200 0300	Bahrain, R Bahrain	6010me	
0200 0300	Canada, CFRX Toronto ON	6070do	
0200 0300	Canada, CFVP Calgary AB	6030do	
0200 0300	Canada, CKZN St Johns NF	6160do	
0200 0300	Canada, CKZU Vancouver BC	6160do	
0200 0300	Cuba, R Havana Cuba	6000na	6165na
0200 0300	Egypt, R Cairo	9720na	9315al
0200 0300	Germany, R 6150	6070eu	
0200 0300	Malaysia, RTM Kajang/Traxx FM	7295do	
0200 0300	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0200 0300	New Zealand, R New Zealand Intl	15720pa	
0200 0300 DRM	New Zealand, R New Zealand Intl	17675pa	
0200 0300	Palau, T8WH/World Harvest R	17650as	
0200 0300	Philippines, R Pilipinas Overseas Svc	15285me	
	17700me	17820me	
0200 0300	Russia, VO Russia	7290ca	
0200 0300	South Korea, KBS World R	9580sa	9640as
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as 15745as
0200 0300	UK, BBC World Service	5875eu	5940eu
	7435af	12095as	15310as
0200 0300	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0200 0300	USA, Overcomer Ministry	3185na	
0200 0300 mtwhf	USA, Overcomer Ministry	7490na	
0200 0300	USA, WBCQ Monticello ME	5110am	7490am
	9330am		

0200 0300	USA, WEWN/EWTN Irondale AL	11520af
0200 0300	USA, WHRI Cypress Creek SC	5920eu
	7315sa	
0200 0300	USA, WINB Red Lion PA	9265ca
0200 0300	USA, WRNO New Orleans LA	7505na
0200 0300	USA, WWCR Nashville TN	3215eu 4840na
	5890va 5935af	
0200 0300	USA, WWRB Manchester TN	3185na
	3195na	
0200 0300	USA, WYFR/Family R	6115na
0215 0227 Sun	Nepal, R Nepal	5005do
0230 0300 twhf	Albania, R Tirana	6100na
0230 0300	Myanmar, Myanma R/Yangon	9731do
0230 0300	Vietnam, VO Vietnam/Overseas Svc	9640na
0255 0300 Sun	Swaziland, TWR Africa	3200af

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

0300 0320	Vatican City State, Vatican R	15460as
0300 0325 Sun	Swaziland, TWR Africa	3200af
0300 0327	Vatican City State, Vatican R	9660af 11625af
0300 0330	Egypt, R Cairo	9720na 9315al
0300 0330	Myanmar, Myanma R/Yangon	9731do
0300 0330	Philippines, R Pilipinas Overseas Svc	15285me
	17700me 17820me	
0300 0330 Sat	Sri Lanka, SLBC	6005as 9770as 15745as
0300 0357	China, China R International	9460am
	9690na 9790as 11785as 13620as	
	15110as 15120as	
0300 0400	Anguilla, University Network	6090na
0300 0400	Australia, ABC/R Australia	9660pa 12080pa
	15160pa 15240as 15415pa 15515pa	
	17750pa 19000pa 21725pa	
0300 0400	Australia, NT VL8A Alice Springs	4835do
0300 0400	Australia, NT VL8K Katherine	5025do
0300 0400	Australia, NT VL8T Tennant Creek	4910do
0300 0400	Bahrain, R Bahrain	6010me
0300 0400	Canada, CFRX Toronto ON	6070do
0300 0400	Canada, CFVP Calgary AB	6030do
0300 0400	Canada, CKZN St Johns NF	6160do
0300 0400	Canada, CKZU Vancouver BC	6160do
0300 0400	Cuba, R Havana Cuba	6000na 6165na
0300 0400	Germany, R 6150	6070eu
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	Oman, R Sultanate of Oman	13600af
0300 0400	Palau, T8WH/World Harvest R	17650as
0300 0400	Russia, VO Russia	7290ca
0300 0400 mtwhf	South Africa, Channel Africa	3345af
	6155af	
0300 0400	Taiwan, R Taiwan Intl	15320as
0300 0400	UK, BBC World Service	3255af 5940eu
	6140af 6190af 7255af 7435af	
	9410eu 9460af 12035af 12095eu	
	15310as 17790as	
0300 0400	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
0300 0400	USA, BBG/VO America	4930af 6080af
	9855af 15580af	
0300 0400	USA, Overcomer Ministry	3185na
0300 0400 mtwhf	USA, Overcomer Ministry	7490na
0300 0400	USA, WBCQ Monticello ME	5110am 7490am
	9330am	
0300 0400	USA, WEWN/EWTN Irondale AL	11520af
0300 0400	USA, WHRI Cypress Creek SC	7520eu
0300 0400	USA, WRNO New Orleans LA	7505na
0300 0400	USA, WWCR Nashville TN	3215eu 4840na
	5890va 5935af	
0300 0400	USA, WWRB Manchester TN	3185na
	3195na	
0300 0400	USA, WYFR/Family R	6115na
0330 0400	Iran, VO Islamic Rep of Iran/VO Justice	9710eu 11700eu 11770eu
0330 0400	USA, WHRI Cypress Creek SC	6175ca
0330 0400	Vietnam, VO Vietnam/Overseas Svc	9640na

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

0400 0427	Iran, VO Islamic Rep of Iran/VO Justice	9710eu 11700eu 11770eu
0400 0456	Romania, R Romania Intl	6130na 7305na
	15220as 17870as	
0400 0457	China, China R International	9460na
	13620va 15120as 17725va 17855va	
0400 0457	Germany, Deutsche Welle	5905af 7285af
	9470af 9800af	
0400 0457	North Korea, VO Korea	7220as 9345as
	9730as 11735ca 13760sa 15180sa	
0400 0458	New Zealand, R New Zealand Intl	15720pa
0400 0458 DRM	New Zealand, R New Zealand Intl	17675pa
0400 0500	Anguilla, University Network	6090na
0400 0500	Australia, ABC/R Australia	9660pa 12080pa
	15160pa 15240pa 15415as 15515pa	
	21725pa	
0400 0500	Australia, NT VL8A Alice Springs	4835do
0400 0500	Australia, NT VL8K Katherine	5025do
0400 0500	Australia, NT VL8T Tennant Creek	4910do
0400 0500	Bahrain, R Bahrain	6010me
0400 0500	Canada, CFRX Toronto ON	6070do
0400 0500	Canada, CKZN St Johns NF	6160do
0400 0500	Canada, CKZU Vancouver BC	6160do
0400 0500	Cuba, R Havana Cuba	6000na 6165na
0400 0500	Germany, R 6150	6070eu
0400 0500	Malaysia, RTM Kajang/Traxx FM	7295do
0400 0500	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0400 0500	Palau, T8WH/World Harvest R	17650as
0400 0500 mtwhf	South Africa, Channel Africa	7230af
0400 0500 Sun	Sri Lanka, SLBC	6005as 9770as 15745as
0400 0500	Turkey, VO Turkey	7240as 9655va
0400 0500	UK, BBC World Service	3255af 6005af
	6190af 7255af 9410eu 11760eu	
	12015af 12035af 12095af 15310as	
0400 0500	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
0400 0500	USA, BBG/VO America	4930af 4960af
	9885af 15580af	
0400 0500	USA, Overcomer Ministry	3185na 5890na
0400 0500	USA, WBCQ Monticello ME	7490am 9330am
0400 0500	USA, WEWN/EWTN Irondale AL	11520af
0400 0500 Sat	USA, WHRI Cypress Creek SC	7520eu
0400 0500 smtwhf	USA, WHRI Cypress Creek SC	9640eu
0400 0500	USA, WINB Red Lion PA	9265ca
0400 0500	USA, WRNO New Orleans LA	7505na
0400 0500	USA, WTWW Lebanon TN	5830na
0400 0500	USA, WWCR Nashville TN	3215eu 4840na
	5890va 5935af	
0400 0500	USA, WWRB Manchester TN	3185na
	3195na	
0415 0420 mtwhf	Kyrgyzstan, Kyrgyz Radiosu	4010do
0430 0500 mtwhf	Swaziland, TWR Africa	3200af
0430 0500	USA, WHRI Cypress Creek SC	6175ca
0455 0500 mtwhf	Nigeria, VO Nigeria	15120eu
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 0527	Germany, Deutsche Welle	5905af
0500 0527	Vatican City State, Vatican R	7360af 13765af
0500 0530	Germany, Deutsche Welle	7425af 11800af
0500 0530	Japan, R Japan/NHK World	9770sa
	11740na 17660va	
0500 0557	China, China R International	7220as
	11880as 15350as 15465as 17505va	
	17540va 17725va 17855va	
0500 0557	North Korea, VO Korea	13650as 15100as
0500 0600	Anguilla, University Network	6090na
0500 0600	Australia, ABC/R Australia	9660pa 12080pa
	13630pa 15240pa 15415as 15515pa	
	21725pa	
0500 0600	Australia, NT VL8A Alice Springs	4835do
0500 0600	Australia, NT VL8K Katherine	5025do
0500 0600	Australia, NT VL8T Tennant Creek	4910do
0500 0600	Bahrain, R Bahrain	6010me

0500 0600	Bhutan, Bhutan BC Svc	6035do	
0500 0600	Canada, CFRX Toronto ON	6070do	
0500 0600	Canada, CKZN St Johns NF	6160do	
0500 0600	Canada, CKZU Vancouver BC	6160do	
0500 0600	Cuba, R Havana Cuba	6010na	6060na
	6125am	6165na	
0500 0600	Eqt Guinea, Pan Am BC/R Africa	15190af	
0500 0600	Germany, Deutsche Welle	9470af	
0500 0600	Germany, R 6150	6070eu	
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 mtwhf	Nigeria, VO Nigeria	15120af	
0500 0600	Palau, T8WH/World Harvest R	17650as	
0500 0600 mtwhf	South Africa, Channel Africa	7230af	
0500 0600	Swaziland, TWR Africa	3200af	9500af
0500 0600	UK, BBC World Service	3955eu	6005af
	7255af	9410af	11760eu 15310as
	15360va	15400af	15420af 17640af
0500 0600	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0500 0600	USA, BBG/VO America	4930af	6080af
	9885af	15580af	
0500 0600	USA, Overcomer Ministry	3185na	5890na
0500 0600	USA, WBCQ Monticello ME9330am		
0500 0600	USA, WEWN/EWTN Irondale AL	11520af	
0500 0600	USA, WHRI Cypress Creek SC	9615af	
0500 0600	USA, WTTWW Lebanon TN	5830na	
0500 0600	USA, WWCR Nashville TN	3215eu	4840na
	5890va	5935af	
0500 0600	USA, WWRB Manchester TN	3185na	
0502 0600	Swaziland, TWR Africa	6120af	9500af
0515 0530	Rwanda, R Rep Rwandaise	6055do	
0530 0557	Germany, Deutsche Welle	9470af	11800af
0530 0600	Australia, ABC/R Australia	17750as	
0530 0600	Thailand, R Thailand World Svc	12015va	
0530 0600	USA, WHRI Cypress Creek SC	6195ca	

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

0600 0630	China, Xizang PBS	6025do	6130do
	9580do		
0600 0630 Sat/Sun	USA, WRMI/R Prague relay	9955ca	
0600 0650 DRM	New Zealand, R New Zealand Intl	13730pa	
0600 0657	China, China R International	11750af	
	11770me	11880as	13645as 15145as
	15350as	15465as	17505va 17540as
	17710va		
0600 0657	North Korea, VO Korea	7220as	9345as
	9730as		
0600 0700	Anguilla, University Network	6090na	
0600 0700	Australia, ABC/R Australia	9660pa	11945pa
	12080pa	13630pa	15240pa 15415as
	17750pa	21725pa	
0600 0700	Australia, NT VL8A Alice Springs	4835do	
0600 0700	Australia, NT VL8K Katherine	5025do	
0600 0700	Australia, NT VL8T Tennant Creek	4910do	
0600 0700	Bahrain, R Bahrain	6010me	
0600 0700	Canada, CFRX Toronto ON	6070do	
0600 0700	Canada, CFVP Calgary AB	6030do	
0600 0700	Canada, CKZN St Johns NF	6160do	
0600 0700	Canada, CKZU Vancouver BC	6160do	
0600 0700	Cuba, R Havana Cuba	6010na	6060na
	6125am	6165na	
0600 0700	Eqt Guinea, Pan Am BC/R Africa	15190af	
0600 0700	Germany, Deutsche Welle	13780af	17800af
0600 0700 wa	Germany, Hamburger Lokalradio	7265eu	
0600 0700	Germany, R 6150	6070eu	
0600 0700	Malaysia, RTM Kajang/Traxx FM	7295do	
0600 0700	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0600 0700	New Zealand, R New Zealand Intl	11725pa	
0600 0700 mtwhf	Nigeria, VO Nigeria	15120af	
0600 0700	Palau, T8WH/World Harvest R	17650as	
0600 0700	Russia, VO Russia	11635eu	21800va
	21820va		
0600 0700 mtwhf	South Africa, Channel Africa	7230af	
	15255af		

0600 0700	Swaziland, TWR Africa	3200af	6120af
	9500af		
0600 0700	UK, BBC World Service	3955eu	6005af
	6190af	9410af	9460af 12095af
	15360eu	15400af	15420af 15310as
	17790as		
0600 0700	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0600 0700	USA, BBG/VO America	6080af	9885af
	15580af		
0600 0700	USA, Overcomer Ministry	3185na	5890na
0600 0700	USA, WBCQ Monticello ME9330am		
0600 0700	USA, WEWN/EWTN Irondale AL	11520af	
0600 0700	USA, WHRI Cypress Creek SC	9615af	7315sa
	9615af		
0600 0700	USA, WTTWW Lebanon TN	5830na	
0600 0700	USA, WWCR Nashville TN	3215eu	4840na
	5890va	5935af	
0600 0700	USA, WWRB Manchester TN	3185na	
0617 0630 Sun	Nepal, R Nepal	5005do	
0630 0656	Romania, R Romania Intl	7310eu	17780as
	21600pa		
0630 0657	Vatican City State, Vatican R	11625af	13765af
0630 0700 DRM	Romania, R Romania Intl	9600eu	
0651 0700 DRM	New Zealand, R New Zealand Intl	11675pa	

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

0700 0730	Myanmar, Myanma R/Yangon	9731do	
0700 0757	China, China R International	11785as	
	11880as	13645eu	15125as 15350as
	15465as	17490eu	17540as 17710as
0700 0758	New Zealand, R New Zealand Intl	11725pa	
0700 0758 DRM	New Zealand, R New Zealand Intl	11675pa	
0700 0800	Anguilla, University Network	6090na	
0700 0800	Australia, ABC/R Australia	7410pa	9475pa
	9660pa	9710pa	11945pa 12080pa
	13630pa	15240pa	
0700 0800	Australia, NT VL8A Alice Springs	4835do	
0700 0800	Australia, NT VL8K Katherine	5025do	
0700 0800	Australia, NT VL8T Tennant Creek	4910do	
0700 0800	Bahrain, R Bahrain	6010me	
0700 0800	Canada, CFRX Toronto ON	6070do	
0700 0800	Canada, CFVP Calgary AB	6030do	
0700 0800	Canada, CKZN St Johns NF	6160do	
0700 0800	Canada, CKZU Vancouver BC	6160do	
0700 0800	Eqt Guinea, Pan Am BC/R Africa	15190af	
0700 0800 wa	Germany, Hamburger Lokalradio	7265eu	
0700 0800	Germany, R 6150	6070eu	
0700 0800	Malaysia, RTM Kajang/Traxx FM	7295do	
0700 0800	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0700 0800	Palau, T8WH/World Harvest R	17650as	
0700 0800	Papua New Guinea, R Fly	3915do	
0700 0800	Russia, VO Russia	11635eu	12015eu
	15745as	21800va	21820va 21840as
0700 0800 mtwhf	South Africa, Channel Africa	9625af	
0700 0800	Swaziland, TWR Africa	3200af	6120af
	9500af		
0700 0800	UK, BBC World Service	5875eu	6190af
	7355eu	13820af	11770af 12095af
	13820af	15310as	15400af 15575va
	17640af	17660eu	17790as 17830af
0700 0800	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
0700 0800	USA, Overcomer Ministry	3185na	5890na
0700 0800	USA, WBCQ Monticello ME9330am		
0700 0800	USA, WEWN/EWTN Irondale AL	11520af	
0700 0800	USA, WHRI Cypress Creek SC	9615af	7315sa
	9615af	9930as	
0700 0800	USA, WTTWW Lebanon TN	5830na	
0700 0800	USA, WWCR Nashville TN	3215eu	4840na
	5890va	5935af	
0700 0800	USA, WWRB Manchester TN	3185na	
0730 0744	Vatican City State, Vatican R	15595va	
0730 0800	Australia, HCJB Global Australia	11750pa	
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, HCJB Global Australia	11750pa
0800 0830	Australia, NT VL8A Alice Springs	4835do
0800 0830	Australia, NT VL8K Katherine	5025do
0800 0830	Australia, NT VL8T Tennant Creek	4910do
0800 0830 Sun	Canada, Bible Voice Broadcasting	7220eu
0800 0830	USA, WHRI Cypress Creek SC	11565pa
0800 0845 Sat	Canada, Bible Voice Broadcasting	7220eu
0800 0850	Austria, TWR Europe	7400eu
0800 0850	Germany, TWR Europe	6105eu
0800 0857	China, China R International	9415as
	11785as 11880as 15350as 15465as	
	15625va 17490eu 17540as	
0800 0900	Anguilla, University Network	6090na
0800 0900	Australia, ABC/R Australia	5995pa 7410pa
	9475pa 9580pa 9710pa 11945pa	
	12080pa 15240pa	
0800 0900	Bahrain, R Bahrain	6010me
0800 0900	Canada, CFRX Toronto ON	6070do
0800 0900	Canada, CFVP Calgary AB	6030do
0800 0900	Canada, CKZN St Johns NF	6160do
0800 0900	Canada, CKZU Vancouver BC	6160do
0800 0900	Eqt Guinea, Pan Am BC/R Africa	15190af
0800 0900	Germany, R 6150	6070eu
0800 0900	Malaysia, RTM Kajang/Traxx FM	7295do
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	Nigeria, VO Nigeria	15120af
0800 0900	Palau, T8WH/World Harvest R	17650as
0800 0900	Papua New Guinea, R Fly	3915do
0800 0900	Russia, VO Russia	9625eu 11635eu
	15745as 21800va 21830va 21840as	
0800 0900 DRM	Russia, VO Russia	9625eu
0800 0900 mtwhf	South Africa, Channel Africa	9625af
0800 0900 Sun	South Africa, R Mirror Intl	7205af 17760af
0800 0900	South Korea, KBS World R	9570as
0800 0900	UK, BBC World Service	5875eu 6190af
	7355eu 12095af 15310as 15400af	
	15575va 17640af 17660eu 17790as	
	17830af 21470af	
0800 0900	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
0800 0900	USA, Overcomer Ministry	3185na 5890na
0800 0900	USA, WBCQ Monticello ME	9330am
0800 0900	USA, WEWN/EWTN Irondale AL	11520af
0800 0900	USA, WHRI Cypress Creek SC	7315sa
	9930as	
0800 0900	USA, WTTWW Lebanon TN	5830na
0800 0900	USA, WWCN Nashville TN	3215eu 4840na
	5890va 5935af	
0800 0900	USA, WWRB Manchester TN	3185na
0815 0827	Nepal, R Nepal	5005do
0830 0900	Australia, NT VL8A Alice Springs	2310do
0830 0900	Australia, NT VL8K Katherine	2485do
0830 0900	Australia, NT VL8T Tennant Creek	2325do
0850 0900 mtwhf	Guam, KTWR/TWR Asia	15200as

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

0900 0930 mtwhf	Guam, KTWR/TWR Asia	15200as
0900 0930	USA, WHRI Cypress Creek SC	6195sa
0900 0930 mtwhfa	USA, WRMI/R Prague relay	9955ca
0900 0957	China, China R International	9415as
	15210as 15270eu 15350as 17490eu	
	17570eu 17650eu 17690va 17750va	
0900 1000	Anguilla, University Network	6090na
0900 1000	Australia, ABC/R Australia	9580pa 11945pa
0900 1000	Australia, NT VL8A Alice Springs	2310do
0900 1000	Australia, NT VL8K Katherine	2485do
0900 1000	Australia, NT VL8T Tennant Creek	2325do
0900 1000	Bahrain, R Bahrain	6010me
0900 1000	Canada, CFRX Toronto ON	6070do
0900 1000	Canada, CFVP Calgary AB	6030do
0900 1000	Canada, CKZN St Johns NF	6160do
0900 1000	Canada, CKZU Vancouver BC	6160do
0900 1000	Germany, Mighty KBC Radio	6095eu
0900 1000	Germany, R 6150	6070eu

