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Monitoring® Times

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Amateur Radio in the Classroom

In this issue:

- W9GRS: From Room 104 to the World!
- KC4WQ: Train Your Replacement
- School Club Roundup 2012
- MT Reviews: Degen DE321

MTXpress

THE Magazine for every radio enthusiast is now fully digital!

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Portable Ham Station in a Briefcase

By Bob Patterson KS0ZE
(Photos by author unless otherwise noted)

The Case for Briefcases

Choosing the Right Radio

The Other Stuff

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Have downloaded my first copy of MTXpress. The clarity of the pages is breathtaking; very easy to read. This is a brilliant idea: Wish I had known about it earlier. - Barry, UK

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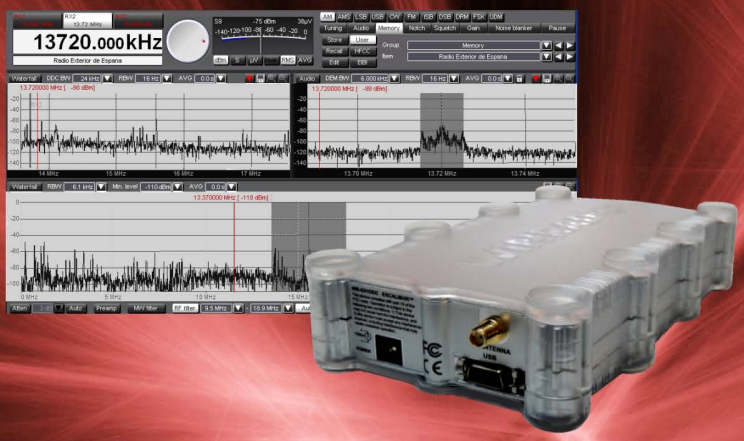


WinRadio Excalibur Pro

WRTH AWARDS 2012
WinRadio Excalibur Pro
BEST SDR

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

CONCLUSION

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

www.wrth.com

Overall rating ★★★★★

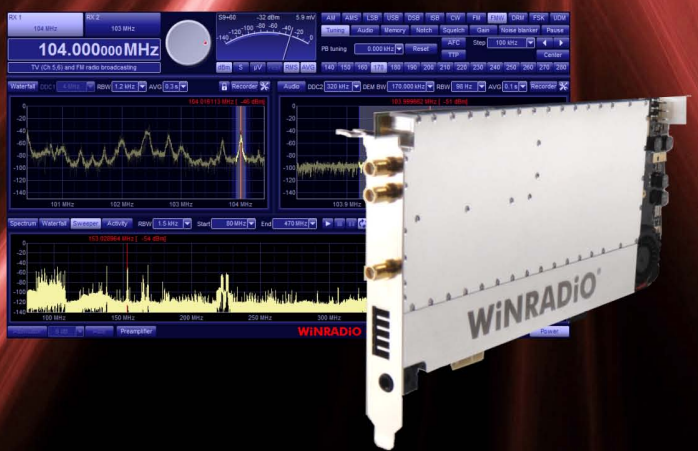
review

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

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

summary

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



FIRST LOOK

MT Takes a Look at the Latest Tech

By Bob Grove, W8JHD

This is the most amazing receiver I've ever encountered. It employs the latest proven SDR architecture, operates well beyond the spectral range that most of us would ever think of trying to hear, and demodulates all conventional modes.

I ordinarily find something to complain about in my reviews, but trying to find something I don't like about the G39DDCe has left me at a loss, and that's a gain for this winner.

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Monitoring Times

Vol. 31 No. 9 September 2012

W9GRS: From Room 104 to the World! 8

By Troy J. Simpson W9KVR

Troy Simpson had no intention of becoming a ham. He thought of himself as a teacher who taught Earth Science at Glenn Raymond School, a middle school with some 300 students in rural southern Illinois. But, his father-in-law had other ideas. Now an Extra Class licensee, Volunteer Examiner and Vice-president of the local amateur radio club in Watseka, Illinois, Troy makes amateur radio part of his students' daily activities.

In this month's cover story, Troy tells the rest of us how he motivates students at an otherwise difficult age to enjoy the world of amateur radio. With the help of the local amateur radio club, Troy's class is a clear voice during the semi-annual School Club Roundup.

These kids know what they're doing; the "Morning DX Crew" at the school's amateur radio station has even achieved DXCC! He tells his students, "The world is just a wave-length away and you never know what part of the world you'll reach today."

On Our Cover

The W9GRS Morning DX Crew from Room 104 display their DXCC certificate. First row - Amanda Musselman, Jake Anderson KC9OQN, Jesse Hurst. Second row - Madi Hebert, Mariah Yelenick, Toby Jones, Troy J. Simpson W9KVR science teacher

C O N T E N T S

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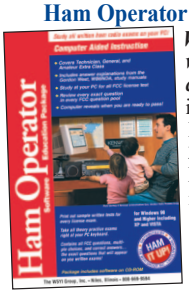

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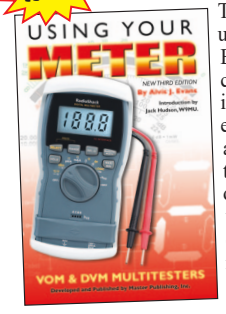

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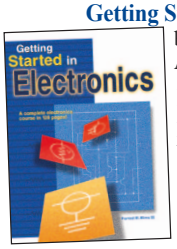

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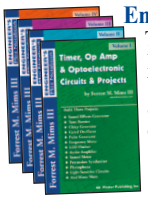

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MT

COMMUNICATIONS

by Ken Reitz

AMATEUR/SHORTWAVE

Illinois OKs State PRB-1

On June 30 the state of Illinois became the twenty-ninth state to codify PRB-1, the FCC's Opinion Memorandum and Order of 1985 that preempts state and local regulations pertaining to amateur radio facilities, into that state's laws. According to a press release from the ARRL, the bill looked doomed for this legislative session until Illinois State Representative Charles Krezwick WV9C and the ARRL's state liaison got together to push the bill through.

Despite being federal law since 1985, states and municipal governments across the country continue to enact laws making unreasonable demands on amateur radio operators regarding placement and height of amateur radio antennas and structures. When challenged, such regulations are overruled by enforcement of PRB-1. As stated in PRB-1, "State and local regulations that operate to preclude amateur communications in their communities are in direct conflict with federal objectives and must be preempted."

However, regulations devised by Home Owners Associations as part of deed restrictions in private developments are a different matter and not necessarily trumped by PRB-1. It's up to the amateur operator under such restrictions to bring action against local regulations. Help in this regard can be found at the ARRL website: **www.arrl.org/antenna-regulation-and-zoning**.

Earlier this year the FCC sought to study the issue of antenna regulation and zoning and asked the League's help during the brief comment filing period. According to the ARRL, more than 1,800 email comments were received.

DRM Glacier inches Forward

The Digital Radio Mondiale (DRM) consortium road show found itself in South Korea in early July, promoting acceptance of DRM transmissions to that country's AM and shortwave broadcasters. Korea is home to many electronic manufacturing companies, some of which produce many of the world's shortwave radios.

According to a DRM press release, "There has been a growing demand from receiver manufacturers, to have a DRM chipset and a number of Korean chipset manufacturers are working hard to develop this as soon as possible." The group then went to Japan to meet with Japanese manufacturers. The group stated, "As in South Korea, Japan has also put together a plan to renew their shortwave transmitters with those with DRM capability."

PUBLIC SERVICE

Pasadena PD allow Press Scanner Access

An article in the *Pasadena Star-News* from June 20 notes that the city's police department had finally allowed the *Star-News* access to the department's fully encrypted police signal. Said *Star-News* editor Frank Girardot, "It still amazes me that officials think the public shouldn't have access to the full spectrum of police communications in Pasadena, but this is a step in the right direction."

The police department relented after more than five months of scanner silence and continued press attention to the issue. Even so, the public continues to be frozen out of police transmissions. The newspaper noted that the public will be able to hear the initial call on scanners capable of receiving their trunked transmissions, but immediately after the initial call, the rest becomes encrypted. Only the newspaper will hear the full transmission.

AM/FM/TV BROADCASTING

An All-HD AM Future?

According to an article in *Radio World* online, the National Association of Broadcasting's (NAB) committee on radio engineering is considering running tests that may show how iBiquity's In-Band On-Channel (IBOC) digital mode, known to mortals as HD-Radio, would function on a completely digital AM band.

I asked *MT*'s Broadcast Bandscan columnist Doug Smith W9WI for his take on the issue. He noted that currently IBOC stations transmit in a "hybrid" mode, "They transmit analog and digital simultaneously, on the same frequency. As a result, the digital power must be greatly limited to avoid self-interference. At the same time, the digital signal spreads out into adjacent channels, generating interference and further limiting the digital power.

"A station that runs 5,000 watts in analog can run no more than 50 watts of digital. By getting rid of the analog signal, they don't need to worry about interfering with it and they can move the digital sidebands into the existing channel, so they don't have to worry about interfering with anyone else. They should be able to run 5,000 watts of digital power.

"Obviously that would lead to vastly better results. Testing is necessary to know just how much better that signal would be. I suspect the difference would be somewhere between dramatic and stunning. Of course, converting a station to 100% digital would also cost it nearly all of its audience, given how few HD Radios are out there. I suspect they'll find something few engineers could dispute: that full-digital IBOC works pretty well both in terms of the station's own coverage, and in less interference to other stations. Unfortunately, the engineers can't fix the lack of receiver penetration."

AM Radio? Nothing Comes to Mind

That's what ten percent of respondents to a survey, conducted in June by Mark Kassoff & Co., a research consultancy, said when asked, "What's the very first thing that pops into your mind when you think of AM radio?" Worse, a further eleven percent said they don't or rarely listen to AM radio. The telephone study interviewed 412 people across the U.S. aged 18-64.

The report concludes in part, "…non-music programming is successfully shifting to FM. As that shift continues, AM's 'franchise' on those services — its remaining raison d'etre — will be gone. Based on this research, many won't even notice. Take away talk, news and sports. What does AM end up with? Nothing."

FCC under Fire on Repacking

Granted that it's one of the most pivotal of modern federal agencies, the FCC has done little to engender friendship on or off Capitol Hill. Now the Commission appears to be dragging its feet on letting Congress in on expectations for its Allotment Optimization Model (AOM): exactly how the FCC plans to develop the "incentive auction" and how many TV stations may be asked to leave the air in order to provide spectrum that will be auctioned off to mobile broadband interests.

According to Deborah McAdams' column in *TV Technology* online, after shrugging off similar requests a year ago, FCC Chairman Julius Genachowski appeared before a congressional committee to say basically, "all will be revealed." To counter this recalcitrance one committee member, John Dingell (D-MI), threatened to sue the FCC to get the information.

McAdams noted in her column, "The AOM would provide information on how many TV stations would go off the air according to how much broadcast spectrum is auctioned off for wireless broadband. The National Association of Broadcasters has estimated that as many as 210 stations would go dark should the FCC secure the 120 MHz it seeks for auction." One broadcast insider noted the difficulty of potentially repacking 1,800 TV stations in a three year period into spectrum cut by 40 percent. Details about the much anticipated spectrum auction are expected to emerge from the FCC this fall.

SATELLITE

Billionaires Compete in Launch Biz

With the U.S. reduced to paying Russia to launch our non-spy satellites the super-rich are clamoring to get in on the action. June's successful launch and rendezvous of the privately built SpaceX spacecraft, named Dragon, to the International Space Station (ISS) showed that its Commercial Orbiting Transfer Service (COTS) was viable. The company plans to transfer astronauts from Earth to space in the future. The brains (and the bucks) behind SpaceX is Elon Musk, co-founder of PayPal, who is listed on the SpaceX web site as founder, Chief Executive Officer and Chief Designer. Musk multi-tasks his SpaceX ventures with his electric car company Tesla Motors.

Not to be outshown in anyone's galaxy is Virgin Record's founder Sir Richard Branson who announced in early July that his own private space company, Virgin Galactic, will also offer its own satellite launch vehicle dubbed, unimaginatively, LauncherOne. Their lofty plans include space tourism for the truly super-rich, an environmental Earth monitoring company and asteroid mining endeavors.

Proving that it's hard to resist the limelight, billionaire co-founder of Microsoft, Paul Allen, has teamed up with Aerospace pioneer Burt Rutan to found Stratolaunch Systems which is currently partnering with SpaceX on a launch project. Apparently everyone needs a hobby.

FCC ENFORCEMENT

Major FM Pirates Hit with NOUO

According FCC records, a Notice of Unlicensed Operation (NOUO) was issued to a Boulder, Colorado man for his illegal FM station on 90.7 MHz with an amazing 351,133 microvolts per meter at three meters. Some 15 lesser pirate operations were also cited in the last month including two in Newark, New Jersey, one in Randolph, Massachusetts and two in Brooklyn, New York.

A pirate in Lawrence, Massachusetts operating on 99.1 MHz with more than 365,000 microvolts at 81 meters must have had a huge signal. A station calling itself Radio Free Olympia, operating on 98.5 MHz from Olympia, Washington, was observed with a signal in excess of 757,000 microvolts at 3 meters.

But, nobody tops this month's QRO (high power) pirate broadcaster, also from Boulder, Colorado, operating on 95.3 MHz with over 900,000 microvolts per meter at 3 meters. The maximum allowed under Part 15 rules for unlicensed operation is 250 microvolts at 3 meters.

Dog Shot in Pirate Raid

According to an article in the southern Florida *Sun-Sentinel*, sheriff's deputies shot a pit bull as it apparently charged them while they were attempting to serve a search warrant on a location thought to be the source of an unlicensed radio station broadcasting, "hip-hop music and coarse language at 89.5 FM," according to the article. The station was said to be interfering with the signals of a Christian formatted station near the pirate station on the FM dial. The report noted that the officers confiscated the broadcast equipment.

FM Pirate is also a Ham

Back on February 4 of this year, FCC field agents operating in Suisun City, California, used direction finding equipment to track an unlicensed FM signal operating on 104.9 MHz and IDing as KBRS. According to FCC documents, the agents heard the station operating in the garage at the residence and attempted to inspect the station, but got no response from their knock at the door. The agents posted a Notice of Unlicensed Operation (NOUO) at the front door and noted that when they left the area, the signal disappeared.

Office of Inspector General

The FCC noted that the operator held a Technician Class license for at least six years and "should be aware that any radio equipment at this station must be made available for inspection at any time when requested by the FCC." Unfortunately, that fact only added to the fine. Operating a radio station without authorization: $10,000. Failure to allow inspection of a radio station: $7,000. Total due: $17,000.

Talkative Miami Pirate Silenced

Sometimes pirate operators make it all too easy for FCC field agents. Last March agents were in Miami monitoring a station transmitting on 92.7 MHz. The announcer identified himself on the air as "DJ Miami of 92.7 Heavy FM" and advertised his website (which has since been taken down). The agents located the website and on the "bio" page learned the operator's name and saw his photograph. The website also linked to his Facebook page.

Sitting around the lobby of the building where the station had leased office space, the agents ran into DJ Miami who admitted who he was and ushered the agents up to a suite of offices where he admitted to having purchased the station equipment. DJ Miami then turned off the equipment, demonstrating he had control of the station. The rest was routine. DJ Miami received a $10,000 fine, but, at least he allowed the inspection and saved himself an additional $7,000 in fines.

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

W9GRS: From Room 104 to the World!

By Troy J. Simpson W9KVR
(Photos courtesy the author)

Mike Marcier KC9HHT answering questions about PSK31 during the Science Club's 30th Anniversary Celebration.

It all began with a visit to my father-in-law's house. Mike Marcier KC9HHT just had to show me his new Kenwood TH-D7 handheld radio. He was all excited about getting his station set up after recently renewing his interest in amateur radio. As he continued to show me the features, I couldn't help but think that my father-in-law was an absolute nerd and I really didn't want any part of it.

But, Mike is not one to easily push aside when it comes to something he is passionate about, and I should have known then that he had something that could make an impact not only on the students of Glenn Raymond School, but on me as well.

But, first, a little background. I teach junior high science in the rural community of Watseka, Illinois. Glenn Raymond School is a public junior high school with approximately 300 students in grades six to eight. Even though my primary focus may be Earth Science, I love to integrate technology whenever possible into my lessons. I'm also chief sponsor of our science club, which taps into a variety of activities from canoeing, to rocketry, to gun safety (we are in deer country, so hunting is a big deal) which meets after school once a week.

It was the fall of 2005, and in the following spring our science club would be celebrating its thirtieth anniversary. Now, enter the Iroquois County Amateur Radio Club (ICARC). The group has been meeting since the 1960s and my good old father-in-law had a plan to help spur me on to get amateur radio in the school. He mentioned that perhaps we could have a special event station to celebrate the milestone with assistance from ICARC.

Before I knew it, I was attending a meeting and explaining about the science club and asking if it would be feasible to put something together. The enthusiasm was contagious as members began to immediately brainstorm how to put this together. By the end of the night, a plan was in place and we would attempt to get on the air to help celebrate our school science club's anniversary.

On the Air from Glenn Raymond School

The day had arrived and it was time to put antennas up. It was decided to put two temporary push-up masts on the roof, directly above my classroom. A 20-meter dipole would be strung between the masts and coax run through a window to my classroom. Mike brought along his Kenwood TS-2000 which we connected to my classroom computer. After a quick test with an antenna analyzer, we were ready to go!

We passed around a copy of the March 2006 *QST* magazine which showed our special event listed, while Mike, along with former teacher Sam Ripple W9QKF (now a Silent Key), demonstrated the different aspects of amateur radio making Morse code (CW), voice, and digital contacts. A highlight was utilizing the classroom interactive whiteboard to project PSK31 for all to see and then with a touch on the screen, view signals going across the waterfall.

In a matter of 90 minutes, we contacted stations in Colombia, Brazil, Belgium, and even Australia. Students and staff alike were amazed that a little signal coming from a classroom in East Central Illinois could make connections literally around the world. At this point, I knew that perhaps my father-in-law might just be on to something.

The first step for me seemed logical: get licensed. After a bit of studying I earned my Technician Class license with the call sign KC9MCA in 2007. Not a bad call, but with the vanity call sign program in place, I wanted something more akin to who I am. I was able to get W9KVR, which signifies my interest in exploring and surveying caves. With that done, the next step was to see what it takes to get a station established at the school.

I talked with the school administration and as far as they were concerned, if it didn't cost the district any money and didn't damage the building, we could proceed. I thought that was fair enough, and with that, I was on my way. I researched what other school stations did to get the equipment they needed. Some schools had equipment on loan from local clubs, others had staff members who donated equipment, and some applied for and earned grants from organizations such as the ARRL.

That idea got my attention, because I had become an ARRL member and read about the School Club Round-Up (SCR) that took place every year with schools across the country. I looked at which schools were awarded grants

Jake Anderson KC9OQN and Justin Moyer operate W9GRS using SSB during School Club Roundup.

and decided to seek some further guidance. I contacted Neil Rapp WB9VPG who teaches high school science at Bloomington South High School, Indiana (K9SOU). I picked his brain about everything from operating, what equipment to get, and how I should approach writing a grant application. He was very helpful in giving me suggestions and was enthusiastic about getting another school on air.

W9GRS's first SCR

We wanted to make a serious attempt at this, so I applied for a club call sign for the school. In April 2008, we were assigned KC-9NEW, but we quickly applied for and received W9GRS to help better identify us as a school station. With the May deadline approaching for ARRL grants, I fine-tuned our purpose and goals in the application. First and foremost we wanted to have a station that could fulfill multiple roles. Yes, the long distance contacts with other countries is a great hook for students, but we could also tap into the civic roles radio plays, such as in SKYWARN and emergency communications.

The proposal addressed all of these ideas as we took advantage of integrating radio communications with the meteorology unit I teach in class. Also written in the grant is the availability for communications during emergencies when the school is utilized as a potential emergency shelter.

The summer of 2008 was an exciting time as the school grounds hosted the Iroquois County Amateur Radio Club (ICARC) for Field Day activities for the first time in several years. Then, as the school year approached, I received a letter from the ARRL congratulating us on earning an Education & Technology Program (ETP) grant to help establish the W9GRS station.

By fall, thanks to the ETP grant, we had vertical HF and VHF/UHF tri-band antennas up on our school roof with a Kenwood TS-480SAT to bring the antennas to life. We added a Kenwood TS-271A to give us the 2 meter local access and also help meet the goal of providing communications capabilities in the event that the school is used as a an emergency shelter.

The equipment arrived in late September and none too soon, as the School Club Round-Up was fast approaching. I thought this might be a great opportunity to test the waters of radio operation and see where it would take us. I set aside on-air times before and after school and even took some time during a couple of classes to share "the magic" of amateur radio. We only operated on SSB and students were nervously calling "Whiskey 9 Golf Romeo Sierra" with hopes of making contacts.

It was definitely a learning process as we made seven contacts with schools that week and had a total of 43 contacts. I was still very much new to the whole idea of operating HF and felt I was learning as well as the students. Two big results of this operation were that a group of students began meeting before school to operate on a regular basis and students now were interested in getting their licenses.

Mariah and Madi operate PSK31 during the February 2012 School Club Round-up. Both students are studying for their Technician Class license and will be taking their tests this month.

Help from the Local Club

As you might imagine, one of the keys to our success was the school's relationship with the local amateur radio club. Not only was that the catalyst for W9GRS, but it has become a continued support system for the school station. Even though the club is relatively small, members go out of their way to make sure the station is provided for.

Members of ICARC have graciously donated coax cable, a rotator and controller for the tri-band Yagi as well as study materials for licensing and antenna construction. They've organized Volunteer Exam Coordinator (VEC) testing sessions, and perhaps most importantly, on-air contacts with students. During each School Club Round-up, members of ICARC make a point to contact the school on various modes to help with the QSO total and show support for the students. ICARC is also fortunate to have members who have traveled to rare DX entities and have made a point to get the school station in the log.

The first such contact was with local DXer Jerry Rosalius WB9Z who traveled to Desecheo

The Wall: Staff and student call signs, along with QSL cards, adorn the wall of Room 104.

The "Back 40" of Glenn Raymond School, Field Day site for the Iroquois County Amateur Radio Club, where club members and students operated during Field Day.

(K5D) during our first year of operation and wanted to make sure the school got the chance to make contact with this rare DX entity. It was quite an experience when the classroom heard "W9GRS, this is K5D, you are 5 and 9. Great to make the contact with the school! 73s!"

Subsequently, Jerry has been at VP8ORK and HK0NA and both times he has made sure to work the school station and whichever licensed students and staff were available at the time.

Another neat experience occurred when Carl Schroeder K9CS traveled to Barbados and set up a schedule for a contact during this past February's School Club Round-up. He then followed up with QSOs with a couple of our students and also got me into the log for a new one on 15 meters. Needless to say, the DX is a big draw for the students and we take advantage of it by further investigating these places and where they are located.

ICARC now has its regular meetings at the school station which promotes the interactions between students and members. This has helped generate not only new members for the local club, but also helped club members find a niche to help promote amateur radio. For me, it's an especially proud moment when former student Chris Jaworski KC9RCD takes over for the Monday night ICARC net on 2 meters, knowing that we have gone full circle.

The school station has also been the location for Field Day activities with the school call representing the GOTA (Get On The Air) station. We have also joined forces with the Kankakee Area Radio Society during the Illinois QSO Party and have been key presenters at their KARSfest convention sharing our experiences regarding what has been going on at the school station.

SCR Still a Big Event

The School Club Round-up is the main event for the school station each year as it takes place in October and again in February. Our first two years had us only operating on 10, 15, and 20 meters, utilizing our vertical antenna. But, once again, the local club helped out with my father-in-law, Mike, adding a 40/80/160 dipole he purchased a while back that had been collecting dust.

He suggested that we test the thing out, so we hung it between two trees on either side of the school. The wire hung horizontal southeast to northwest and was 8 feet above the roof line. We tuned it up and suddenly 40 and 80 meters were at our fingertips. It was amazing how many more schools we could work!

A banner moment was being able to finally make a QSO with Neil and our friends at K9SOU, but it wasn't without difficulty. The year before we had tried to make contact, but Bloomington is just the right distance from us so that 20 meters skips right over them. This year, for some reason, they could hear us transmitting on 20 meters in PSK-31 mode, but we could not copy their reply. Neil's crew didn't have 40 meter capability, so that was out.

I wondered if we could hear them on the 40/80/160 meter dipole, so I switched antennas. Lo and behold, I we could see them on the waterfall! The solution presented itself; we would transmit using the vertical and then quickly switch to the dipole for receive. It worked! Finally, we successfully made the long awaited QSO with K9SOU, which has now become a traditional contact between the two schools.

As the W9GRS enters its fifth year on the air, we have consistently finished among the top in the middle school division, helping the 9-Land stations compete with the more established East Coast stations.

Life with an In-School Ham Shack

As was written in the grant, the goal was to be on-air consistently throughout the year, and the school has been successful at that, despite the struggle to work around other school activity schedules. The W9GRS Morning DX Crew was a direct result of our operations during the October 2008 School Club Round-up.

A group of students began meeting in my classroom each Thursday morning before school starts. They had been infected by the DXing bug! It was rough going, being able to work SSB only initially, but with the addition of a homebrew digital interface, the text friendly interaction became a new draw.

It wasn't long before the students discovered the world of DX Summit, the online list of DX stations on the air. Now students actively patrol the bands to find new ones to add to the map on the wall overlooking the radio. With our QSL card, designed by students, we've begun exchanging cards and building a collection that is posted on the "Call Sign Wall." When a student earns his or her ticket, their call sign is painted on the classroom wall for all to see. Jake KC9OQN is the first and youngest, being at the ripe age of 10, with several other calls now joining his.

The crew has accomplished its goal of making the DXCC (DX Century Club) and WAS (Worked All States). These morning sessions also allow students to practice for future testing, while other students are trolling the bands for contacts. The school now also sponsors the Worked All States School Stations Award to help encourage contacts with other school stations across the country.

The goal of the school station is to promote all aspects of radio, from science, to civil service, from the DXing and rag-chewing to the competitive contesting. It is exciting to see students become involved in the various aspects of operating. I have found it is contagious, as I have become more involved in my own radio operations, having earned my Extra Class license and participated in SKYWARN, DXing, contesting, and as being a Volunteer Examiner.

I'm looking for more ways to enhance our activities and enjoy chatting with other teachers about how to make it work. We're hoping to get more students on the air and licensed. Ultimately, I hope to fill my classroom wall with call signs.

So, if you ever hear "Whiskey 9 Golf Romeo Sierra" or see W9GRS come across the waterfall, give us a shout out, we'd love to hear from you! As I tell the students, the world is just a wave-length away and you never know what part of the world you'll reach today.

About the Author:

Troy J. Simpson W9KVR is an eighth grade science teacher at Glenn Raymond School in Watseka, Illinois. He is chief sponsor and trustee of the W9GRS school station and tries to the get the station on air as much as possible. He is currently the Iroquois County Amateur Radio Club (ICARC) Vice-President and, despite his busy school schedule, he enjoys working DX and contesting, exploring caves, and helping his 5-year old daughter Sophia toward earning her ticket. Troy may be reached at tsimpson@watseka-u9.k12.il.us

Train Your Replacement
A Decade of Amateur Radio in the Classroom

By Buddy Sohl KC4WQ
(All photos courtesy the author)

All great things start with a dream, and so does this story. Amateur radio is something that has been around my family since the 1930s, starting with my great uncle Charlie W4KBR. Charlie had tried to introduce ham radio to his brother, his sons, my dad and a few other family members, but none ever got "bit by the bug." Our family lost Charlie in 1976, his dream of having another ham in the family going unfulfilled. But in 1979, as his great nephew, I got bit by the radio bug and finally there was another ham in the family! One dream fulfilled, albeit a couple of years late, and another just beginning to take root.

It took several years of hands-on learning to get comfortable enough to teach amateur radio, but mentoring and teaching starts early in an active and busy amateur radio avocation. One of the greatest benefits of an amateur radio license is the camaraderie and experience of the 'old timers,' and any ham worth his salt will lend a helping hand to an inquisitive novice. As a new ham I was fortunate to be introduced to some amazing radio operators from all over the country. The amount of information received over just a couple of years was daunting.

The first opportunity at teaching amateur radio came when my daughter was in the first grade and I approached the principal of her school to introduce these little ones to Morse code. While it was well received and the kids learned to send their names in CW, the age group wasn't really appropriate to pursue an amateur radio license.

Over the years there were other opportunities to introduce radio in the classroom, but all were one-day affairs and nothing ever came of it. Honestly, there were times that it seemed that no one in education was interested in the magic of radio. Every administrator that I approached was cordial but not excited, at least not as excited as I was! And of course, the cost of equipment, maintenance, liability concerns about antennas and towers always seemed to kill the deal. Then, along came Cub Scouts, with my sons!

One of the badges a scout can earn has to do with "secret codes." What a great opportunity to introduce these little guys to Morse code. The guys had a great time, but there was no real avenue to get to real radio here. That opportunity came with Boy Scouts and the radio merit badge. This looked like it was a real opportunity to get some licensed amateurs. The Scout Master even wanted to sit in on the class!

After a six week course and a lot of home study, there were seven scouts who earned their radio merit badges and six who earned their amateur radio licenses. This was the event that re-kindled my interest in getting radio in the classroom again. This was also at the time that the ARRL introduced the 'Big Project,' a nationwide effort (now called the Education and Technology Program), that helps teachers and schools establish amateur radio in the classroom.

Gaining a Foothold in School

For me, the next step was to discuss the program with the principal of the school. She was very interested in the program, especially when I could explain that there would be negligible costs to the school. The first year of the St. Aloysius program was a smashing success. We applied for a Big Project grant and had over 20 fourth through eighth graders coming to play on the radio. This was an after school program (through its entire ten year lifespan) and all the kids would take their time to do something different and fun.

KI4GDR operating during School Club Roundup.

There were several times that parents would sit in and listen as we explored the magic of radio. On our first day the class measured and built a 40 meter dipole, tossed it out the window, stretched between a couple of anchor points, and proceeded to talk around the country. In the second year of our program, the ARRL provided a Big Project grant and a local club, the Bullitt ARS (**http://ky4ky.com**), provided sponsorship. Several local amateurs provided a tower and Yagi to complement the antennas that came with the ARRL grant.

