

12th Annual
Air Show Issue

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



Monitoring[®] Times-

A Publication of Grove Enterprises

Volume 30, No. 3
March 2011

U.S. \$6.95
Can. \$6.95
Printed in the
United States



AIR SHOW 2011!



In this issue:

- Photography tips from an air show veteran
- An air show monitor's portable listening post
- MT Reviews:
Alinco DJ-X11T wide coverage receiver

AR5001D Wide Coverage Professional Grade Communications Receiver

The Legend Lives On!



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

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

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

- Multimode receives AM, wide and narrow FM, upper and lower sideband and CW
- Up to 2000 alphanumeric memories (50 channels X 40 banks) can be stored
- Analog S-meter
- Fast Fourier Transform algorithms
- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all of the receiver's functions
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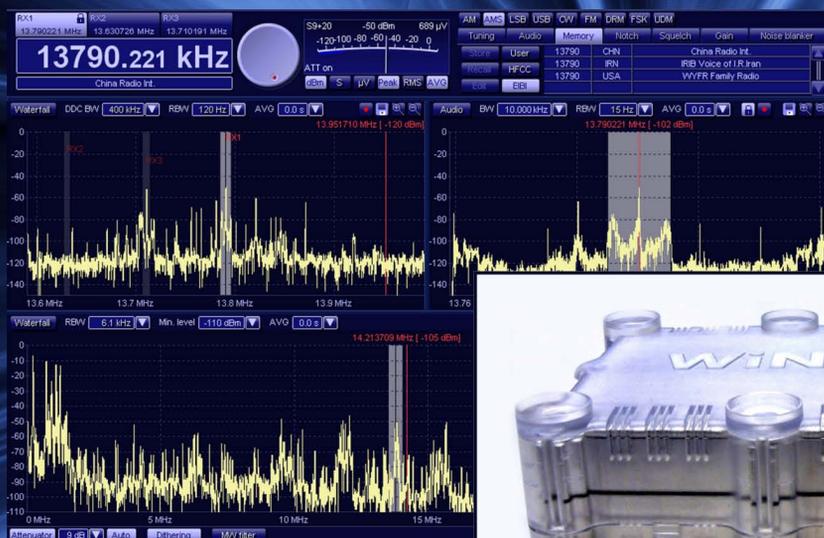
It's a Winner!

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

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

Overall rating: 5 stars

WRTH category award winner: Best SDR 2011



And many other independent reviewers agree:

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

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

Shouldn't you have a look, too?

www.winradio.com



AIR SHOW 2011!.....8

By Larry Van Horn,
MT Assistant Editor

From March through November, across North America, service and civilian air teams from around the world showcase their skills and the capabilities of their aircraft, in the thrilling spectacle that is an air show.

Attending a show is only half the fun; listening to the nonstop action over dozens of radio frequencies is the real fun. But you can't tell the players without a program, and that's what you're holding right now: *MT's* 12th Annual Air Show issue.

In this month's cover story, long time air show enthusiast and *MT's* *Milcom* columnist, Larry Van Horn, lists every known frequency for every possible player at any given air show this season. And, don't miss Larry's column in this issue as he releases his latest tip sheet on which radios work best at the show.

Our other two features this month are from long-time air show enthusiasts who take full advantage of the action in the air with their cameras and on the air with their radios. Learn how they tune in and how they get those great photos!

On Our Cover

Photo by Kevin Burke was taken Saturday, June 26, 2010 at the Quonset Point Rhode Island Air Show, North Kingstown, Rhode Island. Kevin says, "This photo was the fourth in a series of five shots I took rapid fire. As this maneuver is designed, the F-16C's are actually side by side so that they appear stacked." For this shot Kevin used a Canon Digital Rebel XT camera with a 100-400 mm telephoto zoom lens, a shutter speed of 1/2000 and an aperture of 7.1.

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Monitoring and Photography Tips from an Air Show Veteran..... 14

By Kevin Burke



For more than 25 years Kevin Burke has been attending air shows, monitoring the action on a scanner and taking some pretty amazing photos. As evidenced from the cover of this month's issue, Kevin knows what he's doing. His photos are enough to lure anyone to the air field for the amazing stunts, precision flying and total celebration of the art of being in the air. But, how does he get those amazing shots? Knowing which shows are best, when to arrive, where to set up and how to take the best shots are all part of his winning formula.

An Air Show Monitor's Portable Listening Post 18

By Brian and Jo Marie Topolski



With 21 years of air show attendance behind them, this husband and wife team take air show monitoring to new heights. With their very own "Comm-cart," the two never miss a second of the action in the air or on the ground. In this article you'll find out how they configure four Uniden scanners, a bank of antennas and external speakers for each radio to

catch all the VHF and UHF comms from the cockpits to the ground crews.

R E V I E W S

Alinco DJ-X11T Wide Frequency Coverage Scanning Receiver 66

By Bob Grove W8JHD



A wide-band scanning receiver that takes you from 50 kHz to 1.3 GHz in a small enough package to truly be called a pocket radio? "Yes!" says Bob Grove, and if you thought that was impressive, you'll be amazed at the list of features he found on the Alinco DJ-X11T. It's a serious radio package that sports a serious price tag that Bob says is worth a serious look.

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MONITORING TIMES
(ISSN: 0889-5341;
Publishers Mail Agree-
ment #1253492) is
published monthly by
Grove Enterprises, Inc.,
Brasstown, North Caro-
lina, USA.

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Internet Address: www.grove-ent.com or
www.monitoringtimes.com
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Subscriptions: order@grove-ent.com

Subscription Rates: \$32.95 in US; \$42.95 Canada; and \$58.95 foreign elsewhere, US funds. Label indicates number of issues left. Renewal notice is cover sheet 3 months before expiration. See page 76 for subscription information.

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7540 Highway 64 West, Brasstown, NC
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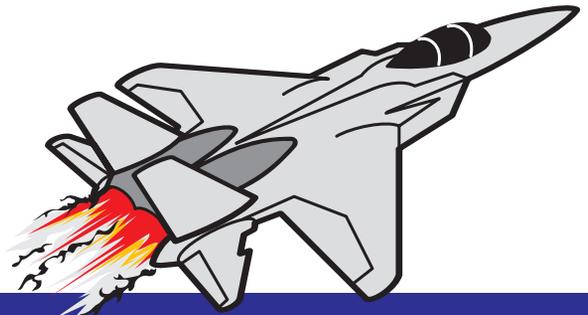
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You may contact any MT staff writer by email by combining their **first and last name @ monitoringtimes.com**. By postal mail, you may write them in care of MT Headquarters in Brasstown. Please enclose a self-addressed, stamped envelope if you wish the columnist to reply.

GROVE



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Uniden BC-346XT	SCN45	\$214.95
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COMMUNICATIONS

by Ken Reitz



AMATEUR /SHORTWAVE

New Amateur Radio Bill Introduced

After earlier versions of a bill to make amateur radio a part of a Homeland Security response in an emergency failed to be enacted into law, a new version known as HR81 has been introduced by Shirley Jackson-Lee (D-Texas) in the current session of Congress. The bill is in the House Committee on Energy and Commerce and seeks to undertake, "...a study of the uses of amateur radio for emergency and disaster relief communications, by indentifying unnecessary or unreasonable impediments to the deployment of amateur radio emergency and disaster relief communications..."

The bill specifically recommends that, "reasonable accommodation for the effective operation of amateur radio from residences, private vehicles and public areas and the regulation at all levels of government should facilitate and encourage amateur radio operation as a public benefit."

K1MAN Ticket Referred to Judge

The FCC issued a Hearing Designation Order January 10 regarding the renewal of amateur license K1MAN, held by Glen Baxter, that refers his license renewal request to be heard by an FCC Administrative Law Judge. The issue stems from a letter sent to Baxter nine years ago detailing complaints received by the FCC regarding his on-air practices, according to FCC documents. That letter cited violation of "...rules regarding interference, station control, broadcasting and pecuniary interest."

It was said that K1MAN's transmissions were actually broadcasts, not directed at any specific amateur operator; that they were not directly under the licensee's control; that they interfered with traffic on an on-going Salvation Army net, and that his transmissions advertised his web site which offers items for sale. The Order explained that the violations addressed in the original letter were not sufficiently responded to by K1MAN and resulted in a second Warning Notice issued in 2004.

From late November 2004 through the end of March 2005, FCC field agents monitored K1MAN on air on both 80 and 20 meters as he racked up the violations, including interfering with on-going communications, broadcasting, advertising, and one transmission during which, "Nothing in the program related to amateur radio and no station call sign was given until the

conclusion of the seventy minute program." In June 2005 the FCC issued a Notice of Apparent Liability (NAL) stemming from the earlier citations.

In July 2005 Baxter filed a license renewal for his Extra Class license, which was to expire in October of 2005, but the FCC set aside the application later that month "for enforcement review," as explained by the FCC in a letter to Baxter. For the next several years K1MAN appeared to have vacated the ham bands and perhaps everyone thought the issue had gone away. Then, on July 10, 2009, he was back on his self-assigned frequency 14.275 MHz and during the next few days agents monitored a host of violations similar to ones reported four years earlier. The pattern of complaints continued throughout 2010, according to the Hearing Designation Order. No hearing date has been set as this is written.

AM/FM/TV BROADCASTING

LPFM Bill now Law

An article in the *Philadelphia Inquirer* detailed the efforts of the Radio Project in getting the Local Community Radio Act signed into federal law. The seven-employee, non-profit group, working out of a church basement office in Philadelphia, was credited with their relentless 10 year effort to get the new law on the books. FCC Chairman Julius Genachowski was quoted on the Prometheus web site (www.prometheus-radio.org) as saying, "The Local Community Radio Act, signed by President Obama, is a big win for radio listeners. Low-power FM stations are small, but they make a giant contribution to local community programming."

Among Prometheus' seven employees is Maggie Avener KB1PBZ, who wrote "Inside the Low Power FM Movement" for the November 2010 issue of *MT*, which detailed the history and future of low power FM in the U.S.

The FCC has yet to write the final rules under which LPFMs may operate. Maggie Avener says, "When there is an opportunity for public comment at the FCC we will encourage those who want to apply for an LPFM license to submit their own comments as well." As to a timeline, Avener says, "Our best guess is that there will be a five day window for filing LPFM applications in early 2012. In the meantime, we recommend that future LPFM applicants take advantage of the delay to start meeting with potential collaborators in



their communities and raising money to cover start-up expenses."

FCC to move on OTA

The Notice of Proposed Rulemaking released last November by the FCC detailed how it expects to "repurpose" portions of the VHF and UHF bands that are currently used to broadcast Over-the-Air (OTA) TV. Specifically, the proposal would co-locate fixed and mobile broadband services with existing broadcast services; establish a framework that would allow two or more stations to share the same 6 MHz wide broadcast channel, and "consider approaches to improve service for television viewers and create additional value for broadcasters by increasing the utility of the VHF bands for the operations of television services."



This last part seems more than a little vague and signals the FCC's tacit admission that it goofed in 2009 when it sent most OTA stations to the UHF band, now the lusted after hot real estate for mobile TV entrepreneurs.

But, according to a recent report in *TV Technology.com*, the FCC's Broadcast Engineering Forum showed that, "...the plan would not leave enough channels for all TV stations to remain on the air in some markets, even if every station shared its channel with another broadcaster..." The article noted that the National Broadband Plan would take 20 of the 37 existing OTA channels off the air.

INTERNET RADIO

In-dash Interconnectivity closer at CES

The Consumer Electronics Show, held in Las Vegas in January, featured a number of hyped "innovations" as it usually does, but one Internet music provider made quite a splash. Pandora, which has 75 million U.S. users, and which is integrating its service in certain Ford models, took advantage of the Vegas show to promote the concept of "personalized radio."

"I think a lot of people don't find traditional radio satisfying because there's a single playlist

that you can't control," Pandora founder Tim Westergren told Agence France Presse, "they want a bigger selection." Millions of Americans are thought to be listening in their cars already via their smartphones plugged into in-dash stereos.

Next up: In-dash interconnectivity through agreements with BMW, Ford, Mini, Mercedes, Toyota and Hyundai.

SATELLITE

DirecTV Fined Millions in Marketing Missteps

Just weeks before taking over as governor of California, Jerry Brown, then California Attorney General, announced a \$13.5 million settlement against satellite TV provider DirecTV, according to an article in the *Sacramento Bee*. The case stemmed from more than 1,100 complaints from California DirecTV customers who were not happy with agreements they signed with the satellite TV provider.

According to the article, the company didn't deliver promised channels, changed the terms of promotions that had viewers paying more than expected, and made bank deductions and credit card charges without knowledge of the customers. California had joined with 49 attorneys general across the U.S. in pursuing the case against the California-based company.

However, Consumer Watchdog, a consumer advocacy group from Santa Monica, California was unhappy with the decision, saying, according to the article, the settlement was "secretive and vague." The group plans to proceed with its own class-action case against the company.



OH Top Court: Tax the Dishes!

The Ohio Supreme Court has ruled that, since Ohio cable companies must pay a franchise fee not applicable to satellite TV distributors, a 5.5 percent sales tax levied on satellite TV viewers does not violate the Commerce Clause of the U.S. Constitution, according to an article in the *Columbus Post Dispatch* from late December. That means the state can keep the extra \$54 million per year it collects from the state's satellite TV viewers who choose satellite over cable TV.

DISH Raises Rates (Again)

Despite news stories trumpeting the lowest consumer inflation rate in years, DISH Network has announced a rate hike for its viewers in the 9 to 12 per cent range or \$3 to \$5 per month, depending on programming package. According to *Multichannel News*, the price hike went into effect February. The company promised not to raise its rates for two more years, an easy



statement to make given the low rate of inflation. Still, figuring an average of \$4 increase per customer, DISH founder Charlie Ergen, already the 148th richest man in the world according to Forbes magazine, will enjoy playing with an additional \$56 million per month that will pour into his company's coffers.

"Zombie-Sat" G15 Recovered

Spacenews.com reported January 7 that Intelsat, which owns Galaxy 15 satellite, dubbed by the press "Zombie-Sat," has regained control over the satellite, which had been drifting around the cable-TV neighborhood of the Clarke Belt since last April when it stopped responding to ground control commands. While there was little risk of collision, the main concern had been the fact that the satellite was "on" and transmitting while it wandered and might have caused interference with better behaved satellites. It didn't and now resides at 93°W where it will resume its U.S. domestic relay duties. The article noted that there are some 100 retired or defective satellites drifting in geosynchronous orbit.



Sleeper Zombie Galaxy 15 on the ground prior to 2005 launch. (Courtesy: Orbital Sciences Corp.)

Meanwhile, *Spaceflight Now.com* reported that a team investigating the initial anomaly believes that the cause for the satellite's zombie condition was "an electrostatic discharge or a buildup of energy from the space environment." And, despite hysterical reporting by worldwide media when the satellite first developed the anomaly, officials were said to have ruled out a solar flare as the cause.

FCC ENFORCEMENT

FCC Rounds up the usual CB Suspects

CB shops and truck stops across the U.S. sell all manner of illegal CB gear, including

modified transceivers and linear amplifiers. Many offer their goods and services directly via the Internet and have done so with seeming impunity for years. It's quite rare for a CB shop or truck stop to actually be cited for such violations. It's so rare that such citations can be seen as symbolic, designed to scare other vendors and operators into stopping their illicit trade. There's little evidence that it does.

January 4 the FCC field office in Michigan issued a Citation for Illegal Marketing of Unauthorized Radiofrequency Devices to Doctor Radio's CB Shop. After paying a visit to the store, field agents were shocked, shocked to discover for sale a Cobra Sound Tracker CB set that had been modified to transmit 170 watts and "a Cobra 150 GTL DX that was an amateur radio that could operate on CB frequencies." The store was advised that continued sales could result in a fine of \$16,000 for each such violation or each day of continuing violation.

Agents inspecting the CB station of an operator in Kentucky observed that a linear amplifier, which had a measured output power of 80 watts, was attached to his CB station and was causing interference, which was why the field agents were there in the first place. The CBER admitted that he used the amplifier, but agents also found a Magnum S-9 CB set, a non-FCC certified transceiver, in the shack. The various discoveries earned the op a Notice of Unlicensed Operation.

Another CBER, this one from Pennsylvania, who was already operating under FCC imposed restrictions, couldn't keep off the air. He had the misfortune of being monitored by field agents who caught him yakking on his CB four times in a two day period during times that he had been warned by letter not to be operating (and you thought *your* job was boring). That earned the operator a Notice of Violation and probably a fine for "willful and repeated."

Cell Jammer Found at High School

FCC field agents, responding to a complaint of interference to land mobile frequencies and using direction finding techniques, narrowed the interference down to McKinley High School in Buffalo, New York. After looking a little closer, the interference was found to be coming from a locked cabinet in the metal shop at the high school. It turned out to be a device designed to jam land mobile and cellular communications which the owner of the device handed over to the agents. He was then issued a Notice of Unauthorized Operation and Interference to Licensed Radio Stations. Now the kids can use their phones.

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

Monitoring the Air Show Experience

The 12th Annual MT Air Show Guide

By Larry Van Horn, MT Assistant Editor
With air show photos by Kevin Burke

Air Show!

It is an event like no other and nothing stirs up the aircraft enthusiasts juices more than those two magical words – Air Show!

Every year, from March through November, millions of people hit the road to watch the excitement and thrills as aerobatic teams put their high performance aircraft through the paces to entertain the crowds 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 by monitoring the performing teams' radio communications. With a radio scanner in hand, you will experience a whole new perspective of the show that few attendees will get experience – the sounds from the aircraft cockpit.

To indulge in monitoring the air show experience you need a current and well researched list of frequencies that the various performers may use during their performance. That requirement is the reason this feature is presented every year in March in the pages of *Monitoring Times*. What started out as an answer to a question by a *MT* reader in my *Milcom* column 12 years ago has now grown into one of the most eagerly anticipated features in this magazine each year and for good reason. Not only will I give you the frequencies you need to monitor the air show groups, but also my recommended list of radio equipment needed to listen to these events (see this month's *Milcom* column).

So here we are again at the start of another air show. It is time to pack up those radio wagons, charge up the scanner batteries, and get ready for a new season of thrills on your scanner. *Monitoring Times* proudly presents our 12th annual *Milcom 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.

When the U.S. Navy Blue Angel flight demonstration team made some major changes back in 2004, seasoned veterans knew the right bands to target to look for the new frequencies being used by the team.

In 2008, we saw major changes in the VHF frequencies in use by the famed U.S. Air Force Thunderbirds. Again, thanks to veteran monitors who knew where to monitor, we were the first to report on our *Milcom Monitoring Post* blog (<http://mt-milcom.blogspot.com>) these frequency changes in use by the boys in Blue.

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

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

406.100-420.000 12.5 kHz search steps (NBFM)

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

The Blue Angels are scheduled to fly approximately 70 air shows at 35 air show sites in the continental United States during this their 65th season. This year also marks the 25th year the team has flown the F/A 18 Hornet. Since its inception in 1946, the Blue Angels have performed in front of more than 463 million fans.

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

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

Blue Angel Aero Frequencies

237.800	Solos when not in the show box (Solo #2) and cross country air/air [Channel 8]
251.600	Air/Air nationwide and at NAS Pensacola
255.200	Circle/arrivals discrete and cross country air/air [Channel 17]
265.000	Diamond formation secondary
275.350	Diamond formation when not in the show box, cross country air/air, and their Pensacola squadron common [Channel 9]



Blue Angels "Dirty Diamond" head-on

- 284.250 Show box for diamond, solos, delta and cross country air/air [Channel 16]
- 289.800 Air refueling during cross country trips
- 305.500 Fat Albert "Bert" primary, solo aircraft (west coast), and maintenance officer [Channel 10]
- 305.900 Fat Albert "Bert" New for 2009 – Heard during San Francisco Fleet Week, at the Pensacola homecoming show (no 305.500 MHz), and the solo aircraft used this at Annapolis.
- 346.500 "Checklist Freq" – Pre-show checklist, ground start/roll out and maintenance [Channel 18]

Blue Angel Aircraft Radio Preset Plan

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

Blue Angel Organization

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

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

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

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

Events Coordinator: The Events Coordination Department schedules pre-season visits with show site sponsors and secures accommodations and ground support for each demonstration show.

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

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

Public Affairs Office: The Public Affairs Office documents and promotes the Blue Angels. It designs, writes, photographs, edits, publishes and distributes all promotional materials. The Public Affairs Office also coordinates coverage and interviews with local, national and international media, and manages the VIP rider program.

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

The Blue Angel ground maintenance crews have their own set of communication frequencies in support of their mission. During the 2004 show season, the Blues started using a new communications cart "comcart" for their ground maintenance net. As a result I have removed all of the old 162-174 MHz VHF frequencies used by their old cart from this guide.

The two confirmed frequencies used by this cart include:

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

In 2007, 141.5625 MHz was reported as an additional comcart fre-

quency. In 2009, I received another report that this frequency was used at a West Coast air show. Since this frequency has been reported sporadically, I believe that it is used only at locations where one of the two regular comcart frequencies listed above are in regular use at an air show site.

Previously used UHF frequencies that have not been reported in recent years include:

- 250.975 This diamond formation frequency was first heard in 2008, but it was not reported in 2009 or 2010. This is one of my infamous UHF military air spectrum hole frequencies.
- 264.550 Reported as an extra frequency by several monitors.

U.S. Air Force Thunderbirds

The U.S. Air Force has a flight demonstration team of their own known as the Thunderbirds. This year marks the 58th season that the T-Birds have performed air shows and they will conduct nearly 70 shows in 25 states, one U.S. territory and 10 European countries. They will kick-off the 2011 season by performing a flyover for the 53rd running of NASCAR's Daytona 500 on February 20.

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

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

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

Thanks to field reports from hobbyists who attended air shows in 2010, we have been able to tighten up our list of valid Thunderbird show frequencies presented below.

U.S. Air Force Thunderbird Aero Frequencies

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

Thunderbirds "Knife Cross"



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 (DCS 431)
 413.325 Ground maintenance – Analog (DCS 503)
 413.375 Ground maintenance – Analog (monitored in Hawaii)
 901.500 Comm cart headset
 905.350 Comm cart headset

Previously reported frequencies used by the team are listed below. If you hear any of these frequencies in 2011, please contact us at our email address listed in the Milcom column masthead.

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

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

Other U.S. DoD Military Flight Demo Teams

In addition to the Blues Angels and Thunderbirds mentioned above, the Department of Defense (DoD) sponsors other flying units that perform at air shows and various civic functions. These units also use a wide variety of VHF and UHF frequencies during their performances. The most commonly reported units and possible frequencies that they use are listed below.

US Military Flight Demo Teams

Air Force ACC A-10 Thunderbolt Demonstration Teams:
 East Coast Demo Team – 23 Wing based at Moody AFB, Georgia
 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
 370.025 375.925 376.025 376.100 377.850
 384.550

Air Force ACC F-16CJ Viper Demonstration Teams:
 East Coast Demo Team – 20 FW Shaw AFB, South Carolina
 123.150 136.475 136.575 136.675 138.150
 138.950 139.825 139.900 140.200
 140.275 140.375 141.025 141.150
 141.175 141.550 141.650 141.675
 141.700 141.900 141.950 142.225
 142.400 149.875 252.100 273.700
 311.200 376.025 384.550

West Coast Demo Team – 388 FW Hill AFB, Utah, Call signs: Viper 1 and Viper 2
 136.475 136.575 136.675 138.150 138.4375 138.750 138.950
 139.1125 140.450 141.150 141.650 141.950 142.1125 142.600
 142.700 142.900 142.9625 143.250 143.625 143.700 252.100
 369.000
 376.025 376.100 384.550

Air Force ACC F-22A Raptor Flight Demonstration Team:
 East Coast Demo Team – 1 FW Langley AFB, Virginia
 233.225 236.550 252.775 308.600 375.925 376.025 384.550

Air Force ACC Heritage Flight
 122.475 123.150 123.475 136.475 136.575 136.675 375.925
 376.025 384.550

Air Force AFRC C-130 Dobbins ARB, Georgia – Air Drop Demonstration
 239.975 379.525

Air Force B-2 Bomber Flyover/Static Displays: 509 BW Whiteman AFB, Missouri
 233.025 257.100 260.250 265.825 267.000 320.525 354.350
 375.925 376.025 388.850

Air Force B-52 Bomber 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)
 123.025 123.450 234.500 242.400

Coast Guard Aircraft/SAR Demonstrations (Air frequencies)
 237.900 282.800 326.150 345.000 379.050

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

Maine Corps AV-8B II Flight Demonstration Teams:
 East Coast – MCAS Cherry Point, North Carolina 363.300
 West Coast – MCAS Yuma, Arizona Frequency information is needed for the west coast harrier units

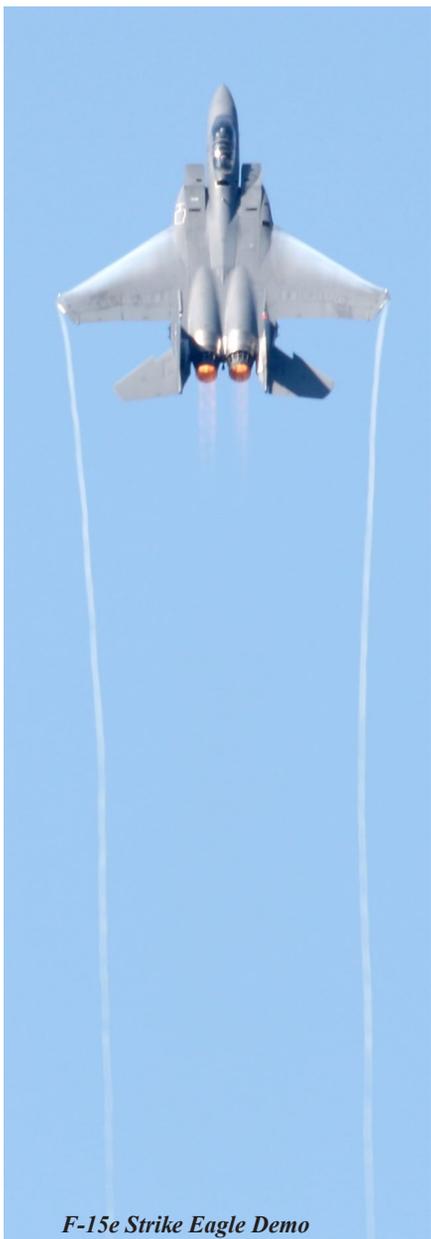
Marine Corps Helicopter Demonstrations
 315.375 315.400

Navy F/A-18C Hornet and Navy F/A-18F Super Hornet Flight Demonstration Teams:
 East Coast – VFA-106 NAS Oceana, Virginia 237.800
 West Coast – NAS Lemoore, California Frequency information is needed for the west coast units

Military Parachute Demonstration Teams

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

The Golden Knights aren't the only para-



F-15e Strike Eagle Demo

chute teams that perform around the country. The U.S. Army Special Operations Command has a parachute team known as the Black Daggers (see *MT Milcom* May 2004). Several frequencies have been uncovered for them during the last few seasons including 123.150, 123.450, 136.000, and 136.500 MHz.

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

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

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

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

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

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

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

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

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

Foreign Military Flight Demonstration Teams

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

Belgium: Swallows – Belgian Air Force Display Team	130.725
Brazil: Esquadilha da Fumaça (The Smoke Squadron) – Brazilian Air Force Air Demonstration Squadron	127.050 130.450 130.550 130.650 132.250
Canada: 15 Wing, Moose Jaw, CT-156 Havard II Trainers, Call sign: Viking #	275.800
Chile: Escuadrilla de Alta Acrobacia Halcones (Falcons High Aerobatics Squad) – Chilean Air Force	136.175
Finland: Midnight Hawks – Finnish AF Academy Demo Team	140.625
France: Patrouille Acrobatique de France – French Air Force Military Flight Team	121.850 123.600 138.450 141.825 (Main formation) 143.100 (Main formation) 143.850 242.650 (Solos) 242.850 (Solos) 243.850 (Team Transport) 263.350 266.175
Ireland: Silver Swallows – Irish Air Corps	130.550
Italy: 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)



Solos Cross-up

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	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
Sweden: Team 60 – Swedish Air Force Aerobatic Team	Frequency reports are requested
Switzerland: Patrouille de Suisse – Swiss Military Flight Team	244.300 266.1750 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)	1 2 0 . 8 0 0 122.700 380.200
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

Canadian Flight and Parachute Demonstration Units

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

The following frequencies have been recently reported for this popular aerial demonstration team: 123.150 (Solos) 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 navaid segment of the civilian aircraft band has been used by this team's solo aircraft in recent

years –116.000 MHz.

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

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

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

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

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	123.350	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
Flight for Diabetes (Michael Hunter)	123.425	
Firecat (Rich Perkins)	123.500	
Flying Colors Hang Glider Aerobatic (Dan Buchanan)		1 2 3 . 1 5 0
	123.300	123.450
Geico Extra 300 (Tim Weber)	123.150	
Hamster Biplane (Ed Hamill)	123.150	
Iron Eagles Aerobatic Team	122.925	123.150
123.475		
John Klatt Air shows	123.475	
Julie Clark's (T-34) American Aerobatics	135.925	
Lima Lima Flight Team	123.150	123.175
123.425	123.575	
Manfred Radius Glider Aerobatics Team	123.1500	
Matt Chapman/Michel Mancuso Aerobatics		136.975
Oreck Vacuum Cleaners Aerobatic Demo (Frank Ryder)		1 2 2 . 8 2 5
	123.425	123.450
Otto the Helicopter	123.150	123.300
Patty Wagstaff Air Shows Inc	122.750	123.475
Red Eagles Aerobatic Team	122.125	123.150
123.425	123.475	
Ritchie's Pyro	467.6375	(NBFM 233.6 Hz PL)
Robosaurus – World's First CAR-NIVOROUS Monster Spotter	4 6 2 . 7 1 2 5	
(NBFM DCS464)		
Sean Tucker Power Aerobatics	122.8750	122.950
123.150	123.450	
123.475		
SIAl Marchetti SF260 (Debbie Gary)	123.150	
Showcopters	123.150	
Skytypers Team	122.750	122.775
123.425	(Formation) 122.775	
123.150	123.425	123.450
(Solos)		
Super Decathlon (Greg Koontz)	123.150	
Swift Magic Aerobatic Team	122.775	122.925
Team Red	123.350	
The Blades Aerobatic Display Team (UK)	121.175	136.175



Sea search and rescue demo



KC-10 on arrival day at the air show

The Horseman P-51 Aerobatic Team 122.925 136.675
 The Patriots (L39) Jet Team 127.300
 The Red Star Formation 127.050 (Pease Air Show)
 Tora Tora Tora Warbirds Team (Commemorative Air Force)
 122.850 122.875 123.150 123.425 123.450 469.500 (NBFM)
 469.550 (NBFM)
 Vintage Thunderbird (T-33) Aerobatics (Fowler Cary) 123.150
 Yakovlevs Team (UK) 124.450 130.900

GMRS Frequencies

During the 2001 and 2002 seasons 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 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]

U.S. Civil Air Patrol Frequencies

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

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

Repeater out/in	PL Tone	Usage [Channel]
141.5750 Simplex	127.3 Hz	Command control 1 [CC1]
141.0000 Simplex	131.8 Hz	Command control 2 [CC2]
149.2750 Simplex	141.3 Hz	Air/Air [Air 1]
150.5625 Simplex	151.4 Hz	Air/Air [Air 2]
150.2250 Simplex	162.2 Hz	Back up guard channel [Guard 1]
139.8750 Simplex	173.8 Hz	Tactical use (Miscellaneous use) [TAC 1]
148.1250 Simplex	100.0 Hz	Primary talk-around [PA TA]
148.1500 Simplex	100.0 Hz	Secondary talk-around [PB TA]
148.1375/143.6250	203.5 Hz	Airborne/Tactical repeater
148.1375/143.6250	192.8 Hz	Airborne/Tactical repeater
148.1375/143.6250	131.8 Hz	Airborne/Tactical repeater
148.1375/143.6250	162.2 Hz	Airborne/Tactical repeater
148.1250/143.5500	Various PLs	National repeater pair
148.1500/143.7000	Various PLs	National repeater pair

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

In Closing

It is always difficult to predict what changes a new air show season will bring, so I strongly encourage readers to watch my *Milcom* Blog, my new Twitter feed (**MilcomMP**) or the *Monitoring Times* Blog RSS feed on the *MT* home page for any late breaking news or frequency information during the 2011 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*.

Blue out....Ready: NOW!

Monitoring and Photography Tips from an Air Show Veteran

By Kevin Burke
(Photos by the author)

Blue Angels "Blues Break"

For me, listening to a scanner at an air show usually involves the Friday and sometimes Thursday before the weekend show. Before I go, I use the *Monitoring Times Air Show Guide* to load the frequencies into my favorite scanner, a Radio Shack PRO-97. While there are other capable radios out there, I have been happy with this one, especially its alpha tagging capability and the fact that the audio is strong enough through the headphone jack, so that any set of ear phones will work well on the flight line.

My first step is to program the frequencies of the Blue Angels or Thunderbirds. If I know which demo teams to expect at the show, I'll load their frequencies from the *MT* guide as well. I really like the way the Thunderbirds mix all of their air traffic and feed it out through their communications trailer, or Comm-cart, on one frequency. It is so nice to just keep my scanner on that frequency during their performance and not miss a split second of their transmissions.

For airport communications I check airnav.com to get the local tower and approach frequen-

cies and to print out the runway layout diagram. On Thursdays and Fridays I sometimes take a second scanner just to monitor the tower and approach frequencies, to let the PRO-97 scan the air traffic control center (ATCC) frequencies for the surrounding areas.

New scanner owners at their first air show might be in for a letdown. The average person who listens to his or her hometown police and fire departments probably has no idea that their scanner does not have selectable AM and wide/narrowband FM modes or that it does not cover the military air band (225 to 400 MHz), all of which are necessary for successful air show monitoring.

What You'll Hear

In the twenty five plus years I have been listening to scanners at air shows I have heard more than a few interesting discussions. In most of these situations, if I hadn't had a scanner I would not have known anything was wrong. At one show in Ohio, a U-2 was making his last pass – a high speed climb through the cloud cover to depart the area. Almost immediately after going through the clouds I heard him call the air boss saying he had a problem. He had a compressor stall, which is not a good thing. During the fly-by there was a U-2 support team with the air boss who put the team member on the radio with the pilot to discuss the options and read from an emergency procedures book. They also discussed a possible location for an emergency landing, but the pilot seemed to get the situation under control and continued on with the flight.

More than once I have heard Thunderbird or Blue Angel pilots discuss problems with their aircraft. In 2010, during a Thunderbirds practice show on a Friday, I heard the Number 7 pilot calling Thunderbird Control asking to land immediately. Number 7 is the show announcer, but on this day she was giving an incentive ride in a two seat F-16D. She apologized for interrupting the show but declared that her passenger was not having a good time and needed to get on the ground NOW!

A couple of times I have heard Thunderbird and Blue Angel pilots discuss landing gear problems, usually involving gear that does not

indicate that it is down and locked safely. In this case another jet will usually fly over to the problem aircraft and inspect the gear to make sure it appears to be down and locked. After that the problem aircraft will land, usually allowing the other jets to land first.

Knowing that a pilot is not sure his landing gear will support his plane without collapsing when he touches down makes for an interesting landing to watch. The pilot makes the softest landing of his life, hoping to feel the plane support itself before easing off of the throttle ... While listening to the scanner and watching, you find yourself holding your breath as the plane touches down ... and then giving a sigh of relief when the landing gear supports the plane. Without the inside information a scanner provides, it's just another landing.

The Highs and Lows

Seeing the F-22 Raptor in the air for the first time, while I was checking into a hotel for the Andrews AFB show, was incredible. Another high was being able to photograph Sean D. Tucker from his chase plane over Quonset Point, Rhode Island a few days before the air show. The weather forecast for the weekend was absolutely horrible, but I went to shake hands with Sean and his crew with a smile ear to ear and said, "That was awesome, you just made my weekend!"

Yet another high for me was seeing two F-117 Stealth Fighters doing a Fighter Break when they arrived at a show in western Massachusetts. I had never seen two in flight together. At an earlier air show that year I had been talking to a Stealth Fighter pilot who informed me that there would be two F-117's at the upcoming western Massachusetts air show. I asked if he could try to get the two pilots to arrive as a flight of two, instead of two separate flights, and do a fighter break. He told me that one of the pilots needs to be qualified as Flight Lead, and if one of the pilots going is qualified, he would try to make it happen. It *did* happen, and it was really cool to see!

When I go to air shows I don't usually monitor the public safety frequencies. I try to have the frequencies with me, but with one radio I'm busy with air activity. I have seen three events where the fire and rescue personnel were



Blue Angels solo with vapor cloud

in action. Two were jet truck roll-overs at different shows. The truck drivers in those incidents survived. The third event was at Oceana Naval Air Station when one of the Geico SkyTypers crashed and burst into flames. I didn't see or hear it because I was walking the other way with a friend to get something to eat. The pilot did not survive. Obviously that was the most traumatic air show event for me.

Air Show Photography

I had been using film-loaded Single Lens Reflex (SLR) cameras, but made the switch to digital SLRs about eight years ago. I bought a Cannon, which was a big investment, not only for the camera but for the big zoom lens I bought as well, mainly for air show photography.

My big lens, about the size of two soda cans held end to end – well, three cans when extended, is a 100-400 mm telephoto zoom and it cost over \$1,000. It is possible to get good photos without spending so much, but I felt it's what I really needed to increase my chances of getting quality shots.

The switch to a digital SLR has made air show photography less of a trial and error experiment. I can see the photo right away instead of taking three to six rolls of film for developing after a show, hoping I made the right guesses on shutter speed and other adjustments.

I also bought a battery grip containing twice the normal battery power, and I charge it the night before. At air shows, I'm wiping the front lens all day long, fearing I have dust on it. I try not to change lenses at an air show because dust on the sensor of the camera body is not easy to remove and can ruin a full day's worth of photos.

Tips for Air Show Photography Beginners

The most important tip I can give about photography is that you are never so good that you don't need to listen to new tips from someone else. In my first year with my big lens I was always trying to use the fastest shutter speed possible, letting the camera adjust the amount of light (aperture) for a properly exposed photo.

Then, while at the show at Oceana Naval Air Station, a photographer I had met at other shows asked me how I liked the lens. I replied that I had not been overly thrilled with the photos I had taken. He then told me that the lens has a "sweet spot" at an aperture setting of F8. That surprised me, because there are other settings that could allow more light in through the lens. Maybe all of the pieces of glass in the lens line up perfectly at that aperture and the best image is seen by the sensor; I'm not sure. But, that night I looked at the day's photos and discovered that all of the ones that were super crisp and focused were all shot at F8. That photographer didn't have to offer that tip, but it certainly changed my photography for the better. Thank you Scotty D!

In my opinion, buying a digital SLR camera system is the best choice. Pick a brand name and buy what you can afford for a camera and lens, and upgrade when you can. There are deals to be found on models that aren't the newest releases. Everyone's financial situation is different, so there are a lot of variables to consider, but you don't need to spend \$1,000 to get good air show photos. With a little research you can find a suitable compromise between what is reasonably affordable, what is reasonably suitable for what you want to do with the camera, and what will give you a reasonable amount of satisfaction.

The camera market is flooded with point and shoot cameras. There are some that look like SLR cameras that feature zoom power equal to what I have or better for \$200 to \$350. And, as I read the specs, they appear to offer quite a bit of what I look for – I just haven't tried them.

Last December, while Christmas shopping, I came across a very powerful Kodak camera on clearance at Staples. It was a \$200 camera but had been replaced with a newer model. It had 10 mega pixels, a 10x optical zoom, and image stabilization. The clearance price was \$72, minus about \$10 after the discount coupon I happened to have. When the receipt printed there was a rebate for a \$25 gift card. That \$200 camera just cost me \$37!

What to Look for in a Camera

Here are the features you need to understand and look for in a digital SLR camera.

Mega pixels

The number of mega pixels a camera has may be the first thing people want to know about



Thunderbirds Solo takeoff

a camera, but it is not the most important feature. In general, more mega pixels mean you have more capability to enlarge a photo and crop it. My first digital SLR was 8 mega pixels and my main camera I use now shoots at 10 mega pixels.

Zoom Power

The point and shoot cameras like to include their digital zoom capabilities when they list their zoom power. Digital zoom is basically where an image is cropped and enlarged. Start with a good clean image recorded through the glass using the camera's *optical zoom*; 3X or 5X is average for a point and shoot camera's optical zoom. That great deal previously mentioned has a 10X zoom, which is very close to the zoom power of my big lens.

Image Stabilization

Camera manufacturers have different copyright names for this feature. It's definitely something you want when using a long (high zoom power) lens. This feature reduces camera shake and helps your chances of getting the subject in focus and exposed correctly.

Memory cards

Any camera will only take consecutive pictures as fast as the memory card is capable of writing or saving the first picture before the camera can take another one. Write speed is very important. In general, the really good deals on memory cards are ones with slow write speeds. It can be hard to tell if a particular card is slow, fast or medium speed, so study the speeds of the cards you are looking to buy. Buy what you can afford, but be aware that \$20 spent now might buy a slow 4 gigabyte card, or a fast 2 gigabyte card.

Research

With all of the camera choices out there, it is best to do some research and see what others have to say about a particular camera. Some point-and-shoot camera owners complain about "shutter lag," the delay from when the shutter button is pressed and the photo is actually taken. This can make it almost impossible to pan or track a

Thunderbirds dramatic "bomb burst" maneuver.





Thunderbirds flying stack

moving subject and take consecutive photos, a serious issue at air shows. Many of the point-and-shoot cameras don't have viewfinders, so you have to look at the LCD screen to frame the subject, but be aware that some LCD screens can be tough to see in full sunlight.

Practice makes Perfect Photos

Once you make your selection, I suggest getting in some practice using the camera. Go to an airport to do this, even a small airport, and play with it to see how long it takes the camera to find a focus on an incoming plane and figure out the best way to get the camera to focus when the planes are moving much faster.

If an inbound plane is just a dot in the distance and the auto focus "sees" clouds, the camera might not see the plane and just focus for the sky in general. You might have to wait until the plane is a certain size in your frame before the camera's autofocus will see the plane. You should have good results using the "sports" or "action" mode on the camera, which allows the camera to select both the aperture and the shutter speed for a properly exposed photograph.

You should also practice panning (tracking a subject from one side to the other) while simultaneously pressing the shutter button without jerking the camera. Once you get comfortable with those basics, here is a curve ball: With the camera making all the choices, you have no way of knowing if the photo will freeze a propeller, or helicopter rotor blade. An ideal picture of a propeller plane in flight should show some blur of the blades. This is accomplished by selecting a slower shutter speed.

Unfortunately, this is trial and error, but this is where digital cameras really pay off, because you can see the photo right away. Zoom in to the prop and see if it is blurred and if the plane itself is in focus. If the prop blur shows a full circle and the plane body is fuzzy, the shutter speed is too slow: make it a little faster and check the results. Lighting conditions are always changing, so you will have to constantly check to see if your settings are working. Or, you might not be bothered by frozen propeller blades: it's an individual preference.

Getting Ready for your First Show

In the days leading up to an air show you most likely will have been checking the weather over and over again. This will help you to plan your wardrobe accordingly. Having spare clothes in your car can come in handy. Changing out of a sweat-soaked T-shirt into a dry one or changing out of puddle-soaked socks and sneakers can really make a difference on a long drive home.

I like to have the car ready the night before. I make sure I have my scanner packed with my camera gear, all my extra batteries for scanner and camera. I like to have a couple of lens cleaning cloths in my camera bag. Other important items are sunscreen and baby wipe-type wet cloths.

Air shows cause a lot of traffic, and it starts to pile up soon after the parking lots open, so get there early! I put a cooler in my car even though they are not allowed on the flight line because, when the show's over, everyone wants to leave at exactly the same time. Don't bother fighting traffic; it's a waste of time and money. Instead, plan ahead and be prepared with plenty of drinks and food for after the show. If packing sandwich-making items and condiments doesn't sound like fun, buy a couple of pre-made submarine

sandwiches at the store where you get the ice to fill the cooler. I also bring cereal bars or snack bars to eat while driving, so I don't walk out on the flight line on an empty stomach.

Heading to the Flightline

I put my sunscreen on before I leave my parking spot. I use a car window as a mirror to make sure I don't have too much sunscreen smeared on my face, then I use the baby wipes (from a package that fits into my photo vest) to clean my hands of all sunscreen residue. I don't want sunscreen on my hands because I don't want it all over my camera, and I don't want to get any in my eye if I happen to rub it. I take the sunscreen and wipes with me onto the flight line.

I once got waterproof sunscreen in my eye at an air show while I was touring a KC-135 Stratotanker. The flight crew took care of me with very cold water and paper towels so I could keep wetting my eye to dissipate the sunscreen. From then on, I have refused to put sunscreen on my forehead, I wear a hat instead. But I try to load up the sunscreen everywhere else. The moistened baby wipes are a really great tool to carry.

I wear a Camel Back, a back pack device that has assorted sizes of pouches for drinks, which I load with ice and a sports drink from the cooler. I usually wear a photo vest over the Camel Back.

My camera bag is designed as a back pack, but back packs are usually frowned upon by security, so I carry it up to the security check point. Most of the time my scanner is in my camera bag, which I happily open for the security personnel. A few times I have been asked about it, but I just explained that I listen to the pilots to help get a heads up for some of the photos.

Also tucked into my camera bag is a tiny cheap fold-up poncho, just in case of rain. I've found that a completely gray sky does not allow for good shots at all, but it does allow me to practice all the techniques I use that get me the results I am happy with.

I'd rather have a forecast with a chance of

USAF F-100





Thunderbirds unique cross

thunderstorms than a “cloudy all day” forecast. Thunderstorms do mean that you’d better have a plan in mind as to where you are going to go if there is lightning in the area. But, thunderstorms can also mean the air is very humid, and that means vapor, boys and girls, and I love getting vapor shots from those high speed passes!

Once out on the flight line, I figure out where I want to be for the shots I want to get. This usually means that I am listening to the air boss activity to see which runway is in use. Then I can guess where aircraft will lift off and coordinate where I want to be. All photographers hate to take pictures while looking into the sun. The sun should be behind you while you face your subject. But, a good day for photographing planes means a bad sunburn on the back or your neck! Figuring out where the sun is in relation to where the crowd is going to be is the most important thing I study when planning to go to a different air show for the first time.

Being up front on the flightline is not always the best place to be. Some crowds will rush up front and make it difficult to move. I like to be in the thinned out areas of the crowd, away from people’s heads that may end up in my photos. I also try to stay away from the tails of the display aircraft that can hide approaching aircraft. I’d rather be in a spot where I can plant my feet facing forward, even though the subject is approaching from one side. Most likely my best shot is going to be in front of me. I’ll twist my body so I can get the camera focused on the planes coming from the side, allow the camera

to get a focus early, then I pan or turn my body as I follow the planes from the side to the front and around to the other side.

If I like what I am seeing, I will fire away being as smooth as I can with the shutter button. If your camera is in the “Smaller-than-the-Big-Boys” category, I suggest you look into the two side-edges of the crowd. The Thunderbirds and Blue Angels do a lot of turning to go behind the crowd, and they get pretty close to the crowd at both the left and right sides, but right up front might put these close turns directly over your head. A little further back from the flight line might help in this situation as well. If you are using a digital camera that can handle it, fire away with that shutter button – just be smooth about it.

Interesting Photo Opportunities

In the past few years I have been able to see and photograph some aircraft I never imagined I would have the chance to experience. The first was the British Red Arrows when one of their stops was at the annual Quonset Point, Rhode Island air show. The weather gods cooperated and I was able to take some nice photographs.

In 2010 the big attraction for me was the scheduled performance of an F-100 Super Sabre at the Barnes Air National Guard Base in Westfield, Massachusetts. I didn’t even know that there was a Super Sabre still flying! The weather turned cloudy on Saturday and rainy on Sunday, but I was able to get photos on the

days before the show.

Besides the usual Thunderbirds and Blue Angels demonstrations, I really enjoy a show that emphasizes the local flying units. Air shows are recruiting tools that feature the major jet teams, and then try to fill the remainder of the aerial lineup with civilian acts, many of which are really good.

The seasoned scanner owner probably knows what military flying units are based in his or her hometown state, but most aren’t likely to know what the military is flying in his or neighboring states. Air shows are the perfect environment to recruit for the local level and not just the Navy or Air Force.

My Favorite Photos

I like to try to get photos of the Thunderbirds and Blue Angels solo pilots crossing at show center, and I’ve been able to get a couple good ones. It’s a very difficult shot to get, but I have had the best luck with the sports or action mode when I’m trying to get this shot.

Another shot I am always ready for is the “sneak pass.” For both the Thunderbirds and Blue Angels, the sneak pilot comes from your left. The Thunderbird sneak comes from behind your left shoulder, at about the same height as their solos. The Blue Angel sneak is out to the left side, lined up with the runway, down really low, at tree top level. The intent of the sneak is to show the audience tactical surprise and it definitely gets the point across!

Another shot I strive to capture is what I call the arrival opener or the remote site opener. The first time I saw this I was at a beach show, in October. I was using film and had just loaded a fresh roll, but the camera didn’t advance quite enough to give me a first frame that wasn’t burnt by sunlight. The shot was partially ruined, but I fixed it as much as I could.