0900 1000 Sat	Italy, IRRS Shortwave	9510va
0900 1000	Malaysia, RTM Kajang/Traxx FM	7295do
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 mtwhf	Nigeria, VO Nigeria	9690af
0900 1000	Palau, T8WH/World Harvest R	17650as
0900 1000	Papua New Guinea, R Fly	3915do
0900 1000	Russia, VO Russia	9625eu 15745as
	21800va 21820va	
0900 1000 DRM	Russia, VO Russia	9625eu
0900 1000 mtwhf	South Africa, Channel Africa	9625af
0900 1000	UK, BBC World Service	6190af 6195as
	9740as 11895as 12095af 15285af	
	15310as 15400af 15575af 17760as	
	17790as 17830af	
0900 1000	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
0900 1000	USA, Overcomer Ministry	3185na 5890na
0900 1000	USA, WBCQ Monticello ME	9330am
0900 1000	USA, WEWN/EWTN Irondale AL	11520af
0900 1000	USA, WHRI Cypress Creek SC	9930as
	11565pa	
0900 1000	USA, WTTWW Lebanon TN	5830na
0900 1000	USA, WWCN Nashville TN	3215eu 4840af
	5890va 5935af	
0900 1000	USA, WWRB Manchester TN	3185na
0905 0910	Pakistan, R Pakistan External Svc	15725eu
	17700eu	
0930 1000 fs	China, VO the Strait	6115do

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

1000 1018 mtwhf	Guam, KTWR/TWR Asia	11840pa
1000 1030 Sat	Guam, KTWR/TWR Asia	11840pa
1000 1030	Japan, R Japan/NHK World	9625as
	11740as	
1000 1030	Vietnam, VO Vietnam/Overseas Svc	9840as
	12020as	
1000 1057	China, China R International	5955na
	7215as 11640as 13590as 13720as	
	15190as 15210pa 15350as 17490eu	
	17690va	
1000 1057	North Korea, VO Korea	6170va 9335sa
	9850as	
1000 1058	New Zealand, R New Zealand Intl	9765pa
1000 1100	Anguilla, University Network	11775na
1000 1100	Australia, ABC/R Australia	6020pa 9580pa
	11945pa	
1000 1100 Sat/Sun	Australia, ABC/R Australia	9475pa
1000 1100	Australia, NT VL8A Alice Springs	2310do
1000 1100	Australia, NT VL8K Katherine	2485do
1000 1100	Australia, NT VL8T Tennant Creek	2325do
1000 1100	Bahrain, R Bahrain	6010me
1000 1100	Canada, CFRX Toronto ON	6070do
1000 1100	Canada, CFVP Calgary AB	6030do
1000 1100	Canada, CKZN St Johns NF	6160do
1000 1100	Canada, CKZU Vancouver BC	6160do
1000 1100	Germany, Mighty KBC Radio	6095eu
1000 1100	Germany, R 6150	6070eu
1000 1100	India, AIR/External Svc	7270as 13605as
	13695pa 15030as 15410as 17510pa	
	17895pa	
1000 1100	Indonesia, VO Indonesia	9526va
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 mtwhf	Nigeria, VO Nigeria	9690af
1000 1100	Russia, VO Russia	7260as 9625eu
	15745as	
1000 1100 DRM	Russia, VO Russia	9625eu
1000 1100	Saudi Arabia, BSKSA/European Pgm	15250as
1000 1100 mtwhf	South Africa, Channel Africa	9625af
1000 1100	UK, BBC World Service	6190af 6195as
	9740as 11760va 12095af 15285as	
	15310as 15575eu 17790as	
	17790as 17830af	
1000 1100 Sat/Sun	UK, BBC World Service	17830af
1000 1100	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	

1000 1100	USA, KNLS Anchor Point AK	9615as
1000 1100	USA, Overcomer Ministry 3185na	5890na
1000 1100	USA, WBCQ Monticello ME9330am	
1000 1100	USA, WEWN/EWTN Irondale AL	11520af
1000 1100	USA, WHRI Cypress Creek SC	7315sa
	9930as 11565pa	
1000 1100	USA, WTWW Lebanon TN 5830na	
1000 1100	USA, WWCR Nashville TN 4840na	5890va
	5935af 6875af	
1000 1100	USA, WWRB Manchester TN	3185na
1030 1100	Iran, VO Islamic Rep of Iran 21575va	21610va
1030 1100 Sun	Italy, IRRS Shortwave	9510va
1030 1100	Mongolia, Voice of Mongolia	12085as
1059 1100	New Zealand, R New Zealand Intl	17675pa

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

1100 1105	Pakistan, R Pakistan External Svc	15725eu
	17700eu	
1100 1127	Iran, VO Islamic Rep of Iran 21575va	21610va
1100 1130 Sat/Sun	Canada, Bible Voice Broadcasting	15390as
1100 1130 f/DRM	Japan, R Japan/NHK World	9760eu
1100 1130 Sat/DRM	South Korea, KBS World R	9760eu
1100 1130 mtwhf	UK, BBC World Service	15400af
1100 1130	Vietnam, VO Vietnam/Overseas Svc	7285as
1100 1157	China, China R International	5955as
	9570as 11650as 11795as 13590as	
	13645as 13665as 13720as 17490va	
1100 1158 DRM	New Zealand, R New Zealand Intl	9870pa
1100 1200	Anguilla, University Network	11775na
1100 1200	Australia, ABC/R Australia	5995pa 6020pa
	6080as 6140as 9580as 11945pa	
1100 1200 DRM	Australia, ABC/R Australia	12080pa
1100 1200	Australia, NT VL8A Alice Springs	2310do
1100 1200	Australia, NT VL8K Katherine	2485do
1100 1200	Australia, NT VL8T Tennant Creek	2325do
1100 1200	Bahrain, R Bahrain	6010me
1100 1200	Canada, CFRX Toronto ON	6070do
1100 1200	Canada, CFVP Calgary AB	6030do
1100 1200	Canada, CKZN St Johns NF	6160do
1100 1200	Canada, CKZU Vancouver BC	6160do
1100 1200 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1100 1200	Germany, R 6150	6070eu
1100 1200 Sun	Italy, IRRS Shortwave	9510va
1100 1200	Malaysia, RTM Kajang/Traxx FM	7295do
1100 1200	New Zealand, R New Zealand Intl	17675pa
1100 1200 mtwhf	Nigeria, VO Nigeria	9690af
1100 1200	Russia, VO Russia	7260as 9560as
	9625eu	
1100 1200 DRM	Russia, VO Russia	9625eu 11640as
1100 1200	Saudi Arabia, BSKSA/European Pgm	15250as
1100 1200 mtwhf	South Africa, Channel Africa	9625af
1100 1200	Taiwan, R Taiwan Intl	7445as 9465as
1100 1200	UK, BBC World Service	6190af 6195as
	9740as 11760va 11895as 12095af	
	15285as 15310as 17790as 17830af	
1100 1200	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
1100 1200	USA, Overcomer Ministry	3185na 5890na
1100 1200	USA, Overcomer Ministry	13570as
1100 1200	USA, WBCQ Monticello ME9330am	
1100 1200	USA, WEWN/EWTN Irondale AL	11520af
1100 1200	USA, WHRI Cypress Creek SC	7315ca
	9930as 11565pa	
1100 1200	USA, WTWW Lebanon TN	5830na
1100 1200	USA, WWCR Nashville TN	5890af 5935af
	6875af 9880va	
1100 1200	USA, WWRB Manchester TN	3185na
1115 1130 f	Canada, Bible Voice Broadcasting	15390as
1130 1200 f	Vatican City State, Vatican R	17590va 21650va
1130 1200	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

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

1200 1230	Japan, R Japan/NHK World	11740as
	15190na	
1200 1230	Saudi Arabia, BSKSA/European Pgm	15250as

1200 1230asmtwh	USA, WHRI Cypress Creek SC	9930as
1200 1256	Romania, R Romania Intl	15460eu 17530eu
	17765af 21570af	
1200 1257	China, China R International	5955as
	7250as 9460as 9600as 9645as	
	9730pa 9760as 11760as 11980as	
	12015va 13655eu 13790eu 17490eu	
1200 1258	New Zealand, R New Zealand Intl	17675pa
1200 1300	Anguilla, University Network	11775na
1200 1300	Australia, ABC/R Australia	6080as 6140as
	9580as 11945pa	
1200 1300 DRM	Australia, ABC/R Australia	5995as
1200 1300	Australia, NT VL8A Alice Springs	2310do
1200 1300	Australia, NT VL8K Katherine	2485do
1200 1300	Australia, NT VL8T Tennant Creek	2325do
1200 1300	Bahrain, R Bahrain	6010me
1200 1300	Canada, CFRX Toronto ON	6070do
1200 1300	Canada, CFVP Calgary AB	6030do
1200 1300	Canada, CKZN St Johns NF	6160do
1200 1300	Canada, CKZU Vancouver BC	6160do
1200 1300	Ethiopia, R Ethiopia/Natl Svc	9705do
1200 1300 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1200 1300	Germany, R 6150	6070eu
1200 1300 Sun	Italy, IRRS Shortwave	9510va
1200 1300	Malaysia, RTM Kajang/Traxx FM	7295do
1200 1300 mtwhf	Nigeria, VO Nigeria	9690af
1200 1300 DRM	Russia, VO Russia	9625eu
1200 1300	Russia, VO Russia	5885as 7260as
	9560as 9625eu 12075as	
1200 1300	UK, BBC World Service	5875as 6190af
	6195as 9740as 11760va 11895as	
	12095af 15310as 17640af 17790as	
	17830af 21470af	
1200 1300	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
1200 1300	USA, BBG/VO America	7520va 9640va
	11750va 12150va	
1200 1300	USA, KNLS Anchor Point AK	9615as
1200 1300	USA, Overcomer Ministry	3185na
1200 1300 mtwhf	USA, Overcomer Ministry	5890na
1200 1300	USA, Overcomer Ministry	13570as
1200 1300	USA, WBCQ Monticello ME9330am	
1200 1300	USA, WEWN/EWTN Irondale AL	11520af
1200 1300	USA, WHRI Cypress Creek SC	9840na
	11565pa	
1200 1300	USA, WTWW Lebanon TN	5830na
1200 1300	USA, WWCR Nashville TN	5935na 9980va
	15825eu	
1200 1300	USA, WWRB Manchester TN	3185na
1215 1300	Egypt, R Cairo	17870as
1230 1300	Bangladesh, Bangladesh Betar/Ext Svc	15105as
1230 1300	South Korea, KBS World R	6095as
1230 1300	Thailand, R Thailand World Svc	9720pa
1230 1300	USA, WHRI Cypress Creek SC	9930as
1230 1300	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

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

1300 1315	Palau, T8WH/World Harvest R	11925as
1300 1330	Egypt, R Cairo	17870as
1300 1330	Japan, R Japan/NHK World	11730as
1300 1357	China, China R International	5995as
	7300na 9570as 9655pa 9730va	
	9765as 9870as 11760as 11900as	
	11980as 13670eu 13790eu	
1300 1357	North Korea, VO Korea	7570eu 9335na
	11710na 12015eu	
1300 1400	Anguilla, University Network	11775na
1300 1400	Australia, ABC/R Australia	5940as 6020pa
	9580pa 11945pa	
1300 1400 DRM	Australia, ABC/R Australia	5995pa
1300 1400	Australia, NT VL8A Alice Springs	2310do
1300 1400	Australia, NT VL8K Katherine	2485do
1300 1400	Bahrain, R Bahrain	6010me
1300 1400	Canada, CFRX Toronto ON	6070do
1300 1400	Canada, CFVP Calgary AB	6030do

1300 1400	Canada, CKZN St Johns NF6160do	
1300 1400	Canada, CKZU Vancouver BC	6160do
1300 1400 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1300 1400	Germany, R 6150	6070eu
1300 1400	Indonesia, VO Indonesia	9526va
1300 1400	Malaysia, RTM Kajang/Traxx FM	7295do
1300 1400	New Zealand, R New Zealand Intl	5950pa
1300 1400 mtwhf	Nigeria, VO Nigeria	9690af
1300 1400 DRM	Russia, VO Russia	9625eu
1300 1400	Russia, VO Russia	7260as 9560as 12075as
1300 1400	South Korea, KBS World R	15575as
1300 1400	Tajikistan, VO Tajik	7245va
1300 1400	UK, BBC World Service	5875as 6190af 6195as 9410as 9740as 11760as 11890as 12095af 15310as 15400as 17790as 17830af 21470af
1300 1400	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1300 1400 Sat/Sun	USA, BBG/VO America	7520va 9640va 11750va 12150va
1300 1400	USA, KJES Vado NM	11715na
1300 1400 mtwhf	USA, Overcomer Ministry	9980na
1300 1400	USA, Overcomer Ministry	13570na
1300 1400	USA, WBCQ Monticello ME9330am	
1300 1400	USA, WEWN/EWTN Irontdale AL	15610eu
1300 1400	USA, WHRI Cypress Creek SC	9930as 11565pa
1300 1400 Sat/Sun	USA, WHRI Cypress Creek SC	9840na
1300 1400	USA, WINB Red Lion PA	13570ca
1300 1400	USA, WTTWW Lebanon TN	5830na
1300 1400	USA, WWCR Nashville TN	7490af 9980va 13845eu 15825eu
1300 1400	USA, WWRB Manchester TN	9370na
1315 1345	Bangladesh, Bangladesh Betar/Ext Svc	7250as
1330 1400 f	Clandestine, JSR/Shiokaze/Sea Breeze	5910as 5985as 6135as
1330 1400	India, AIR/External Svc	9690as 11620as 13710as
1330 1400	Turkey, VO Turkey	12035eu
1330 1400	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

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

1400 1415 Sun	USA, Pan Amer Broadcasting	15205as
1400 1425 mthf	Guam, KTWR/TWR Asia	15225as
1400 1430 f	Clandestine, JSR/Shiokaze/Sea Breeze	5910as 5985as 6135as
1400 1430	Japan, R Japan/NHK World	11695as 11705al 11925as
1400 1430	Laos, LNR Natl Svc/Vientane	6130do
1400 1430	Serbia, International R Serbia	9635eu
1400 1430	Thailand, R Thailand World Svc	9950va
1400 1430	Turkey, VO Turkey	12035eu
1400 1430	USA, WHRI Cypress Creek SC	9950as
1400 1435 swa	Guam, KTWR/TWR Asia	15225as
1400 1445 Sat	Guam, KTWR/TWR Asia	11580as
1400 1457	China, China R International	5955as 7300na 9460as 9765pa 9795as 9870as 11665eu 13625as 13685as 13740va 17630va
1400 1500	Anguilla, University Network	11775na
1400 1500	Australia, ABC/R Australia	5940as 5995pa 9580pa 11945pa
1400 1500	Australia, NT VL8A Alice Springs	2310do
1400 1500	Australia, NT VL8K Katherine	2485do
1400 1500	Australia, NT VL8T Tennant Creek	2325do
1400 1500	Bahrain, R Bahrain	6010me
1400 1500 Sun	Canada, Bible Voice Broadcasting	15470as
1400 1500	Canada, CFRX Toronto ON	6070do
1400 1500	Canada, CFVP Calgary AB	6030do
1400 1500	Canada, CKZN St Johns NF6160do	
1400 1500	Canada, CKZU Vancouver BC	6160do
1400 1500	Eqt Guinea, Pan Am BC/R Africa	15190af
1400 1500 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1400 1500	Germany, R 6150	6070eu
1400 1500	India, AIR/External Svc	9690as 11620as 13710as

1400 1500	Malaysia, RTM Kajang/Traxx FM	7295do
1400 1500	New Zealand, R New Zealand Intl	5950pa
1400 1500 mtwhf	Nigeria, VO Nigeria	9690af
1400 1500	Oman, R Sultanate of Oman	15560af
1400 1500	Russia, VO Russia	4960va 6235as 7260as 9560as 12075as
1400 1500	South Korea, KBS World R	9640as
1400 1500	UK, BBC World Service	5845as 5875as 6190af 11760as 11890as 12095af 15310as 15400as 17640af 17830af 21470af
1400 1500	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
1400 1500 mtwhf	USA, BBG/VO America	7520va 9760va 12150va
1400 1500	USA, BBG/VO America	4930af 6080af 15580af 17530af 17725af
1400 1500	USA, KJES Vado NM	11715na
1400 1500 mtwhf	USA, Overcomer Ministry	9980na 13570ca 13810me
1400 1500	USA, Overcomer Ministry	9370va 9460eu
1400 1500	USA, WBCQ Monticello ME9330am	
1400 1500	USA, WEWN/EWTN Irontdale AL	15610eu
1400 1500 Sat/Sun	USA, WHRI Cypress Creek SC	9840na 21600af
1400 1500	USA, WINB Red Lion PA	13570ca
1400 1500	USA, WJHR Intl Milton FL	15550 lsb
1400 1500	USA, WRNO New Orleans LA	7505na
1400 1500	USA, WTTWW Lebanon TN	9479na
1400 1500	USA, WWCR Nashville TN	7490af 9980va 13845eu 15825eu
1400 1500	USA, WWRB Manchester TN	9370na
1415 1427	Nepal, R Nepal	5005do
1415 1430	USA, Pan Amer Broadcasting	15205as
1425 1455	Swaziland, TWR Africa	6025af
1430 1445 Sun	USA, Pan Amer Broadcasting	15205as
1430 1500	Australia, ABC/R Australia	9475as 11660as
1430 1500 Sat	Canada, Bible Voice Broadcasting	15470as
1430 1500	China, China Business R	6190do 7220do
1430 1500	China, China Natl R/CNR11	4905do 4920do 6130do
1430 1500	Palau, T8WH/World Harvest R	11925as
1430 1500	USA, WHRI Cypress Creek SC	9965as
1430 1500	USA, WRMI/R Prague relay	9955ca
1445 1500	Australia, HCJB Global Australia	15340as

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

1500 1530	Australia, ABC/R Australia	11945pa
1500 1530	Australia, HCJB Global Australia	15340as
1500 1530 Sun	Canada, Bible Voice Broadcasting	13740as
1500 1530 Sun	Germany, R Santec	15190as
1500 1530 Sun	Italy, IRRS Shortwave	15190va
1500 1530	Vietnam, VO Vietnam/Overseas Svc	7285as 9840as 12020as
1500 1550	New Zealand, R New Zealand Intl	5950pa
1500 1557	China, China R International	5955as 6095eu 7325eu 7405as 9435me 9525as 9650as 9720eu 9785eu 9870na 13685af 13740eu 17630af
1500 1557	North Korea, VO Korea	7570eu 9335na 11710na 12015eu
1500 1600	Anguilla, University Network	11775na
1500 1600	Australia, ABC/R Australia	5940as 5995pa 7240pa 9475as 11660as
1500 1600	Australia, NT VL8A Alice Springs	2310do
1500 1600	Australia, NT VL8K Katherine	2485do
1500 1600	Bahrain, R Bahrain	6010me
1500 1600	Canada, CFRX Toronto ON	6070do
1500 1600	Canada, CFVP Calgary AB	6030do
1500 1600	Canada, CKZN St Johns NF6160do	
1500 1600	Canada, CKZU Vancouver BC	6160do
1500 1600	Eqt Guinea, Pan Am BC/R Africa	15190af
1500 1600 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1500 1600	Germany, R 6150	6070eu
1500 1600	Malaysia, RTM Kajang/Traxx FM	7295do
1500 1600 mtwhf	Nigeria, VO Nigeria	15120af
1500 1600	Palau, T8WH/World Harvest R	15680as
1500 1600	Russia, VO Russia	4960va 5900as 11985me