As the program progressed, the students participated in fox hunts; the School Club Roundup (winning the middle school category one year); building antennas, and even venturing into Earth-Moon-Earth (EME) contacts, a project still in the works.

Students from St. Aloysius school radio club at the end of a fox hunt. The fox was in the hole!

Super Side Benefits

My expectations were high from the beginning. While the number of new hams has not met expectations, the cursory benefits have been exceptional. Parents and teachers have been exceptionally supportive. It would have been outstanding to have a teacher or two earn their own

St. Aloysius school radio club from year two; five are now licensed hams.

licenses, but the other forms of support were evident and gratifying.

For five years, any student that earned their amateur license would automatically improve their science grade one full letter grade. The Spanish teacher, Mr. Miller, enjoyed speaking with South American hams, via third party rules, in Spanish, and the kids would chime in occasionally as well. One child started as a fourth grader with a bit of a speech impediment. Her activities on the air and in the classroom gave her the confidence to overcome the speech issue.

The side benefits of amateur radio in the classroom are phenomenal. These students learned the art of conversation. They learned "where in the world is that place" first hand. They learned that "foxes" can be hiding in an old mouse case hidden in the computer lab or in a hole by the baseball field. They were regaled with stories from hams as young as 97 and met other students around the country. These students were challenged with math well beyond their grade level and discovered how magic wireless can really be.

End of an Era

Realizing that the first kids in our first class will be graduating from college this year and that St. Aloysius is closing, due to rising costs and decreasing enrollment, has given me cause for reflection. Looking back on some of the successes from radio in the classroom would take more pages than allowed here. But, this might give you an idea of the role of radio in our classroom: This year, one of the original students will graduate with a major in broadcasting and two will graduate as engineering majors; all three attending on academic scholarships.

One of the more studious girls in the class will be attending MIT this fall and another to Yale on full academic scholarships. So many of the kids who ventured through the ham radio class have blossomed into confident young adults, able to effectively communicate. While most of these radio class kids did not achieve their license during class time, the seed has been planted, and like so many others may rediscover radio years down the road.

For now, the St. Aloysius Radio Club has to relegate itself to a social networking site. All the guys and girls will be attending different schools in the fall, but all wanted to stay in touch and keep learning about radio. It was heartwarming and wrenching, during the last day of radio class – all the kids wanted the program to come to their 'new' schools. And, in usual ham radio fashion, the old timer has extended the hand of friendship to the newcomers, and said, "Whatever you need, just ask."

If you are interested in getting amateur radio in the classroom, start by introducing the staff, administration and kids to the magic of radio. Have all your ducks in a row. Be able to explain the possible costs and the benefits, especially the side benefits. And, be prepared to put a lot of your heart, soul and time into the process, for if you truly love something and want it to continue, you must be willing to train your replacement.

MT

About the Author:

Buddy Sohl KC4WQ, first licensed in 1979 as KA4JMX, upgraded to Advanced 1980 as KC4WQ and then Amateur Extra 1981. Active on bands 160 meters through 70 cm, primarily CW or digital, he is a Life member of the ARRL, Volunteer Examiner, Past President Bullitt Amateur Radio Society, Trustee KY4KY and W4KBR. He is a retired Air Traffic Controller after 25 years service at Memphis ARTCC and Standiford ATCT. He may be reached at kc4wq@arrl.net.

Students from St. Aloysius school radio club discuss radio theory in class.

KI4JAO operating during Kentucky QSO Party as KY4KY.

2012 SCR
Fall Semester Contest

By Ken Reitz KS4ZR
(QSLs courtesy the author)

In many ways the **School Club Roundup** (SCR) is the opposite of what you've come to expect from an amateur radio contest. While most contests take place over a given weekend, SCR operates only during school hours, on weekdays, over the course of a week.

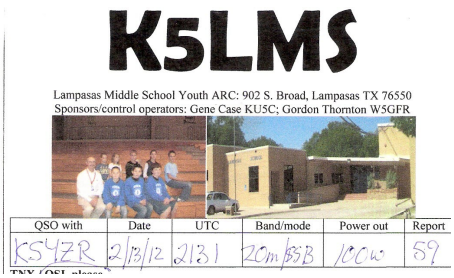
This year the SCR Fall Term begins October 15 at 1300 UTC and ends October 19 at 2359 UTC. Stations are allowed to operate no more than six hours in a 24 hour period and may not operate more than 24 hours total during the 107 hour event.

Not Your Typical Contest

While most amateur radio contesters pride themselves in the speed with which they cycle through contacts, SCR is more about content; taking the time to actually talk with the students in their classrooms. Some SCR contacts can take 5, 10 even 15 minutes to complete. And, while most amateur radio contesters are seasoned contest veterans, many SCR operators have never worked a contest. Their ages may range from first grade to college graduate-level, and students can be from both public and private educational institutions. Veteran hams have to adjust their on-air subject material to the student's level; just don't talk down to them!

SCR is focused on schools contacting other schools, for which they are awarded more points, but individual operators not affiliated with a school are also encouraged to participate though they are given fewer points per contact. While many schools have permanent amateur radio stations in a dedicated classroom, others are temporary stations activated only during SCR.

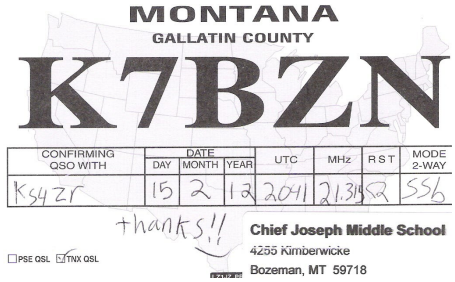
Best practice is to let the school operators set the pace. If they are operating in real


K5LMS

Lampasas Middle School Youth ARC: 902 S. Broad, Lampasas TX 76550
Sponsors/control operators: Gene Case KU5C; Gordon Thornton W5GFR

QSO with	Date	UTC	Band/mode	Power out	Report
K5YZR	2/13/12	2131	20m/SSB	100w	59

K5LMS Lampasas Middle School, Lampasas, Texas, one of 27 Texas schools with amateur radio in the classroom.


MONTANA
GALLATIN COUNTY
K7BZN

CONFIRMING QSO WITH	DATE DAY	MONTH	YEAR	UTC	MHz	RST	MODE 2-WAY
K5YZR	15	2	12	2041	21.312	55	55

thanks!!

Chief Joseph Middle School
4255 Kimberwicke
Bozeman, MT 59718

☐ PSE QSL ☑ TNX QSL

K7BZN Chief Joseph Middle School, Bozeman, Montana, the easiest way to add Montana to your WAS list.

contest mode, don't rag-chew; do the required exchange and move on. Remember, for many of these students, the only operating time they may get is during the time they're operating SCR.

Usually, in the case of elementary schools, the teacher is the control operator and will pick one or two students to ask questions in a single exchange. Be patient with the handoff from the teacher to the students, sometimes the kids are mic-shy and the ensuing dead-air can complicate the exchange. Remember to say, "Over" when you're finished talking, most students are expecting a cue to reply. Also, remember that there may be an audience of 20 or 30 other students listening to the exchange.

Don't assume that all SCR operators are novices at amateur radio. Many SCR operators have earned their own licenses (some hold General and even Extra Class licenses) but are operating under the school's call sign. Regardless, you'll find that most SCR operators are extremely polite and have been well schooled in on-air protocol. All SCR student operators should be accorded the same respect you'd give any fellow operator.

Old-timers need to be polite, too, if SCR operators seem to infringe on "their frequency." Remember, the FCC doesn't assign amateur radio frequencies to nets, no matter how long they've laid claim to a specific frequency. As mentioned, most SCR ops will respond positively to requests to move a few kHz to accommodate a daily net. Still, SCR is only five days, twice a year; you can have the frequency the other 50 weeks.

Try to work as many schools as you can. It'll give you a little more faith in this up and coming generation and you may be amazed at the capabilities these students possess. I once had a PSK31 contact with a seven year-old at an elementary school in Portland, Oregon.

Throughout the years you'll recognize schools and their sponsors/trustees and you'll enjoy seeing how school club stations grow. If you've never worked a contest before because you've been turned off by the "5-9 QRZ" contest style, you'll enjoy SCR with its easy-going pace and the chance to talk with students who are actually interested in amateur radio.

Most official school clubs have photos of their stations, teachers and students which may be seen on **http://QRZ.com** along with URLs directing you to separate home pages maintained by the trustee of the school club itself. In addition, many school clubs have their own Facebook pages.

Scoring Modes and Frequencies for SCR

As with most contests, the WARC bands (12, 17, 30 and 60 meters) are not used for SCR. Though some VHF frequencies are used, primarily 2 meter and 6 meter Single Side Band simplex or possibly operating amateur radio satellites, repeaters are not used for SCR.

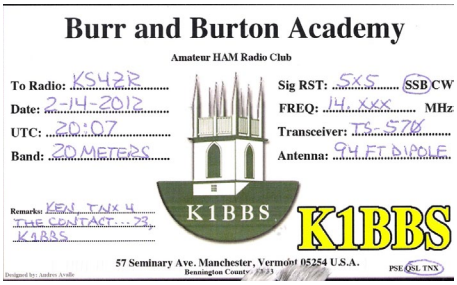
In addition to the above modes, look for school stations on PSK31 and RTTY in the usual digital sub-bands of the above amateur radio bands; they'll usually send "CQ SCR" followed by the school's call sign. Complete rules for operating SCR can be found here: **www.arrl.org/school-club-roundup**.

The exchange is straightforward. According to SCR rules, you must exchange your call sign; signal strength (RST); class (whether you are an "Individual", "Club" or "School"); U. S. state, Canadian province/territory or DXCC country/entity. Multi-operator group stations must choose one call sign to use for the whole operating period. Over the years I've found it hard to work DX schools because band conditions to DX regions during school hours are not necessarily cooperative. Still, I've worked schools and colleges in Europe and Canada in previous SCRs, so it can be done.

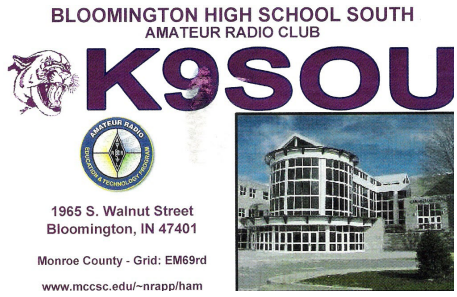
Stations may be contacted once for SSB and once for digital modes (for purposes of this contest CW, PSK31, RTTY or any other digital mode count as a digital contact). The good news for contesters is that SSB contacts count as one point and any digital contact counts as two points. So, by hanging out on the PSK31 or RTTY frequencies, it's easy to rack up a decent score. The bad news is that,

for purposes of this contest, the U.S., Canada, Alaska and Hawaii do not count as separate DX entities; you'll have to contact Mexico, the Caribbean, South America, Europe or Asia to claim DX points.

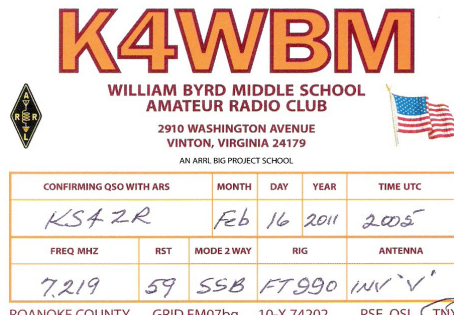
You can submit your SCR logs electronically via the formats specified at the SCR homepage listed above. But, don't expect a quick reply to your submission. SCR logs are examined carefully and it will be months before winners are announced. As you can appreciate, the students find the competition challenging and those who place in the top categories will vigorously defend their position. It's a friendly, but serious, competition for the schools.



K1BBS Burr and Burton Academy, Manchester, Vermont: A private academic high school founded in 1829.



K9SOU Bloomington High School South, Bloomington, Indiana. Last year they came in #4 in the fall term SCR.



K4WBM William Byrd Middle School, Vinton, Virginia, sister station to WB4HS (William Byrd High School). WB4HS had little difficulty getting their station approved by the administration: the principal is a ham!

K3FBI: The FBI has a school? Yes! And, the FBI Amateur Radio Association is always active in SCR. You can bet this is one QSL schools like to put up on their wall! (Courtesy: Author)

QSLing the Schools

Schools don't have a lot of money for QSLs and postage. As with everything else connected to SCR, costs are often paid by the teacher/trustee. Still, collecting QSLs is a significant part of each club's activities and a very active school club can rack up a lot of postage. You can help defray such costs by including an SASE with your QSL.

Most club QSL addresses are often in care of the school amateur radio club at the school's street address. But, many others, particularly if the station is activated only for SCR, will be the home address of the teacher/trustee. The SCR operators will let you know the QSL route and whether or not they prefer an SASE. Some schools pride themselves in being able to raise the funds to pay for their own postage.

As with final results of the contest, expect a fairly lengthy wait to receive your SCR-related QSL cards. They're usually processed by the student operators, who often design and print the cards themselves. The operator who worked you will usually fill out the QSL (the card I got back from the elementary school student operating PSK31 was nicely decorated in crayon and remains one of my all-time favorite QSLs). There's a great satisfaction in seeing another youngster embracing the hobby we all enjoy so much.

MT

Recommended SCR Frequencies (kHz)

Band	*SSB (kHz)*	*CW*
160	1855-1865	1800-1810
80	3850-3880	3530-3540
40	7225-7255	7030-7040
20	14,250-14,280	14,030-14,040
15	21,300-21,330	21,130-21,140
10	28,440-28,460	28,130-28,140

AMATEUR RADIO AND YOUR LOCAL SCHOOL

Carole Perry WB2MGP, a veteran of 30 years teaching amateur radio in the New York City public school system, once wrote in an *MT* article, "You don't have to reinvent the wheel when it comes to starting an amateur radio club at your local school." There are a great number of resources available to anyone wishing to start such a program.

According to the ARRL's list of Education and Technology Program (ETP) schools, there are some 500 school clubs throughout the U.S. This list, compiled in 2011, while the latest available, is incomplete and doesn't list the non-ARRL affiliated schools, private clubs (such as Boys and Girls Clubs which may have amateur radio after-school programs), or those students who are homeschooled by parents who are also hams.

Schools, from elementary to college graduate level, with active amateur radio programs are found from Alaska to Florida, Maine to Hawaii and every state in between. The best way to begin your quest to start an amateur radio program in a school near you is to study the resources available here: **www.arrl.org/amateur-radio-in-the-classroom**. This web site will direct you to the League's ETP and the Teacher's Institute on Wireless Technology; show you how to apply for ETP grants; and show you how to get involved with Amateur Radio on the International Space Station. This web page also has ideas for developing class lessons as well as offering kits and projects you can use in your classroom. There are also very useful tips on how to approach school administrators on the subject of bringing amateur radio to local schools.

If you're a science teacher and a ham, the site has many ideas for incorporating science and amateur radio in your daily classroom schedule. Some ideas include discussion and demonstration of RF-ID technology; robotics; receiving and interpreting satellite telemetry; using GPS and APRS systems to track high-altitude balloons; building and soldering electronic kits; making wire or aluminum tubing antennas – the list is impressive.

Starting such an in-school amateur radio program is best done as a group effort. As Ronny Risinger KC5EES, teacher at the Liberal Arts and Science Academy in Austin, Texas notes, "It's no good starting a program only to have the teacher or trustee burn out after a few years." As seen in the two examples in this issue, successful programs depend on the help of a local club whose combined skills, experience and finances can help the program develop and mature.

The ARRL announced in late June this year that eleven schools received ETP grants in equipment and resources valued at more than $16,000. Since the program's inception, more than 590 schools have received such grants. So, the next time your local club is considering a new direction or program, ask the group to consider starting an amateur radio club in a local school. You may be surprised at the results.

-- *Ken Reitz KS4ZR*

A Quest to Find the Disappearing Sunspots

By Russ Steele KF6TAR

This article is based in part upon work by William Livingston and Matthew Penn writing for the National Solar Observatory which is operated by the Association of Universities for Research in Astronomy (AURA) under a cooperative agreement with the National Science Foundation. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

When I bought my first shortwave radio I was unaware that sunspots played an important role in radio propagation. After my retirement from the Air Force and from my second career in business as a concept developer for TRW, an aerospace company, I started working on my bucket list. One of the items on that list was to become an amateur radio operator. I studied for my Technician Class ticket, took the test, and earned the call sign KF6TAR.

It was a combination of my interest in amateur radio and a TRW project to bid on an upgrade to the Air Force's Solar Observatories around the world, that accelerated my interest in amateur radio astronomy and sunspots. Studying the 11-year sunspot cycle, I understood that the presence or absence of sunspots could have an impact on the earth's climate, but more importantly to hams and shortwave listeners, a significant impact on radio propagation.

I recently also found that some scientists think that sunspots may soon vanish for a generation or more, cooling the earth and creating years of radio silence. Needless to say, I wanted to know more.

Early Radio Monitoring

In the early1950s my mother was the bookkeeper at our small town radio and TV store and I often admired a Hallicrafter S-53A receiver in the display case at the store. The storeowner let me buy it on a lay-away plan. I do not remember how much the radio cost, but it took three paychecks from my Saturday job as an intern at the Empire Mine Engineering Office in Grass Valley, California to pay for it.

The S-53 was a general coverage receiver, covering 5 bands from .54 MHz to 39 MHz and 48-54.5 MHz. I hung a long wire in the oak tree outside my window, and listened to stations well into the night, mainly AM stations as the shortwave bands were very quiet. I was rather disappointed in my radio purchase. Expecting more stations and more excitement on all the bands, I was unaware that it was during a solar minimum when a quiet sun limited some band openings.

Thinking that my quiet receiver was due to my limited long wire antenna, I constructed an elaborate antenna array on the roof, much to my mother's consternation. She was sure I was going to fall off the roof and break some bones. However, my new antenna farm and deep ground stake did not provide much improvement on the higher shortwave bands. I wanted to hear the world, but it seemed to be missing. When I went into the Air Force, I left my S-53 at home, and a renter stole it from my parent's house.

After completing electronics warfare training at Kessler Air Force Base in Mississippi in 1961, I was stationed at Loring Air Force Base. Living in the bachelor officers' quarters, I was looking for something to do on those long winter nights in Northern Maine and missed having a shortwave radio. With time and interest I decided to build my very first Heath Kit, the GC-1A Mohican.

The Mohican was Heath's first all transistor general coverage shortwave and broadcast receiver. I wanted a portable shortwave receiver I could take with me wherever I was stationed. It included a calibrated band-spread for ham bands and a BFO for copying code and Single Sideband Band (SSB) voice.

I was never very satisfied with the receiver; it had a lot of audio distortion that I could not eliminate with my limited experience and available test equipment. Shortly after I finished building the radio, my spare time turned to a young lady who I met when she visited the Air Force Base. I soon discovered it was more fun writing letters to her at night than searching for shortwave stations on a radio that did not work very well. She is now my wife of 49 years.

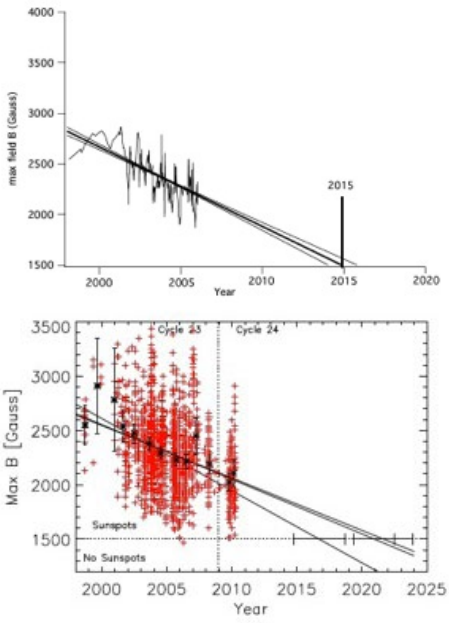
The Vanishing Sunspots

Now my interest in sunspots is related to long-term climate change. In 2004, I became interested in climate change and the role that sunspots might play in influencing temperatures here on earth. While studying sunspots and their impacts on the climate, I came across a paper by William Livingston and Matthew Penn titled, "*Sunspots May Vanish by 2015*."

This paper was published in 2008 and it got my attention not only in terms of climatology but also as an amateur radio operator. If the sunspots vanished, it would have an impact on the hobbies of radio monitoring and amateur radio, especially those hams interested in making long-range contacts.

Livingston and Penn are researchers at the Kitt Observatory, 40 miles south west of Tucson, Arizona, where the McMath-Pierce Solar Telescope dominates the view from the mountaintop. In a subsequent 2009 paper, Penn and Livingston moved the date they think that sunspots would disappear from 2015, which is only three years away, to a period between 2016 and 2020, still not that far way. This second paper included more observations, over 13,000, which refined the declining sunspot data, but also broadening the window of probability.

How did Livingston and Penn determine the spots are going to disappear? They used the McMath-Pierce Solar Telescope that is equipped with a powerful spectrometer. Using these tools they made some long-term observations of sunspots starting in 1990, focusing on three areas:



"Measurements of the total magnetic field strength at the darkest location in umbrae and pores as a function of time. The crosses show the individual measurements, the asterisks show annual bins. Three linear fits are shown: the bottom fit line fits data from 1998-2006 as done in our 2006 paper. The top line fits all the data from Cycle 23, and the middle line fits all of the data." (Figure 1, Long-term Evolution of Sunspot Magnetic Fields; text from a paper by William Livingston and Matthew Penn)

Spectroscopic changes in temperature sensitive molecular lines; changes in the strength of the magnetic fields surrounding the sunspots, and changes in the sunspot umbrae, the darkest region of a sunspot.

All three measurements showed consistent trends in which the darkest parts of the sunspot umbra become warmer by about 45 degrees Kelvin per year, the strength of molecular absorption lines decreased, and the magnetic field strengths decreased by 77 Gauss per year.

These changes were determined to be independent of the normal 11-year sunspot cycle. Using the data collected from 1990 to 2005, Livingston and Penn constructed a linear extrapolation of the three trends. The linear plots suggested that sometime around 2017 very few sunspots would be visible on the sun. The question is; for how long will they disappear?

Visiting the Solar Observers

I wanted to learn more about the solar observations and scheduled a vacation trip to Arizona and the Kitt Peak Observatory with my wife Ellen, my friend George and his wife Jo Ann. George knew one of the guides at the solar observatory from his days in the Army and arranged to meet him for a tour and lunch. We were going to get an inside look at how solar observations are made and some insight into the process. However, a late spring snowstorm threw a wrench into our plans.

On the appointed day we visited the observatory, taking care not to slip and slide in the snow covered road as we approached the summit at 6,875 Feet. There was about a foot of snow on the ground and snow banks in the parking lots. It was only later that we learned our insider friend had canceled due to the snow and the slippery roads.

Author standing at the entrance to the Kitt Peak McMath-Pierce Solar Telescope. (Photo by Ellen Steele)

The McMath-Pierce Solar Telescope was dedicated in 1962, and, is one of the largest solar telescopes in the world, with an unobstructed-aperture of 1.6 meters. Permanent instruments include a dual grating spectrograph capable of extended wavelength coverage (0.3-12 microns), a 1-meter Fourier Transform Spectrometer for both solar and laboratory analysis, and a high-dispersion stellar spectrometer.

Important discoveries include the first measurement of Kilogauss magnetic fields outside sunspots and the very weak intra-network fields; first high resolution images at 1.6 and 10 microns. And, I would add, the discovery that sunspots might soon disappear. The Association of Universities for Research in Astronomy operates the National Solar Observatory under an agreement with the National Science Foundation, which is the main funding source for telescope operations.

The top of the observing tube is crowded with instruments to measure the solar images. Dr. Livingston's instruments are not shown in the photo, according to our guide. (Photo by Ellen Steele)

It was this sophisticated observing tool that Dr. William Livingston used to measure the magnetic fields on the Sun and give a pictorial representation of the variations in strength of the magnetic field surrounding the sunspots. He and his team did this by exploiting the Zeeman Effect. This is where the science gets a bit complicated, so I have provided an explanation of the Zeeman Effect in the sidebar.

The research team's observations of the magnetic field were plotted on a graph. It suggested that when average field strength reached a threshold value of about 1500 Gauss it would be very hard to see sunspots by about 2017. An analysis of the umbra continuum brightness showed another linear trend and extrapolation showed the umbra brightness would be equal to the quiet Sun brightness at about the same year. The conclusion: the sunspots we now can see will be invisible.

Heliostats which collect the sun for observation. There are three mirrors, one large one in the center and two smaller ones on each side, allowing multiple observations. (Photo by Ellen Steele)

Finally, the molecular line depths showed a decreasing strength with time, and again the trend suggested that molecular absorption lines would disappear from the average sunspot umbra near 2017. Not good news for those who are counting on the sunspots to create unexpected band openings and radio amateurs counting on arctic northern lights for long distance VHF band openings.

Disappearing Sunspot History

Have the sunspots disappeared before? Yes, they have. During the period between 1645 and 1715 sunspots vanished. During the period from 1600 to about 1645 the astronomers of the day observed very few spots, as opposed to thousands of spots observed in a single year in modern times, with much more powerful observing tools.

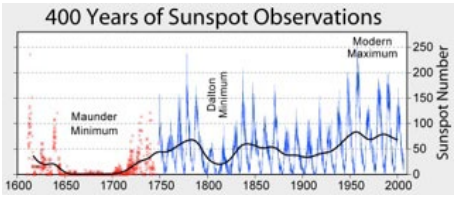
When comparing historical observations in the 1600s and 1700s with modern observations, one has to be cautious. Scientists may see more spots today than historical observers could because early observers had crude telescopes and no recording equipment. They projected the Sun's image on paper, and drew a representation of the dark spots on the paper. Other observers just noted the existence of spots and the aurora that was associated with sunspots in logs, journals, and letters.

Researchers used these drawings, logs, journals, and letters to construct a comprehensive sunspot history starting in 1600, when observations started soon after telescopes were invented.

The most dedicated solar observers were German and French astronomers. In Germany the most active observer was Johannes Hevelius (1611-1687). In France a systematic solar observing program was developed under the direction of Jean Dominique Cassini (1625-1712) at the newly founded Observatoire de Paris – first by Jesuit Jean Picard (1620-1682) and then by Philippe La Hire who carried out the bulk of the observations. These dedicated astronomers from about 1645 to 1715 observed very few sunspots, and when they were present it was a noteworthy event recorded in logs and letters.

There were several periods after 1600 when some spots were observed, but they seem to have vanished from 1644 to 1660. Some more feeble spots were observed up to 1665, then no spots until 1671. The longest period of no observed spots was from 1675 to 1700, a span of 25 years. A period often referred to as the Maunder Minimum.

The Maunder Minimum was named after solar astronomer Edward W. Maunder (1851–1928) who studied how sunspot latitudes changed over time. The period Maunder examined included the second half of the 17th century. He published two papers in 1890 and 1894, citing earlier research by Friederich Wilhelm Gustav Spörer, noted for his studies of sunspot cycles. Spörer was the first to note a prolonged period of low sunspot activity from 1645 to 1715.



"A linear fit to observed magnetic fields extrapolated to the minimum value observed for umbral magnetic fields; below a field strength of 1500G as measured with the Fe I 1564.8nm line no photospheric darkening is observed." (Figure 3, Sunspots may vanish by 2015; text from a paper by William Livingston and Matthew Penn)

When examining the historical reconstructions, it appears that grand minimums happen on a regular cycle of about 200 +/- 20 years. Given that historical schedule, we are due again for another grand minimum. The open question is: Will another Maunder style minimum happen? Will all the spots disappear for a whole generation?

In addition to U.S. scientists, Russian scientists also see a 100-year cooling cycle resulting from diminished sunspots. Dr. Habibullo Abdussamatov, head of the Russian segment of the International Space Station and head of Space Research of the Sun Sector at the Pulkovo Observatory of the Russian Academy of Sciences, led a team of Russian scientists who took an interest in J. A. Eddy's paper on the Maunder Minimum.

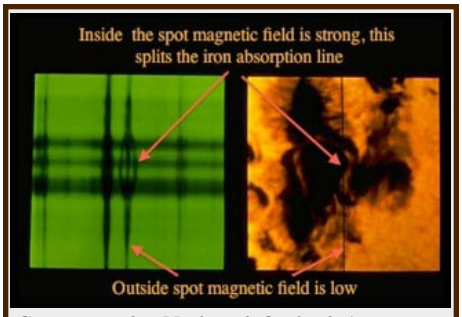
With Eddy's paper as a starting point, the Russian scientists examined historical records and concluded there is a quasi 200-year cycle of global cooling over the past 7,500 years and that this cooling correlates to times of sunspot minimums similar to the Maunder Minimum.

The Maunder Minimum is associated with the Little Ice Age when China, Europe and North America went into an extended deep freeze during which Alpine glaciers extended over valley farmland and crushed villages; sea ice crept south from the Arctic creating huge icebergs in the shipping lanes; the famous canals in the Netherlands and rivers in England froze regularly, and long term droughts in China caused huge political upheaval as millions starved.

Sunspots Today

Where are we today? What is happening on the Sun? Solar Cycle 24 is approaching a maximum, which is much lower than originally projected by the prediction team at NASA's Marshall Space Flight Center, led by Dr. Hathaway. This team originally thought Solar Cycle 24 was going to be the strongest yet, but over time they kept lowering the forecast. Here is the current estimate:

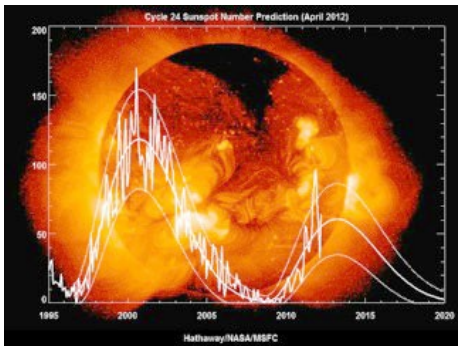
As you can see in the graphic below, not all solar scientists agree that all spots will vanish. Dr. Hathaway and the NASA team see spots out to about 2020 when Cycle 24 comes to an end. History has shown that forecasts by the NASA team have required continual adjustments, as the Sun failed to follow NASA's models. It has proven very difficult to predict what the Sun is going to do, and previous failures are constraining the willingness of solar scientists to step out and predict what Solar Cycle 25 will look like.