While the maneuver is very simple, it looks just awesome to me. The six-ship delta formation approaches from behind the crowd heading straight toward show center. As they get over the crowd the team leader says, “Blue out, ... Ready, NOW” and both solos break off 90 degrees in opposite directions down the flight line, as the four jets in the diamond formation continue straight. The maneuver signals the show has now begun, so have fun and I’ll see you on the flight line!



Thunderbirds 1 and 2 during site survey



An Air Show Monitor's Portable Listening Post

By Brian KA1VCA and Jo Marie Topolski
(Photos by the authors)

Conceiving, planning and successfully executing a crowd-pleasing air show requires months of advance planning and the skilled coordination of many people. And, when all the pieces finally come together on the designated weekend...it's show time!

So, how do the air show venues keep track of crowds, planes, emergencies, traffic flow, parking, security, media, and last-minute details? You guessed it: Radio communications! There is a wealth of information being transmitted through the air if you know where to listen.

When I first began attending air shows back in 1989, I brought along a Uniden BC-200 scanner and wanted to hear everything. My enthusiasm soon turned to frustration as I realized that my monitoring technique needed some fine tuning. Then I heard the sound of a strange radio communication I had never heard before. I followed my ears and met ARRL DXCC manager Bill Moore NC1L who was listening to the USAF Thunderbirds inter-plane communications! Excitedly, I asked, "You can hear them?" When he answered "Yes," I followed him around like a little puppy dog and thus began my education.

Going to Your First Show

My first choice in air shows is NAS Oceana in Virginia Beach, because I love jets and this is a great place to see them. This area is a major focal point of military activity and there's never a dull moment. If you go, the most important thing is to arrive early, between 6:30-8:00 a.m. Nobody likes being stuck in traffic outside the air base while their favorite demo flight is roaring down the runway!

In addition to transporting your equipment, one of the first things you're going to encounter, after you park, is a security checkpoint. Plan on being searched. Military bases are usually more intensive than civilian sponsored shows so be prepared: carry proper identification such as a driver's license with you at all times. If you're a ham, bring along a copy of your license; this gives you a valid reason to have radios on your person.

Keep your radios and camera gear neat and organized. This makes it easier for security personnel to see exactly what it is you have. You may also be asked to power up your equipment. Easy access makes it simple and proves that your radios and cameras function as they are

intended. When you turn on the scanners, make sure that whatever sound is emanating from them is not of a sensitive nature. Lock those banks out for later use. I know from experience that security personnel can get a little anxious when they hear themselves talking through your speakers.

Once you're in, where should you set up? If you're a photographer, position yourself with the sun at your back, as it will illuminate the aircraft in a way that potentially provides you with rich and colorful detail. Pray for a sunny day!

I am passionate about both radios and photography, but my primary interest is radio. Based on that, I usually situate myself slightly to the left or right of show center, which allows for an impressive view of the ground ceremonies, including the pilots' walk-down/salutes, boarding of the aircraft, engine start and taxi.

Chance Tour of a Lifetime

To most people, radio communication is an invisible world. However, when they realize that you can tune in all the behind-the-scene happenings, the invisible world suddenly becomes tangible and the real fun begins! Expect some questions from curious onlookers interested in what you do. You may even end up attracting a small crowd. I always try to be gracious, remembering back to a time when I was just curious; it's a great way to meet people and maybe you too can be an inspiration to some young up-n-comer!

One of my more interesting experiences occurred in Dayton, Ohio during the, "Centennial of Flight Air Show," in the summer 2003. The Ohio State Patrol had a very large and impressive Command Center vehicle on-scene and working. They seemed approachable, so I asked if I could speak to the person in charge of their commu-

tions equipment. After proper introductions were made, it turned out that, like me, this person was also a ham and we hit it off really well.

He then asked me if I wanted to come inside the command center. Not being shy, I jumped at the chance! The tour lasted for one and a half hours and everything I saw was high-tech, state of the art. I couldn't believe my luck! As a thank you, I shared all the latest Blue Angel, Thunderbird and Snowbird frequencies which, with a wink, he assured me they were able to pick up (thanks *Monitoring Times!*). As I left, I described my radio setup and extended the invitation to visit with me on the flightline and he seemed genuinely interested. About an hour later, he and six other uniformed Ohio State Patrol officers showed up at my Comm-Cart to take my tour! Wow, was I ever surprised! People around me thought I was in trouble and we all had some laughs and it turned out to be a wonderful experience.

What to Bring to the Show

I built my "Comm-Cart," respectfully named after the Blue Angels "Comm-Cart," during a winter project as a means of organizing all my scanner gear so it wouldn't become lost or separated. This ensures that I always have what I need in one place. Before I had this, I don't know how many times I would misplace or lose a necessary cable. The method behind my madness was inspired by Dan Myers, a friend from Pennsylvania, and it was he who initially gave me the creative spark for this process. Thanks, Dan!

I began with a red steel wagon with pneumatic wheels that can transport a 300 pound cargo. It may sound like overkill, but the hefty wagon is built to last and the wheels work well on various terrains. The larger wagon also affords me the extra room to carry folding chairs. My wife is also an avid air show lover and assists with setting up the Comm-Cart and photography equipment. We work great together as a team, which comes in handy when one of us has to visit a restroom or dash off to take photos; the gear is never left unattended and we always stay in touch either by cell phone or 2-way radio.

The Comm-Cart radio case consists of a standard rack-mount box commonly used in the music industry. It has a hard shell casing with detachable front



Blue Angels Comm-Cart

and rear covers, which enables me to carry all scanners and cables in one very neat package. All antenna and power cables are permanently mounted inside the box so I don't accidentally leave anything behind. They can be coiled/tied and ready for transport in the enclosed case within minutes.

I also carry an 8 x 6 foot tarp with several bungee cords in case of rain and wind. Even under these conditions, the unit remains capable of operation. The power source is a 12 volt/900 peak amp power battery with cigarette lighter plug adaptor. Inside, the radios are connected to the power source via 1 cable. Everything has a properly rated fuse to protect from any power surges or misconnections.

In the Comm-Cart

All four of my radios contain the premier jet team frequencies found in *Monitoring Times* and are set up so that any bank can be locked

or unlocked at any time, according to what you want to hear. But, be careful not to scan too many things at once. This may result in missing some of the more important air show related communications. Hone the frequencies down as the weekend progresses and take notes of what you want to hear.

Here's what's in the cart:

Uniden BC-780:

Bank #1 is initially left open: I alpha tag it as: "Air Show Primary," and then program it with frequencies that will be utilized throughout the weekend such as Tower, Air Boss, Ground Control, Air/Air Discretes, and Air/Ground Discretes. The rest of the banks are dedicated to Air Routing Traffic Control Centers, such as Boston and New York Centers, all *VHF* mode.

Uniden BC-780:

Bank #1 is programmed exactly the same as radio #1. This allows me the freedom to pause or sit on a channel of interest with one radio while the others continue to scan and I don't miss any of the action. The rest of the banks are dedicated to Air Routing Traffic Control Centers, same as #1 except, the difference being, all *UHF* mode.

Uniden BCT-15X:

This radio contains Huntress and Giant Killer frequencies for starters, abbreviated as Northeast Air Defense Systems (NEADS); air-refueling and Air Routing Traffic Control Centers (ARTCC) including Boston, New York and Washington Centers. These are great for

hearing aircraft operating within your listening range. I also keep some of the various fighter squadron frequencies stored here. Lastly are the non-digital public safety, intra-squad and base operation frequencies relevant to the area I'm visiting. This enables me to monitor conventional public safety in radio #3, while keeping State and Federal frequencies tuned in on radio #4.

Uniden BCD-996T:

This radio has digital receive capability and is primarily used for monitoring State Police and U.S Coast Guard. Also included in the programming are the NADS frequencies, along with ARTCC and Air Refueling, just like radio #3. Having this redundant programming, I can monitor air refueling and ARTCC, for example, in the radio of choice while listening to fighter jets tactical communications on the other. Lastly, some of the air show venues may utilize a digital trunking system. If so, no worries...this radio can do it all!

The antenna mount system is a portable tripod stand initially designed to support a shop light used in work areas. When fully extended it reaches a height of 7 feet and collapses to a manageable 2 foot length when transported. On top of the tripod is a 4 foot long piece of steel with a single hole drilled in the middle. I mount this to the top of the stand so it looks like a letter "T" with a tripod base. I have four Hustler mag-mount antennas, each with a 12 foot BNC cable secured to the top. All four cables are snaked through a single tube to neaten the appearance.



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Easing In and Out of EDACS

Trunking is far and away the most common source of confusion for new scanner listeners. The terminology is unfamiliar and confusing, the equipment is daunting, and the user manuals are often less than helpful.

❖ Mobile County, Alabama

Hey Dan,

I am very new to the scanning world. I have a Radio Shack PRO-164 scanner that does have the trunking feature. I am trying to scan the Emergency Medical Services and the local University Police in the area. Our city uses the EDACS system.

Is there any way to identify what frequency an AFS is on? There are many sites with numerous frequencies. Would I have to add all of these frequencies or can I limit them according to the talkgroups that I want to listen to? Thanks for taking the time to answer my question and bearing with me since I am a newbie.

Amberly in Alabama

Mobile County is in the far southwest corner of Alabama, adjacent to Mississippi and the Gulf of Mexico. It covers more than 1,600 square miles of land and water and has over 400,000 residents, nearly half of whom live in the county seat of Mobile.



Mobile County has operated an EDACS (Enhanced Digital Access Communication System) network for public safety since 1992. It currently serves more than 120 local, state and federal agencies using 4,500 radios and processes more than 170,000 transmissions each day. The system is large, operating from half a dozen repeater sites located around the county, and is interconnected to a three-site, 24-channel simulcast system for the City of Mobile.

❖ Frequency Re-use

Each repeater in a trunked radio system typically has one frequency dedicated for use as a control channel, with the rest serving as

“on-demand” voice channels to carry whatever conversations take place. Radios that are not involved in a conversation will “park” on the control channel frequency and listen for instructions.

Repeaters transmit short digital messages to radios on the control channel. These messages are instructions that tell the radio, among other things, what conversations are taking place and on what frequency each conversation can be found.

For example, when a police officer wants to call the dispatcher,

he or she presses the push-to-talk button on their radio. The radio quickly and automatically sends a short digital request to the repeater, asking for a voice channel. The request includes a talkgroup identifier that had been previously programmed into the radio.

A computerized controller receives the request and checks to see if there is a voice channel that is not in use. If it finds an idle voice channel, it assigns that channel to the talkgroup and broadcasts an assignment message on the control channel. The assignment message includes the talkgroup identifier and a number that represents the voice channel.

The requesting radio receives the assignment message, immediately tunes to the assigned voice channel frequency and begins transmitting. It also emits a tone letting the user know that he or she can begin speaking.

The assignment message is also heard by every radio that is tuned to the control channel. Each radio compares its own pre-programmed talkgroup identifier with the talkgroup identifier in the message. If they match, the radio tunes to the voice channel frequency and turns on the speaker. If they don't match, the radio ignores the message and stays tuned to the control channel.

When the officer eventually stops talking and releases the push-to-talk button, the controller marks the voice channel as idle, meaning that it can now be used for any new request that comes in. The officer's radio tunes to the control channel and starts listening for assignment messages.

At this point, if a second officer using a radio programmed with a different talkgroup presses his push-to-talk button, the controller

may assign the previous voice channel (which is now idle) to the second officer. When the dispatcher responds to the first officer on the original talkgroup, the controller will find that the previous voice channel is now busy and will have to assign a different voice channel to the dispatcher.

In this scenario, the original talkgroup was active on two different voice frequencies. The first officer spoke to the dispatcher on one frequency and the dispatcher responded on a second frequency.

So, the moral of the story is that a conversation may take place on any of the voice channels and may shift from one channel to another as different participants take their turn speaking.

Any nearby scanner that is monitoring the control channel frequency also hears these assignment messages, and, if it is capable of trunked operation and is programmed properly, it will follow the conversation from frequency to frequency without difficulty.

Fortunately for Amberly, the Radio Shack PRO-164 is capable of tracking trunked radio transmissions from most Motorola, EDACS and Logic Trunked Radio (LTR) systems. The scanner was introduced in 2009 and is similar to the GRE PSR-300. It can hold up to 1,000 frequencies in 10 memory banks and covers most frequency bands of interest up to 1.3 GHz.

❖ Logical Channel Numbers

Repeater sites in a trunked radio system transmit control and voice information on a specific set of frequencies. In EDACS systems like the one in Mobile County, each of these frequencies are identified by a Logical Channel Number (LCN), which is a number between 1 and 25. Instead of sending the actual radio frequency of a voice channel, which can be many digits long, the short digital messages on an EDACS control channel use LCNs.

For example, a repeater site that transmits on three frequencies might have a table of LCNs that looks like this:

LCN	Frequency
01	856.0125
02	857.2625
03	857.3125

When a repeater site wants to broadcast the fact that a talkgroup is currently active on 857.2625 MHz, the assignment would contain

“02” instead of “857.2625.” This means that every radio in the system must be programmed with the same LCN table, so that when it receives “02” it knows to tune to 857.2625 MHz.

Scanners following an EDACS system must be programmed with the correct LCN table in order to properly track conversations. What this means for the PRO-164 and similar scanners is that each frequency should be programmed into a memory location that corresponds to the LCN. For instance, for the example LCN table above, memory location 01 in a bank should be programmed with 856.0125, location 02 with 857.2625, and location 03 with 857.3125. This will allow the scanner to retrieve the correct frequency when it receives an LCN.

For each of the repeater sites on the Mobile County system, the active frequencies and their corresponding LCN are listed below.

Site	LCN	Frequency
Springhill	01	856.2375
	02	856.7625
	03	857.2375
	04	857.7625
	05	858.2375
	06	858.7625
	07	859.2375
	08	860.2375
	09	859.7625
	10	860.7625
Bayou La Batre	01	856.2625
	02	857.2625
	03	858.2625
	04	859.2625
	05	860.2625
	06	854.9625
	07	855.2375
Citronelle	01	856.4625
	02	857.4625
	03	858.4625
	04	859.4625
	05	866.2000
	06	868.3500
	07	868.8500
Wilmer	01	856.9875
	02	857.9875
	03	858.9875
	04	859.9875
Saraland	01	856.9625
	02	857.9625
	03	858.9625
	04	859.9625
	05	860.4625
	06	860.9625
	07	855.2125
	08	855.4625
Salco Road	01	866.1000
	02	866.6500
	03	868.3000
	04	868.8750
McGregor Avenue	01	866.1750
	02	866.3500
	03	866.8500
	04	868.5500
	05	868.7750
	06	868.8250
Tillman's Corner	01	866.1750
	02	866.3500
	03	866.8500

04	868.5500
05	868.7750
06	868.82500

Downtown Mobile	01	866.1750
	02	866.3500
	03	866.8500
	04	868.5500
	05	868.7750
	06	868.8250

❖ Talkgroups

In trunked radio systems, conversations are referenced by a number known as a *talkgroup identifier*. In EDACS, these talkgroup identifiers can be represented as either a single decimal number or as a sequence of numbers called Agency-Fleet-Subfleet (AFS). The AFS format provides a hierarchical view of the system, with the “Agency” part identifying a department or organization and the “Fleet-Subfleet” identifying individual functions within the department.

Talkgroups are independent of frequencies. As we’ve seen, in general it’s possible for any talkgroup to appear on any frequency, so it’s best to program all of the frequencies for each repeater site that might be within reception range. Once that’s done, you can filter out the talkgroups you’re not interested in hearing by running the scanner in “Closed” mode and locking them out.

The PRO-164 and similar models can track trunked systems in one of two modes. “Open” mode allows the scanner to stop and let you hear every transmission that it receives. This is good for discovering new talkgroups, which you can then save to memory. “Closed” mode will only stop on transmissions that are part of a talkgroup that you have saved in the scanner’s memory. You can read more about these modes on pages 38 and 39 of the PRO-164 *User’s Guide*.

The following is a list of talkgroups that have been heard on the Mobile County system. Notice how the Agency portion of the AFS makes it easier to identify the organization assigned to the talkgroup.

Decimal	AFS	Description
273	02-021	Sheriff (Administration)
289	02-041	Sheriff (Dispatch)
290	02-042	Sheriff (Tactical 3)
291	02-043	Sheriff (Tactical 4)
294	02-046	Sheriff (Tactical 2)
295	02-047	County Mutual Aid 3
298	02-052	Sheriff (Special Events 1)
299	02-053	Sheriff (Special Events 2)
306	02-062	Sheriff (Tactical 1)
321	02-081	Sheriff (North Civil)
322	02-082	Sheriff (South Civil)
338	02-102	Sheriff (Narcotics)
354	02-122	Sheriff (Warrant Service)
357	02-125	Sheriff (SWAT)
358	02-126	Sheriff (Special Events Common)
359	02-127	Sheriff (Jail 1)
360	02-130	Sheriff (Jail 2)
361	02-131	Sheriff (Jail 3)



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513	04-001	County Fire (Main)
545	04-041	County Highway Department
546	04-042	County Highway Department
547	04-043	County Highway Department
548	04-044	County Highway Department
549	04-045	County Highway Department
550	04-046	County Highway Department
551	04-047	County Highway Department
578	04-082	County Department of Public Works
595	04-103	Animal Control
599	04-107	Metropolitan Corrections
610	04-122	County Mutual Aid 1
625	04-141	District Attorney's Office
689	05-061	Unified Command
690	05-062	Unified Command Fire
691	05-063	Unified Command Police
705	05-081	County Fire Hazardous Materials (North)
706	05-082	County Fire Hazardous Materials (Central)
707	05-083	County Fire Hazardous Materials (South)
708	05-084	County Fire Hazardous Materials (All)
769	06-001	County Fire (Dispatch)
785	06-021	County Fire (Tactical 1)
786	06-022	County Fire (Tactical 2)
787	06-023	County Fire (Tactical 3)
789	06-025	County Fire (Tactical 4)
790	06-026	County Fire (Dispatch)
792	06-030	County Fire (Tactical 5)
793	06-031	County Fire (Tactical 6)
794	06-032	County Fire (Tactical 7)
795	06-033	County Fire (Tactical 8)
799	06-037	County Mutual Aid 4
802	06-042	County EMS (Interoperability)
805	06-045	County EMS to Hospital
811	06-053	County EMS (Dispatch)
812	06-054	County EMS Tactical Primary
813	06-055	County EMS Special Events
814	06-056	County EMS (Supervisors)
815	06-057	Life Flight (Patch)
1296	10-020	University of South Alabama
1297	10-021	University of South Alabama Police (Dispatch)
1298	10-022	University of South Alabama Police (Tactical 1)
1299	10-023	University of South Alabama Police (Tactical 2)
1300	10-024	University of South Alabama Police (Tactical 3)
1301	10-025	University of South Alabama (All Call)
1302	10-026	University of South Alabama Police (Bike Patrol)
1303	10-027	University of South Alabama Police (Game Patrol)
1304	10-030	University of South Alabama Police (Special Events)
1305	10-031	University of South Alabama Police (Headquarters)
1306	10-032	University of South Alabama Police (Campus Patrol)
1307	10-033	University of South Alabama Police (Safety Patrol)
1308	10-034	University of South Alabama Maintenance
1309	10-035	University of South Alabama Supervisors
1310	10-036	University of South Alabama Administration

1311	10-037	University of South Alabama Grounds
1312	10-040	University of South Alabama
1777	13-141	County Mutual Aid 2
1808	14-020	State Police Public Safety Main
1809	14-021	Department of Public Safety Headquarters
1810	14-022	State Police (Patch for State Troopers)
1811	14-023	State Police Public Safety 2
1812	14-024	State Police Public Safety 3
1813	14-025	State Police Public Safety 4
1814	14-026	State Police Public Safety 5
1815	14-027	State Police Public Safety 6
1816	14-030	State Police Public Safety 7
1817	14-031	State Police Public Safety 8
1818	14-032	State Police Public Safety 9
1819	14-033	State Police Public Safety 10
1820	14-034	State Police Executive Protection 1
1821	14-035	State Police Executive Protection 2
1825	14-041	State Police Investigation 1
1826	14-042	State Police Investigation 2
1827	14-043	State Police Investigation 3
1834	14-052	State Police (Main)
1976	15-070	County Mutual Aid (patch to City of Mobile)
1977	15-071	Weather Alerts

❖ OpenSky Closes Out Public

Hi Dan,

The new OpenSky system in Steuben County is active as of January 11, 2011. The old EDACS system is shut off. I haven't seen anything on the local news about the switchover; however, reports from locals advise that there is no media access to the system.

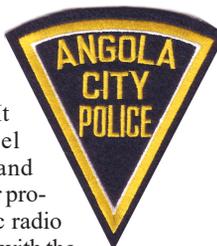
Fire is still being paged out on VHF.

Chris in Indiana

Steuben County is located in far northeast Indiana, on the border with Michigan and Ohio, with a population of just over 33,000. The Indiana Toll Road crosses the northern part of the county, bypassing the county seat of Angola.

The county awarded a contract for the OpenSky system in 2007 with a plan for six repeater sites transmitting on eight channels. It replaced an EDACS network that was more than ten years old.

OpenSky is an all-digital, Internet Protocol-based radio system sold by Harris RF Communications, who bought the old M/A-COM division that developed OpenSky. It uses a unique channel modulation scheme and proprietary over-the-air protocol, making the basic radio operation incompatible with the far more common APCO Project 25 standard and with the existing Indiana statewide public safety radio network.



Steuben County identified three problems with joining the statewide network. The first was coverage, fearing that the advertised 95% coverage was insufficient for their county's terrain and in-building requirements. Second was the lack of sufficient data capability for the county's desired move to mobile data access. Third was that the statewide system is supposed to be limited to public safety activity only, leaving out other county agencies that would need their own radio system anyway. The County intends to interoperate with other non-OpenSky agencies and jurisdictions through the use of a tri-mode radio, one that can operate on EDACS, OpenSky and Project 25.

Although the old EDACS system has gone quiet, there may still be some conventional (non-trunked) activity taking place on the following frequencies:

Frequency	Description
151.070	County Highway Department
153.890	Angola Fire (Tactical)
154.355	County Fire (Mutual Aid)
154.235	Angola Fire (Dispatch)
154.430	County Fire (Paging)
154.965	Angola City Utilities
155.055	County Emergency Management (backup)
155.700	County 800 MHz Backup
155.760	Angola Housing Authority
853.3625	County Jail Repeater

The concern for scanner listeners is that there is no commercial scanner that can monitor an OpenSky system, so citizens, the media, and anyone without a sanctioned OpenSky radio are now in the dark about much of the public safety activity taking place in their community.

Steuben County follows a handful of other jurisdictions that have recently switched to OpenSky. The Cities of Aurora and Naperville in Illinois activated their combined system in December 2010 after spending more than two years and \$26 million.

In September 2010 the City of Milwaukee, Wisconsin finally moved all of their municipal agencies onto a \$15 million system after seven years of repeated setbacks and failures.

Over the spring and summer months of 2010, several towns in Palm Beach County, Florida switched to a shared OpenSky system that so far has cost about \$18 million.

I maintain a web page of known and reported OpenSky systems at www.signalharbor.com/openky.html and I welcome your additions, corrections and updates to the list. Please let me know of any local news articles or press releases that mention these or any other OpenSky systems.

That's all for this month. More information is available on my web site at www.signalharbor.com, including a trunk scanner comparison chart and listings of APCO-25 frequencies. Please send your questions, comments, and frequency reports via electronic mail to danveeneman@monitoringtimes.com. Until next month, happy scanning!



Q. I note that when I put the batteries into my flashlight backwards, the LEDs don't light; are they polarity sensitive? Does that mean that if I applied AC to an LED it wouldn't light? (Mark Burns, Terre Haute, IN)

A. Since an LED is a light emitting diode, it behaves like any other diode and passes current only in one direction, so it is polarity sensitive. However, keep in mind that the polarity of alternating current (AC) reverses with each half cycle, so the LED will light during the half of the cycle when the polarity is correct, thus flashing 60 times per second. Since the eye can't discriminate on/off flashes that fast, it sees the light as constant. That's the same principle behind video and movies – they flash new images so fast that the eye perceives them as smooth motion.

Q. I recently saw your design for a "tunerless all-band dipole." I know it was for transmitting as well as receiving, but if I'm only going to listen, do I really need 134 feet of wire, a balun transformer, and a specific length of TV twin lead for exact impedance matching? (Rick Burr, email)

A. Not at all. My tunerless antenna was designed for critical transmitter applications; you don't need to worry a bit about this for shortwave reception. 50 feet of wire will certainly suffice, and any kind (except tiny RG-174/U) or length of coax will lead the signal to your receiver without a problem. And you can attach the coax directly to the dipole without worrying about twin-lead or a balun matching transformer.

For transmitting, we are concerned about getting every watt of power to radiate, but for receiving shortwave stations, we merely need to get enough signal above the background noise to make the signal intelligible. If there are losses due to mismatch or even some feedline attenuation, both the signal and the noise are reduced proportionately, so the signal is still above the noise!

Q. Given the choice for a multiband HF transmitting antenna, would you prefer using a trapped, resonant vertical without a transmatch (tuner), or a vertical that

requires a tuner? (Mike, KK2DOG)

A. I've used both with about the same communication results. The disadvantages of the loaded whip are:

1. Resistive losses in the coils
2. Restricted bandwidth for 1:1 VSWR

For maximum flexibility and minimum losses, I'd use the untrapped vertical and tuner with low-loss transmission line.

Q. In a previous issue of MT I read about security compromise of the RFID chips which are presently equipped in US passports. For those of us holding US passports with RFID chips, can you recommend any countermeasures we could take to preempt such a compromise? (Kevin, SC)

A. The unwanted intrusion can be virtually eliminated by metal shielding, either wrapping the passport in aluminum foil, or perhaps simply carrying it in an anti-static bag. The higher the frequency used, the easier it is to shield from the interrogation system. In radio parlance this is known as a Faraday shield.

Q. I hear of guys leaving radio equipment on continuously rather than shutting it off when in disuse. Is there any advantage one way or the other? (Mark Morgan, N8QIK, Cincinnati, OH)

A. Probably not. In the old days of vacuum tubes, there were heat and high voltage problems, but modern solid-state equipment doesn't suffer from that. Assuming the equipment does not get hot, the only considerations would be unnecessary power consumption from the grid (both economic and environmental concerns), and internal cooling fans constantly drawing in dust.

Q. The power line near my home is causing electrical interference on my shortwave receiver. The power company drove by with a truck, listening for it with a whip on their truck, but didn't come up with anything. Is there a better way to find the source of the

noise? (Ray Burke, VE9RAY, New Maryland, NB)

A. Chances are you could have done the same thing with your car radio by simply driving down the road tuned to an empty AM frequency that receives the noise. I find these offending poles using a hand-carried transistor AM radio. Holding the radio so I'm looking at its side, not the front, I turn around until it sharply nulls (reduces); that's the direction of the noise source.

Once I find the noisy pole, I kick it several times to see if the noise changes; if it does, that's the source. I note the number on the pole and the address of its location and notify the power company. In the U.S. it's against the FCC regulations to interfere with a licensed service including ham radio. I don't know whether the Canadian Radio-television and Telecommunications Commission has a similar regulation, but I suspect they have.

Q. At the height of the cold war, a red "hotline" phone tied the President's phone directly to the Kremlin. Do you suppose that phone still sits there? (Mark Burns, Terre Haute, IN)

A. Nope. By 1986 the old red phone was replaced by a satellite link for fax/computer intercommunications between the U.S. and Russia.

Q. I'm interested in learning more about radio direction finding (RDF). Can you steer me toward any good sources of information? (Jason Mortimer, UK)

A. The best book on it is by Joe Moell, KØOV, on his informative website: www.homingin.com/THRDFSinfo.html

The subject is also well covered in the ARRL *Handbook* (Chapter 13) and the ARRL *Antenna Book* (Chapter 14).

Personally, I've had good success on HF with a home-made Adcock array, and on VHF/UHF with the Roanoke as sold by Ramsey Electronics (their DDF1).

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.)



HF Aero Mobile: A Breathless Introduction

You might have noticed from recent logs that air-to-ground traffic on the high frequency (HF) band is quite popular with listeners. That's easy to understand. Flying is interesting just in itself. Also, the communication is usually in plain, upper-sideband (USB) voice, and nearly always using international English with a simple vocabulary.

HF is used when the standard VHF (very high frequency) channels are unavailable due to limited range. This is usually out over the ocean or over the world's less populated land areas. HF may also be used as a backup or to take a load off other channels.

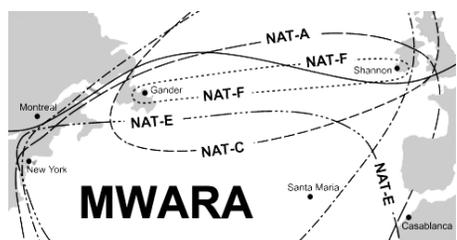
Air-to-ground radio is called aero mobile or "aeronautical mobile" in the international regulations. Its HF allocations are split fairly evenly into the routed ("R") and off-route ("OR") segments.

R refers to aircraft using the aero mobile service while flying established air routes. These are usually civil aviation flights, although military aircraft on these routes use the same procedures. OR refers to everything else, usually military aircraft working whichever ground station has the best signal. The US Air Force High-Frequency Global HF System (HF-GCS) is a typical OR network.

The major HF aero mobile voice bands (in kHz) are as follows: 2850-3155, 3400-3500, 4650-4750, 5450-5730, 6525-6765, 8815-9040, 10005-10100, 11175-11400, 13200-13360, 15010-15100, 17900-18030, 21924-22000, and 23200-23350. Frequency spacing is usually three kHz, with USB voice. The wider bands have R and OR sub-bands, while narrow slivers tend to be one or the other.

❖ Major Air Routes

Whenever international regulations exist, the names for things become important. A "Major World Air Route" is defined as a long-distance path, usually international, over oceans or regions lacking VHF air traffic control and radar services. These routes are grouped geographically into Major World Air Route Areas (MWARA).



The MWARA are AFI (Africa/Indian Ocean), CAR (Caribbean), CEP (Central/East Pacific), CWP (Central/West Pacific), EA (East Asia), EUR (Europe), INO (Indian Ocean, overlaps AFI), MID (Middle East), NAT (North Atlantic), NCA (North Central Asia), NP (North Pacific), SAM (South America), SAT (South Atlantic), SEA (South East Asia), and finally SP (South Pacific).

MWARA frequencies don't change very often and can be found on the Internet. *MT* has a list by Larry Van Horn posted at www.grovent.com/mtmwara.html

The MWARA allow logical nets of ground stations to be created within the R band segments. These subnets are called families. A family is a group of frequencies which allows aircraft to establish 24-hour reliable communication anywhere in the designated area.

Typically, the MWARA will have a letter designation and the family will be a single letter or number after a hyphen. An example is NAT, the North Atlantic, with its families NAT-A through NAT-F.

The existence of these families is the reason for the large number of routed aero mobile frequencies. At any given time, a primary and backup are in use, changing with the day's propagation. The temporarily unused frequencies make the aero bands sound dead, but actually they are busy.

Most operation is oceanic air traffic control. Aircraft use a pre-arranged HF frequency for entry clearance. The non-radar procedure uses wider separations, so routes can't be loaded as heavily as on land. Progress through the area is via waypoints, with regular position checks. Altitude changes must be approved.

Cockpit HF radios are squelched until activated by selective calling (selcal). The two calling tones are themselves dual tones, giving four possible audio frequencies from a lettered list. Selcals are thus referred to in form AB-CD, and they rarely change over the aircraft's life. Duplicates are common.

❖ Regional Air Routes

A "Regional Air Route" is one using the aero mobile service that is not long enough to be assigned to a MWARA. A "Domestic Air Route" is one that stays inside one country. These, too, are assigned to geographic areas, which are called Regional and Domestic Air Route Areas (RDARA).

RDARA divide most of the planet's surface into 14 major numbered areas. These in turn

break down into lettered sub-regions of varying sizes. Worldwide, these total somewhere around 60. Like the families, they are designed for 24-hour coverage.

The Klingenfuss *Guide to Utility Radio Stations* at least used to have a nice foldout RDARA map. Some smaller, largely unreadable ones are kicking around the Internet. A full list of all the actual ground stations would fill a small book and would go out of date almost instantly.

❖ LDOC and VOLMET

LDOC refers to Long-Distance Operational Control. These are the HF frequencies used for phone patches to company offices, consultation with ground-based doctors regarding sick passengers, maintenance write-ups, and everything else not covered by air traffic control.

Designated LDOC frequencies used to have many company stations with exotic names and locations, which made great utility catches. Due to competition from digital and satellite communication, this service is migrating inexorably towards a few large private contractors handling multiple companies.

VOLMET comes from the French for "flying weather." It is a means of getting information regarding observed and forecast weather at airports to pilots far out on the MWARA routes.

HF areas roughly parallel those of the MWARA. Each one has simulcast frequencies spaced through HF for propagation. Full coverage is achieved by specific ground stations taking turns, usually in five-minute segments, at set times after the hour and half hour.

Voices, usually automated, read off lists of specific airports in a format which somewhat resembles METAR (METeo for Aviation, Routine). Some regional variations exist, such as pressure in inches versus millibars/hectopascals. Forecasts are in TAF (Terminal Aerodrome Forecast) format.

While there are certainly faster ways for pilots to get weather info, VOLMET remains in worldwide use. Many countries also have VHF VOLMET, in various languages.

Well, that's our breathless survey of aero mobile communication. We can all exhale now.

❖ We're on Twitter!

Anyone who missed last year's buzz on "social networking" must have spent 2010 in a deep hibernation cave. It refers to the huge proliferation of web sites like Facebook and Twitter, where people share information or just socialize about whatever's on their minds.

In other words, it's like a text version of the rag chewing segments in the ham radio bands. Like the hams, users frequently talk about their equipment. Of course, in this case it's usually smartphones and the latest hip new app.

Beneath the chatter, all this is actually a great way to get out the news. Twitter is so fast and furious that it has been likened to an artificial ionosphere. It produces huge amounts of noise, but there are great rewards buried within for those who know where to look.

As a consequence, *Utility World* has increased its presence on these networks. In January, the column started using Twitter. It can be followed at <http://twitter.com/utilityworld/>. The last four "tweets," as Twitter's 140-character posts are called, will be visible in a box at the side of the existing Utility World Blog. This continues at <http://mt-utility.blogspot.com/>.

The blog is still the best way to get out information that can't be jammed into 140 characters. You can even receive the posts on your computer as they happen, using Really Simple Syndication (RSS). There's a "subscribe" box on the right side of the blog home page. The feeds are then read with the active bookmarks in many Web browsers, or through dedicated news aggregator programs available free online.

And, last but not least, don't forget the *Utility World* web site. It's good for background information that can be really helpful in puzzling out this whole utility thing. Get there with www.ominous-valve.com/uteworld.html

There's one more thing before this goes back to radio waves. *Utility World* has yet another new e-mail address. Hopefully, this will be the last one for quite a while. It's mtutilityworld@gmail.com. The other ones you've been using still work, too, but this one is certainly easier to remember. See you online!

ABBREVIATIONS USED IN THIS COLUMN

AFB.....	Air Force Base
ALE.....	Automatic Link Establishment
AM.....	Amplitude Modulation
ARQ.....	Automatic Repeat reQuest teletyping
AWACS.....	Airborne Warning And Control System
CAMSPAC.....	USCG Communications Area Master Station, Pacific
CW.....	On-off keyed "Continuous Wave" Morse telegraphy
DHFCS.....	UK Defence High Frequency Communications Service
DSC.....	Digital Selective Calling
E07.....	Russian numbers in English, weird computer voice
E10.....	Israeli female phonetic voice, 5-letter groups
EAM.....	Emergency Action Message
FAX.....	Radiofacsimile
FEMA.....	US Federal Emergency Management Agency
FSK.....	Frequency-Shift Keying
G11.....	"Stritch" family ("I"/), German female numbers
HFDL.....	High-Frequency Data Link
HF-GCS.....	High-Frequency Global Communication System
LDOC.....	Long-Distance Operational Control
LSB.....	Lower Sideband
MARS.....	US Military Auxiliary Radio System
MFA.....	Ministry of Foreign Affairs
NASA.....	US National Aeronautics and Space Administration
NAT.....	North Atlantic oceanic air control, families A-F
NATO.....	North Atlantic Treaty Organization
NCS.....	US National Communications System
PACTOR.....	Packet Teletyping Over Radio, modes I-III
PR.....	Puerto Rico
RTTY.....	Radio Teletype
Selcal.....	Selective Calling
SESEF.....	Shipboard Electronics Systems Evaluation Facility
SHARES.....	Shared Resources; US federal frequency pool
SITOR.....	Simplex Telex Over Radio, modes A & B
UK.....	United Kingdom
Unid.....	Unidentified
US.....	United States
USAF.....	US Air Force
USCG.....	US Coast Guard
V02a.....	Cuban "Atencion" female, 3-message format
WSPR.....	Weak-Signal Propagation Reporting (narrow FSK).
XPA.....	Polytone, Russian tone-coded numbers for auto-receive

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 ().

- 410.0 BKQ-British Drilling Vessel *Stena Carron* (2BKQ8), Norwegian Sea, CW helideck beacon at 0338. LXUB-Luxembourg registry oil vessel *Simon Stevin*, CW helideck beacon at 2310 (ALF-Germany).
- 502.4 GM4SLV-600 Meter experimental station, Shetland Islands, WSPR identifier and location, at 2106. G4WGT, England, WSPR at 2116. PA0A, Netherlands, WSPR at 2234. EA4BVZ, Spain, WSPR at 2326 (DL8AAM-Germany).
- 503.0 EA4BVZ-Experimental station, Madrid, Spain, RTTY beacon at 2045 (ALF-Germany).
- 503.6 DI2AF-Experimental station, Erlangen, Germany, WSPR at 2332 (DL8AAM-Germany).
- 505.0 OK0EMW-Experimental station, Breclav, Czech Republic CW QRSS beacon (extremely slow Morse telegraphy), at 2157 (DL8AAM-Germany).
- 505.1 DI2AG-Experimental station, Dormitz, Germany, CW QRSS beacon at 0055 (DL8AAM-Germany).
- 505.2 DI2AM-Experimental station, Rostock, Germany, CW QRSS beacon at 2157 (DL8AAM-Germany).
- 615.0 STB-Statoil, Norway, CW helideck beacon on Staffjord B Platform, North Sea, at 2315 (ALF-Germany).
- 2070.4 BPLEZS-German Federal Police, Cuxhaven, raising police boats BP23, BP25, and BP26; also on 2505 and 3850, ALE at 1753 (MPJ-UK).
- 2142.5 ZLST-German Customs Control Post, Cuxhaven, working customs boats ZEMD, ZKNI, ZPRI, ZSHO, and ZKNI; also on 6934; ALE at 1731 (MPJ-UK).
- 2216.0 XBX-UK DHFCS, working XSS (control, Forest Moor), similar on 4168.5, 5295, 12230, and 14485.5, ALE at 1735 (MPJ-UK).
- 2720.0 SPS-Witowo Radio, Poland, weather at 1336 (Michel Lacroix-France).
- 2749.0 VCO-Canadian Coast Guard, Sydney, NS, weather in French at 0758 (Lacroix-France).
- 2872.0 Gander-Gander Radio (Newfoundland, Canada), selcal EF-JR to unknown aircraft, at 0541 (Allan Stern-FL).
- 2971.0 Gander Radio-NAT-D, working aircraft at 0506 (Stern-FL).
- 3192.0 RMP-Kaliningrad Naval Radio, Russia, CW weather for REO (all ships), at 1743 (MPJ-UK).
- 3455.0 New York Radio-Caribbean route control, selcal check with N887AG, a Gulfstream G550, at 0439 (Stern-FL).
- 3476.0 Shanwick Radio-NAT-F, working Continental 28 and others, at 0347 (Stern-FL).
- 3579.7 Unid-CW marker "hpy new year 2020 de pirate beacon," at 0228 (ALF-Germany).
- 3818.0 RMB80-Russian Navy, passing CW traffic for RMP and RJD69 to unknown station, at 1506 (ALF-Germany).
- 3924.0 Ascot 1009-UK Royal Air Force, working Kinloss, Scotland, at 1252 (Lacroix-France).
- 4040.0 Unid-Turkish Navy, calling "Turgut Burak Aydin" (Headquarters, Ankara), at 2343 (ALF-Germany).
- 4207.5 003669992-USCG, San Juan, PR, DSC with 235483000, tanker *Stena Caribbean* (ZINH8), at 0804 (PPA-Netherlands).
- 4322.0 MGJ-UK Royal Navy, RTTY channel availability marker, at 0610 (Lacroix-France).
- 4593.5 AFA3BC-USAF MARS, net with AFF3WV, AFA3AO, and NE1S1; at 1418 (Jack Metcalfe-KY).
- 4718.0 Rescue177-UK Sea King helicopter, working Kinloss Rescue at 1735 (Lacroix-France).
- 4780.0 Golden Pirate-Control of bi-monthly Indiana North Region Joint Forces net, checking in Crawfordsville, Greencastle, Marion, and Muncie; at 1400 (Metcalfe-KY).
- 5195.0 Unid-Weak Texas Department of Transportation stations in weekly net, at 1434 (Metcalfe-KY).
- 5203.0 Control-NATO, weekly maritime exercise with Kilo Charlie, Kilo India, and many other two-letter-call stations, at 0742 (Lacroix-France).
- 5340.0 Ternate Radio-Sultan Babullah Airport, Indonesia, position from a Garuda flight at 1122 (Eddy Waters-Australia).
- 5366.0 Unid-Russian Air Defense ("PVO"), CW tracking data strings at 1941 (PPA-Netherlands). PVO, null tracking datagrams (all places but initial "99" and local time stamp are "2"), with similar on 7558.5, CW at 2146 (MPJ-UK).
- 5379.0 TYVC1-Spanish Guardia Civil, Castellon, calling TYVV1, Valencia, ALE at 1938 (PPA-Netherlands).
- 5405.0 RH1-Saudi Air Force, calling AAI, ALE at 1906 (PPA-Netherlands).
- 5464.0 CB1-Algerian Military/ Ministry of Information, working PT10, similar on 5770, ALE at 2104 (MPJ-UK).
- 5517.0 RFF8071-Russian Air Force, passing altitude to Tripoli, at 0630 (Patrice Privat-France).
- 5541.0 JA01KZ-Nippon Cargo Airlines B747 freighter, tried selcal AP-BF with Stockholm LDOC, no joy because contract was expired, at 1333 (PPA-Netherlands). Giant 8191-Atlas Air B747 freighter N522MC, selcal MR-EJ and position for Stockholm, at 2248 (ALF-Germany).
- 5550.0 New York-Caribbean route control, selcal check AS-CM with Iberia 6014, an A340 with registration EC-JCZ, at 0417 (Stern-FL).
- 5596.0 Petschora-Petschora Aero, Komi Republic, Russian Federation, calling SIVKAR (Syktyvkar Aero) in Russian, at 0610 (ALF-Germany).
- 5598.0 Santa Maria-NAT-A, Azores, working aircraft at 0550 (Stern-FL).
- 5616.0 Gander-NAT-C, position from Delta 242, went to 8864, at 0307 (Stern-FL).
- 5622.0 "14"-Krasnoyarsk HFDL ground station, Russia, weather for Syktyvkar at JA02KZ, another Nippon Cargo Airlines B747, at 2000 (PPA-Netherlands).
- 5646.0 Saudia 909-Saudia Arabian Airlines/ULS Cargo A310 freighter, registration TC-SGM, with position for Jeddah (Saudia LDOC), at 0033 (ALF-Germany).
- 5649.0 Gander-NAT-C, selcal check EJ-HP with Lufthansa 405, B747 "Dresden," registration D-ABTL, at 0537 (Stern-FL).