1500 1600 mtwhf	South Africa, Channel Africa	9625af	
1500 1600	UK, BBC World Service	5845as	5875as
	5975as	6190af	6195as
	9490af	9740as	9505af
	12095af	15400af	17640af
	21470af		17830af
1500 1600	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
1500 1600	USA, BBG/VO America	4930af	6080af
	7520va	9930va	11840va
	13570va	17725af	17895af
1500 1600	USA, KJES Vado NM	11715na	
1500 1600	USA, KNLS Anchor Point AK		9655as
1500 1600 mtwhf	USA, Overcomer Ministry	9980na	13570ca
	13810me		
1500 1600 Sat	USA, Overcomer Ministry	15420na	
1500 1600	USA, WBCQ Monticello ME9330am		
1500 1600	USA, WEWN/EWTN Irondale AL		15610eu
1500 1600 Sat	USA, WHRI Cypress Creek SC		21630af
1500 1600 Sun	USA, WHRI Cypress Creek SC		17570eu
1500 1600 Sat/Sun	USA, WHRI Cypress Creek SC		9840na
1500 1600	USA, WINB Red Lion PA	13570ca	
1500 1600	USA, WJHR Intl Milton FL	15550	lsb
1500 1600	USA, WRNO New Orleans LA		7505na
1500 1600	USA, WTWW Lebanon TN	9479na	
1500 1600	USA, WWCR Nashville TN	7490af	9980va
	13845eu	15825eu	
1500 1600	USA, WWRB Manchester TN		9370na
1515 1530 Sat	Canada, Bible Voice Broadcasting		13740as
1525 1555 Sat/Sun	Swaziland, TWR Africa	6025af	
1530 1545	India, AIR/External Svc	9910as	
1530 1549 smtwhf	Vatican City State, Vatican R	7485as	
1530 1550 smtwhf	Vatican City State, Vatican R	15595as	
1530 1550 smtwhf/DRM	Vatican City State, Vatican R		15775as
1530 1600	Afghanistan, R Afghanistan	7200as	
1530 1600	Australia, ABC/R Australia	11880pa	
1530 1600 DRM	Belgium, The Disco Palace	12115as	
1530 1600 h	Canada, Bible Voice Broadcasting		13740as
1530 1600	Iran, VO Islamic Rep of Iran	13785va	13785va
	15525va		
1530 1600	Mongolia, Voice of Mongolia		12015as
1530 1600 smtwhf	Sri Lanka, AWR Asia	15255as	
1530 1600 Sat	Vatican City State, Vatican R	7585as	15595as
1530 1600 Sat	Vatican City State, Vatican R	15775as	
1551 1600	New Zealand, R New Zealand Intl		9765pa
1551 1600 DRM	New Zealand, R New Zealand Intl		7440pa

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

1600 1627	Iran, VO Islamic Rep of Iran	13785va	15525va
1600 1630	Australia, ABC/R Australia	9580as	
1600 1630 DRM	Belgium, The Disco Palace	12115as	
1600 1630	Indonesia, AWR Asia/Pacific		15215as
	15660as		
1600 1650 DRM	New Zealand, R New Zealand Intl		7440pa
1600 1657	China, China R International		6060as
	6155as	7235af	7255af
	7435eu	9435eu	9460eu
	9600eu	9875as	9570eu
1600 1657	North Korea, VO Korea	9990va	1154va
1600 1657	Vietnam, VO Vietnam/Overseas Svc		7216me
	7280eu	9550me	9730eu
1600 1658	Taiwan, R Taiwan Intl	9440as	15485as
1600 1700	Anguilla, University Network		11775na
1600 1700	Australia, ABC/R Australia	5940as	5995pa
	7240pa	9475as	11660pa
1600 1700	Australia, NT VL8A Alice Springs		2310do
1600 1700	Australia, NT VL8K Katherine		2485do
1600 1700	Bahrain, R Bahrain	6010me	
1600 1700	Canada, CFRX Toronto ON	6070do	
1600 1700	Canada, CFVP Calgary AB	6030do	
1600 1700	Canada, CKZN St Johns NF	6160do	
1600 1700	Canada, CKZU Vancouver BC		6160do
1600 1700	Egypt, R Cairo	15345af	
1600 1700	Eqt Guinea, Pan Am BC/R Africa		15190af
1600 1700	Ethiopia, R Ethiopia/External Svc		7235af
	9558af		
1600 1700 wa	Germany, Hamburger Lokalradio		7265eu
1600 1700 DRM	Germany, Mighty KBC Radio		9755eu
1600 1700	Germany, R 6150		6070eu

1600 1700	Malaysia, RTM Kajang/Traxx FM		7295do
1600 1700	New Zealand, R New Zealand Intl		9765pa
1600 1700	Palau, T8WH/World Harvest R		15680as
1600 1700	Russia, VO Russia	4960va	5885as
	5900as	5995as	7390as
1600 1700	South Korea, KBS World R	9515eu	9640as
1600 1700	UK, BBC World Service	3255af	5845as
	5975as	6190af	9410va
	9915eu	12095af	15400af
	17830af	21470af	21660af
1600 1700	USA, AFN/AFRTS		4319usb
	12759usb	13362usb	
1600 1700	USA, BBG/VO America	4930af	6080af
	15580af	17895af	
1600 1700 mtwhf	USA, Overcomer Ministry		9980na
1600 1700	USA, Overcomer Ministry		9370va
1600 1700	USA, WBCQ Monticello ME9330am		
1600 1700 Sat	USA, WBCQ Monticello ME	15420am	
1600 1700	USA, WEWN/EWTN Irondale AL		15610eu
1600 1700	USA, WHRI Cypress Creek SC		9840na
	21630af		
1600 1700	USA, WINB Red Lion PA	13570ca	
1600 1700	USA, WJHR Intl Milton FL	15550	lsb
1600 1700	USA, WRNO New Orleans LA		7505na
1600 1700	USA, WTWW Lebanon TN	9479na	
1600 1700	USA, WWCR Nashville TN	9980va	12160af
	13845eu	15825eu	
1600 1700	USA, WWRB Manchester TN		9370na
1630 1700	Indonesia, AWR Asia/Pacific		15660as
1630 1700 m	South Africa, R Mirror Intl		4895af
1645 1700 mw	Canada, Bible Voice Broadcasting		9715me
1645 1700 thfas	Canada, Bible Voice Broadcasting		9715me
1651 1700	New Zealand, R New Zealand Intl		9890pa

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

1700 1710	Pakistan, Azad Kashmir R	3975do	4790do
1700 1710	Pakistan, R Pakistan External Svc		15725eu
	17700eu		
1700 1715 f	Canada, Bible Voice Broadcasting		9715me
1700 1730	Australia, ABC/R Australia	11660as	
1700 1730 DRM	Germany, AWR Europe	9755eu	
1700 1730 m	South Africa, R Mirror Intl	4895af	
1700 1745 h	Canada, Bible Voice Broadcasting		9715me
1700 1750 DRM	New Zealand, R New Zealand Intl		9890pa
1700 1750	New Zealand, R New Zealand Intl		9765pa
1700 1757	China, China R International		6090as
	6100as	6140as	6155eu
	7205af	7255as	7410as
	7425eu	7435af	9460eu
			9570eu
1700 1758	Taiwan, R Taiwan Intl	15690af	
1700 1800	Anguilla, University Network		11775na
1700 1800	Australia, ABC/R Australia	5995pa	9475as
	9500pa	9580pa	11880pa
1700 1800	Australia, NT VL8A Alice Springs		2310do
1700 1800	Australia, NT VL8K Katherine		2485do
1700 1800	Bahrain, R Bahrain	6010me	
1700 1800 tas	Canada, Bible Voice Broadcasting		9715me
1700 1800	Canada, CFRX Toronto ON	6070do	
1700 1800	Canada, CFVP Calgary AB	6030do	
1700 1800	Canada, CKZN St Johns NF	6160do	
1700 1800	Canada, CKZU Vancouver BC		6160do
1700 1800	Egypt, R Cairo	15345af	
1700 1800	Eqt Guinea, Pan Am BC/R Africa		15190af
1700 1800	Germany, R 6150		6070eu
1700 1800	Malaysia, RTM Kajang/Traxx FM		7295do
1700 1800	Palau, T8WH/World Harvest R		15680as
1700 1800	Russia, VO Russia	4960va	5900as
	5955as	7390as	
1700 1800 mtwhf	South Africa, Channel Africa		15235af
1700 1800	Swaziland, TWR Africa	3200af	
1700 1800 Sat/Sun	Swaziland, TWR Africa	3200af	
1700 1800	UK, BBC World Service	3255af	5845as
	5975as	6190af	12095af
	15420af	17640af	15400af
1700 1800	USA, AFN/AFRTS		4319usb
	12759usb	13362usb	
1700 1800	USA, BBG/VO America	6080af	13755af
	15580af	17895af	
1700 1800 mtwhf	USA, Overcomer Ministry		9980na

1700 1800 Sat	USA, Overcomer Ministry	15420na	
1700 1800	USA, Overcomer Ministry	9370va	9625me
1700 1800	USA, WBCQ Monticello ME9330am		
1700 1800	USA, WEWN/EWTN Irondale AL	15610me	
1700 1800	USA, WHRI Cypress Creek SC	9840na	
	21630af		
1700 1800	USA, WINB Red Lion PA	13570ca	
1700 1800	USA, WJHR Intl Milton FL	15550	lsb
1700 1800	USA, WRNO New Orleans LA	7505na	
1700 1800	USA, WTTWW Lebanon TN	9479na	
1700 1800	USA, WWCR Nashville TN	9980va	12160af
	13845eu	15825eu	
1700 1800	USA, WWRB Manchester TN		9370na
1715 1729	Vatican City State, Vatican R11935va		
1730 1757	Vatican City State, Vatican R11625af	13765af	
	15570af		
1730 1800	Australia, ABC/R Australia	6080pa	
1730 1800	Turkey, VO Turkey	11730va	
1745 1800	Bangladesh, Bangladesh Betar/Ext Svc	7250eu	
1745 1800	India, AIR/External Svc	7550eu	9445va
	9950eu	11580af	11670eu
	13695af	17670af	11935af
1751 1800	New Zealand, R New Zealand Intl		11725pa
1751 1800 DRM	New Zealand, R New Zealand Intl		11675pa

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

1800 1815 Sat	Canada, Bible Voice Broadcasting	7365me	
1800 1830	Japan, R Japan/NHK World	15720af	
1800 1830 irreg	Tanzania, Zanzibar BC/VO Tanzania	11735do	
1800 1830	Turkey, VO Turkey	11730va	
1800 1830	UK, BBC World Service	5975as	7600as
1800 1830	USA, BBG/VO America	6080af	13755af
	15580af		
1800 1830 Sat/Sun	USA, BBG/VO America	4930af	
1800 1830	Vietnam, VO Vietnam/Overseas Svc	5955eu	
1800 1850 DRM	New Zealand, R New Zealand Intl	11675pa	
1800 1856 DRM	Romania, R Romania Intl	9780eu	
1800 1856	Romania, R Romania Intl	7300eu	
1800 1857	China, China R International	6100eu	
	7405eu		
1800 1857	North Korea, VO Korea	7570eu	12015eu
1800 1858	Taiwan, R Taiwan Intl	3965eu	
1800 1900	Anguilla, University Network		11775na
1800 1900 mtwhf	Argentina, RAE	15345eu	
1800 1900	Australia, ABC/R Australia	6080pa	9475as
	9500pa	9580as	11880pa
1800 1900 Sat/Sun	Australia, ABC/R Australia	9710as	
1800 1900	Australia, NT VL8A Alice Springs	2310do	
1800 1900	Australia, NT VL8K Katherine	2485do	
1800 1900	Bahrain, R Bahrain	6010me	
1800 1900	Bangladesh, Bangladesh Betar/Ext Svc	7250eu	
1800 1900 Sat/Sun	Canada, Bible Voice Broadcasting	9715me	
1800 1900 Sat	Canada, Bible Voice Broadcasting	9470me	
1800 1900 Sun	Canada, Bible Voice Broadcasting	6030eu	
1800 1900	Canada, CFRX Toronto ON	6070do	
1800 1900	Canada, CFVP Calgary AB	6030do	
1800 1900	Canada, CKZN St Johns NF6160do		
1800 1900	Canada, CKZU Vancouver BC	6160do	
1800 1900	Eqt Guinea, Pan Am BC/R Africa	15190af	
1800 1900	Germany, R 6150	6070eu	
1800 1900	India, AIR/External Svc	7550eu	9445va
	9950eu	11580af	11670eu
	13695af	17670af	11935af
1800 1900	Kuwait, R Kuwait	15540eu	
1800 1900	Malaysia, RTM Kajang/Traxx FM	7295do	
1800 1900	New Zealand, R New Zealand Intl	11725pa	
1800 1900 mtwhf	Nigeria, VO Nigeria	15120af	
1800 1900	Palau, T8WH/World Harvest R	15680as	
1800 1900	Russia, VO Russia	4960va	11985va
1800 1900	South Korea, KBS World R	7275eu	
1800 1900	Swaziland, TWR Africa	3200af	9500af
1800 1900 Sat/Sun	Swaziland, TWR Africa	3200af	
1800 1900	UK, BBC World Service	3255af	5875eu
	5945eu	6190af	9430af
	12095af	15400af	11810af
1800 1900	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	

1800 1900	USA, KJES Vado NM	15385pa	
1800 1900 mtwhf	USA, Overcomer Ministry	9980na	
1800 1900	USA, Overcomer Ministry	9370va	9625me
1800 1900	USA, WBCQ Monticello ME9330am	15420am	
1800 1900	USA, WEWN/EWTN Irondale AL	15610me	
1800 1900	USA, WHRI Cypress Creek SC	9840na	
	9930as	21630af	
1800 1900	USA, WINB Red Lion PA	13570ca	
1800 1900	USA, WTTWW Lebanon TN	9479na	
1800 1900	USA, WWCR Nashville TN	9980va	12160af
	13845eu	15825eu	
1800 1900	USA, WWRB Manchester TN		9370na
1815 1845 Sat	Canada, Bible Voice Broadcasting	6030eu	
1815 1845 Sun	Canada, Bible Voice Broadcasting	9470me	
1830 1845	Rwanda, R Rep Rwanda	6055do	
1830 1900 mtwhf/DRM	Nigeria, VO Nigeria	15120af	
1830 1900	South Africa, AWR Africa	11830af	
1830 1900	UK, BBC World Service	6005af	9410af
1830 1900	USA, BBG/VO America	4930af	6080af
	13755af	15580af	
1851 1900 DRM	New Zealand, R New Zealand Intl		15720pa
1851 1900	New Zealand, R New Zealand Intl		11725pa

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

1900 1930	Germany, Deutsche Welle	11800af	12070af
	15275af		
1900 1930	Vietnam, VO Vietnam/Overseas Svc	7280eu	
	9730eu		
1900 1945	India, AIR/External Svc	7550eu	9445eu
	9950eu	11580af	11670eu
	13695af	17670af	11935af
1900 1950	New Zealand, R New Zealand Intl		11725pa
1900 1957	China, China R International		7295va
	9440af		
1900 1957	North Korea, VO Korea	7219eu	9975va
	11535va	11910af	
1900 2000	Anguilla, University Network		11775na
1900 2000	Australia, ABC/R Australia	6080pa	9500as
	9580pa	11660as	11880pa
1900 2000 Sat/Sun	Australia, ABC/R Australia	9710as	
1900 2000	Australia, NT VL8A Alice Springs	2310do	
1900 2000	Australia, NT VL8K Katherine	2485do	
1900 2000	Bahrain, R Bahrain	6010me	
1900 2000	Canada, CFRX Toronto ON	6070do	
1900 2000	Canada, CFVP Calgary AB	6030do	
1900 2000	Canada, CKZN St Johns NF6160do		
1900 2000	Canada, CKZU Vancouver BC	6160do	
1900 2000	Egypt, R Cairo	15290af	
1900 2000	Eqt Guinea, Pan Am BC/R Africa		15190af
1900 2000	Germany, R 6150	6070eu	
1900 2000	Indonesia, VO Indonesia	9526va	
1900 2000 fas	Italy, IRRS Shortwave	7290va	
1900 2000	Kuwait, R Kuwait	15540eu	
1900 2000	Malaysia, RTM Kajang/Traxx FM	7295do	
1900 2000	Micronesia, V6MP/Cross R/Pohnpei	4755as	
1900 2000 DRM	New Zealand, R New Zealand Intl		15720pa
1900 2000 mtwhf	Nigeria, VO Nigeria	7255af	
1900 2000	Palau, T8WH/World Harvest R		15680as
1900 2000 mtwhf	Spain, R Exterior de Espana	9605af	9665eu
1900 2000	Swaziland, TWR Africa	3200af	
1900 2000 Sat/Sun	Swaziland, TWR Africa	3200af	
1900 2000	Thailand, R Thailand World Svc		9585eu
1900 2000	UK, BBC World Service	3255af	5875eu
	5945eu	6190af	9410af
	11810af	12095af	15400af
1900 2000	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
1900 2000	USA, BBG/VO America	4930af	6080af
	15580af		
1900 2000 mtwhf	USA, Overcomer Ministry	9980na	13570ca
1900 2000	USA, Overcomer Ministry	9370va	9625me
	9835af	13570ca	
1900 2000 Sat/Sun	USA, Overcomer Ministry	9980na	
1900 2000	USA, WBCQ Monticello ME9330am	15420am	
1900 2000	USA, WEWN/EWTN Irondale AL	15610me	
1900 2000	USA, WHRI Cypress Creek SC	9840na	
	21630af		
1900 2000	USA, WINB Red Lion PA	13570ca	
1900 2000	USA, WTTWW Lebanon TN	9479na	



1900 2000	USA, WWCR Nashville TN	9980va	12160af
	13845eu	15825eu	
1900 2000	USA, WWRB Manchester TN		9370na
1905 1920 Sat	Mali, ORTM/R Mali	9635do	
1930 1957	Germany, Deutsche Welle	12070af	15275af
1930 2000	Eqt Guinea, Pan Am BC/R Africa		9515af
1930 2000	Iran, VO Islamic Rep of Iran	6040eu	7345eu
	12670af	15450af	
1930 2000	Serbia, International R Serbia		6100eu
1930 2000	Turkey, VO Turkey	6050eu	
1930 2000 Sun	USA, Pan Amer Broadcasting		6040af
1951 2000	New Zealand, R New Zealand Intl		17675pa

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

2000 2027	Iran, VO Islamic Rep of Iran	6040eu	7345eu
	12670af	15450af	
2000 2027	Vatican City State, Vatican R	11625af	13765af
2000 2030	Australia, ABC/R Australia	6080pa	500as
2000 2030	Egypt, R Cairo	15290af	
2000 2030	Eqt Guinea, Pan Am BC/R Africa		9515af
2000 2030 Sat/Sun	Swaziland, TWR Africa	3200af	
2000 2030	Turkey, VO Turkey	6050eu	
2000 2030	USA, BBG/VO America	4930af	6080af
	15580af		
2000 2030 mtwhf	USA, Overcomer Ministry	13570ca	
2000 2057	China, China R International		5960eu
	5985af	7285eu	7295va
	9440af	9600eu	11640eu
			13630eu
2000 2057	Germany, Deutsche Welle	9655af	
2000 2100	Anguilla, University Network		11775na
2000 2100	Australia, ABC/R Australia	9580pa	11650pa
	11660pa	12080pa	15515pa
2000 2100	Australia, NT VL8A Alice Springs		2310do
2000 2100	Australia, NT VL8K Katherine		2485do
2000 2100	Australia, NT VL8T Tennant Creek		2325do
2000 2100	Bahrain, R Bahrain	6010me	
2000 2100	Belarus, R Belarus	6155eu	11730eu
2000 2100 DRM	Belgium, The Disco Palace	17875na	
2000 2100	Canada, CFRX Toronto ON	6070do	
2000 2100	Canada, CFVP Calgary AB	6030do	
2000 2100	Canada, CKZN St Johns NF	6160do	
2000 2100	Canada, CKZU Vancouver BC		6160do
2000 2100 f	Clandestine, JSR/Shiokaze/Sea Breeze		
	5910as	5985as	6135as
2000 2100	Cuba, R Havana Cuba		11760am
2000 2100	Eqt Guinea, Pan Am BC/R Africa		15190af
2000 2100	Germany, R 6150	6070eu	
2000 2100	Italy, IRRS Shortwave	7290va	
2000 2100	Kuwait, R Kuwait	15540eu	
2000 2100	Malaysia, RTM Kajang/Traxx FM		7295do
2000 2100	Micronesia, V6MP/Cross R/Pohnpei		4755as
2000 2100 DRM	New Zealand, R New Zealand Intl		15720pa
2000 2100	New Zealand, R New Zealand Intl		17675pa
2000 2100	Palau, T8WH/World Harvest R		15680as
2000 2100	UK, BBC World Service	3255af	6190af
	9410af	9430af	11810af
	15400af		12095af
2000 2100	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
2000 2100 mtwhf	USA, BBG/VO America	9480va	
2000 2100	USA, Overcomer Ministry	5900eu	9370va
	9980na		
2000 2100	USA, WBCQ Monticello ME	7490am	9330am
	15420am		
2000 2100	USA, WEWN/EWTN Irontdale AL		15610me
2000 2100	USA, WHRI Cypress Creek SC		9505eu
	21630af		
2000 2100	USA, WINB Red Lion PA	13570ca	
2000 2100	USA, WTWW Lebanon TN	9479na	9905af
2000 2100	USA, WWCR Nashville TN	9980va	12160af
	13845eu	15825eu	
2000 2100	USA, WWRB Manchester TN		9370na
2030 2045	Thailand, R Thailand World Svc		9535eu
2030 2100	Australia, ABC/R Australia	9500pa	11695as
2030 2100	USA, BBG/VO America	4930af	6080af
	7560as	15580af	
2030 2100 Sat/Sun	USA, BBG/VO America		4930af