Courtesy: the National Optical Astronomy Observatories, annotations by the Author.

In a sunspot, the spectral lines that are normally at a single wavelength become split into two or three components in the presence of a magnetic field, depending on the orientation of the field with respect to the line of sight. The separation of the outermost component is proportional to the strength of the magnetic field in this sunspot about 0.4 Tesla, or 4,000 Gauss. The components also have a circular or plane polarization, and the circular polarization, or orientation, indicates the direction, or polarity of the longitudinal magnetic field.

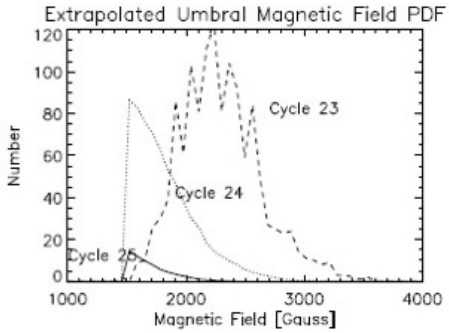
Once again, we will have to rely on Livingston and Penn. They have provided the first hard estimate of Solar Cycle 25 amplitude based on their physical model. Solar Cycles 24 is estimated to peak at about 66. The estimate for Solar Cycle 25 is about 7. This would make it the smallest solar cycle in over 300 years.



The current prediction for Sunspot Cycle 24 gives a smoothed sunspot number maximum of about 61 in the Spring of 2013. The current predicted size makes this the smallest sunspot cycle in about 100 years. (Graphic Credit, NASA Marshall Space Flight Center)

Some solar scientists have indicated we may be on the cusp of another grand minimum when sunspots could vanish for 20-30 years. Others are not so sure. If Solar Cycle 25 predictions are valid, and we are entering another grand minimum like a Maunder, then sunspots could vanish for long periods or be extremely low for up to a hundred years or more.

If the spots disappear, it will have a long-term impact on long distance HF and VHF communications. It could change the hobby of radio monitoring for generations of future listeners, giving us old hands the opportunity to brag about the good old days when there were sunspots.



This is Figure 2 from a paper by Livingston and Penn showing their IR measurements of sunspots during Cycle 23 and, based on their assumptions, have estimated the levels for Cycle 24 and 25. They estimate that Cycle 24 will peak with a sunspot number of 66 and cycle 25 will peak with a sunspot number of 7.

USEFUL RESOURCES

National Solar Observatory Home Page (**www.nso.edu/**)
The Livingston-Penn paper (**www.nso.edu/press/SolarActivityDrop**)
Live Image of the Kitt Peak, McGrath-Pierce Observing Room. (**http://nsokp.nso.edu/mp**)
Kitt Peak Observatory Home Page (**www.noao.edu/kpno/**)
Daily Solar Updates at Spaceweather.com (**www.spaceweather.com/**)
NASA, Marshall Space Flight Center, Solar Physics Predictions (**http://solarscience.msfc.nasa.gov/predict.shtml**)
The K7RA Solar Update (**www.arrl.org/news/the-k7ra-solar-update-213**)

MT

Opposition and Clandestine Broadcasts Target Sudan and Darfur

By Steven Handler
(QSL cards courtesy the author)

Sudan is an African country that has seen more than its share of war and violence. Once governed by the British, it became independent at the end of 1955. However, a dispute erupted, leading to a 17 year civil war. In 1972 the Addis Ababa agreement ended the civil war, but the peace was short lived.

A little over ten years later, in early 2003, a rebellion in the western region of Darfur began. Despite ceasefire agreements and peace talks, violence continued and, in January 2005, a peace treaty was signed which agreed that southern Sudan would have autonomy for six years, after which they could hold a referendum on independence.

In 2005, with the civil war fighting quieting down, the neighboring country of Chad declared a State of war against Sudan. It was not until the beginning of 2010 that the two countries agreed to a ceasefire, ending the conflict.

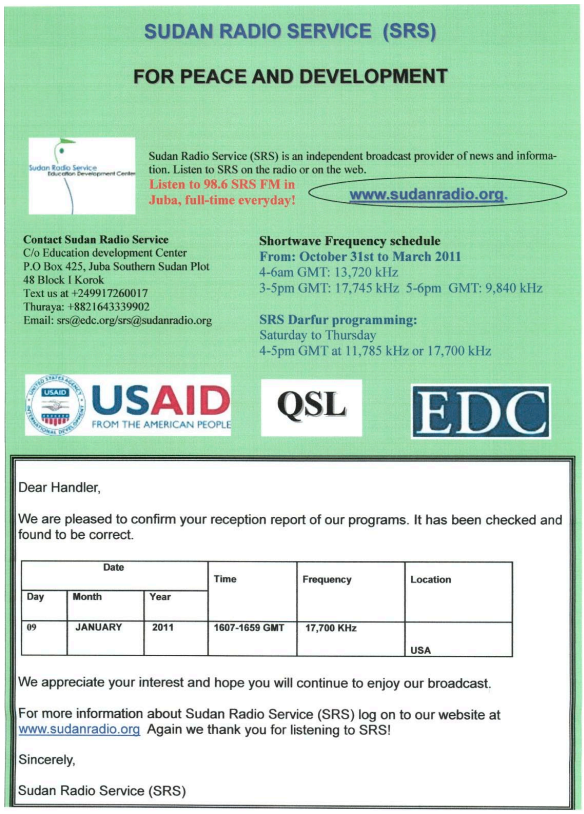
In January of 2011, the referendum for independence for Southern Sudan was held, with the majority of the population voting to secede and create the Republic of South Sudan. Armed violence again broke out between Northern and Southern Sudan, resulting in peacekeeping troops being deployed to the area. On July 9, 2011 South Sudan formally became independent.

Against this backdrop of long term violence, the media within Sudan was perceived by many outside the country as being unable to effectively keep the population informed with fair and unbiased news reporting, so several entities outside the country stepped in to fill the void.

Sudan Radio Service

Sudan Radio Service (SRS) began broadcasting on July 30, 2003, becoming Sudan's first independent broadcast provider of news and information. Their original one hour a day shortwave broadcasts grew into its current schedule of six hours per day of shortwave broadcasting as well as twelve hours a day on FM radio.

To reach as much of the potential Sudanese audience as possible, they broadcast in eleven Sudanese languages (Juba, Dinka, Zande, Moru, Nuer, Bari, Shilluk, Toposa, Fur, Masalit and Zagawa), as well as Arabic and English. Their varied programming includes news, educational, music and entertainment features, and is produced by an all-Sudanese staff at their main offices in Juba (the capital of Southern Sudan), Nairobi, Kenya and a bureau in Khartoum, the capital of Sudan. SRS utilizes a network of Sudanese correspondents located throughout Sudan.



SUDAN RADIO SERVICE (SRS)

FOR PEACE AND DEVELOPMENT

Sudan Radio Service (SRS) is an independent broadcast provider of news and information. Listen to SRS on the radio or on the web.

Listen to 98.6 SRS FM in Juba, full-time everyday!

www.sudanradio.org.

Contact Sudan Radio Service
C/o Education development Center
P.O Box 425, Juba Southern Sudan Plot
48 Block I Korok
Text us at +2499172600l7
Thuraya: +8821643339902
Email: srs@edc.org/srs@sudanradio.org

Shortwave Frequency schedule
From: October 31st to March 2011
4-6am GMT: 13,720 kHz
3-5pm GMT: 17,745 kHz 5-6pm GMT: 9,840 kHz

SRS Darfur programming:
Saturday to Thursday
4-5pm GMT at 11,785 kHz or 17,700 kHz

USAID FROM THE AMERICAN PEOPLE QSL EDC

Dear Handler,

We are pleased to confirm your reception report of our programs. It has been checked and found to be correct.

Date			Time	Frequency	Location
Day	Month	Year			
09	JANUARY	2011	1607-1659 GMT	17,700 KHz	USA

We appreciate your interest and hope you will continue to enjoy our broadcast.

For more information about Sudan Radio Service (SRS) log on to our website at www.sudanradio.org Again we thank you for listening to SRS!

Sincerely,

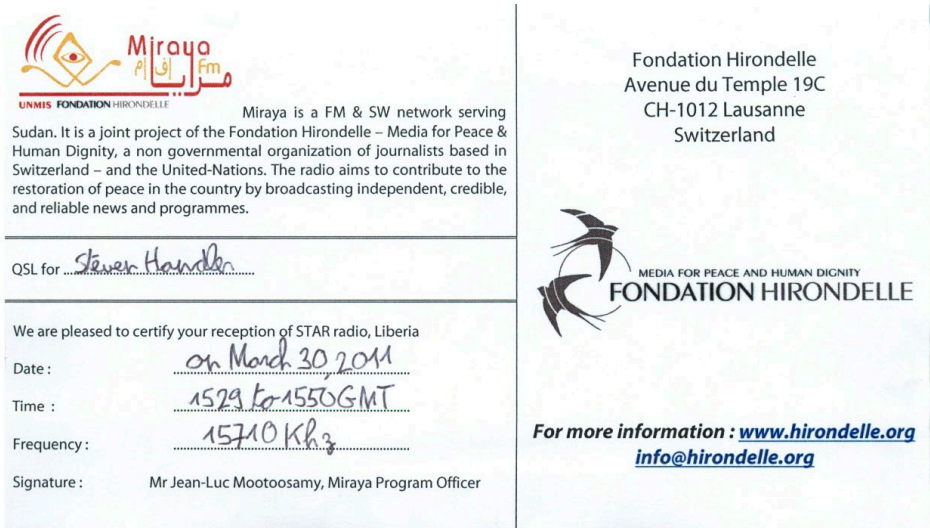
Sudan Radio Service (SRS)

SRS is a project of Education Development Center, Inc., an international non-governmental organization which is supported by the United States Agency for International Development. SRS's goals and objectives include providing balanced news and information, becoming Sudan's premier independent provider of trusted news and information to the people of Sudan living both in Sudan and abroad. It aims to provide listeners with the tools to participate more fully in peace making, reconciliation and the development processes of Sudan, as well as building a corps of Sudanese journalists and media partners.

Radio Miraya

In June of 2006, almost three years after the start of SRS, a second major broadcaster, Radio Miraya/Miraya FM, began operations. Currently broadcasting three hours each day to Sudan on shortwave, they also broadcast using an extensive network of twenty six FM transmitters inside Sudan. Funded by the United Nations Mission in Sudan (UNMISS), Miraya is operated by the Foundation Hirondelle, a Swiss non-governmental organization of journalists and professionals in humanitarian action.

Programs include news, current affairs, needs-based programming, interactivity, music and sports. Besides keeping the people



Miraya Fm مرايا

UNMIS FONDATION HIRONDELLE

Miraya is a FM & SW network serving Sudan. It is a joint project of the Fondation Hirondelle – Media for Peace & Human Dignity, a non governmental organization of journalists based in Switzerland – and the United-Nations. The radio aims to contribute to the restoration of peace in the country by broadcasting independent, credible, and reliable news and programmes.

QSL for ..... Steven Handler .....

We are pleased to certify your reception of STAR radio, Liberia

Date : on March 30, 2011

Time : 1529 to 1550 GMT

Frequency : 15710 Khz

Signature : Mr Jean-Luc Mootoosamy, Miraya Program Officer

Fondation Hirondelle
Avenue du Temple 19C
CH-1012 Lausanne
Switzerland

MEDIA FOR PEACE AND HUMAN DIGNITY
FONDATION HIRONDELLE

For more information : www.hirondelle.org
info@hirondelle.org

informed, they want to be a tool for promoting pluralism, diversity and education and the forging of a national identity.

Miraya's core principles include fairness, accuracy and balance in their programming. They provide diversity with teams composed of staff from different ethnic groups, cultural backgrounds and religious beliefs. The multi-ethnic mix helps build an atmosphere of mutual respect and helps promote cultural diversity and peaceful co-existence. They are also trying to create and support local journalists and media within Sudan.

Radio Dabanga

Toward the end of 2008, Radio Dabanga began its programming over shortwave radio for the Sudan and Darfur regions. It began as a project of the Radio Darfur Network, a coalition of Sudanese journalists and international media. It is operated by Free Press Unlimited and supported by international donors, humanitarian community organizations and local non-governmental organizations. Radio Dabanga claims over 2 million listeners and currently broadcasts via shortwave for two and a half hours per day.

To reach a wide audience they broadcast the news in Arabic as well as the local languages of Fur, Masaliit and Zaghawa. In addition to their 10 minute news program, they air 15 minute programs called "Topic of the Day," presenting both sides of an issue. A twelve minute program titled "Bissaraha" (Frankly Speaking) interviews a key person in Darfur. "Habaabkum Darfur," a 25 minute twice weekly program, features those living in displacement camps sending messages to their families. Other programs are also aired.

Radio Dabanga news is supplied by correspondents in Darfur and other locations in Sudan, with the central editorial team in Hilversum, the Netherlands.

Press Now was established in 1993 and has a long history of promoting journalistic freedom in conflict zones and countries in transition. In 2011 Press Now merged with Radio Netherlands Training Centre and Free Voice, forming a new organization called "Free Press Unlimited." The operations directed to Sudan were, in part, a result of the restrictive media climate fostered by the government owning the country's radio and television stations and print media.

Radio Tamazuj

The newest broadcaster is Radio Tamazuj, which began daily half hour broadcasts in January of 2012. Their target audience is the people of Abyei, South Kordofan, Blue Nile, Unity, Western Bahr El Ghazal, Northern Bahr El Ghazal, White Nile, Renk and the Nuba Mountains. The station's programs are broadcast in Arabic and Dinka. Radio Tamazuj is also an initiative of Free Press Unlimited and their shortwave program airs just before those of Radio Dabanga, using the same frequencies and transmitters sites.

All four of these shortwave broadcasters are working to provide the region with independent news, reporting and entertainment. In addition, there is an effort to train and encourage local journalists who, in the future, can take over providing the population with independent media reporting. The future will be the ultimate judge of their success.

SUDAN RADIO SERVICE
Educational Development Center
1000 Potomac St NW
Washington DC 20007

Email: srs@edc.org or srs@sudanradio.org
QSL: They have responded to email reception reports with a QSL letter

A-12 Season Daily Broadcasts

0400-0500
11800 Darfur Programming via Dhabayya, UAE 250 kW

13720 SRS Radio Programming via Dhabayya, UAE 250 kW

1500-1700
17745 SRS Radio Programming via United Kingdom 250 kW
1600-1700
15500 Darfur Programming via United Kingdom 250kW

RADIO MIRAYA/MIRAYA FM
c/o Foundation Hirondelle
Avenue Du Temple 19c
CH-1012 Lausanne, Switzerland

Email: info@hirondelle.org
Web Site: **www.mirayafm.org**
QSL: They have responded to reception reports by post with a QSL card.

A-12 Broadcasting Schedule

0300-0400 GMT
11560 Khz via Simferopol, Ukraine 250 kW

RADIO DABANGA
Witte Kruislaan 55
1217 AM Hilversum
Postbank 7676
The Netherlands

Email Address: radiodabanga@yahoo.com
Web Site Address: **www.radiodabanga.org**
QSL: They have responded to reception reports by post with a QSL card.

A-12 Season Broadcasts

0430-0557 GMT Daily
11650 via Santa Maria Galeria, Vatican 250 kW
15400 via Talata-Volonondry using 250 kW
15550 via Dhabayya, UAE using 500 kW

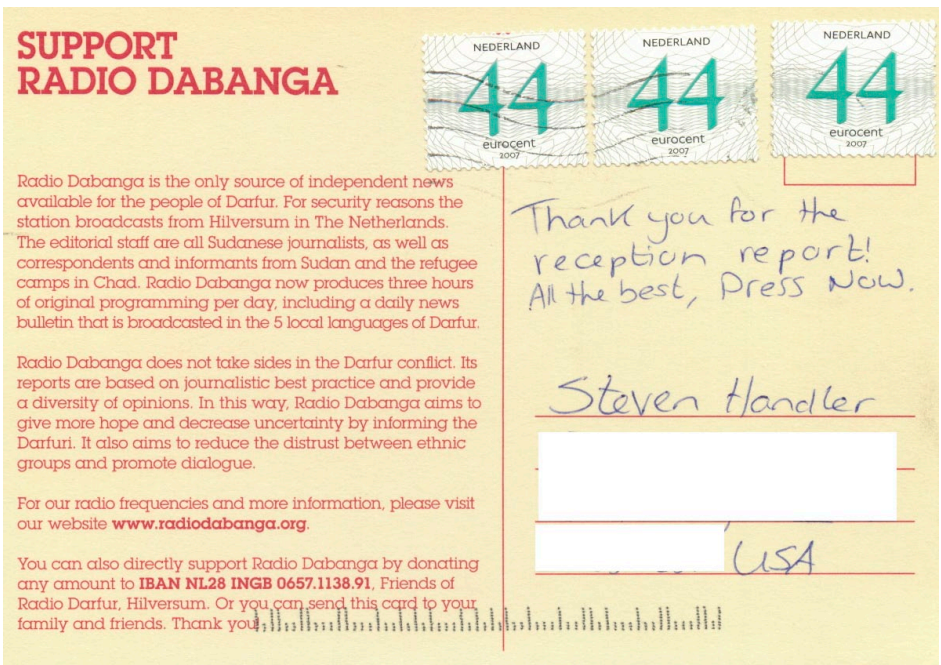
1530-1627 GMT Daily
15150 via Talata-Volonondry using 250 kW
15725 via Trincomali, Sri Lanka using 250 kW

RADIO TAMAZUJ
Witte Kruislaan 55
1217 AM Hilversum
Postbank 7676
The Netherlands
Telephone: 0031 35 62 54 340
Email: radiotamazuj@yahoo.com
Web site: **www.radiotamazuj.org**

A-12 Season Broadcasts

0400-0427 GMT Daily
11650 via Santa Maria Galeria, Vatican using 250 kW
15400 via Talata-Volonondry using 250 kW
15550 via Dhabayya, UAE using 500 kW

Notes:
[1]: Broadcasting times: Radio Dabanga web site www.radiodabanga.org/node/196
[2]: Transmitter locations and technical details via the HFCC B-11 Frequency Schedule located at www.hfcc.org/data/schedbybrc.php?seas=B11&broadc=PNW
[3] Broadcasting times: Radio Tamazuj web site http://radiotamazuj.org/en/page/frequencies
[4] Broadcasting times for Sudan Radio Service www.sudanradio.org/timetable
[5] Miraya FM Broadcasting times: www.hfcc.org/data/schedbybrc.php?seas=B11&broadc=MIR



SCANNING REPORT

THE WORLD ABOVE 30MHZ

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Adapting an AOR8000 to Change

Change is a constant presence in the radio industry. As much as hobbyists might like things to stay the same, technology advances and requirements evolve, leading to new equipment, new regulations and new procedures. This month we take a look at the current usefulness of an older scanner and examine some past and future changes to a few public safety radio systems.

❖ AOR AR8000

Dan, How effective is an AOR AR8000 for monitoring public service bands now?

When this scanner first came out it in the early 1990s it was touted as quite advanced, but is it any good at monitoring today's communications of police, fire, emergency services etc., considering the advances which have been made over the past 15-20 years?

Aren't many of these agencies now using digital transmissions that are impossible for the AR8000 to receive?

What is this scanner still good for and what is it no longer good at?

Many thanks in advance for your expertise in answer these questions.

Joe in California

The AOR AR8000 is a 1994-era handheld scanner that has an excellent reputation as a sensitive and selective receiver. It is capable of tuning anywhere from 500 kHz up to 1900 MHz with no gaps and has sufficient memory to store 1000 individual frequencies in 20 banks. It has a four-line alphanumeric display and scans at 30 channels per second. The hardware design of the scanner also has an internal connector block on the RF board that accepts add-on printed circuit cards, including a DS-8000 speech inversion board that could undo the analog voice scrambling technique of the time.

In 1997 the Federal Communications Commission (FCC) revoked the AR8000's certification, due to the ease with which it could be used to listen to cellular telephone calls. The long, sad history of cell phone lobbying and Congress includes a restriction on the sale of scanners that are capable of monitoring the frequencies used by analog cell phones. This restriction is enforced by the FCC during the regulatory certification process, a necessary legal step for any company to market and sell a radio in the United States. This restriction remains in force today, despite significant changes in cellular technology, and prevents U.S. consumers from easily purchasing truly full-coverage scanners.

One of the most useful features of the AR8000 is computer control. AOR documented a set of software commands that allow an external device to tune the radio, load and store frequencies in memory, and perform other useful actions. Not only does this eliminate the need to tediously program each frequency via the keypad, it also makes it possible for a frequency counter to control the scanner.

A popular combination was the AR8000 with an Optoelectronics Scout, a battery-powered handheld frequency counter. The Scout would detect a nearby transmission and instruct the AR8000 to tune to the detected frequency via the "Reaction Tune" data interface. Today such a capability comes with many newer scanners, but fifteen years ago this was a great leap forward for hobbyists.

The computer control port also made available capabilities that we take for granted today, including the ability to "clone" a radio by automatically copying memory contents from one scanner to another.

A number of software packages provide a user interface for the computer control features. You can find several such programs, along with documentation and comments, in a Yahoo group dedicated to the AR8000. Go to **http://groups.yahoo.com/group/ar8000** and join up. The "Files" section contains software, manuals, and related documentation that will help you to see what can be done with the scanner. A number of web sites also provide programs and information that might be worthwhile.

Besides a lack of modern tracking and digital features, there are a few other drawbacks to the AR8000. The case is made of somewhat flimsy plastic, making it a necessity to use a protective case. The stock antenna that shipped with the unit is not a particularly good performer, so many owners bought after-market antennas to improve reception on their favorite bands.

Over time, some units developed a problem with the audio section that was referred to as "sputtering squelch." The symptom was a rapid interruption of the audio that made the scanner unusable. For those handy with a soldering iron, a minor modification to the circuit board involving the replacement or addition of a capacitor corrected the problem.

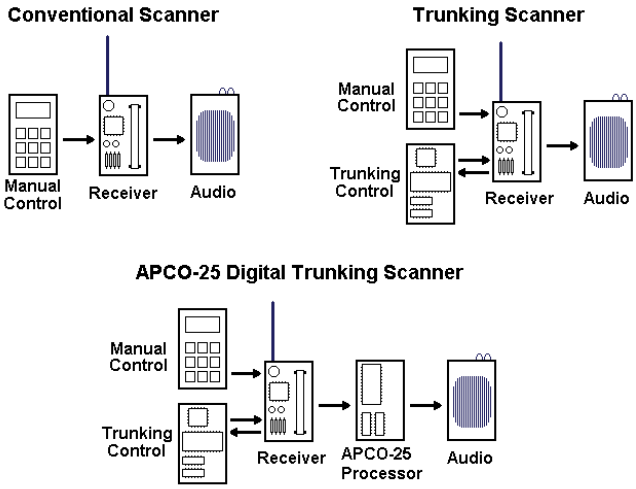
As a stand-alone unit, the AR8000 is not capable of monitoring the trunked and digital public safety networks that are so prevalent today. It lacks the circuitry and firmware of modern scanners that allow automated trunk-tracking and monitoring of digital voice activity.

❖ Scanner Evolution

At the heart of every scanner is a receiver, capable of quickly tuning to a specific frequency and checking whether a transmission is in progress. If so, the received signal is filtered and routed to an audio amplifier, where is it made available to the user via the speaker or a headphone jack. In the AR8000 and other conventional scanners of the time, that's about all the "signal processing" that is done.

As technology developed and trunked radio systems came on the scene, scanner manufacturers added a decoder feature that can take the received signal and extract any digital information it might contain. The decoder, when programmed correctly, is able to understand the instructions sent on a control channel and can tune the receiver to the proper voice frequency. Audio is then sent to the speaker or headphone jack while the decoder puts relevant information on the display. This advancement allows scanners to automatically track conversations occurring on trunked radio systems.

As digital systems like APCO Project 25 (P25) became more common, scanner manufacturers added another step in the signal processing chain. Because P25 voice traffic is digital, the scanner could not route the received voice signal directly to the user – all they would hear would be a loud buzzing noise (which is exactly



what happens when an analog scanner like the AR8000 is tuned to a digital transmission). Instead, the signal is routed to a digital voice decoder where it is converted into an analog sound that a human ear can understand.

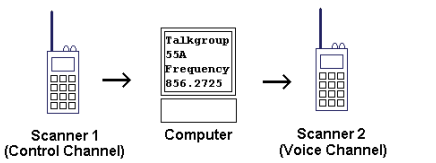
❖ Multi-Scanner Tracking

Even though the AR8000 can't follow trunked systems or decode digital audio, it is as good as it ever was for monitoring non-trunked analog systems that are still quite common in suburban and rural areas. Even in cities you can find a great deal of analog activity, regardless of whether the major police and fire departments have moved to trunked or digital networks.

For the more computer-literate, the AR8000 can also serve a useful role as part of a larger monitoring station. In such an arrangement, two scanners work with a computer to track activity on an analog trunked radio system. The first scanner is tuned to the control channel frequency of the system and feeds the received control data into the computer, either through a sound card or a digital data "slicer." The computer decodes the data and identifies the voice frequencies carrying talkgroup activity.

When a talkgroup of interest becomes active, the computer commands the second scanner to tune to that voice frequency, allowing the station operator to hear the conversation.

A computer-controlled monitoring station like this has a few advantages over a modern scanner. First, because the computer is decoding and processing every message appearing on the control channel, it provides an in-depth view of activity on the radio system that might



Computer-Aided Multi-Scanner Monitoring

otherwise be hidden or skipped.

Private talkgroups identifying unknown, sensitive, or rarely seen users can be found. Lists of individual radio identifiers can be cataloged, along with their geographic location, as they register with local repeater sites. Little-used system features like radio lockout for suspected stolen radios or remote microphone activation can be observed.

Even for the more casual listener it allows talkgroup prioritization, giving the operator the ability to interrupt an ongoing conversation to switch to a more interesting one. The monitoring station can do this because it has two receivers, one of which is constantly monitoring the control channel. A scanner can only tune to one frequency at a time; it is tuned to a voice channel when listening to a conversation and will miss any messages that might appear on the control channel during that time.

❖ Central Virginia

Since 1996, Amherst County, Bedford County, the City of Bedford and the City of Lynchburg in Virginia have been operating a regional emergency communication system called the Central Virginia Radio Communications Board (CVRCB). The CVRCB has determined that the radio equipment purchased fifteen years ago has finally reached the end of its useful life and needs to be replaced.

Early this year the four localities decided to dissolve the CVRCB and replace it with a new Region 2000 Radio Communications Board and make it a committee of Virginia's Region 2000 Local Government Council. The new board will fund, manage and operate the new radio equipment.

Region 2000 is home to nearly 200,000 residents across 2,000 square miles, served by more than 3,000 first responders and other municipal workers.

This summer the Radio Communications Board awarded Harris Corporation a contract worth $11.8 million to design and install a new system using APCO Project 25 standards. The stated goal, as with almost all of these kinds of arrangements, is improved interoperable communications between agencies and departments within the region.

Harris has about 800 employees in the local area. They acquired the Lynchburg facility when they bought the Wireless Systems Segment from Tyco Electronics in 2009.

The new system will have 14 repeater sites and will replace the three existing interconnected systems and the 15-year-old shared infrastructure. The plan calls for testing in 2013 and full operation by early 2014.

Some of the 11 existing repeater sites may be relocated to provider better coverage. Three new towers are planned –- two in Bedford County and one in Amherst County.

Funding remains an issue. The $11.8 million does not include mobile radios, so each jurisdiction will need to expend additional monies. Operational costs will be split in proportion to the amount of equipment each entity needs – Bedford County: 37%, Lynchburg: 30%, Amherst County: 28% and Bedford City: 5%.

Adjacent counties of Campbell and Appomattox were asked to join the new system but both declined.

❖ Lawrence County, Indiana

Can I decode the Lawrence County Sheriff tactical channel from Bedford, Indiana?
Andy in Indiana

Lawrence County is an area of about 450 square miles located in southern Indiana, between Indianapolis and Louisville, Kentucky. Just over 46,000 people live in the county, with nearly a third of them residing in the county seat of Bedford. Curiously, more than a quarter of Bedford's population is over 60 years old, and 17 percent is over 70, which is far higher than the state average.

Much of the public safety radio traffic in Lawrence County is on conventional (non-trunked) frequencies in analog format, including the Sheriff's Department, so there is no need to decode their transmissions. Any scanner capable of tuning to the VHF frequencies listed below should work fine to monitor activity.

Frequency	Description
151.0100	County Highway Department
151.1600	Bedford Parks Department

151.2950	County Emergency Management Agency
151.3775	County EMS (Dispatch)
154.0550	Bedford Fire
154.2350	County Fire (Dispatch)
154.2650	National Fire Mutual Aid
154.2800	National Fire Mutual Aid
154.2950	National Fire Mutual Aid
154.3100	Bedford Fire and Emergency Medical Services (Dispatch)
154.8000	Bedford Police (Encrypted)
154.9500	Sheriff (Operations)
155.0250	County Search and Rescue
155.0700	Bedford Regional Medical Center
155.1300	Indiana Law Enforcement (Statewide)
155.1600	National Search and Rescue
155.2350	Dunn Memorial Hospital Emergency Medical Services
155.2800	Indiana Hospital Emergency Radio Network (IHERN)
155.3400	Indiana Hospital Emergency Radio Network (IHERN)
155.3700	Indiana Law Enforcement (Statewide)
155.4750	Indiana Law Enforcement Emergency Network (ILEEN)
155.5650	Bedford Police (Encrypted)
155.6850	Sheriff (Dispatch)
156.1050	Bedford Street Department
158.7750	Bedford Police (Encrypted)
158.8500	County Jail
159.2250	Department of Natural Resources
159.2400	Department of Natural Resources
159.3450	Department of Natural Resources
159.4050	Department of Natural Resources
159.4350	Department of Natural Resources
161.5500	Sheriff (Tactical)

The unusual exception to the listed frequencies is the Bedford Police Department. According to local reports, the Department encrypts all of their transmissions.

In 2007, Bedford Police began preparations to switch to operation in the 800 MHz band and finally made the transition in early 2009, joining the statewide Project Hoosier SAFE-T network. They experienced a number of problems after the transition, including a complete radio system failure when the community tornado warning sirens were activated in April 2009.