- 5680.0 Rescue 131-UK Sea King helo, working Kinloss Rescue at 1430 (Lacroix-France). Rescue 169-UK Royal Air Force helo, getting new tasking from Kinloss Rescue, at 1550 (ALF-Germany).
- 5687.0 DHM91-German Air Force transport headquarters, Muenster, selcal GJ-EP to a C-160 with tail number 50+40, at 1344 (Lacroix-France).
- 5708.0 JDG-USAF, Diego Garcia, ALE sounding at 2058 (MPJ-UK).
- 5720.0 Herakles-Austrian Air Force, Vogler AFB, working JGP 11, a C-130K, at 1042 (ALF-Germany).
- 5730.0 SSE-Egyptian MFA, Cairo, selcalling TVXV, Qatar embassy, similar traffic on 6785, 7815, 8022, and 9035; ARQ at 1524 (ALF-Germany).
- 5762.0 035-Hungarian military, calling 093, ALE at 1856 (PPA-Netherlands).
- 5836.0 Unid-Russian Intelligence AM "English Man" (E07), callup 788 000, repeat of 1800, at 1820 (Mike-West Sussex, UK).
- 5864.0 Unid-Russian Intelligence Polytone (XPA), numbers message in 20-tone FSK, at 1940 (Mike-UK).
- 5883.0 Unid-Cuban AM Spanish "numbers" (V02A), 5-figure groups in reduced lower sideband AM, at 0709 (PPA-Netherlands). V02A, standard AM 5-figure groups in progress at 0717 (Lacroix-France).
- 5898.0 V02A, 5-figure groups in progress, AM at 0727 (Waters-Australia).
- 6292.0 Unid-Ukrainian vessel with old-style CW company traffic mentioning Ukrichflot (Ukrainian shipping company), duplex with unknown shore station, at 0625 (ALF-Germany).
- 6391.0 AQP4-Pakistan Naval Radio, Islamabad, CW marker at 1530 (ALF-Germany).
- 6470.0 UWS3-Kiev Radio, Ukraine, CW marker and traffic list, also using 8571, at 1821 (ALF-Germany).
- 6480.0 Unid-"Stritch Family" numbers in German (G11), callup 272/32 and repeated message in 5-figure groups, signed "Ende," at 0940 (ALF-Germany).
- 6482.9 9MR-Malaysian Navy, Lumut, RTTY test loop at 2007 (PPA-Netherlands).
- 6521.5 RFH74-Russian Navy vessel, calling RCV (Black Sea Fleet headquarters), CW at 0427 (ALF-Germany).
- 6535.0 Dakar-African route control, Senegal, position from unknown Iberia Airlines flight, at 0450 (Stern-FL).
- 6586.0 New York-Caribbean route control, position from bizjet C-GSLU, a Falcon 2000EX, at 0233 (Stern-FL).
- 6622.0 Port Moresby-regional air control, Papua New Guinea, calling an Airniugini flight, at 0818 (Waters-Australia).
- 6628.0 New York-NAT-E, clearing Condor 111 (Condor Airlines, Germany) to a higher altitude, at 0513 (Stern-FL).
- 6649.0 Atlantico-South American air route control, Recife, Brazil, working unknown flight at 0727 (Lacroix-France). Lima, working LAN 621 at 0800 (Privat-France).
- 6712.0 Cotam 3009-French Air Force, working Circus Vert (Villacoublay) in French, at 1620 (ALF-Germany).
- 6739.0 Andrews-USAF HF-GCS control, Andrews AFB, MD, 18-character EAM parallel on 6712, at 0110 (ALF-Germany).
- 6761.0 Turbo 33-USAF, radio checks with Reach 3003, at 1430 (Metcalfe-KY).
- 6765.0 NCS042-NCS Auxiliary, KY, in SHARES Northern Net with USCG Radio Paradise (USCG Auxiliary, Paradise, MI), and KGD 34 (SHARES, VA), at 1615 (Metcalfe-KY).
- 6774.0 E07, callup 788 000, AM at 1800 (Mike-UK).
- 6800.0 NCS009-SHARES Bulletin Board System, IA, PACTOR schedule and message at 1445 (Metcalfe-KY).
- 6910.0 NNN0ENS-US Navy/ Marine Corps MARS, SHARES Region 6 Net at 1614 (Metcalfe-KY).
- 6940.5 Strike Star-US military, working aircraft at 1726 (Metcalfe-KY).
- 6950.0 Unid-Weak New Year's Eve pirates with music, then a loud FAX (sounded like 120/576) right at midnight Eastern Standard Time, at 0500 (Hugh Stegman-CA).
- 6982.5 KHA940-NASA Glenn Research Center, OH, net check at 1648 (Metcalfe-KY).
- 6988.0 BVW5-Russian military, calling JH4Z with short codes, at 0753 (PPA-Netherlands).
- 6998.0 HWK7-The Italian Crazy Pirate, sending the usual CW political speeches in Italian, at 2158 (ALF-Germany).
- 7305.0 AFA7ET-USAF MARS, net with AFA5GK, at 1451 (Metcalfe-KY).
- 7480.0 RWV74-Possible Russian railway net, Smolensk, encrypted RTTY at 0912 (PPA-Netherlands).
- 7508.0 ZSJ-South African Navy, Silvermine, FAX weather charts at 2235 (ALF-Germany).
- 7535.0 Unid-US Navy, RTTY "Quick brown fox" test loops on a SESEF test frequency, at 1550 (Metcalfe-KY).
- 7630.0 Red Robin 898-US Civil Air Patrol, exercise traffic for unknown station, at 1542 (Metcalfe-KY).
- 7632.0 AAR4LL-USAF MARS, CW net with NCS30, probable NCS Auxiliary station, at 1716 (Metcalfe-KY).
- 7695.0 Unid-Male reading short news clips from USA Today once per minute, said "break" and gone, at 2047 (Metcalfe-KY).
- 7969.0 JH4Z-Russian Military net control, duplex with ARCV on 6988, CW at 1350 (MPJ-UK).
- 8136.0 V02A, usual Spanish 5-figure groups in progress, but in LSB, at 0139 (ALF-Germany).
- 8283.7 Unid-Pakistan Navy, calling ARL2, ARL4, and FRF in PACTOR-I, at 1619 (ALF-Germany).
- 8414.5 005030001-Rescue Coordination Centre Australia, Charleville/ Wiluna, DSC with 371496000, tanker North Contender (3ECY7), at 2207 (PPA-Netherlands).
- 8467.5 Unid-Kyodo News, Japan, transmitter might be in or near Singapore, with a Japanese newspaper in slow FAX (60/576), at 1731 (PPA-Netherlands).
- 8825.0 CS-TLY-Vinair Falcon 7X, position for Santa Maria at 1304. Fix 23-Airfix Aviation, Finland, handed off to Lisboa by Santa Maria, at 1305 (ALF-Germany).
- 8891.0 Gander Radio-NAT-D, requesting unknown aircraft to maintain current altitude and contact N6443C, at 0310 (Stern-FL). [That reg comes back to a classic Cessna T-50 Bobcat. ?? -Hugh]
- 8930.0 G-KKAZ-Thomas Cook Airlines A320, answered selcal CM-DF from Stockholm, at 1339 (Lacroix-France).
- 8977.0 5A-ONB-Afriqiyah Airways A320, working HF DL ground station 03, Reykjavik, Iceland, at 1356 (Lacroix-France).
- 9270.0 Cape Radio-USAF, Cape Canaveral Air Force Station, FL, working NASA Booster Recovery Vessel Freedom Star, in the Pacific Ocean to recover the SpaceX Falcon 9/ Dragon vehicle, at 1534 (Stern-FL).
- 10066.0 VT-VJL-Kingfisher Airlines A330, HF DL position for ground station 06, Hat Yai, Thailand, at 1524 (PPA-Netherlands).
- 10075.0 UAE413-Emirates Airlines A380, registration A6-EDN, HF DL position for Bahrain, at 1430. (Privat-France).
- 10096.0 Piarco-South American air route control, Trinidad and Tobago, position from KLM 714, an MD-11, at 2218 (MDMonitor-MD).
- 10166.4 VCT-St. Johns Radio, Canada, working ships on 10253.4, in Globedata mode at 1204 (PPA-Netherlands).
- 10194.0 FC6FEM-FEMA Region 6, TX, ALE sounding at 1151. FC4FEM-FEMA Region 4, GA, also on 14776, ALE sounding at 1156 (PPA-Netherlands).
- 10271.0 Unid-Unknown Russian station with automated RTTY number strings, also on 14432, at 1020 (PPA-Netherlands).
- 10310.0 RKA76-Possible Russian railway net, Minsk, encrypted RTTY at 0950 (PPA-Netherlands).
- 10315.0 DHN66-German Air Force, NATO Geilenkirchen, working an unknown AWACS at 1302 (Lacroix-France).
- 10547.0 FDI 22-French Air Force, Narbonne, CW marker at 1308 (PPA-Netherlands).
- 10648.0 YHF2-Israeli intelligence (E10), null-message format with identifier only, in reduced-carrier USB, at 1215 (PPA-Netherlands).
- 11080.0 S1B-Lithuanian Navy, working P1G in ALE, at 1106 (PPA-Netherlands).
- 11125.0 CM2-Algerian Air Force, calling COF, ALE at 0941 (PPA-Netherlands).
- 11175.0 McClellan-USAF HF-GCS, patching Test Head to a military number, at 2123 (Stern-FL).
- 11226.0 ICZ-USAF, Sigonella, Italy, ALE sounding, also 13215, at 1551 (MPJ-UK).
- 11266.0 N6-6168-USAF C-17A, ALE sounding at 1758 (Lacroix-France).
- 11525.0 K4MT-Commonwealth of Independent States government, duplex with NT9P in CW and RTTY, sent message in 5-figure groups, at 0934 (PPA-Netherlands).
- 11557.0 CENTR2-Romanian MFA, Bucharest, working YPM21, Stockholm embassy, ALE at 0925 (PPA-Netherlands).
- 12165.0 RWD59-Russian military/government, Moscow, RTTY loop calling RUO2, at 0759 (PPA-Netherlands).
- 12224.0 Unid-Russian Mazielka selcal in AM, too weak to decode, at 0617 (Waters-Australia).
- 12577.0 A8PG5-Libyan container ship Nirint Eagle, DSC safety check with A8MD3, bulk carrier Peter S, at 1312 (MPJ-UK).
- 13215.0 ADW-USAF, Andrews AFB, MD, working JNR (USAF Salinas, PR), ALE at 1501 (MPJ-UK).
- 13490.0 RCG77-Possible Russian railway net, Moscow, encrypted RTTY at 0918 (PPA-Netherlands).
- 13985.0 Unid-Possible Russian railway net, Krasnoyarsk, encrypted RTTY at 0951 (PPA-Netherlands).
- 14119.0 YW2-Unknown, calling TXZ4, ALE net also uses 16314.0, at 0800 (Waters-Australia).
- 14463.0 MNA-Algerian Air Force, working DJT, Djanet, ALE at 1305 (MPJ-UK).
- 14778.5 Unid-North Korean MFA, Pyongyang, encrypted messages in 600/600 ARQ, also on 16131.5 and 18523.5, at 0055 (Waters-Australia).
- 14871.0 N26-Unknown, calling A16, LSB ALE at 0927 (Waters-Australia).
- 14923.7 Unid-Egyptian embassy, selcalls SSTA and SSBT, both MFA Cairo, with Arabic ARQ operator chatter and digital exchanges, at 1227 (MPJ-UK).
- 15040.0 XSS-UK DHFCS control, Forest Moor, ALE sounding at 1307 (PPA-Netherlands).
- 15043.0 JNR-USAF, Salinas, PR, ALE sounding at 1320 (PPA-Netherlands).
- 16067.7 Unid-Egyptian MFA, Cairo, SITOR-A selcal TVXV to Algiers embassy, at 1408 (PPA-Netherlands).
- 16236.7 Unid-Egyptian MFA, Cairo, SITOR-A selcal QQTP to Moscow embassy, at 1325 (PPA-Netherlands).
- 16319.7 Unid-Egyptian MFA, Cairo, Arabic ARQ messages to KKVI, Dar Es Salaam, Tanzania, at 1054 (Waters-Australia).
- 16806.5 NMC-USCG CAMSPAC Pt. Reyes, CA, SITOR-B weather and maritime information, at 0922 (Waters-Australia).
- 16907.5 JFC-Misaki Prefectural Fishery, Japan, FAX navigation warnings in Japanese, headed "JFC-FAX," at 0030 (Stegman-CA). JFA-Japanese Fisheries Association, FAX weather map at 1047 (Waters-Australia).
- 17976.0 ADWSPR-USAF Secure Internet Protocol Routed Network (SIPRNET) gateway, Andrews AFB, ALE sounding at 1249. PLASPR, SIPRNET gateway, Lajes, Azores, ALE sounding at 1307 (MPJ-UK).
- 18000.0 MAN-Mandalay, Burma, calling YGN, possibly Yangon, at 1000 (Waters-Australia).
- 18475.0 HIJ-Unknown new US government net, probably eastern US, ALE sounding at 2218 (Stegman-CA).
- 18690.5 MCQ-Unknown ALE net with 678 and 998, at 0407 (Waters-Australia).
- 18722.7 8WD2-New Delhi, India, RTTY messages in 5-letter groups to 8WA3, Yangon, at 1020 (Waters-Australia).
- 21955.0 CS-TFX-Arik Air A340, flight 5K0101, HF DL position for ground station 17, Canary Islands, at 1254 (PPA-Netherlands).



Easy Digital Listening

This month we continue to look at digital stations you can catch on the air with modest decoding software. Since we're mainly concerned with FSK signals, all frequencies are given as center of data rather than USB (dial) frequency.

SITOR-A

Coast Stations:

This venerable ARQ (Automatic Repeat ReQuest) mode is still in daily use by plenty of stations around the world. Once used by ships and coastal stations, SITOR-A has declined markedly over the recent years with the takeover of the Globe Wireless systems, but there are still some to be found. Here are a few:

WLO (ShipCom, Mobile, AL)

Try: 4213, 6317, 8421, 12581.5, 12584.5, 16809, 16814, 19685.5 & 22383.5 kHz

IAR Rome Radio, Italy

Try: 8418, 16820 kHz

TAH Istanbul Radio, Turkey

Try: 4209.5, 8431, 8434, 12654, & 16886.5 kHz

These stations usually mark their frequency with a SITOR tuning burst (or phasing signal), followed by the station's callsign in CW. Patient listening is rewarded with traffic, generally in plain text, when ships connect to the station to download email, traffic lists, weather, etc.

MFA Cairo:

By far the most prolific and long-lived user of SITOR-A outside the maritime bands is the Egyptian Diplomatic Service. MFA Cairo can still be heard daily, communicating with embassies around the world. The mode is used to send traffic, make call-ups, and chat with operators after the more modern Codan 9001/3012-series high speed modems are used.

Four-letter selcals are used during the call-up phase of SITOR-A. The MFA typically uses Txxx to call an embassy and the embassies call the MFA using SSxx-series selcals, so it's pretty easy to determine whether you're hearing Cairo or an outstation.

Traffic is usually sent using the ATU-80 alphabet, which can be translated by hand, but most of the important words like the embassy names, etc. have already been detailed by listeners (See www.chace-ortiz.org/umc/mfatext/Egypt.txt).

Sometimes coded messages are sent using an unusual hexadecimal coding scheme. In this case, the destination embassy is usually listed in the header in English. Here's an example:

from : 71

to : sanaa

time & date: 14:07, wednesday, december 02, 2009

number of groups: 124

urgent

[coded message follows]

Since 1996, I have logged about 500 discrete frequencies used by MFA Cairo and its embassies, but here are some of the more regularly used channels (kHz) recently heard: 9046.7, 12222.7, 12223.7, 13523.7, 14445.7, 14523.7, 14926.7, 14981.7, 16061.7, 16066.7, 16221.7, 16318.7, 17426.7, 18036.7, 18056.7, 18216.7

SITOR-B

Maritime Navigation and Weather Stations:

Some stations, Istanbul Radio for example, switch to SITOR-B to send news, traffic lists, weather and navigation information. Here are a few more stations and frequencies (kHz) to try:

WLO (Mobile, AL): 4213

SVO (Olympia Radio, Greece): 8424, 12603.5, 22387.5

TAH (Istanbul Radio, Turkey): 4560, 8431, 12654

XSG (Shanghai Radio, China): 8425.5

NMO (USCG, Honolulu): 12579

NMC (USCG, Point Reyes): 8416.5 & 12579

NMF (USCG, Boston): 5001.7, 12579

KSM (MHRS, Salinas CA): 8433, 12631

PWN33 (Brazilian Navy, Natal): 12566.7

VFF (Canadian Coast Guard, Iqaluit): 8282.7, 8292.7

You'll note that MFA Cairo also switches to SITOR-B on occasion, usually in order to inform the embassies of their return (QSX) frequency, if working split-frequency.

NAVTEX Stations:

No review of SITOR-B stations would be complete without mentioning the hundreds of coast stations around the world that transmit regularly scheduled navigation information on 490 and 518 kHz.

With so many stations available, it's pretty easy to hear one near you during the day or night and the low frequencies are much less affected by solar conditions. You might be pleasantly surprised.

PacTOR-I, II and III

The oldest variant of PacTOR sends data at 100bd and remains downwardly compatible with the newer versions, PacTOR-II and PacTOR-III. While PacTOR-I is available on many budget decoders, PacTOR-II and III remain the preserve of the higher-end decoders like WaveCom and Hoka.

Fortunately, since the original mode is often used as the call-up mechanism for stations that then switch to the newer and faster mode, monitoring

and identifying PacTOR stations is still accessible to most of us. Here are some stations to try:

US Forces MARS:

PacTOR is still used by some stations to move email from place to place. In most cases, traffic is sent in plain text. Stations from the Navy, Army and Air Force affiliates can be seen most times of the week, generally in the evenings.

Try: 6801.5, 6996.5, 9218.5, 9305, 10268.5, 10577.5, 14403.5, 14514 kHz

SailMail:

This is probably the most extensive email network using PacTOR, operating more than a dozen stations around the world. Mainly designed for yachters at sea, SailMail stations are strategically placed to maximize coverage of major oceans used by small craft. While most traffic is sent using PacTOR-II or III, during the call-up the yachts all identify with their official registered callsigns, like FGB2145 or WHY3467, so you can look the vessel up on the Internet. Try these frequencies: **KZN508** (Rock Hill, SC): 7961.4, 7981.4, 10331, 18630 kHz

WPTG385 (Corpus Christi, TX): 18376.4 kHz

WPUC469 (Daytona, FL): 8009.4, 10366.4, 13921.4, 18381.4 kHz

9Z4DH (Trinidad): 18172 kHz

OSY (Brugge, Belgium): 6330.5 kHz

HPPM1 (Chiriqui, Panama): 5735, 8181.5, 10450, 13880 & 18436.5 kHz

Medecins Sans Frontieres:

With conflict continuing throughout the world, the MSF (Doctors without Borders) provides aid and services to refugees and those who are under threat from war and hunger. Again, most stations now use PacTOR-II and III for traffic, but call-ups can still be heard and use the format PACMxx or PACMxxx. In the US at least, signals from many of the outstations are very weak; what is mostly heard is HQ in Geneva calling them.

Try: 10825, 13909.2, 14785.5, 16274.8, 17432.7, 18042, 18925.7, 19109.9, 20107 & 20535.6kHz

Peruvian Navy:

This PacTOR-II based network can sometimes be heard under good conditions in Europe and the US. Call-ups are visible using PacTOR-I. Tactical, but static calls like S9BF, C6KZ and A7YF are used. If you do have PacTOR-II, you can see plain text traffic in Spanish but non-standard CRC (error checking codes) of 10104 and 37772 are used.

Try: 8096.25, 8311.25, 8329.25 kHz

That's all for this month; do please keep the letters and emails coming.



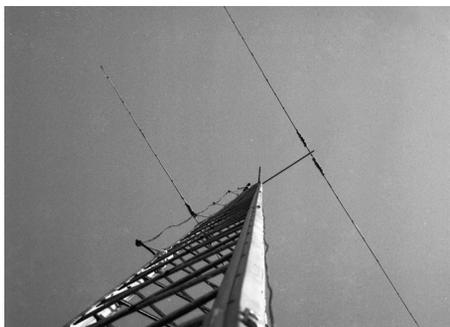
Coaxial Confessions

When I got started in amateur radio, despite the fact that I didn't have a lot of high-end tools or test gear (and even less experience), I wanted my antennas to be effective and well-built. When assembling my dipoles and loops, I measured every wire segment religiously – after proper stretching (the soft-drawn, enamel-covered copper wire was mostly donated to my cause by the owner of a local motor-winding shop. If I didn't stretch it on the ground it would stretch in the air).

I used good-quality ceramic insulators (top-of-the-line Collins, Johnson and Uncle Sam-branded dog-bone types, also mostly donated, this time by the Old-Timers from the local chapter of the Civil Air Patrol). I even had a 50-foot tower in my backyard from which to hang my creations (I worked part-time, after school and on weekends, for a local TV repair shop. On one exciting day, the shop owner gave me an "extra" 48-foot Rohn tower that "wasn't on the invoice" of his latest received shipment. To this day I can't prove it, but I've always suspected that my dad made this happen behind the scenes.)

As a teenage antenna experimenter, I made quads and wire Yagis out of bamboo poles scavenged from local carpet stores (they were used as spindles inside carpet as they came from the factory). I made G5RVs from the copper wire mentioned above (the ends of the big spools were too small for winding coils for big electric motors) and 300-ohm twin-lead from the corner Radio Shack store. I even made an end-fed antenna from a 100-foot orange extension cord, which my folks didn't really appreciate. Apparently, nothing says "a crazy ham kid lives here" like a blaze-orange extension cord strung from point to point around the yard!

In the late '70s the sunspot cycle was quite a bit more cooperative than it is today, so I



Who would feed this lovely 2-element "bamboo beam" with miles of junky coax? Your author, that's who (at age 17)! (NT0Z photo)

worked plenty of domestic and DX stations, but if I had known just a bit more about feed lines, my experiences would have undoubtedly been better.



With crimp-on Type-F connectors, "Type-F to PL-259" adapters (this one complete with sealant residue!) and a supply of RG-6, 75-ohm coaxial cable, your transmission line troubles will likely be a thing of the past. Adapters for Type-N, BNC, RCA and others allow for an even wider array of applications. (NT0Z photo)

One of my biggest mistakes consisted of multiple 150-foot runs of cheap, low-quality coaxial cable. My quad at 65 feet – which took a lot of "doing" to build and erect – was fed with an endless run of disgusting, super-lossy coax! It was the same story for the two-element "bamboo Yagi" for 15 meters. I didn't have a decent rotator, so I aimed the beams at Europe or Africa. When it was seasonally time to point them toward Japan or the South Pacific, I climbed the tower and re-aimed them! The quad loop was bi-directional, so its orientation wasn't as critical. The G5RV, also fed via the disgusting black stuff, had a 29-foot length of twin-lead attached to the feed point, so the length of junky coax was that much shorter.

Because my after-school job paid all of \$3.50 an hour, instead of saving up for something better (and a lot more expensive) or trying to wrangle some leftover 75-ohm hardline from the cable company, I used what I could afford and what was available: cheap RG-58 coax. I didn't know it then, but I would pay a heavy price in the long run.

It's no wonder I took to QRP right from the start. Even though my trusty Tempo One transceiver was putting out 100 watts or more, I shudder to think of how little RF was actually making it to the antenna! And when you consider my "soldered by a teenage ham" PL-259 connectors, all bets are off!

Although there's still plenty of questionable-quality 50-ohm coaxial cable on the market – in addition to plenty of good stuff, which, unfortunately, isn't exactly inexpensive – the

satellite and cable TV industries have provided us with an excellent, affordable coaxial cable that's available everywhere (heck, it's even affordable with a \$3.50 an hour job!). This ubiquitous wonder cable is 75 ohms and not 50, but despite what you may have read or been told, that's really a non-issue! The benefits dramatically outweigh the drawbacks.

RG-6 - The Wonder Coax!

Hams at every experience level often wonder which feed lines work best for specific applications. They also wonder about connectors and how to attach them – a particularly frustrating issue for otherwise fearless operators!

Like anything else these days, when it comes to 50-ohm coax, you usually get what you pay for. It's pretty hard to go wrong with RF cables made by mainstay companies such as Belden, Andrew, or Times Microwave, but there are other high-quality makers that you'll discover if you do a little research.

Which 50-ohm coax should be avoided? Anything priced too good to be true. Good-quality 50-ohm cable rarely comes cheap. And watch out for knockoffs, which also exist in the marketplace. It doesn't take a rocket scientist to stamp a popular brand-name on a cable's vinyl jacket (only an unscrupulous vendor or manufacturer). Be especially wary of 50-ohm coax sold at truck stops, mass-market chain stores or from eBay sellers who have less-than-stellar feedback ratings.

By now you've probably noticed that I've carefully been using the term "50-ohm coax." That's what hams are supposed to use, right? The stuff that's been in countless books and magazine articles since WWII, right? Well, yes, but for most ham applications below 50 or 144 MHz, 75-ohm RG-6 "satellite cable" works just as well – or better – and has many advantages:

Superior shielding: Unlike inexpensive 50-ohm "ham coax," which can have a skimpy 65% braided outer shield, RG-6 is at least double-shielded (a continuous foil shield and an outer woven braid) with "quad-shielded" versions readily available.

Economy of scale: Because RG-6 is produced in huge quantities (compare the number of people who have TV sets with the number of hams), it's inexpensive.

Frequency response: Because it's used in cable TV and satellite TV applications, RG-6 has to be relatively low-loss up to 700 MHz (which is particularly awesome if you're using it at 7 MHz!). Low-cost 50-ohm cables often fail

HAM2011.03.4 K4AVU2 CRIMPER

Crimp-on PL-259 connectors are available for a few bucks apiece, but the crimpers and the cable prep tools can cost as much as \$700, making them impractical for non-commercial use. The K4AVU PL-259 crimp tool is an unusual tool that fills the gap between expensive commercial crimp systems and the RG-6 solution described in this month's column.



The K4AVU tool actually crimps conventional PL-259 connectors onto a variety of half-inch, 50-ohm coaxial cables (and smaller cables such as RG-58 with standard reducers). The simple, rugged \$40 tool has been playing to mixed reviews, and its ultimate success seems to hinge on the specific PL-259s being used. According to users, some connectors can handle the crimping process, while some crack. The happiest users seem to have a large supply of connectors that can tolerate the process. For more info, see <http://www.k4avu.webs.com>.

miserably at higher frequencies if they're more than a few feet long.

Wide availability: Unlike traditional RG-8/RG-58, you can find good quality RG-6 just about everywhere – even at Wal-Mart (which is amazingly handy for middle-of-the-night runs for coax and contesting snacks!).

Easy-on connectors: Because RG-6, like its little brother RG-59, is designed to use crimp-on “F-style” connectors, attaching them is a breeze and requires no voodoo. With a variety of readily available adapters you can transform an F connector into a PL-259, a BNC or whatever you need.

Look Ma - No Solder!

Correctly soldering PL-259 connectors to the ends of 50-ohm coaxial cables can be pure torture. The procedure, in a variety of variations, is documented in dozens of radio handbooks and web sites, but making high-quality cable ends is just plain difficult unless you are taught (in the flesh by another expert) a good technique and practice it *regularly*. If you're making a few cables here and there using el-cheapo connectors and “bargain coax” – forget it. Literally!

If you're at all like me, you hate soldering PL-259 connectors to coax (and let's not talk about N connectors and BNCs). Although I can *usually* do an okay job if I use high-quality components, I still don't like the process, especially because I don't perform it frequently enough to stay consistent. Like many hams, I used to simply buy manufactured cables! That's fine for indoor jumpers, but what about antenna installations?

Confession time: I now use RG-6 sat cable, attach a high-quality crimp connector with a heavy crimping tool (about \$20 on eBay and elsewhere) and add adapters as needed. It's fast, easy, and it works well.

Traditionalists may launch into rarified dissertations about the connectors adding “impedance bumps” or the cable's heretical 75-ohm impedance, but unless you're making phasing harnesses or coaxial impedance-matching lines, it doesn't really matter. Not even a bit!

For typical amateur radio transmission lines, 75 ohms is close enough to 50 ohms for just about any purpose. Many of the antennas we assume to have 50-ohm feed-point impedances actually match better to 75-ohm coax. Similarly, we assume that our rigs are designed to work into 50-ohm loads, but what if your specific final amplifier actually likes 40 ohms better? Or 67 ohms? And your receiver won't even notice such an insignificant difference.

When it comes to power handling, in my experience, RG-6 can easily handle 100 watts of RF at any feed line SWR (and probably a lot more). In installations with low feed line SWRs, 300 to 500 W should be no problem, even at 6 meters. On 160 through 40 meters, you could probably safely make that 1000 watts, as some hams have reported doing on internet blogs, etc. Above 100 watts, connectors and adapters affect power-handling capabilities much more than the voltage breakdown and thermal capacity of the cable itself.

If you need to run more power or require less attenuation, consider RG-11, RG-6's older brother. Essentially, it's RG-6 on steroids. You'll need crimp connectors and crimping tools sized to fit, and the beefier cable is more expensive, but it offers nearly double the performance, especially at the higher end of the frequency scale. See Table 1 for a comparison.

Some RG-6 cable intended for use in satellite TV installations has an added bonus – a separate, insulated “ground wire” molded into the outer jacket. Designed to connect outdoor satellite dishes to grounding blocks and ground rods, this heavy-gauge wire can be used to provide dc to remote antenna feed points, outdoor relay boxes or outdoor auto-couplers. Until I switched to a battery-powered unit, I powered my external coupler for years via this handy wire (12 V dc on the wire and the coaxial shield, RF on the coaxial inner conductor and the outer shield). See the photo.

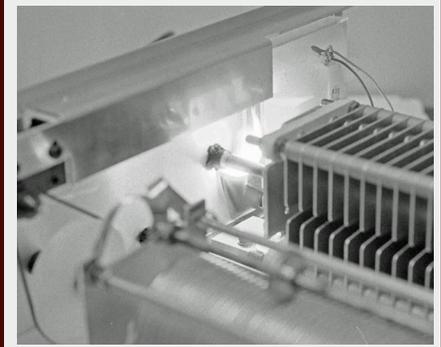
I started using RG-6 for all of my coax-fed antennas several years ago, but I was initially reluctant to give it a try. An internet search and in-person discussions with bona fide experts convinced me to forge ahead. I've never looked back, and it's clear that more and more hams are enjoying the benefits and the flexibility of good-quality, low-cost RG-6 sat cable for feeding ham antennas (scanner and SWL antennas, too).

If you're looking for price, performance and convenience – which are rarely found together – give RG-6 a try! – NTOZ

TABLE 1

Typical Coaxial Cable Signal Loss in dB per 100 ft for Matched Loads

Freq.	RG-58	RG-8X	RG-8U	RG-6	RG-11
1 MHz	0.4	0.5	0.2	0.2	0.2
10 MHz	1.4	1.0	0.6	0.6	0.49
50 MHz	3.3	2.5	1.6	1.4	0.8



This isn't a ghostly apparition – it's an antenna tuner that starts on fire every time you press the key! I described the incident in February's discussion of antenna tuners and was surprised when I recently discovered my 20-year-old, thought-to-be-lost photo. The tuner, rated for a kW but running only 100 W for the photo, worked just fine on 80-10 meters but its balun suffered from voltage breakdown when trying to match high-SWR loads on 160 meters. Many tuners will arc and spark under these conditions, which can produce RF voltages north of 10,000 V, but this is the only one I've ever seen that could produce a flame on command. Naturally, we “tested” it about 50 times in a row! (NTOZ photo)

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Whatever Happened to TVRO?

You'd have to be nearly eligible for your first Social Security check to know what TVRO stands for. *TeleVision Receive Only earth terminal* was the name the FCC gave to the large (typically 16 foot diameter), metal, parabolic satellite TV dishes required to pick up the very few domestic, low powered, communications satellites in geosynchronous orbit in the late 1970s. Despite the fact that these were receive-only dishes, the FCC required them to be licensed. A few years later, so many dishes were being installed coast to coast that, as they did with CB radio licenses, the Commission threw in the towel. By the late 1980s more than 90,000 TVRO dishes were being installed each month nationwide.

Despite the fact that these satellite TV systems were expensive (\$2,500 to \$7,500 installed) and required professional installation as well as an unending stream of service calls, they were wildly popular, especially in rural areas not served by any cable-TV franchise. But, by the late 1990s TVRO systems were giving way to the far more aesthetically pleasing 18" direct broadcast satellite TV systems of DISH Network and DirecTV. Unlike the big dish, these little dishes could be mounted on balconies, window ledges, gable-ends, and roof-tops, no real estate required. And, without any moving parts, the little dish was virtually service-free.

❖ Return of the Satellite TV Hobby

What had started out in the 1970s as an experimental frontier for amateur radio operators and electronics hobbyists had turned into a major American industry, turning many millions of dollars in the U.S. economy. In the beginning, most dishes and receivers were made in the U.S. Receiver design; dish construction, feed horn assemblies and actuator motors were all American made and provided hundreds of thousands of fulltime jobs across the country. There are those who spent their entire careers over the last 35 years in the home satellite TV industry.

The big dish industry led the way in electronic innovation, and those viewers were the first to enjoy HDTV broadcasts, years before most local cable companies or small dish satellite TV offered them. But, once the little dish took hold, the old-fashioned, big-dish satellite TV systems began to disappear. Now the only cable-TV fare available is via a digital receiver that delivers only standard definition digital signals of a limited number of cable channels.

The good news is that big-dish TVRO has returned to its hobby roots. Those who started out with a big dish early on, because of their interest in the technology and the non-cable-TV aspects of satellite transmissions, continue to enjoy an amazing assortment of viewing and listening opportunities. Additional good news is that reception equipment, dish, feed horn and receiver, are still widely available at remarkably low prices and often free.

Over the years several million big dishes ended up at metal scrap yards, since most mesh dishes were almost entirely aluminum. They were scrapped for cash when the market for such dishes dried up and the scrap metal market soared. Many "orphaned" big dishes can still be had for the asking, with owners happy not to have to do the disposing themselves.



Traxis DBS-4000 FTA receiver (\$130) from Skyvision offers SD FTA reception. (Courtesy: Skyvision)

The biggest change over the years, as with virtually all broadcast technology, is that most satellite transmissions are digital, with many encrypted and others in the clear or Free-to-Air (FTA). The FTA part of the hobby never slowed down. Complete FTA satellite TV reception systems cost under \$200 and are capable of tuning both C and Ku-band FTA signals. And, while most systems are intended for Ku-band reception (using 1 meter dishes), they can easily be used with a big dish system as well. Several long-time satellite TV sales sources are still around (see resources list) and sell this gear.

For years the FTA part of the hobby had been associated with the illegal activity of using hacked receivers to let the user watch DISH or DirecTV programming without paying. But, a crackdown by the two satellite services on such activities and rigorous legal pursuit has resulted in the arrest and imprisonment as well as heavy fines of those involved. In addition, the move to MPEG4 technology on the part of DISH and DirecTV has further reduced such activities.

Thanks to FCC rules, anyone wishing to watch or listen to FTA satellite programming may do so, regardless of whatever Home Owners Association or local municipal regulations are in



TC-1000HD (PVR)

DVB-S2 Premium Kit

Pansat TC-1000HD (\$370) from Global Communications receives satellite and terrestrial HD FTA signals. (Courtesy: Pansat USA)

place. You have a right to install a dish of 1 meter diameter or less on any part of property that you have full control over, even if you are only renting, including balconies, patios, window ledges, or front steps. You may be intimidated by the local "sight police," whose job it is to remove items that offend their eyes, but you have the right to such devices.

❖ What you can See and Hear

In order to fully access the universe of interesting TV and radio programming found among the domestic satellites over North American skies, you'll still need a big motorized dish. And to get the most out of your system, you need to be able to see both C and Ku-band satellites. While there are still a few analog C-band channels that may be tuned in with even the oldest receivers still functioning, most will require an FTA receiver. The problem is that such receivers are not designed to drive the dish mover or actuator. But, just about any used analog receiver will be able to do that. Hooking up your FTA receiver to an analog receiver/dish actuator is the only way to see and hear it all.

One of the premier sources of international radio news is World Radio Network (www.wrn.org) which rebroadcasts many long-time international shortwave stations, some of which are no longer broadcasting on shortwave, such as Radio Prague and Radio Sweden. You'll also hear RTE Ireland, Radio Netherlands, Radio Australia, Voice of Russia and many more. You can set up a cheap FTA 1 meter system on Galaxy 19 at 97° W and listen to WRN programming 24/7. For a complete schedule of WRN programming go here:

www.wrn.org/listeners/assets/PDFs/WRN_NAM1_-_Winter_2010-11.pdf

And, while you're set up on G19 you'll also get the video feeds from Russia Today, Al Jazeera's English service, Press TV (Iran), and MHz Networks (a D.C.-based public TV broadcaster making a line-up of foreign TV broadcasts from Japan, Germany, France, South



DiSeqC switch (\$13 plus shipping) connects up to four fixed-mount dishes to one run of coax into your house. Switching from satellite to satellite is done with the FTA receiver's remote control. (Courtesy: Sadoun Satellite)

Asia, Taiwan and China available all day.

I have one small dish set up on listener supported WCVE-FM, Raleigh-Durham, North Carolina which broadcasts the best classical music 24/7. I have another set up on G19 for its video and audio. Using a DiSeqC (Digital Satellite Equipment Control) switch out at the dish site I can go from one dish to the other using the remote control on the FTA receiver. All FTA receivers are set up to do this. With a couple of small dishes aimed at your favorite satellites you don't need a dish mover, the signals are switched instantly.

One of the big pluses of FTA TV is full time (and full HD if you are using an HDTV FTA receiver) NASA programming. You get live mission coverage plus special space-related programs produced by NASA. And, if you can swing your C-band dish over to Intelsat 805 at 55.5° W, you can tune in BBC World Service radio along with many Latin American TV and radio channels. A list of the latest channel lineup for C and Ku-band satellites in the Atlantic region is found here: www.global-cm.net/MPEGlistATL.html

❖ 4DTV: Not Dead Yet

Meanwhile, the old 4DTV satellite TV receiver system is still clinging to life. 4DTV's maker, Motorola, is a company that has long been at the forefront of electronic technology. Their various divisions have pioneered public service radio systems, personal cell phones as well as cable and satellite TV technology. I first wrote about Motorola's 4DTV satellite receiver in *MT* in 1997. Its astounding feat was that it offered analog and digital satellite reception and would serve as a transition between the old and the new in broadcast satellite technology. The company swung the entire cable TV industry toward the use of its proprietary DigiCipherII encryption system and basically drove the competition out of the market.

But, over the last 14 years broadcast and cable TV services adopted a combination of DigiCipher and Digital Video Broadcast (DVB) standards which, while not compatible, could be combined at any cable headend to downlink satellite signals for rebroadcast on any cable TV system. While both systems use the MPEG2 video and audio standard, Motorola has slowly

lost dominance (some would say interest) in the industry. As a result it's been years since any new 4DTV receivers have been made and those available now are refurbished.

The slow shrinking of the backyard satellite TV market culminated in the last of the programming providers throwing in the towel December 31, 2010. Except, that is, for Skyvision, the lone provider of cable programming and decades-old source of big dish equipment. Working with Programming Center (www.programming-center.net), Skyvision has made it possible for the last remaining tens of thousands of 4DTV owners to continue to use their systems. Details on making the switch to the new service are found on the Programming Center's web site. Setting up the new system is very easy and clearly explained.

One big benefit from making the switch is having access to the 39 commercial-free DMX music channels, which include classical, classic jazz, coffeehouse rock, country, blues, new age and classic rock channels, among others. Another benefit is being able to choose from 16 popular cable TV channels on a \$6 per month subscription basis, picking as few as one channel – something you'll never get on any cable or satellite TV service. Movie channels from Starz and Encore are also available. Sorry, no ESPN or Weather Channel. The new service features an on-screen programming guide, but it's not interactive. However, you can put together a custom TV guide by going to www.titantv.com. On the set-up prompt, choose C-band and your time zone.

While it's difficult to know how long Skyvision/Programming Center's service will last, as long as enough subscribers are signed up, the company will be able to afford to lease full-time C-band transponders for the services. But, subscribers may purchase programming for as little as one month at a time, and being the sole service provider does give them an edge in the market!

RESOURCES

SATELLITE TV EQUIPMENT DEALERS:

- Global Communications www.global-cm.net 608-546-2523
Specializes in Ku-band FTA equipment but sells C-band dishes as well as multi-feed Ku-band dishes. Has the most up to date list of all C and Ku-band channels on all domestic, Pacific Rim and Atlantic region satellites that can be seen from U.S. coasts. It's indispensable and can be found here: www.global-cm.net/mpeg2central.html
- Sadoun Satellite Sales www.sadoun.com 888-519-9595
Offers a huge selection of mostly FTA Ku-band equipment and parts at good prices.
- Skyvision www.skyvision.com 800-500-9275
Last remaining cable-TV program provider and exclusive seller of Motorola DSR410 receiver. Offers C and Ku-band FTA equipment and hard to find parts for older TVRO systems as well as close-outs and clearance items. Good source of new 10 foot black mesh dishes.

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PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

Fred Waterer

fredwaterer@monitoringtimes.com

www.doghousecharlie.com/radio

March Delight

This month we shine the *Programming Spotlight* on a number of topics, including Internet Radios, remembering an old friend from the Voice of Russia, the New Capitalists and Culinary Delights from Around the World.

❖ The Migration to the Internet

Many stations are leaving the shortwave bands but remain audible via the internet. My friend Roger Chambers in Utica, NY recently dropped me a line to tell me, "I now have a Crane Internet Radio (the past two days) and it is wonderful! Many of the stations I used to hear on SW without interference, FM quality. **Radio Educacion** in Mexico, and now **Radio Tarqui** in Ecuador. This is after about 2-3 years of less and less SW, to next to *no* SW the past three months."

I have to agree with Roger that it is wonderful to hear some stations that I have listened to for decades, now in near CD quality. I use my computer to listen to these internet streams, but these internet radios seem to be the "wave" of the future. Looking back, it's rather cool to see how far we have come in the past 20 or 30 years.

In 1986 when I began writing for the then *DX Ontario*, I used a manual typewriter with a newly purchased ribbon each month and cut and pasted the images myself into the document. At that time, shortwave *was* the internet, and it took weeks to get printed schedules from stations to maybe hear programs depending on reception conditions. Now, all this information is a few clicks away.

Don't get me wrong, those were fun times and there are aspects of that era that I miss. However, it's also interesting to be alive today when one can do a quick Google search, click some links, and find live coverage of the recent flooding in Australia, or a music program from the Czech republic, or the unique perspectives from countries like Iran. Good times then, good times now.

❖ Rest in Peace, Carl Watts

"The thing is that I like coming to the radio," Carl Watts says. "Honestly, this is not a propaganda thing, I come to the radio, because I'm going to meet very good people here – my closest friends. People I can joke with. We talk about our work and everything else, and I

can say that I try to give everything I have to the radio." This is one of the opening paragraphs of an article about Carl from 2005.

Carl Watts, also known for many years as **Carl Yegorov**, was an institution at the **Voice of Russia** and its predecessor **Radio Moscow** for half a century. To long-time listeners, his voice was as familiar as that of **Joe Adamov**, **Lucy Pravdina** or **Estelle Winters**.

I only knew Carl through his radio programs, but well-known listener Maryanne Kehoe was a friend. I asked her for a comment about Carl, and she sent this: "Yes! Carl was a dear friend, we could talk about anything and I always told him that I 'looked forward to continuing our conversation from last time.' The last time I saw him was in 2002, the week of the Moscow theatre siege, and his first question



Carl Watts

was if I was staying as far away as possible from the area; in fact I was about 5 miles away. Carl will be very much missed. – I have lost a dear friend."

Carl led a very interesting life. Born in Winnipeg, Canada to Russian-speaking immigrant parents (from Ukraine), he grew up a typically Canadian kid, with interests in history, geography and music (he took violin lessons). And of course he played hockey! This hockey background would later prove crucial, as he related later, "here in Moscow, somebody heard my voice, and they invited me to do the announcements in English at the stadium."

He was the PA announcer at the famous Canada-Russia hockey summit in 1972. (As a side note, for Canadians like me, this series was a defining moment, Canada's "where were you when..." moment. Four games were played in Canada, four in the USSR. All Canadians assumed that this would be a cakewalk and that, when the Soviets played our professional stars, they would be humiliated. Instead, the Canadians flew to Moscow down two games to one with one draw. However in Moscow, Team Canada won the last three matches to win the series on a goal in the dying seconds by Paul Henderson. Also of note, that final goal was the last time that Foster Hewitt, the father of hockey broadcasting would ever utter the phrase for which he was



immortalized: "He Shoots, He Scores!!" and Carl was there!)

Carl also had the distinction of serving in both the Royal Canadian Air Cadets and the Red Army! Carl's parents returned to the USSR in the late '40s, and he and his brother George returned in the early '50s. A few short years later, because of their proficiency in English, both ended up working for Radio Moscow.

"In my younger days I used to do simultaneous interpretation," Carl Watts goes on to say recalling his work at the radio. "I used to interpret some 'pretty big names.' The first one was Minister of Culture Furtseva, and then Primakov, Gorbachev, and other names. Although you feel that you know the language, but still your knees are shaking. And, after it's all over, you feel good."

In more recent years, Carl was host of **Jazz Show**, a favorite among listeners of the **Voice of Russia**. It's hard to think of **Voice of Russia** and not think of Carl Watts. He will be missed. There seem to be a lot of new voices at the station, but I do hope that they keep **Jazz Show** in some form.

❖ The Story of Pop

For many years, **BBC 6Music** (heard online here in Canada) has offered some sort of music documentary every night/morning at 3am local time. Since these programs are archived for 7 days there is no need to listen "live" as it were, but one can listen at one's leisure. Personally, I like to listen to a bunch of these in a row.

In January they started airing the marathon, "**Story of Pop**," which was originally broadcast over 50 weeks. Yes, 50 one-hour programs! For music fans this is a great listen. While this series will be pretty much wrapped up by the time you read this, it comes up a couple of times per year.

Even if you miss it this time, every night there is some sort of pop/rock-oriented program well worth hearing. It may be the story of The Beatles over several days, Elvis Presley, the Rolling Stones, the Story of Reggae – you name it and it will come up eventually. So be sure to have a look at the **BBC 6Music** website, and see what's on offer...your ears will thank you. www.bbc.co.uk/6music/programmes/schedules

❖ Hits in Germany

In January, **Deborah Freedman** stepped away from host duties of this delightful program from Deutsche Welle. "Deborah was regular host/editor of **Hits in Germany** from 2000-2010

and in that time also produced the monthly chart round-up feature for Deutsche Welle's youth lifestyle programme **Pulse**. After a decade reporting on the ups and downs in the German Top 100, Deborah has stepped down from her full-time position behind the **Hits in Germany** mic but still occasionally pops up hosting special editions of the programme."

The new host of **Hits in Germany** is **Neil Litolis** (sp?), who speaks with a British accent, giving the program a bit of a Europop feel. This reporter really enjoyed Deborah's style, but she seems to be leaving the program in very good hands. Give it a listen any time at www.dw-world.de/dw/0,,4703,00.html

❖ The New Capitalists

Two countries, which have even in recent history railed against capitalism, are now its biggest exponents! This dramatic change is reflected in their programming output. In news broadcasts, one used to hear breathless (and sometimes improbable) reports on economic output as an example of the triumph of socialism. Nowadays, one is more likely to hear the latest figures from the Moscow or Shanghai Stock Exchanges.

China Radio International - Biz China

"There is a serious tendency towards capitalism among the well-to-do peasants. This tendency will become rampant if we in the slightest way neglect political work among the peasants during the co-operative movement and for a very long period after." From: Introductory note to "A Resolute Struggle Must Be Waged Against the Tendency Towards Capitalism" (1955), The Socialist Upsurge in China's Countryside, Chinese ed., Vol. I. By Mao Zedong.

Listening to **CRI** these days it's clear that Mao's heirs have "neglected their political work." China is "open for business" in a remarkably capitalist way. In 2006 when **CRI** was featured in *Programming Spotlight*, the only Chairman who made an appearance during a week of listening was not Mao, but the Chairman of the Board, Frank Sinatra!

Listen on Tuesdays to hear **Biz China**, "CRI's answer to the growing demand for business and financial news in the Chinese market." (Biz China web page)

It's hard (in fact it's impossible!) to imagine the **Radio Peking** of Mao's day broadcasting a report on "(the realization by people) that collecting art works not only provide aesthetical pleasure, but also help increase their wealth." Other reports suggested that the robust growth of the Chinese auto industry might slow in 2011; the cinema industry could be a catalyst for economic growth and about how China's aging population creates a business boom. No little red books of Mao quotations to be seen. With the Chinese economy booming, no red ink anywhere! **Biz China** is an interesting perspective on the World's new economic superpower. <http://english.cri.cn/cribb/programs/biz.htm>

Voice of Russia - Russia Business Report

"Russia Business Report brings you all the latest business and economic news from

Russia and the countries of the former Soviet Union. Here you can find the biggest stories on mergers, IPOs energy production and macroeconomic data from the region. Experts often stop by to discuss the day's events and offer insight to what's going on in one of the world's most strategically important regions" (Russia Business Report Web Page)

Not a single report was heard in recent weeks on tractor production, but many reports looked at stocks and bonds, monetary policy, tax reform and mergers.

So far this "radio program" seems to be strictly web-based. If past experience is any measure, these programs that start out on the web site tend to find their way into the radio schedule. Time will tell. http://english.ruvr.ru/radio_broadcast/34718245/

❖ Food, Glorious Food

One thing we cannot do without is food. (Although getting over a bout of stomach flu tends to make me disagree.) One of my favorite all-time songs is "Hungarian Goulash No. 5" by Allan Sherman. I was listening to the song on youtube the other day and started thinking about culinary programs around the world on radio. Here's a look at a few of them.

Czech Republic

While **Radio Prague** does not have a food program per se, a lot of programs tend to swerve into topics like food. One thing on which Czechs are experts (just like Ontario DX Camps) is beer. This page <http://old.radio.cz/en/article/46095> will take you to a page full of links about everything you ever wanted to know about beer, Czech or otherwise. At Christmastime, **Radio Prague** will also tell you about their peculiar Christmas dinner treat, Carp. To each his own.



Korea

At the end of every UTC Wednesday broadcast of **KBS World**, one can hear *Happy Cooking and Healthy Eating*, the culinary program. Each week, KBS presenters introduce you to such Korean dishes as Yaksik (Rice cooked with honey), Yukgaejong (a beef soup) and Baeksoelgi, a type of rice cake. If you miss a program,



the audio, and recipes with instructions for each dish are available at the **KBS World** website for some time back. Not just a recipe program, *Happy Cooking and Healthy Eating* also includes health tips on such things as exercise and the health benefits of foods such as chestnuts. Listen online at http://rki.kbs.co.kr/english/culturelife/culturelife_kfoodrecipe_list.htm or listen at UTC Wednesdays at 1245 on 9650 kHz, or 0245 on 9580 kHz.

Romania

The Cooking Show comes to you from **Radio Romania International**. One of the newer shows from **RRI**, it provides a culinary tour of Romania that is well worth hearing. For a nation that has a reputation for being rather bland (as a result of the years of the Ceaucescu dictatorship), Romanians enjoy a colorful and tasty diet indeed. *The Cooking Show* can be heard every second UTC Saturday with such Romanian delights as Bean Soup in a Bread Bun, Sarmale, Sour Cabbage Rolls Stuffed with Mincemeat, and Home Made Chocolate. Check out the recipes at www.rri.ro/cat.shtml?lang=1&sec=602 and listen UTC Saturdays (bi-weekly) online or at 0100 UTC on 6145 and 7315 kHz; 0400 on 6130 and 7305 kHz.

BBC Radio 4

The **BBC** seemingly has a program on every topic under the sun. While most **BBC** food programming is limited to television, one favorite is *The Food Programme* on **BBC Radio 4**. This is definitely NOT a recipe program; however, it is a fascinating look at food and the food industry from a journalistic perspective.

The program is hosted by **Sheila Dillon**, a food journalist for over three decades, who has been with the program for 20 years, as a reporter, producer and now presenter. She looks at issues like cut-price foods and how they hurt the growers, gadgets, pub food and its health benefits (or otherwise) and a review of Food Writing in 2010. Fascinating stuff. Listen online to the latest edition and some recent past editions at www.bbc.co.uk/programmes/b006qnx3



❖ Programming Advance Notice

Many stations and programs will send you advance programming information weekly (or even daily), delivered right to your e-mail inbox. Each month we'll highlight one of these newsletters and tell you how to get it, so you don't miss out on a program of interest.

Radio Australia and the **ABC** domestic services offer many email newsletters of interest to the listener. You can subscribe at www.radioaustralia.net.au/services/email_subscribe.htm and www.abc.net.au/corp/email_newsletter/multi-subscribe.htm Never miss another show!



HOW TO USE THE SHORTWAVE GUIDE

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af
 ① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Standard Time) 5, 6, 7 or 8 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

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

FIND THE STATION YOU WANT TO HEAR

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

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

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

CHOOSE PROMISING FREQUENCIES

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

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

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

print deadline.

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

Target Areas

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

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

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Thank You to ...

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

Alokesh Gupta, New Delhi, India; Hans Johnson/WINB; Dino Bloise, FL; Dragan Lekic, Serbia; Eduardo Peñailillo, Santiago Chile; Jeff White/WRMI; Mike Barraclough, UK; Ivo Ivanov/Radio Bulgaria; Tom Taylor, UK; Ron Howard, CA; Sean Gilbert, UK/WRTH; Wolfgang Büeschel, Stuttgart, Germany; Yimber Gaviria, Colombia; Rachel Baughn/MT; Rich D'Angelo/NASWA-Flash Sheet, NASWA-Journal.

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 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
- Note 4

"MISSING" LANGUAGES?