2030 2100	Vietnam, VO Vietnam/Overseas Svc	7216me	
	7280eu	9550me	
		9730eu	
2045 2100	India, AIR/External Svc	7550eu	9445eu
	9910pa	11620pa	11670eu
			11740pa
2045 2100 DRM	India, AIR/External Svc		9950eu

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

2100 2115 mtwhf	Moldova, R PMR/Pridnestrovye		7290eu
2100 2130 mtwhfa	Albania, R Tirana		7465eu
2100 2130	Australia, NT VL8A Alice Springs		2310do
2100 2130	Australia, NT VL8K Katherine		2485do
2100 2130	Australia, NT VL8T Tennant Creek		2325do
2100 2130	Austria, AWR Europe		9830af
2100 2150	New Zealand, R New Zealand Intl		17675pa
2100 2150 DRM	New Zealand, R New Zealand Intl		15720pa
2100 2157	China, China R International		5960eu
	7205af	7285eu	7405af
			7415eu
	9600eu		
2100 2157	North Korea, VO Korea	7570eu	12015eu
2100 2200	Angola, R Nac de Angola/Intl Svc		7217af
2100 2200	Anguilla, University Network		11775na
2100 2200	Australia, ABC/R Australia	9500pa	9660as
	11650pa	11695pa	12080pa
	15515pa	21740pa	
2100 2200	Bahrain, R Bahrain	6010me	
2100 2200	Belarus, R Belarus	6155eu	11730eu
2100 2200	Canada, CFRX Toronto ON	6070do	
2100 2200	Canada, CFVP Calgary AB	6030do	
2100 2200	Canada, CKZN St Johns NF	6160do	
2100 2200	Canada, CKZU Vancouver BC		6160do
2100 2200	Egypt, R Cairo	11890eu	12050al
2100 2200	Eqt Guinea, Pan Am BC/R Africa		15190af
2100 2200	Germany, Deutsche Welle	11800af	12070af
2100 2200	Germany, R 6150	6070eu	
2100 2200	India, AIR/External Svc	7550eu	9445eu
	9910pa	11620pa	11670eu
			11740pa
2100 2200 DRM	India, AIR/External Svc		9950eu
2100 2200	Malaysia, RTM Kajang/Traxx FM		7295do
2100 2200	Micronesia, V6MP/Cross R/Pohnpei		4755 as
2100 2200	Palau, T8WH/World Harvest R		15680as
2100 2200	Syria, R Damascus	9330va	
2100 2200	UK, BBC World Service	3255af	3915as
	5875as	5905as	5995af
	6195as	9410af	9915af
			12095af
2100 2200	USA, AFN/AFRTS	4319usb	5765usb
	12759usb	13362usb	
2100 2200	USA, BBG/VO America	6080af	15580af
2100 2200	USA, Overcomer Ministry	5900eu	9370va
2100 2200 Sat/Sun	USA, Overcomer Ministry	9980na	
2100 2200	USA, WBCQ Monticello ME	7490am	9330am
	15420am		
2100 2200	USA, WEWN/EWTN Irontdale AL		15610me
2100 2200	USA, WHRI Cypress Creek SC		9490eu
	21630af		
2100 2200	USA, WINB Red Lion PA	13570ca	
2100 2200	USA, WTWW Lebanon TN	9479na	9905af
2100 2200	USA, WWCR Nashville TN	6875eu	9350af
	9980va	13845eu	
2100 2200	USA, WWRB Manchester TN		3215na
	9370na		
2130 2156 DRM	Romania, R Romania Intl	6030eu	
2130 2156	Romania, R Romania Intl	7310na	7380eu
	9435na		
2130 2200	Australia, NT VL8A Alice Springs		4835do
2130 2200	Australia, NT VL8K Katherine		5025do
2130 2200	Australia, NT VL8T Tennant Creek		4910do
2130 2200	Turkey, VO Turkey	9610va	
2145 2200 mtwhf	Moldova, R PMR/Pridnestrovye		7290eu
2151 2200	New Zealand, R New Zealand Intl		15720pa
2151 2200 DRM	New Zealand, R New Zealand Intl		17675pa

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

2200 2230	India, AIR/External Svc	9910pa	11620pa
	11670eu	11740pa	
2200 2230 DRM	India, AIR/External Svc		9950eu

2200 2230	Serbia, International R Serbia	6100eu
2200 2230	South Korea, KBS World R	3955eu
2200 2230	Turkey, VO Turkey	9610va
2200 2245	Egypt, R Cairo	11890eu 12050al
2200 2257	China, China R International	5915eu
2200 2300	Anguilla, University Network	6090na
2200 2300	Australia, ABC/R Australia	9660as 9855as
	12080pa 13630pa 15230pa	15415pa
	15515pa 21740pa	
2200 2300	Australia, NT VL8A Alice Springs	4835do
2200 2300	Australia, NT VL8K Katherine	5025do
2200 2300	Australia, NT VL8T Tennant Creek	4910do
2200 2300	Bahrain, R Bahrain	6010me
2200 2300	Canada, CFRX Toronto ON	6070do
2200 2300	Canada, CFVP Calgary AB	6030do
2200 2300	Canada, CKZN St Johns NF	6160do
2200 2300	Canada, CKZU Vancouver BC	6160do
2200 2300	Cuba, R Havana Cuba	11880af
2200 2300	Eqt Guinea, Pan Am BC/R Africa	15190af
2200 2300	Germany, R 6150	6070eu
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	Palau, T8WH/World Harvest R	15180na
	15680as	
2200 2300	Russia, VO Russia	9395ca
2200 2300 Sat/Sun	Spain, R Exterior de Espana	6125eu
2200 2300	Taiwan, R Taiwan Intl	6115na 15440na
2200 2300	UK, BBC World Service	3915as 5875as
	5885af 5905as 6135as	6195as
	7490as	
2200 2300	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
2200 2300 smtwhf	USA, BBG/VO America	5895va 7365va
	7425va 7480va	11860va
2200 2300	USA, Overcomer Ministry	5900eu 9370va
	9980na	
2200 2300	USA, WBCQ Monticello ME	7490am 9330am
2200 2300	USA, WEWN/EWTN Irondale AL	15610me
2200 2300	USA, WHRI Cypress Creek SC	9490eu
	9505eu	
2200 2300	USA, WINB Red Lion PA	9265ca
2200 2300	USA, WTWW Lebanon TN	9479na 9905af
2200 2300	USA, WWCR Nashville TN	6875eu 9350af
	9980va 13845eu	
2200 2300	USA, WWRB Manchester TN	3215na
	9370na	
2230 2300	China, Xizang PBS	4905do
2230 2300	Indonesia, AWR Asia/Pacific	15320as
2245 2300	India, AIR/External Svc	9690as 9705as
	11710as 13605as	
2245 2300 DRM	India, AIR/External Svc	11645as

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

2300 0000	Anguilla, University Network	6090na
2300 0000	Australia, ABC/R Australia	9660as 9855as
	12080pa 15230pa 15415pa	15230pa
	15415pa 17795pa 19000pa	21740pa
2300 0000	Australia, NT VL8A Alice Springs	4835do
2300 0000	Australia, NT VL8K Katherine	5025do
2300 0000	Australia, NT VL8T Tennant Creek	4910do
2300 0000	Bahrain, R Bahrain	6010me
2300 0000	Canada, CFRX Toronto ON	6070do
2300 0000	Canada, CFVP Calgary AB	6030do
2300 0000	Canada, CKZN St Johns NF	6160do
2300 0000	Canada, CKZU Vancouver BC	6160do
2300 0000	Egypt, R Cairo	9965am 11510al
2300 0000	Germany, R 6150	6070eu
2300 0000	India, AIR/External Svc	6055as 9690as
	9705as 11710as 13605as	
2300 0000 DRM	India, AIR/External Svc	11645as
2300 0000	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	Palau, T8WH/World Harvest R	7385na
	15680as	
2300 0000	Romania, R Romania Intl	6015eu 7220eu
	9530as 11810as	
2300 0000	Russia, VO Russia	9395ca
2300 0000	Turkey, VO Turkey	5960va
2300 0000	UK, BBC World Service	3915as 5875as
	5980as 6135as 6195as	7490as
	9740as 11955as	
2300 0000	USA, AFN/AFRTS	4319usb 5765usb
	12759usb 13362usb	
2300 0000	USA, BBG/VO America	5830va 7365va
	7480va 11860va	
2300 0000	USA, Overcomer Ministry	9370va
2300 0000 mtwhf	USA, Overcomer Ministry	9980na
2300 0000	USA, WBCQ Monticello ME	7490am 9330am
2300 0000	USA, WEWN/EWTN Irondale AL	15610me
2300 0000 smtwhf	USA, WHRI Cypress Creek SC	7315ca
	9490eu	
2300 0000 Sat	USA, WHRI Cypress Creek SC	7315ca
	9505eu	
2300 0000 smtwhf	USA, WHRI Cypress Creek SC	9490eu
2300 0000	USA, WINB Red Lion PA	9265ca
2300 0000	USA, WTWW Lebanon TN	9479na 9905af
2300 0000	USA, WWCR Nashville TN	3195eu 5070af
	9980va 13845eu	
2300 0000	USA, WWRB Manchester TN	3215na
	9370na	
2300 2357	China, China R International	5915as
	5990ca 6145na 7350eu	7415as
	9535as 11790as	
2330 0000	Australia, ABC/R Australia	17750pa
2330 0000 tw	Indonesia, AWR Asia/Pacific	17700as
2330 0000	USA, WYFR/Family R	6115na
2330 0000	Vietnam, VO Vietnam/Overseas Svc	9840as
	12020as	

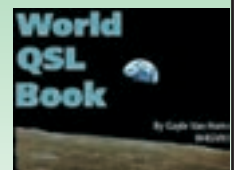
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Mexico, R Mil Onda Corta.....	www.radiomil.com.mx	USA, BBG/VOA/Studio 7.....	www.voanews.com
Mexico, R Universidad.....	www.uaslp.mx	USA, BBG/VOA/Sudan in Focus.....	www.voanews.com
Micronesia, V6MP/Cross R/Pohnpei.....	www.pmapacific.org/	USA, KNLS Anchor Point AK.....	www.knls.org/
Moldova, R PMR/Pridnestrovye.....	www.radiopmr.org	USA, Overcomer Ministry.....	www.overcomerministry.org
Mongolia, Mongolian R/Pgm 2.....	www.mnb.mn	USA, WBCQ Monticello ME.....	www.wbcq.com/
Mongolia, Voice of Mongolia.....	www.vom.mn/	USA, WEWN/EWTN Irondale AL.....	www.ewtn.com/
Morocco, R Marocaine.....	www.snrt.ma	USA, WHRI Cypress Creek SC.....	www.whr.org/
Morocco, R Mediterranee Intl/Medi 1.....	www.medi1.com	USA, WINB Red Lion PA.....	www.winb.com
Nepal, R Nepal.....	www.radionepal.org/	USA, WRMI Miami FL.....	www.wrmi.net/
New Zealand, R New Zealand Intl.....	www.rnzl.com	USA, WRMI/R Prague relay.....	www.wrmi.net/
Nigeria, VO Nigeria.....	www.voiceofnigeria.org	USA, WRMI/R Slovakia Intl relay.....	www.wrmi.net/
North Korea, VO Korea.....	www.vok.rep.kp	USA, WRNO New Orleans LA.....	www.wrnradio.com
Oman, R Sultanate of Oman.....	www.oman-tv.gov.om	USA, WWWW Lebanon TN.....	www.wwww.us/
Pakistan, R Pakistan External Svc.....	www.radio.gov.pk	USA, WWCN Nashville TN.....	www.wwcn.com
Pakistan, R Pakistan/Dom SW Svc.....	www.radio.gov.pk	USA, WWRB Manchester TN.....	www.wwrb.org/
Palau, T8WH/World Harvest R.....	www.whr.org/	USA, WYFR/Family R Worldwide.....	www.familyradio.com/
Papua New Guinea, Wantok R Light.....	www.wantokradio.org	Uzbekistan, CVC/The Voice Asia.....	www.christianvision.com/
Peru, La Voz de la Selva.....	www.radiolavozdelaselva.org/	Vatican City State, Vatican R.....	www.vaticanradio.org/
Peru, R Altura.....	www.radioalturatv.com	Vietnam, VO Vietnam 1/Buon Ma Thuot.....	www.vov.org.vn
Peru, R Ancash.....	www.ancash.org	Vietnam, VO Vietnam 1/Hanoi.....	www.vov.org.vn
Peru, R Bethel.....	www.bethelradio.fm/	Vietnam, VO Vietnam 1/Son Tay.....	www.vov.org.vn
Peru, R del Pacifico.....	www.grupopacifico.org/radio.html	Vietnam, VO Vietnam 1/Xuan Mai.....	www.vov.org.vn
Peru, R JPJ del Peru.....	www.radiojpp.com	Vietnam, VO Vietnam 2/Xuan Mai.....	www.vov.org.vn
Peru, R Libertad de Junin.....	www.rlibertadjunin.com/	Vietnam, VO Vietnam 4/Buon Ma Thuot.....	www.vov.org.vn
Peru, R Logos.....	www.ethnicradio.org	Vietnam, VO Vietnam 4/Xuan Mai.....	www.vov.org.vn
Peru, R Maranon.....	www.radiomaranon.org.pe	Vietnam, VO Vietnam/Overseas Svc.....	www.vov.org.vn
Peru, R Melodia.....	www.radiomelodia.com.pe	Yemen, Rep of Yemen R/R Sana'a.....	www.adenradio.net
Peru, R Quillabamba.....	http://quillabambanoticias.org	Zambia, Christian Voice.....	www.voiceafrica.net
Peru, R Santa Rosa.....	www.radiosantarosa.com.pe/	Zambia, CVC Intl/1 Africa.....	www.1africa.tv
Peru, R Sicuani.....	www.radiosicuani.org.pe	Zambia, Zambia Natl BC.....	www.znbc.co.zm
Peru, R Victoria.....	www.ipda.com.pe/	Zimbabwe, VO Zimbabwe/Ext Svc.....	www.zbc.co.zw
Peru, R Vision.....	www.visionradioperu.com	Zimbabwe, Zimbabwe BC.....	www.zbc.co.zw
Peru, R Voz Cristiana.....	www.radiovozcristianaperu.com		

SHORTWAVE GUIDE



# Monitoring Foreign Military and Civilian Air Show Teams

**A**s I mentioned in this month's lead feature, air show monitoring is a lot of fun and a fascinating aspect of the Milcom monitoring hobby. Monitoring Department of Defense flight teams make up the bulk of what you are likely to hear at any U.S. air show. You should also keep in mind that 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.

Below are some of the teams which perform at air shows worldwide and their known frequencies.

- 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: Freccia 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 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)

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 reportedly 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. Several 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.

## ❖ 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
- Firebirds X-Treme Team.....122.125

## ❖ 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.

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	122.925	
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 .....	122.125	123.300	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	122.925	123.150
	123.425	123.475	
Ritchie's Pyro.....	467.6375	(NBFM 233.6 Hz PL)	
Robosaurus – World's First CAR-NIVOROUS Monster Spotter .....	462.7125	(NBFM DCS464)	
SIAl 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).....	122.875	122.950	123.150
	123.450	123.475	133.000
Team Red.....	123.350		
Texas T-Cart Aerobatic Aircraft (Randy Henderson).....	118.400		
The Blades Aerobatic Display Team (UK).....	121.175	136.175	
The Horseman P-51 Aerobatic Team .....	122.475	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)
Tuskegee Flight Motor Gliders.....	123.300		
Vans RV Aerobatics (Team RV) .....	123.475		
Vintage Thunderbird (T-33) Aerobatics (Fowler Cary).....	123.150		
Yakovlevs Team (UK).....	124.450	130.900	



Photo by Brian Toposki

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]		

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]			

## ❖ 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 are 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

## ❖ 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. Below is the latest listings of nationwide CAP VHF frequencies.

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 were published in this column in the May 2010 issue of *Monitoring Times*.

## ❖ Finally . . .

This year I'm dedicating our entire air show guide to one of the finest milcom monitors I have ever known that we lost in 2012 - Don Edwards. Don was a dedicated milcom monitor and air show enthusiast. He filled my email inbox over the years with great field reports on various air show events he attended. I was proud to call Don my friend. I will miss his reports and I really miss him. Rest in peace my friend. Until next time, 73 and good hunting.



## Can You Hear Me Now?

### More Federal Interoperability Troubles

The public safety communications world has been obsessing over the concept of “interoperability” for many years now. Although the concept goes back much further, it seemed to make it to the forefront of discussions after the terror attacks in New York City and Washington, D.C. in 2001. In the aftermath of these disasters, the concept of various agencies being able to effectively communicate via radio with each other has been at the core of the interoperability discussion.

However, the goal of seamless communications between local, state and federal agencies continues to elude most areas of the country. While some suggest that the problem is money, hardware or available radio spectrum, there continues to be evidence that simply training personnel to utilize the communications resources that are already in place may be the key to achieving their goal.

Over recent years, *Monitoring Times* has presented several articles concerning public safety communications and the issues of interoperability. A terrific presentation by our own Larry Van Horn in the February 2006 issue of *Monitoring Times* showed there is no shortage of available radio frequencies for various agencies to use for communications between themselves and other agencies. In fact, most of these frequencies are probably already in the radios these

agencies use every day, but are rarely used and field personnel don’t know they are there.

While the radio is an important tool to the law enforcement officer, the truth is that many of them know less about their radios and their radio systems than some radio monitoring hobbyists. Many police officers, fire personnel and federal agents alike know how to turn the radio on and select channels, but really don’t know what goes on behind that sound coming out of the radio speaker. I have personally monitored surveillance operations that were carried out over a repeater channel, but then, as the agents moved further away from the repeater service area, were unable to all select a common simplex channel to continue with their communications.

In late 2012, there were several news stories concerning a report issued by the Department of Homeland Security (DHS) Office of the Inspector General (OIG) that stated there were problems with the ability of DHS personnel to communicate using their issued radio equipment. The OIG report explained that personnel of the various component agencies of DHS were unable to properly find and use the common radio channels that had been provided in their radios. You can find a copy of the OIG report here:

[http://www.oig.dhs.gov/assets/Mgmt/2013/OIG\\_13-06\\_Nov12.pdf](http://www.oig.dhs.gov/assets/Mgmt/2013/OIG_13-06_Nov12.pdf)

The news reporting generated much debate on the Internet. Many on-line pontificators took the opportunity to slam not only the DHS, but also federal agencies in general for their wasteful spending on these new-fangled, encrypted, digital radio systems that we can’t listen to any more, as well as incompetence by the federal agency employees. But in reality, this report did accurately show that in most cases, training and communications management, not the radio hardware could be the key to reliable interagency communications.

In the preparation of this report, the OIG audited the communications capabilities of some of the DHS component agencies, including Customs and Border Protection, Transportation Security Administration, Coast Guard, Immigration and Customs Enforcement, Secret Service, Federal Protective Service, Federal Emergency Management Agency and the Federal Law Enforcement Training Center.

In this auditing process, they looked at agency radio programming and radio users abilities to find and communicate on specific DHS “common” channels meant for interagency use. In most cases, the radios they examined had the incorrect name or frequency information programmed, preventing the users from finding or using this channel. In other cases the radio users were unaware of these common channels or how to find them in their radios.

One attempt was made to standardize these various frequencies and channel names and the

result is the DHS National Interoperability Field Operations Guide, or NIFOG. This guide is a must-have resource for anyone using a radio or even a scanner to monitor public safety communications. This publication is available in printed form or as a downloadable PDF file. You can download your own copy of the NIFOG here: <http://www.safecomprogram.gov/nifog/Default.aspx>

But the OIG report mentioned that the DHS themselves were not consistently utilizing the information contained in the NIFOG in their own radio equipment. The OIG reported that DHS personnel were unable to correctly select the radio channels designated as “DHS Common” and “Federal Common” from the many radio channels available. But which DHS common were they referring to? Unfortunately, there have been several changes to the “common” channels used by several federal agencies over the years, so I can understand some of the confusion suffered by radio users out there.

When the Department of Homeland Security was formed back in late 2002, it took components of existing agencies and combined them under one title. These agencies sometimes brought some of their existing radio frequencies with them, some moved to new frequencies altogether. Prior to DHS, the U.S. Customs Patrol was part of the Department of the Treasury, and often utilized the frequency of 166.4625 MHz, which was then known as “Treasury Common.” The name indicated that this was a common frequency amongst all agencies under the Treasury Department. Once Customs became part of Customs & Border Protection under DHS, they continued utilizing this channel, and the name simply changed to “DHS Common.”

However, the frequency was still utilized by not only Treasury agencies, but began to show up in Justice Department radios as well. Finally the frequency started to be identified as “Federal Common,” since so different many agencies had access to the channel. But, since apparently many federal agencies are very protective of their turf, it was decided that each component agency within DHS also needed their own “common” channel. So now, we have a Federal Common, DHS Common, and ICE Common channels. (I am fairly certain that there is a CBP Common somewhere, but I haven’t yet identified it.)