Bedford Police also made the decision to encrypt all of their transmissions, preventing helpful citizens from reporting timely information that could help law enforcement. For a town of less than 14,000 people, such a decision seems unnecessary and shortsighted. It's also counterproductive, since one of the primary purposes of the SAFE-T network was to allow seamless interoperability with other agencies. Encryption makes such cooperation much more difficult.

In 2010 the Bedford Police Department used Federal grant money to purchase ten Kenwood Nexedge 800 radios, which was sufficient to equip half the department fleet.

Although the Bedford Police Department is listed as a participating local agency on the SAFE-T network, the Federal Communications Commission (FCC) license database currently shows 154.800, 155.565, and 159.030 MHz as actively licensed to the Bedford Police Department. These frequencies are used by repeater sites located on the water tank at the corner of 5th and K Streets and at City Hall.

The Project Hoosier SAFE-T system is a Motorola Type II SmartZone network that first went live ten years ago. It serves nearly 50,000 users from hundreds of state and local public safety agencies. The system carries voice activity in both analog and digital formats and can be monitored by any digital-capable scanner, since digital transmissions use the APCO Project 25 standard Common Air Interface (CAI).

There are two SAFE-T repeater sites in Lawrence County, identified in the system as numbers 35 and 522. The first is located in the town of Georgia and transmits on the following frequencies: 851.4875, 852.4875, 852.9875 and 853.4875 MHz. The second site is in Bedford and uses 851.6750, 851.9125, 852.3875, 852.8125 and 853.9625 MHz.

Talkgroups on the system for Lawrence County include the following:

Decimal	Hex	Description
21968	55D	County Emergency Management Agency 1
21984	55E	County Emergency Management Agency 2
21728	54E	County Fire (Dispatch)
21744	54F	County Fireground 1
21760	550	County Fireground 2
21776	551	County Fireground 3
21792	552	County Fireground 4
21872	557	Bedford Regional Medical Center (Dispatch)
21888	558	Bedford Regional Medical Center Operations 1
21904	559	Bedford Regional Medical Center Operations 2
21920	55A	Dunn Memorial Hospital (Dispatch)
21936	55B	Dunn Memorial Hospital Operations 1
21952	55C	Dunn Memorial Hospital Operations 2
21648	549	County Sheriff (Dispatch)
21664	54A	County Sheriff Operations 1
21680	54B	County Sheriff Operations 2
21808	553	Bedford Fire (Dispatch)
21824	554	Bedford Fireground 1
21600	546	Bedford Police (Encrypted)
21616	547	Bedford Police Operations 1
21632	548	Bedford Police Operations 2

❖ Allen County, Indiana

In the northeastern part of Indiana, Allen County and the City of Fort Wayne agreed in May to spend about $17 million on new Motorola equipment and radios. Under the spending plan, the county would purchase $2.9 million worth of radios while the city would spend $5.6 million for their units. The $8.5 million cost of infrastructure, including new software and repeater site equipment, would be split between the two entities.

The current system is Motorola Type II network, meaning the control channel follows the traditional Motorola 3600-baud format. All trunk-tracking scanners understand this format and can follow conversations on the system. However, those conversations may use either analog format or digital P25, so only digital-capable trunk-tracking scanners can hear every conversation (unless they're encrypted as well).

System frequencies are 851.3250, 851.3500, 851.5625, 851.5875, 851.7375, 851.8250, 851.8625, 852.0750, 852.1125, 852.1375, 852.3375, 852.7125, 852.7625, 852.8375, 853.1500, 853.2750, 853.3000, 853.7625 and 853.8375 MHz.

Talkgroups on the system include:

Decimal	Hex	Description
1744	06D	Sheriff (Corrections 1)
1776	06F	Sheriff (Corrections 2)
1872	075	Sheriff (Corrections 3)
8016	1F5	Fort Wayne Fire Alerts
24688	607	Sheriff Tactical 2
24720	609	Sheriff Tactical 3
24752	60B	Sheriff Tactical 4
24784	60D	Sheriff Tactical 5
24816	60F	Sheriff Tactical 6
24848	611	Sheriff Tactical 7
24880	613	Sheriff Tactical 8
25616	641	Sheriff (Dispatch)
25648	643	Sheriff (Records)
25680	645	Sheriff (Car-to-Car)
25712	647	Sheriff (Common)
25744	649	Sheriff (Traffic)
25776	64B	Sheriff (Detectives)
25808	64D	Sheriff (Warrants)
25840	64F	Sheriff (Vice) (Encrypted)
26032	65B	Sheriff (Home Detention)
25936	655	County Animal Control
25968	657	Sheriff (Special Weapons and Tactics)
27216	6A5	Fort Wayne Police (Dispatch Northwest)
27248	6A7	Fort Wayne Police (Car-to-Car Northeast)
27280	6A9	Fort Wayne Police (Dispatch Southwest)
27312	6AB	Fort Wayne Police (Car-to-Car Southeast)
27344	6AD	Fort Wayne Police (Information North)
27376	6AF	Fort Wayne Police Investigations 1
27408	6B1	Fort Wayne Police Investigations 2 (Encrypted)
27472	6B5	Fort Wayne Emergency Services Team 1 (Encrypted)
27504	6B7	Fort Wayne Emergency Services Team 2
27568	6BB	Fort Wayne Police (Records)
27632	6BF	Fort Wayne Police (Car-to-Car 1)
27664	6C1	Fort Wayne Police (Car-to-Car 2)
27856	6CD	Fort Wayne Police (Canines)
28048	6D9	Fort Wayne Parking Enforcement
28208	6E3	Fort Wayne Police (Gang Unit)
28240	6E5	Fort Wayne Police (Information South)
30416	76D	Fort Wayne Fire (Dispatch)
30448	76F	Fort Wayne Fireground 1
30480	771	Fort Wayne Fireground 2
30512	773	Fort Wayne Fireground 3
30544	775	Fort Wayne Fire Prevention
30576	777	Fort Wayne Fire Training
30608	779	Fort Wayne Arson Investigation
30640	77B	Fort Wayne Fire Command 1
30672	77D	Fort Wayne Fire Command 2 (Encrypted)
30704	77F	Fort Wayne Fireground 4
30736	781	Fort Wayne Fireground 5
30768	783	Fort Wayne Fireground 6
30800	785	Fort Wayne Fire Academy
32016	7D1	County Fire (Dispatch)
32176	7DB	County Fireground 1
32208	7DD	County Fireground 2
32240	7DF	County Fireground 3
32464	7ED	County Fire (Northeast)
33744	83D	Airport Operations
35520	8AC	County Fire (Southwest)

That's all for this month. You can get more scanner and radio-related information on my website at **www.signalharbor.com** and I welcome your electronic mail to *danveeneman@monitoringtimes.com*. Until next month, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
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❖ Correction to AC plug wiring answer

In my July column I mistakenly identified the narrow flat blade of an AC plug as neutral; it's actually the wide blade. The narrow blade is hot. In three-wire AC systems, the green wire is ground, the white wire is neutral, and the black wire is hot. Thanks for sharp eyed readers for catching me on this one!

❖ And an oversight

In my short list of services that won't have to narrowband by 2013, I shouldn't have listed railroads. They, too, as FCC Part 90 licensees, are required to go narrowband, and have already started converting. Thanks to sharp-eyed reader J.J. Owens for spotting the error.

Q. *If I were to make a square of four 450-ft wires for a receiving antenna, would I get signals from all four directions equally? And does it matter where I "tap" the antenna? (George Santulli, Lovettsville, VA)*

A. If you make a square antenna like you propose, you've created a horizontal loop, and it's essentially non-directional in its uniform response from all directions.

Staying with 450 feet on a side, you would have an excellent, horizontal-loop, omnidirectional receiving antenna for the AM broadcast band as well as shortwave. The actual formula for this is to divide 1005 by the lowest critical frequency in megahertz to get the total perimeter in feet. This provides a balanced feedpoint impedance of about 450 ohms for 1.8 MHz and higher.

But you are more concerned with the uniform pattern from all directions rather than impedance matching for transmitting. If you want to provide closer impedance matching, you could use a common 4:1 balun transformer (or wind your own 6:1) and run low-loss coax like RG-6/U to it.

You can break the loop to feed it at any point, although it is most commonly fed at one of the corners since that's a physical support point.

Height should be at least 40 feet for best response; the higher, the better. Lower elevation increases ground reflectivity – great for receiving overhead aircraft, but poor for long distance reception!

Q. *Can Earth's shortwave broadcasts be heard from outer space, and have astronauts in orbit ever monitored these broadcasts? (Joe Wood, Greenback, TN).*

A. Yes, signals in the HF spectrum can penetrate the ionosphere and radiate into space depending on solar influences which change throughout the day and night. The higher the frequency, the more likely they escape. We can listen to Jupiter's electrical storms on 20 MHz, and 15.016 MHz SSB was a backup frequency for the Gemini space program. It is unlikely, however, that the astronauts made any attempts to listen to international broadcasters during their busy missions, nor that they had tunable radios with which to do it.

Q. *I would like to use two shortwave receivers at the same time on the same antenna; will a standard TV splitter allow this without losing signal strength? (Bill Von Wida, email)*

A. Absolutely. You will lose about 3 dB since you are splitting the signal in half, but you won't notice it in listening.

Q. *I've installed an outdoor wire antenna, but I'm concerned about grounding. Just what do I need to do and where to I connect it? (Dave Scheffler, email)*

A. In the radio lexicon, there are several meanings for "grounding." One refers to a common connection for all components that need to be eventually tied together, and that's usually the radio chassis and includes the negative power connection.

Another refers to actual earth ground. This is for two reasons: To provide a complete radio-frequency antenna system using the earth as part of the system, and to make sure there are no AC hum components to interfere with reception.

When your radio room is high above the earth, it's hard to get any antenna system improvement because of the wavelength issue – the common signals should be in phase to be zero in voltage difference. But neutralizing the hum voltage and other electrical interference from power lines and nearby accessories is still a possibility.

A good earth ground consists of at least one 8-ft metal pipe in moist earth; better, two pipes separated by several feet). The ground wire going down from your radio's chassis or coax connector (shielding) should be large, like coax braid or heavy-duty braided wire.

Even so, noise reduction isn't guaranteed; it's a hit and miss proposition, but you are always better off with the ground than without it, even if only for shock protection.

Q. *As a youth I remember that a drug store had a tube tester with many different sockets in which to insert a vacuum tube. Can you enlighten me on what these were? (Mark Burns, Terre Haute, IN)*

A. Indeed I can; I even owned one! These were very simple and strictly tested cathode emission to the plate of the tube (electrons migrating from the filament-heated cathode to the positive plate). They could also test for shorts, but they were not what is known as dynamic tube testers (transconductance or mutual conductance) that actually did in-circuit emulation using the grid(s) as well as the cathode and plate.

Rather than requiring the customer to complicate the procedure by turning switches to different positions for a given socket as different types of tubes were inserted, the manufacturer provided enough prewired sockets to anticipate the pin-out of just about every tube on the market.

Q. *I have heard that NASA keeps an eye on every piece of "space junk" that orbits the earth. Is this true and, if so, how do they do it? (Mark Burns, Terre Haute, IN)*

A. Orbital space debris, which includes everything from particles and paint chips up to satellites, numbers in the tens of millions. Keeping track of all this is not NASA, nor is it NORAD. That job falls to the Joint Space Operations Center of the U.S. Strategic Command at Vandenberg Air Force Base, through the Space Surveillance Network (SSM), a global network of 29 space surveillance sensors that include military and civilian radar and optical telescopes used to observe these objects. SSN makes up to 420,000 observations each day.

So far as how many pieces are currently being tracked – those pieces as small as a couple of inches and as large as three feet – the most recent quote I've seen is 22,000 individual.

Other, more sensitive radars are being developed, but particles smaller than those now tracked are considered relatively harmless against the rubber bumpers on the International Space Station (ISS). Even so, these tiny particles travel at a velocity of up to 17,500 miles per hour – more than 20 times the speed of sound! Depending on size, the impacts can be consequential.

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

UTILITY WORLD

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Dutch Spy Bust Fuels New "Numbers" Intrigue

The timing of changes in Russian "numbers" broadcasts continues to reinforce the common theory as to what they are about: Indeed, they are for spies.

When we left off this particular story, members of ENIGMA 2000, the online incarnation of the European Numbers Information Gathering and Monitoring Association, were tracking a specific schedule. It was designated "XPA b" on their list of these mysterious broadcasts.

XPA b is thought to come from the SVR, a Russian foreign intelligence service. It had gone to null messages (one group of zeroes) on October 20, 2011.

This change came only two days after the rather dramatic arrest of a German couple. As the story goes, police broke down their door while they were receiving this station and decoding it on their computer. Investigation linked them to the same United States sleeper cell whose exposure made Anna Chapman into a media phenomenon.

As we know, the attractive Chapman and nine others were subsequently sent back to Russia in a diplomatic exchange. She is still promoting her Mata Hari image there, with jobs in modeling and television, not to mention an action figure on **www.HeroBuilders.com**.

Last year, Paul Beaumont of ENIGMA contacted this column offering an explanation which connected the German arrests with the XPA b changes. He also predicted that, if the responsible Russian intelligence agency ran true to form, it would continue with the null messages for some months, and then vanish. Sure enough, on June 7, 2012, it did just that. Nothing has been heard since.

That's mildly interesting, for hard core utility fans, but it gets much better.

❖ Raymond P

We pick up our story on March 31, 2012. This is the date of a story in *Telegraaf*, a Dutch newspaper, which describes one "Raymond P," a well-traveled employee of the Dutch foreign ministry. He had been picked up on suspicion of laundering money. He had a Glock handgun and a large sum of cash in his possession.

Subsequent news accounts in April describe the assertion of a prosecutor in The Hague that "Raymond P" was one Raymond Poeteray. He was subsequently accused of passing hundreds of classified documents to that same German couple arrested last October.

Poeteray had the usual sensitive material on his computer. Russian intelligence had allegedly just paid him 90,000 Euros for his services. Various other accusations indicate that Mr. P was probably not a very nice man at all. And yes, the prosecutors linked him to the Chapman cell.

Paul Beaumont has once again contacted this column, with the very credible theory that another XPA b behavior was linked to all this. It seems that, in the long string of null messages, two that did have content stand out. They were sent on October 25th and 27th of last year, presumably to give Poeteray his instructions.

After Mr. P's arrest, another Russian number schedule vanished from the air. This one is designated E06, one of Russian intelligence's gaggle of English broadcasts using the same machine-generated format as those in several other languages.

E06, also known as The English Man, sent the last broadcasts of this particular weekend schedule on June 16. The frequencies, which changed monthly, had been 7608 and 8142 kilohertz (kHz), at 0030 Saturday and 0130 Sunday, with a repeat an hour later on both days. (All times in this column are UTC - Coordinated Universal Time.) Signal strength was high in Western Europe, suggesting a beam in that direction.

Beaumont notes that E06 slots have vanished before. The last time it happened was after the former head of Estonia's National Security Authority had been picked up as a Russian spy. Soon after, the E06 schedule on Sunday at 1830 and 1930 UTC had vanished.

This episode of our continuing narrative ends with the publication of a news item dated June 27, 2012 in *The Moscow Times*. It reports Mr. P's arrest as if it had just happened, complete with a large photo of the attractive Ms. Chapman. It is not known why this publication took three months to run the story. Perhaps the news had been embargoed until their country's intelligence service was done doing the damage control suggested by these numbers station changes.

As always, this column thanks Paul and ENIGMA 2000 for their valuable assistance in sorting all this out.

❖ Are "Numbers" Obsolete?

Comments on a web site reporting this story have once again raised the question of whether the numbers broadcasts, or radio in general, are needed any more. After all, we are now in an age when everyone in industrial countries carries global information sharing capacity around with them.

In fact, spies already use computers, and they always will. However, don't rule out the traditional "one-time pad" system used by the numbers broadcasts. It is still the most secure system known, as long as everyone follows the proper procedures.

An interesting paper by Dirk Rijmenants, called *Cuban Agent Communications: Failure of a Perfect System* addresses this issue. It cites several provocative Cuban spy arrests in the United States, and how these were facilitated by various lapses in their communications system.

Most of these failures were caused by attempts to render the traditional system less tedious by putting various procedures onto computers. Perhaps the digital modulation coming from Cuba's "SK01" station was part of all this.

Obviously, these mistakes were fortunate for the national security of the United States. However, they were very unfortunate for those who, to quote the paper's conclusions, showed "how you can turn a perfectly secure pencil-and-paper encryption scheme into an insecure computer application."

And this is not even addressing the issues raised by the tendency of computers to leave data in all manner of inconvenient places, making the receivers of messages easier to identify. In the case of radio, the transmitters are easy to locate, but finding the receivers is vastly harder.

It will be interesting to see if other agencies try to fix things that were never really broken.

❖ USCG Discontinues Telex

For years, the United States Coast Guard communications station NRV, in Guam, had been the service's last holdout for traditional, on-demand, ship telex using Simplex Teleprinting Over Radio, mode A (SITOR-A). This mode

is easily recognizable on-air from its screechy burst markers with a Morse code station identification, and its chirp-chirp-chirp sound when passing traffic.

Most large vessels, including Coast Guard cutters, now use various satellite systems for this. And so, on March 31 at 2359 UTC, the service stopped. Ships can no longer use NRV's automated menus to send such traffic as AMVERs (positions for the Automated Mutual-Assistance Vessel Rescue System), or OBS (formatted weather observations from participating vessels). However, the remaining commercial stations will still take these for free.

Interestingly, as of July 2012, NRV is still sending markers with this call sign on their usual frequencies. Mario Filippi has confirmed 8422.0 kHz, and this editor hears 16812.5 and 22382.0 daily. This leaves only 12579.0 and 12585.0 as unconfirmed.

Despite recent ownership changes, ShipCom LLC still accepts SITOR-A traffic on its many frequencies at WLO (Mobile, AL), and KLB (Seattle, WA). Also, other Coast Guard services such as weather and radiofax are unaffected.

❖ CODAR Chaos May Diminish

CODAR stands for Coastal Ocean Dynamics Applications Radar. It was developed in the 1970s by the US National Oceanic and Atmospheric Administration (NOAA) for the accurate real time mapping of sea waves and surface currents.

Since then, several other uses have been found for this technology. A private company, also known as CODAR, offers a whole line of SeaSondes and RiverSondes. Agencies have also shown some interest in its use for coastal surveillance.

For reasons relating to the physics involved, these radars operate in the high frequency (HF) band, around 5, 12, and 25 megahertz (MHz). They produce a distinctive pweeng, pweeng, pweeng sound, often sweeping out 25 to 50 kHz. While the power used is quite low, signals can still be loud. Those who have tried hunting weak utilities at night around 4.5 MHz may be all too aware of this situation.

While HF sea surface radar is here to stay, order may finally be coming to its licensing and spectrum management. The International Telecommunications Union (ITU) has published its new frequencies and regulations for these radars.

Here are the new bands (in kHz): 4438-4488, 5250-5275, 9305-9355, 13450-13550, 16100-16200, 24450-24650, 26200-26420, and three bands above 30 MHz. The exact status of these allocations will vary between ITU regions and even some specific countries, the way it always does.

It is extremely likely that the 50-kHz bands below 10 MHz will be divided into two 25-kHz ranges, allowing more radars to co-exist while also restricting their sweep ranges. The higher 100-kHz bands will probably be split into 50-kHz channels.

Finally, it will become possible to DX these radars. They will be required to identify in the International Morse Code every 20 minutes.

As with all ITU decisions, nothing will happen overnight. Expect a period of months to years for the transition. After that, expect less chaos.

ABBREVIATIONS USED IN THIS COLUMN

AFB..... Air Force Base
ALE..... Automatic Link Establishment
AWACS..... Airborne Warning and Control System
CAMSLANT..... Communications Area Master Station, Atlantic
COTHEN..... US Customs Over-The-Horizon Enforcement Network
CW..... On-off keyed "Continuous Wave" Morse telegraphy
DHFCS..... UK Defence High-Frequency Communications System
DSC..... Digital Selective Calling
EAM..... Emergency Action Message
FAX..... Radiofacsimile
FEMA..... US Federal Emergency Management Agency
FSK..... Frequency-Shift Keying
HFDL..... High-Frequency Data Link
HFGCS..... High-Frequency Global Communications System
LDOC..... Long-Distance Operational Control
M12..... Russian CW "numbers"
M89..... Chinese military CW coded call signs
MARS..... US Military Auxiliary Radio System
MX..... Generic for Russian single-letter beacons/markers
NASA..... US National Aeronautics and Space Administration
NATO..... North Atlantic Treaty Organization
NCS..... US National Communications System
PACTOR..... Packet Teleprinting Over Radio, modes I-IV
PSK..... Phase-Shift Keying
RTTY..... Radio Teletype
Selcal..... Selective Calling
SHARES..... SHAred RESources, US Federal interagency freq 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
V13..... Taiwan "New Star," music and numbers in Chinese
VC01..... Robotic "Voice Chip" Chinese numbers
Volmet..... Scheduled, formatted, aviation weather broadcasts
XPA..... Russian Intelligence, tone-coded numbers messages
WMD-CST..... US Weapons of Mass Destruction Civil Support Team

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 ().

3176.0 LOR-Argentine Navy, Puerto Belgrano, RTTY weather in Spanish, at 0038 (Mario Filippi-NJ).

4149.0 WPE Jacksonville-Crowley Marine, FL, getting status of tugboat Navigator, at 0457. Similar check-ins with Crowley tugs WBN 6511 at 0459, Seahorse at 0501, Ranger at 0505, WBN 4382 at 0509, and Sea Breeze at 0511 (Allan Stern-FL).

4553.5 ZLST-German Customs Control Center, Cuxhaven, calling ZKNI, patrol boat Kniepsand, ALE at 0751 (Michel Lacroix-France).

4594.0 4XZ-Israeli Navy, CW message in 5-letter groups, parallel on 6608, similar on 6830, at 0212 (Filippi-NJ).

4945.0 EPA-Unknown Canadian station, sending random multi-frequency dialing tones and periodically identifying, "This is EPA, Vancouver, testing," at 0409 (Hugh Stegman-CA).

5505.0 Shannon Volmet, Ireland, aviation weather for several European airports, at 0023 (Filippi-NJ).

6577.0 American 94-Flight making a selcal check with an unknown ground station on the Caribbean air control net, at 0010 (Filippi-NJ).

6640.0 New York LDOC, patching Air Transat 610 to company for a long maintenance discussion, mostly in an unknown language *[French? -Hugh]* with some English error messages, at 0535 (Stern-FL).

6699.9 Veilleur-French Air Force command center, Taverny, working Cyrano, Avord AWACS, at 1251 (Lacroix-France).

6738.0 Top Rider-US military Skymaster exercise, many EAMs, some very long, simulcast on at least 8992, 11175, and 15015 HFGCS; then "standing by for traffic," at 0030 (Hugh Stegman-CA).

6826.0 FAV-French military Morse code training, CW drill messages at 0844 (Lacroix-France).

6840.0 NYZ-Auto-generated call of Chinese military CW marker (M89), calling Q2M, parallel 10640, at 1020 (Ary Boender-Hong Kong Remote).

6846.0 VMSZ-Russian military, passing CW message in Russian Morse to collective call JFQ2, then getting rogers from BWSA, 9P1X, and IJ7I, at 2050 (MPJ-UK).

6853.0 FAV-French Morse code training (M51), Favières, CW drill message in 5-letter groups at 2048 (MPJ-UK).

6949.0 M51, different CW drill message from one on 6853, at 2035 (MPJ-UK).

6985.0 BULLTOC-US military Tactical Operations Center, calling PALADIN6, BULL1, BULL2, and BULL3; ALE at 1521 (Jack Metcalfe-KY).

7527.0 708-USCG HC-130H #1708, ALE sounding on COTHEN, at 0613 (MDMonitor-MD).

7739.0 Unid-Chinese Robot (VC01), fast machine voice at 0811 and 1023 (Boender-Hong Kong).

8414.5 9V8312-Singapore flag tanker *Maersk Hakone*, DSC safety test with Vung Tau, Vietnam, at 1828. C6LO4-Bahamas flag Multipurpose Offshore Vessel *Dynamic Installer*, DSC safety test with Cape Town, South Africa, at 1843 (MPJ-UK).

8422.0 NRV-USCG, Guam, CW identifier in SITOR-A sync marker, at 1205 (Filippi-NJ). *[USCG dropped its last telex services in March, but these freqs stayed up. -Hugh]*

8425.0 XSG-Shanghai Radio, China, CW identifier in SITOR-A sync bursts, at 1948 (MPJ-UK).

8438.3 KSM-Maritime Radio Historical Society, Pt. Reyes National Seashore, CA, usual CW marker stopping abruptly for hand sent version with distinctive semiautomatic "bug" sound, simulkeying 12993.0, at 1940 (Stegman-CA).

8473.0 WLO-ShipCom, AL, RTTY international news at 1108 (Filippi-NJ).

8502.0 NMN-USCG CAMSLANT Chesapeake, VA, "Iron Mike" voice-synthesized weather, at 1007 (Filippi-NJ).

8886.0 G-VOGE-Virgin Atlantic A340 "Cover Girl," flight VS0201, HFDL log-on with Krasnoyarsk, Russia, at 1948 (MPJ-UK).

8888.0 Syktyvkar Volmet, male voice in Russian with aviation weather, off at 1934 (MPJ-UK).

8912.0 LNT-USCG CAMSLANT, VA, raising 718 (USCG HC-130H #1718) in ALE, then in voice asking Coast Guard 1718 to call MH-60J helicopter Coast Guard 6036 on a search for a drifting barge, at 1149 (MDMonitor-MD).

8977.0 ZS-SNC-South African Airways A340, flight SA0265, HFDL log-on with Reykjavik, Iceland, at 2102 (MPJ-UK).

8992.0 Ali Baba-US military, likely airborne command post, with 3 EAMs and then "standing by for traffic," at 0010 (Jeff Haverlah-TX).

9014.0 Unid-Possible Spanish Air Force flight, getting weather from unknown ground station, at 0801 (Lacroix-France).

9025.0 OFF-USAF, Offutt AFB, NE, raised HIK (Hickam AFB, HI) in ALE, then voice radio checks at 1125 (MDMonitor-MD).

9106.0 WWLNNN-US Navy/Marine Corps MARS station NNN0WWL, NJ, ALE sounding at 0220. RGI-Saudi Arabian military, calling JDI; also on 9117, 9160, 9176, 9199, 10333, 10366, and 10384; ALE at 1906 (PPA-Netherlands).

9110.0 NMF-USCG, Boston, MA, FAX text of request for comments, at 0311 (PPA-Netherlands).

9124.5 HLNI-Russian military, control of CW duplex net with NPHL and SO8O, similar on 10310, at 0332 (PPA-Netherlands).

9134.0 4IZ4-Russian military tactical call sign, typical CW marker calling YR8A with traffic; similar on 9149, 10362, 10394, and 12593; at 0454 (PPA-Netherlands).

9145.0 RIW-Russian Navy headquarters, Moscow, working RGR35, CW at 0238 (PPA-Netherlands).

9157.0 HEC-Bern Radio, Switzerland, hexadecimal identifier "CC" in Globe Wireless data marker, also on 10341, at 0522 (PPA-Netherlands).

9165.0 HLL-Korean weather office, Seoul, noisy FAX weather chart at 1830 (PPA-Netherlands).

9176.0 Unid-Russian Intelligence (M12), CW callup 257 257 257 1, then message in 5-figure groups with no repeat, ended TTT TTT (cut zero), at 1900 (PPA-Netherlands).

9182.0 L02-Chinese military, calling A96, also on 13241, 13422, and 13438.5, ALE at 1833 (PPA-Netherlands).

9200.0 2011-Moroccan Internal Security control station, calling 2519, ALE at 2009 (MPJ-UK).

9276.0 New Star Radio Station (V13)-Program 3, musical intro and coded messages in live female voice, at 0700 and 0800 (Boender-Hong Kong).

10000.0 Italcable Radio-Italian amateur AM experimental time station, beep and announcement in Italian 7 seconds before each minute, at 0831 (Lacroix-France).

10075.0 VH-OQE-Qantas Airbus A380 "Lawrence Hargrave," flight QFA1, HFDL position for Al-Muharraq, Bahrain, at 1907 (MPJ-UK).

10093.0 "09"-HFDL ground station, Barrow, AK, squitters and working Polar Air Cargo flight PO0214, at 0430 (Stegman-CA).

10242.0 N03-USCG HC-144A #2303, calling Z16 (probably USCG Sector Mobile, AL), on COTHEN at 1449 (MDMonitor-MD).

10300.0 CM3-Algerian military command, Bechar, calling COF, ALE at 1910 (PPA-Netherlands).

10313.0 Unid-French Intelligence Morse training, Favières, CW drill message in 5-letter groups, at 1810 (PPA-Netherlands).

10315.0 DHN66-NATO, Geilenkirchen, Germany, working Magic 52 (E-3 AWACS back end), regarding reception of RTTY traffic, at 1904 (PPA-Netherlands).

10321.0 NJT-21st WMD-CST, NJ, calling CA3, WMD-CST in CA, ALE at 2202 (Metcalfe-KY).

10329.0 DG2089-German pleasure boat *Paso Doble*, working Sailmail in Chiriqui, Panama in PACTOR-III, at 0516 (PPA-Netherlands).

10343.0 Unid-M12, CW callup 124 124 124 1, then message header 5504 65, and message in 5-figure groups ending 000 000, at 1801 (PPA-Netherlands).

10344.5 XJD-UK DHFCS mobile, calling XSS, control in Forest Moor, UK; also on 11208, 11217, 11223, and 11241; ALE at 1728 (PPA-Netherlands).

10360.0 SAB-Goteborg Radio, Sweden, hexadecimal identifier DE in Globe data marker, at 1617 (PPA-Netherlands).

10379.4 A96-Chinese military, raised L03 in ALE, then data modem traffic, at 1754 (PPA-Netherlands).

10390.0 1303-Moroccan Police, ALE sounding, many other calls also copied, at 0421 (PPA-Netherlands).