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

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

0000 0030	Egypt, Radio Cairo	11590am	
0000 0030	USA, Voice of America	7560af	
0000 0045	India, All India Radio	6055as 7305as	
	9950as 11645as 13605as	9705al	
0000 0057	Canada, Radio Canada International	9880af	
0000 0057	China, China Radio International	6005eu	
	6020eu 6180eu 7350as	7425eu	
	9425as 9570as 11650as	11790eu	
	11885eu		
0000 0058	Germany, Deutsche Welle	9445as	9785as
0000 0100	Anguilla, Worldwide Univ Network		6090am
0000 0100	Australia, ABC NT Alice Springs		4835do
0000 0100	Australia, ABC NT Katherine	5025do	
0000 0100	Australia, ABC NT Tennant Creek		4910do
0000 0100	Australia, Radio Australia	9660pa	12080pa
	13690pa 15240as 15415as	17715pa	
	17750as 17795pa		
0000 0100	Bahrain, Radio Bahrain	6010me	
0000 0100	Bulgaria, Radio Bulgaria	5900na	7400na
0000 0100	Canada, CFRX Toronto ON	6070na	
0000 0100	Canada, CFVP Calgary AB	6030na	
0000 0100	Canada, CKZN St Johns NF	6160na	
0000 0100	Canada, CKZU Vancouver BC		6160na
0000 0100	Germany, Deutsche Welle	11855as	
0000 0100	Malaysia, RTM/Traxx FM	7295do	
0000 0100	New Zealand, Radio NZ International		15720pa
0000 0100	New Zealand, Radio NZ International		13730pa
0000 0100	Russia, Voice of Russia	6240na	7250na
0000 0100	Spain, Radio Exterior de Espana		5970na
0000 0100	Thailand, Radio Thailand World Service		13745na
0000 0100	UK, BBC World Service	5970as	6195as
	7360as 9410as 9740as		
0000 0100	USA, American Forces Network		4319usb
	5446usb 5765usb 7812usb	12133usb	
	12759usb 13362usb		
0000 0100	USA, EWTVN/WEWN Irondale, AL		11520me
0000 0100	USA, FBN/WTJC Newport NC		9370na
0000 0100	USA, WBCQ Monticello ME	5110na	7415am
	9330am		
0000 0100	USA, WHRI Cypress Creek SC		5875 ma
	7315na		
0000 0100	USA, WHRI Cypress Creek SC		5920na
0000 0100	USA, WINB Red Lion PA	9265am	
0000 0100	USA, WRNO New Orleans LA		7505am
	15590al		
0000 0100	USA, WTWW Lebanon TN	9479va	
0000 0100	USA, WWCR Nashville TN	5070na	9980na
	13845na		
0000 0100	USA, WWRB Manchester TN	3215na	6890va
0000 0100	USA, WYFR/Family Radio Worldwide	5950am	
	6085am 7360sa 9505am	11720ca	
	11730ca 15440am		
0004 0100	Canada, Radio Canada International		9755na
0030 0100	UK, Bible Voice Broadcasting Network		5950as
0030 0100	USA, Voice of America/Special English		6170va
	9325va 9490va 9715va	11695va	
	12005va 15185va 15205va	15290va	
0030 0100	USA, WHRI Cypress Creek SC		15680na

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

0100 0104	Canada, Radio Canada International		9755na
0100 0130	Vietnam, Voice of Vietnam	6175am	
0100 0157	China, China Radio International		6005eu
	6020eu 6075eu 6175eu	7350eu	
	9410as 9420as 9570as	9580as	
	11650eu 11885eu		
0100 0157	China, China Radio International		6080na
0100 0157	North Korea, Voice of Korea	7220as	9345as
	11735am 13760sa 15180sa		
0100 0200	Anguilla, Worldwide Univ Network		6090am
0100 0200	Australia, ABC NT Alice Springs		4835do
0100 0200	Australia, ABC NT Katherine	5025do	
0100 0200	Australia, ABC NT Tennant Creek		4910do
0100 0200	Australia, Radio Australia	9660pa	12080pa
	13690pa 15240as 15415as	17715pa	
	17750as 17795pa		
0100 0200	Bahrain, Radio Bahrain	6010me	
0100 0200	Canada, CFRX Toronto ON	6070na	
0100 0200	Canada, CFVP Calgary AB	6030na	
0100 0200	Canada, CKZN St Johns NF	6160na	
0100 0200	Canada, CKZU Vancouver BC		6160na

0100 0200	Cuba, Radio Havana Cuba	6000na	6050na
0100 0200	Malaysia, RTM/Traxx FM	7295do	
0100 0200	New Zealand, Radio NZ International		15720pa
0100 0200	New Zealand, Radio NZ International		13730pa
0100 0200	Romania, Radio Romania International		6145na
	7355na		
0100 0200	Russia, Voice of Russia	6240na	7250na
0100 0200	Serbia, International Radio of Serbia		6190na
0100 0200	Taiwan, Radio Taiwan International		11875as
0100 0200	UK, BBC World Service	5940as	5970as
	9740as 11750as		
0100 0200	Ukraine, Radio Ukraine International		7440na
0100 0200	USA, American Forces Network		4319usb
	5446usb 5765usb 7812usb	12133usb	
	12759usb 13362usb		
0100 0200	USA, EWTVN/WEWN Irondale, AL		11520me
0100 0200	USA, FBN/WTJC Newport NC		9370na
0100 0200	USA, Voice of America	7325va	9435va
	11705va		
0100 0200	USA, WBCQ Monticello ME	5110na	7415am
	9330am		
0100 0200	USA, WHRI Cypress Creek SC		5875na
	7315na 15680na		
0100 0200	USA, WHRI Cypress Creek SC		5920na
0100 0200	USA, WINB Red Lion PA	9265am	
0100 0200	USA, WRNO New Orleans LA		7505am
0100 0200	USA, WTWW Lebanon TN	5755va	
0100 0200	USA, WWCR Nashville TN	4840na	5935na
	7490na 9980na		
0100 0200	USA, WWRB Manchester TN	3185va	3215na
	6890va		
0100 0200	USA, WYFR/Family Radio Worldwide		6100ca
	7445am 9505am 15440am		
0104 0200	Canada, Radio Canada International		9755na
0130 0145	Albania, Radio Tirana	6130na	
0130 0200	Iran, VOIRI/IRIB	6120na 7250na	
0130 0200	Slovakia, R Slovakia Intl/WRMI		9955ca
0130 0200	Sri Lanka, SLBC	6005as 9770as	15745as
0130 0200	USA, Voice of America/Special English		5960va
	7465va		
0140 0200	Vatican City State, Vatican Radio		5895va
	7335va		

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

0200 0204	Canada, Radio Canada International		9755na
0200 0227	Iran, VOIRI/IRIB	6120na 7250na	
0200 0230	Thailand, Radio Thailand World Service		15275na
0200 0257	China, China Radio International		11785as
	13640as		
0200 0257	North Korea, Voice of Korea	13650as	15100as
0200 0300	Anguilla, Worldwide Univ Network		6090am
0200 0300	Argentina, RAE	11710na	
0200 0300	Australia, ABC NT Alice Springs		4835do
0200 0300	Australia, ABC NT Katherine	5025do	
0200 0300	Australia, ABC NT Tennant Creek		4910do
0200 0300	Australia, Radio Australia	9660pa	12080pa
	13690pa 15240as 15415as	15515as	
	17750as 21725va		
0200 0300	Bahrain, Radio Bahrain	6010me	
0200 0300	Canada, CFRX Toronto ON	6070na	
0200 0300	Canada, CFVP Calgary AB	6030na	
0200 0300	Canada, CKZN St Johns NF	6160na	
0200 0300	Canada, CKZU Vancouver BC		6160na
0200 0300	Cuba, Radio Havana Cuba	6000na	6050na
0200 0300	Egypt, Radio Cairo	6270na	
0200 0300	Indonesia, Voice of Indonesia/Jawa Barat		
	9525va 15150va		
0200 0300	Malaysia, RTM/Traxx FM	7295do	
0200 0300	New Zealand, Radio NZ International		15720pa
0200 0300	New Zealand, Radio NZ International		13730pa
0200 0300	Philippines, PBS/ Radyo Pilipinas		11880me
	15285me 17710me		
0200 0300	Russia, Voice of Russia	6240na	7250na
0200 0300	South Korea, KBS World Radio		9580sa
0200 0300	Sri Lanka, SLBC	6005as 9770as	15745as
0200 0300	Taiwan, Radio Taiwan International		5950na
	9680ca		
0200 0300	UK, BBC World Service	5875me	5940as
	7445af		
0200 0300	USA, American Forces Network		4319usb
	5446usb 5765usb 7812usb	12133usb	
	12759usb 13362usb		
0200 0300	USA, EWTVN/WEWN Irondale, AL		11520me
0200 0300	USA, FBN/WTJC Newport NC		9370na

0200 0300	USA, KJES Vado NM	7555na	
0200 0300	USA, WBCQ Monticello ME 9330am	5110na	7415am
0200 0300	USA, WHRI Cypress Creek SC	5875na	
		5920na	7315na 7385na 15680na
0200 0300	USA, WINB Red Lion PA	9265am	
0200 0300	USA, WRNO New Orleans LA	7505am	
0200 0300	USA, WTWW Lebanon TN	5755va	
0200 0300	USA, WWCR Nashville TN	3215na	4840na
		5890na	5935na
0200 0300	USA, WWRB Manchester TN	3145va	3185va
		5050va	
0200 0300	USA, WYFR/Family Radio Worldwide	5930sa	
		5985ca	6885ca 6890ca 7455am
		9505am	9525am
0215 0227	Nepal, Radio Nepal	5005as	
0230 0255	China, Voice of the Strait (News Channel) Fuzhou	9505do	
0230 0300	Vietnam, Voice of Vietnam	6175am	
0245 0300 twhf	Albania, Radio Tirana	6130na	
0245 0300	Australia, HCJB Global Australia	15400as	
0250 0300	Vatican City State, Vatican Radio	7305am	6040am
0250 0300	Zambia, Zambia Broadcasting Corp		6165do
0255 0300 Sun	Swaziland, TWR Swaziland	3200af	

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

0300 0310	Pakistan, Azad Kashmir Radio/Islamabad	7265do	
0300 0310	Pakistan, Azad Kashmir Radio/Rawalpindi	4790do	
0300 0315	Croatia, HRT Voice of Croatia	3985eu	
		7375am	
0300 0320	Vatican City State, Vatican Radio	15460as	
0300 0325 Sun	Swaziland, TWR Swaziland	3200af	
0300 0330	Philippines, PBS/ Radyo Pilipinas	15285me	17710me
0300 0330	Sri Lanka, SLBC	6005as	9770as 15745as
0300 0330	USA, KJES Vado NM	7555na	
0300 0330	Vatican City State, Vatican Radio	9660af	
0300 0330 DRM	Vatican City State, Vatican Radio	9660af	
0300 0357	China, China Radio International	6190na	
		9460na	9690as 9790as 11785eu
		13620as	15110as 15120as
0300 0357	North Korea, Voice of Korea	7220as	9345as
		9730as	
0300 0358	Germany, Deutsche Welle	11695as	
0300 0400	Anguilla, Worldwide Univ Network	6090am	
0300 0400	Australia, ABC NT Alice Springs	4835do	
0300 0400	Australia, ABC NT Katherine	5025do	
0300 0400	Australia, ABC NT Tennant Creek	4910do	
0300 0400	Australia, Radio Australia	9660pa	12080pa
		13690pa	15240as 15415as 15515as
		17750as	21725va
0300 0400	Bahrain, Radio Bahrain	6010me	
0300 0400	Bulgaria, Radio Bulgaria	5900na	7400na
0300 0400 twhf	Canada, CBC Northern Quebec Service	9625na	
0300 0400	Canada, CFRX Toronto ON	6070na	
0300 0400	Canada, CFVP Calgary AB	6030na	
0300 0400	Canada, CKZN St Johns NF	6160na	
0300 0400	Canada, CKZU Vancouver BC	6160na	
0300 0400	Cuba, Radio Havana Cuba	6000na	6050na
0300 0400	Malaysia, RTM/Traxx FM	7295do	
0300 0400	New Zealand, Radio NZ International	15720pa	
0300 0400 DRM	New Zealand, Radio NZ International	13730pa	
0300 0400	Oman, Radio Sultanate of Oman	15355af	
0300 0400	Russia, Voice of Russia	6240na	7250na
		7440na	12030na 12040na 13735na
0300 0400	Slovakia, NEXUS/IRRS SW	9670af	
0300 0400	South Africa, Channel Africa	3345af	6120af
0300 0400	Taiwan, Radio Taiwan International	15320as	6875na
0300 0400	UK, BBC World Service	3255af	5940va
		6100af	6145af 6190af 7255af
		7445af	9410as 9460af
0300 0400	Ukraine, Radio Ukraine International	7440na	
0300 0400	USA, American Forces Network	4319usb	
		5446usb	5765usb 7812usb 12133usb
		12759usb	13362usb
0300 0400	USA, EWTN/WEWN Irondale, AL	11520me	
0300 0400	USA, FBN/WTJC Newport NC	9370na	

0300 0400	USA, Voice of America	4930af	6080af
		9885af	15580af
0300 0400	USA, WBCQ Monticello ME	5110na	7415am
		9330am	
0300 0400	USA, WHRI Cypress Creek SC	5920na	
		7315na	7385na 7590na 15680na
0300 0400	USA, WINB Red Lion PA	9265am	
0300 0400	USA, WRNO New Orleans LA	7505am	
0300 0400	USA, WTWW Lebanon TN	5755va	
0300 0400	USA, WWCR Nashville TN	3215na	4840na
		5890na	5935na
0300 0400	USA, WWRB Manchester TN	3145va	3185va
		5050va	
0300 0400	USA, WYFR/Family Radio Worldwide	5930sa	
		9505am	9930ca 9985ca
0300 0400	Zambia, Zambia Broadcasting Corp		6165do
0330 0400 twhf	Albania, Radio Tirana	6100na	
0330 0400 Sun	Sri Lanka, SLBC	6005as	9770as 15745as
0330 0400	UK, BBC World Service	11860af	
0330 0400	USA, WINB Red Lion PA	9405am	
0330 0400	Vietnam, Voice of Vietnam	6175am	

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

0400 0430 mtwhf	France, Radio France Internationale	7315af	
		9805af	
0400 0455	Turkey, Voice of Turkey	7240as	9655va
0400 0457	China, China Radio International	9460na	13620as 15120eu 17725as
		17855af	
0400 0457	Germany, Deutsche Welle	5905eu	5945eu
		6180af	9450af 15600af
0400 0458	New Zealand, Radio NZ International	15720pa	
0400 0458 DRM	New Zealand, Radio NZ International	13730pa	
0400 0500	Anguilla, Worldwide Univ Network	6090am	
0400 0500	Australia, ABC NT Alice Springs	4835do	
0400 0500	Australia, ABC NT Katherine	5025do	
0400 0500	Australia, ABC NT Tennant Creek	4910do	
0400 0500	Australia, Radio Australia	9590pa	12080pa
		13690pa	15240as 15515as 21725va
0400 0500	Bahrain, Radio Bahrain	6010me	
0400 0500 twhf	Canada, CBC Northern Quebec Service	9625na	
0400 0500	Canada, CFRX Toronto ON	6070na	
0400 0500	Canada, CKZN St Johns NF	6160na	
0400 0500	Canada, CKZU Vancouver BC	6160na	
0400 0500	Cuba, Radio Havana Cuba	6000na	6050na
0400 0500	Malaysia, RTM/Traxx FM	7295do	
0400 0500	Romania, Radio Romania International	6130na	
		7305na	9690as 11895as
0400 0500	Russia, Voice of Russia	6240na	12030na
		12040na	13735naq
0400 0500 DRM	Russia, Voice of Russia	15735as	
0400 0500	Slovakia, NEXUS/IRRS SW	9670af	
0400 0500	South Africa, Channel Africa	7230af	
0400 0500 Sun	Sri Lanka, SLBC	6005as	9770as 15745as
0400 0500	UK, BBC World Service	3255af	6055af
		6190af	7255af 9410as 9460af
		11860af	
0400 0500	USA, American Forces Network	4319usb	
		5446usb	5765usb 7812usb 12133usb
		12759usb	13362usb
0400 0500	USA, EWTN/WEWN Irondale, AL	11520me	
0400 0500	USA, FBN/WTJC Newport NC	9370na	
0400 0500	USA, Voice of America	4930af	4960af
		6080af	9885af 15580af
0400 0500	USA, WBCQ Monticello ME	5110na	7415am
		9330am	
0400 0500	USA, WHRI Cypress Creek SC	5920na	
		7315na	7385na
0400 0500 smtwhf	USA, WHRI Cypress Creek SC	7465na	
0400 0500 Sat	USA, WHRI Cypress Creek SC	9640na	
0400 0500	USA, WINB Red Lion PA	9405am	
0400 0500	USA, WRNO New Orleans LA	7505am	
0400 0500	USA, WTWW Lebanon TN	5755va	
0400 0500	USA, WWCR Nashville TN	3215na	4840na
		5890na	5935na
0400 0500	USA, WWRB Manchester TN	3145va	3185va
		5050va	
0400 0500	USA, WYFR/Family Radio Worldwide	5950am	
		7455am	9505am 9680am 9715am
0400 0500	Zambia, CVC/1 Africa	9430af	
0400 0500	Zambia, Zambia Broadcasting Corp		6165do
0430 0500 twhf	Albania, Radio Tirana	6100na	
0430 0500	Australia, Radio Australia	15415as	

0430	0500	mtwhf	Swaziland, TWR Swaziland	3200af	4775af
0430	0500		USA, WHRI Cypress Creek SC		15680na
0455	0500		Nigeria, Voice of Nigeria/Ikorodu		15120va
0459	0500		New Zealand, Radio NZ International		11725pa
0459	0500	DRM	New Zealand, Radio NZ International		11675pa

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

0500	0507	twhf	Canada, CBC Northern Quebec Service		
			9625na		
0500	0527		Germany, Deutsche Welle	9755af	
0500	0530		Eritrea, Radio Bana	5060do	
0500	0530	mtwhf	France, Radio France Internationale		9805af
			11995af		
0500	0530		Germany, Deutsche Welle	6130af	6155af
			6180af	12045af	
0500	0530		Japan, Radio Japan NHK World Network		
			5975eu	6110na	9770af
			17810as		15205as
0500	0530		Vatican City State, Vatican Radio		7360af
			9660af	11625af	
0500	0557		China, China Radio International		7220na
			11880na	15350me	15465as
			17540as	17725af	17855as
0500	0600		Anguilla, Worldwide Univ Network		6090am
0500	0600		Australia, ABC NT Alice Springs		4835do
0500	0600		Australia, ABC NT Katherine	5025do	
0500	0600		Australia, ABC NT Tennant Creek		4910do
0500	0600		Australia, Radio Australia	9590pa	12080pa
			13630as	15160pa	15240pa
					17750as
0500	0600		Bahrain, Radio Bahrain	6010me	
0500	0600		Bhutan, Bhutan Broadcasting Service		6035do
0500	0600		Canada, CFRX Toronto ON	6070na	
0500	0600		Canada, CKZN St Johns NF	6160na	
0500	0600		Canada, CKZU Vancouver BC		6160na
0500	0600		Cuba, Radio Havana Cuba	6000na	6010na
			6050na	6060na	6150na
			Liberia, Star Radio		3960do
0500	0600		Malaysia, RTM/Traxx FM	7295do	
0500	0600		New Zealand, Radio NZ International		11725pa
0500	0600	DRM	New Zealand, Radio NZ International		11675pa
0500	0600		Nigeria, Voice of Nigeria/Ikorodu		15120va
0500	0600		Russia, Voice of Russia	12030na	
0500	0600	DRM	Russia, Voice of Russia	15735as	
0500	0600		Slovakia, NEXUS/IRRS SW	9670af	
0500	0600		South Africa, Channel Africa	7230af	
0500	0600		Swaziland, TWR Swaziland	4775af	9500af
0500	0600		Taiwan, Radio Taiwan International		6875na
0500	0600		UK, BBC World Service	3255af	3955eu
			5875eu	6005af	6190af
			9410as	11770af	11860af
0500	0600		USA, American Forces Network		4319usb
			5446usb	5765usb	7812usb
			12759usb	13362usb	
0500	0600		USA, EWTN/WEWN Irondale, AL		11520af
0500	0600		USA, FBN/WTJC Newport NC		9370na
0500	0600		USA, Voice of America	4930af	6080af
			9885af	15580af	
0500	0600		USA, WHRI Cypress Creek SC		7315va
			7465va	11565va	
0500	0600		USA, WINB Red Lion PA	9405am	
0500	0600		USA, WRNO New Orleans LA		7505am
0500	0600		USA, WTWW Lebanon TN	5755va	
0500	0600		USA, WWCR Nashville TN	3215na	4840na
			5890na		
0500	0600		USA, WWRB Manchester TN	3185va	
0500	0600		USA, WYFR/Family Radio Worldwide		5950am
			9680am		
0500	0600		Zambia, CVC/1 Africa	9430af	
0500	0600		Zambia, Radio Christian Voice		6065af
0500	0600		Zambia, Zambia Broadcasting Corp		6165do
0502	0600		Swaziland, TWR Swaziland	6120af	
0505	0600		Russia, Voice of Russia	9855na	
0530	0600		Thailand, Radio Thailand World Service		11730va
0530	0600		USA, WHRI Cypress Creek SC		15680va

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

0600	0620	mtwhfa	Vatican City State, Vatican Radio		4005eu
			7250eu		
0600	0629		Germany, Deutsche Welle	5945af	7240af
			15205af		
0600	0630	Sat/Sun	Australia, Radio Australia	15290pa	15415as

0600	0630	mtwhf	France, Radio France Internationale		7315af
			13680af	15160af	
0600	0630		Laos, Lao National Radio	7145as	
0600	0630	mtwhfa	Vatican City State, Vatican Radio		5965eu
0600	0645	mtwhf	South Africa, TWR Africa	11640af	
0600	0657		China, China Radio International		11750af
			11770af	11880as	13645as
			15350as	15465as	17505af
			17710as		17540as
0600	0658		New Zealand, Radio NZ International		11725pa
0600	0658	DRM	New Zealand, Radio NZ International		11675pa
0600	0700		Anguilla, Worldwide Univ Network		6090am
0600	0700		Australia, ABC NT Alice Springs		4835do
0600	0700		Australia, ABC NT Katherine	5025do	
0600	0700		Australia, ABC NT Tennant Creek		4910do
0600	0700		Australia, Radio Australia	9590pa	12080pa
			13630as	13690pa	15160pa
			17750as		15240pa
0600	0700		Bahrain, Radio Bahrain	6010me	
0600	0700		Canada, CFRX Toronto ON	6070na	
0600	0700		Canada, CFVP Calgary AB	6030na	
0600	0700		Canada, CKZN St Johns NF	6160na	
0600	0700		Canada, CKZU Vancouver BC		6160na
0600	0700		Cuba, Radio Havana Cuba	6000na	6010na
			6050na	6060na	6150na
0600	0700		Greece, Voice of Greece	11645eu	
0600	0700		Liberia, Star Radio		3960do
0600	0700		Malaysia, RTM/Traxx FM	7295do	
0600	0700		Nigeria, Voice of Nigeria/Ikorodu		15120va
0600	0700		Papua New Guinea, Radio Fly		3915do
			5960do		
0600	0700		Russia, Voice of Russia	9855na	12030na
0600	0700		South Africa, Channel Africa	7230af	15255af
0600	0700		Swaziland, TWR Swaziland	4775af	6120af
			9500af		
0600	0700		UK, BBC World Service	3995eu	5875eu
			6005af	6190af	9410af
			11760as	11770af	9860af
0600	0700		USA, American Forces Network		4319usb
			5446usb	5765usb	7812usb
			12759usb	13362usb	12133usb
0600	0700		USA, EWTN/WEWN Irondale, AL		11520af
0600	0700		USA, FBN/WTJC Newport NC		9370na
0600	0700		USA, Voice of America	6080af	9885af
			15580af		
0600	0700		USA, WHRI Cypress Creek SC		7385va
			9615va	15680va	
0600	0700		USA, WINB Red Lion PA	9405am	
0600	0700		USA, WRNO New Orleans LA		7505am
0600	0700		USA, WTWW Lebanon TN	5755va	
0600	0700		USA, WWCR Nashville TN	3215na	4840na
			5890na	5935na	
0600	0700		USA, WWRB Manchester TN	3185va	
0600	0700		USA, WYFR/Family Radio Worldwide		5745va
			6000ca	9680am	9885af
					11530va
0600	0700		Zambia, CVC/1 Africa	13590af	
0600	0700		Zambia, Radio Christian Voice		6065af
0600	0700		Zambia, Zambia Broadcasting Corp		6165do
0600	07000		Malaysia, RTM/Voice of Malaysia		6175as
			9750as	15295as	
0600	615	Sat/Sun	South Africa, TWR Africa	11640af	
0630	0700		Australia, Radio Australia	15415as	
0630	0700		Congo Dem. Republic, Radio Kahuzi		6209do
0630	0700		Romania, Radio Romania International		7370eu
			17780pa	21600pa	
0630	0700	DRM	Romania, Radio Romania International		6020eu
0630	0700		Vatican City State, Vatican Radio		7360af
			9660af	11625af	
0659	0700		New Zealand, Radio NZ International		9765pa
0659	0700	DRM	New Zealand, Radio NZ International		11675pa

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

0700	0705	mtwhf	Croatia, HRT Voice of Croatia		6165eu
			17860pa		
0700	0730		China, Xizang People's Broadcasting Sta/Lhasa		
			4905do	4920do	5240do
			6130do	9490do	9580do
0700	0730	mtwhf	France, Radio France Internationale		11725af
0700	0757		China, China Radio International		11785as
			13645as	15125me	15350as
			17490as	17540as	17710af
0700	0758		New Zealand, Radio NZ International		9765pa
0700	0758	DRM	New Zealand, Radio NZ International		11675pa
0700	0800		Anguilla, Worldwide Univ Network		6090am

0700 0800	Australia, ABC NT Alice Springs	4835do	
0700 0800	Australia, ABC NT Katherine	5025do	
0700 0800	Australia, ABC NT Tennant Creek	4910do	
0700 0800	Australia, Radio Australia	9475pa 9590pa	
	9710pa 11945pa 12080pa	15160pa	
	15240as		
0700 0800	Bahrain, Radio Bahrain	6010me	
0700 0800 m/DRM	Belgium, TDP Radio	6015eu	
0700 0800	Canada, CFRX Toronto ON	6070na	
0700 0800	Canada, CFVP Calgary AB	6030na	
0700 0800	Canada, CKZN St Johns NF	6160na	
0700 0800	Canada, CKZU Vancouver BC	6160na	
0700 0800	Equatorial Guinea, Radio East Africa/Malabo	15190af	
0700 0800	Liberia, Star Radio	3960do	
0700 0800	Malaysia, RTM/Traxx FM	7295do	
0700 0800 Sun	Palau, T8WH/World Harvest Radio/Koror	9930as	
0700 0800	Papua New Guinea, Radio Fly	5960do	3915do
0700 0800	Russia, Voice of Russia	17665pa	17805pa
0700 0800 DRM	Russia, Voice of Russia	11635eu	
0700 0800	Swaziland, TWR Swaziland	4775af	6120af
	9500af		
0700 0800	UK, BBC World Service	3955eu	6190af
	9860af 11760me 11770af		
0700 0800 DRM	UK, BBC World Service	5875eu	
0700 0800	USA, American Forces Network	5446usb	4319usb
	12759usb 13362usb	7812usb	12133usb
0700 0800	USA, EWTN/WEWN Irondale, AL	11520af	
0700 0800	USA, FBN/WTJC Newport NC	9370na	
0700 0800	USA, WHRI Cypress Creek SC	15680va	9615va
0700 0800	USA, WINB Red Lion PA	9405am	
0700 0800	USA, WRNO New Orleans LA	5890na	7505am
0700 0800	USA, WTWW Lebanon TN	5755va	
0700 0800	USA, WWCR Nashville TN	5935na	4840na
0700 0800	USA, WWRB Manchester TN	3185va	
0700 0800	USA, WYFR/Family Radio Worldwide	5745va 6875am 7455am	5950am 9495ca
0700 0800	Zambia, CVC/1 Africa	13590af	
0700 0800	Zambia, Radio Christian Voice	6065af	
0700 0800	Zambia, Zambia Broadcasting Corp	6165do	
0709 0712 mtwhf	Austria, Radio Austria International	6155eu	
0730 0745 mtwhf	Vatican City State, Vatican Radio	7250eu 9645eu	5965eu
0730 0745 mtwhfa	Vatican City State, Vatican Radio	11740eu 15595eu	4005eu
0730 0800	Australia, HCJB Global Australia	11750as	
0730 0800	Bulgaria, Radio Bulgaria	5900eu	7400eu
0730 0800	Clandestine, Cotton Tree News	15220af	
0730 0800 Sun	USA, WHRI Cypress Creek SC	11565va	
0745 0800 Sun	Germany, TWR Europe	6105eu	
0745 0800 Sun	Monaco, TWR Europe	9800eu	
0759 0800 DRM	New Zealand, Radio NZ International	9870pa	

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

0800 0820	Indonesia, RRI Cimanggis/Jawa Barat	9680do	
0800 0830	Australia, ABC NT Alice Springs	4835do	
0800 0830	Australia, ABC NT Katherine	5025do	
0800 0830	Australia, ABC NT Tennant Creek	4910do	
0800 0830 Sun	UK, Bible Voice Broadcasting Network	7220eu	
0800 0845 Sat	UK, Bible Voice Broadcasting Network	7220eu	
0800 0850 mtwhf	Germany, TWR Europe	6105eu	
0800 0850 mtwhf	Monaco, TWR Europe	9800eu	
0800 0857	China, China Radio International	9415as	
	11785as 11880as 15350as	15465as	
	15625as 17490as 17540as		
0800 0900	Anguilla, Worldwide Univ Network	6090am	
0800 0900	Australia, HCJB Global Australia	11750pa	
0800 0900	Australia, Radio Australia	5995as 9475pa	
	9485pa 9580va 9590pa	11945pa	
	12080pa 13630pa		
0800 0900	Bahrain, Radio Bahrain	6010me	
0800 0900 t/DRM	Belgium, TDP Radio	6015eu	
0800 0900	Canada, CFRX Toronto ON	6070na	
0800 0900	Canada, CFVP Calgary AB	6030na	
0800 0900	Canada, CKZN St Johns NF	6160na	
0800 0900	Canada, CKZU Vancouver BC	6160na	
0800 0900	Equatorial Guinea, Radio African 2/Malabo	15190af	

0800 0900	Equatorial Guinea, Radio East Africa/Malabo	15190af	
0800 0900	Greece, Voice of Greece	11645eu	
0800 0900	Liberia, Star Radio	3960do	
0800 0900	Malaysia, RTM/Traxx FM	7295do	
0800 0900	Malaysia, RTM/Voice of Malaysia	9750as 15295as	6175as
0800 0900	New Zealand, Radio NZ International	9765pa	
0800 0900 DRM	New Zealand, Radio NZ International	9870pa	
0800 0900 Sun	Palau, T8WH/World Harvest Radio/Koror	9930as	
0800 0900	Papua New Guinea, Radio Fly	5960do	3915do
0800 0900	Russia, Voice of Russia	17665pa	17805pa
0800 0900 DRM	Russia, Voice of Russia	11635eu	
0800 0900 Sun	South Africa, SA Radio League	17860af	7205af
0800 0900	South Korea, KBS World Radio	9570as	
0800 0900	UK, BBC World Service	9860af 11760me	6190af
0800 0900 DRM	UK, BBC World Service	9610eu	
0800 0900	USA, American Forces Network	5446usb	4319usb
	12759usb 13362usb	7812usb	12133usb
0800 0900	USA, EWTN/WEWN Irondale, AL	11520af	
0800 0900	USA, FBN/WTJC Newport NC	9370na	
0800 0900	USA, KNLS Anchor Point AK	7355as	
0800 0900	USA, WHRI Cypress Creek SC	15680va	11565va
0800 0900	USA, WINB Red Lion PA	9405am	
0800 0900	USA, WRNO New Orleans LA	5890na	7505am
0800 0900	USA, WTWW Lebanon TN	5755va	
0800 0900	USA, WWCR Nashville TN	5935na	4840na
0800 0900	USA, WWRB Manchester TN	3185va	
0800 0900	USA, WYFR/Family Radio Worldwide	5745va 6875am 7455am	5950am 9495ca
0800 0900	Zambia, CVC/1 Africa	13590af	
0800 0900	Zambia, Radio Christian Voice	6065af	
0800 0900	Zambia, Zambia Broadcasting Corp	6165do	
0815 0827	Nepal, Radio Nepal	5005as	
0815 0850 Sat	Germany, TWR Europe	6105eu	
0815 0850 Sat	Monaco, TWR Europe	9800eu	
0820 0900 smtwhf	Guam, KTWR/TWR	15170as	
0830 0900	Australia, ABC NT Alice Springs	4835do	2310do
0830 0900	Australia, ABC NT Katherine	5025do	
0830 0900	Australia, ABC NT Tennant Creek	4910do	2325do
0830 0900 mtwhfa	Guam, KTWR/TWR	11840pa	
0840 0855	Mongolia, Mongolian Radio 2/Murun	7260do	4895do
0840 0855	Mongolia, Mongolian Radio 2/Ulaanbaatar	7260do	

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

0900 0910 mtwhfa	Guam, KTWR/TWR	11840pa	
0900 0910	Papua New Guinea, Wantok Radio Light	7325do	
0900 0930	Australia, HCJB Global Australia	11750pa	
0900 0957	China, China Radio International	9415as	
	15210as 15270as 15350as	17490eu	
	17570eu 17690eu 17750as		
0900 0958	Germany, Deutsche Welle	21780as	
0900 1000	Anguilla, Worldwide Univ Network	6090am	
0900 1000	Australia, ABC NT Alice Springs	2310do	
0900 1000	Australia, ABC NT Katherine	2485do	
0900 1000	Australia, ABC NT Tennant Creek	2325do	
0900 1000	Australia, Radio Australia	9475pa 9485pa	
	9580va 9590pa 11945pa	12080pa	
	13630pa		
0900 1000	Bahrain, Radio Bahrain	6010me	
0900 1000 w/DRM	Belgium, TDP Radio	6015eu	
0900 1000	Canada, CFRX Toronto ON	6070na	
0900 1000	Canada, CFVP Calgary AB	6030na	
0900 1000	Canada, CKZN St Johns NF	6160na	
0900 1000	Canada, CKZU Vancouver BC	6160na	
0900 1000	Equatorial Guinea, Radio African 2/Malabo	15190af	
0900 1000	Equatorial Guinea, Radio East Africa/Malabo	15190af	
0900 1000 2nd Sun	Germany, Blue Star Radio	6140eu	
0900 1000	Germany, Deutsche Welle	17710as	
0900 1000 3rd Sat	Germany, Radio City	9510eu	
0900 1000 1st Sat	Germany, Radio Joystick	9510eu	
0900 1000	Malaysia, RTM/Traxx FM	7295do	

0900	1000	Malaysia, RTM/Voice of Malaysia	6175as
		9750as 15295as	
0900	1000	New Zealand, Radio NZ International	9765pa
0900	1000	DRM New Zealand, Radio NZ International	9870pa
0900	1000	Nigeria, Voice of Nigeria/Ikorodu	9690af
0900	1000	Sun Palau, T8WH/World Harvest Radio/Koror	9930as
0900	1000	Papua New Guinea, Radio Fly	3915do
		5960do	
0900	1000	Russia, Voice of Russia	17665pa 17805pa
0900	1000	3rd Sat Slovakia, NEXUS/IRRS SW	9510va
0900	1000	Tajikistan, Voice of Tajik	7245va
0900	1000	UK, BBC World Service	6195as 9740as
		9860af 11760me 11895as	
0900	1000	USA, American Forces Network	4319usb
		5446usb 5765usb 7812usb 12133usb	
		12759usb 13362usb	
0900	1000	USA, EWTVN/WEWN Irondale, AL	9390as
0900	1000	USA, FBN/WTJC Newport NC	9370na
0900	1000	USA, WHRI Cypress Creek SC	9840va
		11565va 15680va	
0900	1000	USA, WINB Red Lion PA	9405am
0900	1000	USA, WRNO New Orleans LA	7505am
0900	1000	USA, WTWW Lebanon TN	5755va
0900	1000	USA, WWCR Nashville TN	3215na 4840na
		5935na	
0900	1000	USA, WWRB Manchester TN	3185va
0900	1000	USA, WYFR/Family Radio Worldwide	5950am
		6875am 7455am 9465as	
0900	1000	Zambia, CVC/1 Africa	13590af
0900	1000	Zambia, Radio Christian Voice	6065af
0900	1000	Zambia, Zambia Broadcasting Corp	6165do
0930	0945	Papua New Guinea, Radio Fly	3915do
		5960do	
0930	1000	China, Voice of the Strait/Fuzhou	6115do

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

1000	1025	China, Voice of the Strait (News Channel) Fuzhou	9505do
1000	1030	Sat/Sun/DRM Bulgaria, Radio Bulgaria/Euranet	11900eu
1000	1030	Japan, Radio Japan NHK World Network	9605as 9625pa 9840pa 11780as
1000	1030	Vietnam, Voice of Vietnam	9840as 12020as
1000	1057	China, China Radio International	5955as
		7215eu 7255eu 11640as 13590as	
		13720as 15190pa 15210pa 15350as	
		17490as 17690as	
1000	1057	Netherlands, R Netherlands Worldwide	9720as
		12065as	
1000	1057	North Korea, Voice of Korea	6185as 6285sa
		9335sa 9850as	
1000	1058	New Zealand, Radio NZ International	9765pa
1000	1058	DRM New Zealand, Radio NZ International	9870pa
1000	1100	Anguilla, Worldwide Univ Network	11775am
1000	1100	Australia, ABC NT Alice Springs	2310do
1000	1100	Australia, ABC NT Katherine	2485do
1000	1100	Australia, ABC NT Tennant Creek	2325do
1000	1100	Australia, Radio Australia	6140as 9475pa
		9485va 9580pa 9590pa 11945pa	
		12080pa	
1000	1100	Bahrain, Radio Bahrain	6010me
1000	1100	h/DRM Belgium, TDP Radio	6015eu
1000	1100	Canada, CFRX Toronto ON	6070na
1000	1100	Canada, CFVP Calgary AB	6030na
1000	1100	Canada, CKZN St Johns NF	6160na
1000	1100	Canada, CKZU Vancouver BC	6160na
1000	1100	Equatorial Guinea, Radio African 2/Malabo	15190af
1000	1100	Equatorial Guinea, Radio East Africa/Malabo	15190af
1000	1100	3rd Sun Germany, European Music Radio	6140eu
1000	1100	4th Sun Germany, Radio Gloria International	6140eu
1000	1100	India, All India Radio	7270as 13710pa
		15235as 15260as 17510pa 17800as	
		17895pa 13695al 15020al	
1000	1100	Indonesia, Voice of Indonesia/Jawa Barat	9525va 11785va
1000	1100	Malaysia, RTM/Traxx FM	7295do
1000	1100	Nigeria, Voice of Nigeria/Ikorodu	9690af
1000	1100	Sun Palau, T8WH/World Harvest Radio/Koror	9930as
1000	1100	Russia, Voice of Russia	7205as 17665pa
		17805pa	

1000	1100	Saudi Arabia, BSKSA/Saudi Radio	15250af
1000	1100	UK, BBC World Service	6195as 9605as
		9740as 9860af 11760me 11895as	
1000	1100	USA, American Forces Network	4319usb
		5446usb 5765usb 7812usb 12133usb	
		12759usb 13362usb	
1000	1100	USA, EWTVN/WEWN Irondale, AL	9390as
1000	1100	USA, FBN/WTJC Newport NC	9370na
1000	1100	USA, KNLS Anchor Point AK	7355as
1000	1100	USA, WHRI Cypress Creek SC	11565va
1000	1100	USA, WINB Red Lion PA	9405am
1000	1100	USA, WRNO New Orleans LA	7505am
1000	1100	USA, WTWW Lebanon TN	5755va
1000	1100	USA, WWCR Nashville TN	4840na 5890na
		5935na 9985na	
1000	1100	USA, WWRB Manchester TN	3185va
1000	1100	USA, WYFR/Family Radio Worldwide	5950am
		6890am 6895na 7455am 9465as	
1000	1100	Zambia, CVC/1 Africa	13590af
1000	1100	Zambia, Radio Christian Voice	6065af
1000	1100	Zambia, Zambia Broadcasting Corp	6165do
1030	1100	Iran, VOIRI/IRIB	15460as 17630as
1030	1100	Mongolia, Voice of Mongolia	12085as
1030	1100	Slovakia, NEXUS/IRRS SW	9510va
1030	1100	Sun USA, WHRI Cypress Creek SC	7385va
1059	1100	New Zealand, Radio NZ International	13660pa
1059	1100	DRM New Zealand, Radio NZ International	9870pa

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

1100	1105	Pakistan, Azad Kashmir Radio/Islamabad	7265do
1100	1110	Pakistan, PBC/Radio Pakistan	15100eu 17700eu
1100	1127	Iran, VOIRI/IRIB	15460as 17630as
1100	1130	Sat/DRM South Korea, KBS World Radio	9760eu
1100	1130	USA, WINB Red Lion PA	9405am
1100	1130	Sun Vatican City State, Vatican Radio	7250eu
1100	1130	Vietnam, Voice of Vietnam	7280as
1100	1157	China, China Radio International	5955as
		5960na 9570as 11650as 11795na	
		13590as 13645as 13665as 13720as	
		17490eu	
1100	1158	DRM New Zealand, Radio NZ International	9870pa
1100	1200	Anguilla, Worldwide Univ Network	11775am
1100	1200	Australia, ABC NT Alice Springs	2310do
1100	1200	Australia, ABC NT Katherine	2485do
1100	1200	Australia, ABC NT Tennant Creek	2325do
1100	1200	Australia, Radio Australia	5995as 6020pa
		6140as 9475pa 9485pa 9560va	
		9580va 9590pa 11945pa	
1100	1200	DRM Australia, Radio Australia	12080as
1100	1200	Bahrain, Radio Bahrain	6010me
1100	1200	f/DRM Belgium, TDP Radio	6015eu
1100	1200	Sat/Sun Canada, CBC Northern Quebec Service	9625na
1100	1200	Canada, CFRX Toronto ON	6070na
1100	1200	Canada, CFVP Calgary AB	6030na
1100	1200	Canada, CKZN St Johns NF	6160na
1100	1200	Canada, CKZU Vancouver BC	6160na
1100	1200	Equatorial Guinea, Radio African 2/Malabo	15190af
1100	1200	Equatorial Guinea, Radio East Africa/Malabo	15190af
1100	1200	Malaysia, RTM/Traxx FM	7295do
1100	1200	New Zealand, Radio NZ International	13660pa
1100	1200	Nigeria, Voice of Nigeria/Ikorodu	9690af
1100	1200	Palau, T8WH/World Harvest Radio/Koror	9965as
1100	1200	Russia, Voice of Russia	7205as
1100	1200	Saudi Arabia, BSKSA/Saudi Radio	15250af
1100	1200	Sun Slovakia, NEXUS/IRRS SW	9510va
1100	1200	Taiwan, Radio Taiwan International	7445as
		11715as	
1100	1200	UK, BBC World Service	6195as 9605as
		9740as 9860af 11760me 11895as	
1100	1200	USA, American Forces Network	4319usb
		5446usb 5765usb 7812usb 12133usb	
		12759usb 13362usb	
1100	1200	USA, EWTVN/WEWN Irondale, AL	9390as
1100	1200	USA, FBN/WTJC Newport NC	9370na
1100	1200	USA, WHRI Cypress Creek SC	9840va
		9985va	
1100	1200	Sat/Sun USA, WHRI Cypress Creek SC	17540va
1100	1200	USA, WINB Red Lion PA	9265am
1100	1200	USA, WRNO New Orleans LA	7505am

1100	1200	USA, WTTW Lebanon TN	5755va	
1100	1200	USA, WWCN Nashville TN	4840na	5890na
		5935na	15285na	
1100	1200	USA, WWRB Manchester TN	3185va	
1100	1200	USA, WYFR/Family Radio Worldwide	6000ca	
		6875am	6890na	7300af
		11725ca	11830am	7455am
1100	1200	Zambia, CVC/1 Africa	13590af	
1100	1200	Zambia, Radio Christian Voice		6065af
1100	1200	Zambia, Zambia Broadcasting Corp		6165do
1130	1200	Vietnam, Voice of Vietnam	9840as	12020as

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

1200	1225	Saudi Arabia, BSKSA/Saudi Radio	15250af	
1200	1230	France, Radio France Internationale	21620af	
1200	1230	Germany, AWR Europe	15495as	
1200	1230	Japan, Radio Japan NHK World Network		
		6120na	9625pa	9790eu
1200	1257	China, China Radio International	5955as	
		7250eu	9460as	9600as
		9730as	11760as	11780me
		12015as	13665eu	13790eu
		17490eu		
1200	1258	New Zealand, Radio NZ International	13660pa	
1200	1300	Anguilla, Worldwide Univ Network	11775am	
1200	1300	Australia, ABC NT Alice Springs	2310do	
1200	1300	Australia, ABC NT Katherine	2485do	
1200	1300	Australia, ABC NT Tennant Creek	2325do	
1200	1300	Australia, Radio Australia	6020pa	6140as
		9475pa	9485pa	9560va
		9590pa	11945pa	9580va
1200	1300	DRM	Australia, Radio Australia	5995pa
1200	1300		Bahrain, Radio Bahrain	6010me
1200	1300	Sat/ SRM	Belgium, TDP Radio	6015eu
1200	1300	Sat/Sun	Canada, CBC Northern Quebec Service	
			9625na	
1200	1300		Canada, CFRX Toronto ON	6070na
1200	1300		Canada, CFVP Calgary AB	6030na
1200	1300		Canada, CKZN St Johns NF	6160na
1200	1300		Canada, CKZU Vancouver BC	6160na
1200	1300		Equatorial Guinea, Radio African 2/Malabo	
			15190af	
1200	1300		Equatorial Guinea, Radio East Africa/Malabo	
			15190af	
1200	1300		Japan, Radio Japan NHK World Network	
			9695as	
1200	1300		Malaysia, RTM/Traxx FM	7295do
1200	1300		Nigeria, Voice of Nigeria/Ikorodu	9690af
1200	1300		Palau, T8WH/World Harvest Radio/Koror	
			9930as	9965as
1200	1300		Romania, Radio Romania International	11970eu
			15430eu	15430af
			17765af	
1200	1300	DRM	Russia, Voice of Russia	7340as
1200	1300		Russia, Voice of Russia	7350as
			9695as	
			11660as	
1200	1300	Sun	Slovakia, NEXUS/IRRS SW	9510va
1200	1300		South Korea, KBS World Radio	9650na
1200	1300		UK, BBC World Service	5875as
			6190af	
			6195as	9605as
			9740as	9860af
			11760me	
1200	1300		United States, Overcomer Ministries	15320af
1200	1300		USA, American Forces Network	4319usb
			5446usb	5765usb
			7812usb	12133usb
			12759usb	13362usb
1200	1300		USA, EWTN/WEWN Irondale, AL	15610me
1200	1300		USA, FBN/WTJC Newport NC	9370na
1200	1300		USA, KNLS Anchor Point AK	7355as
1200	1300		USA, Voice of America	7575va
			9640va	
			11700va	11750va
1200	1300		USA, WHRI Cypress Creek SC	9965va
1200	1300	Sat/Sun	USA, WHRI Cypress Creek SC	17540va
1200	1300		USA, WINB Red Lion PA	9265am
1200	1300		USA, WRNO New Orleans LA	7505am
1200	1300		USA, WTTW Lebanon TN	9479va
1200	1300		USA, WWCN Nashville TN	4840af
			5935na	
			9980na	15825na
1200	1300		USA, WWRB Manchester TN	3185va
1200	1300		USA, WYFR/Family Radio Worldwide	6890am
			7455am	11530ca
			11970am	17545ca
1200	1300		Zambia, CVC/1 Africa	13590af
1200	1300		Zambia, Radio Christian Voice	6065af
1200	1300		Zambia, Zambia Broadcasting Corp	6165do
1215	1300		Egypt, Radio Cairo	17870as
1215	1300	mtwhf	UK, BBC World Service	9410ca
			11860sa	

1230	1300	smtwhf	Australia, HCJB Global Australia	15400as
1230	1300		Bangladesh, Bangladesh Betar	7250as
1230	1300		Thailand, Radio Thailand World Service	9720as
1230	1300	Sun	USA, WHRI Cypress Creek SC	7385va
1230	1300		Vietnam, Voice of Vietnam	9840as
1259	1300		New Zealand, Radio NZ International	5950pa

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

1300	1330		Australia, HCJB Global Australia	15400as
1300	1330		Egypt, Radio Cairo	17870as
1300	1330		Japan, Radio Japan NHK World Network	
			9875as	
1300	1357		China, China Radio International	5995as
			7300na	9570na
			9655as	9730as
			9765as	9870as
			11760me	11885as
			11900eu	11980as
			13670as	13790as
			15230as	
1300	1357		North Korea, Voice of Korea	7570eu
			11710na	12015eu
1300	1359		Poland, Polskie Radio Warsaw	9460eu
			11860eu	
1300	1400		Anguilla, Worldwide Univ Network	11775am
1300	1400		Australia, ABC NT Alice Springs	2310do
1300	1400		Australia, ABC NT Katherine	2485do
1300	1400		Australia, Radio Australia	6020pa
			9560va	9580va
			9590pa	9595pa
1300	1400	DRM	Australia, Radio Australia	5995pa
1300	1400		Bahrain, Radio Bahrain	6010me
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na
1300	1400	Sat/Sun	Canada, CBC Northern Quebec Service	
			9625na	
1300	1400		Canada, CFRX Toronto ON	6070na
1300	1400		Canada, CFVP Calgary AB	6030na
1300	1400		Canada, CKZN St Johns NF	6160na
1300	1400		Canada, CKZU Vancouver BC	6160na
1300	1400		Equatorial Guinea, Radio East Africa/Malabo	
			15190af	
1300	1400		Germany, Overcomer Ministries	15495af
1300	1400		Indonesia, Voice of Indonesia/Jawa Barat	
			9525as	11785as
1300	1400		Malaysia, RTM/Traxx FM	7295do
1300	1400		New Zealand, Radio NZ International	5950pa
1300	1400		Nigeria, Voice of Nigeria/Ikorodu	9690af
1300	1400	mtwhf	Palau, T8WH/World Harvest Radio/Koror	
			13745as	
1300	1400	Sat/Sun	Palau, T8WH/World Harvest Radio/Koror	
			9930as	
1300	1400		Russia, Voice of Russia	7205as
1300	1400		South Korea, KBS World Radio	9570as
1300	1400		UK, BBC World Service	5875as
			6190af	
			6195as	9410as
			9740as	9860af
			11760me	11805as
1300	1400		United States, Overcomer Ministries	11860af
			17765af	
1300	1400		USA, American Forces Network	4319usb
			5446usb	5765usb
			7812usb	12133usb
			12759usb	13362usb
1300	1400		USA, EWTN/WEWN Irondale, AL	15610me
1300	1400		USA, FBN/WTJC Newport NC	9370na
1300	1400		USA, WHRI Cypress Creek SC	9965va
1300	1400		USA, WYFR/Family Radio Worldwide	6890am
			7455am	11530ca
			11970am	17545ca
1300	1400		Zambia, CVC/1 Africa	13590af
1300	1400		Zambia, Radio Christian Voice	6065af
1300	1400		Zambia, Zambia Broadcasting Corp	6165do
1330	1400	st	Guam, KSDA/AWR	11935as
1330	1400	mtw	Guam, KSDA/AWR	15660as
1330	1400		India, All India Radio	9690as
			11620as	
			13710as	
1330	1400		Laos, Lao National Radio	7145as
1330	1400		Turkey, Voice of Turkey	11735as
1330	1400		Vietnam, Voice of Vietnam	9840as
1345	1400	Sun	UK, Bible Voice Broadcasting Network	13365as