The DHS Common frequency now is **165.8375 MHz**. The Federal Common frequency is now **166.4625 MHz**. Both of these channels are available in all DHS radios in both analog and P-25 digital mode. In addition to these common channels, there is a known ICE Common frequency of **168.3500 MHz**. Sharp-eyed readers will notice that this frequency is one of several “common” federal VHF frequencies that are available to any federal agency. And, **170.0000 MHz** has been referred to as



Secret Service Common in some material I have seen. Over the years there have been some other frequencies that have been referred to in hobbyist circles as "DHS Common," but I have not yet confirmed these from any official sources. Here are a few to put in your scanners and see if anything pops up:

166.5875, 168.5875, 170.7875, 408.2875, 412.4375, 417.3875

One can conclude that no matter how many channels, frequencies or talk groups an agency has available for its use, they won't do anyone much good if not everyone is trained to utilize the channels that they have.

### ❖ FLETC, The Federal Law Enforcement Training Center

Speaking of federal agents and training, it is time to take a closer look at the Federal Law Enforcement Training Center in Brunswick, Georgia. The FLETC was specifically identified in the OIG report mentioned earlier in this column.

The Federal Law Enforcement Training Center began life in its current location in September of 1975. The FLETC operates as an interagency law enforcement training organization for nearly 90 different federal agencies. The FLETC also provides training for state, local, campus, tribal, and international law enforcement agencies as well. It started out as part of the U.S. Treasury Department, but was transferred to the DHS family of agencies in March of 2003. You can read more about FLETC and its history here:

<http://www.fletc.gov>  
[http://en.wikipedia.org/wiki/Federal\\_Law\\_Enforcement\\_Training\\_Center](http://en.wikipedia.org/wiki/Federal_Law_Enforcement_Training_Center)

The FLETC operates a multi-site, P-25 VHF trunked radio system to cover their facilities in southeast Georgia. Site 102 appears to cover the property overall, and Site 103 appears to be providing additional coverage in the campus buildings, but appears to be a low-power or perhaps using leaky coax inside the buildings. Outside the campus area, Site 103 is barely readable. Interestingly, no one has reported hearing Site 101 of this system yet. There is some speculation that Site 101 might exist at some other FLETC operating facility, but so far it has eluded listeners. Here is the trunked system information as we have it now:

Federal Law Enforcement Training Center, Brunswick, Georgia  
 System Type – APCO P25  
 System ID – 4C1  
 WACN – BE000  
 Site 102 – 162.7500, 163.0125, 164.1875, 164.5375, 164.9375  
 Site 103 – 162.6500, 162.9125, 164.7375, 166.0625, 166.7375

Listeners report several dozen active talk groups on this system, with a majority of them being (obviously) training. Only one talk group is reportedly used by facility security.

### ❖ Tennessee Valley Authority Trunked System

In late 2012, some folks near Nashville, Tennessee reported hearing some P-25 trunking control channels in the federal UHF land mobile band and wondered what was up. A lot of speculation about federal prisons, VA Medical Centers and others proved to be dead ends, but finally someone came up with some hard-core data that helped solve the mystery. These UHF channels are part of a new wide-area, digital trunked radio system being built for the Tennessee Valley Authority.

The Tennessee Valley Authority (TVA) is a federally owned, but independent corporation that provides flood control, navigation and power generation for the area around the Tennessee Valley. It began in the 1930s as a response to the Great Depression, but its creation and continued operation has been controversial.

The TVA radio system currently uses a number of VHF conventional channels for operations, maintenance and security. The TVA also is one of a few federal agencies that continue to utilize VHF low-band frequencies for power maintenance operations. TVA frequency allocations are included to the right.

The new P-25 digital trunked system site heard in the Nashville, Tennessee reveals the following information:

Tennessee Valley Authority Trunked Radio System  
 System Type – APCO P25  
 System ID – 372  
 WACN – 00001  
 Site 005 – 406.9125, 407.3125, 408.1125, 410.5125, 410.9125

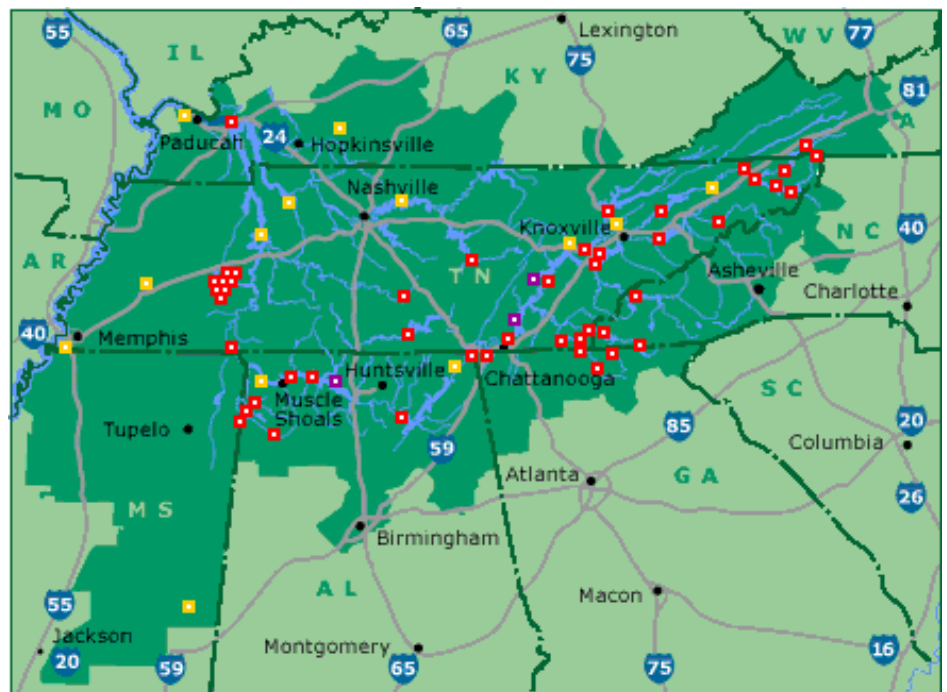
Additional information indicates that this system is being designed and built by the Harris Corporation and, although the system appears to be currently using APCO P-25 Phase I digital voice, it can be upgraded to Phase II (TDMA)



mode, which is not monitorable on most digital scanners.

That is all for this installment of the Fed Files. The 57<sup>th</sup> Presidential Inauguration and Super Bowl XLVII are ramping up as this column is being written. I will be back with more federal monitoring information from both events in the May column, so check back then!

40.3100	164.5750	169.4000
40.3700	164.7250	169.6250
40.4300	164.7500	169.6750
40.4900	166.2250	169.7250
40.5300	166.2500	170.0250
40.5700	166.2750	170.0500
40.6100	166.3250	170.0750
40.6500	166.3750	170.1500
40.6900	166.6375	171.3875
40.7300	166.8250	171.6500
40.7700	166.8750	171.7000
40.8300	167.0250	171.7500
40.8700	167.0750	172.0250
	167.1000	172.4250
	167.1250	172.4500
	167.1500	172.4750
	167.1750	172.5750
	168.2250	172.6250
	168.2750	172.6500
	168.3250	172.7500
	168.4750	173.0500
	168.5750	173.7625
162.0250		
163.0500		
163.1250		
163.1500		
163.1750		
163.3750		
164.2500		
164.4750		





## Events Large and Small

**W**hile I generally dislike events with large crowds—something that goes back to my early days of general news coverage when I frequently had no choice in attending such events (and dealing with their hassles, like traffic congestion)—I do make an exception for most railroad events.

Aside from the fact that I obviously like railroads and their equipment, there are two other main factors at work here: being able to touch base with railroad employees and officials, and seeing the face that railroads offer to the general public.

Having produced many dozens of railroad news stories and features, I've managed to build a list of railroad contacts, most of whom will get back to me when I need a quick answer. However, I hate to bother these officials when I don't need an immediate response to a specific question.

So, when I encounter these officials at events their railroad is sponsoring or participating in, I always look forward to a quick informal chat that can provide useful background information for the future. Of course, you don't have to be a journalist to get an opportunity for such chats at these events.

And, often it's not just the top officials who can be helpful. At the media preview day for the huge Norfolk Southern (NS) heritage locomotive event at the North Carolina Transportation Museum in mid 2012 (that made national headlines even outside the railroad press), I had an interesting discussion with an NS locomotive engineer about electro-pneumatic (EP) brakes.

### ❖ EP brakes

If you have followed railroads for a while, you know that trains use air brakes, with an air line (also called the trainline) running the length of the train. For long trains, a change in brake line pressure initiated on the locomotive at the front of the train can take a while to get to the back of the train. And, that can be a problem with different parts of the train braking (or not) at different



*The event also provided an opportunity to get a close-up look at the new locomotives. Here, the rear of one of these new units has the EP (electro-pneumatic) braking equipment mounted just to the right of the coupler.*

rates.

Yes, emergency brake applications can be initiated at the back of the train, via the brake line telemetry box (called an EOT or FRED), but that still results in uneven braking and works only for emergencies. Remote-controlled slave locomotives spaced throughout a train can also distribute the brake application. But, not all trains have additional locomotives back in the train.

EP brakes are the solution to this problem. When a train is equipped for EP braking (all cars have to have EP equipment and the locomotives also have to be equipped for EP control) braking is uniform throughout the train. EP controls are issued via an extra cable that runs from the locomotives through all the cars in an EP train. With EP braking, the brakes on the individual cars still get their force for application from air pressure in the brake line (which is stored in individual reservoirs on each car) but the control of the application is done electrically. And, it's simultaneous throughout the train, as the electrical control signals are, for all practical purposes, instantaneous.

EP-equipped cars can still be moved in conventional trains, if needed, though in that case the EP equipment is cut out and not func-



*But, the event also provided an opportunity to photograph a rare North Carolina light engine move, as the "City of Durham" and a sister engine returned to the state maintenance base in Raleigh after the ceremonies.*

tional.

Overall, EP braking provides much better train handling, and, with crew-initiated emergency braking, a much shorter stopping distance, because all cars begin braking immediately, which is also true in a normal brake application.

### ❖ Runaway trains

EP has another big advantage. Locomotive engineers have a limited amount of air pressure on the train and, if they don't handle it correctly they can have a runaway train. Yes, really.

With the standard air brakes, a reduction in the brake line air pressure causes air to be sent from the reservoirs on the cars to the brake cylinders. Repeated reductions in brake line pressure eventually use up all the air in the reservoirs.

These can be recharged, but remember, an increase in the trainline air pressure releases the brakes. So trains that have used up too much air have to stop at some point to replenish the air supply. In that case, once the train is stopped, hopefully at a level location, it can be held in place with the independent brakes on the engines while the air in the rest of the train is



*The display of the parade of Norfolk Southern locomotives in special heritage paint schemes got most of the attention at the three-day special event at the N.C. transportation museum at Spencer, North Carolina last year*





replenished.

You can hear this when a stopped train revs up its engines to get the compressors to run faster. With EP brakes, the engineer can replenish the air in the train while applying brakes electrically at the same time.

The EP system is redundant on top of the normal air brakes, and any failure in the EP equipment still allows the brakes to be applied via a reduction in the trainline. Any sudden reduction in pressure, such as would be caused if the train breaks apart, would still initiate an emergency brake application.

As noted above, EP can only be used if the entire train is equipped for this system. EP braking has been used on some passenger trains for a number of years. Of course, passenger trains are much shorter and it's much easier to have it consist of entirely EP-equipped cars.

EP is now finding its way into freight service, such as on coal trains. Unit coal trains typically consist of cars of the same type, often ordered and built at the same time. Though many unit coal trains consist of cars owned by an electric utility, it's also easy for the railroads to work with the utilities to have them supply EP-equipped cars, particularly once they are convinced that the EP equipment will result in better handling of their freight.

Look for EP to also make inroads in intermodal service, particularly when a railroad operates an entire intermodal train for a single customer. Many intermodal trains also use pool equipment from a company called TTX, which in turn is owned jointly by the major freight railroads. So, TTX is likely to add EP-equipped cars to its fleet.

## ❖ Smaller Events

Another, much smaller event in my hometown back in 2011 also provided an opportunity for photos and to talk to railroad and state officials. North Carolina owns a growing fleet of passenger locomotives for its in-state services (operated by Amtrak under contract, as part of Amtrak's total network). All of the locomotives carry the name of a major North Carolina

city, with the locomotive number reflecting the incorporation date of that city.

When it came time for the formal dedication of the "City of Durham" locomotive in my hometown of Durham, I set aside time for the event. The locomotive and a sister engine ran light from the state's railroad maintenance base in Raleigh to the dedication ceremony at the



*At a much smaller event back in 2011 for the official dedication of one of North Carolina's new passenger locomotives, no. 1869, "City of Durham," Congressman David Price was among the speakers. The event was at the Durham, my hometown, passenger station. The number 1869 is the date of incorporation for Durham; other North Carolina passenger locomotives are also named after major cities in the state, with the numbers reflecting the incorporation date of those cities.*

Durham passenger station.

When the events were over, I was able to photograph a rare light engine move of the two state engines, which would normally only operate on the points of passenger trains.

And, yes, I do keep my scanner on at these events to help keep aware of what's moving and what moves are planned. It does get turned down (or I switch to an earphone) during the formal programs.

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## Aviation NDBs

**H**istorically, the main focus of longwave DXing has been in chasing aviation beacons. NDBs (non-directional beacons) first became operational in the 1920s to help guide pilots to their destinations and to determine their own positions in the air. While declining in number today, the 190 to 535 kHz band remains well populated with beacons, and they are still a popular DXing target. Why? For starters, they transmit a continuous ID in slow Morse code (CW) that can be used to determine a beacon's location (see online resources later in this article). Also, most use antenna systems that are essentially omni-directional and these stations operate 24 hours a day.

While power outputs are typically low (less than 50 watts), beacons are often heard hundreds of miles away. In the case of high-powered beacons, the range could be several thousand miles! If there ever was a class of stations meant for DXing, it would have to be beacons.

This month we'll cover some essential facts for radio beacons. If you've never tried this facet of radio monitoring, I hope you'll take a spin in radio's "basement band" to see what you've been missing. The right antenna can make all the difference, with LF loops and active antennas being the prime choice in most urban/suburban environments. Wire antennas can work well if noise is not an issue in your area.

### ❖ Facts for Non-Directional Beacons

Frequencies of Operation: 190-535 kHz, except 285-325 kHz, which is populated by DGPS stations.

Frequency Increments: Most commonly on "whole" frequencies such as 260, 344, and 400 kHz; check for beacons every 1 kHz.

Transmission Modes: Morse code, most commonly with a constant carrier and sideband keying; a few are keyed carrier A1 emission (mostly found outside North America). A few beacons carry recorded weather or aviation information.

Antenna Types: Omni-Directional; typically 60 foot vertical top hat type, or flat top "T" wire

Power Levels: Many operate at 25-50 Watts, some higher, especially in remote areas of Canada.

ID Format: Typically 2-3 Morse code characters (may include a number), cycling several times per minute.

ID Pitch: Typically 1020 Hz in U.S., 400 Hz in Canada, but exceptions exist where the opposite is true.

Transmission Range: Typically intended for use up to a hundred miles or so, but often heard by DXers at ten times that range, especially at night. Loggings in excess of 4,000 miles have been reported.

Transmission Anomalies: Keying errors are possible, including negative keying (dash where there should be a



*Typical NDB, MDE/379 kHz in Cincinnati, Ohio, this site uses one of the newer "tophat" style antennas. (File Photo)*

dot, and vice-versa), constant tone, no ID, or mixed-up characters. These instances are rare, but a few reports are received per year.

Online ID Resources: [www.classaxe.com/dx/ndb/rna](http://www.classaxe.com/dx/ndb/rna), [www.airnav.com/navaids](http://www.airnav.com/navaids), <http://worldae-rodadata.com>

Online Airport Data: [www.airport-data.com](http://www.airport-data.com)

Online NDB Info (general): [http://en.wikipedia.org/wiki/Non-directional\\_beacon](http://en.wikipedia.org/wiki/Non-directional_beacon)

### ❖ Mailbag

Herb Raemsch WA3HGT (Pennsylvania) writes: "I wanted to drop a line or two to let you know I enjoy your many articles. I have been a ham since the early 1960s and must admit I never took any interest in anything below the AM broadcast band and now must admit that is a shame on me. Actually, my interest came about with my getting a subscription to *Monitoring Times* a couple of years ago.

"I am able to tune to some degree below 500 kHz with my two ham transceivers. What I would like to know is whether or not any company still makes LF converters. I have built several kits and scratch projects in my time so building does not scare me but I have limited use of my hands now. I would appreciate any info and will be looking forward to your next issue."

Hello Herb, I'm thrilled that you've discovered the fun of longwave. Welcome aboard!

Nowhere else in the radio spectrum will you find so much variety in just 500 kHz of spectrum. You inquired about LF converters that are still being offered today. LF Engineering Co. ([www.lfengineering.com](http://www.lfengineering.com)) still makes its L-111-C - PCB LF Converter, which you can mount inside an enclosure of your choice. It is a well-regarded unit. This might be a good choice if you still want some part in the construction process, but don't want to deal with small PC board components. You can also buy the converter enclosed and combined with an active antenna (see L-111 - LF/VLF Converter/Antenna System). K1EL Ham Radio Kits also advertises a new version of the classic Palomar Engineers VLF converter. You can find full information at <http://k1el.tripod.com/VLF.html>. Thanks again for writing, and we hope to hear from as your loggings grow.

Jim Pedersen writes: "Several days ago I ordered a plastic coated 28 inch ferrite bar from Stormwize.com. This Ferrite material has a Mu rating of 2000 and should be usable from 0 Hz to 500 kHz. It looks like it's time to wind some antenna coils! I have read most everything on the Stormwize web site, which has great information and ideas. Also, the site 'Radio Waves below 22 kHz' (<http://www.vlf.it>) has many excellent articles. Do you have a favorite site for ferrite antennas, and does anyone have a formula to estimate the antenna aperture of a ferrite antenna compared to, say a 1 square yard loop antenna?"

Hello Jim, and thanks for the update on your work with ferrite antenna coils. I have not personally built any ferrite antennas, but in addition to Stormwize site, another place I suggest checking is Amidon Corporation (<http://www.amidoncorp.com>). They are a long time supplier of ferrite materials and their website has some useful reference material. The undisputed "king" of ferrite technical info was Jerry Sevick W2FMI (SK), and you can do a search on his name for his many articles and books. As for pre-built ferrite antennas, you might check out the offerings from Palomar Engineers. It's unclear whether they still actively make these antennas, but I do see them at online auctions from time to time, along with raw ferrite materials. Good luck with your experiments; Ferrite is a good way to go if you are looking for a compact antenna with the benefits of directionality.

Jim also wrote to report an interesting finding when using a Frequency Selective Voltmeter as an LF receiver. He connected the receiver to several metal objects such as a garage door, metal storage locker, refrigerator etc., and noted that the best reception came from connecting the input of the receiver to a 2 x 3 foot plate lying on the cement floor of his garage. The signal-to-noise ratio was much

better than the 25 foot length of wire that runs along his fence. When tuning to 344 kHz for a beacon in Fresno, he had the strongest signal on the 25 foot wire, but it was noisy, so he could not hear the Morse code ID. Using the metal plate on the floor dropped the signal level by 5 dB, but the ID was fully readable. Lifting the plate off the floor several inches caused the signal to drop 15 dB or more, and he got a similar reduction by connecting the antenna lead to ground. All of this has raised several questions that Jim asks for input on:

- 1) Is this a variation on the buried long wire?
- 2) Am I receiving the ground wave?
- 3) Am I capacitive-coupling into/onto the Earth?

This is a very interesting finding, indeed, Jim. I believe you are seeing the effects of ground coupling. Wire antennas for LF receive typically act as “noise collectors” in urban/suburban environments where man-made noise prevails. Even natural static (QRN) can play havoc with wire antennas. They may deliver a strong signal, but the noise is also strong, and the desired content may be lost in the mix, as you saw with 344/FCH in Fresno.

With a small aperture antenna, particularly one tuned for LF, the signal-to-noise ratio is going to be much higher. In your case, with the plate on the floor, I believe you are capacitively coupling to the ground, but there must also be a resistive component if the metal is sitting on a concrete floor, and it appears to me that you have struck a combination of “R” and “C” coupling that is agreeable to your receiver. It would be interesting to try a pre-amp in line to see if you could make up for the signal loss that is occurring. If so, you might have a very effective (and quiet) antenna.

Today, there are extremely small antennas used for WWVB (60 kHz) reception, some of these can even fit inside a wrist watch. While no one is suggesting this type of antenna for general DXing use, it points out just how effective a compact, tuned antenna can be.