10585.0 NJT-21st WMD-CST, NJ, ALE and ALE text with FC8FEM001006, unknown FEMA Region 8 entity using 3rd-generation long address, also on 12212, at 2113 (Metcalfe-KY).

10588.0 FR5FEM-FEMA Region 5, MI, testing their new ALE chat with text message, "FR5FEM SAYS: ^ WGY912 :THIS IS WGY 905 CHAT CHECK ?" at 1449 (MDMonitor-MD). *[WGY 912 is FEMA Emergency Center, deep inside Mt. Weather in VA. -Hugh]* WGY 907-FEMA Region 7, MO, voice patch to WGY 908, Region 8, CO, at 1605 (Metcalfe-KY).

11111.0 STAT21-Tunisia National Guard, working TUD, ALE at 0817 (Lacroix-France).

11175.0 Top Rider-US military, gave 3 EAMs (prefixes PAUUA3, PA536C, and PA6IA6), then by for traffic at 0127. Jane (sounds like)-same three EAMs and by for traffic at 0136. Ali Baba, same 3 EAMs and by for traffic at 0146. Top Rider, same 3 EAMs and by for traffic at 0156 (Stegman-CA). N323BD-Gulfstream GV-SP bizjet, users unknown, given a radio check by Puerto Rico HFGCS, at 0238 (Stern-FL). Andrews-USAF HF-GCS control station, multi-transmitter Skyking message "6JG," at 1732 (PPA-Netherlands).

11176.0 Reach 579-USAF transport, calling Mainsail (any station), at 0730 (PPA-Netherlands). *[The frequency changed 19 years ago. -Hugh]*

11181.0 DL0005DAT-USAF E-3C Sentry #83-0005, an AWACS, ALE sounding at 0430 (PPA-Netherlands).

11184.0 5Y-KYF-Kenya Airways B737, flight KQ0511, HFDL position for Reykjavik, at 1905 (MPJ-UK).

11190.0 EP-IAD-Iran Air B747-SP86, selcal check with "Charlie Charlie" (company LDOC in Tehran), at 2020 (PPA-Netherlands).

11193.0 Moscow LDOC, Russia, selcal check FK-HJ with Transaero Airlines EI-XLG, a B747, at 0433 (PPA-Netherlands).

11205.0 Ascot 3669-UK Royal Air Force transport, calling Tascomm flight watch, also on 11217, at 2044 (PPA-Netherlands).

11217.0 GAF 163-German Air Force aircraft, calling DHM 91, also on 11265, at 1819 (PPA-Netherlands).

11220.0 Ascension-USAF, Wideawake Field, Ascension Island, calling Lajes, Azores, at 2023 (PPA-Netherlands). Offutt-USAF HFGCS, Offutt AFB, NE, attempting a secure patch with Air Mobility Command transport Reach 253, went to 12093, back to 11220, then tried 12109, all starting at 2105 (Stern-FL).

11232.0 Trenton Military-Canadian Forces, passing airfield weather to Canforce 4004, at 1809 (PPA-Netherlands).

11253.0 GQF-RAF Volmet, Inskip, aviation weather at 0812 (PPA-Netherlands).

11256.0 ETH701-Ethiopian Airlines flight ET701, a B767 reg ET-ANU, reporting delay to Holloway LDOC, Addis Ababa, at 2045 (PPA-Netherlands).

11318.0 Syktyvkar Volmet, identifying in Russian at 0733 (Lacroix-France).

11348.0 N419MC-Atlas Air B747-48EF freighter, flight 5Y0616, HFDL position for Canarias, at 2008 (MPJ-UK).

11430.0 New Star (V13), in progress at 0514, 0610, and 1300 (Boender-Hong Kong).

11494.0 LNT-CAMSLANT, calling 001 (USCG HC-130J #2001), ALE on COTHEN, at 1600. LNT, calling F04 (USCG HU-25C+ # 2104), ALE at 1635 (MDMonitor-MD).

12087.0 N010HN-US National Guard, NH, calling N011HNEMERGEN, also NH National Guard, ALE at 1756 (Metcalfe-KY).

12109.0 Offutt, came from 12220 with Reach 253, went secure and did the patch, at 2115 (Stern-FL).

12160.0 H401-Moroccan military, calling C3, ALE at 0750 (Lacroix-France).

12222.0 Z19-USCG Sector Corpus Christi, TX, calling F05 (USCG HU-25D Falcon Jet #2105), at 0016 (MDMonitor-MD).

12353.0 WPE Jacksonville-Crowley Marine, getting status of a vessel at 2210 (Stern-FL).

12431.0 GWPWN33-Brazilian Navy, Natal calling GWPWSB and GWPWAE, also on 12437, ALE at 0851 (Lacroix-France). CAGLIARI-Italian Financial Police, Cagliari, working LOMBARDI, Coast Guard Patrol Boat *Lombardi*, at 1436 (MPJ-UK).

12577.0 ZCDQ5-Bermuda flag cargo vessel *Cala Pira*, setting up call on 12990 simplex with ZCDQ4, cargo vessel *Cala Paradiso*, DSC at 1804 (MPJ-UK).

12637.5 XSG-Shanghai Radio, China, CW marker at 1543 (Lacroix-France).

12750.0 CWA-Cerrito Radio, Uruguay, CW weather observations in Spanish, at 0019 (Filippi-NJ).

12843.0 HLO-Seoul Radio, Korea, weak CW marker at 1027 (Filippi-NJ).

13110.0 WLO-ShipCom, AL, "female" voice-synthesized weather for Caribbean and Bahamas, at 1112. WLO, voice announcing traffic for vessel Avenger, parallel on 13152, at 1304 (Filippi-NJ).

13270.0 B-6076-Air China A330, flight CCA940, HFDL position for Hat Yai, Thailand, at 1934 (MPJ-UK).

13427.1 Unid-Russian Polytone (XPA2), multiple FSK tone coded message in 5-figure groups, at 1910 (PPA-Netherlands).

13446.0 FC0FEM-FEMA Region 10, WA, ALE sounding at 0441. FC6FEM, Region 6, TX, sounding at 0457. FC4FEM, Region 4, GA, sounding at 0459 (PPA-Netherlands).

13528.0 "C"-Russian Navy cluster beacon (MX), Moscow, CW identifier at 0009 (Filippi-NJ).

13528.4 "M"-Russian Navy CW cluster beacon (MX), Magadan, at 1305 (Boender-Hong Kong).

13927.0 AFA5QW-USAF MARS, IN, working (unintelligible) 42, self-identified as a U-2, at 1815. Evac 626-Probable partial call of a USAF Air Evac mission, looking for a patch with USAF MARS AFA6GG (TX), AFA4QK (TN), and then AFA9AY, CA; at 2140 (Stern-FL).

14396.5 NCS 202-NCS, FL, controlling SHARES Region IV weekly net; checking in AAR0NM (US Army MARS), NNN0MB (US Navy/ Marine Corps MARS), and NCS 312 (NCS), at 1500 (MDMonitor-MD).

14411.0 RDL-Russian military strategic broadcast, many short, coded messages in FSK Morse, at 1349 (MPJ-UK).

14452.5 CIW650-Canadian Forces Affiliate Radio System, net with 327, 444, and 624; at 1648 (Metcalfe-KY).

14455.0 KHA946-NASA Michoud Assembly Facility, LA; weekly net with KHA925, Johnson Space Center, TX; and KHA959, NASA Wallops Island Flight Facility, VA; at 1635 (Metcalfe-KY).

14484.0 Desert Eagle-Probable US Army MARS control station in southwestern US, radio check with Showdown 393, exercise or net call for another MARS station, at 1515 (MDMonitor-MD). *[All these "Showdowns" and the other western-movie call signs appear to be a new MARS emergency net with government and military agencies. -Hugh]*

15867.0 Z01-USCG Sector Northern New England, calling F35 (USCG Falcon Jet #2135), ALE on COTHEN, at 1839 (MDMonitor-MD).

16402.0 ABA-Maltese Navy squadron headquarters, Hay Wharf, ALE text message for AB2, Patrol Boat P-22, at 1431 (MPJ-UK).

16806.5 NMF-USCG comm station, Boston, weather in SITOR-B at 1632 (Lacroix-France)

17478.5 NJT-21st WMD-CST, NJ, calling DTRA1, Defense Threat Reduction Agency, VA, at 2016 (Metcalfe-KY).

17928.0 "16"-HFDL ground station, Canarias, Canary Islands, loud squitters but no traffic, at 2057 (MPJ-UK).

17967.0 VP-BRX-Aeroflot A320, flight SU1530, HFDL log-on with Al-Muharraq, at 2004 (MPJ-UK).

26374.7 Unid-"Freeband" AM chatter in Spanish, with whistles, distorted music, recorded horse neigh, and other bizarre electronic sounds, at 2208 (Stegman-CA).

DIGITAL DIGEST

DIGITAL MODES ON HF

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Digital Spotlight on Brazil

This month we take a look at various digital signals from this large South American country that can be heard up and down the shortwave bands.

❖ Navy

Probably the most widely and regularly heard inhabitant of the HF bands is the Brazilian Navy (Marinho do Brasil) which operates a large fleet of warships on the high seas in addition to various smaller vessels that serve on large rivers and estuaries, most notably, the Amazon. Their Naval Air Arm also operates more than 80 aircraft made up of A1F Skykings and various helicopters.

❖ High Seas Fleet

The Brazilian high seas fleet consists of 1 aircraft carrier, 9 frigates, 5 submarines, 4 landing ships, 5 corvettes, 2 tankers and a couple of training ships including the sailing ship *Cisne Branco*. With such a large expanse of coastline and open ocean to survey, the Brazilian Navy operates 14 hydrographic vessels including the icebreaker *Almirante Maximiano*. Naval bases, together with their ITU callsigns, are located at:

Rio de Janeiro (PWZ33)
Natal (PWN33)
Belem (PWB33)
Fortaleza (PWF33)
Brasilia (Armed Forces HQ) (PWX33)

Throughout the day and night, you can hear these bases communicating with vessels using MIL-188-141A ALE and occasionally with MIL-188-110A high speed modem data. The data is often carried in the clear using 7N1 ASCII coding after the ALE AMD text string "FAXDATA OK" is sent.

Callsigns are always prefixed with "GW" (gateway?) followed by the ITU callsign of the base or the ITU ship callsign: for example, GWPWSB for the landing ship *Almirante Saboia* or GWPWBO for the frigate *Bosisio*.

Frequencies on which you can hear the high seas fleet include: 4303, 6275, 6298.5, 6412, 6510, 8310, 8422.5, 8584, 8624, 10914, 10914.5, 11010, 11481, 11498, 12254, 12370, 12431, 12437, 12725, 13101, 14780, 15932, 16408, 16607, 16623.5, 16954, 17010, 17398, 18872.5, 19709, 22168 & 22843 kHz USB

Although not heard for some time now – probably due being superseded by high speed modems – the Brazilians also made extensive use of SITOR-B, using unusual 400Hz and 850Hz tone shifts (and later PacTOR-I FEC) to transmit long hexadecimal encrypted messages that are headed "TOUROS DE WINDOWS". Perhaps they are still used some of the time? These messages have been heard on the following channels: 8304.2, 8403.2, 8623, 9261, 11505.2, 12170, 12256, 12256.2, 12566.7, 16232.9 and 16982.4 kHz (center of data).

Here is an example "TOUROS" message:

TOUROS FOR WINDOWS 2.0
XSYTGV073DEUSS8BOJ,SBV6
P
192300Z/SET/10
13
JUAFSE RALTZW
0
1204
A7AAA10F696C90C35FF46BE6B3A8C1C8499FF-865D98413A06DF99CAC396EF03FA769
(etc, etc) 5026BC7AE1BFA87BA0741C26006F4C3B8C1EB-818DB307077
BT

NNNN

Note that operator chatter and call-ups using Baudot RTTY or SITOR-B usually use just the last two letters of the station identifiers. For example, PWF33 is shortened to "WF" and PWBO to "BO".

❖ Riverine Fleet

The riverine fleet consists of more than 20 small patrol vessels, 5 oilers, 1 monitor and 5 hospital ships. Unusually, most of the activity among these vessels is with GTOR and takes place on 8623, 8630.2, 9255.2, 11505.2 and 12256.2 kHz (center of data). Note that this network does not use the usual "GW" set of six letter identifiers instead preferring its own NPF (Naval Patrol Fluvial) prefix for vessels such as:

NPFRRM	Patrol ship *Roraima*
NPFAMP	Patrol ship *Amapa*
NPFRTV	Patrol ship *Raposo Tavares*
ESNVNG	Rivernine Naval Base Rio Negra

❖ Navigation and Weather

The naval base in Rio also provides regular navigation and meteorological information, in both English and Portuguese, using PacTOR-I's FEC (Forward Error Correction) broadcast mode, which can be heard on the following frequencies: 6244, 6450, 8570, 8582, 12711, 16975, 16984, 19707 and 22475.6 kHz (center of data)

Rio has also been noted using Fax on 16980.4 kHz (center of data) and meteorological data using 75bd/850Hz Baudot RTTY on 6450, 12710.5, 16976 and 22475.5 kHz (center of data). Here's the typical call-up string sent by Rio when starting met or nav reports using RTTY or PacTOR-I FEC:

CQ CQ CQ DE PWZ-33 PWZ-33 PWZ-33 Z Z Z
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
SGSGSGSGSGSGSGSGSGSGSGSGSGSGSGSGSG34567890
0987654321 1234567890 0987654321
TEST THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG

❖ Air Force

The Brazilian Air Force or FAB (Força Aérea Brasilia) was formed with the integration of the Naval (see above) and Army air arms and operates from some twenty air bases dotted around the country. Aside from typical air defense operations, the FAB has also been busy of late fighting drug trafficking and production taking place in remote parts of the Brazilian jungle. The FAB operates a mixed set of aircraft from the Embraer R99 for AWACS, P3 Orion for submarine hunting, Mirage jet fighters, the Tucano and Super Tucano prop-driven fighter-bombers and various helicopters.

Like the Navy, most Air Force activity is heard using MIL-188-141A ALE, on the channels listed below, but pilots and bases often use voice after making contact with ALE: 6709, 7929, 8834, 9010, 11271, 12070, 13224, 13586, 13972, 13975, 13978, 16355 & 17982 kHz USB

CANIBAL	**Air Transport Command, Rio**
CERRADO	**UNID**
ESCORPIAO	**1st Squadron, 3rd Group, Boa Vista**
FAB1	**HQ Rio**
HERMES	**HQ Brasilia**
INDIAVICTOR	**Special Inspection Group, Rio**
JUPITER	**UNID**
OM1EG	**UNID**
OMEGA	**UNID**
ORUNGAN	**1st Squadron, 7th Group, Salvador**
RS1, 2	**UNID, possibly Rio Grande do Sul bases**
SA2, 3, 5	**UNID**
SARBR	**Search & Rescue Coordination Center, Brasilia**
SARCT	**Search & Rescue Coordination Center, Curitiba**
SARMN	**Search & Rescue Coordination Center, Manaus**
SARPV	**Search & Rescue Coordination Center, Porto Velho**
SARRF	**Search & Rescue Coordination Center, Recife**
SARRJ	**Search & Rescue Coordination Center, Rio**
SCORPIUS	**1st Squadron, 3rd Group, Boa Vista**
SFAMN	**Manaus AFB**

❖ Army

The Brazilian Army comprises more than 220,000 soldiers and is organized in 12 military regions, each covering one or more states, with headquarters in the federal capital of Brasilia.

The same state-based identifiers have been used by the Army over many years, first using AX.25 Packet Radio and SITOR-B, and more recently with MIL-188-141A ALE and 110A high speed modem, over which encrypted messages are sent.

In a very recent development, a number of channels appear to be using a 5 digit identifier, like "00013" or "11011". In these cases, AMD texts like "000*5066**D" are usually sent between stations, perhaps indicating how many STANAG5066 messages are awaiting transmission or delivery. Here are the Army channels:

6933, 7602, 7850, 8035, 8045, 9059, 10711, 11452, 11530, 12132, 13490, 13492, 13942, 14582, 14600, 14752, 16090, 16333, 16336, 16345, 18172, 18218, 19677, 20300 and 20535 kHz USB

The identifiers heard are as follows (note that suffixes of 2 to 9 have also been heard with many of these IDs):

AM1	**Amazonas (Manaus)**
BA1	**Bahia (Salvador)**
BR1	**HQ Brasilia**
CE1	**Ceara (Fortaleza)**
ES1	**Espirito Santo**
MG1	**Minas Grande (Belo Horizonte)**
MS1	**Matto Grosso do Sul (Campo Grande)**
PA1	**Para (Belem)**
PE1	**Pernambuco (Recife)**
PR1	**Parana (Curitiba)**
RJ1	**Rio de Janeiro**
RS1	**Rio Grande do Sul (Porto Alegre)**
SP1	**Sao Paulo**

That's all for this month. Enjoy the good conditions and please keep the letters and emails coming with ideas for what you would like to see here next.

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

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Antenna Secrets I Wish I'd Known

Now that Field Day 2012 is over, the customary "post-game" analysis took place at a nearby Wendy's restaurant over an unending supply of chili. A local group of hams did amazingly well this year score-wise, despite relatively horrible propagation on any bands other than 20 and 40 meters.

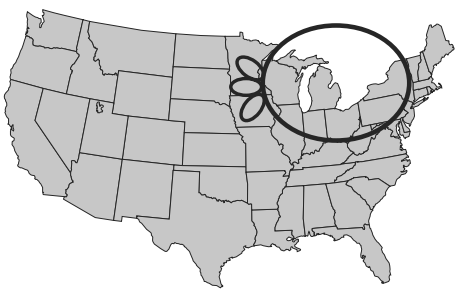
One recurring issue is the group's tradition of putting up an aluminum tri-band beam for the high bands. The group's founding fathers feel strongly that the directivity and gain will provide an edge in signal strength. Which brings me to this month's topic: antenna secrets I wish I'd know when I was a beginner.

It's been my experience that the real world nuts and bolts of antennas sometimes seem to contradict conventional wisdom. In future columns I plan to cover the surprisingly tricky and controversial world of antenna radiation patterns and wave angle information, so I will only touch on them here briefly.

A beam may not be the best Field Day antenna

My contention is that a beam isn't worth the effort *and danger* required to erect it under field conditions. First, the energy and effort required to disassemble, transport, assemble, tune and erect a full-size aluminum tri-bander is considerable. Second, because Minnesota is centrally located in relation to almost all Field Day "action," a beam is probably detrimental to the Field Day "contest-style" on-air process. Third, towers and beams are sometimes erected during real emergency operations, but they're far from the norm and are almost always unnecessary from a communications quality perspective.

The biggest perceived advantage for the beam is directivity and signal strength. If you were working Field Day from Hawaii or Alaska, where almost every station is in one general direction and suitably distant to take advantage of the beam's gain, directivity and coverage zones, the beam is definitely useful (or even necessary). The same may hold true if operating from one of the continental four corners such as Maine, Florida, southern California or Washington.



From southeastern Minnesota, a typical beam antenna aimed at New York puts most of the rest of the country off the side or back of the pattern, reducing signal strength or forcing frequent re-aiming. See text.

But, from Minnesota, if the beam is aimed at New York, for example, two-thirds of the country is off the side or back of the beam, so when stations from Texas, Arizona or Oregon call, they're probably below the signal levels that would be provided by a basic inverted vee or dipole, and almost certainly below the levels provided by a horizontal loop.

When centrally located, the temptation is to twirl the beam from QSO to QSO, which adds complexity and probably hurts QSO rates. With all of the lower 48 states falling within 1500 miles, the tri-bander may actually make things worse. It certainly adds complexity, and simply putting it up and taking it down increases danger!

A pair of dipoles or inverted vees (so you can instantly switch between fixed patterns) has made an excellent Field Day antenna setup for Midwestern stations since Field Day One. If I were planning a Field Day outing in this neck of the woods I'd put up a horizontal loop (or two, one sized for 80-40, one for 20-10) fed with open-wire line and an autocoupler. These antennas provide excellent signals in all directions, on all bands (roughly equivalent to tri-band beams) and require no rotating whatsoever. But then, I *am* a horizontal loop evangelist. See my columns for April, May and October of 2011 for more information.

A low beam may be no better than no beam

Ground-mounted verticals aside, a "low beam" is often a "no beam." That is, to achieve textbook gain and directivity, typical Yagi beams must be installed at least a half wavelength above RF ground.

Installing Yagis at heights above a half wavelength can make them work better over certain (often longer) paths and poorer over other (often shorter) paths, but for our basic discussion, the important thing to remember is the "half wavelength minimum."

For 20 through 6 meters this is fairly easy to achieve. A half wavelength at 20 meters is only 10 meters, about 33 feet. For a 10-meter beam a half wavelength is only 5 meters, about 16 feet.

In looking ahead to a future column, it's interesting to note that a tri-band beam mounted at 33 feet meets the minimum height requirement for "expected beam behavior" on 20 meters (a half wavelength), but when used on 10 meters the antenna is actually a full wavelength above the ground. At these heights the tri-bander exhibits gain and directivity in the direction in which it's pointing, but the antenna's response to signals of varying distances changes between a half wavelength and a full wavelength.

If you had a 200-foot tower with identical Yagis mounted every 40 feet (assuming they were aimed in the same direction and that feed line losses were normalized), signal strengths would vary from antenna to antenna, and the highest antenna would not always produce the strongest signal! This isn't intuitive, but it's true.

That's why beams for 80 and 40 meters don't work up to spec when they're mounted at low heights. The same goes for any conventional, non-vertical antenna. If it's not mounted at a half wavelength or more, forget about textbook radiation patterns, predictable performance, etc. Antennas mounted below certain minimum heights tend to be more omnidirectional. They still radiate, of course, but predicting exactly how and where is anybody's guess.

Size does matter

With few exceptions, the bigger an antenna is (in length and wire/element diameter), the better it performs. A 50-foot vertical whip works better than a 15-footer, which works better than a five-footer. If you could make a full-size antenna from solid copper wire (or hollow copper pipe) the diameter of a telephone pole, it would outperform a similarly sized antenna made from the highest quality conventional antenna wire (assuming all other variables such as height, RF power, etc, were the same).

Taken to extremes, however, the physics no longer hold true. A dipole antenna made with 30 miles of wire (say, 15 miles on a side) probably won't work better than a dipole cut for 160 meters. Actually, it might not do much of anything! A similar limit exists for vertical antennas. Once the length of the radiating element exceeds 5/8-wavelength or so, almost all of the radiated energy goes straight up off the end of the vertical element. Unless you're working through an overhead satellite, a 300-foot vertical for 10 meters is pretty much useless for terrestrial QSOs.

The most important practical take-away in this section is that physically small antennas tend to really suffer in performance. An 8-foot vehicle-mounted whip antenna might be 90% efficient at 10 meters (and work great), but only 5% efficient on 80 meters (and work not so great), despite the fact that it loads and tunes just fine.

Just because an antenna, through loading coils, antenna tuners or other impedance-matching wizardry, can be made to tune and load properly ("take power"), doesn't mean it will radiate that power efficiently (perform well as an antenna instead of a dummy load).

Potential exceptions to the size rule are magnetic loops, but in general, full-size antennas rule the day.

Take it outside

Unfortunately for condo dwellers such as myself, outdoor antennas almost always outperform indoor antennas. Although a 6-meter dipole inside the presidential suite of a skyscraper may work better than a similar outdoor dipole 10 feet off the ground, try to put up some kind of outdoor antenna if at all possible. An invisible or somewhat stealthy outdoor antenna almost always trumps its indoor counterparts.

Towers and skyhooks to the rescue

Within the above-mentioned limits, in general, the higher an antenna is, the better it performs. This isn't *always* true, of course, especially when you're trying to work nearby stations on the lower HF bands and want a commanding signal (in which case, you'll make use of NVIS – near vertical incidence skywave).

If you're only looking to work stations out to 200 miles, say, a 40-meter dipole that's six feet off the ground will dramatically outperform a dipole at 66 feet (the requisite half wavelength). For contacts outside the local region, however, the standard-height dipole is an easy winner.

Having your antenna outside and up in the air (or atop a tower) has an added benefit that isn't immediately apparent: Unwanted RFI is greatly minimized compared to similar antennas mounted indoors or much closer to the ground.

Resonant antennas don't necessarily work better

For decades I thought (incorrectly), as many hams do, that resonant antennas radiate RF signals better than non-resonant antennas – that there was RF magic in the simple act of resonance. Amazingly, this is just not true!

Resonance imparts several characteristics that are useful and important in many other ways, but the radiation efficiency of your wire antenna elements, within reason, isn't one of them.

I'm simplifying a lot here, but if we imagine operating on 40 meters with two wire dipoles, one "resonant" at 40 meters and one "resonant" at 60 meters, both antennas will radiate "all" (let's say 99%) of the energy fed to them, resonant or not. The radiation patterns of the antennas will be different and will vary with height, ground type, etc, but "all" of the RF energy fed to each dipole will be radiated.

The efficiency of the feed line and any impedance-matching techniques (baluns, tuners, inductors) can vary greatly, and it's *these losses* that we often wrongly associate with the desirability of using resonant antennas.

It's better to think of radiation efficiency in terms of "percentage of full size," with a full-size antenna being "100% efficient" and antennas smaller than full size being proportionally less efficient. That helps to explain why an 8-foot vehicle whip works well on 10 meters (where a full-size quarter-wavelength vertical is about 8.5 feet) and not so well on 80 meters (where a full-size quarter-wavelength vertical is about 69 feet).

Using the same antenna on the bands in-between shows an expected reduction in efficiency as we go down in frequency. It's no surprise, then, that using short vehicle whips works best from 20 meters an up. On the low bands the antenna is just too small to be efficient, even if it can be matched to whatever feed line you're using.

In the same way, from an efficiency perspective, when using an antenna tuner to feed a dipole on multiple bands, the dipole should be "full size" on the lowest band of operation.

Balanced antennas are easier

For beginners, balanced antenna designs such as dipoles, loops, triangles and vees are easier to successfully build and use than unbalanced antennas such as verticals, end-fed wires, random wires and the like. Achieving an efficient RF ground for unbalanced antennas can be difficult to impossible for non-experts, while balanced antenna designs need no RF ground to perform as intended.

Use coax only for low-SWR installations

Contrary to popular convention, coaxial cable is only suitable for low-SWR installations. For example, feeding a 40-meter dipole with 50-ohm coax works great (on 40 or 15 meters, where the SWR is reasonable), but using the same antenna and feed line on 80 meters – even with a fancy shack-mounted antenna tuner – is an SWR disaster! Almost all of your precious RF power will be used to heat up the coax instead of radiating into space.

If you can only put up a single wire antenna and need to use it on multiple bands, feed it with open-wire line or place an autocoupler at the feed point of the antenna. Either solution is *far better* than using coax in a high-SWR situation. See my column in the October 2011 issue for more detail.

Your antenna tuner belongs on the other end!

If your antenna tuner is in your shack, it's probably on the wrong end of your feed line. To eliminate potentially devastating SWR losses, put your antenna tuner at the feed point of your antenna and not in your shack!

As long as you're willing to improvise a weather-proof housing, at $179, SGC's SG-239 autocoupler is a real bargain in cost and performance.

This compact unit automatically tunes your antenna from 160 through 10 meters (many users also report success at 6 meters) with 1.5 to 200 W of RF output. With 170 memories, tuning is fast and accurate.

Shown here is the SG-239 being tested with an "up the tower" run of open-wire line by Kevin, AC0TA. A plastic kitchen container provides ultimate weather-proofing while an inverted plastic trash can is fitted on top for extra WX and UV protection (not shown). Yes, that's RG-6 and RG-11 feeding all antennas on the tower!

This arrangement lets you use your antenna on multiple bands, and because the SWR on the coax that runs between your radio and your antenna is always low, feed line losses are also low. There's still loss in the tuner's impedance-matching network, and the antenna's efficiency is still impacted by its size (percentage of full size), but the "tuner at the feed point" approach is a huge step above the old-fashion "tuner in the shack" approach in most situations.

Antenna tuners designed for feed point installation are often called autocouplers. They require dc power at the feed point (via separate wires or via a dc power injector connected to the coax that feeds RF), but they're also completely automatic. You talk or hit the key and the auto-coupler matches the antenna for you in a few seconds or less.

Autocouplers are available from SGC, Icom, Alinco, MFJ and elsewhere. See my column in the February 2011 issue for more details.

75-ohm RG-6 coax works great on HF!

Although it's becoming more popular, most hams think 75-ohm satellite TV coax is just for satellite receiver and cable TV installation, and that 50-ohm "ham coax" must be used for legitimate HF and VHF work. Nothing could be further from the truth.

Performance-wise, 75-ohm RG-6 (or RG-6 quad shield) coax equals or bests all but the most expensive 50-ohm cables – but at a fraction of the cost. Other benefits include universal availability (any Wal-Mart, day or night) and easy, inexpensive connector installation (RG-6 connectors attach with inexpensive crimping tools or if you buy from Grove no tools are required as F-connecters and adapters are supplied.)

If you're wondering where you can conveniently buy 50-ohm coaxial cable on a budget, just forget about it and buy 75-ohm RG-6 satellite cable instead! Buy from Radio Shack, WalMart, or your favorite supplier like Grove Enterprises. (Photo by Daniel Christensen via Wikimedia Commons)

Unless you're using the coax for precise phasing lines or in-line impedance-matching, the real world difference between a 50- or 75-ohm characteristic impedance is negligible.

RG-6 will handle a kilowatt at 80 meters and an easy 200 W at 10 or 6 meters. If you need less loss or more beef, RG-6's big brother, RG-11, will get the job done. RG-11 connectors are several dollars each (and require a dedicated crimping tool), but the performance and power-handling specs rival 50-ohm cables that cost three to four times as much.

I have used RG-6 exclusively on 160-6 meters for the past 10 years with fabulous results. You can, too. For more details, see my column in the March 2011 issue.

As hams we essentially never stop learning, so we will never run out of antenna secrets, but knowing the few discussed this month would have saved me *lots* of trial, error and teeth gnashing over the years. I hope they serve you in the same way!