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

1400 1425	mh	Guam, KTWR/TWR	9975as	
1400 1425		Turkey, Voice of Turkey	11735as	12035eu
1400 1430	Sun	Germany, Pan American Broadcasting		13645as
1400 1430		Japan, Radio Japan NHK World Network		
		5955as	9875as	21560af
1400 1430		Serbia, International Radio of Serbia		9505eu
1400 1430		Thailand, Radio Thailand World Service		9725as
1400 1430	Sun	United Arab Emirates, FEBA Radio		12045as
1400 1435	twfas	Guam, KTWR/TWR		9975as
1400 1457		China, China Radio International		5955as
		7300na	9460na	9700as
				9765as
				9795eu
				9870as
				11665na
				13675eu
				13685af
				13740as
				15230as
				17630af
1400 1500		Anguilla, Worldwide Univ Network		11775am
1400 1500		Australia, ABC NT Alice Springs		2310do
1400 1500		Australia, ABC NT Katherine		2485do
1400 1500		Australia, ABC NT Tennant Creek		2325do
1400 1500		Australia, Radio Australia		5995pa
				6080pa
				7240pa
				9590pa
1400 1500		Bahrain, Radio Bahrain		6010me
1400 1500	DRM	Belgium, TDP Radio/Disco Palace		6015eu
1400 1500	Sat/Sun	Canada, CBC Northern Quebec Service		
				9625na
1400 1500		Canada, CFRX Toronto ON		6070na
1400 1500		Canada, CFVP Calgary AB		6030na
1400 1500		Canada, CKZN St Johns NF		6160na
1400 1500		Canada, CKZU Vancouver BC		6160na
1400 1500		Equatorial Guinea, Radio East Africa/Malabo		
				15190af
1400 1500		Ethiopia, Radio Ethiopia/Home Service		5989do
				7110do
				9705do
1400 1500		Germany, Overcomer Ministries		15495af
1400 1500		India, All India Radio		9690as
				11620as
				13710as
1400 1500		Libya, LJC Voice of Africa		17725af
				21675af
				21695af
1400 1500		Malaysia, RTM/Traxx FM		7295do
1400 1500		Netherlands, R Netherlands Worldwide		12080as
				15595va
1400 1500		New Zealand, Radio NZ International		5950pa
1400 1500		Nigeria, Voice of Nigeria/Ikorodu		9690af
1400 1500		Oman, Radio Sultanate of Oman		15140va
1400 1500		Palau, T8WH/World Harvest Radio/Koror		
				9930as
1400 1500		Russia, Voice of Russia		7205as
				11660as
1400 1500	DRM	Russia, Voice of Russia		7340as
1400 1500		Slovakia, NEXUS/IRRS SW		15710va
1400 1500		UK, BBC World Service		5845as
				5875as
				6190af
				6195as
				9410as
				9740as
1400 1500		United States, Overcomer Ministries		9460eu
				13810me
1400 1500		USA, American Forces Network		4319usb
				5446usb
				5765usb
				7812usb
				12133usb
				12759usb
				13362usb
1400 1500		USA, EWTN/WEWN Irondale, AL		15610me
1400 1500		USA, FBN/WTJC Newport NC		9370na
1400 1500		USA, KJES Vado NM		11715na
1400 1500		USA, KNLS Anchor Point AK		7355as
1400 1500		USA, Voice of America		6080af
				15580af
				17650af
				17715af
1400 1500	mtwhf	USA, Voice of America		7575va
				9760va
				12150va
1400 1500		USA, WBCQ Monticello ME		9330am
1400 1500	Sat/Sun	USA, WHRI Cypress Creek SC		9840va
				15180va
				17540va
1400 1500		USA, WINB Red Lion PA		13570am
1400 1500		USA, WJHR International Milton FL		15550na
1400 1500		USA, WRNO New Orleans LA		7505am
				15590al
1400 1500		USA, WTWW Lebanon TN		9479na
1400 1500		USA, WWCR Nashville TN		7490af
				9980na
				13845na
				15825na
1400 1500		USA, WWRB Manchester TN		9385na
1400 1500		USA, WYFR/Family Radio Worldwide		5835as
				6070as
				9485as
				11560am
				11565am
				11855am
				13695am
				17760am
1400 1500		Zambia, CVC/1 Africa		13590af
1400 1500		Zambia, Radio Christian Voice		6065af
1400 1500		Zambia, Zambia Broadcasting Corp		6165do
1405 1435	Sat/Sun	UK, Bible Voice Broadcasting Network		6225as

1415 1427		Nepal, Radio Nepal		5005as
1415 1445		Germany, Pan American Broadcasting		13645as
1415 1500	Sun	UK, Bible Voice Broadcasting Network		13365as
1425 1455		Swaziland, TWR Swaziland		6025af
1430 1445		Bangladesh, Bangladesh Betar Home Service		
				4750do
1430 1500		Australia, Radio Australia		9475pa
1430 1500	Sat	UK, Bible Voice Broadcasting Network		13365as
1445 1500		Australia, HCJB Global Australia		15340as

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

1500 1510	mtwhfa	Turkmenistan, Turkmen Radio Service 1		5015do
1500 1515	Sun	UK, Bible Voice Broadcasting Network		12035as
1500 1530		Australia, HCJB Global Australia		15340as
1500 1530		Guam, KSDA/AWR		12025as
1500 1530		UK, BBC World Service		9410af
1500 1530		Vietnam, Voice of Vietnam		7280as
				12020as
1500 1550		New Zealand, Radio NZ International		5950pa
1500 1555	Sat/Sun	Swaziland, TWR Swaziland		6025af
1500 1557		Canada, Radio Canada International		
				11975as
1500 1557		China, China Radio International		5955as
				6095me
				7325as
				7405as
				9435as
				9525as
				9720as
				9785eu
				9870eu
				13685af
				13740as
				17630af
1500 1557		Libya, LJC Voice of Africa		17725af
				21675af
				21695af
1500 1557		Netherlands, R Netherlands Worldwide		15595as
1500 1557		North Korea, Voice of Korea 7570eu		9335na
				11710na
				12015eu
1500 1600		Anguilla, Worldwide Univ Network		11775am
1500 1600		Australia, ABC NT Alice Springs		2310do
1500 1600		Australia, ABC NT Katherine		2485do
1500 1600		Australia, Radio Australia		5995pa
				6080pa
				7240pa
				9475pa
				9590pa
				11825as
1500 1600		Bahrain, Radio Bahrain		6010me
1500 1600		Bhutan, Bhutan Broadcasting Service		6035do
1500 1600	Sat/Sun	Canada, CBC Northern Quebec Service		
				9625na
1500 1600		Canada, CFRX Toronto ON		6070na
1500 1600		Canada, CFVP Calgary AB		6030na
1500 1600		Canada, CKZN St Johns NF		6160na
1500 1600		Canada, CKZU Vancouver BC		6160na
1500 1600		Equatorial Guinea, Radio East Africa/Malabo		
				15190af
1500 1600		Malaysia, RTM/Traxx FM		7295do
1500 1600		Nigeria, Voice of Nigeria/Ikorodu		15120va
1500 1600		Russia, Voice of Russia		4975va
				7260as
				9660as
1500 1600	DRM	Russia, Voice of Russia		5905eu
1500 1600		Slovakia, NEXUS/IRRS SW		15710va
1500 1600		Uganda, Dunamis Shortwave		4750af
1500 1600		UK, BBC World Service		5845as
				5875as
				5975as
				6190af
				6195as
				7395as
				9485as
				9740as
				9860af
1500 1600		United States, Overcomer Ministries		9460eu
				13810me
				17485af
1500 1600		USA, American Forces Network		4319usb
				5446usb
				5765usb
				7812usb
				12133usb
				12759usb
				13362usb
1500 1600		USA, EWTN/WEWN Irondale, AL		15610me
1500 1600		USA, FBN/WTJC Newport NC		9370na
1500 1600		USA, KJES Vado NM		11715ca
1500 1600		USA, Voice of America		4930af
				6080af
				7575va
				9930va
				11765va
				12055va
				12150va
				15580af
				17715af
				17895af
1500 1600		USA, Voice of America/Special English		6140va
				7520va
				9760va
				9945va
1500 1600		USA, WBCQ Monticello ME		9330am
1500 1600	Sat	USA, WBCQ Monticello ME		15420am
1500 1600	Sat	USA, WHRI Cypress Creek SC		9840af
				21630af
1500 1600	Sun	USA, WHRI Cypress Creek SC		15680va
1500 1600	Sat/Sun	USA, WHRI Cypress Creek SC		15180va
1500 1600		USA, WINB Red Lion PA		13570am
1500 1600		USA, WJHR International Milton FL		15550na
1500 1600		USA, WRNO New Orleans LA		7505am
				15590al
1500 1600		USA, WTWW Lebanon TN		9479na
1500 1600		USA, WWCR Nashville TN		7490af
				9980na
				13845na
				15825na
1500 1600		USA, WWRB Manchester TN		9385na

1500 1600	USA, WYFR/Family Radio Worldwide	6280as
	9895af 11565am 11855am 11995as	
	12015af 15210sa 15795am 17760am	
	21840af	
1500 1600	Zambia, CVC/1 Africa	13590af
1500 1600	Zambia, Radio Christian Voice	6065af
1500 1600	Zambia, Zambia Broadcasting Corp	6165do
1504 1600 DRM	Canada, Radio Canada International	9800na
1504 1600	Canada, Radio Canada International	9610na
1515 1545 Sat	UK, Bible Voice Broadcasting Network	13670as
1530 1545	India, All India Radio	9910as 7255af
	9820af	
1530 1550 smtwhf	Vatican City State, Vatican Radio	11850as
	13765as	
1530 1558 Sat	Vatican City State, Vatican Radio	7585am
	11850as 13765as	
1530 1600 mtwhfa	Albania, Radio Tirana	13640na
1530 1600	Germany, AWR Europe	11675as
1530 1600	Iran, VOIRI/IRIB	9915as 11655as
1530 1600	Mongolia, Voice of Mongolia	9665as
1530 1600 Sat	UK, BBC World Service	9410af 11860af
1530 1600 h	UK, Bible Voice Broadcasting Network	13670as
1551 1600	New Zealand, Radio NZ International	7440pa
1551 1600 DRM	New Zealand, Radio NZ International	5950pa

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

1600 1615	Pakistan, PBC/Radio Pakistan	7510va 11575va
1600 1627	Iran, VOIRI/IRIB	9915as 11655as
1600 1630	Eritrea, Radio Bana	5060 d0
1600 1630	Guam, KSDA/AWR	9585as 11690as
1600 1630	Vietnam, Voice of Vietnam	7220me 7280eu
	9550me 9730eu	
1600 1650 DRM	New Zealand, Radio NZ International	5950pa
1600 1650	New Zealand, Radio NZ International	7440pa
1600 1657	China, China Radio International	6060as
	6100as 7235af 7255eu 7420eu	
	7435eu 9435eu 9525eu 9570eu	
	9600af 11650af	
1600 1657	North Korea, Voice of Korea	9990va 11545va
1600 1658	Taiwan, Radio Taiwan International	11550as
	12055as	
1600 1700	Anguilla, Worldwide Univ Network	11775am
1600 1700	Australia, ABC NT Alice Springs	2310do
1600 1700	Australia, ABC NT Katherine	2485do
1600 1700	Australia, Radio Australia	5995pa 6080pa
	7240pa 9475pa 9590pa 9710pa	
	11825as	
1600 1700	Bahrain, Radio Bahrain	6010me
1600 1700 Sat	Canada, CBC Northern Quebec Service	9625na
1600 1700	Canada, CFRX Toronto ON	6070na
1600 1700	Canada, CFPV Calgary AB	6030na
1600 1700	Canada, CKZN St Johns NF	6160na
1600 1700	Canada, CKZU Vancouver BC	6160na
1600 1700	Canada, Radio Canada International	9610na
1600 1700	Egypt, Radio Cairo	12170af
1600 1700	Ethiopia, Radio Ethiopia	7165af 9559af
1600 1700	France, Radio France Internationale	15605af
1600 1700	Germany, Deutsche Welle	5965as 15275as
1600 1700	Malaysia, RTM/Traxx FM	7295do
1600 1700	Russia, Voice of Russia	4975me 6130as
	7305as 9470va	
1600 1700 DRM	Russia, Voice of Russia	7340as
1600 1700	Slovakia, NEXUS/IRRS SW	15710va
1600 1700	South Korea, KBS World Radio	9640as
	9515eu	
1600 1700	Uganda, Dunamis Shortwave	4750af
1600 1700	UK, BBC World Service	3255af 5975as
	6190af 7355as 9740as	
1600 1700 Sat	UK, BBC World Service	9410af 11860af
1600 1700	USA, American Forces Network	4319usb
	5446usb 5765usb 7812usb 12133usb	
	12759usb 13362usb	
1600 1700	USA, EWTN/WEWN Irondale, AL	15610me
1600 1700	USA, FBN/WTJC Newport NC	9370na
1600 1700	USA, Voice of America	4930af 6080af
	15580af 17895af	
1600 1700	USA, Voice of America/Special English	9395va
	13600va 15460va	
1600 1700	USA, WBCQ Monticello ME	9330am
1600 1700 Sat	USA, WBCQ Monticello ME	15420am
1600 1700	USA, WHRI Cypress Creek SC	9840af
	15180af 21630af	
1600 1700	USA, WINB Red Lion PA	13570am

1600 1700	USA, WJHR International Milton FL	15550na
1600 1700	USA, WRNO New Orleans LA	7505am
	15590af	
1600 1700	USA, WTWW Lebanon TN	9479na
1600 1700	USA, WWCN Nashville TN	9980na 12160af
	13845na 15825na	
1600 1700	USA, WWRB Manchester TN	9385na
1600 1700	USA, WYFR/Family Radio Worldwide	6085ca
	9795af 11565am 11740af 11830am	
	13695am 17540af 17690af 17760am	
	18980va	
1600 1700	Zambia, CVC/1 Africa	13590af
1600 1700	Zambia, Radio Christian Voice	6065af
1600 1700	Zambia, Zambia Broadcasting Corp	6165do
1604 1700	Canada, Radio Canada International	9610na
1604 1700 DRM	Canada, Radio Canada International	9800na
1615 1700 Sun	UK, BBC World Service	9410af 11860af
1630 1657	Clandestine, Sudan Radio Service/ SRS	17745af
1630 1700	China, Xizang People's Broadcasting Sta/Lhasa	6110do
	4905do 4920do 5240do 6110do	
	6130do 7255do 7385do	
	Guam, KSDA/AWR	9790as
1630 1700 Sat/Sun	Palau, T8WH/World Harvest Radio/Koror	9930as
1630 1700 mtwhf	UK, BBC World Service	9410af
1630 1700 Sun	UK, Bible Voice Broadcasting Network	9460me
1630 1700 mtwhf	USA, Voice of America	9785af 11905af
	13635af	
1640 1650	Turkmenistan, Turkmen Radio Service 2	4930do
1645 1700 mf	UK, Bible Voice Broadcasting Network	9460me
1645 1700 twhfa	UK, Bible Voice Broadcasting Network	9460me
1651 1700	New Zealand, Radio NZ International	9765pa
1651 1700 DRM	New Zealand, Radio NZ International	9890pa

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

1700 1705 Sat/Sun	Croatia, HRT Voice of Croatia	6165eu
1700 1715 mtwhfa	Croatia, HRT Voice of Croatia	6165eu
1700 1715 f	UK, Bible Voice Broadcasting Network	9460me
1700 1720 t	UK, Bible Voice Broadcasting Network	9460me
1700 1745 h	UK, Bible Voice Broadcasting Network	9460me
1700 1746	UK, BBC World Service	9410af 11860af
1700 1750	New Zealand, Radio NZ International	9765pa
1700 1750 DRM	New Zealand, Radio NZ International	9890pa
1700 1757	China, China Radio International	6090as
	6100as 6140eu 7205eu 7255af	
	7335af 7410af 7420as 7425as	
	7435eu 9570af	
1700 1800	Anguilla, Worldwide Univ Network	11775am
1700 1800	Australia, ABC NT Alice Springs	2310do
1700 1800	Australia, ABC NT Katherine	2485do
1700 1800	Australia, Radio Australia	5995pa 6080pa
	9475pa 9580pa 9710pa 11880pa	
1700 1800	Bahrain, Radio Bahrain	6010me
1700 1800 Sat	Canada, CBC Northern Quebec Service	9625na
1700 1800	Canada, CFRX Toronto ON	6070na
1700 1800	Canada, CFPV Calgary AB	6030na
1700 1800	Canada, CKZN St Johns NF	6160na
1700 1800	Canada, CKZU Vancouver BC	6160na
1700 1800	Canada, Radio Canada International	9610na
1700 1800 DRM	Canada, Radio Canada International	9800na
1700 1800	Egypt, Radio Cairo	12170af
1700 1800	Equatorial Guinea, Radio Africa/Malabo	15190af
1700 1800	Malaysia, RTM/Traxx FM	7295do
1700 1800 Sat/Sun	Palau, T8WH/World Harvest Radio/Koror	9930as
1700 1800	Russia, Voice of Russia	4975va 7240as
	7330as 9470va 9880as	
1700 1800	South Africa, Channel Africa	15235af
1700 1800	Swaziland, TWR Swaziland	3200af
1700 1800	Taiwan, Radio Taiwan International	15690af
1700 1800	Tajikistan, Voice of Tajik	7245va
1700 1800	UK, BBC World Service	3255af 5975as
	6190af 9740as	
1700 1800 Sun	UK, Bible Voice Broadcasting Network	9460me
1700 1800 Sat	UK, Bible Voice Broadcasting Network	9460me
1700 1800	USA, American Forces Network	4319usb
	5446usb 5765usb 7812usb 12133usb	
	12759usb 13362usb	
1700 1800	USA, EWTN/WEWN Irondale, AL	15610me
1700 1800	USA, FBN/WTJC Newport NC	9370na
1700 1800	USA, Voice of America	6080af 13635af
	15580af 17895af	

1700 1800	USA, WBCQ Monticello ME	9330am	
1700 1800 Sat	USA, WBCQ Monticello ME	15420am	
1700 1800	USA, WHRI Cypress Creek SC	15180af	21630af
1700 1800 smtwhf	USA, WHRI Cypress Creek SC	9840af	
1700 1800	USA, WINB Red Lion PA	13570am	
1700 1800	USA, WJHR International Milton FL	15550na	
1700 1800	USA, WRNO New Orleans LA	7505am	15590al
1700 1800	USA, WTWW Lebanon TN	9479na	
1700 1800	USA, WWCR Nashville TN	9980na	12160af
		13845na	15825na
1700 1800	USA, WWRB Manchester TN	9385na	
1700 1800	USA, WYFR/Family Radio Worldwide	7230af	7385af 12045af 13695am 15795am
		17555am	18980va 21680af
1700 1800	Zambia, CVC/1 Africa	4965af	13590as
1700 1800	Zambia, Radio Christian Voice	4965af	
1700 1800	Zambia, Zambia Broadcasting Corp	6165do	
1714 1800	Congo Dem. Republic, Radio Kahuzi	6209do	
1715 1730	Vatican City State, Vatican Radio	4005eu	5885eu 7250eu 7290eu 9645eu
1720 1740 fas	USA, Voice of America	4930af	12080af 15775af
1730 1800	Clandestine, Sudan Radio Service/ SRS	9590af	
1730 1800 mtwhf	USA, Voice of America	4930af	12080af 15775af
1730 1800	Vatican City State, Vatican Radio	9755af	11625af 13765af
1745 1800	Bangladesh, Bangladesh Betar	7250as	
1745 1800 DRM	India, All India Radio	9950eu	
1745 1800	India, All India Radio	6280eu	7400af 7410af 7550eu 9415af 9445af 11935af 6120al
1751 1800	New Zealand, Radio NZ International	11725pa	
1751 1800 DRM	New Zealand, Radio NZ International	11675pa	

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

1800 1804	Canada, Radio Canada International	9610na	
1800 1804 DRM	Canada, Radio Canada International	9800na	
1800 1810	Tanzania, Radio Tanzania/Zanzibar	11735af	
1800 1815	UK, Bible Voice Broadcasting Network	9460me	
1800 1830 w	Austria, AWR Europe	9515af	
1800 1830	Congo Dem. Republic, Radio Kahuzi	6209do	
1800 1830 DRM	Romania, Radio Romania International	5895eu	
1800 1830	South Africa, AWR Africa	3215af	3345af
1800 1830	UK, BBC World Service	7260as	7355as
1800 1830 Sat	UK, Bible Voice Broadcasting Network	9460me	
1800 1830	USA, Voice of America	6030af	13635af 15580af
1800 1830 f	USA, Voice of America	4930af	12080af 15775af
1800 1830 Sat/Sun	USA, Voice of America	4930af	
1800 1850	New Zealand, Radio NZ International	11725pa	
1800 1850 DRM	New Zealand, Radio NZ International	11675pa	
1800 1857	China, China Radio International	6100eu	7405eu
1800 1857	Netherlands, R Netherlands Worldwide	6020af	11655af
1800 1857	North Korea, Voice of Korea	7570eu	12015eu
1800 1858	Taiwan, Radio Taiwan International	3965eu	
1800 1859	Canada, Radio Canada International	9740va	11845af 15365af 17790af
1800 1859	Poland, Polskie Radio Warsaw	9650eu	
1800 1859 DRM	Poland, Polskie Radio Warsaw	5895eu	
1800 1900	Anguilla, Worldwide Univ Network	11775am	
1800 1900	Argentina, RAE	9690eu	15345eu
1800 1900	Australia, ABC NT Alice Springs	2310do	
1800 1900	Australia, ABC NT Katherine	2485do	
1800 1900	Australia, Radio Australia	6080pa	7240pa 9475pa 9580pa 9710pa 11880pa
1800 1900	Bahrain, Radio Bahrain	6010me	
1800 1900	Bangladesh, Bangladesh Betar	7250as	
1800 1900	Canada, CFRX Toronto ON	6070na	
1800 1900	Canada, CFVP Calgary AB	6030na	
1800 1900	Canada, CKZN St Johns NF	6160na	
1800 1900	Canada, CKZU Vancouver BC	6160na	
1800 1900	Equatorial Guinea, Radio Africa/Malabo	15190af	
1800 1900 DRM	India, All India Radio	9950eu	
1800 1900	India, All India Radio	6280eu	7400af 7410af 9415af 9445af 11935af 6120al
1800 1900	Kuwait, Radio Kuwait	15540va	

1800 1900	Liberia, Star Radio	3960do	
1800 1900	Malaysia, RTM/Traxx FM	7295do	
1800 1900	Nigeria, Voice of Nigeria/Ikorodu	15120va	
1800 1900	Palau, T8WH/World Harvest Radio/Koror	9955as	
1800 1900 DRM	Romania, Radio Romania International	6065eu	7415eu
1800 1900	Russia, Voice of Russia	4975va	7240as 7305va 7330as 9880af 12060af
1800 1900	South Korea, KBS World Radio	7275eu	
1800 1900	Swaziland, TWR Swaziland	3200af	
1800 1900	UK, BBC World Service	3255af	5875eu 5945as 5955as 6005af 6190af 7225eu 9615af 11810af
1800 1900 Sat	UK, Bible Voice Broadcasting Network	6110me	
1800 1900 Sun	UK, Bible Voice Broadcasting Network	6110me	
1800 1900	USA, American Forces Network	4319usb	5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
1800 1900	USA, EWTV/WEWN Irondale, AL	15610me	
1800 1900	USA, FBN/WTJC Newport NC	9370na	
1800 1900	USA, WBCQ Monticello ME	9330am	
1800 1900	USA, WHRI Cypress Creek SC	9840af	21630af
1800 1900	USA, WINB Red Lion PA	13570am	
1800 1900	USA, WJHR International Milton FL	15550na	
1800 1900	USA, WRNO New Orleans LA	7505am	15590al
1800 1900	USA, WTWW Lebanon TN	9479na	
1800 1900	USA, WWCR Nashville TN	9980na	12160af
		13845na	15825na
1800 1900	USA, WWRB Manchester TN	9385na	
1800 1900	USA, WYFR/Family Radio Worldwide	6045af	6915va 7240af 7395af 9895af
		11665af	13695af 15115af 1755am 17535am
1800 1900	Yemen, Yemen RTV Corp/Radio Sana	6005me	9780me
1800 1900	Zambia, CVC/1 Africa	4965af	13590as
1800 1900	Zambia, Radio Christian Voice	4965af	
1800 1900	Zambia, Zambia Broadcasting Corp	6165do	
1830 1900	Bulgaria, Radio Bulgaria	6200eu	7400eu
1830 1900 DRM	Bulgaria, Radio Bulgaria	9700eu	
1830 1900 mtwhf	Moldova, (Transnistria) Radio PMR	6240na	
1830 1900	South Africa, AWR Africa	11830af	
1830 1900	UK, BBC World Service	9410af	
1830 1900	USA, Voice of America	4930af	6080af 13635af 15580af
1830 1900 Sat	USA, WHRI Cypress Creek SC	15180af	
1845 1850	Guinea, RTV Guineenne	7125do	
1851 1900	New Zealand, Radio NZ International	11725pa	
1851 1900 DRM	New Zealand, Radio NZ International	15720pa	

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

1900 1915 Sun	UK, Bible Voice Broadcasting Network	9460me	
1900 1928	Germany, Deutsche Welle	15275af	
1900 1930	Germany, Deutsche Welle	9735af	13780af
1900 1930	Vietnam, Voice of Vietnam	7280eu	9730eu
1900 1945 DRM	India, All India Radio	9950eu	
1900 1945	India, All India Radio	6280eu	7400af 7410af 9415af 9445af 11935af 6120al
1900 1945 Sun	UK, Bible Voice Broadcasting Network	9470me	
1900 1950 DRM	New Zealand, Radio NZ International	15720pa	
1900 1950	New Zealand, Radio NZ International	11725pa	
1900 1957	China, China Radio International	7285af	7295af 9440af
1900 1957	Netherlands, R Netherlands Worldwide	7425af	9895af 11615af 11655af
1900 1957	North Korea, Voice of Korea	7210af	9975af 11535va 11910af
1900 2000	Anguilla, Worldwide Univ Network	11775am	
1900 2000	Australia, ABC NT Alice Springs	2310do	
1900 2000	Australia, ABC NT Katherine	2485do	
1900 2000	Australia, Radio Australia	6080pa	7240pa 9475pa 9500as 9580pa 9710pa 11880pa
1900 2000	Bahrain, Radio Bahrain	6010me	
1900 2000	Canada, CFRX Toronto ON	6070na	
1900 2000	Canada, CFVP Calgary AB	6030na	
1900 2000	Canada, CKZN St Johns NF	6160na	
1900 2000	Canada, CKZU Vancouver BC	6160na	
1900 2000	Egypt, Radio Cairo	11510af	

1900 2000	Equatorial Guinea, Radio Africa/Malabo		
	15190af		
1900 2000	Indonesia, Voice of Indonesia/Jawa Barat		
	9525eu 11785eu		
1900 2000	Kuwait, Radio Kuwait	15540va	
1900 2000	Liberia, Star Radio	3960do	
1900 2000	Malaysia, RTM/Traxx FM	7295do	
1900 2000	Nigeria, Voice of Nigeria/Ikorodu	7255af	
1900 2000 Sat/Sun	Palau, T8WH/World Harvest Radio/Koror		
	9930as		
1900 2000	Russia, Voice of Russia	4975va 7330eu	
	12060af		
1900 2000 smtwhf	Slovakia, NEXUS/IRRS SW	6090va	
1900 2000 mtwhf	Spain, Radio Exterior de Espana	9605af	
	9665eu		
1900 2000	Swaziland, TWR Swaziland	3200af	
1900 2000	Thailand, Radio Thailand World Service	7570eu	
1900 2000	UK, BBC World Service	3255af 5875eu	
1900 2000		5945as 5955as 6005af 6190af	
		7225eu 9410af 9615af 11810af	
1900 2000 Sat	UK, Bible Voice Broadcasting Network	9470me	
1900 2000 Sun	UK, Bible Voice Broadcasting Network	6030eu	
1900 2000	USA, American Forces Network	4319usb	
	5446usb 5765usb 7812usb 12133usb		
	12759usb 13362usb		
1900 2000	USA, EWTN/WEWN Irondale, AL	15610af	
1900 2000	USA, FBN/WTJC Newport NC	9370na	
1900 2000	USA, KJES Vado NM	15385ca	
1900 2000	USA, Voice of America	4930af 4940af	
	6080af 15580af		
1900 2000	USA, Voice of America/Special English	9585va	
	12020va		
1900 2000	USA, WBCQ Monticello ME	9330am 15420am	
1900 2000 mtwhfa	USA, WBCQ Monticello ME	7415am	
1900 2000	USA, WHRI Cypress Creek SC	9840af	
	15180af 17520na		
1900 2000	USA, WINB Red Lion PA	13570am	
1900 2000	USA, WJHR International Milton FL	15550na	
1900 2000	USA, WRNO New Orleans LA	7505am	
	15590al		
1900 2000	USA, WTWW Lebanon TN	9479na	
1900 2000	USA, WWCN Nashville TN	9980na 12160af	
	13845na 15825na		
1900 2000	USA, WWRB Manchester TN	9385na	
1900 2000	USA, WYFR/Family Radio Worldwide	3230af	
	6020af 6085ca 6915va 7395af		
	9705af 9885af 9925af 15115af		
	15565va		
1900 2000	Zambia, CVC/1 Africa	4965af 13590as	
1900 2000	Zambia, Radio Christian Voice	4965af	
1900 2000	Zambia, Zambia Broadcasting Corp	6165do	
1905 1910 mtwhfa	Croatia, HRT Voice of Croatia	6165eu	
1905 1920 Sat	Mali, RTV Malienne	5995do	
1905 2000 m	South Africa, SA Radio League	3215af	
1915 1945 Sat	UK, Bible Voice Broadcasting Network	6030eu	
1930 2000	Iran, VOIRI/IRIB	6010eu 6115eu 7320eu	
	11695af 11860af		
1930 2000	Serbia, International Radio of Serbia	6100eu	
1930 2000	South Africa, RTE Radio Worldwide	6225af	
1930 2000	Turkey, Voice of Turkey	6050eu	
1945 2000 mtwhfa	Albania, Radio Tirana	7465eu 11635na	
1951 2000	New Zealand, Radio NZ International	11725pa	
1951 2000 DRM	New Zealand, Radio NZ International	17675pa	

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

2000 2005 m	South Africa, SA Radio League	3215af	
2000 2025	Turkey, Voice of Turkey	6050eu	
2000 2027	Iran, VOIRI/IRIB	6010eu 6115eu 7320eu	
	11695af 11860af		
2000 2030	Egypt, Radio Cairo	11510af	
2000 2030	Niger, ORTN/La Voix du Sahel	9705do	
2000 2030	South Africa, RTE Radio Worldwide	6225af	
2000 2030 Sat	Swaziland, TWR Swaziland	3200af	
2000 2030	USA, Voice of America	4930af 4940af	
	6080af 15580af		
2000 2030	Vatican City State, Vatican Radio	7365af	
	9755af 11625af		
2000 2045	Rwanda, Radiodiffusion Rwandaise	6055do	
2000 2050	New Zealand, Radio NZ International	11725pa	
2000 2050 DRM	New Zealand, Radio NZ International	17675pa	
2000 2057	China, China Radio International	5960eu	
	5985af 7285eu 7295af 9440af		
	9600eu 11640eu 13630af		

2000 2057	Germany, Deutsche Welle	9735af 13780af	
	15275af		
2000 2057	Netherlands, R Netherlands Worldwide	5935af	
	7425af 11655af		
2000 2059	Germany, Deutsche Welle	9690af	
2000 2100	Anguilla, Worldwide Univ Network	11775am	
2000 2100	Australia, ABC NT Alice Springs	2310do	
2000 2100	Australia, ABC NT Katherine	2485do	
2000 2100	Australia, ABC NT Tennant Creek	2325do	
2000 2100	Australia, Radio Australia	9500as 9700as	
	11650as		
2000 2100 Sat/Sun	Australia, Radio Australia	6080va 7240pa	
	12080pa		
2000 2100	Bahrain, Radio Bahrain	6010me	
2000 2100 DRM	Belgium, TDP Radio/Disco Palace	17755am	
2000 2100	Canada, CFRX Toronto ON	6070na	
2000 2100	Canada, CFVP Calgary AB	6030na	
2000 2100	Canada, CKZU St Johns NF	6160na	
2000 2100	Canada, CKZU Vancouver BC	6160na	
2000 2100	Cuba, Radio Havana Cuba	11760am	
2000 2100	Equatorial Guinea, Radio Africa/Malabo		
	15190af		
2000 2100	Kuwait, Radio Kuwait	15540va	
2000 2100	Liberia, Star Radio	3960do	
2000 2100	Malaysia, RTM/Traxx FM	7295do	
2000 2100	Nigeria, Voice of Nigeria/Ikorodu	7255af	
2000 2100 Sat/Sun	Palau, T8WH/World Harvest Radio/Koror		
	9930as		
2000 2100	Russia, Voice of Russia	7330eu	
2000 2100	Syria, Radio Damascus	9330eu 12085va	
2000 2100	UK, BBC World Service	3255af 6005af	
	6190af 9410af 9615af 11810af		
2000 2100	Ukraine, Radio Ukraine International	6030na	
2000 2100	USA, American Forces Network	4319usb	
	5446usb 5765usb 7812usb 12133usb		
	12759usb 13362usb		
2000 2100	USA, EWTN/WEWN Irondale, AL	15610af	
2000 2100	USA, FBN/WTJC Newport NC	9370na	
2000 2100 mtwhf	USA, Voice of America	7470va 9490va	
2000 2100	USA, WBCQ Monticello ME	7415am 15420am	
2000 2100	USA, WBCQ Monticello ME	5110am	
2000 2100	USA, WINB Red Lion PA	13570am	
2000 2100	USA, WJHR International Milton FL	15550na	
2000 2100	USA, WRNO New Orleans LA	7505am	
	15590al		
2000 2100	USA, WTWW Lebanon TN	9479na	
2000 2100	USA, WWCN Nashville TN	9980na 12160af	
	13845na 15825na		
2000 2100	USA, WWRB Manchester TN	9385na	
2000 2100	USA, WYFR/Family Radio Worldwide	5745va	
	6915va 9925af 11615af 15115af		
	15195af 15520af 17535am 17555am		
	17575sa		
2000 2100	Zambia, CVC/1 Africa	4965af 9505af	
2000 2100	Zambia, Radio Christian Voice	4965af	
2000 2100	Zambia, Zambia Broadcasting Corp	6165do	
2000 21000	USA, WHRI Cypress Creek SC	7540na	
	15180na 15665na		
2030 2045	Thailand, Radio Thailand World Service	9535eu	
2030 2100 mtwhf	Moldova, (Transnistria) Radio PMR	6240eu	
2030 2100	USA, Voice of America	4930af 6080af	
	7560as 15580af		
2030 2100 Sat/Sun	USA, Voice of America	4940af	
2030 2100	Vietnam, Voice of Vietnam	7220me 7280eu	
	9550me 9730eu		
2045 2100	India, All India Radio	6280eu 7550eu	
	9445eu 11620pa 11715pa 9910al		
	9940al		
2045 2100 DRM	India, All India Radio	9950eu	
2045 2100 DRM	Vatican City State, Vatican Radio	9800am	
2050 2100	Vatican City State, Vatican Radio	4005eu	
	5885eu 7250eu		
2051 2100	New Zealand, Radio NZ International	11725pa	
2051 2100 DRM	New Zealand, Radio NZ International	15720pa	

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

2100 2110	Papua New Guinea, Wantok Radio Light		
	7325do		
2100 2120	Vatican City State, Vatican Radio	4005eu	
	5885eu 7250eu		
2100 2130 mtwhfa	Albania, Radio Tirana	7530eu 9895na	
2100 2130	Australia, ABC NT Alice Springs	2310do	
2100 2130	Australia, ABC NT Katherine	2485do	

2100 2130	Australia, ABC NT Tennant Creek	2325do
2100 2130	Austria, AWR Europe	9830af
2100 2130 Sat	Canada, CBC Northern Quebec Service	9625na
2100 2130 DRM	Vatican City State, Vatican Radio	9800am
2100 2150	New Zealand, Radio NZ International	11725pa
2100 2150 DRM	New Zealand, Radio NZ International	15720pa
2100 2157	China, China Radio International	7250af
	11640af 13630af	
2100 2157	China, China Radio International	5960as
	6135as 7205eu 7225as 7250as	
	7285as 7405eu 7415eu 9600af	
	11640af 13630af	
2100 2157	Germany, Deutsche Welle	12070af 13780af
2100 2157	North Korea, Voice of Korea	7570eu 12015eu
2100 2159	Germany, Deutsche Welle	7280af 9545af
2100 2200	Anguilla, Worldwide Univ Network	11775am
2100 2200	Australia, Radio Australia	9500as 9660pa
	11650as 11695va 12080pa 13630pa	
	15515va	
2100 2200	Bahrain, Radio Bahrain	6010me
2100 2200	Belarus, Radio Station Belarus	7360eu 7390eu 6155eu
2100 2200 DRM	Belgium, TDP Radio	17755eu
2100 2200	Canada, CFRX Toronto ON	6070na
2100 2200	Canada, CFVP Calgary AB	6030na
2100 2200	Canada, CKZN St Johns NF	6160na
2100 2200	Canada, CKZU Vancouver BC	6160na
2100 2200	Equatorial Guinea, Radio Africa/Malabo	15190af
2100 2200	India, All India Radio	6280eu 7550eu 9940al 11620pa 11715pa 9910al
2100 2200 DRM	India, All India Radio	9950eu
2100 2200	Malaysia, RTM/Traxx FM	7295do
2100 2200 Sat/Sun	Palau, T8WH/World Harvest Radio/Koror	9930as
2100 2200	Russia, Voice of Russia	7290eu 7330eu
2100 2200	Syria, Radio Damascus	9330va 12085va
2100 2200	UK, BBC World Service	3255af 3915as 5875as 5910af 5965as 6190af 6195as 7465af 9915af
2100 2200	USA, American Forces Network	4319usb
	5446usb 5765usb 7812usb 12133usb	
	12759usb 13362usb	
2100 2200	USA, EWTVN/WEWN Irondale, AL	15610af
2100 2200	USA, FBN/WTJC Newport NC	9370na
2100 2200	USA, Voice of America	6080af 15580af
2100 2200	USA, WBCQ Monticello ME	7415am 9330am
	15420am	
2100 2200 Sat	USA, WBCQ Monticello ME	5110am
2100 2200	USA, WHRI Cypress Creek SC	15180na 15665na 7555na
2100 2200	USA, WINB Red Lion PA	13570am
2100 2200	USA, WJHR International Milton FL	15550na
2100 2200	USA, WRNO New Orleans LA	15590al 7505am
2100 2200	USA, WTWW Lebanon TN	9479na
2100 2200	USA, WWCR Nashville TN	7465na 9350na
	9980na 13845na	
2100 2200	USA, WWRB Manchester TN	9385na
2100 2200	USA, WYFR/Family Radio Worldwide	5950am
	6915va 7510va 9925af 15195af	
	17535am 17555am	
2100 2200	Zambia, CVC/1 Africa	4965af 9505af
2100 2200	Zambia, Radio Christian Voice	4965af
2100 2200	Zambia, Zambia Broadcasting Corp	6165do
2115 2200	Egypt, Radio Cairo	6270eu
2130 2157	Romania, Radio Romania International	6030na
	6115na 7310eu 7380eu	
2130 2200	Australia, ABC NT Alice Springs	4835do
2130 2200	Australia, ABC NT Katherine	5025do
2130 2200 mtwhfa	Canada, CBC Northern Quebec Service	9625na
2130 2200 DRM	Romania, Radio Romania International	6030eu
2130 2200	Turkey, Voice of Turkey	9610va
2151 2200	New Zealand, Radio NZ International	15720pa
2151 2200 DRM	New Zealand, Radio NZ International	17675pa

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

2200 2205	Zambia, Zambia Broadcasting Corp	6165do
2200 2210	Guinea, Radio Familia FM	4900do

2200 2225	Turkey, Voice of Turkey	9610va
2200 2230	India, All India Radio	6280eu 7550eu 9445eu 11620pa 11715pa 9910al 9940al
2200 2230 DRM	India, All India Radio	9950eu
2200 2230	Serbia, International Radio of Serbia	6100eu
2200 2230	South Korea, KBS World Radio	3955eu
2200 2245	Egypt, Radio Cairo	6270eu
2200 2257	China, China Radio International	5915as
2200 2259 DRM	Canada, Radio Canada International	9800na
2200 2300	Anguilla, Worldwide Univ Network	6090am
2200 2300	Australia, ABC NT Alice Springs	4835do
2200 2300	Australia, ABC NT Katherine	5025do
2200 2300	Australia, Radio Australia	11695pa 12080pa 13590va 13630pa 15230as 15240pa 15360pa 15415as 15515va 15560pa
2200 2300	Bahrain, Radio Bahrain	6010me
2200 2300	Belarus, Radio Station Belarus	7360eu 7390eu 6155eu
2200 2300	Bulgaria, Radio Bulgaria	6200eu 7400eu
2200 2300 smtwhf	Canada, CBC Northern Quebec Service	9625na
2200 2300	Canada, CFRX Toronto ON	6070na
2200 2300	Canada, CFVP Calgary AB	6030na
2200 2300	Canada, CKZN St Johns NF	6160na
2200 2300	Canada, CKZU Vancouver BC	6160na
2200 2300	Equatorial Guinea, Radio Africa/Malabo	15190af
2200 2300	Malaysia, RTM/Traxx FM	7295do
2200 2300	New Zealand, Radio NZ International	15720pa
2200 2300 DRM	New Zealand, Radio NZ International	17675pa
2200 2300 fa	Palau, T8WH/World Harvest Radio/Koror	9930as
2200 2300	Russia, Voice of Russia	7300eu
2200 2300 Sat/Sun	Spain, Radio Exterior de Espana	6125eu
2200 2300	Syria, Radio Damascus	9330va 12085va
2200 2300	UK, BBC World Service	3915as 5875as 5910af 5965as 6135as 6195as 9740as 9915af
2200 2300	USA, American Forces Network	4319usb
	5446usb 5765usb 7812usb 12133usb	
	12759usb 13362usb	
2200 2300	USA, EWTVN/WEWN Irondale, AL	15610af
2200 2300	USA, FBN/WTJC Newport NC	9370na
2200 2300 smtwh	USA, Voice of America	5835va 7365va 7425va 7570va 11860va
2200 2300	USA, WBCQ Monticello ME	9330am
2200 2300 fasmt	USA, WBCQ Monticello ME	7415am
2200 2300 Sat	USA, WBCQ Monticello ME	5110am
2200 2300	USA, WHRI Cypress Creek SC	9615na
	15180na	
2200 2300	USA, WINB Red Lion PA	9265am
2200 2300	USA, WJHR International Milton FL	15550na
2200 2300	USA, WTWW Lebanon TN	9479na
2200 2300	USA, WWCR Nashville TN	7465na 9350na
	9980na 13845na	
2200 2300	USA, WWRB Manchester TN	3215na
2200 2300	USA, WYFR/Family Radio Worldwide	5950am
	15440am 11740am 17690af	
2200 2300	Zambia, Radio Christian Voice	4965af
2230 2300	Guam, KSDA/AWR	15320as
2230 2300 mtwhf	Moldova, (Transnistria) Radio PMR	6240eu
2230 2300	USA, Voice of America/Special English	5850va 7230va 9570va
2245 2300	India, All India Radio	6055as 7305as 11645as 13605as 9705al 9950al

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

2300 0000	Anguilla, Worldwide Univ Network	6090am
2300 0000	Australia, ABC NT Alice Springs	4835do
2300 0000	Australia, ABC NT Katherine	5025do
2300 0000	Australia, Radio Australia	9660pa 12080pa 13590va 13690pa 15230as 15360pa 15145as 15560pa 17795pa
2300 0000	Bahrain, Radio Bahrain	6010me
2300 0000 smtwhf	Canada, CBC Northern Quebec Service	9625na
2300 0000	Canada, CFRX Toronto ON	6070na
2300 0000	Canada, CFVP Calgary AB	6030na
2300 0000	Canada, CKZN St Johns NF	6160na
2300 0000	Canada, CKZU Vancouver BC	6160na
2300 0000	Cuba, Radio Havana Cuba	5040am
2300 0000	Egypt, Radio Cairo	11590am

2300 0000	India, All India Radio	6055as	7305as	2300 0000	USA, WTTW Lebanon TN	9479va	
	11645as	13605as	9705af	2300 0000	USA, WWCR Nashville TN	5070na	7465na
2300 0000	Malaysia, RTM/Traxx FM	7295do			9980na	13845na	
2300 0000	New Zealand, Radio NZ International	15720pa		2300 0000	USA, WWRB Manchester TN	3215na	6890va
2300 0000 DRM	New Zealand, Radio NZ International	17675pa		2300 0000	USA, WYFR/Family Radio Worldwide	15400ca	9430ca
2300 0000	Romania, Radio Romania International	5915va					
	6015eu	7220as	7300as	2300 0000	Zambia, Radio Christian Voice		4965af
2300 0000	Russia, Voice of Russia	7250na		2300 2330	Australia, Radio Australia	11695pa	15240pa
2300 0000	UK, BBC World Service	3915as	5875as	2300 2330	USA, Voice of America/Special English	7460va	6180va
	6135as	6195as	7385as			11655va	11840va
2300 0000	USA, American Forces Network	4319usb		2300 2330 DRM	Vatican City State, Vatican Radio		7370am
	5446usb	5765usb	7812usb	2300 2345	USA, WYFR/Family Radio Worldwide		11740na
	12759usb	13362usb	12133usb	2300 2357	China, China Radio International		5915as
2300 0000	USA, EWTN/WEWN Irondale, AL	15610af			5990ca	6040na	6145eu
2300 0000	USA, FBN/WTJC Newport NC	9370na			7415as	9610pa	11790as
2300 0000	USA, Voice of America	5830va	7365va	2300 2357	Turkey, Voice of Turkey		73335va
	7480va	7570va	11860va	2315 2330 mtwhf	Croatia, HRT Voice of Croatia		3985eu
2300 0000	USA, WBCQ Monticello ME	9330am			7375sa		
2300 0000 fasmt	USA, WBCQ Monticello ME	7415am		2330 0000	Australia, Radio Australia	17750as	
2300 0000 Sat	USA, WBCQ Monticello ME	5110am		2330 0000	UK, BBC World Service	6170as	
2300 0000	USA, WHRI Cypress Creek SC	7315na		2330 0000	USA, Voice of America/Special English	7460va	6180va
2300 0000 smtwhf	USA, WHRI Cypress Creek SC	5920na				11655va	11840va
2300 0000 Sat	USA, WHRI Cypress Creek SC	7335na		2330 0000	Vietnam, Voice of Vietnam	9840as	12020as
2300 0000	USA, WINB Red Lion PA	9265am					

MT SHORTWAVE STATION RESOURCE GUIDE

Albania, Radio Tirana	http://rtsh.sil.at/
Anguilla, Worldwide Univ Network	www.worldwideuniversitynetwork.com/
Australia, ABC NT Alice Springs	www.abc.net.au/radio/
Australia, ABC NT Katherine	www.abc.net.au/radio/
Australia, ABC NT Tennant Creek	www.abc.net.au/radio/
Australia, HCJB Global Australia	www.hcjb.org/
Australia, Radio Australia	www.abc.net.au/ra/
Austria, AWR Europe	www.awr2.org/
Austria, Radio Austria International	http://oe1.orf.at/service/international
Bahrain, Radio Bahrain	www.radiobahrain.fm/
Bangladesh, Bangladesh Betar	www.betar.org.bd/
Belarus, Radio Station Belarus	www.radiobelarus.tvr.by/eng/
Belgium, TDF Radio	www.airtime.be/schedule.html
Belgium, TDF Radio/Disco Palace	www.airtime.be/schedule.html
Bhutan, Bhutan Broadcasting Service	www.bbs.com.bt
Bulgaria, Radio Bulgaria	www.bnr.bg/
Bulgaria, Radio Bulgaria/Euranet	www.bnr.bg/
Canada, CBC Northern Quebec Service	www.cbc.ca/north/
Canada, CFRX Toronto ON	www.cfrb.com
Canada, CFVP Calgary AB	www.classiccountrym1060.com
Canada, CKZN St Johns NF	www.cbc.ca/listen/index.html
Canada, CKZU Vancouver BC	www.cbc.ca/bc
Canada, Radio Canada International	www.rcinet.ca/
China, China Radio International	www.cri.cn/
China, Voice of the Strait (News Channel) Fuzhou	www.vos.com.cn
China, Voice of the Strait/Fuzhou	www.vos.com.cn
China, Xizang People's Broadcasting Sta/Lhasa	www.tibetradio.com
Clandestine, Cotton Tree News	www.coffontreenews.org/
Clandestine, Sudan Radio Service/ SRS	www.sudanradio.org/
Congo Dem. Republic, Radio Kahuzi	www.radiokahuzi.com
Croatia, HRT Voice of Croatia	www.hrt.hr/
Cuba, Radio Havana Cuba	www.radiohc.cu/
Egypt, Radio Cairo	www.ertu.org
Equatorial Guinea, Radio Africa/Malabo	www.panambc.com
Equatorial Guinea, Radio African 2/Malabo	www.panambc.com
Equatorial Guinea, Radio East Africa/Malabo	www.panambc.com
Ethiopia, Radio Ethiopia	www.erta.gov.et
Ethiopia, Radio Ethiopia/Home Service	www.erta.gov.et
France, Radio France Internationale	http://rfienglish.com
Germany, AWR Europe	www.awr2.org/
Germany, Deutsche Welle	www.dw-world.de/
Germany, European Music Radio	www.emr.org.uk/
Germany, Overcomer Ministries	www.overcomerministry.org/
Germany, Pan American Broadcasting	www.radiopanam.com/
Germany, Radio Gloria International	www.radiopanam.com/
Germany, TWR Europe	www.twr.org
Greece, Voice of Greece	www.voiceofgreece.gr/
Guam, KSDA/AWR	www.awr2.org/
Guam, KTWR/TWR	www.twr.org/
India, All India Radio	www.allindiaradio.org/
Indonesia, Voice of Indonesia/Jawa Barat	www.voi.co.id
Iran, VOIRI/IRIB	www.irib.ir/English/
Japan, Radio Japan NHK World Network	www.nhk.or.jp/english/
Kuwait, Radio Kuwait	www.media.gov.kw/
Laos, Lao National Radio	www.lnr.org.la
Liberia, Star Radio	www.starradio.org.lr/
Malaysia, RTM/Traxx FM	www.traxxfm.net/index.php
Malaysia, RTM/Voice of Malaysia	www.rtm.gov.my

Mali, RTV Malienne	www.ortm.ml
Monaco, TWR Europe	www.twr.org/
Mongolia, Mongolian Radio 2/Murun	www.mnb.mn
Mongolia, Mongolian Radio 2/Ulaanbaatar	www.mnb.mn
Mongolia, Voice of Mongolia	www.mnb.mn
Nepal, Radio Nepal	www.radionepal.org/
Netherlands, R Netherlands Worldwide	www.radionetherlands.nl/
New Zealand, Radio NZ International	www.rnzi.com
Niger, ORTN/La Voix du Sahel	http://telesahel.org/
Nigeria, Voice of Nigeria/Ikorodu	www.voiceofnigeria.org
Oman, Radio Sultanate of Oman	www.oman-tv.gov.om
Pakistan, PBC/Radio Pakistan	www.radio.gov.pk
Palau, T8WH/World Harvest Radio/Koror	www.whr.org/
Philippines, PBS/ Radyo Pilipinas	www.pbs.gov.ph/
Poland, Polskie Radio Warsaw	www.polskieradio.pl
Romania, Radio Romania International	www.rri.ro/
Russia, Voice of Russia	www.ruvr.ru/
Rwanda, Radiodiffusion Rwandaise	www.orinfor.gov.rw/radiorwanda.eng.html
Saudi Arabia, BSKSA/Saudi Radio	www.saudiradio.net
Serbia, International Radio of Serbia	www.glassrbije.org
Slovakia, NEXUS/IRRS SW	www.nexus.org
Slovakia, R Slovakia Intl/WRMI	www.wrmi.net/
South Africa, AWR Africa	www.awr2.org/
South Africa, Channel Africa	www.channelafrica.org
South Africa, RTE Radio Worldwide	www.rte.ie/radio1/
South Africa, SA Radio League	www.sarl.org.za
South Africa, TWR Africa	www.twr.org/
South Korea, KBS World Radio	http://rki.kbs.co.kr/english/
Spain, Radio Exterior de Espana	www.ree.rne.es/
Sri Lanka, SLBC	www.slbc.lk
Swaziland, TWR Swaziland	www.twrafrika.org
Syria, Radio Damascus	www.rtv.gov.sy/
Taiwan, Radio Taiwan International	http://english.rti.org.tw/
Thailand, Radio Thailand World Service	www.hsk9.com/
Turkey, Voice of Turkey	www.trt.net.tr
Uganda, Dunamis Shortwave	www.biblevoice.org/stations/east-africa
UK, BBC World Service	www.bbc.co.uk/worldservice/
UK, Bible Voice Broadcasting Network	www.biblevoice.org/
Ukraine, Radio Ukraine International	www.nrcu.gov.ua/
United Arab Emirates, FEBA Radio	www.febaradio.info
United States, Overcomer Ministries	www.overcomerministry.org/
USA, American Forces Network	http://myafn.dodmedia.osd.mil/
USA, EWTN/WEWN Irondale, AL	www.ewtn.com
USA, FBN/WTJC Newport NC	www.fbnradio.com/
USA, KNLS Anchor Point AK	www.knls.org/
USA, Voice of America	www.voanews.com/
USA, Voice of America/Special English	www.voanews.com/
USA, WBCQ Monticello ME	www.wbcq.com/
USA, WHRI Cypress Creek SC	www.whr.org/
USA, WINB Red Lion PA	www.winb.com/
USA, WRNO New Orleans LA	www.wrnoworldwide.org/
USA, WTTW Lebanon TN	www.wttw.us
USA, WWCR Nashville TN	www.wwcr.com
USA, WWRB Manchester TN	www.wwrb.org/
USA, WYFR/Family Radio Worldwide	www.familyradio.com/
Vatican City State, Vatican Radio	www.vaticanradio.org
Vietnam, Voice of Vietnam	www.vov.org.vn
Yemen, Yemen RTV Corp/Radio Sana	www.yemenradio.net
Zambia, CVC/1 Africa	www.1africa.tv
Zambia, Radio Christian Voice	www.1africa.tv

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com



QSL Mix-Alert

Shortwave Central Blog and Facebook a Winning Combination

With the tremendous success of the Shortwave Central blog, I am pleased to announce the launch of the Facebook Fan page, listed on the Facebook System as Monitoring Times Shortwave Central. Postings complement my Shortwave Central blog plus additional monitoring observations, MT previews, last minute tips and informal radio-related posts from our readers and fans. Facebook followers are invited to visit the Monitoring Times Shortwave Central page and click "Like" to be a fan. For Twitter fans, do not forget QSLRptMT for my radio tweets throughout the day.