Our loggings this month are from new contributor Marc Tarplee N4UFP (SC). Marc uses an Elecraft K3 transceiver for longwave reception, along with a homebrew upconverter and preselector. His antenna is a 460-foot inverted L resonant at 530 kHz. Many thanks for the loggings, Marc, and welcome aboard to *Below 500 kHz!*

**Selected Loggings from SC**

kHz	ID	ST/PR	City
221	BJT	GA	Athens
224	BH	AL	Birmingham
227	CPC	NC	Whiteville
230	BES	SC	Bennettsville
233	HEM	TN	Sparta
236	VJ	VA	Abingdon
239	GIW	SC	Greenwood
239	HKF	OH	Middletown
242	MMI	TN	Athens
245	JYL	GA	Sylvania
257	CEU	SC	Clemson
257	SQT	FL	Melbourne
326	ZEF	NC	Elkin
329	RVN	TN	Rogersville
329	YHN	ON	Algoma
332	FIS	FL	Key west
332	HK	NC	Hickory
335	YLD	ON	Coniston

344	JA	FL	Jacksonville
350	BEP	GA	Perry
365	DYB	SC	Summerville
379	BRA	NC	Asheville
394	DTE	TN	Dayton
415	FDW	SC	Fairfield
426	FTP	AL	Fort Payne
510	HMY	OK	Muldrow
512	OS	OH	Columbus
516	YWA	ON	Petawawa

❖ **SAQ 17.2 kHz**

The annual Christmas Eve broadcast of historic station SAQ 17.2 kHz (Grimeton, Sweden) was heard by many people, perhaps the most ever reported. While most listeners were in Europe, several reports came in from other regions, including the U.S. By the way, are you wondering how to pronounce “Grimeton?” I was, until I attended a radio conference some time ago, where a native Swedish speaker presented a program covering SAQ. I learned there that the proper pronunciation sounds similar to “Grimm-eh-ton.” SAQ’s holiday message this timewas as follows:

CQ CQ CQ DE SAQ SAQ SAQ—THIS IS GRIMETON RADIO/SAQ IN A TRANSMISSION USING THE ALEXANDERSON 200 KW ALTERNATOR ON 17.2 KHZ—WE WISH YOU ALL A MERRY CHRISTMAS AND A HAPPY NEW YEAR—SIGNED: THE WORLD HERITAGE AT GRIMETON AND THE ALEXANDER-GRIMETON VETERAN RADIOS VAENNER ASSOCIATION + — FOR QSL INFO PLEASE READ OUR WEBSITE : WWW.ALEXANDER.N.SE — DE SAQ SAQ SAQ @

Be sure to check our next month’s issue, where a copy of Ken Cornell’s *Low and Medium Frequency Radio Scrapbook* will be given away to a lucky reader! We’ll be looking for brief write-ups on how you got started in longwave, and what makes this part of the spectrum special to you. Everyone submitting an essay will be entered in the drawing for the book. A second drawing will be made for a copy of my *VLF Radio! Sounds of Longwave* CD. That’s it for this month. Please stay in touch with what you are doing in the radio hobby, and keep those loggings and photos coming. I’d especially like to see some shack photos, along with the operators in the picture. We’ll run them here as space allows.



*SAQ, Grimeton, Sweden (17.2 kHz) uses a 1920s General Electric RF alternator to send its powerful CW signals (Source: Wikipedia; Author, Gunther Tschuch)*



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## The S-38D Alignment Hits a Snag

In last Month's column we introduced the latest restoration project: a Hallicrafters S-38D "starter" type communications receiver. Introduced about 1954, this was the next-to-last model to be released in the popular S-38 line and was preceded by the S-38 and S-38 A through C. In the S-38D, Hallicrafters abandoned the classic Raymond Loewy cabinet design, with its half-moon main tuning and bandspread dials, in favor of a design having a single rectangular dial incorporating slide rule style scales for its four bands and bandspread control.

In most other respects, however, the S-38D is almost identical electrically to the previous S-38 models. It's an AC-DC set utilizing the familiar "All American Five" tube complement, with the exception of substituting a 12SG7 IF amplifier for the usual 12SK7. Like the previous S-38s, it covers the frequency range 540-32,000 kHz in four bands. The final S-38 model, the "E," introduced about 1956, was a little more of a departure from its predecessors. It was still a 5-tube AC-DC radio, but the tubes were now miniatures instead of the octals used in all earlier models. In addition, the size of the dial window was expanded and the length of the dial scales was increased, giving the set a fresh modern appearance.

In our initial survey of the S-38D, we noted that the cabinet looked almost factory fresh, including the composition back, a feature often found broken or missing in most small AC-DC radios. Inside there was a thin layer of fine dust covering the top surface of the chassis. Some discoloration was revealed when it was removed, but there was no sign of corrosion. The underside of the chassis was not only dust free but notable in that everything looked factory mint. Obviously this set had been stored where there was good environmental control; not in a shed or garage.

I was particularly struck by the artistic job that had been done on the lead dress. I don't know if the wiring technique had been a matter of company policy or if the person who had done the wiring was expressing his or her own aesthetic sense. But the work that was done on this radio was unlike anything I'd seen before.



*A couple of sprays with contact cleaner smoothed out the bandswitch operation.*

It's hard to describe. But where straight point-to-point wiring would have sufficed, often there would be a little extra bend in a wire to make it parallel with a neighboring wire or to create some extra space around it.

Several months back I had taken on another restoration project, a small Magnavox AC-DC as I recall, that also looked mint under the chassis. At that time, I deviated from my long-standing policy of completely recapping every radio to be restored. Applying power slowly, the radio came to life and is still operating well today. With that as an example, I thought I'd try the same thing with the Hallicrafters. If it worked, this would be more of a reawakening than a restoration!

### ❖ Powering up the Halli

It is so rare for me to power up a set with the original capacitors, with its attendant need for bringing up the line voltage slowly, that I've somehow never quite gotten around to putting together a Variac supply. I do have the Variac, as well as the meters I would like to use with it, but right now they're just loose parts. If I begin working with many other sets this way, however, that project will need to be moved to a much higher spot in my priorities list! For now, though, I do have a small switched autotransformer that provides voltages between about 60 and 100, in three steps, from the AC line.

Before I could begin to fire up this radio, I needed to install a new line cord. The old one, for whatever reason, had been cut off flush with the chassis rear apron. The tubes had been tested last month and found good, so I reinstalled those. The speaker, still mounted in the cabinet, was temporarily reconnected. I now plugged the set into the autotransformer and plugged the latter into the obligatory isolation transformer that should be used, for safety's sake, when working on any AC-DC radio.

Connecting a meter across the B plus line to make sure that the DC voltage would rise normally, I set the autotransformer for the lowest voltage and held my breath as I watched the meter and also kept my eyes open for signs of smoke. In a few minutes, the B plus was starting to come up nicely and there were no signs of smoke. Then the speaker began to emit slightly odd sounds, not the static crashes that one might expect, but rather something that sounded like popcorn popping.

At first I assumed that this might be interference from a lamp dimmer or some digital appliance and took it as a sign that the radio was coming to life. Indeed, lightly scratching the antenna terminal produced more static—another good sign!

After running the voltage up to 100 with no sign of smoke or other failure, I removed the autotransformer and plugged the radio directly into

the isolation transformer, where it would receive the full 117 volts. Connecting a short length of antenna wire, I was able to receive stations all over the broadcast band. The band switch did operate erratically at first, but a quick spray with contact cleaner on each of its two wafers took care of the problem. The set now seemed to be airworthy and ready for alignment.

### ❖ Preparing for Alignment

To carry out a receiver alignment, one needs a modulated signal generator and some sort of receiver output indicating device to monitor the effect of the alignment adjustments. The easiest way of monitoring output is simply to connect a sensitive AC voltmeter across the voice coil of the loudspeaker. However, the output at this point is relatively low and readings on ordinary multimeters tend to be inadequate. This is especially true because the signal input must be kept as low as possible to avoid engaging the receiver's automatic volume control. However, I get away with this method because I have a very sensitive laboratory grade AC vacuum tube voltmeter.



*For IF alignment, the signal generator is connected between the antenna capacitor stator and ground.*

Higher output can be obtained by connecting the instrument across the primary of the output transformer in series with a blocking capacitor (perhaps .01 or .05 uF) to keep the DC out of the meter. A more sophisticated method is to use a vacuum tube voltmeter (VTVM) to measure the receiver's AVC voltage. In this case a stronger test signal is used so as to deliberately engage the AVC. The stronger the signal the greater the voltage indication. The VTVM is used because it has enough sensitivity to measure the very small voltages involved without overloading the AVC circuits.

To align the IF transformers, a modulated test signal at the IF frequency (455 kHz) is injected into the front end of the receiver and the IF trimmers are adjusted for maximum receiver output. The Hallicrafters service notes specify that the modulated test signal be injected at the front end of the receiver; specifically through

the stator plates of the antenna section of the two-gang tuning capacitor.

The receiver is to be switched to the broadcast band (band 1) and set at 1,000 kHz. The AM/CW switch is to be set to AM and the antenna and ground posts shorted together to minimize interference from broadcast stations.

### ❖ IF Alignment Problem

With everything set up as described, I prepared to settle back and enjoy touching up the IF alignment on this S-38D. Normally, adjusting the IFs is the first, and one of the easiest and most rewarding parts of a receiver alignment. The receiver output peaks are very sharp and, especially if the set has not been aligned in some time, each adjustment boosts the output significantly higher and higher so that one has to continually attenuate the signal from the generator to save one's eardrums, not to mention avoid engaging the AVC.

But none of that happened on this particular alignment job. For one thing, the peaks were quite flattened out, so that the adjusting screws had to be rotated quite far to get to, and through, an output peak. For another, there was no significant increase in output as I progressed from one adjusting screw to the next. Even worse, as I repeated the adjustments to try to get more output, the peaks



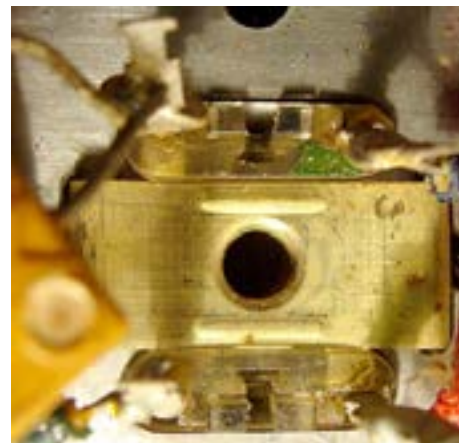
*Attempting an IF adjustment using a non metallic tool.*

disappeared entirely and then no amount of twisting on an adjustment screw had the slightest effect on the receiver output.

This effect had me stumped! At first I thought that maybe a capacitor had failed somewhere and I spent a lot of time studying the schematic to try to figure out which one might have caused that particular effect. I got nowhere with that and nothing else I could think of made much sense. Finally I Googled "S-38" and "IF transformer," which led me to what seems to be the answer. And, the odd popping noise I had heard when first firing up the radio is what gave me the clue.

A couple of people had posted descriptions of the noise on line, including a recording of it on YouTube, pointing out that the noise did indeed suggest a capacitor failure, but not of the type of capacitor one might imagine. The coils in an IF transformer, like any other coils, must have a capacitor across them if they are to resonate at a particular frequency. Often these capacitors are screwdriver adjustable for the fine frequency adjustments one makes during alignment.

But sometimes, as in the S-38D, the adjustment is made by screwing powdered iron cores in and out of the transformer primary and secondary. A capacitor is still needed for each, but now it is fixed. Sometimes these capacitors are discrete units, either installed within the IF can or outside it; soldered across the transformer's connection lugs. These give no particular trouble. However, in what looks to be my case, the capacitors



*The bottom of an IF can, where we will attempt surgery next month.*

are built into the structure of the base as sandwiches of thin silver plates and mica wafers.

Apparently, under some environmental and electrical conditions, silver particles can migrate between the plates. This apparently can cause barrages of miniature short circuits resulting in that popping noise and degrading the performance of the transformer. Seemingly, the effect began as soon as I first applied power to the radio and continued throughout my adjustment efforts until the transformer could not function normally.

If this is the problem, as I hope to find out next time, it can be resolved by dismantling the tricky built-in capacitors and replacing them with standard silver micas installed across the transformer's connection lugs.

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## Understanding the Vertical: It's A Dipole Stuck In The Ground!

**W**elcome back, my friends. We've discussed here the workings of dipoles and verticals, which form a sort of foundation for all the other designs. This month, let's examine another level in antenna evolution; the array. At VHF/UHF and higher, wavelengths are so small that some remarkable "arrays" are possible; I'll let Kent tell you about those! Down here in the HF spectrum, the necessary sizes due to wavelength generally limit us to dipole-derived arrays, and a few vertical-derived ones. These come in two basic flavors: *driven arrays*, and *parasitic arrays*.

### ❖ Reflection Direction

Let's look at the parasitic array first, since the most prominent version of it is immensely popular and successful, and is easily perceived visually as an "array." I speak, of course, of the beam, or Yagi, or more properly the Yagi-Uda antenna.

Drs. Uda and Yagi, experimenting in Japan in the 1920s, discovered that an additional element placed parallel to a dipole had definite effects on the directivity, and therefore the gain, of the original dipole. It was seen that the extra element did not need to be driven with RF current like the dipole, but rather was activated by the fact that it was located in parallel with the radiating dipole and fairly close to it in terms of wavelength. This is the essence of the *parasitic effect*; the near-resonance of nearby conductors that aren't wired directly to any signal source.



**Cushcraft A3S: classic Yagi 3-element beam antenna has 8 dB forward gain. (Courtesy: Universal Radio)**

Some more experimenting showed the good doctors that an added element *longer* than the driven dipole would, at the right length and spacing, bounce the signal back toward the dipole. This in effect is roughly like pointing the two bidirectional lobes of a dipole in the same direction, with a resulting increase in gain. An element *shorter* than the driven dipole, on the other hand, tended to focus the pattern more sharply forward, that is, in the same direction



**Two-band Cubex MKII cubical quad antenna. (Courtesy: Cubex Quad Antennas)**

it was traveling when it reached the added element. The longer elements, that bounced the signal back toward the dipole, came to be called *reflectors*; and the shorter elements on the other side of the dipole, that focused the signal more sharply, came to be called *directors*.

More research revealed that additional reflectors and/or directors could be added, increasing gain and directivity, as long as each additional element was the proper amount longer or shorter than the previous one. In other words, an added reflector is longer than the first reflector, and added directors are shorter and shorter. Viewed from above or below, we begin to see the unmistakable outline of an arrowhead, pointing the way we want to send and receive.

The accepted practice for a long time is to stick with a single reflector, and add multiple directors if desired. This makes sense from a weight management as well as a turning radius viewpoint. Here in the HF spectrum, we rarely exceed one or two directors due to the huge size and weight the assembly begins to assume. At VHF and UHF, where wavelengths are much shorter, beams with 20 or 30 or more directors are not at all uncommon. As you might guess, these high-element-count arrays provide tremendous gain and directivity, often crucial in the success of QSOs at these extremely high frequencies.

One interesting sidebar of the Yagi story is the various ways in which modifying the dimensions of the array alters different performance concerns. A good example is the fact that the Yagi's maximum gain is optimum

at some definite spacing of the array's elements. There is also an ideal spacing that will yield a maximum front-to-back ratio. *They rarely if ever are the same spacing.* So most Yagi designs make some best-case compromise, or else go for maximum gain. A huge step forward was the realization that all the elements can be made of metal tubing and clamped solidly to the metal boom, most likely more metal tubing, which of course greatly simplifies grounding the assembly from a lightning standpoint.

Quads use the same basic concept of a reflector element slightly longer than the

driven element, but don't have a lot in common with their cousin Yagis otherwise. Quads by the nature of their construction tend to be less robust and weatherproof than the typical Yagi, and almost certainly have less elements; the two-element quad, driven element and reflector, is probably by far the most common arrangement. On the other hand, they can be adapted to multiband design more readily, since higher bands merely need smaller loops inside the first loop.

### ❖ Driven to Distraction

As you might have guessed, friends, the other major class of arrays we'll talk about is the *driven array*. There are no parasitic elements; all portions of the antenna are fed RF from a feedline. A dipole can be thought of as an array; two elements of equal length and arranged end to end, in line—*collinear*—with each other. A particular *phase relationship* is thus set up which produces the dipole's characteristic "gain" and directionality.

However, in common usage, I think most of us tend to equate a term like "array" with some special advantage in gain or directivity or both. Of course, this becomes real for a long enough dipole; my 102 foot dipole has impressive gain on ten and six meters due to the 51 foot element lengths versus the short wavelength on those bands. This definitely constitutes an array! Some proponents of this sort of array go in for a very particular elements length: 0.64 wavelengths. This is the classic *extended double Zepp*, which has about twice the gain of two half-wave elements, an easy enough increase to attain.

The venerable "lazy H" we've discussed here before is another example, with basically



two one-wavelength long dipoles a half-wave apart and fed in phase. A variation of this theme is the "ZL Special," which is actually two 20 meter folded dipoles about an eighth-wavelength apart and fed together via a balanced line connecting the two.

One of the most elegant driven array arrangements, though, has to be the array of three in-line vertical antennas, fed in phase. This one seems awfully busy to me, what with all that coaxial cable to be routed, but its proponents swear by its results. The interesting aspect here is that the "array" is a group of separate antennas, not a group of elements of one antenna. And, the system is touted to have 5.7 dB forward gain, with a bidirectional pattern.

The array is certainly a powerful concept for increasing the gain and directivity of an antenna. Once again we see the familiar building blocks of dipole and vertical providing the foundation on which we've built these improved performance aspects. The real epiphany comes when you learn to see long dipoles and even longwires as *arrays*, discrete sections working together to generate the needed gain, in principle no different from the vaulted beam above a tall tower.

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A GPS option is also available which integrates the receiver with a high-resolution global mapping facility.

This high-performance marine receiver is extremely sensitive and optimized to work with relatively short antennas, typically found in a marine environment, yet featuring a respectable dynamic range making the receiver resistant to strong signal overload.

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## Join the FUNcube Fun!

An MT reader and Navspasur meteor monitor, Dennis KOLGI, recently tipped me off to a receiver capable of tuning from approximately 60 to 1700 MHz. The FUNcube is not much larger than a memory stick. Developed in the UK for amateur use to listen to Cube Satellites, the little SDR (Software Defined Receiver) can be adapted easily for other uses. I did the usual web searches to check it out. I ordered one from the UK folks and had one delivered to New Mexico in two days, all for \$150.00. Part of that cost is donated to the Cube Satellite program.

With an additional project in mind, a recent check on the availability of the FUNcube indicates there is a waiting time. However, Dennis KOLGI again tipped me off that a ham wanted to sell an unused one. I bought that at a considerable savings.

In September 2012 it was announced an improved FUNcube is coming out with nearly double the amount of parts, improved stability, wider frequency coverage, etc. Their web site indicates it will sell for about \$200.00 U.S.

What you get in the small package is a SDR with a miniature SMA connector on one end and the usual USB plug on the other. Below, shows my FCD in operation. Note the jumper is plugged into the speaker and microphone jacks. It is a cheap way to get the audio from SDR-Radio's software to the Argo software which listens to the microphone input.



The FUNcubeDongle, often called a FCD for short, sets up when plugged into a PC USB port. In order to program the FCD, a free application is available from the folks in the UK at [http://www.funcubedongle.com/?page\\_id=313](http://www.funcubedongle.com/?page_id=313).

Below is a screen shot of the FCD application. I entered 216979 kHz (216.980 MHz) for the NAVSPASUR frequency I use to monitor meteor activity. You can make parameter changes to the FCD system. Again, there's no demodulation; that occurs using other software. SDR-Radio or SpectraVue can handle the usual demodulation schemes. I use USB (Upper Side Band) for the NAVSPASUR frequency on 216.980 MHz for monitoring echoes using the



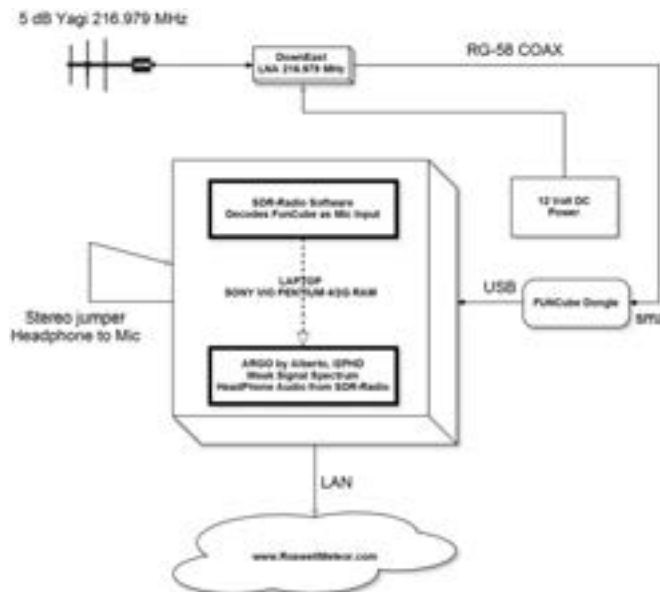
Doppler shift.