GETTING STARTED

THE BEGINNER'S CORNER

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Beginner's Update: Antenna Lead-in

Over the last few years I've written on a number of subjects that occasionally need to be updated. This was brought to my attention recently by an email from longtime *MT* reader Martin Steindler who wrote to *MT* Publisher Bob Grove, "I have been a reader of *MT* for years and a shortwave listener for more than 60 years. You are to be highly commended for the quality and breadth of the articles in *MT*. However, one aspect of shortwave listening (and transmitting) is to feed the antenna (often and well described in *MT*) to the receiver/transmitter (also well described). But, no article in my memory has touched on the feed-through from the outside to the inside of the house/shack. This is not a trivial issue, especially in cold and wet climates, and can impact all sort of matching issues between antenna and receiver… Most of us cannot easily drill holes in outside walls to insert wires or connectors."

Martin is right, it's a critical issue and sometimes the main reason hams and SWLers don't bother to put up an outside antenna. The April 2010 *Beginner's Corner* (pages 30 and 31), titled "Your Antenna is Up: Now What?" takes a look at the issue of getting an outside antenna feedline into your house. Since that column was written there have been some additions to the number of options available, so this month I'll take a look at what's old and what's new.

❖ DIY Hole in the Wall

It was some 34 years ago that I started bringing antenna wires into the house. It started out innocently enough with a single coax cable for a VHF-UHF TV antenna. Later, an antenna rotator control wire was added, then single VHF and UHF cables. These were brought through the gable end vent at the peak of the house, where the antenna mast was located, and slipped through a small cut in the wire mesh that prevented bugs and other critters from making a home in the attic space. I had added a "drip loop," an extra few feet of coax and wire that dip below the entry point into the gable vent that prevented rain from following the coax into the attic space.

Then in 1984 I installed my first C-band satellite TV dish, a monstrously heavy ten foot fiberglass dish with all manner of cables: one for the LNA downconverter coax cable, a polarizing motor (three wires) and a dish drive that had two heavy duty DC wires and two sensor wires. They all had to be run from the dish into the house and to the satellite receiver.

In those days the preferred method was to run a two inch PVC pipe directly through the exterior wall of the house followed by a 90 degree bend and then down below ground level (most such cables in those days were not direct-burial rated), another 90 degree bend and straight out to the dish where it was met by another 90 degree bend and straight up to the dish where the pipe was terminated in two final 90 degree bends (to prevent rain from flooding in). Sealant would be added to plug the hole and prevent critters from turning the pipe into a highway into your home.

Later, with the adoption of direct burial cable, a simple exterior wall plate would be fixed to the exterior and interior walls, and the cable bundle or ribbon would be buried a few inches below ground level and emerge out at the dish where it would be attached to the various components. This system also works well for amateur radio/SWL antenna lead in wires.

The UG363 bulkhead feed-through (pictured) can be a solution if you can drill one 5/8 inch diameter hole discreetly into your exterior wall (watch for hot electric wires behind the siding and sheetrock!). If you have to, drill two or three such holes to accommodate your antennas. But, once you get to three, you'll wonder why you didn't try one of MFJ's antenna solution panels.

UG-363 Bulkhead 5/8 inch feed through will accept a PL-259 connector at both ends and comes in lengths from 1 inch ($2) to 12 inches ($19). Use individually or several in a piece of wood for a DIY multi-antenna window feed-through. (Courtesy: Universal Radio)

❖ The All-purpose Antenna Window Feed-through

If you're a new ham or SWL, imagine that you'll eventually want to put up more than one outside antenna and need to feed it into the house. I didn't imagine such a thing and as a result I've got no fewer than five different places in the exterior walls where I have drilled holes and stuffed no fewer than 12 coax cables, rotator, sensor and ground wires that serve as lead-in for longwave, HF, VHF/UHF and satellite antennas. I don't recommend that sort of hodge-podge approach if you can instead use something like MFJ's lineup of feed-through antenna window strips (see photos).

These antenna connector strips include connectors for up to six coax feeds and can accommodate PL, N and F connectors in various combinations. Some have ceramic connectors for twin-lead and random wire antennas as well. The MFJ-4605 ($160 directly from MFJ Enterprises) is a two-tier connector feed with space for full cables to be inserted (no cutting cables or insertion loss). They are attached to a four foot long, pressure-treated piece of wood that is covered in exterior paint and has weather stripping attached.

MFJ-4605 two-tiered feed-through ($160) offers connectors in addition to whole cable feeds. Construction is the same as the other MFJ products. (Courtesy: MFJ Enterprises)

To use these connector strips, just measure your window opening and cut the wood to fit. The finished connector leaves a professional looking installation (certainly compared to my random-holes-through-the-siding solution) and a secured window (by using a piece of wood you'll have to cut and insert between the other edge of the window and the frame either in a vertical or horizontal window configuration).

Installing one of these "ready-made" connector strips is not particularly easy. But then neither is drilling half a dozen holes in your exterior walls (again, watch out for electrical house wires inside the walls that you can't see!)

MFJ-4603 antenna feed-through ($80) is the deluxe version of the other two models. With the same wood, this model includes SO-239 jacks for HF/VHF, an N connector for VHF/UHF, one F connector for satellite TV, a balanced line twin feed on ceramic insulators, a random wire feed on a ceramic insulator, a ground wire connectors, a set of DC binding posts and a rubber-grommet channel for a rotator control cable (Cinch-Jones plug shown is not supplied). (Courtesy: Universal Radio)

Reviews of the MFJ window feed-though solutions on eham.net were mixed. The 4603 model garnered a 3.8 out of 5 (hams either loved it or hated it), the 4602 also received a 3.8 out of 5, while the 4605 had only one review (a 4.0 out of 5).

MFJ-4602 antenna feed through ($65) is a variation on the 4601model that has provisions for three SO-239 coax, one twin-lead, one random wire (both using ceramic insulators) and one ground feed-through. Like the 4601, this model is enamel painted, pressure-treated wood with weather stripping on the edges. (Courtesy: Universal Radio)

MFJ-4601 antenna feed-through ($58) can handle as many as six coax-fed HF, VHF and/or UHF antenna leads and one ground lead into your house. Use it horizontally or vertically in spaces up to 48 inches. Comes with enamel painted, pressure-treated wood panel for a cut-to-size fit. (Courtesy: Universal Radio)

You can make your own multi-connector window antenna feed-through by cutting a piece of wood to the exact window opening and drilling holes to accommodate a UG363 bulkhead feed-through (they come in lengths from 1 inch to 12 inches). You should be able to put six or more in a standard window opening. If you use a pressure treated 1 x 2, try the two-inch model ($4 each); if you use a 2 x 4, try the three-inch long model ($5 each). A length of adhesive-backed weather stripping on the top, bottom and sides of the wood should stop weather from coming in through the cracks.

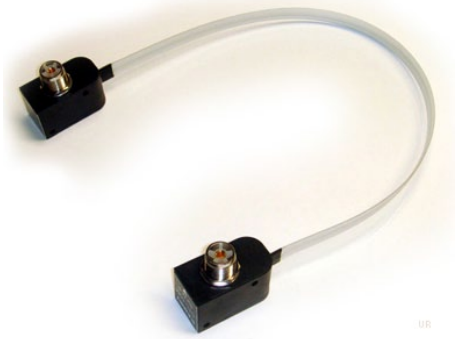
❖ The Condo-Solution

Many hams operate in stealth mode from rented or leased condos. Home Owners Associations and landlords don't like to see renters drilling holes in the sides of their units. What's a ham or SWL to do? Try a Comet CTC-50M flat wire coax cable jumper. Again, as with the MJF solutions above, it may not be ideal, but it does work. The hams on eham.net gave it a 4.1 out of 5 (again, most loved the product while a few hated it). It's particularly useful if you're just trying to get one coax into the house (or apartment). It might not be so great trying to get four or more into the house. There's also a 100 watt limit on the amount of power you'll want to pass through the flattened wire.

The Diamond MGC50 window/door

Diamond MGC50 ($50) feed-through has SO-239 connectors at each end. It's designed for a maximum power output of 150 watts PEP SSB or 50 watts CW on HF, 40 watts FM on VHF, 30 watts on UHF and 10 watts from 900-1300 MHz. (Courtesy: Universal Radio)

feed-through jumper looks very similar to the Comet CTC-50M, there's about a $5 difference between the two. I would expect you will get similar results with either. Installation of either should be very easy and may be done on traditional sash windows or horizontal/vertical sliders. It should also work on patio or balcony sliding glass doors. The only problem is that you can accommodate only one antenna with one jumper.



Comet CTC-50M ($46) feed-through has SO-239 connectors at each end can handle 100 watts PEP SSB on HF, 60 watts FM on VHF, 40 watts FM on UHF and 10 watts FM from 900-1,300 MHz. (Courtesy: Universal Radio)

The above mentioned bulkhead feed-through solution could be perfect in a condo, but issues of where the wires go from your apartment or condo could be a big thing to overcome. The sight police have sharp eyesight! You might also have security issues as well.

❖ Security Issues

If properly done, the window feed-through panels should be secure; a piece of wood wedged into the gap between the window and the frame can prevent the window from being opening accidentally or by an intruder. But, it won't help if they throw a brick through the window and then slide it open: nothing would.

Still, having all those wires leading into a window in your house or apartment/condo could be an invitation to a thief to take a closer look. Anyone familiar with amateur radio equipment will know that much of the gear is expensive and there's a great deal of trading in used (no questions usually asked) equipment. You may want to use an antenna connector panel on a window that's hidden from street view or has an AC unit or dense evergreen shrubs in front of it. In addition, many houses are protected by alarm systems that may not allow the use of such window feed-throughs.

Another security issue is lightning. Having antenna feeds coming directly from great height above your house could have the same results as having a lightning rod looped right through your house.

You can reduce the lightning threat by disconnecting all antennas from both sides of the feed-through and inserting each into a common ground rod installation such as the Alpha Delta USGC special copper grounding clamp ($50).

Alpha Delta antenna surge protectors ($55 to $75 each) and Alpha Delta UCGC copper grounding clamp ($50) in action (surge protectors ground rod and ground wires not included). (Courtesy: Universal Radio)

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Revisiting the Former Yugoslavia

In September 2006, my first *Programming Spotlight* column was published in *Monitoring Times*. In that first column, we shone the programming spotlight on the nations of the Former Yugoslavia. What has changed in the intervening six years? As we did then, let's tour the various republics in alphabetical order.

Bosnia Herzegovina –

Now as then, Bosnia has no international service, but via the internet, one can hear the domestic service of Bosnian radio. Formerly known as the **Public Broadcasting Service of Bosnia-Herzegovina**, it is now known as **Radio-Television of the Federation of Bosnia and Herzegovina**. **Radio FBiH** can be found by going to **www.rtvfbih.ba/loc/** You can use Google Chrome to translate the page, or simply click on the "Live program Radiia FbiH" link in the banner.

In early July I listened to some very mellow, almost "new age" music that wasn't quite pop and wasn't quite classical but fell somewhere in between. There were many references to Srebrenica, location of a notorious massacre during the ugly war in the region in the 1990s. As it turns out, I later learned that the 17th anniversary of the massacre was approaching which perhaps explains the almost somber music being played. Strictly local languages here, but it is an interesting listen nonetheless.

Croatia –

Glas Hrvatske or **The Voice of Croatia** can be heard daily from 2200-0500 UTC on 9925 kHz via transmitters in Germany. It can also be heard online at **www.hrt.hr/streamf/HrstreamGH.** Brief English segments can be heard at 0200 UTC. Lots of music can be heard here, almost continuously. Like other stations from the region, the music is mostly light, pop music which wouldn't be out of place on any station in North America. Often the music incorporates traditional folk rhythms with modern electronic instruments. It is an entertaining fusion and quite a contrast. The music is so alive in a region that has seen so much death.

Macedonia –

It is very easy to watch Macedonian television online (**www.mtv.com.mk/**), but I spent the better part of an hour going in circles, even with the help of Google Translate, trying to find a link to **Macedonian Radio**. What I did find was a page which linked to almost 40 Macedonian FM stations.

Picking one at random, I "tuned in" to **Radio Fortuna 96.8**. It is described as a soft pop station in Skopje, the capital. Like the other nations of the region, I was impressed with the variety of music to be heard. Songs that would never be played in North America, which, in many cases, is a real pity, as there is some very good music to be heard here. You can check out these Macedonian radio stations by going to **http://delicast.com/radio/Macedonia.** This site links to literally thousands of radio stations around the world and is well worth checking out!

Montenegro –

Like 2006, Montenegro posed a problem when it came to finding audio. Montenegro or Crne Gore (Black Mountain) was the last republic to leave the Former Yugoslav state. **Radio Televizija Crne Gore** has a web presence but no audio links (**www.rtcg.me/lajnet.html**). However Mr. Google suggested the site **www.listenlive.eu/montenegro.html** which provided a link to **Radio Crne Gore**, which I immediately fell in love with! The music was more local, more "folkish." I will definitely listen to this stream again. I enjoyed listening to the local language, here and throughout the region. I found that I could follow most of these languages, as they share many words with Russian and German, both of which I am familiar with.

Slovenia –

Radio Slovenia International was an integral part of the program ***Insight Central Europe***, a co-production of several broadcasters including **Radio Slovenia, Radio Slovakia, Radio Prague, Polish Radio, Hungarian Radio** and **Austrian Radio**. The program was suspended in 2008, however the website is still active, but sadly the program links don't seem to work anymore. Check it out at **http://incentraleurope.radio.cz/**

The ICE Team from Radio Slovenia

I tuned in to **Radio Slovenia International** and found that the music was very similar to the music that I recalled from 2006. Such "famous Slovenians" as Will Smith were featured. Slovenia was the most Western leaning Yugoslav republic, so it is not surprising that it would feature more American and British music. I should mention that there was Slovenian music played as well, although it could have been from anywhere in the region as well.

I was pleasantly surprised to hear a bit of English, about 0530 UTC, during which a man gave a brief weather forecast for the region. Later there was an English segment discussing what makes a successful band. When I listened, there were frequent mentions of Maribor. This is a town in Slovenia that was caught in the crossfire of the Balkan Wars. (*Star Trek* fans will remember Maribor as Captain Jean Luc Picard's daughter in an alternative reality).

If you like Europop, and English language music, **SRI** is a good listen. If you prefer something more local, pop back across the border to Montenegro or to Serbia.

Serbia –

Serbia is home to the old Federal Capital of Belgrade, and **International Radio of Serbia** is the successor to the old **Radio Yugoslavia.** Serbia continues to broadcast on shortwave to North America on 9685 kHz at 0030 UTC (except Sunday and Monday). At 0000 you can hear the Serbian language (on Sunday, Serbian replaces the English broadcast). News is dominated by two subjects which represent the Yin and Yang of Serbia; its longing to be part of Europe and its reluctance to give up Kosovo (which it refers to as Kosmet or Kosovo-Metohija). This is an open wound in Serbian-European relations.

You can listen to the most recent English

broadcast online, or watch the latest television news in English on demand, from the **International Radio of Serbia** website **http://voiceofserbia.org/.** You can also read the latest news in English via this website.

Also available online is the independent radio station **B92**. Originally begun as a youth oriented station in 1989, it became one of the few independent voices in Serbia during the Milosevic regime, and as a result has a wide following in Serbia to this day. It has a nice mix of music both Western and Serbian and is often an enjoyable listen. Give it a try at **www.b92.net/radio/** (Click the mp3 link in the orange box under the masthead on the right, marked "Slušajte uživo".

The republics of the former Yugoslavia are fiercely independent, yet strive to be part of the European Union, and all seem to share similar tastes in music, if not in politics.

❖ Elsewhere...

***Out and About* – Voice of Russia** This program is heard at 0100 on UTC Tuesdays. It is one of the "new breed" of **Voice of Russia** programs. This is not the **Radio Moscow** of the 1970s with its reports of tractor production. There are many new voices to be heard, and they all sound younger and hipper. **Marina Kosareva** hosts this fast-paced show, highlighting entertainment, culture, life in Russia and interesting things in Moscow and the rest of the country. In early July, the topic was an advertising website that is very popular among Russians, and what Russians are reading these days.

Other programs in the series looked at fast food in Russia and people's opinions about it, a Portuguese film festival in Moscow, and a gathering in St. Petersburg in honor of the anniversary of Michael Jackson's death. **Kosareva** presents the program in a very entertaining way. She reminds me of **Sook Yin-Lee** of **CBC Radio's DNTO** program. She brings a lot of enthusiasm and preparation to the show.

You can listen to the program on 9800 and 9665 kHz on UTC Tuesdays at 0100 (following the news). Listen to the live stream online at **http://english.ruvr.ru/radio_broadcast/schedule/** or listen to archived shows from the series at **http://english.ruvr.ru/radio_broadcast/35614392/80826224.html**

Give this and other programs from the **Voice of Russia** a listen. Many new presenters can be heard, many of whom appear to be non-Russians. Newscasts are very well done and the newsreaders would not be out of place at VoA or CNN. Russia is a happening place, tune in and see what you think!

***Slovakia Today* – Radio Slovakia International** may have left the shortwave bands but their programming lives on. And if you believe as I do, that a computer is just a World Band Radio that does other things, you are still just a few clicks away from the programming of this interesting country in the heart of Europe.

Slovakia rarely makes headlines, but it pops up now and then. In April 2012 Team Slovakia almost pulled off a major upset at the World Hockey Championships, knocking off some powerful squads until finally being defeated in the finals by Russia. Until the early 1990s, it formed the eastern part of Czechoslovakia. After the break-up of that country, **Radio Slovakia International** was a very reliable signal, but it has joined the increasing number of stations which have left the shortwave bands. While I miss the romance of carefully tuning them in, it is also rather nice to listen online with near FM quality.

Despite the budget cuts that have hit most major broadcasters, ***Slovakia Today*** is still a good program, although it does seem to cover fewer topics. In early July one program focused on a Slovak architect living in London, as well as other young Slovaks who have left the country seeking a life abroad. They also looked at a Slovak entry in the Olympic Art Festival. Listen online at **www.rozhlas.sk/radio-international-en**

Radio Slovakia International can also be heard via the **World Radio Network** daily at 1730 UTC. You can listen at **www.wrn.org** RSI is also heard via **WRMI** in Miami weekdays at 0030 UTC on 9955 kHz.

The Internet also allows one to hear many domestic programs that one couldn't hear before, even with a shortwave radio. The domestic network of **Slovak Radio** (Slovensky Rozhlas – Slovak is one of the few European languages that has its own word for "radio") has some very entertaining programming, even if one does not speak the language. I took a course in Slovak at university; sadly most of it has been lost to me over the intervening years. Nevertheless, one can often glean the gist of a program. A particularly good program is ***Espresso*,** heard on Saturdays at 0530 and 1930 Bratislava time (0330 and 1730 UTC), featuring music of "the golden age of Czech and Slovak pop music. Click on the link at **www.rozhlas.sk/radio-slovensko/ako-nas-pocuvat-internet#.** Then click the **Radio Slovakia** logo, which should take you to the live stream. Saturdays and Sundays especially provide the listener with lots of music and light entertainment. Give it a listen for something a bit out of the ordinary!

❖ Radio New Zealand

Radio New Zealand International is one of the best reasons to own a radio and a computer. In 1984 I managed to hear their then puny 7.5 kW transmitter...barely...just enough to get a QSL card. Later when they opened their more powerful 100 kW transmitter, listening became that much easier. I became a fan of tuning in to **RNZI** when conditions were favorable, and recall listening spellbound to (what I presume to have been) ***Sounds Historical,*** recounting the tragedy of the sinking of the car ferry *Wahine* in the late 1960s.

Over the years many hours were spent listening to the entertaining programming from this small island nation. Early in this century, with the advent of the Internet and streaming audio, I discovered not only **Radio New Zealand International**, available around the clock, but also the domestic networks of **Radio New Zealand**. A few years ago, I tuned in around Christmas for a Louis Armstrong concert and discovered my perhaps all-time favorite program, which has been mentioned in this column before, ***Matinee Idle*** hosted by **Phil O'Brien** and **Simon Morris**.

Matinee Idle is only heard for a month or so around Christmas and on statutory holidays. You might say that the lunatics run the asylum, lots of fun, frivolity and both good music and amusingly bad music.

I particularly like the **Radio New Zealand** local morning program ***Morning Report*** which runs for three hours at 1800 UTC. It features news and interviews, Pacific news, rural news, sports, New Zealand newspapers, traffic and business news. It is presented by Geoff Robinson and Simon Mercep and gives one a unique insight into life in the South Pacific. **www.radionz.co.nz/national**

❖ Alternative Sources of Programming

You never know where you might trip over an international broadcaster. For instance, my cable television provider here in Southern Ontario offers **Polish Radio**. A few months back, while surfing the various TV channels, I stopped on ***Voiceprint***, a service for the blind, which to my surprise carried programming from **Radio Netherlands**. In Canada, ***CBC Overnight*** on the **Radio One** network, features programming from the **BBC** and **World Radio Network**. While it doesn't have the variety it once had, night owls can hear programming from the **BBC, CBC, ABC Australia** and others. The website is hopelessly outdated, for instance by clicking on the link to the "Latest Show" you get the programs from November 22, 2009! However, if you go to the CBC Radio One schedule, it is all spelled out (just make sure you select "Full Day" view).

While this schedule will be subject to change by the time you read this, in July one could hear programming such as: ***From Our Own Correspondent,*** the flagship reportage program of the **BBC** (at 3 am local), ***Outlook*** **(BBC)** at 330 am local time, and ***Connect Asia*** **(Radio Australia)** at 4 am weekdays. The **Australian Broadcasting Corporation's *The Philosopher's Zone*** can be heard Sundays at the same time.

I have given local times, since there are a number of potential time zones to choose from, beginning with Newfoundland Time on the East Coast all the way to Pacific Time on the West Coast.

CBC is not the only broadcaster to air international broadcasters over night. Many **PBS** stations do the same thing. **WNED 970** in Buffalo, New York, becomes a relay of the **BBC World Service** from 10 pm until 5 am Eastern on weekdays, Midnight until 6 am on Sundays, and 11 pm until 6 am on Saturdays. Many other **PBS** stations do this – as they say, check your local listings – you never know what gem you might discover or where!

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

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QSLing from the Most Wanted List

In amateur and shortwave radio circles, there are stations considered a snap to hear and verify, and then there are those at the top of the heap for "Most Wanted." Swains Island, north of Tutuila Island, America Samoa, is one of the most wanted islands to verify, and one whose availability occurs rarely.

Despite its small size and remote location, a multinational team will again activate Swains Island and operate on six fully functional stations for 14 days on 1.8-50 MHz, using SSB, CW and RTTY. They expect to arrive on the island and set up on September 4 and plan to begin operations as NH8S the following day.

Amateur radio operators and shortwave listeners can learn more about this historic event on the team website at **www.nh8s.org** Links include a log search, photos, bios, sponsorship, QSL information and much more.

The suggested frequencies are where the NH8S team will be *transmitting*, and most of the time they will likely not be listening on their transmitting frequency. Remember to listen for their complete instructions before calling them.

One of the features of the Club Log is the Geo Propagation tab, which gives you an idea of what time and on what band listeners from your area are getting through to the DXpedition station. Logs for NH8S will be accessible via their website.

Plans are to cease operating on September 18 and return to Pago Pago on September 20. Questions should be sent to *info@nh8s.org*.

Don't miss this chance to verify Swains Island from the Most Wanted List.

ALBANIA

Radio Tirana, 7465 kHz. Full data Native Costume design card, unsigned. Received in 250 days for an English report, $2.00US and souvenir postcard. Station address: Rruga Ismail Qemali 11, Tirana, Albania (Frank Hillton, Charleston, SC). Website: **http://rtsh.al**

CANADA

CFVP, 6030 kHz. Full data large cowboy/antenna logo card, signed by Harold Sellers, QSL Manager/ODXA. Received in 81 days for an English report and $2.00US. QSL address: 3211 Centennial Drive, Apt. 23, Vernon, British Columbia VIT 2T8, Canada (Al Muick, PA). Email: ***QSLCalgary@gmail.com***.

Radio Japan/NHK World, 6110 kHz relay via Sackville. Full data squirrel card with site noted as "West Canada," unsigned. Received in 22 days for an English report and two IRCs. Station address: 2-1, Jinnan 2-chome, Shibuya-ku, Tokyo 150-8001, Japan (Bill Wilkins, Springfield, MO).

FM/MEDIUM WAVE

KACV, 89.9 MHz FM. ***Amarillo College's Cutting Edge***. Full data E-QSL from Trey Holt, Music Director. Mentioned power as 100 kW. Received in nine days for an e-report to ***kacvfm90@actx.edu*** Station address: P.O Box 447, Amarillo, TX 797178 USA (Joe Wood, Greenback, TN). Streaming audio **www.kacvfm.org/**

KVNS, 1700 kHz AM. ***Rio Grande Valley's Classic Hits***. Personal letter from Billy Santiago, Operations Manager. Received 81 days for an AM report. Station address: 1050 McIntosh, Brownsville, TX 78521 USA (Vashek Korinexi, South Africa/playdx).

WLW, 700 kHz AM. Full data station logo/antenna card, signed by Ted Ryan, Chief Engineer, ***tedryan@clearchannel.com*** plus station stickers. Received in 25 days for an AM report and two US mint stamps. Station address: 8044 Montgomery Rd., Suite 650, Cincinnati, OH 45236 USA (Rod Pearson, St. Augustine, FL). Streaming audio **www. 700wlw.com.**

WMVP, 1000 kHz AM, ESPN. Partial data (no time) on computer-generated paper QSL from John Hurni, Chief Engineer. Received in nine days for an AM report, $1.00US and address label (used on reply). Station address: 190 N. State St., Chicago, IL 60601-3302 USA (Wilkins).

WSCR, 670 kHz AM, ***The Score Sports Radio***. Full data verification letter, signed by Mark Nielsen, Chief Operator. Received in 24 days for an AM report, $ 1.00US and address label (not used for reply). Station address: 180 N. Stetson Ave., Suite 1250, Chicago, IL 60601 USA (Wilkins).

WWL, 870 kHz AM, ***News-Talk-Sports***. Full data transmitter card, unsigned. Also received a coverage map and WWL 90th Anniversary info sheet. Received in one week for an AM report, $1.00US (returned) and address label (used on reply). Station address: 400 Poydras St., Suite 900, New Orleans, LA 70130-3738 USA (Wilkins). Streaming audio **www.wwl.com/**

UTILITY

Croatia: DVN-NDB, 418 kHz. Full data prepared QSL card signed and stamped. Received in 36 days for a utility report. QSL address: Hrvatska kontrola zracne plovidbe o.o., Podruznica Split, p.p. 48, 21216 Split, Croatia (Partick Robic, Austria/UDXF).

Czech Rep.:LA-NDB, 514.5 kHz. Partial data verification letter and prepared QSL card signed and stamped by Capt. Ing. Rudolf Pavlik, Head of Radionavigation Service and Col. Ing Miroslav Svoboda. Received in 20 days for a utility report. QSL address: Head of Radionavigation Service, Vojensky Utvar 5525, 67571 Namest nad Oslavu, Czech Republic. TRI-NDB Trogir, 378 kHz. Full data prepared QSL card signed and stamped. Received in 36 days. QSL address same as DVN, 418 kHz (Robic).

Germany: AE1RD-US Army MARS Neidenbach, 6910 kHz. No data email reply from Daniel V. Wolff, Jr., US Army MARS regional Director. Received in one day for email to: ***aem1wf@qsl.net*** (Robic).

Greece: Leros Aero, 5637 kHz. Full data prepared QSL card signed and stamped. Received in 47 days for a utility report. QSL address: Civil Aviation Authority, Leros Airport 85400 Leros, Greece (Robic).

Hungary: TO-NDB, Zalaegerszeg/Andráshida, 358 kHz. Full data prepared QSL card signed and stamped. Received in 14 days for a utility report. QSL address: Gratis Közlekdesi Kft., Air Traffic Services, Mártírok útja 22, 890 Zalaegerszeg, Hungary (Robic).

Italy: PIS-NDB, Pisa, 379 kHz. Full data prepared QSL card signed and stamped. Received in 33 days for a utility report. QSL address: Aeronautica Militare, 46 Brigata Aerea, gruppo Telecom, Il Capo Servizi Tlc, Viale Caduti di Kindú 1, 56100 Pisa, Italy (Robic).

USA: Air Force Mars Station-AIR-2. Armed Forces Day Test broadcast. Full data verification letter. Received in 30 days. QSL address: U.S. Air Force Military Auxiliary Radio System, Hancock Field Air National Guard Base, 6001 E. Molley Rd., Syracuse, NY 13211 USA (Ewald Glantschnig, Switzerland/UDXF).

USA

WTWW, 9479 kHz. Full data E-QSL from George McClintock, President/Manager, ***george@wtww.us***. Received in 138 days for English report via postal mail, and follow up email. Station address: 1784 West Northfield Blvd., Murfreesboro, TN 37129 USA (Muick).