All about a Rabbit

In the Chinese Lunar New Year, this is the year of the rabbit. To commemorate the year, Radio Free Asia is offering their 35th QSL card entitled, The Year of the Rabbit. This QSL card will be used to verify all valid reception reports to March 31, 2011. Programming details may be posted at the QSL Report link on the RFA website www.techweb.rfa.org or email qsl@rfa.org Postal reports: Reception Reports, Radio Free Asia, 2025 M. Street NW, Suite 20036, Washington, DC 20036 USA.

Slovakia relays from Florida

Jeff White, General Manager of WRMI, is lending a helping hand to continue shortwave transmissions from Radio Slovakia International. RSI discontinued their shortwave broadcast December 31, 2010, reverting to Internet broadcasting. WRMI stepped up to provide a relay for listeners. "We are glad to be able to help Radio Slovakia International continue its shortwave transmissions to this part of the world," said Jeff White.

Listener reports will be appreciated and verified with a special WRMI QSL card commemorating the RSI relay. Email reports may be sent to info@wrmi.net or P.O. Box 526852, Miami, FL 33152 USA. Consult MT's English SW Guide and MT ExPress for the Spanish broadcast schedules.

A surprise from Radio Prague

"Really?!" That was my first reaction when Radio Prague announced they will continue to QSL despite their absence from the shortwave bands. At editorial deadline, Radio Prague was scheduled to move all their shortwave services to the Internet. However, during this column preparation, they announced a new eight card QSL series for 2011 featuring Czech Castles. This may be a first in the hobby: a station QSLing "reception" via the web. Tune

in to streaming audio at www.radio.cz and send details to cr@radio.cz or to Vinohradská, 120 99 Prague 2, Czech Republic.

Clandestine schedule updates

Radio Free Sarawak has dropped their 2230-2330 broadcast and replaced it with 1200-1300 UTC on 6205, while the 1000-1100, 15420 remains intact. Program details at the Contact link www.radiofreesarawak.org Democratic Voice of Burma shifts to 9355 at 1430-1530. Email your report to acn@dvb.no or postal: P.O. Box 6720, ST Olav Plass, N-0130 Oslo, Norway. Website with on-demand video and Facebook www.dvb.no/

Rhein-Main Radio Club 2011 Calendar

RMRC and ADDX clubs are offering their 2011 QSL calendar. This unique annual edition offers colorful historical cards from the 1930's to present. For cost and ordering information go to www.rmr/d Bill Wilkins of Springfield, Missouri sends in a full data Robert Kipp/DX Camp verification card for MRCC via the Sitkuai, Lithuania relay on 6130 kHz. Received in 27 days for an English report and two IRCs. QSL address: Postfach 700849, D-60558 Frankfurt am Main, Germany.



CHILE

CVC La Voz, 17680 kHz. Full data QSL card, unsigned. Received in 115 days for e-report to ondacorta@lavoz.cl (Christian Ghibaudo, France/playdx) Streaming, on-demand audio/video, Facebook and Twitter links www.cvcavoz.com

JAPAN

Nikkei Radio Broadcasting Corp./Radio Nikkei, 6055 kHz. Full data caricature of listeners' card. Received in 54 days for an English report and \$ 3.00US. Station address: 9-15, Akasaka 1-chome, Minato-ku, Tokyo 107-8373. (Albert Munick, Kandahar Airfield, Afghanistan) Streaming audio at www.radionikkei.jp

MARIANAS ISLANDS

Radio Free Asia 12140 kHz via Tinian. Full data RFA card. Received in nine days for e-report to qsl@rfa.org (Ghibaudo) Streaming audio, podcast and RSS www.rfa.org/english

MEDIUM WAVE

BBC/Radio Scotland, 810 kHz AM. Full data verification via email in one day from Alan Braidwood, Producer. Report sent to radio.scotland.online@bbc.co.uk (Mauricio Molano, Salamanca, Spain/DX News) Streaming audio www.bbc.co.uk/radioscotland/

Cyprus, 963 AM kHz via Limassol. Full data color studio card. Received in 42 days for an AM report and \$2.00US. Station address: CyBC Street, Athalassa, Nicosia 2120, Cyprus. (Muick) Website with streaming audio and live/on-demand video www.cybc.com.cy

Cyprus (Northern) Radyo 1/Bayrak RTV, 1098 kHz AM. No data letter signed by Arben Fetoshi, Director of RTV. Received in 126 days for an AM report and \$3.00US. Station address: BRT Sitesi, Dr. Fasil Küçük Bulvan, Lefkosa, Northern Cyprus via Mersin 10, Turkey. (Muick) Website with streaming audio, video and Twitter links www.brtk.cc

KSKY, 660 kHz AM. Full data prepared card signed by Andy Pickard, Chief Engineer. Also received business card, three large advertising cards and religious book. Received in eight days for an AM report and \$1.00US (returned). Station address: 6400 N. Beltline Road, Suite 110, Irving, TX 75063 (Wilkins) Website with streaming audio, Facebook and Twitter links www.ksky.com/

Magic 1161 kHz AM. No data verification letter from one of the DJ's, Darry Lethem. Received in four days for an AM report to: Magic 1161, Commerical Road, Hull HU1 2SQ England (Eike Bierwirth, Germany/HCDX)

WPHT, 1210 kHz AM. Talk Radio 1210. Email confirmation in eight minutes after second follow up email to Marc M. Rayfield, Senior Vice President/Market Manager. Details to: marc.rayfield@cbsradio.com (Molano)

MOROCCO

Radio Méditerranée Internationale/Medi Un, 9575 kHz. QSL card, personal letter and station sticker. Received in 13 weeks for an e-report to technique@medi.com (Artur Fernandez Llorella, Italy/playdx). Streaming/on-demand audio www.medi1.com

RUSSIA

WYFR/Family Radio via Armavir, 15450 kHz. Full data 50 Years Anniversary card and religious literature. Received in three weeks for program details to international@familyradio.com (Bierwirth) Website with streaming/on-demand audio www.familyradio.com

UTILITY

Non-directional beacon "7 B" St Thomas, Ontario, Canada, 375 kHz. Listed as 25 watts. Full data prepared card, signed by Dale Arndt, Airport Superintendent. Received in 33 days for a utility report, self-addressed envelope and \$2.00US. Station address: St. Thomas Municipal Airport, c/o St. Thomas City Hall, P.O. Box 520, 545 Talbot Street, St. Thomas, ON N5P 3V7 Canada (Jim Pogue, Memphis, TN).



MTXTRA

Shortwave Broadcast Guide

CHINESE

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

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

0600	0700	mtwhfas	China, China Huayi Broadcasting Corp	4830do	5050do
0600	0700		China, Hulun Buir PBS	3900do	6080do
0600	0700		China, Nei Menggu PBS	6040do	7270do
			7420do	9520do	9750do
0600	0700		China, Qinghai PBS	4220do	5990do
0600	0700		China, Sichuan PBS	4750do	6060do
			7225do		
0600	0700		China, Voice of the Strait	9505do	
0600	0700		China, Voice of the Strait/Entertainment Ch	7280do	
0600	0700		China, Xinjiang PBS	5960do	7260do
			9600do	11770do	
0600	0700		China, Xizang PBS/Tibet	4820do	4905do
			5240do	5935do	6130do
			7240do	7255do	11860do
					11950do
0630	0700		China, Qinghai PBS	4220do	4750do
			5990do	6145do	9780do

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

0700	0800	mtwhfas	China, China Huayi Broadcasting Corp	4830do	5050do
0700	0800		China, Nei Menggu PBS	6040do	7270do
			7420do	9520do	9750do
0700	0800		China, Qinghai PBS	4220do	4750do
			5990do	6145do	9780do
0700	0800		China, Sichuan PBS	4750do	6060do
			7225do		
0700	0800		China, Voice of the Strait	9505do	
0700	0800		China, Voice of the Strait/Entertainment Ch	7280do	
0700	0800		China, Xinjiang PBS	5960do	7260do
			9600do	11770do	
0700	0800		China, Xizang PBS/Tibet	4820do	4905do
			5240do	5935do	6130do
			7240do	7255do	11860do
					11950do

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

0800	0857		North Korea, Voice of Korea	7220as	9345as
0800	0900	mtwhfas	China, China Huayi Broadcasting Corp	4830do	5050do
0800	0900		China, Hulun Buir PBS	3900do	6080do
0800	0900		China, Nei Menggu PBS	6040do	7270do
			7420do	9520do	9750do
0800	0900		China, Qinghai PBS	4220do	4750do
			5990do	6145do	9780do
0800	0900		China, Sichuan PBS	4750do	6060do
			7225do		
0800	0900		China, Voice of the Strait	9505do	
0800	0900		China, Voice of the Strait/Entertainment Ch	7280do	
0800	0900		China, Xinjiang PBS	5960do	7260do
			9600do	11770do	
0800	0900		China, Xizang PBS/Tibet	4820do	4905do
			5240do	5935do	6130do
			7240do	7255do	11860do
					11950do
0800	0900		Saudi Arabia, BSKSA/Saudi Radio	15610as	
0830	0900		China, Fujian PBS3990do	5970do	

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

0900	0930		Japan, NHK World/Radio Japan	6090as	
0900	1000	mtwhfas	China, China Huayi Broadcasting Corp	4830do	5050do
0900	1000		China, Fujian PBS3990do	5970do	
0900	1000		China, Hulun Buir PBS	3900do	6080do
0900	1000		China, Hunan PBS	4990do	
0900	1000		China, Nei Menggu PBS	6040do	7270do
			7430do	9520do	9750do
0900	1000		China, Qinghai PBS	4220do	4750do
			5990do	6145do	
0900	1000		China, Sichuan PBS	4750do	6060do
			7225do		
0900	1000		China, Voice of the Strait	9505do	
0900	1000		China, Voice of the Strait/Entertainment Ch	7280do	
0900	1000		China, Xinjiang PBS	5960do	7260do
			9600do	11770do	
0900	1000		China, Xizang PBS/Tibet	4820do	4905do
			5240do	5935do	6130do
			7240do	7255do	11860do
					11950do
0900	1000	Sat/Sun	Clandestine, Sound of Hope Radio Network	9540as	11760as
0900	1000		Saudi Arabia, BSKSA/Saudi Radio	15610as	
0900	1000		USA, Voice of America	9845as	9855as
			11855as	11965as	13650as
			15670as		
0930	1000		France, Radio France Internationale	7325as	
			11875eu	12025as	
0945	1000		China, Fujian PBS5005do	5040do	

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

1000	1030		China, Fujian PBS5005do	5040do	
1000	1030		China, Yunnan PBS	6035as	
1000	1030		France, Radio France Internationale	7325as	
			11875eu	12025as	
1000	1100	mthfas	China, China Huayi Broadcasting Corp	4830do	5050do
1000	1100		China, Fujian PBS3990do	5970do	
1000	1100		China, Hulun Buir PBS	3900do	6080do
1000	1100		China, Hunan PBS	4990do	
1000	1100		China, Nei Menggu PBS	6040do	7270do
			7420do	9520do	9750do
1000	1100		China, Qinghai PBS	4220do	4750do
			5990do	6145do	
1000	1100		China, Sichuan PBS	4750do	6060do
			7225do		
1000	1100		China, Voice of the Strait	9505do	
1000	1100		China, Voice of the Strait/Entertainment Ch	7280do	
1000	1100		China, Xinjiang PBS	5960do	7260do
			9600do	11770do	
1000	1100		China, Xizang PBS/Tibet	4820do	4905do
			5240do	5935do	6130do
			7240do	7255do	7385do
1000	1100	Sat/Sun	Clandestine, Sound of Hope Radio Network	9540as	11760as
1000	1100		Malaysia, RTM/Voice of Malaysia	11885as	
			15295as		
1000	1100		USA, Voice of America	9530as	9845as
			9855as	11965as	13650as
			15670as		

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

1100 1130	China, Yunnan PBS	6035as	
1100 1157	North Korea, Voice of Korea	7220as	9345as
1100 1200	China, China Huayi Broadcasting Corp	4830do	5050do
1100 1200	China, Fujian PBS	3990do	5970do
1100 1200	China, Hulun Buir PBS	3900do	6080do
1100 1200	China, Hunan PBS	4990do	
1100 1200	China, Nei Menggu PBS	6040do	7270do
		7420do	9520do
		9750do	
1100 1200	China, Qinghai PBS	4220do	4750do
		5990do	6145do
1100 1200	China, Sichuan PBS	4750do	6060do
		7225do	
1100 1200	China, Voice of the Strait/Entertainment Ch		7280do
1100 1200	China, Xinjiang PBS	5960do	7260do
		9600do	11770do
1100 1200	China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do
		6130do	6200do
		7240do	7255do
		7385do	
1100 1200	Clandestine, Ikuan Tao	7460as	
1100 1200	Clandestine, Sound of Hope Radio Network		7280as
1100 1200	Malaysia, RTM/Voice of Malaysia		11885as
		15295as	
1100 1200	Sweden, IBRA Radio	9945as	
1100 1200	USA, Voice of America	9530as	9785as
		9825as	12045as
		15670as	
1130 1200	China, Voice of Jinling	5860do	
1130 1200	South Korea, KBS World Radio		6065as
		9770as	
1145 1200	India, All India Radio	11840as	15795as
		17705as	

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

1200 1230	China, Yunnan PBS	6035as	
1200 1230	Clandestine, Sound of Hope Radio Network		11520as
1200 1230	Clandestine, Voice of Tibet	15550as	
1200 1230	Japan, NHK World/Radio Japan		6090as
1200 1230	South Korea, KBS World Radio		6065as
		9770as	
1200 1255	Turkey, Voice of Turkey	17715as	
1200 1257	Iran, VOIRI/IRIB	9900as	11670as
		15150as	13650as
1200 1300	China, China Huayi Broadcasting Corp	4830do	5050do
1200 1300	China, Fujian PBS	3990do	5970do
1200 1300	China, Hulun Buir PBS	3900do	6080do
1200 1300	China, Hunan PBS	4990do	
1200 1300	China, Nei Menggu PBS	6040do	7270do
		7420do	9520do
		9750do	
1200 1300	China, Qinghai PBS	4220do	4750do
		5990do	6145do
		6190do	
1200 1300	China, Sichuan PBS	4750do	6060do
		7225do	
1200 1300	China, Voice of Jinling	5860do	
1200 1300	China, Voice of the Strait	9505do	
1200 1300	China, Voice of the Strait/Entertainment Ch		7280do
1200 1300	China, Xinjiang PBS	5960do	7260do
		9600do	11770do
1200 1300	China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do
		6130do	6200do
		7240do	7255do
		7385do	
1200 1300	Clandestine, Sound of Hope Radio Network		7280as
1200 1300	India, All India Radio	11840as	15795as
		17705as	
1200 1300	Pakistan, PBC/Radio Pakistan	9670as	11510as
1200 1300	USA, Voice of America	6040as	9530as
		9785as	9825as
		11635as	12045as
1230 1240	Vatican City State, Vatican Radio		5985as
		6020as	15235as
1230 1300	Clandestine, Sound of Hope Radio Network		9355as
1230 1300	Vatican City State, Vatican Radio		5985as
		6020as	

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

1300 1315	India, All India Radio	11840as	15795as
		17705as	
1300 1330	China, Yunnan PBS	6035as	
1300 1330	Germany, Deutsche Welle	12010as	
1300 1330	Japan, NHK World/Radio Japan		6190as
		11740as	
1300 1357	North Korea, Voice of Korea	6185as	9850as
1300 1358	Germany, Deutsche Welle	11945as	13745as
1300 1400	Australia, Radio Australia	9475pa	11825as
1300 1400	China, China Huayi Broadcasting Corp	4830do	5050do
		5970do	
1300 1400	China, Hulun Buir PBS	3900do	6080do
1300 1400	China, Hunan PBS	4990do	
1300 1400	China, Nei Menggu PBS	6040do	7270do
		7420do	9520do
		9750do	
1300 1400	China, Qinghai PBS	4220do	4750do
		5990do	6145do
1300 1400	China, Sichuan PBS	4750do	6060do
		7225do	
1300 1400	China, Voice of Jinling	5860do	
1300 1400	China, Voice of the Strait	9505do	
1300 1400	China, Voice of the Strait/Entertainment Ch		7280do
1300 1400	China, Xinjiang PBS	5960do	7260do
		9600do	11770do
1300 1400	China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do
		6130do	6200do
		7240do	7255do
		7385do	
1300 1400	Clandestine, Minghui Radio	6030as	
1300 1400	Germany, Deutsche Welle	6225as	9380as
1300 1400	South Korea, KBS World Radio		7275va
1300 1400	USA, Voice of America	6040as	7295as
		9530as	9785as
		9825as	11635as
		12045as	
1315 1330	Clandestine, Voice of Tibet	15540as	

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

1400 1400	Clandestine, Sound of Hope Radio Network		9450as
			9955as
1400 1430	Australia, Radio Australia	9475pa	11825as
1400 1430	China, Yunnan PBS	6035as	
1400 1430	Guam, KSDA/AWR	11940as	
1400 1430	Romania, Radio Romania International	5900as	9660as
1400 1440	China, Hulun Buir PBS	3900do	6080do
1400 1500	China, China Huayi Broadcasting Corp	4830do	5050do
		5970do	
1400 1500	China, Hunan PBS	4990do	
1400 1500	China, Nei Menggu PBS	6040do	7270do
		7420do	9520do
		9750do	
1400 1500	China, Qinghai PBS	4220do	4750do
		5990do	6145do
1400 1500	China, Sichuan PBS	4750do	6060do
		7225do	
1400 1500	China, Voice of Jinling	5860do	
1400 1500	China, Voice of the Strait	9505do	
1400 1500	China, Voice of the Strait/Entertainment Ch		7280do
1400 1500	China, Xinjiang PBS	5960do	7260do
		7310do	11770do
1400 1500	China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do
		6130do	6200do
		7240do	7255do
		7385do	
1400 1500	Clandestine, Voice of China	7270as	
1400 1500	USA, Voice of America	6105as	7295as
		7525as	9785as
		9825as	
1430 1457	Philippines, Radio Veritas Asia		9520as
		9620as	
1430 1500	Clandestine, Sound of Hope Radio Network		7540as
1430 1500	Japan, NHK World/Radio Japan		6190as

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

1500 1515	China, Sichuan PBS	4750do	6060do
		7225do	
1500 1530	Clandestine, Sound of Hope Radio Network		7465as
			7585as

1500 1600	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
1500 1600		China, Hunan PBS	4990do	
1500 1600		China, Nei Menggu PBS	6040do	7270do
		7420do	9520do	9750do
1500 1600		China, Qinghai PBS	4220do	4750do
		5990do	6145do	
1500 1600		China, Voice of Jinling	5860do	
1500 1600		China, Voice of the Strait	9505do	
1500 1600		China, Voice of the Strait/Entertainment Ch	7280do	
1500 1600		China, Xinjiang PBS	5960do	7260do
		7310do	11770do	
1500 1600		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
1500 1600		Clandestine, Sound of Hope Radio Network	9450as	11765as
1530 1600		Clandestine, Sound of Hope Radio Network	7475as	
1530 1600		Japan, NHK World/Radio Japan	6190as	

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

1600 1605		China, Nei Menggu PBS	6040do	7270do
		7420do	9520do	9750do
1600 1605		China, Qinghai PBS	4220do	4750do
		5990do	6145do	
1600 1630		Japan, NHK World/Radio Japan	9540as	
1600 1700	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
1600 1700		China, Hunan PBS	4990do	
1600 1700		China, Xinjiang PBS	5960do	7260do
		7310do	11770do	
1600 1700		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
1600 1700		Clandestine, Sound of Hope Radio Network	11765as	

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

1700 1800	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
1700 1800		China, Xinjiang PBS	5960do	7260do
		7310do	11770do	
1700 1800		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
1800 UTC - 1PM EST / 12PM CST / 10AM PST				
1800 1805		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
1800 1900	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do

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

1900 2000	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
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2000 UTC - 3PM EST / 2PM CST / 12PM PST

2000 2100	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
2000 2100		China, Xizang PBS/Tibet	4820do	4905do
		5935do	6050do	7240do
				7450do

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

2100 2157		North Korea, Voice of Korea	7235as	9345as
		9975as	11535as	

2100 2200	mtthfas	China, China Huayi Broadcasting Corp	4830do	5050do
2100 2200		China, Xizang PBS/Tibet	4905do	4920do
		5240do	6110do	6130do
		7255do	7385do	6200do
2125 2200	w	China, China Huayi Broadcasting Corp	4830do	5050do
2130 2200		China, Hunan PBS	4990do	
2150 2200		China, Nei Menggu PBS	6040do	7270do
		7420do	9520do	9750do
2155 2200		China, Sichuan PBS	4750do	6060do
		7225do		

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

2200 2230		Clandestine, Sound of Hope Radio Network	7515as	
2200 2245		Vatican City State, Vatican Radio	5900as	9600as
2200 2257		North Korea, Voice of Korea	7235as	9345as
		9975as	11535as	
2200 2300	mtwhfas	China, China Huayi Broadcasting Corp	4830do	5050do
2200 2300		China, Fujian PBS	3990do	5970do
2200 2300		China, Hunan PBS	4990do	
2200 2300		China, Nei Menggu PBS	6040do	7270do
		7420do	9520do	9750do
2200 2300		China, Qinghai PBS	4220do	4750do
		5990do	6145do	
2200 2300		China, Sichuan PBS	4750do	6060do
		7225do		
2200 2300		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
2200 2300	fa	Clandestine, Sound of Hope Radio Network	7105as	
2200 2300		France, Radio France Internationale	12045as	
2200 2300		South Korea, KBS World Radio	7275as	
2200 2300		USA, Voice of America	6045as	7440as
		9545as	9755as	9875as
				11925as
2230 2250		Japan, NHK World/Radio Japan	9560as	
2230 2300		China, Voice of the Strait	9505do	
2230 2300		Clandestine, Sound of Hope Radio Network	7585as	
2240 2300		Japan, NHK World/Radio Japan	13650as	
		15195as	17810as	
2250 2300		China, Fujian PBS	5005do	5040do

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

2300 0000	w	China, China Huayi Broadcasting Corp	4830do	5050do
2300 0000		China, Fujian PBS	3990do	5970do
2300 0000		China, Hulun Buir PBS	3900do	6080do
2300 0000		China, Hunan PBS	4990do	
2300 0000		China, Nei Menggu PBS	6040do	7270do
		7420do	9520do	9750do
2300 0000		China, Qinghai PBS	4220do	6145do
		9850do		
2300 0000		China, Xinjiang PBS	5960do	7260do
		7310do	11770do	
2300 0000		China, Xizang PBS/Tibet	4820do	4905do
		5240do	5935do	6130do
		7240do	7255do	7385do
2300 0000	fa	Clandestine, Sound of Hope Radio Network	6280as	
2300 0000		Clandestine, Sound of Hope Radio Network	7520as	
2300 0000		Clandestine, Voice of China	7270as	
2300 0000		Germany, Deutsche Welle	6090as	9865as
		11830as		
2300 0000		South Korea, KBS World Radio	9805as	
2300 2325		China, Fujian PBS	5005do	5040do
2300 2330		China, Yunnan PBS	6035as	
2300 2330		Clandestine, Sound of Hope Radio Network	7540as	

WANT MORE?

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Monitoring the Air Show Experience

Equipment and Tips

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

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

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

If you are going to a Thunderbird team event, then you will need a scanner that can monitor the 138-150 MHz military land mobile band in the AM mode. Most of the older Uniden scanners cannot be used for air show monitoring due to their lack of independent transmission mode selection.

In addition to the civilian aircraft band (118-137 MHz), you will also need a scanner that has the 225-400 MHz military aeronautical band in it. Most of the action (especially the Blues) will be heard in this military UHF portion of the spectrum. Adding these two criteria to the mix, the list of possible air show scanners is narrowed down even further. Table One is our list of scan-

ners that meet all of the criteria for monitoring all the military flight demonstration teams at air shows worldwide.

MILITARY AIR SHOW CAPABLE RECEIVERS

Handhelds

Alinco DJ-X3, DJ-X7, DJ-X30, DJ-X2000T
AOR AR-8200 MK III, AR-Mini B
GRE PSR-300, PSR-500, PSR-700
Icom IC R-5 Sport, IC R-20, IC-RX7
MFJMFJ-8322

Radio Shack Pro-106, Pro-107, Pro-164
Uniden BC-246T, BC-346XT, BCD-396XT,
HomePatrol-1 (only by using third party
software such as ScanCat and Butel to load
air show frequencies).
Yaesu VR-500

Base/Mobile Units

AOR AR-8600 Mk IIB
GRE PSR-400, PSR-600
Radio Shack Pro-163, Pro-197
Uniden BCT-15X, BCD996XT
Yaesu VR-5000

Computer Receivers

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

Professional Receivers (Government sales only)

AOR AR-Alpha, AR-One, AR-One-C, SR-2200
Icom IC-R1500, PCR-1500U, IC-R2500, R-8500,
R-9500

Discontinued Radios/Scanners

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

❖ Plan Ahead

If you want to have a great time at the air show, you should plan ahead and get some stuff together to take to the event. Here are some tips from my personal list that I use to

gather the things that I take with me to the air show.

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

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

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

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

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

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

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

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

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

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

Earplugs - Not only do jets make a lot of noise, but you may find yourself next to an overly loud speaker system used by the air show announcer.

Scanner - I know it is silly to remind you of this,



Photo by Ken Lin

AIR SHOW RESOURCE GUIDE

but be sure to bring along the scanner and our air show guide and extra batteries. You might actually enjoy listening to the air show pilots and demonstrations teams.

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

❖ Do's and Don'ts

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

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

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

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

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

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

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

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

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

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

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

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

❖ DoD VHF High Band The Hidden Aircraft Band

In the last six years, the Department of Defense has completely changed their bandplan for the 138.000 to 150.800 MHz (less 144-148 MHz) military LMR bands. In the past, each frequency was spaced 25 kHz and assigned to a specific military service.

Milcom Blog	http://mt-milcom.blogspot.com
Milcom Twitter Feed	MilcomMP
MT 2010 Air Show Guide.....	http://tinyurl.com/2bhecks
Canadian Forces Snowbirds 2010-2011 Schedule.....	http://tinyurl.com/39ug9fd
US Air Force Thunderbirds 2011 Schedule.....	http://tinyurl.com/3xu8jy2
US Army Golden Knights 2011 Schedule.....	http://tinyurl.com/39bcuty
US Navy Blue Angels 2011 Schedule	http://tinyurl.com/38es6me
US Navy Leap Frogs 2011 Schedule	http://tinyurl.com/3yz9fhx

Official Websites:

Air Combat Command Aerial Events.....	www.acc.af.mil/aerialevents/
Blue Angels	www.blueangels.navy.mil/index.htm
Golden Knights.....	www.usarec.army.mil/hq/goldenknights/
Leap Frogs	www.leapfrogs.navy.mil/
Navy Office of Community Outreach	www.navy.mil/navco/
Snowbirds	www.snowbirds.dnd.ca/v2/index-eng.asp
Thunderbirds.....	www.airforce.com/thunderbirds

Twitter Feeds:

Air Combat Command Aerial Events.....	http://twitter.com/#!/aerialevents
Blue Angels	http://twitter.com/#!/BlueAngels
Golden Knights.....	http://twitter.com/#!/ArmyGK
Thunderbirds	http://twitter.com/#!/USAFThunderbird

Facebook Pages:

Air Combat Command Aerial Events.....	www.facebook.com/aerialevents
Blue Angels	www.facebook.com/pages/Blue-Angels/34985920343
Golden Knights..	www.facebook.com/usarmygoldenknights
Leap Frogs	www.facebook.com/leapfrogs
Skyhawks	www.facebook.com/group.php?gid=112105354592
Snowbirds	www.facebook.com/pages/The-Canadian-Forces-Snowbirds/23613917381
Thunderbirds	www.facebook.com/pages/US-Air-Force-Thunderbirds/267550469245

In 2004, we heard that DoD would be changing to a 12.5 kHz spacing and the frequencies would be assigned to a particular usage and not a service as in previous plans.

Since these changes were made, the Milcom monitoring team has spent hundreds of hours in locations all over the country documenting the changes that have been made to this frequency range. One of the major changes we have observed are new exclusive frequencies that have AM mode air operations assigned to them.

Air Operations

138.200	138.250	138.825	139.600
139.900	140.200	140.500	141.175
141.250	141.300 (Air Refueling)	141.650	
141.950	142.1125	142.225	142.600
142.700	142.800	142.900	142.9625
143.000	143.150	143.200	143.250
143.600	143.725	143.750	143.825 MHz

Air Defense Combat Air Patrols

139.700 MHz
Pilot-to-Dispatcher
139.300 142.300 MHz

US Air Force Air/Air

141.150 141.400 MHz

US Coast Guard Air/Air

141.550 150.150 MHz

US Marine Corps Air/Air

141.600 150.300 MHz

US Navy Air/Air

140.300 150.250 MHz

We will continue to monitor this portion of the military radio spectrum and report any additional information on the various frequency assignments we uncover in future Milcom columns.

So, if you have the scanner space, program in the frequencies above and let me know what you are hearing. You can send reports to the address in the masthead. I will also report new information on the Milcom blog and late breaking news on the Milcom Twitter feed. See this month's resource

guide for address information.

Until next time, 73 and good hunting.



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TSA Expands Its Reach

Around the holiday travel season late last year one federal agency was making more news than any other – the Transportation Security Administration, or TSA. During the last few months of 2010, the TSA and the Department of Homeland Security took a lot of heat for the increased “aggressive” search techniques that were being used on holiday air travelers in the United States. In some cases people were arrested for various forms of passenger protests and not complying with security procedures.

While most people may think that the TSA is just the blue-shirted personnel checking bags and identification at the airport, there is a lot more going on than meets the eye. Beyond the body scanners and pat-downs, there are many programs and operations going on behind the scenes that the public may not be aware of.

The TSA started out as part of the Federal Aviation Administration (FAA). The agency was formed as a response to the terrorist attacks of September 11, 2001. It was felt that the patchwork of private security personnel were not what was needed to fight the potential terror threats to commercial air travel. Shortly after the formation of the new Department of Homeland Security in 2002, the TSA was transferred into DHS.

Over the years since its inception, the TSA has expanded from its initial responsibilities of airport passenger screening to many other operations. Programs under the TSA umbrella include:

- Federal Air Marshals Service (FAMS)
- Federal Flight Deck Officers (FFDO)
- Behavior Detection Officers Program (BDO)
- Canine Explosive Detection Teams
- Air Cargo Screening and Security Initiatives
- Intermodal Security Training and Exercise Program (I-STEP)
- Surface Transportation Security Inspection Program (STSI)
- Visible Intermodal Protection Response (VIPR)

Many of these programs include the TSA being involved in other areas besides commercial air travel, such as rail passenger, air and sea-going freight. The Behavior Detection Officers (BDO) are now circulating amongst not only airline passengers, but have been called on to operate at passenger rail terminals and large sporting events or public gatherings – anywhere that might have the potential to be a target of terrorism.

With these additional duties, it appears that the TSA is expanding its use of technology and communications systems to meet the new demands placed upon them. In the November 2010 *Fed Files*, I noted that the TSA had posted a request for bids on a UHF tracking beacon and receiver system that operates in the 380-420 MHz band.

The TSA has also proposed the addition of

Over-The-Air Re-keying (OTAR) to their digital P-25 radio nets. Although the TSA has rarely used encryption on their digital radios, this would give them the ability to send or change encryption keys to TSA radios over the air. A test was set up using the Key Management Facility operated by the Customs and Border Protection National Law Enforcement Communications Center in Orlando, Florida.

When the TSA first began operations, it was utilizing a mixed bag of radio systems until it was able to contract for some agency-wide communications. The first wave of P-25 digital radios purchased by the TSA contained a standard channel plan that utilized frequency assignments from the FAA. The original frequencies used were 169.3000, 172.1500, 172.9000 and 166.4625 MHz, now known as DHS Common.

Since then, some new P-25 frequencies have been heard in addition to these standard channels and in 2009 additional radios were purchased to assist the security checkpoints with communications. The new radios are analog Icom F-50V models with voice inversion scrambling. These radios were assigned to security checkpoint personnel for short-range communications.

I have been collecting the various frequencies that are active at airports across the country. While this is by no means a complete list, it should give you an idea of what to look for while scanning for TSA activity. The frequencies labeled as “Scanner Operators” are used in conjunction with the millimeter wave or backscatter full body scanners. All frequencies are in megahertz (MHz) and analog channels are shown with known CTCSS squelch tones. P-25 digital channels are shown with P-25 NAC (Network Access Code) if known:

Boston, MA (BOS)

- 166.2875, N001 – Scanner operators
- 172.9000, N001

Chicago, IL O’Hare (ORD)

- 165.0750, 131.8 PL
- 169.1625, 123.0 PL
- 169.1625, N001
- 169.3000, 136.5 PL
- 172.1500, 103.5 PL
- 172.1500, 123.0 PL
- 172.9000, N002

Denver, CO (DEN)

- 163.6250, 151.4 PL – Behavior Detection Officers using ICE repeater at DEN airport
- 166.4625, N001 – Scanner operators
- 172.1500, 123.0 PL
- 172.1500, 131.8 PL
- 172.1500, 136.5 PL
- 172.1500, N001
- 172.9000, N001

Dallas / Ft. Worth, TX (DFW)

- 169.9125, 123.0 PL – TSA Terminal E
- 170.3375, N001 – TSA “Coordination Center”



Transportation Security Administration

Hartford, CT (BDL)

- 172.9000, N001

Indianapolis, IN (IND)

- 169.3000, 136.5 PL
- 172.1500, 146.2 PL
- 172.1500, N001
- 172.9000, 151.4 PL
- 172.9000, N001

Las Vegas, NV (LAS)

- 166.2875, N002 – Scanner operators
- 166.4625, N001 – Scanner operators
- 168.0875, N002 – Scanner operators
- 168.9625, N001 – Scanner operators
- 168.9625, N002 – Scanner operators
- 169.3000, N001
- 172.9000, N001 – TSA “Coordination Center”

Los Angeles, CA (LAX)

- 166.7875, 123.0 – Terminal 3
- 168.9625, N001
- 168.9625, N002
- 169.1625, N001
- 169.3000, N001
- 172.1500, 131.8 – Terminal 7

New York, NY LaGuardia (LGA)

- 172.1500, N001
- 172.9000, N001

Ontario, CA (ONT)

- 172.1500, N001

Portland, OR (PDX)

- 169.3000, N001
- 169.3000, 146.2 PL – Checkpoint D-E
- 172.1500, N002
- 172.1500, N001
- 172.1500, 123.0 PL – Checkpoint A-B-C
- 172.9000, N001

San Francisco, CA (SFO)

- 162.2750, 131.8 PL
- 172.9000, 123.0 PL

Salt Lake City, UT (SLC)

- 172.1500, 123.0 PL
- 172.1500, N001

St. Louis, MO (STL)

- 169.1625, 123.0 PL
- 172.1500, N001
- 172.1500, 123.0 PL

Seattle, WA (SEA)

- 168.6125, N001 - Behavior Detection Officers working rail terminals

Tampa, FL (TPA)

- 169.3000, 123.0 PL
- 172.1500, 123.0 PL

Washington, DC (Reagan National Airport)

- 172.1500, 136.5 PL
- 172.9000, N001 - TSA “SCC” heard as control center ID

So keep searching – I am certain that there are more new frequencies being used by the TSA that are out there; let me know if you find anything interesting.

❖ Gifford Pinchot National Forest

In the January *Fed Files* column, I passed along some confirmed frequency information for Mt. Hood National Forest. This month, I will take a look at its neighboring forest in Washington State, Gifford Pinchot National Forest, www.fs.fed.us/gpnf/

Gifford Pinchot National Forest is located across the Columbia River from Mt. Hood National Forest and is named after the first director of the US Forest Service. It is one of the oldest national forests in the United States and the Mt. St. Helens National Volcano Monument is located in GPNF:

www.fs.fed.us/gpnf/volcanocams/msh/

In late 2009, the regional Forest Service dispatch centers for the Mt. Hood National Forest and the Gifford Pinchot National Forest were combined into a common dispatching center, now referred to as the Columbia Cascade Communications Center. Here is a rundown of the VHF radio networks in use in the Gifford Pinchot National Forest as of late 2010:

Repeater Out	Repeater In
NORTH NET	
Cowlitz Valley RD	
Burley 171.4250, 123.0	170.3500, 123.0
South Point 171.4250, 123.0	
170.3500, 88.5	
Mineral 171.4250, 123.0	170.3500, 110.9

PROJECT WORK CHANNEL

All Forest Personnel	
GP Work 1	170.5000, 123.0
170.5000, 123.0	
GP Work 2	170.1250, 123.0
170.1250, 123.0	

CENTRAL NET

Cowlitz Valley Road and Mt Saint Helens National Volcano Monument	
Davis 172.2250, 123.0	168.7750, 127.3
Mitchell 172.2250, 123.0	168.7750, 167.9
Coldwater 172.2250, 123.0	168.7750, 136.5
Pt 3670 172.2250, 123.0	168.7750, 100.0

SOUTH NET

Mt Adams Road – Trout Lake and Wind River	
Flat Top 172.3250, 123.0	168.4750, 127.3
Mt Defiance 172.3250, 123.0	
168.4750, 192.8	
Lookout Mountain 172.3250, 123.0	
168.4750, 100.0	

DNR COMMON

All Forest Personnel	151.4150, CSQ, simplex
GP Air to Ground	
Fire and Aviation	166.6875, CSQ, simplex

North Net Scene of Action Portable Repeater

All Forest Personnel	171.4250, 123.0
170.3500, 131.8	
171.4250, 123.0	170.3500, 146.2
171.4250, 123.0	170.3500, 156.7

Central Net Scene of Action Portable Repeater

All Forest Personnel	172.2250, 123.0
168.7750, 131.8	
172.2250, 123.0	168.7750, 146.2
172.2250, 123.0	168.7750, 156.7

South Net Scene of Action Portable Repeater

All Forest Personnel	172.3250, 123.0
168.4750, 131.8	
172.3250, 123.0	168.4750, 146.2
172.3250, 123.0	168.4750, 156.7

AVIATION NET

All Forest Personnel
Air Guard 168.6500, 110.9, simplex
National Flight Following 168.6250, 110.9, simplex
GPNF Air-To-Ground 168.3125, CSQ, simplex

In addition to the VHF radio nets, there are also quite a few UHF “links” that connect base stations or repeaters together. These links are used when controlling a repeater from a location that may not have line-of-sight to the repeater site.

Since the communications infrastructure serving the forest service has been upgraded to accommodate future use of APCO P-25 digital modes, some of these links have started operating in P-25 mode, although all of the VHF channels are all still analog. Listeners in the area are still working to figure out what link channel is associated with which VHF repeater channel, but here is a quick look at what has been found so far:

406.3875 MHz, 136.5 PL
406.5250 – Linked with 172.3250 South Net
406.5750 – Linked with 171.4250 North Net
408.5750 MHz
408.9875 MHz, N788
415.3875 MHz, 114.8 PL
415.4250 MHz, 162.2 PL
415.5250, N4F9 – Linked with 172.3250 South Net
415.5750, N4CE – Linked with 171.4250 North Net
415.5750, N459 – Linked with 171.4250 North Net
417.9875 MHz, N68F
418.1875 MHz, N47C
419.7875 MHz, N4F9

In the next *Fed Files* column, I will explore the radio frequencies of Mount Rainier National Park in Washington State.

❖ CBP Border Patrol in Arizona

Recently, there have been some major changes to the Customs and Border Protection (CBP) radio networks along the southern Arizona border area. The traditional VHF Border Patrol channels used for decades have become virtually silent, with many new P-25 digital repeaters taking their place.

This appears to be a major move towards a new network along the lines of what has been in use along the Southern California region for quite some time. It is also noted in government budget documents that this is now considered part of the federal IWN or Integrated Wireless Network project, already deployed as trunked VHF sites in the Pacific Northwest and Washington DC areas.

Many of these frequencies appear to be utilizing the “vote-scan” function of the P-25 digital radios that allows mobile units to automatically select the nearest repeater. This system is not a trunked system, but does allow for various repeaters to be linked to allow users connect across wide areas. Encryption is now pretty much standard procedure, although some clear traffic is still heard.

It appears that Immigrations and Customs Enforcement (ICE), as well as CBP Border Patrol, are utilizing many of the new frequencies. Here is a listing of what has been confirmed as active in southern Arizona. All frequencies are in megahertz (MHz) and P-25 NAC’s are provided.

If channel names were known, they have been listed:

PHOENIX AREA

166.8500, N310	171.5750, N167
166.8500, N40F	171.5750, N673
166.8500, NC40	172.2375, N710
168.0875, N710	172.4125, N670
168.8250, N710	173.0500, N670
170.3500, N340	173.6125, N310
170.8500, N293	173.6125, NC40
171.3500, N307	173.9375, N340
171.5750, N730	

TUCSON/NOGALAS SECTOR

162.0500, N209
163.5250, N203
163.6250, N206
163.6500, N305 - Casa Grande area
163.7000, N201
163.7875, N30E - Nogalas area
164.1000, N230
164.4875, N330 - Green Valley area
165.2250, N304
165.6875, N293 - Nogalas area
165.8250, N293 - CBP OMAHA aircraft heard
165.8500, N293
166.7375, N30E
166.8500, N210
168.0875, N210
168.8250, N302 - RED MOUNTAIN
168.8250, N330 - WIDE AREA
168.8250, N710 - WIDE AREA
168.8375, N293 - CBP AIR 1
169.1625, N293 - CBP AIR 4
169.5500, N203 - Tubac area
169.9375, N330
169.9375, N653 - GILIO 1
170.3500, N130 - WIDE AREA INTEROP
170.3500, N20C - WIDE AREA INTEROP
170.3500, N230 - WIDE AREA INTEROP (Nogalas, AZ)
170.3500, N340 - WIDE AREA INTEROP
170.4375, N301 - AJO
170.4375, N130 - AJO
170.4375, N230 - Far East Arizona
171.0375, N201
171.1875, N110
171.2125, N207
171.3250, N230
171.3250, N20C - Tucson area
171.6625, N210 - Tucson area
172.0625, N20A
172.7125, N210
172.7625, N210 - Tucson area
173.1750, N209
173.1875, N110
173.1875, N230 - INTEROP MT. LEMMON
173.5000, N20B
173.6125, N210 - SCAN 3
173.6125, NC40
173.6500, N206
173.7375, N130
173.9375, N340

I have only noted these new frequencies along the southern Arizona area, but listeners should be on the lookout for these types of frequency changes for the CBP in southern New Mexico and Texas soon. If you find any of these new frequencies active in your area, please let me know.