You can download the free SDR-Radio software package at <http://www.sdr-radio.com/Software/FUNcubeDongle/tabid/475/language/en-GB/Default.aspx>. With it, you can change the parameters in the FCD and you can also use SpectraVue's software that works with the FCD. This program allows you to use some or all of the 90 kHz bandwidth delivered by the FCD. Keep in mind the FCD does not demodulate. It delivers the bandwidth as I&Q data that can be decoded. Both programs recognize the FCD as a sound card microphone input.

Here's a list of web resources that will give you a good start on using the FUNcube:  
<http://funcube.org.uk/>  
[http://www.funcubedongle.com/?page\\_id=313](http://www.funcubedongle.com/?page_id=313) Software for FUNcube Dongle  
<http://www.sdr-radio.com/Software/FUNcubeDongle/tabid/475/language/en-GB/Default.aspx>

### ❖ Testing the FCD

The following sketch shows my test setup to get familiar with the FCD. Nothing here is ideal. I grabbed a 5 dB Yagi antenna that oper-



ates in the 217 MHz range and loaded the SDR-Radio and Argo software. The latest version of Argo supports FTP (File Transport Protocol). It allows you to send the latest image to a remote FTP server while Argo continues to log. The logs can be saved to any accessible location. I save mine to a high capacity 3 terabyte external network hard drive. Each file can be in the order of 85 to 110 kilobytes and the recordings happen about once a minute. Though this creates a lot of data, it allows for quick retrieval of an image for a specific time.

Setting the correct frequency is a minor problem since the FCD is not dead-on when you program the frequency. There is a way to compensate for the difference. Next to FCD's frequency entry box is a correction box. Here you can correct the frequency which is different for each unit. Rather than mess with the adjustment at this time, I simply tuned the software in SDR-Radio until I got a 1000 Hz trace using Argo software with the SDR-Radio set to demodulate Upper-Side-Band (USB).

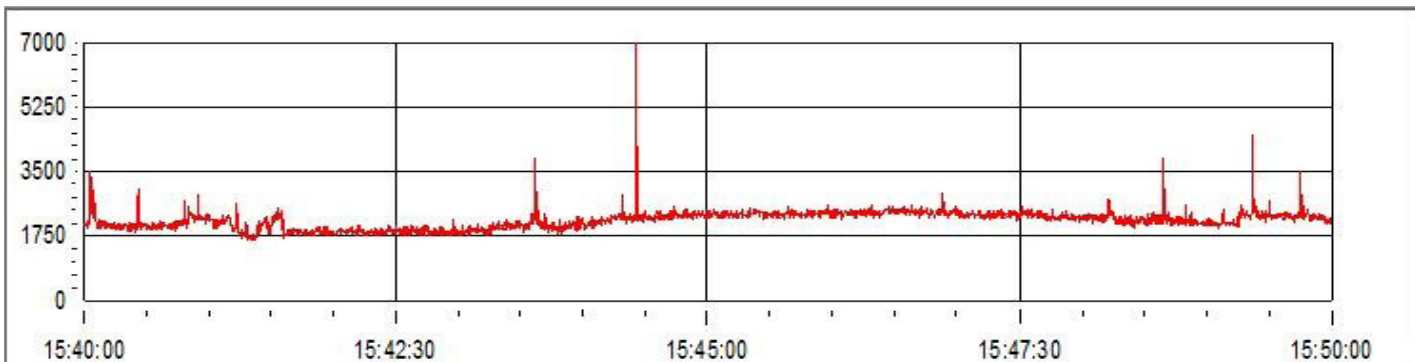
FCD Frequency Test Comparisons  
SN: 0006415 216.976832 MHz 1000 Hz USB  
SN: 0003080 216.978700 MHz 1000 Hz USB  
lcom R-8500 216.979440 MHz 1000 Hz. USB  
TheFUNcubes drift some until warmed up.

### ❖ FM Band Meteor Detection

Another more accessible meteor activity is to listen to distant FM stations which you cannot normally hear. Meteor activity reflects the distant signal that you can detect as a sudden enhancement. I used this technique some time ago but always found it hard to find a clean channel. Recently I decided to give it another try. I found 97.5 MHz without a local signal. Tuning the Marantz FM receiver to 97.5 MHz with the narrow band filter on, I was able to hear the echoes. I quickly installed an FM antenna beam pointing north-east to improve the signal. To log the received echoes, I use Radio Sky's SkyPipeII.

Update: I have retuned the FM receiver to 107.5 and finally to 104.3 MHz due to adjacent channel interference.





Though I have a narrow band option, one of the problems using FM stations for meteor burst detection is finding a clear channel within several hundred miles of your receiver site. I start with the normal filter and if I hear nothing but noise, I try the narrow band mode. Unfortunately, that condition changes with weather, etc.

Above is a SkyPipe II 10 minute chart of echoes on the FM channel 104.3 MHz. The vertical scale is not calibrated. The horizontal scale is in UTC. When working with a variety of logs it helps to keep everything in UTC, especially when sharing the files with folks in different time zones.

I decided to try the FCD on other signals to detect meteor echoes. I had used TV carriers in the past but they recently disappeared with the advent of digital TV. However, with the FCD hooked up and monitoring TV channel 3's carrier frequency 61.25 MHz, to my surprise, I saw echoes. Using Argo's software, I began logging the echoes, saving the capture image every minute or so. The echoes are most likely from Mexican stations which still are using analog TV. I live about 250 miles north of the border. I quickly built a simple two element beam tuned to 61.25 MHz.

The echoes charts are uploaded to my web site, [www.RoswellMeteor.com](http://www.RoswellMeteor.com), where you can view them. One of the Argo images below is from November 1, 2012. Note the wild echo returns from what appear to be two TV carriers.

The specifications for the FCD suggest the lower frequency limit of operation is about 60 MHz. This unit appears to work well on 61.25 MHz. If you can receive the TV carrier signals

from Mexico, be aware they plan to convert to digital TV in the near future.

As mentioned earlier, there is some noticeable frequency drift when the FCD is first turned on or when it experiences temperature changes. I covered it with a small length of PVC and stuffed some insulation inside the tube to control the temperature. It stabilized the temperature drift.

Are you're interested in using the FCD to build a simple radio telescope? Here's a link with experimental details for the FCD's use on 1420 MHz using a 10 foot dish.

[www.britastro.org/radio/projects/An\\_SDR\\_Radio\\_Telescope.pdf](http://www.britastro.org/radio/projects/An_SDR_Radio_Telescope.pdf)

### ❖ Radio Astronomy in the Movies

The only radio telescope I saw in a movie recently was actually part of a 2012 New Mexico political ad that showed various scenery clips from around the state. I searched for other possibilities and discovered a couple of links that showed 'movies' made from radio telescope data gathered by the VLA in Socorro, New Mexico. Here's one link showing solar flares observed in 1992 at 5 and 15 GHz, using all 27 dishes divided in to two sub-arrays. Check it out at: [http://www.astro.umd.edu/~white/images/VLA\\_flare.html](http://www.astro.umd.edu/~white/images/VLA_flare.html).

### ❖ Correction

Dennis, K0LGI, noted I mentioned he lived in Indiana in the December 2012 issue of

my column. He quickly got out his GPS and confirmed he still lives in Iowa. Dennis is an *MT* reader and an active meteor NAVSPASUR listener. Keep Listening Up!

### Links used in article:

[http://www.funcubedongle.com/?page\\_id=313](http://www.funcubedongle.com/?page_id=313)

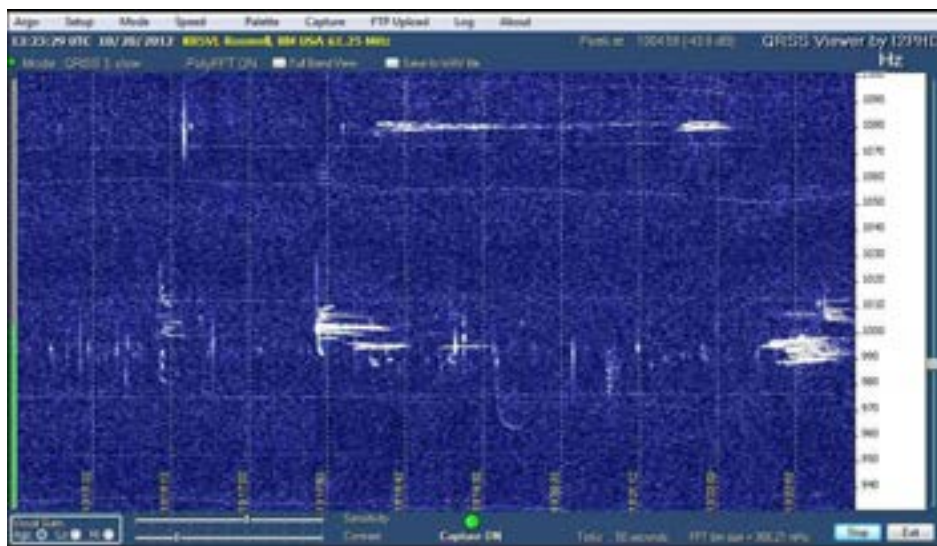
<http://funcube.org.uk/>

[http://www.funcubedongle.com/?page\\_id=313](http://www.funcubedongle.com/?page_id=313) Software for FUNCube Dongle.

<http://www.sdr-radio.com/Software/FUNCubeDongle/tabid/475/language/en-GB/Default.aspx>

[www.britastro.org/radio/projects/An\\_SDR\\_Radio\\_Telescope.pdf](http://www.britastro.org/radio/projects/An_SDR_Radio_Telescope.pdf)

[http://www.astro.umd.edu/~white/images/VLA\\_flare.html](http://www.astro.umd.edu/~white/images/VLA_flare.html)



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# WiNRADiO G33EM Marine Receiver

By Bob Grove W8JHD

It's hard to believe that several years have gone by since Radixon's WiNRADiO division released the advanced G31 Excalibur software defined radio (SDR) receiver. It was designed to appeal to serious shortwave hobbyists, and it still does.

Next in production was an advanced model for the same frequency range, but with improved specifications. The G33 Excalibur Pro continues to amaze its owners and is a very popular product for both shortwave listeners and agencies with special interest in the high frequency (HF) spectrum.

Since the under-30 MHz frequency range is loaded with digital modes of interest to the shipping industry, it seemed reasonable to produce a receiver specially designed for that application. Thus was born the G33EM marine receiver (Figure 1).

## ❖ So, What's the Difference?

Since both the G33DDC Pro and G33EM share similar design architecture, how can the listener decide which one is best suited for his application? First of all, the Pro covers 9 kHz to 50 MHz, while the 33EM cuts off at 30 MHz since all of the global marine digital communications are conducted below that frequency. Savvy readers will point out that there are satel-



**Figure 1: The rugged case of the WiNRADiO G33EM has three ports for 12 VDC power, antenna, and USB interconnect.**

lite shipboard comms to be heard as well, but those specialized systems are much higher in frequency, well out of reach of these two models.

Reception modes on the G33DDC Pro are the standard cluster of AM, SSB, FM, FSK, and CW signals. The G33EM deletes the FM (which is rarely heard below 30 MHz) and adds DSC, NAVTEX, HF FAX, and TELEX for the more popular digital HF marine modes.

A real-time spectrum analyzer offers continuously variable bandwidth, a graphical notch filter, and IF recording capability. But while the G33DDC can simultaneously display all the signals in its entire 50 MHz-wide spectrum, the G33EM is intentionally confined to a 20 kHz span. It is important, therefore, to differentiate

between the two basic applications for these receivers.

Simply put, the G33DDC is ideal for signal hunting and identification, and spectrum surveillance, while the G33EM is designed for single-signal monitoring and analysis, specifically marine navigation and telecommunications (Figure 2).

## ❖ Features

The SMA antenna connector has +12 VDC on it for powering a remote amplified antenna like the popular WiNRADiO AX81S marine whip antenna.

A world map displays day/night boundaries for the continents along with a position indicator and time zone information as shown in figure 2; adding the optional GPS function provides a high-detail zoom-able map.

The screen image may be expanded or reduced both horizontally and vertically to suit the computer screen, and without distorting the proportions of fixed images like the tuning knob, S-meter, and panel legends.

Frequency entry may be accomplished by direct keyboard typing, by rotating the on-screen tuning knob with the mouse, or by clicking on the up/down arrow buttons in steps as fine as 1 Hz.

Offering high sensitivity and wide dynamic range to avoid strong-signal overload, the rugged G33EM connects to a PC (desktop or laptop) via its supplied USB cable. A GPS option is available to enable the receiver to produce high-resolution global mapping.

Up to 10,000 frequencies and respective modes can be stored in a memory file, and multiple files may be stored on the host computer. Factory-preinstalled memories for international Fax, NAVTEX, and DSC are included.

The recorder/playback function features a task scheduler which controls the receiver to automatically tune to preset frequencies and times for later playback. The signal may be selected to record at the intermediate frequency (IF) in order to signal-process the recording later for optimum adjustments of filters.

A notch filter can be selected in the radio mode for any frequency in the passband, and its width adjusted as well for suitable rejection of unwanted interference.

The IF passband can be adjusted continuously in width to include or exclude sideband signals and the IF center may also be offset continuously for shifting the passband.

Digital selective calling (DSC) auto-records safety messages transmitted on distress frequencies (Figure 3). Those messages can be scrolled and read later or even printed out. The same capabilities are provided in the NAVTEX mode,



**Figure 2: The upper-right screen displays the signal contents with adjustable bandwidth and notch filter. The zoomable world map shows the area of Earth currently illuminated by the Sun.**

extensively monitored at sea for maritime safety, weather, positioning information, search and rescue, and pirate alerts.

For decades, facsimile transmissions have been popularly monitored by maritime interests and radio hobbyists. Oceanographic fleet weather broadcasts are regularly updated and widely available as shown in Figure 4.

The FAX imaging can be adjusted for color, contrast, brightness, and gamma and allows name, date, and frequency tagging as well.

The G33EM can receive, display, and record these transmissions, then zoomed, rotated, and printed automatically or manually as desired.

TELEX is a radio teletype (RTTY) mode for sending text, in this case marine messages. Baudot and SITOR B modes are supported, read, stored, and may be printed. Code filters like Buoy (buoy observations), MAFOR (shipping forecasts), Ship (sea surface reports from ships), SYNOP (sea surface reports from land stations), Syn.Mobile (sea surface observations from a mobile station), and plain text are all available. Fixed frequency shift offsets are 85, 170, 425, and 850 Hz.

### ❖ Operation

The signal strength indicator (S meter) is calibrated both in S units and dBm. It also reveals the manual setting of the squelch level as a color bar.

Automatic gain control (AGC) is a method of self-adjusting a receiver's sensitivity to incoming signal strength to avoid overloading. Settings of none, slow, medium and fast response times may be selected either from legends beneath the S meter or from the settings menu. Medium is always a good start.

Automatic volume control (AVC) is a method of self-adjusting a receiver's audio gain to accommodate variations in the audio content level of a received signal. Like the AGC feature, AVC also has the manual settings of none, slow, medium and fast response times.

All receivers, no matter how good they are, have a maximum received signal strength above which they develop "ghost" signals in the tuning range on frequencies where there are no actual received signals. Repeated presses of the attenuator button allow successive levels of signal level suppression up to 18 dB.

### ❖ The Spectrum Analyzer

While oscilloscopes operate in the time domain to show what a single signal does in amplitude over a period of time, spectrum analyzers operate in the frequency domain, examining the contents of a specific frequency or band of frequencies.

The purpose of a spectrum analysis function in the G33EM is to assist perfect tuning of a desired signal by centering on its exam frequency, attenuating interference above and below that frequency, and nulling any interference within the passband of that channel.

The passband, also known as the sweep span, is the spectrum width displayed, in this case up to 20 kHz wide. It is limited by a roofing filter. The roofing filter is, in turn, assisted by a



Figure 3: Digital selective calling (DSC) logs and records distress messages for later playback or printout

variable IF (intermediate frequency) bandwidth filter which can be manually adjusted from 100 Hz to 15 kHz.

Although normally centered right in the middle of the received signal window, the variable IF filter can be moved anywhere within the 20 kHz span of the signal in order to select only a part of the signal bandwidth.

A peak-finder button immediately tracks the highest amplitudes in a crowded or complex channel at that point in time. This works very well to determine the offset in frequency-shift keying, especially invoking the zoom feature for precise measurement.

A colorful spectrogram function permits the trace to flow continuously up the window showing the signal contents over time for detailed signal analysis.

### ❖ Memory

Files of retrievable frequencies have an unlimited capacity since they are stored on the host computer hard drive. Along with the frequency, additional attributes may be written including IF shift, IF bandwidth, call sign, hotkey, squelch, mode, and user comment. The settings will command the receiver when recalled. Memory entries may be edited, deleted, and stepped through sequentially.

Factory installed presets DSC, NAVEX, HF FAX, TELEX, and marine distress frequencies may be modified by the user as desired. Printing files can be manual or automatic.

### ❖ Recorder

The built-in recorder digitally memorizes audio files at a 16 kHz sam-

pling rate in 16 bit mono, however, IF files are recorded at a 48 kHz sampling rate also in 16 bit mono. The output is formatted in a Windows .wav file. Normal recorder functions like stop, pause, play, record, and skip back or forward are selectable.

### ❖ The Bottom Line

We found the WinRADIo G33EM marine receiver extraordinarily versatile in signal processing for best reception. Of course, you need to have some idea of what you're doing in the digital modes. The instruction manual provides some guidelines for successful monitoring.

This receiver is well designed and well suited for its specialized monitoring applications. It comes with application software, user's manual, test antenna, BNC/SMA adapter, USB interface cable, low-noise AD linear power supply, and a fused fly lead for a DC supply.

Contact Grove Enterprises for pricing: sales@grove-ent.com, or phone (800) 438-8155.

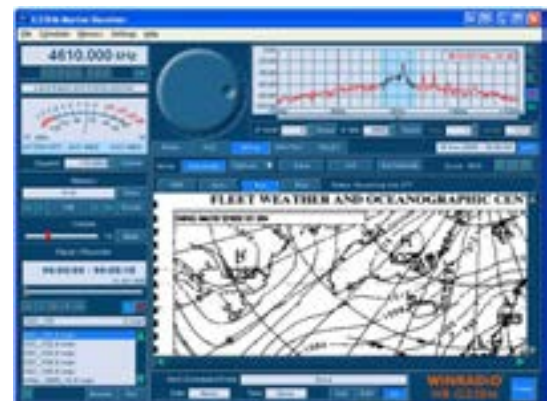


Figure 4: Weather fax (facsimile) is a prime target for digital reception.



## Puerto Rico: A State of Streaming

If you have been reading this column for any length of time, you probably know I have a fascination for the Latin American part of the world. Central America, South America, even into the Caribbean, the history and culture has captivated me since my childhood.

One part of this region though has always seemed elusive to me, almost hidden on the outskirts, just waiting for me to explore its sounds and sights: Puerto Rico.

As a landlocked mediumwave DXer, I have often dreamed of tuning in the sounds of Puerto Rico. For years, stations from the island have sat on my NRC AM Log pages, tantalizing prospects for Spanish-formatted audio coming through my headphones. Alas, these have usually turned out to be domestic or Cuban stations. With not much signal thrown my way from the island, and without the benefit of seawater between us, its stations have eluded me thus far.

However, my dreams of the sounds of the islands filling my ears no longer have to go unrealized. There are a number of stations to be found from Puerto Rico online. Since they fall under the jurisdiction of the FCC, being a U.S. territory, the stations here are assigned U.S. call letters. Most of the formatting is in Spanish, with a few English stations thrown in. There is a lot of music to be found, including some fantastic island salsa music. One great example of this format comes from WZNT – La Zeta 93 – 93.7 FM.



Another great option for salsa and calypso music is Cumbre 1470, WKCK in Orocovis. In my listening sessions, Cumbre played the type of music that comes immediately to mind when one thinks of Puerto Rico. Also, try Radio Sol, WSOL in San German. Their stream is through Ustream, so you will need to go directly to the station web site to access it.

One of my favorite Spanish music stations is Radio Casa Pueblo 1020, WOQI in Adjuntas. They don't play the super-high-energy techno-salsa like so many stations do. Here you will find a more classic salsa and calypso sound. I have even heard music that borders on Ecuadorian/Peruvian here. Casa Pueblo is an environmental



watchdog group in Puerto Rico, focused on protecting the undeveloped areas of Puerto Rico. They have a lot of information on their Web site about the many topics and initiatives they are involved in.