How to Use the Shortwave Guide

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

① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

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

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

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

FIND THE STATION YOU WANT TO HEAR

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

If a broadcast is not ***daily***, the days of broadcast⑤ will appear in the column following the time of broadcast, using the following codes:

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

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

MT MONITORING TEAM

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

BCL News; BDX Club; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News; BCDX/WWDX/Top News. Adrian Peterson/AWR; Alokesh Gupta, New Delhi, India; Ivo Ivanov, Bulgaria; Nigel Holmes/R Australia; Rachel Baughn/MT; Sean Gilbert UK/WRTH 2012; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

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

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

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

0000 0030	Egypt, R Cairo	9965na			
0000 0030	USA, BBG/Voice of America				7555as
0000 0045	India/AIR/External Service	6055as	9705as	9950as	11670as
	13605as				
0000 0045 DRM	India/AIR/External Service	9950eu			
0000 0045	USA, WYFR/Family R Worldwide				11650as
0000 0056	Romania, R Romania Intl	9700na			11965na
0000 0100	Anguilla, University Network				6090na
0000 0100	Australia, ABC NT Alice Springs				4835do
0000 0100	Australia, ABC NT Katherine				5025do
0000 0100	Australia, ABC NT Tennant Creek				4910do
0000 0100	Australia, ABC/R Australia	12080pa	15160pa	15240pa	15415pa
	17795pa	19000pa	21740pa		
0000 0100	Bahrain, R Bahrain	6010me			
0000 0100	Canada, CFRX Toronto ON	6070na			
0000 0100	Canada, CFVP Calgary AB	6030na			
0000 0100	Canada, CKZN St Johns NF	6160na			
0000 0100	Canada, CKZU Vancouver BC				6160na
0000 0100	China, China R International				6020eu
	6075as	6180as	7350eu	7415as	9570na
	11790as	11885as	13750as	15125as	
0000 0100	Malaysia, RTM Kajang/Traxx FM				7295do
0000 0100	Micronesia, V6MP/Cross R/Pohnpei				4755 as
0000 0100	New Zealand, R New Zealand Intl				15720pa
0000 0100 DRM	New Zealand, R New Zealand Intl				17675pa
0000 0100	Russia, Voice of Russia	9665va			9800va
0000 0100	Spain, R Exterior de Espana	6055na			
0000 0100	Thailand, R Thailand World Svc				15275na
0000 0100	UK, BBC World Service	5970as			6195as
	7395as	9410as	9740as	12095as	15335as
	15755as	17685as			
0000 0100	USA, Amer Forces Network/AFRTS				4319usb
	5446usb	5765usb	7811usb	12133usb	12759usb
	13362usb				
0000 0100	USA, FBN/WTJC Newport NC				9370na
0000 0100 Sat/Sun	USA, WBCQ Monticello ME	5110am			
0000 0100	USA, WBCQ Monticello ME	7490am			9330am
0000 0100	USA, WEWN/EWTN Irondale AL				11520af
0000 0100	USA, WHRI Cypress Creek SC				5920va
	7315ca	9860na			
0000 0100	USA, WINB Red Lion PA	9265am			
0000 0100	USA, WTWW Lebanon TN	5755va			
0000 0100	USA, WWCR Nashville TN	4840eu	5935af	6875af	9980eu
0000 0100	USA, WWRB Manchester TN				3185na
	5050na				
0000 0100	USA, WYFR/Family R Worldwide				17580as
0000 0100	Zambia, Christian Voice	4965af			
0030 0100	Australia, ABC/R Australia	17750as			
0030 0100	USA, BBG/Voice of America				7430as
	9715as	9780as	11725as	12005as	15205as
	15290as	17820as			
0030 0100 mtwhf	USA, WRMI/R Slovakia Intl relay				9955am
0035 0045	India, AIR/Aizawl	5050do	7295do		
0035 0045	India, AIR/Chennai	4920do			
0035 0045	India, AIR/Guwahati	4940do			
0035 0045	India, AIR/Hyderbad	4800do			
0035 0045	India, AIR/Imphal	4775do			
0035 0045	India, AIR/Port Blair/Andaman & Nicobar	4760do			
0035 0045	India, AIR/Shimla	4965do	6020do		
0035 0045	India, AIR/Thiruvananthapuram				5010do

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

0100 0115 Sat	Canada, Bible Voice Broadcasting				9490as
0100 0130	Vietnam, VO Vietnam/Overseas Svc				6175na
0100 0200	Anguilla, University Network				6090na
0100 0200	Australia, ABC NT Alice Springs				4835do
0100 0200	Australia, ABC NT Katherine				5025do
0100 0200	Australia, ABC NT Tennant Creek				4910do
0100 0200	Australia, ABC/R Australia	12080pa	15160pa	15240pa	15415pa
	17750as	17795pa	19000pa		
0100 0200	Bahrain, R Bahrain	6010me			
0100 0200	Canada, CFRX Toronto ON	6070na			
0100 0200	Canada, CFVP Calgary AB	6030na			
0100 0200	Canada, CKZN St Johns NF	6160na			
0100 0200	Canada, CKZU Vancouver BC				6160na
0100 0200	China, China R International				6020eu
	6175eu	9410eu	9470eu	9535as	9570na
	9580na	9675eu	9790na	11870as	15125as
	15785as				
0100 0200	Cuba, R Havana Cuba	6000na			6050na
0100 0200	Malaysia, RTM Kajang/Traxx FM				7295do
0100 0200	Micronesia, V6MP/Cross R/Pohnpei				4755 as
0100 0200	New Zealand, R New Zealand Intl				15720pa
0100 0200 DRM	New Zealand, R New Zealand Intl				17675pa
0100 0200	Russia, Voice of Russia	9665va			9800va
0100 0200	Taiwan, R Taiwan Intl	11875as			
0100 0200	UK, BBC World Service	7395as			9410as
	9740as	11750as	12095as	15310as	15335as
	15755as	17685as			
0100 0200	USA, Amer Forces Network/AFRTS				4319usb
	5446usb	5765usb	7811usb	12133usb	12759usb
	13362usb				
0100 0200	USA, BBG/Voice of America				7430as
	9780as	11705as			
0100 0200	USA, FBN/WTJC Newport NC				9370na
0100 0200	USA, KJES Vado NM	7555na			
0100 0200 Sat/Sun	USA, WBCQ Monticello ME	5110am			
0100 0200	USA, WBCQ Monticello ME	7490am			9330am
0100 0200	USA, WEWN/EWTN Irondale AL				11520af
0100 0200 m	USA, WHRI Cypress Creek SC				9605na
0100 0200	USA, WHRI Cypress Creek SC				9840na
	9860na				
0100 0200	USA, WINB Red Lion PA	9265am			
0100 0200 irreg	USA, WRNO New Orleans LA				7505am
0100 0200	USA, WTWW Lebanon TN	5755va			
0100 0200	USA, WWCR Nashville TN	3215eu	4840na	5890af	5935af
0100 0200	USA, WWRB Manchester TN				3185na
	5050na				
0100 0200	Zambia, Christian Voice	4965af			
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as		15745as
0130 0200 twhfas	Albania, R Tirana				7425na
0130 0200	Myanmar, Thazin BC Sta	6030do			
0130 0200 mtwhfa	USA, BBG/Voice of America				7465ca
	9820sa				
0140 0200	Vatican City State, Vatican R	9580as			11730as

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

0200 0230	Thailand, R Thailand World Svc				15275na
0200 0230	USA, KJES Vado NM	7555na			
0200 0230 Sat	USA, WBCQ Monticello ME	5110am			
0200 0300	Anguilla, University Network				6090na
0200 0300 twhfa	Argentina, RAE	11710am			
0200 0300	Australia, ABC NT Alice Springs				4835do
0200 0300	Australia, ABC NT Katherine				5025do
0200 0300	Australia, ABC NT Tennant Creek				4910do
0200 0300	Australia, ABC/R Australia	12080pa	15160pa	15240pa	15415pa
	17750as	17795pa	19000pa		
0200 0300	Bahrain, R Bahrain	6010me			
0200 0300	Canada, CFRX Toronto ON	6070na			
0200 0300	Canada, CFVP Calgary AB	6030na			
0200 0300	Canada, CKZN St Johns NF	6160na			
0200 0300	Canada, CKZU Vancouver BC				6160na
0200 0300	China, China R International				11770as
	13640as				
0200 0300	Cuba, R Havana Cuba	6000na			6050na
0200 0300	Egypt, R Cairo	9720na			
0200 0300	Malaysia, RTM Kajang/Traxx FM				7295do
0200 0300	Micronesia, V6MP/Cross R/Pohnpei				4755 as
0200 0300	New Zealand, R New Zealand Intl				15720pa
0200 0300 DRM	New Zealand, R New Zealand Intl				17675pa
0200 0300	Palau, T8WH/World Harvest R				17800as
0200 0300	Philippines, R Pilipinas Overseas				11880me
	15285me	17700me			
0200 0300	Russia, Voice of Russia	9665va			15425na
0200 0300	South Korea, KBS World R	9580sa			
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as		15745as

0200 0300	Taiwan, R Taiwan Intl	5950na	9680na	
0200 0300	UK, BBC World Service	6005af	6195me	
	12095as	15310as	17790as	
0200 0300	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0200 0300	USA, FBN/WTJC Newport NC			9370na
0200 0300 Sat/Sun	USA, WBCQ Monticello ME	5110am		
0200 0300	USA, WBCQ Monticello ME	7490am		9330am
0200 0300	USA, WEWN/EWTN Irondale AL			11520af
0200 0300	USA, WHRI Cypress Creek SC			5920va
0200 0300	USA, WINB Red Lion PA	9265am		
0200 0300 irreg	USA, WRNO New Orleans LA			7505am
0200 0300	USA, WTWW Lebanon TN	5755va		
0200 0300	USA, WWCR Nashville TN	3215eu	4840na	
	5890af	5935af		
0200 0300	USA, WWRB Manchester TN			3185na
	5050na			
0200 0300	USA, WYFR/Family R Worldwide			5985ca
	6115na			
0200 0300	Zambia, Christian Voice	4965as		
0215 0227	Nepal, R Nepal	5005do		
0230 0300	Myanmar, Myanma R/Yangon			9731do
0230 0300	Vietnam, VO Vietnam/Overseas Svc			6175na
0245 0300	Australia, HCJB Global Australia			15400as
0245 0300	India, AIR/Bhopal	4810do		
0245 0300	India, AIR/Guwahati	4940do		
0245 0300	India, AIR/Hyderbad	7420do		
0245 0300	India, AIR/Imphal	4775do	7335do	
0245 0300	India, AIR/Itanagar	4990do		
0245 0300	India, AIR/Jaipur	4910do	7325do	
0245 0300	India, AIR/Jeypore	5040do		
0245 0300	India, AIR/Kolkata	4820do	7210do	
0245 0300	India, AIR/Kuresong	4895do		
0245 0300	India, AIR/Lucknow	4880do	7440do	
0245 0300	India, AIR/Shillong	4970do		
0245 0300	India, AIR/Shimla	4965do	6020do	
0245 0300	India, AIR/Thiruvananthapuram			5010do
0250 0300	Vatican City State, Vatican R	7305am		
0255 0300 Sun	Swaziland, TWR Africa	3200af		

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

0300 0315	India, AIR/Aizawl	5050do	7295do	
0300 0315	India, AIR/Imphal	4775do	7335do	
0300 0315	India, AIR/Itanagar	4990do		
0300 0315	India, AIR/Shillong	4970do		
0300 0320	Vatican City State, Vatican R	7305am		
0300 0325 Sun	Swaziland, TWR Africa	3200af		
0300 0330	Egypt, R Cairo	9720na		
0300 0330	Myanmar, Myanma R/Yangon			9731do
0300 0330	Philippines, R Pilipinas Overseas			11880me
	15285me	17700me		
0300 0330	Vatican City State, Vatican R	7360af		15460as
0300 0355	South Africa, Channel Africa			5980af
0300 0355	Turkey, Voice of Turkey	6165as		9515va
0300 0356	Romania, R Romania Intl	9645na		11795na
	11895as	15340as		
0300 0400	Anguilla, University Network			6090na
0300 0400	Australia, ABC NT Alice Springs			4835do
0300 0400	Australia, ABC NT Katherine			5025do
0300 0400	Australia, ABC NT Tennant Creek			4910do
0300 0400	Australia, ABC/R Australia	15160pa	15240pa	
	15415pa	17750as	21725pa	
0300 0400	Bahrain, R Bahrain	6010me		
0300 0400	Canada, CFRX Toronto ON	6070na		
0300 0400	Canada, CFVP Calgary AB	6030na		
0300 0400	Canada, CKZN St Johns NF	6160na		
0300 0400	Canada, CKZU Vancouver BC			6160na
0300 0400	China, China R International			9690am
	9790na	11770as	13750as	15110as
	15120as	15785as		
0300 0400	Cuba, R Havana Cuba	6000na	6050na	
0300 0400	Malaysia, RTM Kajang/Traxx FM			7295do
0300 0400	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0300 0400	New Zealand, R New Zealand Intl			15720pa
0300 0400 DRM	New Zealand, R New Zealand Intl			17675pa
0300 0400	Oman, R Sultanate of Oman			15355af
0300 0400	Palau, T8WH/World Harvest R			17800as
0300 0400	Russia, Voice of Russia	9665va	15424na	
0300 0400	South Africa, Channel Africa			3345af
0300 0400 Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0300 0400	Taiwan, R Taiwan Intl	5950na	15320as	
0300 0400	UK, BBC World Service	3255af	5875af	
	6005af	6145af	6190af	6195me
	9410me	9750af	12035af	12095as
	15310as	15365as	17790as	
0300 0400	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0300 0400	USA, BBG/Voice of America			4930af
	6080af	9855af	15580af	
0300 0400	USA, FBN/WTJC Newport NC			9370na
0300 0400	USA, WBCQ Monticello ME	7490am		9330am
0300 0400	USA, WEWN/EWTN Irondale AL			11520af
0300 0400	USA, WHRI Cypress Creek SC			5920va
	7385na	9825va		
0300 0400 irreg	USA, WRNO New Orleans LA			7505am
0300 0400	USA, WTWW Lebanon TN	5755va		
0300 0400	USA, WWCR Nashville TN	3215eu	4840na	
	5890af	5935af		
0300 0400	USA, WWRB Manchester TN			3185na
	5050na			
0300 0400	USA, WYFR/Family R Worldwide			11740ca
0300 0400	Zambia, Christian Voice	4965as		
0330 0400	Australia, ABC/R Australia	15515pa		
0330 0400	Iran, VO Islamic Rep of Iran	11920eu	13650eu	
0330 0400	Vietnam, VO Vietnam/Overseas Svc		6175na	
0335 0345	India, AIR/Kolkata	4820do	7210do	

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

0400 0430	Iran, VO Islamic Rep of Iran	11920eu	13650eu	
0400 0430	USA, BBG/Voice of America			9855af
0400 0457	Germany, Deutsche Welle	6180af	7240af	
	9470af	12045af		
0400 0457	North Korea, Voice of Korea			3560as
	7220as	9345as	9730as	11735as
	13760as	15180as		
0400 0458	New Zealand, R New Zealand Intl			15720pa
0400 0458 DRM	New Zealand, R New Zealand Intl			17675pa
0400 0500	Anguilla, University Network			6090na
0400 0500	Australia, ABC NT Alice Springs			4835do
0400 0500	Australia, ABC NT Katherine			5025do
0400 0500	Australia, ABC NT Tennant Creek			4910do
0400 0500	Australia, ABC/R Australia	15160pa	15240pa	
	15415pa	15515pa	21725as	
0400 0500	Bahrain, R Bahrain	6010me		
0400 0500	Canada, CFRX Toronto ON	6070na		
0400 0500	Canada, CKZN St Johns NF	6160na		
0400 0500	Canada, CKZU Vancouver BC			6160na
0400 0500	China, China R International			6020na
	6080na	17730va	17855va	
0400 0500	Cuba, R Havana Cuba	6000na	6050na	
0400 0500	Malaysia, RTM Kajang/Traxx FM			7295do
0400 0500	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0400 0500	Russia, Voice of Russia	13775na	15760me	
0400 0500	South Africa, Channel Africa			3345af
0400 0500 Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400 0500 DRM	UK, BBC World Service	3955eu		
0400 0500	UK, BBC World Service	3255af	5875af	
	6005af	6190af	7310af	11945af
	12035af	12095me	15310as	15365as
	17790as			
0400 0500	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0400 0500	USA, BBG/Voice of America			4930af
	4960af	6080af	12025af	15580af
0400 0500	USA, FBN/WTJC Newport NC			9370na
0400 0500	USA, Overcomer Ministry	15750af		
0400 0500	USA, WBCQ Monticello ME	9330am		
0400 0500	USA, WEWN/EWTN Irondale AL			11520af
0400 0500	USA, WHRI Cypress Creek SC			5920va
	7385na	9825va		
0400 0500	USA, WTWW Lebanon TN	5755va		
0400 0500	USA, WWCR Nashville TN	3215eu	4840na	
	5890af	5935af		

0400 0500	USA, WWRB Manchester TN			3185na
0400 0500	Zambia, Christian Voice	4965as		
0430 0500	Myanmar, Thazin BC Sta	6030do		
0430 0500 mtwhf	Swaziland, TWR Africa	3200af		
0455 0500	Nigeria, Voice of Nigeria	15120af		
0459 0500	New Zealand, R New Zealand Intl			11725pa
0459 0500 DRM	New Zealand, R New Zealand Intl			11675pa

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

0500 0527	Germany, Deutsche Welle	5925af		
0500 0530	Japan, R Japan NHK World			5975eu
	6110na	11970va		
0500 0530	Vatican City State, Vatican R	11625af		13765af
0500 0557	North Korea, Voice of Korea			13650as
	15100as			
0500 0600	Anguilla, University Network			6090na
0500 0600	Australia, ABC NT Alice Springs			4835do
0500 0600	Australia, ABC NT Katherine			5025do
0500 0600	Australia, ABC NT Tennant Creek			4910do
0500 0600	Australia, ABC/R Australia	13630pa	15240pa	
	15415pa	15515pa	21725as	
0500 0600	Bahrain, R Bahrain	6010me		
0500 0600	Bhutan, Bhutan BC Svc	5030do	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	China, China R International			6020na
	6190na	11710af	11895as	15350as
	15465as	17505va	17730va	17855va
0500 0600	Cuba, R Havana Cuba	6010na	6050na	
	6060ca	6125am		
0500 0600	Eqt Guinea, Pan Am BC/R Africa			15190af
0500 0600	Germany, Deutsche Welle	9470af	9800af	
	9850af	11800af		
0500 0600	Malaysia, RTM Kajang/Traxx FM			7295do
0500 0600	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0500 0600	Myanmar, Thazin BC Sta	6030do		
0500 0600	New Zealand, R New Zealand Intl			11725pa
0500 0600 DRM	New Zealand, R New Zealand Intl			11675pa
0500 0600	Nigeria, Voice of Nigeria	15120	ad	
0500 0600	Russia, Voice of Russia	13755na		
0500 0600	South Africa, Channel Africa			7230af
0500 0600 Sat/Sun	Swaziland, TWR Africa	3200af		
0500 0600	Swaziland, TWR Africa	9500af		
0500 0600	Taiwan, R Taiwan Intl	5950na		
0500 0600	UK, BBC World Service	3255af	5875af	
	6005af	6190af	9410af	11945af
	12095me	15310as	15365as	15420af
	17640as	17790as		
0500 0600 DRM	UK, BBC World Service	3955eu		
0500 0600	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0500 0600	USA, BBG/Voice of America			4930af
	6080af	12025af	15580af	
0500 0600	USA, FBN/WTJC Newport NC			9370na
0500 0600	USA, Overcomer Ministry	15750af		
0500 0600	USA, WBCQ Monticello ME	9330am		
0500 0600	USA, WEWN/EWTN Irondale AL			11520af
0500 0600	USA, WHRI Cypress Creek SC			5920am
	7385na	9825va		
0500 0600	USA, WTWW Lebanon TN	5755va		
0500 0600	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0500 0600	USA, WWRB Manchester TN			3185na
0500 0600	Zambia, Christian Voice	6065af		
0530 0556 DRM	Romania, R Romania Intl	11875eu		
0530 0556	Romania, R Romania Intl	9700eu		17760eu
	21500eu			
0530 0600	Australia, ABC/R Australia	17750as		
0530 0600	Thailand, R Thailand World Svc			17770eu

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

0600 0627	Germany, Deutsche Welle	15275af		
0600 0630	Germany, Deutsche Welle	13780af		17820af
0600 0630	Myanmar, Thazin BC Sta	6030do		
0600 0630 Sat/Sun	USA, WRMI/R Prague relay	9955ca		
0600 0645 mtwhfa	Vatican City State, Vatican R	15595me		
0600 0650	New Zealand, R New Zealand Intl			11725pa
0600 0650 DRM	New Zealand, R New Zealand Intl			11675pa
0600 0655	South Africa, Channel Africa			15255af
0600 0657	North Korea, Voice of Korea			7220as
	9345as	9730as		
0600 0700	Anguilla, University Network			6090na
0600 0700	Australia, ABC NT Alice Springs			4835do
0600 0700	Australia, ABC NT Katherine			5025do
0600 0700	Australia, ABC NT Tennant Creek			4910do
0600 0700	Australia, ABC/R Australia	11945pa	13630pa	
	15240pa	15415pa	17750as	21725as
0600 0700	Bahrain, R Bahrain	6010me		
0600 0700	Canada, CFRX Toronto ON	6070na		
0600 0700	Canada, CFVP Calgary AB	6030na		
0600 0700	Canada, CKZN St Johns NF	6160na		
0600 0700	Canada, CKZU Vancouver BC			6160na
0600 0700	China, China R International			11710af
	11870me	11895as	13660as	15140me
	15350as	15465as	17505va	17710as
0600 0700	Cuba, R Havana Cuba	6010na	6050na	
	6060ca	6125am		
0600 0700	Eqt Guinea, Pan Am BC/R Africa			15190af
0600 0700	Malaysia, RTM Kajang/Traxx FM			7295do
0600 0700	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0600 0700	Nigeria, Voice of Nigeria	15120af		
0600 0700	Papua New Guinea, R Fly	3915do		
0600 0700	Russia, Voice of Russia	21800pa		
0600 0700 DRM	Russia, Voice of Russia	11830eu		
0600 0700	South Africa, Channel Africa			7230af
0600 0700	Swaziland, TWR Africa	6120af		9500af
0600 0700 Sat/Sun	Swaziland, TWR Africa	3200af		
0600 0700	UK, BBC World Service	6005af	6190af	
	9410af	12095va	15105af	15310as
	17640af	17790as		
0600 0700 DRM	UK, BBC World Service	5875eu		7355eu
0600 0700 mtwhf	UK, BBC World Service	15420af		
0600 0700	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0600 0700	USA, BBG/Voice of America			6080af
	12025af	15580af		
0600 0700	USA, FBN/WTJC Newport NC			9370na
0600 0700	USA, Overcomer Ministry	15750af		
0600 0700	USA, WBCQ Monticello ME	9330am		
0600 0700	USA, WEWN/EWTN Irondale AL			11520af
0600 0700	USA, WHRI Cypress Creek SC			5920am
	7385na	11910va		
0600 0700	USA, WTWW Lebanon TN	5755va		
0600 0700	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0600 0700	USA, WWRB Manchester TN			3185na
0600 0700	Zambia, Christian Voice	6065af		
0600 0700	Zambia, CVC Intl/1 Africa	13590af		
0617 0630 Sun	Nepal, R Nepal	5005do		
0630 0645	India, AIR/Guwahati	4940do		7280do
0630 0645	India, AIR/Hyderbad	7420do		
0630 0645	India, AIR/Mumbai	4840do		7240do
0630 0645	India, AIR/Thiruvananthapuram			5010do
0630 0700	Germany, Deutsche Welle	13780af		17820af
0630 0700	Vatican City State, Vatican R	11625af		13765af
	15570af			
0645 0700 mtwhf	Israel, Kol Israel	9955na		
0651 0700	New Zealand, R New Zealand Intl			11725pa
0651 0700 DRM	New Zealand, R New Zealand Intl			9890pa

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

0700 0730	Myanmar, Myanma R/Yangon			9731do
0700 0750	Austria, TWR Europe	6105eu		
0700 0750	Germany, TWR Europe	6105eu		
0700 0758	New Zealand, R New Zealand Intl			11725pa
0700 0758 DRM	New Zealand, R New Zealand Intl			9890pa
0700 0800	Anguilla, University Network			6090na
0700 0800	Australia, ABC NT Alice Springs			4835do
0700 0800	Australia, ABC NT Katherine			5025do
0700 0800	Australia, ABC NT Tennant Creek			4910do
0700 0800	Australia, ABC/R Australia	7410pa	9475pa	
	9710pa	11945pa	13630pa	15240pa
0700 0800	Bahrain, R Bahrain	6010me		

0700 0800 m/DRM	Belgium, TDP Radio	6015eu		
0700 0800	Canada, CFRX Toronto ON	6070na		
0700 0800	Canada, CFVP Calgary AB	6030na		
0700 0800	Canada, CKZN St Johns NF	6160na		
0700 0800	Canada, CKZU Vancouver BC			6160na
0700 0800	China, China R International			11895as
	13660as	13710eu	15125va	15350as
	15465as	17490eu	17540as	17710as
0700 0800 mtwhfa	Ecuador, HCJB/LV de los Andes			3995eu
0700 0800	Eqt Guinea, Pan Am BC/R Africa			15190af
0700 0800	Malaysia, RTM Kajang/Traxx FM			7295do
0700 0800	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0700 0800	Papua New Guinea, R Fly	3915do		
0700 0800	Russia, Voice of Russia	21800va		
0700 0800 DRM	Russia, Voice of Russia	11830eu		
0700 0800	South Africa, Channel Africa			9625af
0700 0800	Swaziland, TWR Africa	6120af		9500af
0700 0800 Sat/Sun	Swaziland, TWR Africa	3200af		
0700 0800	UK, BBC World Service	6190af		11760me
	11770af	12095af	15310af	15400af
	15575me	17640af	17790as	17830af
0700 0800 DRM	UK, BBC World Service	5875eu		7355eu
0700 0800	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0700 0800	USA, FBN/WTJC Newport NC			9370na
0700 0800	USA, WBCQ Monticello ME	9330am		
0700 0800	USA, WEWN/EWTN Irondale AL			11520af
0700 0800	USA, WHRI Cypress Creek SC			5920am
	7385na			
0700 0800	USA, WTWW Lebanon TN	5755va		
0700 0800	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0700 0800	USA, WWRB Manchester TN			3185na
0700 0800	Zambia, Christian Voice	6065af		
0700 0800	Zambia, CVC Intl/1 Africa	13590af		
0730 0745	India, AIR/Aizawl	5050do		7295do
0730 0745	India, AIR/Chennai	4920do		7380do
0730 0745	India, AIR/Guwahati	4940do		7280do
0730 0745	India, AIR/Imphal	4775do		7335do
0730 0745	India, AIR/Jaipur	4910do		7325do
0730 0745	India, AIR/Kolkata	4820do		7210do
0730 0745	India, AIR/Shimla	4965do		6020do
0730 0800	Australia, HCJB Global Australia			11750as
0759 0800	New Zealand, R New Zealand Intl			6170pa
0759 0800 DRM	New Zealand, R New Zealand Intl			7440pa

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

0800 0830	Australia, ABC NT Alice Springs			4835do
0800 0830	Australia, ABC NT Katherine			5025do
0800 0830	Australia, ABC NT Tennant Creek			4910do
0800 0830	Australia, HCJB Global Australia			11750as
0800 0830 Sun	Canada, Bible Voice Broadcasting			5945eu
0800 0830	France, R France International			9955na
0800 0845 Sat	Canada, Bible Voice Broadcasting			5945eu
0800 0900	Anguilla, University Network			6090na
0800 0900	Australia, ABC/R Australia	5995pa		7410pa
	9475pa	9580pa	9710pa	11945pa
	15240pa			
0800 0900	Bahrain, R 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	China, China R International			11620as
	11895as	13710eu	15350as	15465as
	15625va	17490eu	17540as	
0800 0900	Eqt Guinea, Pan Am BC/R Africa			15190af
0800 0900 Sat	Italy, IRRS SW	9510va		
0800 0900	Malaysia, RTM Kajang/Traxx FM			7295do
0800 0900	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0800 0900	New Zealand, R New Zealand Intl			6170pa
0800 0900 DRM	New Zealand, R New Zealand Intl			7440pa
0800 0900 mtwhfs	Palau, T8WH/World Harvest R			9930as
0800 0900	Palau, T8WH/World Harvest R			17650as
0800 0900	Papua New Guinea, R Fly	3915do		
0800 0900	Russia, Voice of Russia	21800va		
0800 0900 DRM	Russia, Voice of Russia	9850eu		11830eu
0800 0900	South Africa, Channel Africa			9625af
0800 0900 Sun	South Africa, R Mirror Intl	7205af		17570af
0800 0900	South Korea, KBS World R	9570as		
0800 0900	UK, BBC World Service	6190af		11760me
	12095af	15310as	15400af	15575me
	17640af	17790as	17830af	21470af
0800 0900	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0800 0900	USA, FBN/WTJC Newport NC			9370na
0800 0900	USA, WBCQ Monticello ME	9330am		
0800 0900	USA, WEWN/EWTN Irondale AL			11520af
0800 0900	USA, WHRI Cypress Creek SC			5920am
	7385na			
0800 0900	USA, WTWW Lebanon TN	5755va		
0800 0900	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0800 0900	USA, WWRB Manchester TN			3185na
0800 0900	Zambia, Christian Voice	6065af		
0800 0900	Zambia, CVC Intl/1 Africa	13590af		
0815 0827	Nepal, R Nepal	5005do		
0820 0900 mtwhfa	Guam, KTWR/TWR Asia	15170as		
0830 0845	India, AIR/Aizawl	5050do		7295do
0830 0845	India, AIR/Chennai	4920do		7380do
0830 0845	India, AIR/Hyderbad	7420do		
0830 0845	India, AIR/Imphal	4775do		7335do
0830 0845	India, AIR/Kolkata	4820do		7210do
0830 0845	India, AIR/Shillong	4970do		7315do
0830 0845	India, AIR/Thiruvananthapuram			5010do
0830 0900	Australia, ABC NT Alice Springs			2310do
0830 0900	Australia, ABC NT Katherine			2485do
0830 0900	Australia, ABC NT Tennant Creek			2325do
0830 0900 mtwhfa	Guam, KTWR/TWR Asia	11840pa		
0830 0900	India, AIR/Itanagar	4990do		