❖ Super Bowl XLV

As this column is being written, I am preparing to head to Arlington, Texas for Super Bowl XLV. I will be back in the next *Fed Files* with a complete wrap up of federal activities that occurred at the event. Until then – keep searching and I’ll see you in May!



Gazing into a Murky Crystal Ball

Like many other businesses, North American railroads spent the transition from 2010 into 2011 trying to figure out what lies ahead in the economy – and in government policy. Unlike smaller businesses, railroads, which have to build and maintain their own infrastructure, have to look ahead to meet increases in demand.

Building new sidings or double-tracking an existing single-track segment can take a year or more, once all the permitting, surveying, and ordering of materials are factored in. Similarly, if the railroad is going to need additional freight cars, it's not as simple as going to your local automobile dealer and buying something that's already on the lot. Manufacturers have backlogs of many months – and also end up playing the anticipation game in managing their production capacity.

By all indications, trends continue solidly positive for railroads of all sizes, but particularly for the largest American freight railroads. Amtrak, which is the only national player in the passenger train market, also saw solid gains,

with new trains added in the previous year doing even better than anticipated. Continued increases in gasoline prices at the beginning of the year are also likely to bring Amtrak and regional rail services more ridership.

Commuter railroads and transit systems face a more complex financial picture, as both depend on local, regional, and state support, and municipalities and states are struggling with budget shortfalls. In most cases, this will mean that some planned expansions of equipment pools and building of new lines will be slowed down or delayed. Major cuts in existing services aren't really an option, since commuters rely heavily on these services.

❖ As Anticipated

As mentioned in my previous column, victories by Republican gubernatorial candidates in Ohio and Wisconsin – both of whom had come out strongly against projects to increase speeds for and expand passenger train services in their states – led to the cancellation of those projects. The Federal government had already allocated grants for work in both of those states, but, when it became clear that these states would not proceed with these projects (by allocating the required state matching funds) the grants were reallocated to other states, which did want the money.

The two major, truly high-speed passenger rail projects (in California and Florida) appear to be moving forward, though not without the difficulties that face all large infrastructure problems, including local opposition from people who may lose property through condemnation.

❖ On the Positive Side

One of the strongest sectors in freight rail has been intermodal – the movement of highway trailers and containers. Intermodal freight is gradually shifting more and more from trailers to containers, though a few companies, such as UPS, still move a considerable number of trailers by rail. Interestingly, FedEx, which is best known for air transport of packages, announced in early 2011 that it would begin using rail intermodal for transport of some of its “economy” class services, where shippers don't mind multi-day transit time.

Amtrak has placed major orders for new rolling stock, including both new electric locomotives for the Northeast Corridor (NEC) and passenger cars to be used on a variety of routes. The new equipment replaces old equipment that

is wearing out and will also permit some small expansions in service.

So, whether you monitor rail traffic on a scanner or follow one or more lines on ATCSM, or both, you should find traffic continuing to grow.

❖ Out in the Field

If you're out in the field watching trains, keep an eye out for new antenna installations at control points. Major railroads are continuing to test equipment for positive train control (PTC) systems. As mentioned in previous columns, the government-mandated move to PTC for routes with passenger service or where hazardous materials are transported will provide an additional level of safety in enforcing train operating limits and speeds.

On the whole, the major railroads that are testing equipment are keeping somewhat quiet about these tests. Almost all of the other railroads, beyond the five or so largest national lines, are waiting on the sidelines to see what those larger railroads come up with. Again, because locomotives and other equipment move from major railroad to major railroad across the country, whatever system is ultimately adopted will have to be based on a national standard so that all equipment is interoperable and compatible.

Where PTC tests are underway, you are likely to find that subject coming up increasingly on the railroad voice channels and you may be able to learn about the progress of those tests that way.

❖ Doggone Terminology

Adverse weather in much of the country at the beginning of the year brought to mind a term you may hear on the scanner: “dog-catch crews.” Dog-catch crews are a railroad slang term for crews sent out to trains that have “gone out on the law.”

That latter term refers to trains whose crews have reached the end of the “hours of service” law, currently 12 hours for operating crews. That law covers both freight and passenger train crews, such as engineers and conductors, but not onboard service crews, such as passenger car attendants, dining car cooks and waiters, and other support personnel not directly involved in the movement of trains. (Dispatchers are also covered by the hours of service law.)

The point of the law, is, of course, to keep



Routine scheduled crew change on northbound Amtrak train at Raleigh, N.C.



A signal maintainer in a hi-rail truck prepares to enter the almost seven-mile-long Moffat Tunnel in central Colorado. The single-track tunnel runs under the Continental Divide and contains a variety of safety equipment, including a continuous repeater antenna (for voice and radio control of remote locomotives) and equipment defect detectors

crews from reaching a state of fatigue that would lead them to inattentiveness or even falling asleep, endangering themselves and others.

In monitoring your scanner, you may hear dispatchers ask crews what their “on duty” time is. That’s the beginning of the crews’ hours of service, and it often comes well before they actually board the train and the train departs.

The dispatcher needs that information to try to figure out how far the crew can get its train before needing to be relieved. When everything is running smoothly, crew changes for both passenger and freight trains take place at scheduled locations, such as passenger stations (if designated to be at the end of a crew district) or major freight terminals.

But in railroading, particularly during bad weather, things do not always go smoothly. If it becomes obvious to the dispatcher that the crew is running out of time, he will put the train in the next available siding to “tie down” and wait for a relief crew.

This relief crew, the “dog-catch crew,” will, depending on location, be delivered either by a railroad shuttle van or a contract van service. In or near urban areas, regular commercial taxis may also be used. Railroad crew vans are always equipped with railroad radios. The vans of contract shuttle services are typically equipped with two radios – one for the driver to communicate with his own dispatcher, the other so that railroad crews can talk to dispatchers, if needed.

A little known fact is that, in severe weather, the reason railroad lines become jammed up is not so much that trains cannot make progress

through snow, but that the crew vans cannot make it on snow-covered roads to get relief crews out to trains.

The hours of service law is very strict and railroads face huge fines if they violate the hour limit – other than in situations where lives are in danger. One example would be if a crew member is severely injured in remote terrain and the only way to get him to medical help is by rail. A crew that has already reached its hours of service limit would be granted an extension to transport the injured worker, but only to the point that the emergency is addressed.

In some situations, where no empty sidings are available, crews that are out of time may have to tie down a train on the main line. Those trains get priority for dog-catch crews, to help open up the main line.

Ideally, when a crew ties down a train, crews swap out on site. But when things go badly wrong, a railroad may run out of relief crews. That often happens when, due to snow or ice or other problems, crews cannot get to their on-duty terminals.

In that case, tying down the train includes setting handbrakes on a number of cars, and the crew simply leaves the train whenever transportation becomes available. If the train is in a siding, the available transportation may include another passing train whose crew still has sufficient hours to reach the next terminal.

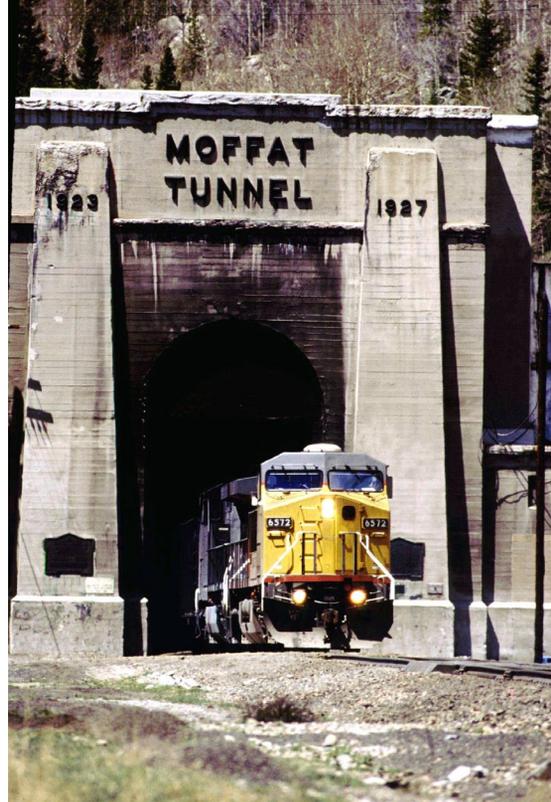
Years ago, while doing photography on the Union Pacific line between Denver and the East Portal of the Moffat Tunnel, a major transcontinental route, I witnessed unusual cooperation involving three railroads. The 6.2-mile long Moffat Tunnel is a major choke point on the route, as diesel fumes have to be vented from the bore after each train passes. At best, the single-track tunnel handles about one train every half hour, and if there are problems, traffic quickly begins to back up on either side.

Safety in the tunnel is critical, and there are actually “talking” defect detectors inside the tunnel, which you can hear (if monitoring a scanner nearby) because of a repeater antenna that runs through the tunnel and allows trains in the tunnel to continue to talk to dispatchers.

On the day in question, a UP train was stopped inside the tunnel by a defect detector. The crew needed to inspect their train inside the tunnel, with the tunnel’s exhaust fans running – not an easy task. The crew found no problems with their train, though the train was in the tunnel for about an hour. Then a signal maintainer in a hi-rail truck had to go into the tunnel to check and repair the faulty defect detector.

By now, traffic was beginning to back up. Though the female UP dispatcher working the line remained calm, the stress was clearly evident in her voice as she tried to update trains up and down the line as to what was happening. Once the tunnel was cleared, traffic resumed.

However, a BNSF trackage rights train that was between the East Portal and Denver was running out of time for its crew. So the dispatcher put the train into the nearest siding. When it became evident that it might take several hours to get a relief crew to the site from Denver (remember, the crew schedulers had not planned on having this major backup up on



An eastbound (headed toward Denver) Union Pacific freight train emerges from the East Portal of the Moffat Tunnel in this 1999 photo. This site is reachable via a well-maintained unpaved public road most of the year, though forecasts should be checked for possible snow. The East Portal is almost a mile higher than Denver and could see some snow from fall through spring.

the mountain), the dispatcher came up with a creative solution.

She called the eastbound Amtrak California Zephyr, which had been trapped on the west side of the Moffat Tunnel during the problems and which was then just exiting the tunnel. The Amtrak train made a 30-second stop to pick up the crew of the BNSF train, which then got a comfortable ride back into Denver.

❖ Springing into Action

Spring is typically the time when most railroads begin their major track and infrastructure projects. Frozen ground, snow, and ice usually lead railroads in much of North America to postpone all but emergency repairs during the winter. For the major railroads that cover much of the nation, crews usually begin projects in the southernmost states and then move northward as the season progresses.

Keep an ear out for this type of activity on your scanner. If you get a chance, go trackside to watch. Seeing the men and machines in action can teach you a lot about railroad infrastructure. And, of course, listening in on the scanner helps explain a lot of the activity.

You may find up to a dozen different types of machines used on major projects.

❖ Next Time

By next time, I may have more information on the progress of PTC tests by various railroads.



The Sounds of the Skies, Online

One of the best things about growing up with a parent in the Navy was the chance to go to the air shows. There are few things cooler to an adolescent male than getting to be around big, powerful jets.

I remember my father often breaking out the scanner and listening to the communications of the Blue Angels and other demonstration teams. This provided me with a fascinating glimpse into the cockpit of some of the most powerful aircraft on the planet.

Currently, I live a little too far away from any major air bases to enjoy the same on-site experience of air shows that I did as a child. However, that doesn't mean I can't still listen in to the cockpit communications of the demonstration teams!

Online streaming audio has revolutionized everything from the broadcast radio stations and police and fire communications one normally hears, to even being able to tune remote receivers from around the world. Fortunately for aircraft enthusiasts, it also opens up the ability to listen to air show communications from around the world!

One of the more popular places to tune in air show communications is at W2LIE's Web site, which carries a stream of the Jones Beach Air Show.

For the past five years, Phil, W2LIE has provided listeners with a stream of air show communications from the popular Long Island Air Show. Last year's air show was attended by 382,000 people over the course of three days during the Memorial Day weekend. Phil even has archives of past air shows available for download on his Web site.

W2LIE also has a lot of streaming content for other Long Island communications, including police, fire, EMS, aviation, government and more. Membership is required for most audio content, and there is a premium content section that includes a Web-controlled radio. Subscription rates for this content are available in 1-month, 6-months or 12-month rates: a 12-months subscription is \$19.99.

If you are looking for streaming audio from one of the busiest and most interesting communication cities in the world, check out W2LIE's Web site. The link to his Web site can be found in the GlobalNet links at the conclusion of the column.

If you are looking for audio streams of air shows from other parts of the country, check out the Radio Reference Web site. There are usually a couple of streams from various air shows that pop up, some more reliable than others. You can even do a quick Google search to find streaming audio, and sometimes video, from air shows in

Europe and other parts of the globe.

For instance, FlightGlobal and FLIR systems last year provided streaming audio and video of the UK Farnborough International Air Show in July. This air show is held once every two years, so the next one will not be until July of 2012. But it does provide an example of the kind of growing streaming coverage that is available online for air show fans.

If you find something good, be sure to pass it along to me and I will include it on my GlobalNet blog!

❖ Eyes and Ears on the Sky

For those who are big enthusiasts of aviation, there are several Web sites available that can provide you with streaming audio and video coverage to quench your aeronautical thirst.

I have already mentioned in this column Web sites such as [LiveATC.net](#) and the related application for mobile devices that stream air traffic controller audio from across the globe. This isn't the only one to keep an eye on.

Futura Studios has a Web site devoted to **Live Air Traffic Controller** programming content. Not only can you find links for streaming audio from various airports across the globe, but you can also find radar streams of inbound flights and even Web cams from the airports themselves.

There is also [FlightRadio.com](#) which has links for streaming ATC audio, much of which comes from LiveATC.net. There is also a regular aviation podcast that discusses aviation history.

If you have an up-to-date frequency list, there are also Web-controlled receivers that you can access from around the world. A great Web site to find these is [GlobalTuners](#). The GlobalTuners Web site has an extensive list of receivers from around the globe including Europe and Asia.

So, if you are an aviation enthusiast looking for air show communications, there is a large assortment of options available on the Internet for you to browse through.

❖ United in the Search for Streams

I find myself scouring the Internet from time to time, looking for new sources for streaming audio links and information, especially now that I am running the GlobalNet blog and podcast. So when you want to find something that is constantly dynamic and fresh, these are resources you want to keep your eye on, because they might save you a few steps.

I was turned on to the **LiveScannerAudio Yahoo Group** several years ago, but hadn't really looked at it much since. One of the nice things about the group is that you receive email reminders when a new post is put on the forum. This way, you can keep track of breaking news and streams related to it.

In addition to the LiveScannerAudio group, there are other streaming scanner and other streaming content groups available on Yahoo. There are even scanner groups specific to certain areas. There are also scanner groups you can find that are geared towards standard scanner information, but also include information on scanner streams.

Yahoo Groups and other forums can be a great source of information on streaming audio and video information. Just do a search to find the group that suits your needs.

❖ Toyota puts Pandora in their Cars

Add Toyota to the growing list of car manufacturers that are adding Internet Radio into their vehicles. Toyota's Entune multimedia system, announced during the CES show in January, is part of an overall push by automakers to include Internet Radio and other Internet-based interactive content in their vehicles.

The penetration of Internet radio into cars is something I will be watching closely in 2011. This is the last frontier for an industry that is trying to take over from traditional broadcasters. The growth in 2010 of mobile streaming apps has helped services like Pandora and other Internet Radio services to make a concerted effort to push into automobiles. Already, manufacturers including Ford, BMW, Mercedes, and others have put similar services in their vehicles.

You can keep an eye on this column for further developments in this area of the Internet Radio industry.

❖ GlobalNet Mailbag

This month, we reach back in to the GlobalNet mailbag for comments from you! With the growing popularity of the GlobalNetCast podcast, the GlobalNet blog, and the Facebook and Twitter feeds, I have been getting a lot of correspondence lately from readers.

Part of the mail I am receiving is in the form of submissions for my Stream of the Week on the blog. Each week, I highlight a different stream from around the world. I invite each of you to participate and send me your favorite streams.

My hope is that we can help each other find new streams and interesting programming content to enjoy. I will include contact information at the conclusion of this column.

This month's mailbag entry comes to us from Kelly, AE4FG in North Carolina:

Hi Loyd, I just discovered your blog this week (thanks to Larry). One of my favorite internet radio streams is Newstalk ZB Wellington. I like the discussions they have there. One recent discussion was call-ins about the November mining accident and how people dealt with it. Another interesting stream is Garrison Radio from Aldershot. I like hearing the call-ins and messages to the soldiers.

BTW, is your podcast going to be available on iTunes? I'd like to be able to listen on my iPod. I have several internet radios and use the TuneIn and Reciva Radio apps on my iPod. Most of my internet radios are now made by Grace. I really like the iPod/iPhone app that lets you remote control the radios. The app was a little rough around the edges at first, but is now pretty nice. I also have two Roku SoundBridge radios, a LinkSys radio, and just gave away the Com-One Phoenix.

Also, do you think that the Grace radios will ever have the option of carrying the RadioTime database instead of Reciva? I'm tempted to get the Squeezebox Radio just for the portability, but I'm also waiting to see how the Sangean WFR-27 will work. Hopefully it will get more than four hours of battery time per charge.

Thanks for the column in MT. Kelly, AE4FG – North Carolina.

Kelly – Thanks for your support on both the blog and the column. The GlobalNetCast podcast is now available on iTunes. The link can be found in the links at the end of this column. Hope you enjoyed the spotlight on Garrison FM and the other military radio stations last month. I am hoping to get to test the Grace remote app; I have some inquiries into the folks at Grace for some radios to review.

Regarding Grace radios going to RadioTime, I don't see it happening anytime soon, unless Reciva folds entirely. RadioTime does seem to be having a growth spurt, especially among mobile apps and WiFi radios, but there are no indications of any current Reciva units switching to RadioTime.

I recently found TuneIn, along with WunderRadio, and it is now my favorite streaming radio app. I recently downloaded the Reciva remote control app, and I will put my observations in the columns as soon as I try it out.

Again I thank you for your support and contribution! Everyone else, feel free to submit your own favorite streams; you can email me at the email address below.

❖ GlobalNet Stream of the Month

Each month, I will take one of the streams I pick as a Stream of the Week on the blog and podcast and will highlight them in the column as a stream of the month. This month's stream is also submitted by Kelly: NewsTalk ZB in Wellington, New Zealand. The station is a 24-hour news station with talk shows with discussions on local and national topics.

You can find news articles on current news

and events, a schedule of hosts as well as an in-studio Web cam. Be sure to check out the link listed below.

If you have a favorite stream, email me or send me a message on Facebook or Twitter. Maybe it will get highlighted here in the pages of *Monitoring Times*!

❖ GlobalNet goes Interactive!

If you have been reading the past few columns, you have probably seen me mention the new Twitter account. From this, I have added a few other interactive options online to give all of you a chance to get more information, especially breaking news, and more of a chance to interact with each other.

I have added an online blog, where I will be putting time-sensitive information that can't make the monthly column, information on streaming audio mobile app updates, streams related to breaking news stories, and more.

In addition, I have added a podcast, available on iTunes. The GlobalNetCast comes out each week and highlights information from the blog, previews of the upcoming columns before they hit the newsstand, and audio clips from the stream of the week. You can visit the link to my iTunes page below and subscribe to the podcast.

There is also a Facebook fan page. On it, you can find links to blog stories and the podcast, as well as a forum for discussion topics. You can find it easily by searching "GlobalNet" from the Facebook search field.

I am including links to all of my online content below. You can also find links to the Twitter account as well as the blog from the main *Monitoring Times* Web site.

That should do it for this month, until next time, 73. Loyd, W4LVH

GLOBALNET ONLINE CONTENT

Blog: www.globalnetmt.com
 Twitter: @GlobalNetMT
 Facebook: Search GlobalNet
 Podcast: <http://itunes.apple.com/us/podcast/globalnetcast/id409705579>
 Email: loyd@globalnetmt.com

GLOBALNET LINKS

W2LIE's Airshow Page - www.w2lie.net/airshow
 Farnborough Airshow - www.flightglobal.com/articles/2010/07/13/344356/flightglobal-and-flir-systems-team-up-to-stream-live-video-of-farnborough-international-airshow-2010.html
 Airport streams and radar - www.futurastudios.com/atc.html
 GlobalTuners Receiver list - www.globaltuners.com/receiver/list.php
 LiveScannerAudio Group - <http://groups.yahoo.com/group/LiveScannerAudio/>
 Garrison Radio - www.mediauk.com/radio/421/102.5-garrison-fm
 NewsTalk ZB - www.newstalkzb.co.nz/featdetail.asp?recnumber=18
 Toyota adds Pandora in cars - www.pnnewsire.com/news-releases/pandora-internet-radio-coming-to-toyota-vehicles-112863194.html



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The Aviation-Longwave Bond

The link between aviation and longwave is a strong one, dating back to at least the 1920s, when radiobeacons and the four-course A/N Radio Range took to the air. Several decades before GPS and Radar, longwave was helping to guide pilots safely home from all corners of the map. It wasn't long before Automatic Direction Finding (ADF) equipment became standard gear aboard most aircraft, making the use of radio-navigation essentially a "hands-off" affair. Want to know more about how the Range worked? Don't miss the excellent video recreation at <http://tinyurl.com/3anbh5j>

Longwave's reliable, steady propagation over short and medium distances gave it the edge over other radio frequencies and made it a natural choice for both navigation and Transcribed Weather Broadcasts (TWEBs) that pilots could tune to for enroute weather reports and conditions at regional airfields. Several of these stations dotted the U.S. including two powerhouses in the Northeast that I could hear regularly in Western NY; TUK/194 kHz (Nantucket, MA) and ELM/375 kHz (Elmira, NY).

Today, the only remaining TWEBs that I'm aware of are located in Alaska, but there are many Automated Weather Observing System (AWOS) stations operating on both longwave and the VHF Airband. These stations, as their name implies, broadcast automated weather readings taken at airports. They are used to help pilots understand the conditions around them and to receive Notice to Airmen (NOTAM) broadcasts.

An excellent list of beacons with notations for those with TWEB or AWOS service is maintained by William Hepburn at www.dxinfocentre.com/ndb.htm. Also, the main www.dxinfocentre.com site includes a number of aviation, time, and weather services, covering the spectrum from VLF to VHF.



An early view of an LF Radio Range station

❖ Other LW Services

Few people today are aware that as recently as the 1950s, the standard frequency of 278 kHz (AM) was used by airport towers to communicate directly with aircraft. Special receivers had 278 kHz highlighted on the dial so that pilots could easily tune there. (Remember, this was well before digital readout!)

Later, the frequency of 3023.5 kHz was added, and a remnant of this service can still be found today at 3023.5 kHz USB. A photo of an airborne LF receiver is shown below. Note the "TWR" marking on the dial. An alternate frequency was sometimes used in the case of nearby airports, where interference might result, but 278 kHz was the standard frequency used.

Dropping even lower in the band, LORAN-C (90-110 kHz) was another important tool for aviators until its final shutdown in February 2010. While not providing the worldwide coverage of today's GPS system, it did give a 1/4 mile or better accuracy. Its clickety-clack signals were often heard all over the spectrum by listeners unfortunate enough to live near one of the stations.

Going to nearly the rock-bottom of the radio spectrum, OMEGA (10-14 kHz) was once used as a long range, global navigation system for pilots on inter-continental flight paths. The system offered a 4-nautical-mile accuracy, which was pretty impressive in its day for a worldwide system. OMEGA was finally decommissioned in September of 1997 after nearly 30 years of successful operation. For an excellent write-up on the history, operation, and equipment used for OMEGA, I highly recommend the web page at www.jprocc.ca/hyperbolic/omega.html.



The Motorola Airboy: An example of an LF receiver used by aviators.

❖ What's Next?

What is the future of longwave in the field

of aviation? It's no secret that the numbers of non-directional beacons (NDBs) are in decline today. The FAA has stated that future navigation aids will rely less on ground-based systems, and more on modern GPS-based techniques. With improved accuracy through locally transmitted "correction" signals, GPS will likely play a much bigger role in aviation.

Conventional beacons are likely to remain active for some time in isolated areas, or in regions underserved by other navigation options. One source, familiar with the Canadian situation, says that he expects most beacons there to last until the 2020 to 2025 timeframe. I believe that most U.S. beacons will be gone more quickly, perhaps by 2015 or even sooner. Some existing beacons could be retrofitted to send GPS correction signals, so they may still play a role in navigation.

Having fewer beacons on the air may open up the LW spectrum for new uses, including amateur radio, data transmission/automation, and emergency applications. Whatever the future holds for longwave, *Below 500 kHz* will be there to cover it!



Many U.S. beacons remain on the air at this writing. This is GF/209 kHz, Glens Falls, NY (Photo courtesy of Todd Brown, AB2MS)

❖ Mailbag & Loggings

Tom Humes (AZ) writes: "On 1-1-11 at 0448 UTC I heard a signal that at first I had a negative reaction to. I thought, what screwball is transmitting on 426 kHz? It was not the normal NDB ID signal I'm used to hearing. It was CW text. This lasted off and on for quite some time. At the end of one transmission the ID of KSM was given, as well as a URL of www.radiomarine.org.

"I looked it up online, and boy was I wrong about what was going on! An organization called the Maritime Radio Historical Society located

in CA has a licensed operation authorized by the FCC. I listened for about a half hour and then shut down for the evening. This is truly my biggest surprise reception. I did not expect to hear any text on this frequency, but got it anyway. Their website lists other frequencies they transmit on and services rendered. What a way to start a new year!"

Hi Tom, glad you were able to hear the MRHS folks on longwave. Dick Dillman and the crew at KSM are doing a great job to preserve the legacy of marine CW operations, which has a long history on MF and HF frequencies. Several years ago, you could have heard lots of traffic in this band, and also on the International marine calling channel of 500 kHz. These bands are very quiet today, with the great exception of KSM. How about sending us a scan or copy of a QSL card when you get one? Thanks also for your loggings, which are shown below.

SELECTED LF/MF LOGGINGS

(From AZ)

kHz	ID	Location	Miles
275	GUY	Guymon, OK	599
326	MA	Midland, TX	585
329	TAD	Trinidad, CO	455
338	RYN	Tucson, AZ	195
338	PBT	Red Bluff, CA	637
344	FCH	Fresno, CA	409
359	BO	Boise, ID	624
362	RPX	Roundup, MT	834
368	SX	Skookum, BC	1033
371	TVY	Tooele, UT	398
380	BBD	Brady, TX	742
400	FN	Ft. Collins, CO	564
404	MOG	Montague, CA	717
410	GDV	Glendive, MT	949
414	ATS	Artesia, NM	450
428	SYW	Greenville, TX	1143
521	INE	Missoula, MT	840

Al Deutschmann writes: "I wonder if you could suggest how I could improve my LW listening? I have a Realistic DX-440 and a Grundig Satellit 800. I like listening to and logging aviation beacons. I have been doing this for about a month now and have had satisfactory success. I listen mainly on sideband, where I get clearer reception. I have a decent longwave antenna about 50 feet from my house and about 16 feet up in the air. It is an LF Engineering Co. Model L-400B.

"So far I have logged over 70 beacons, the farthest of which is PPA (450 kHz) in Puerto Plata in the Dominican Republic. That is my prize catch so far at 1,900 miles from my house NW of Chicago. Another one of my prizes is QD (284 kHz) in The Pas, Manitoba.

"I seem to have a lot of background noise and it is difficult to pull out the Morse code identifier signals. I am wondering if there is a radio available that would maximize the signal and minimize the background noise, or maybe you can offer another remedy? I enjoy your column every month and it is the first thing I read in *Monitoring Times*."

Hi Al, it's good to hear from you, and it sounds like you are off to a great start with LW DXing. I also use an L-400B antenna with very good results. One thing you might try is repositioning the antenna for the lowest noise pickup. I have seen cases where active antennas are moved 20 feet or so and it makes a large difference in noise pickup. Of course, this applies only to man-made noise, such as from fluorescent lights, TVs and motors, not natural (QRN) noise.

If you're open to spending a few more bucks, you may be able to further improve your results with a tabletop receiver. Most tabletop units have a selection of bandwidth filters, a noise blanker, and an IF shift capability, which can net you more loggings of weak and marginal signals. My Drake R8, for example, has a very effective noise blanker for pulse-type noise, and I can bring the filter down to 500 Hz. Using the IF shift, I can separate between 400 Hz and 1020 Hz tone beacons on the same carrier frequency, resulting in at least two beacons on one dial setting. The Icom IC-R75 is another excellent receiver that includes Digital Signal Processing.

Good used receivers can often be found secondhand at the online auction place or via the used equipment areas of Universal Radio, Grove, and AES websites. I hope this gives you some ideas for better results on longwave, and keep in touch on what you are hearing. Loggings are always welcome in *Below 500 kHz!*

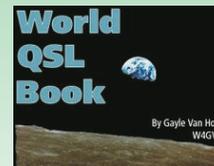
NOW AVAILABLE

Radio hobbyists interested in receiving and identifying radio stations in the HF/VHF/UHF radio spectrums now have a new whopping 1414 page CD-ROM publication to aid them.

International Callsign Handbook is a concise world directory of various types of radio station identifications covering the military, government, maritime, aeronautical, and fixed radio stations on CD-ROM. Thousands of callsigns and other types of identifiers have been collected from our own personal log book, official sources and dedicated hobbyists who contributed their material.



World QSL Book - Radio hobbyists interested in receiving verifications from radio station now have a new CD-ROM publication to aid them in the art of QSLing. This 528-page eBook covers every aspect of collecting QSL cards and other acknowledgments from stations heard in the HF spectrum.



"I'm impressed. This is a comprehensive collection of worldwide radio identifiers likely (and even some less likely) to be heard on the air. Over the years the Van Horns have earned the well-deserved respect of the monitoring community. Accurately assembling a collection like this is a mammoth undertaking. Congratulations on a job well done."

Bob Grove - December 2008 *What's New Column*, *Monitoring Times* magazine

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From the great north, we are pleased to hear from **Ken Alexander, VE3HLS** near Toronto. Ken writes: "Hi Kevin, I'm about to start building a neat little receiver kit. It's a software defined receiver kit by the ham who used to make the Softrock 40 kits years ago. His kits are definitely more sophisticated; the current receiver kit will cover any three ham bands, but the real neat thing is that you can also configure them to cover 180 kHz to 3 MHz! I ordered two kits for a friend and I, and they just arrived yesterday. The kits are only \$56 each!

"There are a lot of surface mount components on them, including 4 or 5 ICs, so I'll need a finer tip for my soldering iron. I'm going to try and pick that up soon and get to work on them. You can read about the kit at: www.wb5rvz.com/sdr/ensemble_rx_ii/, and they can be ordered at <http://kb9yig.com/>. It's basically a one man show, so kits are only available for order every few weeks. The fellow takes a pile or orders then fills them, and updates his website to indicate he'll take orders again.

"I'll put up my Wellbrook Loop when I finish them and give them a good run to see how they perform. I'll let you know how it goes. Some *MT* readers might find it interesting. I have a feeling that LW listeners will find the receiver will benefit from a low pass filter that cuts off just below the MW band. That could be a project for next year!"

Ken, thanks for writing with information on this receiver kit. I would be very interested in hearing how it works for you, so we can share this with our readers. It appears that kit building is alive and well, even if the kits are no longer coming from Benton Harbor, MI!

❖ End Notes

Surprisingly, I did not receive any loggings for our January featured beacon, which was **AVN/344 kHz** near Rochester, NY. I would still be interested in who can hear this station from the farthest distance. Send your loggings to me at the address in the masthead.

See you next month!



RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ

marcellis@monitoringtimes.com

Reader Mail and More Philco Progress

FROM THE READERS

Dealing with Bakelite Blocks

After I had announced the scrapping (temporarily as it turned out) of the Philco 37-62 restoration project, partly because of the presence of those proprietary Bakelite potted capacitors-cum-terminal strips, I received a couple of interesting tips on dealing with the units.

Gary Maker points out that such capacitors do not necessarily have to be totally disconnected from the radio to be rebuilt, nor does the potting material have to be melted out of the case. The method depends on the wiring to the block being flexible enough so that it can be turned on its side. If that's not the case, you may be able to free up the component by unsoldering one or two connections.

Assuming that turning is going to be possible, begin Gary's procedure by clipping the fine wires soldered to the terminals where they emerge from the terminal mounting rivets (Figure 1). These are the leads from the internal components. A study of the schematic and parts list will help you figure out the type and values of the components inside. Another source of Bakelite block data will be found at www.philcorepairbench.com/bblokcap.htm. One-capacitor and two-capacitor blocks are common. Capacitor and resistor combinations are sometimes encountered.



Fig. 1. First step in Gary Maker's Bakelite block rebuild procedure is to cut, at the terminal strip, the fine wires coming from potted components. Gary Maker photo.

Now warm the block evenly on all four sides. It doesn't take much. Gary uses a small heat gun made for embossing (\$19 or less at craft stores). The narrow tip makes it possible to confine the heating just to the surfaces of the Bakelite. Finally, insert a thin stiff wire through the center rivet on

the block and push. A block of unmelted sealant, containing the components, should emerge. If not, a little more heating will do the trick. Now a new component or components can be inserted into the empty Bakelite block (Figure 2) with the leads run up through the appropriate rivet holes and soldered in place.



Fig. 2. With the potted capacitor removed, a modern unit can be installed in the Bakelite block. Gary Maker photo.

What might be called a "lazy man's Bakelite block fix" was offered by Irvin Sanders *K3IUY*. It would be particularly helpful in cases where it isn't practical to turn the block on its side. In Irvin's approach, one just disconnects the internal wires running to the terminals as shown in Gary Maker's picture (Figure 1). Then the new capacitor can be connected externally to the freed-up terminals.

Actually, rather than clipping the wires, Irvin prefers to run a drill bit through the rivet hole – the drill being a few thousandths bigger than the hole. This effectively disconnects all leads. But be careful not to use too big a bit, Irvin warns. You could end up drilling the rivet completely out, leaving the terminal with no support.

Rust Remedy

I had solved the problem of the Philco's rusted chassis top by wire brushing followed by an application of good quality metallic paint. However, Irvin wanted to recommend a product called Bartender's Helper or Barkeeper's Helper found at some supermarkets. It comes in a canister similar to Comet or Old Dutch, but is a much more potent cleaner. He likes to put the powder in a glass vessel mixing with water to the consistency of cream. He scrubs with a wad of paper towel, q-tip, hog's hair scrubber from the supermarket or steel wool depending on the surface. Irvin finishes up by cleaning with a paper towel moistened with lacquer thinner. The surface is now suitable for painting or lacquering.

Transformer Testing

In my column on starting up a long-disused set (October issue) I recommended an early check on the power transformer voltages. However, Bill Ruck suggests a more thorough method to be used if the power transformer is at all suspect. Remove all the tubes so there is no load on the transformer, plug the set in and turn it on. If the transformer warms up a little, that's ok. But if it begins to get progressively warmer, there is likely to be a shorted winding – reducing the transformer to paperweight status.

Alternatively, one could put a hundred-watt bulb in series with the transformer primary and the line. If there is a problem, the light bulb will glow. This is probably a little safer procedure than just letting the transformer heat up, possibly arcing over and causing a fire.

This 'N That

From time to time I receive a letter from a mystery reader. He never signs his name, and the only personal information I have about him is that his letters are all postmarked "Coastal Carolina Area." His letters are also hard to read. They totally fill 8-1/2 X 11 sheets with no margins: top, bottom, left or right. But they are chock full of interesting information. Right now I have four of his letters in my "in" box and it's about time I tried to share some of that information with you. For ease of reference I need to give him a name. We'll call him "Sam."

Sam seconds the annoyance I first felt when I discovered the Bakelite block capacitors in our 37-62. Only he doesn't put such sets aside as I was tempted to do. He goes after them with a vengeance, disconnects all the wiring, and rebuilds the circuit using individual components mounted on terminal strips. That's dedication!

According to Sam, Philco used every cost-cutting trick in the book – including those infernal Bakelite blocks – to deliver more radio per dollar than most competitors. And they were able to manufacture and sell in such volume that their parts cost was kept very low. However, most radio servicemen disliked working on the sets.

Sam offers an interesting tip for bringing certain a.c. sets with bad power transformers back to life even if a replacement transformer is unobtainable. If the set is a pre-world war II wood-cased 5-tube a.c. radio it may well have an a.c.-d.c. twin. That being the case, with some careful rewiring the a.c. set with the bad transformer can be converted to the a.c.-d.c. version.

As an example, Sam offers the a.c. Philco 37-610 (tube complement 6A8, 6K7, 6Q7, 6F6,

5Y3) and the a.c.-d.c. Philco 37-611 (tube complement 6A8, 6K7, 6Q7, 25A6, 25Z6). To change the former into the latter, you can substitute a 25A6 and 25Z6 for the 6F6 and 5Y3 (circuit changes are necessary, including changing over the heater circuit from parallel to series – refer to the circuit diagrams). Of course you would have to add a ballast resistor or equivalent to substitute for the 37-611's line cord resistor.

Sam stresses that the converted set should have a line cord with a polarized plug, wired so that the wide blade is the one grounded to the chassis. The on-off switch should be placed in series with the hot side of the line (narrow blade of the plug). For extra safety, a fuse should also be wired in series with the hot side of the line.

I had imagined that the main reason for the creation of a.c.-d.c. sets, aside from producing inexpensive models, was the fact that certain areas of many large cities were (and may still be) supplied with d.c. But Sam points out that there was another major market just as important or more so – the pre rural electrification farm market.

Before REA, the best source of current to operate a radio and other household appliances on a farm was a 120-volt light plant consisting of a wind generator charging a bank of batteries. And of course the current from the batteries was d.c.

BACK TO THE RESTORATION

Re-Mounting the I.F. Transformers

You'll recall that last month I removed the two i.f. cans and the can-type multiple electrolytic capacitor to clear the chassis top as much as possible for painting. Of course, this required removing all of the connections to the i.f. transformers and the capacitor. The chassis top and sides were then primed and painted with two coats of a fine quality metallic aluminum color paint. The transformer shell got a coat of black enamel.

This month's work session began with a cleaning of the aluminum i.f. cans. I used Brasso, which is my metal cleaner of choice, and the cans soon lost their dingy look. I also "Brasso'd" the electrolytic capacitor can, though there were areas of corrosion that required stronger treatment with steel wool. This can, too, looks a lot cleaner, though some stained areas remain.

Now I was ready to re-mount and reconnect the i.f. transformers (Figure 3). The electrolytic can would be re-mounted and left in place for show. It would be replaced, electrically, with individual capacitors mounted under the chassis.

The transformer reconnection went smooth-



Fig. 3. The chassis top with the multisection electrolytic and i.f. transformers reinstalled.

ly, thanks to the large photograph of the chassis bottom that I had taken and printed out prior to disconnection. I had numbered each wire using a temporary masking tape tab and marked the connection point of each wire with a matching number. As an extra precaution, I left a small stub of wire on each connection that I clipped just in case I might have some reason to verify later that it was indeed a connection point.

Because I had clipped rather than unsoldered the wires, some of them were no longer long enough to reach their destination. Usually, just an inch or two of extension was needed. I supplied that with some stiff bus bar that I had on hand – soldering one end to the connection point and splicing the other end to the too-short wire.

Replacing the Multiple Electrolytic

Connections to the electrolytic were not mapped for obvious reasons. I had clipped its leads off right at the can after making sure that their color coding could be identified later. I found a clear spot under the chassis on which to mount the terminal strip that would hold the three individual capacitors replacing the ones in the disconnected can (Figure 4).



Fig. 4. The three-capacitor assembly replacing the original multisection electrolytic.

When mounting an extra terminal strip under a vintage chassis, I do try to avoid drilling a hole for a screw. I don't like the vibrations that are set up, the metal shavings that are spun off, or the violent shaking that occurs as the drill breaks through. In the absence of an existing screw or screw hole, I usually solder the terminal strip's mounting lug directly to the chassis.

To that end, I keep in my tool box a very large soldering iron I was lucky enough to pick up at a garage sale some time ago. Wattage is unknown, its paper tag having dropped off long ago, but I wouldn't be surprised if it were in the 200 range. At any rate, just a few seconds of applying its large tip to the work resulted in very well bonded bead of solder holding the lug firmly in place. This same iron also comes in quite handy when it's necessary to remove the copper braid often used to ground tuning capacitors.

Because the replacement capacitors were not located in the same spot as the original, it was judged easier to install completely new wiring than to reroute the original leads. So, one by one, the originals were disconnected and replaced with new leads from the new capacitor assembly. I happened to have a hank of plastic-coated wires, in various primary colors, salvaged from a discarded computer power supply – so it was easy to pick out the required red, green, blue and black.

Replacing the Paper Caps

This set has nine paper capacitors. Five of

them are individual units and the other four are embedded in three Bakelite blocks (one dual and two singles). I had decided earlier that I would change out all of the individual caps, but would assume that all of the Bakelite block caps were good until it was proven otherwise.

The replacement of the individual capacitors went quickly and smoothly – though a couple of values were a little odd by today's standards. I used a 0047 uF to replace the original .006 and a 0.22 uF to replace the original 0.25.

The wiring of the dual capacitor Bakelite unit, used as a line filter, was such that it could be checked in circuit. I observed no reading across them even on the highest ohms scale. So that leaves only the two individual capacitor Bakelites to worry about. If they give trouble, we can deal with them using Irvin Sanders' drilling method, because the wiring around both seems too tight to use the Gary Maker "turning over" method.

❖ ARC Changes Hands

Long a premier source for those interested in buying or selling antique radio gear, *Antique Radio Classified* has been sold to a new publisher. The magazine was founded in 1984 and purchased by John Terrey two years later. John has been a well-known figure in antique radio circles both as the publisher of *ARC* and as a dealer of current books on vintage radio topics.

The publication changed hands last November, when John sold it to Jon Kummer. Jon has been associated with various electronics trade and hobby magazines since 1980. He plans to publish *ARC* monthly with expanded editorial coverage including test equipment and the growing tube audio equipment market.

We'd like to thank John Terrey for his many years of publishing and growing *ARC* and wish Jon Kummer every success in his stewardship of this fine publication. The *ARC* web site continues at www.antiqueradio.com. Contact information is PO Box 1558, Port Washington, NY 11050; Phone 866-371-0512; e-mail jon@antiqueradio.com.

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Air Band Antennas

This month's issue of *Monitoring Times* highlights the aircraft bands. The antennas presented in this column were first developed for a California Civil Air Patrol group as portable antennas when searching for aircraft ELT, or Emergency Locator Transmitters at 121.5 MHz. But, they work just fine over the entire 108-130 MHz band if there is a control tower that's just a bit too far for your discone antenna to pull in. We have six versions: a 2, 3, and even a 4 element model in both 50 and 75 Ohm feeds.

Why 75 Ohms? Well, there is a lot of low cost and surplus RG-59 and RG-6 out there, and the 75 Ohm coaxes have less loss than the similar sized 50 Ohm coax. And scanners are just as happy with 75 Ohm antennas as they are with 50 Ohm antennas. Yes, there is a tiny impedance mismatch where the coax enters the scanner, but this loss is more than offset by the lower losses in the 75 Ohm coax.

❖ Theory

The 'J' driven element, sometimes called 3/4th of a folded dipole, has about a 150 Ohm impedance when mounted by itself. The loading effects of the other elements can now be used to pull the 150 Ohms down to 75, or even 50 Ohms. Thus, the driven element impedance matching is the spacing and structure of the Yagi itself.

The antennas are first modeled in the Yagi-Max software program for gain, pattern, and driven element impedance. This gets close, but while the programs are giving you driven element impedance to several decimal places, they seem

to have trouble with this calculation.

At this point I build one of the antennas, then adjust the driven element for best return loss, or SWR. The width of the loop in the driven element is not a critical dimension and can vary between 1 and 2 inches with no change in performance. This also holds true for the little bend at the end where the driven element goes into your boom. Just be sure to keep the coax ends short as in Figure 3. Now the published antenna has the dimensions that worked best, not just something a computer spit out.

All spacing dimensions are measured from the longest, or the reflector element. There are several reasons for doing this, especially when we get to much longer Yagis. First, it gives you a good idea of just how long the antenna is going to be, but measuring techniques are the real problem. If the spacing is given element to element, then there tends to be a consistent error build-up. In most cases, the antenna grows longer than was intended.

Electrically, it is the spacing between the elements and the driven element that are important, not the spacing between individual elements. So the bias that most of us have in marking our drill points can quickly build up.

The very center of a Yagi driven element is a voltage null. By attaching the coax shield at, or

near, the voltage null, we keep RF off the coax shield. The coax center and shield connections need to be long enough to do the job and not much more.

The J driven element also acts like a balun. If you want to optimize the Yagi to a particular frequency and you have the test equipment, the free end of the driven element can be trimmed or lengthened as necessary. On my test Yagis, I'll make the tip a little longer and trim, trim, trim. If I trim too much, I slip some brass tubing on the element and slide it back and forth to find the best SWR, much in the way I splice elements in Photo 3.

❖ Construction

I'm not a fan of PCB plastic, but many of these antennas have been built using PCB plastic for the boom. I prefer to use wood for the boom. A quick coating of clear varnish, or better yet spar varnish, or even house paint will keep the wood dry for as long as it would your house trim. Even wood protection products such as Thompsons' Water Seal (R) can add years to the life of one of these antennas when mounted outside.

For the shorter versions of the Air Band antenna 1/2" x 3/4" wood can be used; for the longer 3 and 4 element antennas, something like 1" square wood can be used. Heck, one chap built his out of broom handles!

The elements can be any stiff rod between 1/8th and 1/4th inch in diameter. For the driven element, I prefer to use something I can solder to. On the higher frequency models #10 or #12 bare copper wire works well, but bare copper wire is kind of floppy when it gets this long. I used a bronze welding rod and a bit of 1/8th inch brass tubing to splice two pieces together as in Photo 3.

If the antenna is going outside, a good blob of RTV or similar sealant on the coax end is a good idea to help keep out water. As a note, I have about a half dozen of the antennas on different frequencies mounted in my attic. This keeps them dry and losses through my composition shingles are low. Some of these antennas have been up there for nearly 20 years and are still working fine.

❖ Mounting

A metallic mast will detune the antenna a bit. But if you have at least 6" of space between the mast and the last element, you'll be fine. You also want to keep the coax away from the ends of the elements. The element tips are the most sensitive parts of a Yagi antenna prone to detuning.

As mentioned earlier, I have many of these types of antennas mounted in my attic, where

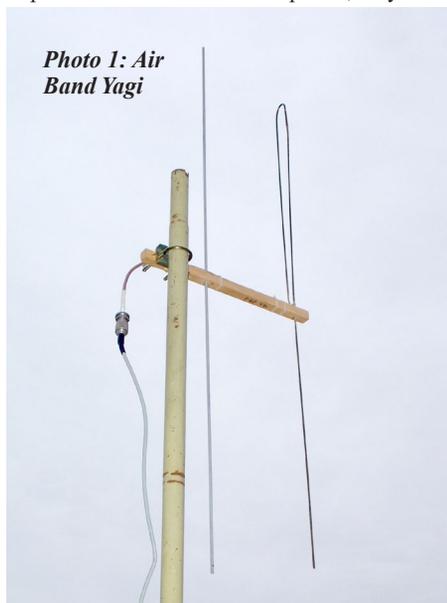


Photo 1: Air Band Yagi

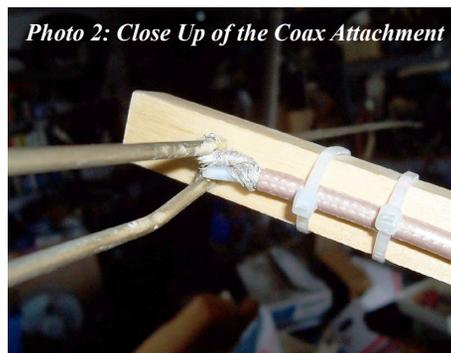


Photo 2: Close Up of the Coax Attachment

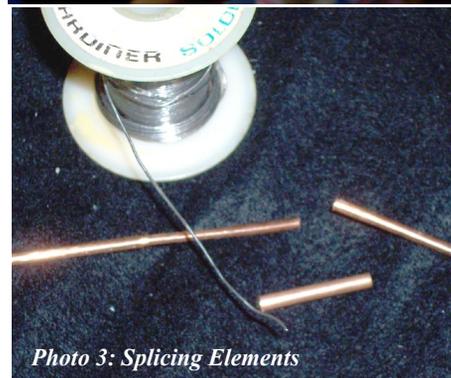


Photo 3: Splicing Elements

I have often used an old cardboard box as my antenna mount.