Having a large Catholic community, there are several Catholic broadcast stations as well, both AM and FM. There are also a number of talk and news stations on AM, mostly in Spanish, but WOSO-1030 does offer English programming.

In addition to traditional broadcasts, you can also find other streaming audio options online coming from Puerto Rico. Still stuck in cold temperatures as winter is making it's final exit for the year? How about tuning in the local NOAA Weather Radio station (also in Spanish)? This will be a good one to keep handy when the tropical winds start blowing during hurricane season in a few months.

All told, Puerto Rico is a treasure trove of great listening opportunities. Even for those who don't speak the language, there is still plenty here to enjoy.

From the tropical music, to the spirited discussions on the talk stations, Puerto Rico's culture and sense of community leaps from your speakers in a way that is unique to the island.

### ❖ Streaming the Friendly Skies

In honor of our annual air show issue, I always like to remind my readers that radio stations and scanners aren't the only streaming audio goodies lurking about on the Net. In the summer of 2012, I was able to move into a new home that put me within a very short distance from an airport here in upstate South Carolina. Coupled with my close proximity, which makes air traffic listening on my scanner quite easy, there are also a couple of fantastic viewing areas to watch planes take off and land which has always been among my favorite past times.

However, I'm not at home all of the time, able to take in the action directly with my eyes and ears. For those times when I am not near my scanner, or when

I want to listen to air traffic from around the world, I still can tune in the communications through the LiveATC mobile app or Web site.

The LiveATC app is available for download from both the iOS App Store and Android Market for \$2.99. You can also tune in streams directly from the LiveATC Web site. There are a

ton of airports to be found here, including some of the busiest airports in the world. There are links to instantly see any airports where the weather may be problematic.

There is a slight delay when listening to the LiveATC streams, but nothing that should be discouraging during your listening session.

Normal approach/departure communications found in the 'air band' aren't the only things to be found here. You can also tune in HF communications from "Oceanic" flights (those crossing the Atlantic or Pacific). There is some fascinating listening on these streams, especially during times of inclement weather.

For the air show buffs reading this month's copy of MT, there is something to be found for you too online. For the past seven years, Phil W2LIE of [w2lie.net](http://w2lie.net) has had a special feed of communications from the Jones Beach Air Show that runs in late May available from his web site. No official word yet from Phil as of press time if he will be bringing back the feed again this year, but be sure to check his web site for the latest details.

All told, air traffic enthusiasts have quite a bit to enjoy online, even if you are hundreds of miles from the nearest international airport. All you have to do is know where to look!

### ❖ GlobalNet Links

- Puerto Rico at Tuneln - <http://tunein.com/radio/Puerto-Rico-r100013/?other=true>
- San Juan, Puerto Rico at Tuneln - <http://tunein.com/radio/San-Juan-r101050/>
- WZNT – San Juan, PR - <http://zeta93.fm>
- WKCK – Orocovis, PR - <http://cumbre1470am.com/Portal/>
- WOQI – Adjuntas, PR - [www.casapueblo.org](http://www.casapueblo.org)
- NOAA Weather Radio Station WXJ69 – San Juan, PR - <http://tunein.com/radio/NOAA-Weather-Radio-1624-s88303/>
- LiveATC - [www.liveatc.net](http://www.liveatc.net)
- W2LIE.net - [www.w2lie.net/news.php](http://www.w2lie.net/news.php)

**LiveATC.net**  
Live Air Traffic – From Their Headsets to You.



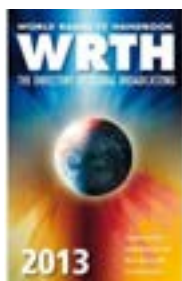
# What's NEW

Tell them you saw it in *Monitoring Times*

Larry Van Horn, New Products Editor

## 2013 World Radio TV Handbook

The New Year brings many things to radio hobbyists, including new goals for a successful DX season. Ultimately, listeners always welcome the new edition of *World Radio TV Handbook* (WRTH), a stalwart in the industry for 67 years.



This year's edition is no exception, as WRTH continues their reputation as a comprehensive reference book for broadcast radio hobbyists.

The 2013 edition begins with a receiver review on the Newstar DR 111. This small and capable SDR (software-defined radio) continues to gain interest, and review leaves little doubt that high performance is now available at very affordable prices. The world of Internet radio continues to expand and WRTH reviews the best of the year in this category, the Roberts Stream 83i. This year's WRTH reviews also include a look back at classic DSP receivers.

The features section begins with *Children's Radio Foundation* (CRF), a non-profit organization in Cape Town. CRF provides tools and skills to make the voices of African youths, an outlet to tell their stories.

With the absence of broadcasting in the Netherlands Antilles, and unfortunately a decrease in tropical band stations, resourceful DXers have shifted to medium wave and FM transmissions. *Listening on Curaçao*, by DXer Max van Arnhem, reflects on the political and radio changes in the small island of Curaçao.

*Digital Update* revises the annual round-up of what has occurred in the world of digital radio and TV during last year.

Freelance writer Hans Johnson explains why newly-founded clandestine station Khmer Post Radio has chosen to send their message via shortwave radio.

George Jacobs updates his annual *HF Broadcasting Reception Conditions Expected* during 2013, with a prediction of improved grade of service for the worldwide HF listening audience.

The national radio section of the WRTH includes domestic radio stations which broadcast to a national listening audience on medium wave, shortwave and FM. Listings are arranged by country and include frequencies, transmitters, power, contact information and website if applicable.

The international radio section contains stations broadcasting to an international audience. Similar to the latter, this section includes frequencies, transmitters, power, contact information and website.

Clandestine and other target broadcasts

are stations broadcasting politically motivated programming, or those targeted at zones of local or regional conflicts. A one-page listing cross reference of religious broadcasters closes this section.

The by-frequency list covers medium wave, shortwave, DRM, and a by-hour listing of multilingual international and DRM broadcasters, plus an update on terrestrial television. Closing out this year's edition is an extensive reference section of global transmitting sites, radio clubs, standard time and frequency stations, and selected Internet Resources.

The *World Radio TV Handbook 2013* is the ultimate directory of global broadcasting aimed at its worldwide radio and broadcast audience. WRTH continues their tradition of producing the very best, most comprehensive and authoritative radio reference book in the marketplace.

*World Radio TV Handbook* (BOK 03-13) is available from Grove Enterprises [www.grove-ent.com](http://www.grove-ent.com) for \$30 plus shipping and handling. For orders call 1-800-438-8155 or email [order@grove-ent.com](mailto:order@grove-ent.com) Address: Grove Enterprises, 7540 Highway 64 West, Brasstown, NC 28902 USA. - Gayle Van Horn W4GVH.

## 2013 Super Frequency List on CD

Joerg Klingenfuss has released the 2013 edition of his popular *Super Frequency List on CD*. This is the only CD that includes all shortwave broadcast stations worldwide, all HF utility stations from 0 to 30 MHz, and hundreds of digital data decoder screen shots from stations around the world.



The shortwave broadcast database includes 6,351 entries with the latest schedules of all clandestine, domestic and international broadcasting services on shortwave.

The utility database includes 7,597 special frequencies from his 2013/2014 *Guide to Utility Radio Stations*. This database also includes 930 abbreviations and 22,699 formerly active frequencies.

This compact disk is designed to operate on PCs with the Windows OS. You can either browse or search this CD in milliseconds for specific frequencies, countries, stations, languages, call signs, and times as well.

This Klingenfuss CD-ROM is available from Grove Enterprises for \$35 plus shipping and handling at the website/address mentioned above.

## Sangean Releases a New Stereo Headphone

Sangean America, Inc. recently announced release of their new EU-55 full size stereo headphones. The new EU-55 is designed for spectacular highs and lows, has a soft cushion headband and adjustable full size ear cups to ensure comfortable listening for hours on end.



A pair of powerful dynamic voice coils in the EU-55 are to provide rich and balanced full-range sound from your favorite music, podcasts and audio books. Delivering strong bass response with a low end reaching to 20Hz and a lightweight, but sturdy Mylar diaphragm for reduced headphone weight, the EU-55 is the perfect companion for listening to your music on the go.

The high density compressed ear cups allow for comfortable listening, long-term wear, and superior passive noise isolation. You can block out the outside world for hours with the supra-aural (on-ear) ear cups that feature plush, comfortable leatherette material to reduce pressure and ear fatigue during extended periods of listening.

These headphones also feature an adjustable soft cushion and flexible headband, and a tangle resistant cable.

### Specifications:

Style	On-ear
Driver Design	Dynamic Voice Coil
Driver Components	Mylar diaphragm, CCAW voice coil, NdFeB magnet
Driver Diameter	40mm
Rated Power	30 mW (0.98V)
Maximum Power	100 mW (1.79V)
Frequency Response	20Hz- 20kHz
Sensitivity	113db +/- 3db @ 1mW
Impedance	32 ohms
Input Connections	3.5mm
Weight	4.3 oz
Color	Black
Dimension	7.56-inches (L) by 6.38-inches (W) by 2.68-inches (H)

The Sangean EU-55 retails for \$40 and is available at many retail outlets including Amazon.com.

## Etón Solarlink FR600B

The Etón Solarlink FR600 does more than keep you connected. This self-powered all-band radio boasts an impressive list of features that include AM/FM and shortwave radio reception, all seven NOAA weather band channels as well as Specific Area Message Encoding (S.A.M.E) for location based weather alerts specific to the area the user is currently in.

Added features include an easy to read digital display, hand-crank power generator, solar power, rechargeable Ni-MH batteries, built-in flashlight, flashing red LED light as well as built-in USB cell phone and MP3 charging capabilities.

The built-in rechargeable battery pack can be charged from the integrated dynamo hand crank, or from an optional USB adapter. An array of water resistant, shatterproof, high performance glass encapsulated amorphous solar cells can also run the Solarlink FR600. They are efficient enough to power the unit under direct sunlight. These multiple power supplies can also be used to recharge cell phones via USB charging cable (not included).

The Etón Solarlink FR600 is designed for rugged outdoor use, and is ready to operate with no additional plugs or wires needed. Its clever case design protects the analog controls from damage, while rubber gaskets and plugs help keep moisture out of the unit.

#### Product Features

- AM (520-1700 kHz), FM (88-108 MHz), SW (5800-12200 kHz) and all seven channels of NOAA weather radio.
- Digital display with LED illuminated backlight
- Digital clock function with alarm snooze
- Power from the AC via USB adapter (not included) and solar power which charges the unit's Ni-MH battery
- USB cell phone charger (USB cable not included)
- Connectors with rubber gaskets/plugs to seal out moisture
- Dimensions: 7.75-inches (196.9 mm) by 8.5-inches (215.9 mm) by 2.5-inches (63.5 mm) (W x H x D)  
Weight: 1.9 lbs. (0.86 kg)

The Etón Solarlink FR600 retails for \$100 and is available from a wide variety of merchandisers nationwide.

## Icom R-2500 Dual Watch, Digital Mode, Diversity Black Box Receiver

If you are looking for a wideband mobile rig black box receiver then the Icom R-2500 might be the answer.

The IC-R2500 has dual watch receive (two antennas are required) capability which allows you to receive two bands simultaneously. It covers a whopping 0.01 to 3299.999 MHz in AM, FM, WFM, SSB, CW, DV (optional UT-118 required) and P25 (optional UT-122 required) modes on the main receiver, while the sub-receiver covers 50-1300MHz in AM, FM and WFM modes.

The diversity receive mode is useful for mobile operation where the received signal changes continuously. It compares the signal strength and chooses the antenna with the better signal to maintain good sound and receive quality.



Courtesy: Icom America

The wide LCD display shows both main/sub receiver settings in an easy-to-read symmetric side-by-side layout. The controller provides separate tuning, volume, squelch knobs and function buttons for the left (Main) and right (Sub) receivers. The LCD backlight color is selectable between amber and green for your preference.

The optional UT-118 D-STAR digital unit and UT-122 P25 digital unit provide the latest digital mode reception.

With Icom's Dynamic Memory Scan (DMS), you have a versatile memory channel management system at your command. The 1000 memory channels can be arranged by service or personal preference in the 21 memory banks. Selectively link the channels together to scan depending on your needs. Programming the memory channels and six character memory names is simple with your PC.

Other features include:

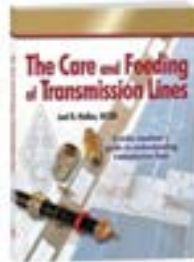
- Weather alert function (U.S.A. and Canada versions only)
- Optional DSP capability with UT-106
- VSC (Voice Squelch Control) ignores unmodulated signals or heterodynes
- IF filter selection for changing IF filter width
- Noise blanker eliminates pulse type noise (SSB, CW, AM mode only)
- AFC function automatically follows an FM signal when the signal's frequency drifts BW: 6-kHz or 15-kHz
- IF shift function (SSB, CW mode only)
- 30 min - 2 hour auto power off timer
- Fast/slow AGC setting
- Short/long squelch delay
- CTCSS/DTCS tones and duplex mode operation for monitoring a repeater
- RF attenuator attenuates 20dB (approx.) below 1300MHz
- All IC-PCR2500 functions are available when connected to a PC
- Cloning function allows you to read/write memory contents from your PC. Sharing data with IC-PCR2500 is also possible.

This unit has now been discontinued by Icom, but Grove Enterprises still has a few units available at \$880 plus shipping and handling. Order soon before their inventory is sold out.

## The Care and Feeding of Transmission Lines

Transmission lines are an integral part of the art of radio. Designed to carry RF power over short to medium distances with minimal loss, properly selected and installed transmission lines can be as important as radio equipment and antennas for a station's success.

*The Care and Feeding of Transmission Lines* by Joe R. Hallas W1ZR, is a radio amateur's guide to understanding transmission lines. It includes an introduction to the various types of transmission lines, key parameters of coaxial cable and balanced line types, as well as the different types of connectors. With this book, you'll learn how to select the most appropriate transmission line for an application, how to



install it, and maintenance techniques to help extend the useful life of the line.

Contents include:

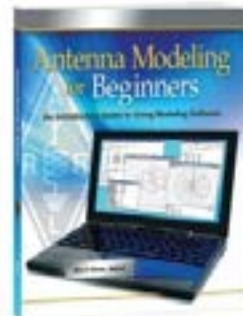
- What is a Transmission Line and Why Do We Need One?
- What are the Types of Transmission Lines and Why So Many?
- Let's Examine Coaxial Transmission Line
- Other Types of Unbalanced Line
- Let's Examine Balanced Transmission Line
- Transmission Line Interconnections
- Determining Which Line is Best Suited for a Particular Application
- Application and Installation Notes
- Transmission Line Care and Maintenance

This soft cover, 112 pages, ARRL published book retails for \$28.00.

## Antenna Modeling for Beginners

Over the last decade, computerized antenna modeling has advanced greatly with inexpensive and even free modeling software now available. Modeling, a powerful tool in amateur radio, can help you design antennas and optimize their performance.

*Antenna Modeling for Beginners* is an introductory guide to using modeling software for designing and evaluating antennas. It provides a detailed introduction to EZNEC, the most popular antenna modeling program used by radio amateurs today. With this book, you'll set up basic modeling software, evaluate and adjust pre-designed models, and create your own models. Step-by-step exercises and explanations will familiarize you with important functions and procedures along the way. As you progress, you'll discover antenna modeling is simple to learn and use!



Material in this book includes:

- Test Drive of EZNEC
- Patterns and Tables
- Building a Model - From the Dipole to Inverted V
- Modifying a Model
- Building a Model - Adding Ground
- Building a Model - VHF Vertical Ground-plane
- Building a Model - Design Examples
- Developing Reliable Models
- Testing the Model and a whole lot more.

This 176 page soft covered book from the ARRL retails for \$39. The two books mentioned above are both available from the ARRL, 225 Main Street, Newington, Connecticut 06111-1494, toll free 1-860-594-0200/ Fax: 1-860-594-0259 or via their website at [www.arrl.org](http://www.arrl.org).

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](mailto: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.

# The Best in Radio Communications

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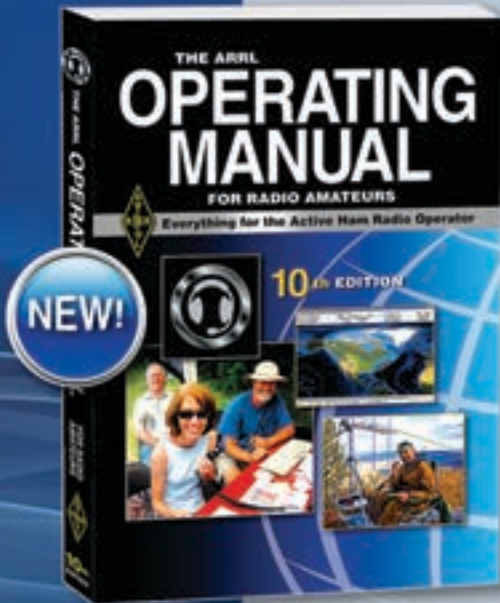
## The ARRL Handbook—2013 Edition

*The ARRL Handbook for Radio Communications* is widely recognized as being the standard reference among radio amateurs and other technologists—experimenters, engineers and students. It's filled with essential information from across the expanse of radio communication fundamentals, covering nearly every aspect of radio and antenna design, equipment construction, and station assembly. CD-ROM included!\*

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**Softcover Book and CD-ROM.** Retail **\$49.95**

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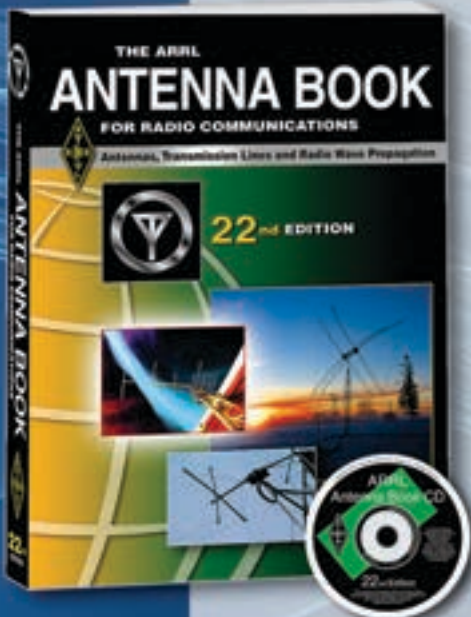


## The ARRL Operating Manual—10th Edition

*The ARRL Operating Manual for Radio Amateurs* is the most complete guide to Amateur Radio operating. You'll find everything you need to know—from exploring the broad range of ham radio activities, to sharpening your on-air skills. Put your equipment to use!

**Softcover Book.** Retail **\$34.95**

Exciting Antenna Projects and Design!



## The ARRL Antenna Book—22nd Edition

*The ARRL Antenna Book for Radio Communications* includes all of the information you need for complete antenna systems—from planning, to design and construction. It includes antennas from the HF low bands through VHF, UHF and microwave; fixed station, portable, mobile, maritime, satellite and more. CD-ROM included!\*

**Softcover Book and CD-ROM.** Retail **\$49.95**

\*System Requirements: Windows® 7, Windows Vista®, or Windows® XP, as well as Macintosh® systems, using Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at [www.adobe.com](http://www.adobe.com). PDF files are Linux readable. The ARRL Antenna Book utility programs are Windows® compatible, only. Some utilities have additional limitations and may not be compatible with 64-bit operating systems.



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- 0.005–3335.000MHz\*
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- 1020 Alphanumeric Memory Channels
- P25 (Option UT-122)
- Five Roofing Filters and so much more!

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## IC-R75 Wide Band Receiver

- 0.03–60.0 MHz\*
- Triple Conversion
- Twin Passband Tuning
- Digital Signal Processing (DSP)



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### IC-R20 Advanced Ops

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- AM, FM, WFM, SSB, CW
- 1250 Alphanumeric Memory Channels
- Dualwatch Receive
- 4-hour Digital Recorder



### IC-RX7 Track Ready

- RX: 0.150–1300.0MHz\*
- AM, FM, WFM
- 1825 Alphanumeric Memory Channels
- 100 Ch/Second High Speed Scan
- Computer Programmable<sup>2</sup>
- Water Resistance Equivalent to IPX4



### IC-R6 Pocket Compact

- RX: .100–1309.995MHz\*
- AM, FM, WFM
- 1300 Alphanumeric Memory Channels
- 100 Ch/Second High Speed Scan
- Computer Controllable<sup>1</sup>



### Information & Downloads

RECEIVERS | AMATEUR TOOL KIT | COMIC BOOKS | VIDEOS | [WWW.ICOMAMERICA.COM](http://WWW.ICOMAMERICA.COM)

*Electronic advertisements feature active links for each radio.*

\*Frequency specs may vary. Refer to owner's manual for exact frequency specs. <sup>1</sup>Optional CT-17 required. <sup>2</sup>Optional CS-RX7 required.  
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