Dimensions for the 50 Ohm Versions

Element	Length inches	Distance from the Reflector
2 Element Reflector	48.0	0
Driven Element	See Fig 1	6.0
3 Element Reflector	48.0	0
Driven Element	See Fig 1	9.0
Director 1	41.0	30.0
4 Element Reflector	48.0	0
Driven Element	See Fig 1	10.0
Director 1	44.5	23.0
Director 2	39.0	48.0

Dimensions for the 75 Ohm Versions

Element	Length inches	Distance from the Reflector
2 Element Reflector	48.0	0
Driven Element	See Fig 1	10.0
3 Element Reflector	49.0	0
Driven Element	See Fig 1	13.0
Director 1	41.0	32.0
4 Element Ref	48.0	0
Driven Element	See Fig 1	13.0
Director 1	43.0	25.5
Director 2	40.5	50.0

❖ Performance

You will get about 6 dBi gain out of the 2 element versions of this antenna with about a 12 dB front to back ratio. The 3 element is closer to 7.5 dBi, but with a much better front to back ratio of 20-25 dB. The 4 element version of the Air

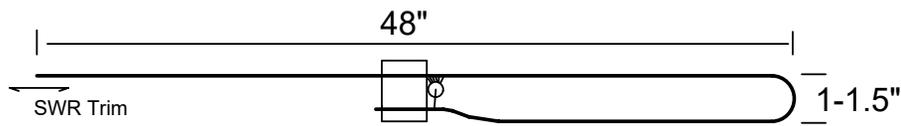


Figure 1: Driven Element dimensions for all 6 versions



Figure 2: Elements and dimensions

Band Yagi brings the gain up to 8.5 dBi, again with a front to back ratio that varies between 20 and 25 dB. I have included the 4 element model, but it's an awful lot more antenna for just another dB or so. But I'm sure there is someone out there who desperately wants that last dB, so I included the dimensions.

❖ Future Topics

You, our readers, are one of my best sources of topics for antenna columns. If there is enough interest, I can work up a 406 MHz Yagi for the

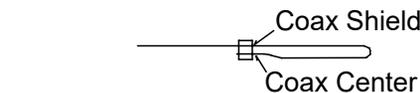
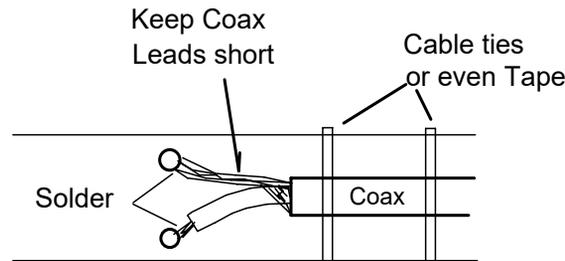


Figure 3: Coax Attachment

new Digital Aircraft ELT beacons. For the public service sectors I can work up 150 MHz, 460 MHz, and 800 MHz beam antennas. For the digital side of the hobby, there are 915 MHz, 2400 MHz, and even some 5700 MHz antenna prototypes strewn around my work bench. For the amateur radio community, I also have a collection of ham antennas available as downloads from my website: www.wa5vjb.com Reference section.

The quickest way to contact me is at kentbritain@monitoringtimes.com or snail mail to the QRZ.COM address for WA5VJB. Now, go get some more antennas in the air!

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Alinco DJ-X11T Wide Frequency Coverage Scanning Receiver

By Bob Grove, W8JHD

In spite of the lagging economy, scanner manufacturers have been unleashing a series of new products with advanced features. The recent emphasis made by GRE, Uniden, and Radio Shack has been on simplicity of operation – a welcome addition, while manufacturers like Alinco and ICOM have emphasized wide, continuous frequency coverage and more features.

An example of the latter is Alinco's new DJ-X11T with its 50 kHz-1300 MHz (less cellular) tuning range, which includes SSB reception for voice and data demodulation found in the shortwave range – a mode not available on conventional VHF/UHF-only scanners or even on many scanner models that include shortwave.

Selectable reception modes are FM, WFM, AM, USB, LSB, SSB, CW, and Auto which automatically enters the proper mode for the frequency chosen.

An internal ferrite bar or external earphone cord (not provided) may be selected for medium wave (AM broadcast band) reception; the whip antenna is used above 1.8 MHz.

The receiver's triple-conversion architecture reduces image response and improves selectivity. Its compact 2-1/2"W x 4-1/4"H x 1-1/2"D sits nicely in the hand, while its 8 oz. weight is easy to carry. A rugged polycarbonate case with rubber lower-edge bumpers offers further protection; the rubber bumpers also prevent slipping on a slick surface.

❖ What is in the Box

The DJ-X11T comes with an SMA-base rubber whip, belt clip (EBC-23), wrist lanyard, 3.7V 1800 mAh high-capacity Li-ion battery (EBP-74), four-hour AC charger (EDC-139), 3 x AA dry-cell battery holder (EDH-36), and comprehensive manual.

You'll want to keep that manual handy until you are thoroughly familiar with all the features and functions: they aren't intuitive.

❖ Operating Features on the DJ-X11T

Two pairs of concentric knobs on the top panel are used to select menu changes as well as adjust squelch and volume. Since the knobs are rather tightly placed (or if your choice of right-handed or left-handed use is preferable), the function of these knobs may be interchanged. For more rapid access to a menu item, a WILD key allows you to set instant access to a particular item. To avoid accidental or intentional

corruption of your settings, a keypad lock can be enabled.

Up to 15 hours of continuous, full-volume operation is available from one charge of the 1800mAh Li-Ion battery pack. For reserving unnecessary power, you can choose the amount of time between 1/2 and 8 hours before an auto-power-off function switches off the scanner. This little Alinco can also be powered by an external source of 6 VDC.

Dual-frequency reception allows the monitoring to two separate frequencies simultaneously, anywhere in the receiver's tuning range for the main choice, and anywhere between 118-171 or 336-470 MHz AM or FM mode for the secondary choice.

A frequency shift function allows the quick selection from one frequency to another, such as the up and down links (input and output) of a repeater system.

Selectable tuning/scanning steps are chosen from a remarkably flexible list of options which should cover virtually anyone's requirements: 0.05 / 0.1 / 1 / 5 / 6.25 / 8.33 / 9 / 10 / 12.5 / 15 / 20 / 25 / 30 / 50 / 100 / 125 / 150 / 200 / 500kHz / 1 MHz.

1200 memory channels can store favorite frequencies, and the bank sizes can be individually selected to any number of channels by using third party software (not provided); an optional PC cable will be required.

A 3.5 mm (1/8") IQ jack adjacent to the whip connector on the top panel functions as an IQ signal and discriminator output. The IQ signal output can be used with a 3rd-party software package to allow the DJ-X11T to operate as an SDR (Software Defined Receiver). Also available on the IQ jack is a 10.7 MHz IF discriminator signal that can be used with other receiver-related software available on the net, such as AIS-plotting to decode FSK data streams.

Decoding circuitry decodes and identifies both tone squelch and DSC squelch; you may encode your scanner channels as well to restrict reception to only those users on the channel(s) that you want to hear.

A feature rarely found in hand-helds is the ability to contour your audio spectrum to suit your personal listening preference. Like it bassy? Shrill? Suit yourself at the touch of a key.

The audio output is nominally 100 milliwatts, adequate for room listening,

but marginal in a noisy environment. The tiny internal speaker faces quite a task, and shows some distortion at high listening levels.

❖ DJ-X11T Scan Features

The scan feature offers five different configurations: preset, programmed, memory, VFO, and tone, thereby allowing the user to search his memory banks, scan a range for new signals, or even check for specific squelch tones to monitor a channel.

Scan speeds are also selectable depending on the mode. For VFO search, 25, 33, or 100 channels per second; for memory channels, 4.5, 8.3, or 20 channels per second. The faster the speed, the more likely the scanning will skip over weaker signals, because it takes a finite time for the switching circuitry to come up to full performance.

A priority selection samples your choice of an important frequency every five seconds so you don't miss a transmission while monitoring or scanning other channels.

The memory scan function may seem slow



compared to VHF/UHF scanners, but if you're in a busy metropolitan area, it doesn't take long to find a busy channel, and if you're in a remote, radio-quiet location, then you probably won't have many channels in memory anyway!

Years ago, Alinco was the first scanner manufacturer to introduce an automatic signal-capture feature which quickly displayed the frequency of an unknown, nearby transmission and monitored its contents. This function is now found on a number of models from GRE, Uniden, and Radio Shack.

The DJ-X11T allows two different modes for this feature; "F Count" performs a frequency counter function, immediately displaying that unknown frequency, while "F Tune" engages the full receiver for finer tuning accuracy and to allow audible reception.

The channel sampling function of the receiver can be used as a "bug" detector as well, searching for nearby, surreptitious, wireless microphones. The user can choose which bands the search should cover.

In that mode, the DJ-X11T's speaker emits a tone which is picked up by the wireless mike and then retransmitted by the bug. The receiver recognizes its own tone and then will either register a silent message on its screen for privacy, or signal an audible alarm.

❖ DJ-X11T LCD Display

Up to 16 alphanumeric characters may be shown on the back-lit LCD window. The keypad is also backlit for night-time manipulation. And, you're not stuck with the factory's choice of character font; you can custom select size, style, language, contrast, illumination and even the welcome message!

A "dual channel-scope" presents a bar graph of signal presence on 11 contiguous channels – five up and five down from the chosen center frequency. Relative signal strengths are indicated by the height of the bars. The total span from edge to edge is determined by the selected step intervals between each channel frequency.

❖ Stability Specifications

The receiver's frequency stability is quite acceptable: $-7/+3$ ppm (parts per million) over a temperature range of $+14$ to $+140$ degrees Fahrenheit. This means that if you were listening to a frequency of 1 MHz at the lowest temperature, and then stepped into a blazing-hot area at the higher temperature, the receiver would drift no more than 3-7 Hz.

Of course, at 10 MHz it could drift as much as 70 Hz so that an SSB signal might be somewhat distorted. At 450 MHz it could drift about 3 kHz (3000 Hz), but with the wide bandwidths

of FM signals at that part of the UHF spectrum, it would be barely noticeable on the recovered audio except for some minimal distortion.

But, the reality is that no one is likely to subject the receiver to such an enormous ambient temperature excursion, so the good frequency stability rating for the DJ-X11T stands.

❖ Selectivity Specifications

Selectivity – the ability of a receiver to isolate the center frequency from adjacent interference – varies considerable with the bands and modes chosen.

SSB/CW (single sideband/continuous wave, or Morse code) measurement for a desirable 2 kHz bandwidth is down -6dB at its edges, increasing to -50 dB at 7.5 kHz or less, which is commendable for a consumer scanner.

AM/FM (amplitude modulation/frequency modulation) bandwidth of 12 kHz is down -6 dB, and increases -60 dB at 35 kHz; that's fairly broad, but under most reception conditions, is acceptable.

WFM (wideband FM), as found in the FM and analog TV broadcast bands, has a bandwidth of a broad 180 kHz for only a -6dB rolloff, and increases to only -20 dB at 470 kHz bandwidth – very poor by rigid standards, but once again, typical of radios whose main application is not FM broadcast DXing. Apologists may argue that the FM capture effect automatically selects the stronger of two interfering signals anyway. While that may be true, what if you want to hear the weaker one?

❖ Sensitivity Specifications

The receiver's high sensitivity may invite phantom signals from strong signal overload, in which case the user may opt to reduce the RF gain, enlist the attenuator, or change the squelch level.

Sensitivity (typical) for 10dB S/N on AM/SSB/CW, or 12dB SINAD for FM/WFM

Main Band Measurements

0.050 to 0.531 MHz	AM	5dBu
0.531 to 1.620 MHz	AM	2dBu
1.620 to 76.00 MHz	AM	-5dBu, SSB and CW -10dBu, FM -15dBu
76.00 to 108.0 MHz	WFM	-3dBu
108.0 to 136.0 MHz	AM	-6dBu (Sub band measurement below)
136.0 to 174.0 MHz	FM	-14dBu (Sub band measurement below)
175.0 to 221.75 MHz	WFM	-6dBu
221.8 to 336.0 MHz	AM	0dBu
336.0 to 475.75 MHz	FM	-13dBu (Sub band measurement below)
475.75 to 770 MHz	WFM	-13dBu
770 to 1260 MHz	FM	-9dBu
1260 to 1300 MHz	FM	-6dBu

Sub Band Measurements

118 to 136MHz (AM)	-3dBu
136 to 170MHz (FM)	-14dBu
336 to 470MHz (FM)	-14dBu



❖ DJ-X11T Accessories

There are quite a few accessories available for the DX-X11T. These include:

EDH-33	Cigar-plug DC conversion cable (12VDC/24VDC to 6VDC)
EDS-12	Wire Remote-controller
EME-6	Straight-cord Earphones
EME-26	Curly-cord Earphones
ERW-7	Allows you to use clone or utility software only.
ERW-8	Mini USB/USB ports PC interface cable (Full-functions).

Approved government agencies can also purchase an analog inversion-scramble decoder for the DX-X11T.

The ERW-8 cable enables the use of both clone-utility and real-time control software. Both types of software are available for download at no charge from a link below the Alinco website at www.alinco.com/Products/DJ-X11/utildown.html. To use third party SDR freeware, you will need to purchase a 3.5mm stereo mini-plug cable for connection to a PC. All functions are not guaranteed when used with third party software.

❖ The Bottom Line

A complete list of features and specifications may be seen at www.grove-ent.com/DJX11T.html

Considering the pricing points of competitive scanners on the market, the Alinco DJ-X11T is reasonably placed. It offers a wide frequency range with multiple reception modes and an array of functions not presently found elsewhere.

The Alinco DJ-X11T is available from Grove Enterprises for \$329.95 and from other MT advertisers.

TABLE ONE: GENERAL SPECIFICATIONS

Receiver range: Main VFO 0.05 - 1299.99995 MHz in all available modes
Sub VFO 118 - 170.995 MHz and 336 - 469.995 MHz using the AM/FM modes.
Mode: FM, WFM, AM, SSB (USB/LSB), CW (CU/CL)
Antenna Impedance: 50 ohms (SMA)
Supply voltage: DC 3.7V (EBP-74) / DC 4.5V (EDH-33) / DC 5.4V - 6.0V (external regulated source) negative ground
Current consumption: Approx. 130mA Mono band / 180mA Dual band
Temperature range: -10 to +60 deg C (+14 to +140 deg F)
Frequency stability: -7 to +3 ppm (-10 to +60 deg C) (+14 to +140 deg F)
Weight: Approximately 235-grams / 8.29 oz (Antenna and EBP-74 inclusive)
Receiver: Triple-conversion super heterodyne receiver using the AM/SSB/CW/FM modes on the Main VFO.
Double-conversion super heterodyne receiver using the AM/FM modes on the Sub VFO and WFM on the Main VFO.
Audio Output power: More than 100-mW (8-ohm)

Specifications subject to change without notice or obligation. Cellular frequencies blocked on USA model. Unblocked versions available with proper documentation for authorized users only.



SKY SURFING

RADIO FROM THE OUTER REACHES

Stan Nelson, KB5VL

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Listen up, Sky Surfers!

Welcome to my first *SkySurfing* column in *Monitoring Times*. This month we'll discuss inexpensive ways to use radio to explore the world of astronomy, space weather, and related topics.

If you're new to radio astronomy, you may wonder why anyone would want to listen to or record noise? Radio astronomy involves detecting many types of emissions from many types of distant sources, and most of them do sound like noise to our ears. I like to think of them as radio signals without call signs, whose message can often be inferred by the frequency on which it appears out of a wide range of possibilities.

For example, some sources, such as the Sun, emit noise on different frequencies depending on the process or physics involved, as well as factors like magnetic fields and all those messy mixtures of heat and fusion. What frequency should you listen to when getting started? We'll explore that a bit here today and bring you more details in future columns.

Practically speaking, amateur radio astronomers use various frequencies from LF (Low Frequencies, 3 to 30 kilohertz, kHz) to UHF (Ultra High Frequencies, 300 to 3000 megahertz, MHz) and even higher, into the SHF (Super High Frequencies, 3 to 30 gigahertz, GHz). For example, Jupiter's noise can be heard on 20.1 MHz. The Sun generates a lot of noise of different types from frequencies in the 10 to 500 MHz range that can be detected with inexpensive amateur astronomy equipment.

Do you think of radio astronomy as requiring large arrays of dishes or antennas? Few amateurs can rustle up the resources for a giant microwave dish to get into the game with the big guys. However, there are entry level projects available that won't break the bank and offer a lot of fun trying to detect radio outbursts from the Sun and Jupiter. Since these powerful sources of energy are reasonably close to us, the antennas and receivers can be more modest. Let's take a look at some ways to "surf the sky."

❖ Almost Free Astronomy

For the deep space stuff, my favorite "low cost" project has been Seti@Home. Where else can you harness the signals from a huge dish at Arecibo in Puerto Rico? The signals are captured and digitally sent out as parcels of recorded data for you to help extract possible, intelligent signals and pulsars (directed energy emitted from a highly magnetized star, like a light house beam that flashes our way at regular intervals) via Seti@Home at Berkeley. This project started in

started in May 1999.

You can easily create a Seti@home account and download "work units" that run in the background on your PC. When the package of data is analyzed, it sends it back to Berkeley. You can watch the animation as a screen saver. If the SETI signals are detected with your parcel of data, you get the recognition. I'm still waiting, of course, with over 314,000 "units" or credits processed. Check it out at www.setiathome.berkeley.edu/index.php.

When using the screensaver, you'll see the recording date and frequency used to receive the data you're currently processing – (typically around 1.420 GHz, 1000 MHz = 1 GHz). Don't be surprised if the data you're processing is several months old. When your parcel of data is through being processed, it is automatically returned, provided you're connected to the internet. The software keeps you posted on your work done and can be adjusted to run only during screen saver time.

Another organization dedicated to SETI you can explore is at <http://www.seti.org/>

❖ Radio JOVE Project

Another low cost way to get involved in Sky Surfing is building a simple receiver from a kit. Radio Jove is designed as a 20.1 MHz receiver. It can detect radio noise from Jupiter and the Sun. You can buy various levels of kits. The version I bought included a simple two-element wire beam. Complete details can be found at <http://radiojove.gsfc.nasa.gov/>

If you're interested only in listening for bursts from the Sun, a single dipole will do. But Jupiter requires at least a dual dipole beam. Download the complete construction details before deciding what's right for you. The antennas take up a little real estate, about 20 by 30 feet or so for the dual beam, and may need to be as high as 20 feet. Depending on the season or year, the antenna may need a phasing cable added to accommodate Jupiter's path. Again, the details are on line.

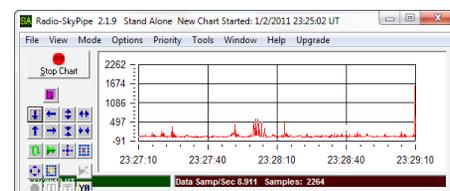
If you find Radio Jove of interest, I highly recommend shelling out the extra dollars (around \$90.00 plus shipping) for the RF2080 Calibrator/Filter to help calibrate the chart and eliminate foreign broadcasts. The calibrator lets you calibrate the software trace to a known noise level. The software, "Radio-SkyPipe" also ships with the receiver. It's also available at www.radiosky.com/

I have used this software for variety of signal detection projects. It is a great product at

a reasonable price. The program gets the non-AGC (automatic gain controlled) audio from one of two audio output ports on the back of the Radio Jove receiver which is connected to either a microphone or line input on the PC. Setting up the levels will require a little experimentation, but the defaults get you going quickly.

The non-AGC receiver audio is used because it is important not to control the gain of the audio so you can observe a wide range of levels. If you drop into the Radio Jove website, there's a great article you can print out entitled, "Measuring Antenna Temperature." It will help you set up and calibrate the Radio-SkyPipe software to the receiver. The software produces an on-screen strip-chart that can be adjusted for time scale and amplitude, and saves your data for review later.

I have ordered the calibrator/filter and will report on the details in a future column.



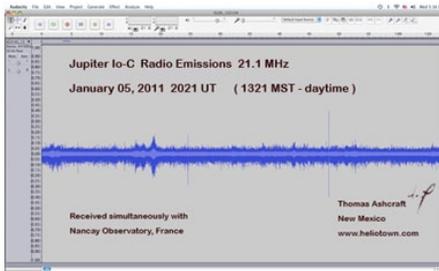
Screen capture of Radio-SkyPipe of local noise from Radio-Jove Receiver, non-calibrated)



The 20.1 MH. Jove Receiver Kit

While browsing the Radio Jove web page, you can sign up for their newsletter. The project is targeted to teachers and students, but anyone can participate. Give it a try: I recently signed up for the Radio-Jove email list and I started getting some e-mails today regarding Jupiter noise and strange other signals. It appears they may be detecting some distant lightning, too – and having fun! The trace below was captured by Thomas Ashcraft, here in New Mexico.

During preparation for this column, my copy of the February 2011 issue of *Sky & Telescope* arrived. I recommend the article on page 66, "Solar Radio Astronomy," by J. Kelly



Recent capture of noise from Jupiter, daytime, Io, by Thomas Ashcraft, New Mexico.

Smith, David L. Smith, and William Joyner, to help you understand the processes that generate solar signals.

❖ INSPIRE VLF (Very Low Frequency) Natural Radio

INSPIRE (Interactive NASA Space Physics Ionosphere Radio Experiments) is another low cost way to explore interesting radio activity, natural noise, that occurs at VLF (Very Low Frequencies, 3-30 kHz). Natural noise is generated by lightning that can travel great distances. There are different types of signals that you can detect with the Inspire unit: Sferics, Tweaks, Whistlers, etc.



The INSPIRE receiver is designed to amplify the signal in the audio range. There have been improvements in the design, and I understand the new version, VLF-3, has a better filter to

reduce hum. The unit is best taken out to a rural or electrically isolated area to avoid 60 Hz hum from power-lines.

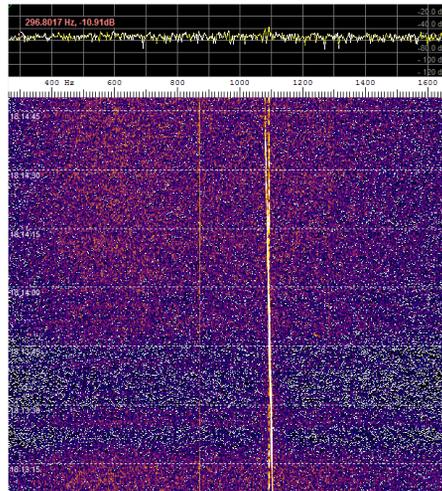
You can run the receiver on batteries, and the web site notes the use of a 72 inch whip antenna. You use an audio recorder to record the signals and replay the recordings on your PC using a spectrograph display software to see the time versus frequency plot. Go to INSPIRE's web site at <http://theinspireproject.org/> for details on their VLF-3 Receiver, and be sure to download and read the "Types of VLF Radio Signals" to see the different types of signals.

Another freeware that should be useful for the INSPIRE radio is Spectrum Lab, by DL4YHF, available at www.qsl.net/dl4yhf/spectral1.html. This software has several quick settings for natural radio modes. Two presets are available for tweaks and spherics monitoring.

❖ Cheaper Yet Astronomy

If you read my feature article in January about listening to meteor pings via 218 MHz CW (continuous wave) radar signals using SSB (single side-band) detection, you may be interested in a very inexpensive way to monitor them using a spectrographic program in real-time.

First, go to www.spaceweatherradio.com and click on the monitor button. It will load the live feed from my receiver via a streaming web broadcast. Listen for a while to the mostly noise.



A screen capture using DL4YHF's software - Aircraft Doppler on 218 MHz.

Now and then, you can hear a 1000 Hz pitched tone detected from the distant radar. Occasionally, the signal will get stronger due to reflections from aircraft passing over the Lubbock, Texas area. Now and then, you will hear pings. Those are meteors. They can be detected day or night. Mornings tend to be more active during meteor showers.

Next, you'll need to use an audio spectrum display software to appreciate the ping's arrival and see the slope caused by the Doppler effect (frequency shift cause by the velocity of the meteor relative to the signal). I use Horne's Spectrogram 15 or 16 freeware which is easily found on the Web.

The trick is to make your computer play the www.spaceweatherradio.com broadcast into Horne's Spectrogram, which requires a recording input. I found that a stereo jumper cable from the audio output on my PC, with the audio output level turned low, plugged back into the microphone jack works well. I recommend you find an isolation transformer and pad to prevent any problems. It runs fine on Windows 7 on an HP laptop. Some fine tuning on the levels are required. Spectrogram has a slide bar on the right-hand side that helps adjust the level.

With both programs running, you should now be able to watch the audio spectrum and see pings. Interestingly, during the summer months, there are lots of lightning induced pings. They are always short-lived and look like a sharp spike on the trace. We apparently can detect lightning out to a hundred miles or so. At 218 MHz!

❖ Stepping Up to that Dish

Okay, this isn't the cheap part of the column. There are many amateurs who have built, revamped surplus dishes, etc. to do radio astronomy. A steerable dish and other possibilities may lurk in your wallet. Both kits and ready-made units are available. For folks new to the concept of a dish antenna or parabolic reflector, the gain (gathering or signal concentration factor) depends mostly on the frequency and the area of the dish. Bigger dish, more gain. Higher frequency, more gain. More gain, narrower beam. Here's a simple chart to show you the idea:

Frequency	Diameter of Dish (1 meter = 3.28 feet)			
	1 meter	2 meter	3 meter	6 meter
1 GHz	18.0 dB	24.0 dB	27.5 dB	33.6 dB
5 GHz	32.0 dB	38.0 dB	41.5 dB	47.5 dB
10 GHz	38.0 dB	44.0 dB	47.5 dB	53.6 dB

The dB (decibel) is the logarithmic ratio of the power delivered by the dish compared to a very fictional but useful isotropic antenna (a sphere or point that either radiates or absorbs radio energy equally in all directions). More dBs means more signal delivered to your receiver. You get a narrower beam or view as the dish increases in size and the frequency. This can help by increasing the resolution of the received signal.

The VLA (Very Large Array) in Plains of San Agustin, located fifty miles west of Socorro, New Mexico, consists of 27 dishes that can process the signals and produce almost visual quality images of the radio spectrum. But it takes time to scan the areas of interest, and, meanwhile, the Earth's moving. In a future article, I plan to cover the VLA in more detail. I had visited it when it was newly built, years ago. Another trip is surely in the works.

If you choose to erect or build that dish, keep in mind that the weight and need for support (financially and mechanical) will increase dramatically. And your neighbors will look over your fence more often.

❖ Radio Astronomy at the Movies

There are two movies that stand out for me. Remember *Contact*, based on Carl Sagan's novel? The VLA in New Mexico and Arecibo's dish were featured in it.

My favorite movie is *The Dish*, an Australian movie that tells the story about the Parkes dish that was used to receive TV signals from Apollo 11. The story is highly fictionalized, of course, but a real dish was used. One item I wondered about was the use in the movie of portable radios for guard-to-control room communications. Wouldn't that cause interference? Hey, it's Hollywood.

Let me know if you have a favorite movie that features "radio astronomy."

❖ Some Books on Radio Astronomy

Here are a few books in my collection that you might want to read to get a good start:

- Shields, John Potter, *The Amateur Radio Astronomer's Handbook*, 1986, Crown Publishers
- Kraus, John D., *Radio Astronomy*, 2nd ed., 1986, Cygnus-Quasar Books
- Burke, Bernard F. and Grahm-Smith, Francis, *An Introduction to Radio Astronomy*, 1997, Cambridge University Press.
- Christiansen, W. N. & Høgbom, J. A., *Radio Telescopes*, 2nd ed., 1985, Cambridge University Press.
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Salvaging California Amplifier Downconverters for Satellite Usage

John M. Franke, WA4WDL*

I recently acquired a box full of California Amplifier model 130001 and 130002 MMDS (Multichannel Multipoint Distribution Service) channel downconverters (see Photo A) through a buy-it-now purchase from auction for less than \$1.50 each, including shipping. Surely these treasure troves of microwave components could find use for satellite projects.

Since the days of AO-40, many MMDS downconverters like the Drake 28801 and California Amplifier models 317322 and 1300163 have been modified for amateur satellite reception. I wanted to look into other possible modifications/applications.

Like many downconverters designed for MMDS, the RF input is 2,500-2,686 MHz and the IF output is 222-408 MHz. The local oscillator is a crystal controlled PLL operating at 2,278 MHz.

The downconverters have a type N RF input connector and two type F IF output connectors. One F connector serves double duty as the IF output port and the dc input port.

The downconverters are powered from a +16 to +24V supply and an internal 78M12A 12V three-terminal voltage regulator. The other F connector provides a test port 20 dB down from the IF port.

While this article focuses on the 130001 and 130002 downconverters, the information is general enough for a multitude of California Amplifier MMDS converters.

❖ S-band Marker Generator

A good reference website for S-band reception is: www.uhf-satcom.com/sband/ The listing of satellite frequencies reinforces my use of the downconverter local oscillator as a good marker generator. Another interesting non-amateur radio S-band reception website is: www.svengrahn.pp.se/trackind/UpOnSband/UpOnSband.htm

I removed the cover from one California Amplifier model 130001 downconverter (see Photo B) and applied power through the IF output connector. Applying +18V, the converter drew 190mA. One project that immediately came to mind was to salvage and remount the local oscillator in its own shielded enclosure. The local oscillator would make a nice marker beacon for the 2.2 – 2.3 GHz satellite telemetry band and could also be used as part of a homebrew converter or transverter for 2.4 GHz.

It is easy to visually separate the local os-



California Amplifier MMDS Downconverters

illator section from the rest of the circuitry. The local oscillator, with bandpass filter, occupies a little less than half of the 2-3/8" x 4-7/8" printed circuit board. Bringing a BNC to dual banana adapter probe near the local oscillator output stripline filter, I could easily see the 2,278 MHz signal using my Hewlett-Packard 8441A swept YIG filter spectrum analyzer⁴ and I could also read the frequency on my homemade 12.5 GHz frequency counter⁵.

The 12V power bus runs along the bottom edge of the circuit board. Cutting circuit traces to remove unused sections from the internal voltage regulator load, the current drain dropped to 79mA.

Judging from figures for similar downconverters⁶, the frequency accuracy of the local oscillator is +/-20 kHz and the frequency stability is +/-30-50 kHz. But, the figures are based on the downconverter being mounted on a pole and exposed to the weather.

Better stability can be expected in the ham shack or if provisions are made to limit temperature variations. There is another way to improve the stability as I will show later in this article.

In one example, a California Amplifier model 130002, I was able to tune the local oscillator from 2,277.995 MHz to 2,278.273 MHz using the onboard trimmer capacitor; a total range of 278 kHz for a crystal oscillator shift just over 1 kHz. I have not run a temperature dependency test. That will have to wait until I can finish building my adjustable test oven.

I did find the schematic for a California Amplifier downconverter local oscillator on the Internet⁷. The schematic appears to cover at least the models 130001, 130002, and 31732 downconverters or is close enough for my purposes. The 506 Prescaler is similar to a Motorola MC12079.

As shown in Photo C, I fabricated a small plate to mount a BNC connector having a bent wire probe, and I mounted it on the sidewall of a model 130002 downconverter. The new probe

is physically more stable and has a greater coupling coefficient than my crude handheld probe. The signal level was still influenced by cable position and hand waving, but my hands were now free while I was making measurements. Even with the crude coupling, I was measuring 3dBm local oscillator output power.

I compared a California Amplifier model 130001 downconverter with a model 130002 downconverter. At first glance, the units are very similar. There are some differences in parts placement around the crystal oscillator stage. In the 130001, the crystal is on the top or component side of the printed circuit board. In the 130002, the crystal is on the bottom side of the printed circuit board.

In both cases, the marked crystal frequency is 8.89844 MHz, which implies a multiplication factor of 256. The current drain and output power of the two downconverters are similar. The 130001 has a 1994 copyright date and the 130002 printed circuit board has a copyright date of 1991.

❖ Construction Begins

I spent some time looking for a suitable enclosure for one of the downconverter local oscillators before I started cutting the circuit board. Whenever I can find a nice shielded box at a hamfest, I latch on to it no matter what is inside. I did find a couple used enclosures that would be large enough to contain a PLL oscillator, along with a 12V three-terminal voltage regulator. The internal cavity measures 2-7/8" x 3-7/16" and is 1" deep unless the internal 1/8" high mounting pads are used.



Model 13001 Downconverter

I used the existing circuit board to size and layout the mounting hole pattern for drilling a 1/16" thick aluminum shelf plate. I cut the local oscillator section from the main printed circuit board of a model 130001 downconverter using a 4" hobby table saw. Adding an RF output cable to the printed circuit board was tricky. I used two U-shaped wires to ground the coax braid

and physically restrain the cable.

I was able to mount the local oscillator printed circuit board directly to the shelf plate with seven 4-40 screws, lock washers, and hex nuts, using the original holes in the circuit board. I drilled a 1/2" diameter hole through the shelf plate under the crystal and a 3/8" diameter hole under the coax connection to prevent shorts and allow the circuit board to sit flush on the shelf.

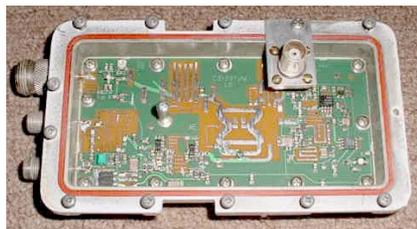


Photo C - Model 130002 Downconverter with Probe

Model 130002 downconverters will require a larger cutout for the crystal under the circuit board. Unused circuit traces were cut and peeled from the circuit board using a razor blade and needle-nose pliers.

With the new arrangement, the RF output power measured 10dBm and the second and third harmonics are at least 20 dB below the fundamental. Hence, the local oscillator can be used to directly drive a double-balanced mixer with



Photo D - Remounted PLL

a little power to spare. The enclosure cover plate being on or off had no noticeable effects.

Later, I fabricated and installed a three-terminal voltage regulator, 7812, on a short piece of angle aluminum. Photo D shows the local oscillator in the new enclosure without the 7812 and Photo E shows the complete assembly. In future conversions, I will use a #30 wire between the regulator and the oscillator circuit board to reduce the stress on the trace.

❖ Fine Tuning

I will be using a Clarke 167-J-2 FM receiver for an IF and was not overly concerned about the usable frequency range of the unmodified local oscillator. The Clarke receiver, predecessor to Nems-Clarke, has a tuning range of 55 to 260 MHz, and I have a panadaptor for the 21.4 MHz IF frequency. The receiver IF bandwidth is 300 kHz, which is good for monitoring high speed telemetry.

However, I did decide to try an assortment of six crystals from my junk box in the model 130002 test oscillator. The highest frequency crystals, 9.2250 and 9.1750 MHz, produced the same output frequency, 2,342 MHz, which is below the expected frequencies of 2,361.6 MHz and 2,348.8 MHz. So, I believe the upper frequency limit of the unmodified VCO is 2,342 MHz. The other test crystals; 9.075, 8.975, 8.875, and 8.625 MHz, all produced the expected output frequencies and power. With no crystal, the output frequency was 2,167.0 MHz. The output power does begin to drop off a couple dB at the frequency limits.

Based on the measurements, the absolute VCO range is 2,167 MHz to 2,342 MHz and the output bandpass filter is a little wider. The absolute VCO range implies a crystal range of >8.465 MHz to <9.148 MHz. Many amateurs have reported no problems with using an 8.8125 MHz crystal to get an IF frequency of 145 MHz for an input frequency of 2,401 MHz. Information for ordering crystals from ICM is found on another web site⁸.

I removed the onboard crystal, the chip capacitors, and trimmer connected to the crystal. I applied an external 0dBm signal, terminated with a 47 Ohm load, through a 1000 pF series block-

ing capacitor to pin 1 (the crystal pin connected to the trimmer capacitor) of the FS4347E oscillator/phase detector integrated circuit. The shield from the reference source is grounded. There is no connection to pin 2.

The VCO would lock for drive frequencies from 8.48 MHz to 9.13 MHz. The corresponding output frequencies are 2,171 MHz and 2,337 MHz, a range of +59 MHz to -107 MHz or a total range of 166 MHz. The lock limits, of course, do fall within the VCO low and high limits. Remember that this was with one specific circuit board; results may vary. But, if you do want increased stability, you can drive the PLL with an external oscillator or synthesizer.

The end result is a compact, stable, low power S-band source for little more than the cost of a crystal. For this effort, I have obviously drawn together the work of others, added some details of my own, and hope others will continue to add as they are able. This is in line with the spirit of amateur radio.



Photo E - Remounted PLL with Voltage Regulator

*jmfranke@cox.net. This article previously appeared in the AMSAT Journal.

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Larry Van Horn, New Products Editor

Klingenfuss 2011 Shortwave Frequency Guide

The 15th Edition of the *2011 Shortwave Frequency Guide*, one of several annual radio reference books and CDs available from Klingenfuss Publications, has recently been released.

This year's 428 page book starts out with a general overview of radio observations by Joerg Klingenfuss (author/publisher), followed by a section devoted to monitoring utility stations. This chapter will be of special interest to utility listeners and includes a basic explanation of the various aspects of utility monitoring and a by-frequency listing of stations with call signs, station name, mode and details.

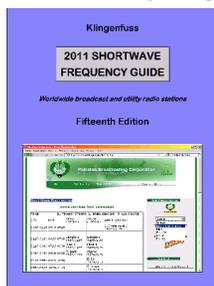
The heart of this book and its primary focus is on shortwave broadcast stations, frequencies, and schedules. The *2011 Shortwave Frequency Guide* covers the latest 2011 schedules for all clandestine, domestic, and international broadcast stations worldwide, which is derived from the *Klingenfuss 2011 Super Frequency List on CD*.

In the broadcast radio stations by frequency section there is some introductory material and a segment devoted to the future of Digital Radio Mondiale (DRM) that includes a comprehensive list of DRM schedules. The by-frequency list starts at 2310 kHz and goes up to 26060 kHz. Each frequency listing includes the station name, location, start and end times of each broadcast, language, target area, and selected remarks.

If focusing on a particular country of interest is useful to you, then the by-country section of the book, labeled the "Alphabetical List of Broadcast Radio Stations" in the Table of Contents, will be of particular interest.

Frequency information for international broadcast stations, clandestine, and domestic stations are accurate at time of publication and does include seasonal frequency adjustments. Klingenfuss uses a volunteer staff of radio listeners and broadcasters worldwide that contribute information to this publication and keep its information accurate and up-to-date.

The easy-to read book is a real asset in the radio shack, regardless of whether you monitor the utility bands or enjoy transmissions from shortwave broadcast stations. The *2011 Shortwave Frequency Guide* is an excellent annual publication for the beginner or experienced radio hobbyist who wants a complete HF spectrum reference book (utility/broadcast station listings). This is a basic no-frills radio reference guide and it will definitely complement your monitoring time at the dials.



To order the *2011 Klingenfuss Shortwave Frequency Guide* book, check out the Klingenfuss website at www.klingenfuss.org or order from U.S. source Universal Radio at www.universal-radio.com. From Universal, it is book number 5538 selling for \$49.95 plus shipping and handling. You can also order from Universal via phone 1-800-431-3939 or Fax at 1-614-866-2339 (snail mail: Universal Radio, Inc., 6830 Americana Parkway, Reynoldsburg, OH 43068-4113 USA). – Gayle Van Horn, W4GVH

2011 World Radio TV Handbook

The *2011 World Radio TV Handbook*, the quintessential reference book for broadcast radio hobbyists, is now available from Grove Enterprises and other *Monitoring Times* advertisers.

This year's 65th edition begins with receiver reviews for the AOR ARD5001 and the Winradio G31DDC Excalibur; and the Tecsun PL-310/PL-380, Kchibo KK-D6110, and Degen DE-1103/Kaito KA-1103 ultra light portable radios. Two software defined receivers are also reviewed: Medav LR2 and the Flexradio FLEX-1500. There is also a one-page guide to HF radios currently available in the marketplace that gives an objective comparison for each receiver based on size, selectivity, dynamic range and overall value.

Vintage collectors will enjoy the feature on *80s and 90s Classic Receivers*, which includes one of my favorites – the Watkins-Johnson 8711A. Other classics mentioned include the AEG-Telefunken E1700/E1800, Plessey PRS2282A, and the Racal RA3701 high end receivers.

Another feature is entitled *QSLing Then and Now*, in which author Jerry Berg takes a look at the long-standing fascination in collecting verification cards from shortwave and medium wave stations. The art of receiving station verifications via the postal system is alive and well, even in this new age of electronic QSLing.

Freelance writer Hans Johnson has a feature on the Armed Forces Network station on Saddlebunch Key in the Florida Keys. The *Digital Update* feature summarizes the latest news from the world of digital radio and TV over the past year. Two features of special interest to shortwave broadcast DXers are a profile of *Radio St Helena* and an article on the *Ears To Our World* charitable group.

As in past editions of the *WRTH*, George Jacobs analyzes likely listening conditions for

the new year in the *HF Broadcast Reception Conditions During 2011* feature. He delves into how Solar Cycle 24 will affect your listening habits.

The national radio section of the *WRTH* covers worldwide domestic radio services. Listings in this section are arranged by-country and include stations broadcasting to a national listening audience on medium wave, shortwave, and FM, and include contact information and a website (if known) for each station.

The international radio section contains listings of stations broadcasting to an international audience in the shortwave and medium wave bands. Information on each station includes station name, contact information, broadcast schedules, and website, if available.

The clandestine and other target broadcast section includes stations broadcasting politically motivated programming or those targeted at zones of regional or local conflict.

The by-frequency section of the *WRTH* cover medium wave and shortwave frequencies in this year's list, plus by-hour listings for transmissions in English, French, German, Portuguese, and Spanish.

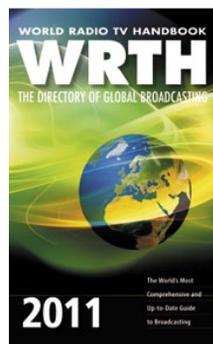
For the Digital Radio Mondiale monitoring enthusiasts, the DRM International Broadcast section provides by-hour schedules of stations broadcasting in this digital broadcast mode.

The by-country terrestrial television section brings readers up to date on terrestrial TV stations and accompanying radio programs also broadcast on those systems.

Finally, there is an extensive reference section that includes global transmitting sites, radio clubs, and standard time and frequency transmission schedules.

The *World Radio TV Handbook* has consistently set the gold standard in broadcast reference information and it remains the very best, most authoritative, and comprehensive reference book in the broadcast world. Quite simply, it is an exceptional annual guide that should be in every radio hobbyist listening post.

The *2011 World Radio and TV Handbook* (BOK03-11) is available from Grove Enterprises www.grove-ent.com for \$29.95 plus S/H. To place an order, call 1-800-438-8155, email order@grove-ent.com, or mail Grove Enterprises, 7540 Highway 64 West, Brasstown, NC 28902 USA. – Gayle Van Horn, W4GVH



Books and equipment for announcement or review should be sent to What's New, c/o *Monitoring Times*, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, larryvanhorn@monitoringtimes.com.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

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*This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com
Happy monitoring!
Rachel Baughn, Editor*

MT Welcomes New Writers

Please join us in welcoming Stan Nelson KB5VL and Kent Britain WA5VJB as quarterly columnists in *MT*'s outstanding team of writers.

You'll remember Stan from his enjoyable feature on *Monitoring Meteors* in the January 2011 issue. Stan will be writing a quarterly segment of *Sky Surfing* on radio astronomy and other out of this world reception. Stan is a member of the Roswell Astronomy Club in Roswell, NM.

Kent Britain will be writing the VHF/UHF installment of *Antenna Topics*, sharing the column with Dan Farber who covers HF antennas and theory. Kent's work is well known in the hobby from a variety of publications, and if you visit the Kent Electronics website at www.wa5vjb.com website you'll see he is an experienced designer of antennas to receive VHF/UHF, continuing into gigahertz.

We look forward to both authors taking *MT* readers "to infinity and beyond" as we explore new frontiers!

Thanks, MT!

"MT was instrumental in inspiring me to obtain my ham license (now extra) after I picked up a copy to help me get my new Sony SW7600GR going back in May."

Jim Manley

"I would like congratulate Dan Veeneman on his article 'Dragged into the Digital Age' which appeared in the January issue of *MT*. It was by far the clearest explanation of digital trunking I have ever read! Nice to see some great technical writing!"

Jon Huneault, VE1FTL

Shortwave on Facebook?

Gayle Van Horn announces that "With the tremendous success of the Shortwave Central blog, I am pleased to announce the launch of the Facebook Fan page, listed on the Facebook System as Monitoring Times Shortwave Central.

"Postings complement the Shortwave Central Blog and include additional monitoring observations, MT previews, last minute tips and informal radio related post from our readers. We invite Facebook followers to visit the new Monitoring Times Shortwave Central page and click 'Like' to be a fan.

"For Twitter fans, don't forget QSLRpt-MT for brief radio 'tweets' throughout the day."

Shortwave on Streaming

Audio

"My hobby since 1988 has been Shortwave Radio. Now over 20 years later many International Broadcasters have switched to streaming audio on their web sites. Here are some of the

radio stations you can listen to via your computer. Some of them use Windows Media Player:

Radio France International: www.english.rfi.fr/
Radio Havana Cuba: <http://www.radiohc.cu/>
(Click on C2)

BBC: www.bbc.co.uk/ (Go down to Radio and click on Listen Live)

Deutsche Welle (Germany): www.dw-world.de/ (Choose language and then click on Listen to World Headlines)

VOA (Voice of America): www.voanews.com/english/news/ (Click on Latest Newscast)

Radio Australia: www.abc.net.au/ra/ (Click on Listen Now)

Radio New Zealand: www.radionz.co.nz/ (Click on Play News Bulletin)

NHK Japan: www.nhk.or.jp/nhkworld/
China Radio International: <http://english.cri.cn/>

Radio Canada International: www.rcinet.ca/
Radio Taiwan International: <http://english.rii.org.tw/default.aspx>

Voice of Russia: <http://english.ruvr.ru/>

"Another favorite of mine Radio Netherlands Worldwide www.radionetherlands.nl There are many more. This is just an abbreviated list of my favorites. Happy Listening!

"A cautionary note: listening to Internet Radio uses up gigabytes on your monthly usage. We just got hit with \$148 in overcharges due to grandson watching Youtube for 10 hours straight over Thanksgiving."

Laurence D'Alberti

Internet Radios

"Thanks for your review of the C. Crane small internet radio in the January 2011 edition of *Monitoring Times*. The review is spot on and I agree with your conclusions about the set. I should know, as I have owned the same model for about a year. The set is simple to operate and does not take up a lot of room. I use this set as a travel radio. This is very nice, since OTA radio has become less listener friendly. Music is hardly heard on AM any more and the FM band has programming that I don't care for.

"The set works well with any open WiFi connection and has a lot of volume (audio) for its size. The ethernet connection in the back is useful if one does not have a wireless connection handy.

"I have a feeling future internet radios will become more versatile, but more complicated. This small radio should be a reminder to everyone that the latest technology, whatever it is, should be user-friendly and not be a crazy bell-and-whistle device to please just its designer."

Dan Ramos

"The CC Radio looks like a nice radio but with one huge flaw. That is, no aux input jack. I have had a Sangean WFR20 for three years on my nightstand. I also have a Sony AM/FM tuner and an XM radio into the aux jack. With these I

feel I really have the world in my headphones. Nowadays a radio is nothing without an aux jack."

Steve Waldron

"I bought my wife a WiFi radio for Christmas. I tried out two and finally ended up with a more expensive, but better sounding radio. I purchased a Livio NPR radio at Sears for \$129, and see it now on eBay for \$99; the second radio I tried out was a Logitech Squeezebox, at \$159 from Best Buy; and finally ended up with a Logitech Squeezebox Boom, purchased on Amazon for \$250, available on eBay for \$195, but with a 'no return' policy. I ended up with the Boom because it has four speakers, thus the sound carries better in the kitchen where my wife will listen to the radio.

"We live out in the country, where there are only three or four (lousy) local stations; having a WiFi radio has opened up a whole new world of radio listening for us. My wife tends to listen to classic music, while I prefer talk and news shows.

"I attempted to attach the Logitech Squeezebox to the existing multi-speaker system in the kitchen, but it did not put out enough watts to do so – not sure I will be able to connect the Boom to that system either, but it seems to have enough speaker power that it will be heard in all parts of the kitchen and family room with the internal speakers.

"In playing with these radios I discovered that they have very unique coverage possibilities. On the Livio NPR radio, there was a specific icon for weather and aircraft radio. When I pushed that button it gave me an interesting array of online weather, aircraft and even police frequencies! ...

"At the same time, and of interest to your general coverage fans, WiFi Radios are capable of picking up internet transmissions by worldwide broadcast stations normally found on general coverage receivers. For instance, on the basic Squeezebox radio I was able to find several BBC and other international broadcasters with simultaneous programming being broadcast on shortwave radio and at the same time on their Internet broadcasts.

"Although this radio was a present for my wife, when she is out shopping or not in the kitchen, I can see myself out playing with her WiFi radio searching for interesting news, weather and police broadcasts on the Internet. This week, when northeast airports were closing down, it was interesting to be able to push one button on the Livio radio and see a variety of air traffic control stations to listen to in Boston, New York and Washington, D.C."

Dave Kaiser, AL7HG

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Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of *Monitoring Times*.

AMERICAN BANDSCAN
<http://americanbandscan.blogspot.com/> - by Doug Smith

BELOW 500KHZ
<http://below500khz.blogspot.com/> - by Kevin Carey

FED FILES
<http://mt-fedfiles.blogspot.com/> - by Chris Parris

LARRY'S MONITORING POST
<http://monitor-post.blogspot.com/> - by Larry Van Horn

MILCOM
<http://mt-milcom.blogspot.com/> - by Larry Van Horn

SCANNING REPORT
<http://www.signalharbor.com/> - by Dan Veeneman

SHORTWAVE
<http://mt-shortwave.blogspot.com/> - by Gayle Van Horn

UTILITY WORLD
<http://mt-utility.blogspot.com/> - by Hugh Stegman
www.ominous-valve.com/uteworld.html

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