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

0900 0910 mtwhfa	Guam, KTWR/TWR Asia	11840as		
0900 0930 mtwhfa	USA, WRMI/R Prague relay	9955ca		
0900 1000	Anguilla, University Network			6090na
0900 1000	Australia, ABC NT Alice Springs			2310do
0900 1000	Australia, ABC NT Katherine			2485do
0900 1000	Australia, ABC NT Tennant Creek			2325do
0900 1000	Australia, ABC/R Australia	6020pa		9580pa
	11945pa			
0900 1000	Bahrain, R Bahrain	6010me		
0900 1000 w/DRM	Belgium, TDP Radio	6015eu		
0900 1000	Canada, CFRX Toronto ON	6070na		
0900 1000	Canada, CFVP Calgary AB	6030na		
0900 1000	Canada, CKZN St Johns NF	6160na		
0900 1000	Canada, CKZU Vancouver BC			6160na
0900 1000	China, China R International			11620as
	13790pa	15210as	15270eu	15350as
	17490eu	17570eu	17750as	
0900 1000 Sat/Sun	Germany, Mighty KBC Radio			6095eu
0900 1000	Malaysia, RTM Kajang/Traxx FM			7295do
0900 1000	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0900 1000 3rd Sun	Netherlands, XVRB Radio	6045eu		
0900 1000 DRM	New Zealand, R New Zealand Intl			7440pa
0900 1000	New Zealand, R New Zealand Intl			6170pa
0900 1000	Nigeria, Voice of Nigeria	9690af		
0900 1000	Palau, T8WH/World Harvest R			9930as
0900 1000	Papua New Guinea, R Fly	3915do		
0900 1000	Russia, Voice of Russia	9560as		15170as
	21800va			
0900 1000 DRM	Russia, Voice of Russia	9850eu		11830eu
0900 1000	South Africa, Channel Africa			9625af
0900 1000	UK, BBC World Service	6190af		6195as
	9740as	11760me	12095af	15285as
	15310as	15575me	17640af	17760as
	17790as	17830af	21470af	21660as
0900 1000	USA, Amer Forces Network/AFRTS			4319usb
	5446usb	5765usb	7811usb	12133usb
	12759usb	13362usb		
0900 1000	USA, FBN/WTJC Newport NC			9370na
0900 1000	USA, WBCQ Monticello ME	9330am		
0900 1000	USA, WEWN/EWTN Irondale AL			11520as

0900 1000	USA, WHRI Cypress Creek SC	11565pa
0900 1000	USA, WHRI Cypress Creek SC	7315am 7385na
0900 1000	USA, WTWW Lebanon TN	5755va
0900 1000	USA, WWCR Nashville TN	4840eu 5890af 5935af 6875af
0900 1000	USA, WWRB Manchester TN	3185na
0900 1000	USA, WYFR/Family R Worldwide	9465as
0900 1000	Zambia, Christian Voice	6065af
0900 1000	Zambia, CVC Intl/1 Africa	13590af
0905 0910	Pakistan, PBC/R Pakistan	15725as 17720as
0930 1000 Sun	Italy, IRRS SW	9510va

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

1000 1030	Japan, R Japan NHK World	9605as 9625pa 9695as
1000 1030	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as
1000 1057	North Korea, Voice of Korea	3560ca 11710sa 15180as 11735as 13650as
1000 1058	New Zealand, R New Zealand Intl	6170pa
1000 1100	Anguilla, University Network	11775na
1000 1100	Australia, ABC NT Alice Springs	2310do
1000 1100	Australia, ABC NT Katherine	2485do
1000 1100	Australia, ABC NT Tennant Creek	2325do
1000 1100	Australia, ABC/R Australia	6020pa 9580pa 11945pa
1000 1100	Bahrain, R Bahrain	6010me
1000 1100 h/DRM	Belgium, TDP Radio	6015eu
1000 1100	Canada, CFRX Toronto ON	6070na
1000 1100	Canada, CFVP Calgary AB	6030na
1000 1100	Canada, CKZN St Johns NF	6160na
1000 1100	Canada, CKZU Vancouver BC	6160na
1000 1100	China, China R International	6040na 11610as 11635as 13620as 13690as 13720as 13790pa 15190as 15210as 15350as 17490eu
1000 1100 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1000 1100	India/AIR/External Service	7270as 13695pa 15020as 15410as 17510pa 17800as 17895pa
1000 1100	Indonesia, VO Indonesia	9526va
1000 1100	Malaysia, RTM Kajang/Traxx FM	7295do
1000 1100	Micronesia, V6MP/Cross R/Pohnpei	4755as
1000 1100 DRM	New Zealand, R New Zealand Intl	7440pa
1000 1100	Nigeria, Voice of Nigeria	9690af
1000 1100	Palau, T8WH/World Harvest R	17650as
1000 1100	Russia, Voice of Russia	9560as 11500as 15170as
1000 1100	Saudi Arabia, BSKSA/External Svc	15250as
1000 1100	South Africa, Channel Africa	9625af
1000 1100	UK, BBC World Service	6190af 6195as 9740as 11760me 12095af 15285as 15310as 15575me 17640af 17760as 17790as 21470af 21660as
1000 1100 Sat/Sun	UK, BBC World Service	15400af 17830af
1000 1100	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
1000 1100	USA, FBN/WTJC Newport NC	9370na
1000 1100	USA, KNLS Anchor Point AK	9655as
1000 1100	USA, WBCQ Monticello ME	9330am
1000 1100	USA, WEWN/EWTN Irondale AL	11520as
1000 1100	USA, WHRI Cypress Creek SC	7315am 7385na
1000 1100	USA, WTWW Lebanon TN	5755va
1000 1100	USA, WWCR Nashville TN	4840na 5890af 5935af 6875af
1000 1100	USA, WWRB Manchester TN	3185na
1000 1100	USA, WYFR/Family R Worldwide	9465as
1000 1100	Zambia, Christian Voice	6065af
1000 1100	Zambia, CVC Intl/1 Africa	13590af
1030 1100	Iran, VO Islamic Rep of Iran	21590va 21640va
1030 1100	Mongolia, Voice of Mongolia	12085as
1030 1100	USA, WINB Red Lion PA	9265am
1059 1100	New Zealand, R New Zealand Intl	9655pa

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

1100 1104	Pakistan, PBC/R Pakistan	15725as 17720as
1100 1127	Iran, VO Islamic Rep of Iran	21590va 21640va
1100 1130 Sat/DRM	South Korea, KBS World R	9760eu
1100 1130	UK, BBC World Service	15400af
1100 1130	Vietnam, VO Vietnam/Overseas Svc	7285as
1100 1156	Romania, R Romania Intl	15210eu 15430eu 17510af 17670af
1100 1158 DRM	New Zealand, R New Zealand Intl	7440pa
1100 1200	Anguilla, University Network	11775na
1100 1200	Australia, ABC NT Alice Springs	2310do
1100 1200	Australia, ABC NT Katherine	2485do
1100 1200	Australia, ABC NT Tennant Creek	2325do
1100 1200	Australia, ABC/R Australia	6020pa 6080pa 6140as 9475as 9580pa 11945va
1100 1200 DRM	Australia, ABC/R Australia	12080pa
1100 1200	Bahrain, R Bahrain	6010me
1100 1200 f/DRM	Belgium, TDP Radio	6015eu
1100 1200	Canada, CFRX Toronto ON	6070na
1100 1200	Canada, CFVP Calgary AB	6030na
1100 1200	Canada, CKZN St Johns NF	6160na
1100 1200	Canada, CKZU Vancouver BC	6160na
1100 1200	China, China R International	5955as 6040na 11650as 11660as 11750na 11795as 13590as 13645as 13650eu 13720as 17490eu
1100 1200 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1100 1200	Malaysia, RTM Kajang/Traxx FM	7295do
1100 1200	New Zealand, R New Zealand Intl	9655pa
1100 1200	Nigeria, Voice of Nigeria	9690af
1100 1200 DRM	Russia, Voice of Russia	12030as
1100 1200	Russia, Voice of Russia	9560as 11500as 12065as
1100 1200	Saudi Arabia, BSKSA/External Svc	15250as
1100 1200	South Africa, Channel Africa	9625af
1100 1200	Taiwan, R Taiwan Intl	7445as 9465as
1100 1200	UK, BBC World Service	6190af 6195as 9740as 11760me 12095af 15285as 15310as 15575me 17640af 17790as 17830af 21470af
1100 1200	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
1100 1200	USA, FBN/WTJC Newport NC	9370na
1100 1200	USA, WBCQ Monticello ME	9330am
1100 1200	USA, WEWN/EWTN Irondale AL	11520as
1100 1200	USA, WHRI Cypress Creek SC	7315am 9795am
1100 1200	USA, WINB Red Lion PA	9265am
1100 1200	USA, WTWW Lebanon TN	5755va
1100 1200	USA, WWCR Nashville TN	4840na 5890af 5935af 15825eu
1100 1200	USA, WWRB Manchester TN	3185na
1100 1200	Zambia, Christian Voice	6065af
1100 1200	Zambia, CVC Intl/1 Africa	13590af
1130 1145 f	Palau, T8WH/World Harvest R	15525as
1130 1200 f	Vatican City State, Vatican R	15595me 17590me
1130 1200	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as
1135 1145	India, AIR/Aizawl	5050do 7295do
1135 1145	India, AIR/Shillong	4970do

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

1200 1225	Saudi Arabia, BSKSA/External Svc	15250as
1200 1230	Germany, AWR Europe	17535as
1200 1230	Indonesia, AWR Asia/Pacific	17535as
1200 1230	Japan, R Japan NHK World	6120na 9695as
1200 1259	New Zealand, R New Zealand Intl	9655pa
1200 1300	Anguilla, University Network	11775na
1200 1300	Australia, ABC NT Alice Springs	2310do
1200 1300	Australia, ABC NT Katherine	2485do
1200 1300	Australia, ABC NT Tennant Creek	2325do
1200 1300	Australia, ABC/R Australia	5995pa 6020pa 6080pa 6140as 9475as 9580pa 11945as 12080pa
1200 1300	Bahrain, R Bahrain	6010me

1200	1300	Sat/DRM	Belgium, TDP Radio	6015eu	
1200	1300		Canada, CFRX Toronto ON	6070na	
1200	1300		Canada, CFVP Calgary AB	6030na	
1200	1300		Canada, CKZN St Johns NF	6160na	
1200	1300		Canada, CKZU Vancouver BC		6160na
1200	1300		China, China R International		5955as
			9460as	9645as	9660as 9730as
			9760pa	11650as	11660as 11690va
			11760pa	11980as	13645as 13650eu
			13790eu	17490eu	
1200	1300		Ethiopia, R Ethiopia/Natl Pgm		9705do
1200	1300	Sat/Sun	Germany, Mighty KBC Radio		6095eu
1200	1300		Malaysia, RTM Kajang/Traxx FM		7295do
1200	1300		Nigeria, Voice of Nigeria	9690af	
1200	1300		Palau, T8WH/World Harvest R		9930as
1200	1300	DRM	Russia, Voice of Russia	9850eu	9445as
			12030as		
1200	1300		Russia, Voice of Russia	9560as	11500as
1200	1300		South Korea, KBS World R	9650na	
1200	1300		UK, BBC World Service	5875as	6190af
			6195as	9740as	11750as 11760me
			15310as	15575me	17790as 17830af
			21470af		
1200	1300		USA, Amer Forces Network/AFRTS		4319usb
			5446usb	5765usb	7811usb 12133usb
			12759usb	13362usb	
1200	1300		USA, BBG/Voice of America		7575as
			9510as	12075as	12150as
1200	1300		USA, FBN/WTJC Newport NC		9370na
1200	1300		USA, KNLS Anchor Point AK		7355as
1200	1300		USA, WBCQ Monticello ME	9330am	
1200	1300		USA, WEWN/EWTN Irondale AL		11520as
1200	1300		USA, WHRI Cypress Creek SC		9795am
			9840na		
1200	1300		USA, WINB Red Lion PA	9265am	
1200	1300		USA, WTWW Lebanon TN	5755va	
1200	1300		USA, WWCR Nashville TN	7490na	9980af
			13845af	15825eu	
1200	1300		USA, WWRB Manchester TN		9385na
1200	1300		Zambia, Christian Voice	6065af	
1200	1300		Zambia, CVC Intl/1 Africa	13590af	
1215	1300		Egypt, R Cairo	17870as	
1225	1245		India, AIR/Imphal	4775do	
1230	1245		India, AIR/Aizawl	5050do	7295do
1230	1245		India, AIR/Chennai	4920do	
1230	1245		India, AIR/Hyderbad	4800do	
1230	1245		India, AIR/Imphal	4800do	
1230	1245		India, AIR/Jeypore	5040do	
1230	1245		India, AIR/Kuresong	4895do	
1230	1245		India, AIR/Port Blair/Andaman & Nicobar		
			4760do		
1230	1245		India, AIR/Shillong	4970do	
1230	1245		India, AIR/Thiruvananthapuram		5010do
1230	1245		India/AIR/R Kashmir	4950do	
1230	1300		Australia, HCJB Global Australia		15400as
1230	1300		Thailand, R Thailand World Svc		9890va
1230	1300		Turkey, Voice of Turkey	15450va	
1230	1300		Vietnam, VO Vietnam/Overseas Svc		9840as
			12020as		

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

1300	1325		Turkey, Voice of Turkey	15450va	
1300	1330		Egypt, R Cairo	17870as	
1300	1330		Japan, R Japan NHK World		15735as
1300	1330		Serbia, International R Serbia		9635eu
1300	1357		North Korea, Voice of Korea		9335na
			11710na	13760eu	15245eu
1300	1400		Anguilla, University Network		11775na
1300	1400		Australia, ABC NT Alice Springs		2310do
1300	1400		Australia, ABC NT Katherine		2485do
1300	1400		Australia, ABC/R Australia	6020pa	9580pa
			11945pa		
1300	1400		Bahrain, R Bahrain	6010me	
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na	
1300	1400		Canada, CFRX Toronto ON	6070na	
1300	1400		Canada, CFVP Calgary AB	6030na	
1300	1400		Canada, CKZN St Johns NF	6160na	
1300	1400		Canada, CKZU Vancouver BC		6160na
1300	1400		China, China R International		5995as
			9570na	9650na	9730as 9760pa
			9765va	9870as	11660as 11760pa
			13610eu	13755as	13790eu 15260na
1300	1400	Sat/Sun	Germany, Mighty KBC Radio		6095eu
1300	1400		Indonesia, VO Indonesia	9526va	
1300	1400		Italy, IRRS SW	15190va	
1300	1400		Malaysia, RTM Kajang/Traxx FM		7295do
1300	1400		New Zealand, R New Zealand Intl		6170pa
1300	1400		Nigeria, Voice of Nigeria	9690af	
1300	1400		Palau, T8WH/World Harvest R		9930as
1300	1400	DRM	Russia, Voice of Russia	9850eu	12095as
1300	1400		Russia, Voice of Russia	12065as	
1300	1400		South Korea, KBS World R	9570as	
1300	1400		Tajikistan, VO Tajik	7245va	
1300	1400		UK, BBC World Service	5875as	6190af
			6195as	9740as	11760me 15310as
			15420af	15575me	17640af 17790as
			17830af		
1300	1400		USA, Amer Forces Network/AFRTS		4319usb
			5446usb	5765usb	7811usb 12133usb
			12759usb	13362usb	
1300	1400		USA, BBG/Voice of America		7575as
1300	1400	Sat/Sun	USA, BBG/Voice of America		7575as
			9510as	9610as	12150as
1300	1400		USA, FBN/WTJC Newport NC		9370na
1300	1400		USA, KJES Vado NM	11715na	
1300	1400		USA, WBCQ Monticello ME	9330am	
1300	1400		USA, WEWN/EWTN Irondale AL		15615as
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC		9795na
			9840am		
1300	1400		USA, WINB Red Lion PA	13570am	
1300	1400		USA, WTWW Lebanon TN	9479va	
1300	1400		USA, WWCR Nashville TN	7490af	9980af
			13845eu	15825eu	
1300	1400		USA, WWRB Manchester TN		9385na
1300	1400		USA, WYFR/Family R Worldwide		11540as
1300	1400		Zambia, Christian Voice	6065af	
1300	1400		Zambia, CVC Intl/1 Africa	13590af	
1330	1400	f	Clandestine, JSR/Shiokaze/Sea Breeze		
			5985as		
1330	1400		India/AIR/External Service	9690as	11620as
			13710as		
1330	1400		Vietnam, VO Vietnam/Overseas Svc		9840as
			12020as		

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

1400	1430	f	Clandestine, JSR/Shiokaze/Sea Breeze		
			5985as		
1400	1430		Japan, R Japan NHK World		11705as
			15735as		
1400	1430		Thailand, R Thailand World Svc		9395va
1400	1430	Sun	USA, Pan Amer Broadcasting		15205as
1400	1500		Anguilla, University Network		11775na
1400	1500		Australia, ABC NT Alice Springs		2310do
1400	1500		Australia, ABC NT Katherine		2485do
1400	1500		Australia, ABC NT Tennant Creek		2325do
1400	1500		Australia, ABC/R Australia	5995pa	9580pa
			11945pa		
1400	1500		Bahrain, R Bahrain	6010me	
1400	1500	Sun	Canada, Bible Voice Broadcasting		17495as
1400	1500		Canada, CFRX Toronto ON	6070na	
1400	1500		Canada, CFVP Calgary AB	6030na	
1400	1500		Canada, CKZN St Johns NF	6160na	
1400	1500		Canada, CKZU Vancouver BC		6160na
1400	1500		China, China R International		5955as
			9765va	9870as	11665me 11675as
			11765as	13710eu	13740na 13790eu
			17630af		
1400	1500		Eqt Guinea, Pan Am BC/R Africa		15190af
1400	1500	Sat/Sun	Germany, Mighty KBC Radio		6095eu
1400	1500		India/AIR/External Service	9690as	11620as
			13710as		
1400	1500		Italy, IRRS SW	15190va	
1400	1500		Malaysia, RTM Kajang/Traxx FM		7295do
1400	1500		New Zealand, R New Zealand Intl		6170pa
1400	1500		Nigeria, Voice of Nigeria	9690af	
1400	1500		Oman, R Sultanate of Oman		15140va

1400 1500 DRM	Russia, Voice of Russia	12095eu			
1400 1500	Russia, Voice of Russia	4975va	9560as	11500as	11840as
1400 1500	South Korea, KBS World R	9570as			
1400 1500	UK, BBC World Service	5845as	5875as	6190af	6195as
	9740af	11890as	12095af	13820me	15310as
	17640af	17830af	21470af		
1400 1500	USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb	7811usb
	12133usb	12759usb	13362usb		
1400 1500	USA, BBG/Voice of America	4930af	6080af	15265af	15580af
	17530af				
1400 1500 mtwhf	USA, BBG/Voice of America	7540as	7575as	12150as	
1400 1500	USA, FBN/WTJC Newport NC	9370na			
1400 1500	USA, Overcomer Ministry	9655eu			
1400 1500	USA, WBCQ Monticello ME	9330am			
1400 1500 Sat/Sun	USA, WBCQ Monticello ME	15420am			
1400 1500	USA, WEWN/EWTN Irondale AL	15615as			
1400 1500 Sat/Sun	USA, WHRI Cypress Creek SC	9795am	9840am	21670va	
1400 1500	USA, WJHR Intl Milton FL	15550usb			
1400 1500	USA, WTWW Lebanon TN	9479va			
1400 1500	USA, WWCR Nashville TN	7490af	9980af	13845eu	15825eu
1400 1500	USA, WWRB Manchester TN	9385na			
1400 1500	USA, WYFR/Family R Worldwide	11540as			
1400 1500	Zambia, Christian Voice	6065af			
1400 1500	Zambia, CVC Intl/1 Africa	13590af			
1405 1435 Sat/Sun	Canada, Bible Voice Broadcasting	15270as			
1415 1427	Nepal, R Nepal	5005do			
1415 1430 mtwhfa	USA, Pan Amer Broadcasting	15205as			
1420 1440	India, AIR/Itanagar	4990do			
1420 1455	Swaziland, TWR Africa	4760af			
1430 1445	India, AIR/Aizawl	5050do	7295do		
1430 1445	India, AIR/Gangkok	4835do			
1430 1445	India, AIR/Jeypore	5040do			
1430 1445	India, AIR/Mumbai	4840do	7240do		
1430 1445 Sun	USA, Pan Amer Broadcasting	15205as			
1430 1500	Australia, ABC/R Australia	9475as	11660as		
1430 1500 Sat	Canada, Bible Voice Broadcasting	17495as			
1430 1500	USA, WRMI/R Prague relay	9955ca			
1445 1500	Australia, HCJB Global Australia	15340as			
1450 1500	India, AIR/Itanagar	4990do			
1450 1500	India, AIR/Kuresong	4895do			

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

1500 1515 Sun	Canada, Bible Voice Broadcasting	13740as			
1500 1525 Sun	China, Haixa zhi Sheng/VO Strait	4940do	9505do		
1500 1525 mhf	Guam, KTWR/TWR Asia	15200as			
1500 1530	Australia, ABC/R Australia	11945pa			
1500 1530	Australia, HCJB Global Australia	15340as			
1500 1530	Vietnam, VO Vietnam/Overseas Svc	7285as	9840as	12020as	
1500 1535 twas	Guam, KTWR/TWR Asia	15200as			
1500 1550	New Zealand, R New Zealand Intl	6170pa			
1500 1557	North Korea, Voice of Korea	9335na	11710na	13760eu	15245eu
1500 1600	Anguilla, University Network	11775na			
1500 1600	Australia, ABC NT Alice Springs	2310do			
1500 1600	Australia, ABC NT Katherine	2485do			
1500 1600	Australia, ABC/R Australia	5940as	5995pa	7240pa	9475as
	11660as				
1500 1600	Bahrain, R Bahrain	6010me			
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	China, China R International	5955as	6095me	7325as	7395as
	9720me	9800as	9870as	11965eu	13640eu
	13740na	17630af			
1500 1600 Sat	Clandestine, Sudan R Service	17745af			
1500 1600	Eqt Guinea, Pan Am BC/R Africa	15190af			
1500 1600 Sat/Sun	Germany, Mighty KBC Radio	6095eu			
1500 1600 Sat	Italy, IRRS SW	15700va			
1500 1600	Malaysia, RTM Kajang/Traxx FM	7295do			
1500 1600	Nigeria, Voice of Nigeria	15120af			
1500 1600 DRM	Russia, Voice of Russia	6070as	7370as		
1500 1600	Russia, Voice of Russia	4975va	9560as	11840as	15640me
1500 1600	South Africa, Channel Africa	9625af			
1500 1600	Uganda, Dunamis Shortwave	4750do			
1500 1600	UK, BBC World Service	5845as	5875as	6190af	6195as
	7435af	9410as	9740as	11890as	12095af
	13820me	15310as	15400af	17640af	17830af
	21470af				
1500 1600	USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb	7811usb
	12133usb	12759usb	13362usb		
1500 1600	USA, BBG/Voice of America	4930af	6080af	6140as	7465as
	7520as	9485as	9760as	12150as	13570me
	15265af	15530me	15580af	17895af	
1500 1600	USA, FBN/WTJC Newport NC	9370na			
1500 1600	USA, KNLS Anchor Point AK	9655as			
1500 1600	USA, Overcomer Ministry	13810me			
1500 1600	USA, WBCQ Monticello ME	9330am			
1500 1600 Sat/Sun	USA, WBCQ Monticello ME	15420am			
1500 1600	USA, WEWN/EWTN Irondale AL	15610eu			
1500 1600 Sat/Sun	USA, WHRI Cypress Creek SC	9795am	9840am		
1500 1600 Sun	USA, WHRI Cypress Creek SC	21630af			
1500 1600	USA, WINB Red Lion PA	13570am			
1500 1600	USA, WJHR Intl Milton FL	15550usb			
1500 1600	USA, WTWW Lebanon TN	9479va			
1500 1600	USA, WWCR Nashville TN	9980af	12160af	13845eu	15825eu
1500 1600	USA, WWRB Manchester TN	9385na			
1500 1600	USA, WYFR/Family R Worldwide	6280as	13690as	15520as	
1500 1600	Zambia, Christian Voice	6065af			
1500 1600	Zambia, CVC Intl/1 Africa	13590af			
1515 1530 Sat	Australia, HCJB Global Australia	15340as			
1515 1530 f	Canada, Bible Voice Broadcasting	15275as			
1525 1555 Sat/Sun	Swaziland, TWR Africa	4760af			
1530 1545	India, AIR/Aizawl	5050do	7295do		
1530 1545	India, AIR/Bhopal	4810do	7430do		
1530 1545	India, AIR/Chennai	4920do			
1530 1545	India, AIR/Guwahati	4940do			
1530 1545	India, AIR/Hyderbad	4800do			
1530 1545	India, AIR/Imphal	4775do			
1530 1545	India, AIR/Itanagar	4990do			
1530 1545	India, AIR/Jaipur	4910do	7325do		
1530 1545	India, AIR/Jeypore	5040do			
1530 1545	India, AIR/Kuresong	4895do			
1530 1545	India, AIR/Lucknow	4880do	7440do		
1530 1545	India, AIR/Port Blair/Andaman & Nicobar	4760do			
1530 1545	India, AIR/Shillong	4970do			
1530 1545	India, AIR/Shimla	4965do	6020do		
1530 1545	India, AIR/Thiruvananthapuram	5010do			
1530 1545	India/AIR/R Kashmir	4950do			
1530 1600	Afghanistan, RTV Afghanistan	7200as			
1530 1600	Australia, ABC/R Australia	11880pa			
1530 1600 DRM	Belgium, The Disco Palace	15775as			
1530 1600 h	Canada, Bible Voice Broadcasting	15275as			
1530 1600 Sun	Clandestine, Sudan R Service	17745af			
1530 1600 smtwa	Germany, AWR Europe	15255as			
1530 1600 mtwas	Indonesia, AWR Asia/Pacific	15255as			
1530 1600	Iran, VO Islamic Rep of Iran	11945va	13780va	13720al	
1530 1600	Mongolia, Voice of Mongolia	12015as			
1530 1600	Vatican City State, Vatican R	11850as	13765as	17520as	
1530 1600 DRM	Vatican City State, Vatican R	17815as			
1551 1600	New Zealand, R New Zealand Intl	7440pa			
1551 1600 DRM	New Zealand, R New Zealand Intl	6170pa			

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

1600 1627	Iran, VO Islamic Rep of Iran	11945va	13780va	13720al	
1600 1630	Australia, ABC/R Australia	9540as			

1600 1630 DRM	Belgium, The Disco Palace	15775as	
1600 1630	Vietnam, VO Vietnam/Overseas Svc	7220me	7280eu
	9550me	9730eu	
1600 1657	North Korea, Voice of Korea	3560eu	9990va
	11545va		
1600 1700	Anguilla, University Network	11775na	
1600 1700	Australia, ABC NT Alice Springs	2310do	
1600 1700	Australia, ABC NT Katherine	2485do	
1600 1700	Australia, ABC/R Australia	5940as	5995pa
	7240pa	9475as	11660as
	11880pa		
1600 1700	Bahrain, R Bahrain	6010me	
1600 1700	Canada, CFRX Toronto ON	6070na	
1600 1700	Canada, CFVP Calgary AB	6030na	
1600 1700	Canada, CKZN St Johns NF	6160na	
1600 1700	Canada, CKZU Vancouver BC	6160na	
1600 1700	China, China R International	6060as	
	7235as	7420af	9570af
	11900af	11940eu	11965eu
	13760eu		
1600 1700	Egypt, R Cairo	15345af	
1600 1700	Eqt Guinea, Pan Am BC/R Africa	15190af	
1600 1700	Ethiopia, R Ethiopia	7235va	9560va
1600 1700 Sat/Sun	Germany, Mighty KBC Radio	6095eu	
1600 1700	Malaysia, RTM Kajang/Traxx FM	7295do	
1600 1700 DRM	New Zealand, R New Zealand Intl	6170pa	
1600 1700	New Zealand, R New Zealand Intl	7440pa	
1600 1700	Palau, T8WH/World Harvest R	15530as	
1600 1700 DRM	Russia, Voice of Russia	6070as	7370eu
1600 1700	Russia, Voice of Russia	4975as	7285me
	11985me		
1600 1700	South Korea, KBS World R	9515eu	9640as
1600 1700	Taiwan, R Taiwan Intl	9435as	15485as
1600 1700	Uganda, Dunamis Shortwave	4750do	
1600 1700	UK, BBC World Service	3255af	5845as
	5975as	6190af	9410as
	11890as	12095af	13820me
	15400af	17795af	17830af
	21470af		
1600 1700	USA, Amer Forces Network/AFRTS	4319usb	
	5446usb	5765usb	7811usb
	12133usb	12759usb	13362usb
1600 1700	USA, BBG/Voice of America	4930af	
	6080af	7465as	12080af
	13570af	15470af	15580af
1600 1700	USA, FBN/WTJC Newport NC	9370na	
1600 1700	USA, Overcomer Ministry	15425as	
1600 1700	USA, WBCQ Monticello ME	9330am	
1600 1700 Sat/Sun	USA, WBCQ Monticello ME	15420am	
1600 1700	USA, WEWN/EWTN Irondale AL	15610eu	
1600 1700 Sat/Sun	USA, WHRI Cypress Creek SC	9795am	
1600 1700	USA, WHRI Cypress Creek SC	9840na	
	11630af		
1600 1700	USA, WINB Red Lion PA	13570am	
1600 1700	USA, WJHR Intl Milton FL	15550usb	
1600 1700	USA, WTWW Lebanon TN	9479va	
1600 1700	USA, WWCR Nashville TN	9980af	12160af
	13845eu	15825eu	
1600 1700	USA, WWRB Manchester TN	9385na	
1600 1700	USA, WYFR/Family R Worldwide	11850as	
1600 1700	Zambia, Christian Voice	6065af	
1600 1700	Zambia, CVC Intl/1 Africa	13590af	
1615 1630	Vatican City State, Vatican R	15595va	
1630 1700	Clandestine, Sudan R Service	17745af	
1630 1700	Indonesia, AWR Asia/Pacific	11740as	
1630 1700	Turkey, Voice of Turkey	15520as	
1630 1700	USA, BBG/Voice of America	9490af	
	11655af	13800af	
1645 1700	Canada, Bible Voice Broadcasting	15215me	

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

1700 1710	Pakistan, Azad Kashmir R	3975do	4790do
1700 1710	Pakistan, PBC/R Pakistan	11575eu	
1700 1715 mf	Canada, Bible Voice Broadcasting	15215me	
1700 1720 h	Canada, Bible Voice Broadcasting	15215me	
1700 1725	Turkey, Voice of Turkey	15520as	
1700 1730	Australia, ABC/R Australia	11660as	
1700 1730	USA, BBG/Voice of America	6080af	
	11795va	17895af	
1700 1730	Vietnam, VO Vietnam/Overseas Svc	9625eu	
1700 1750 DRM	New Zealand, R New Zealand Intl	6170pa	
1700 1750	New Zealand, R New Zealand Intl	7440pa	
1700 1755	South Africa, Channel Africa	15235af	
1700 1756 DRM	Romania, R Romania Intl	9535eu	
1700 1756	Romania, R Romania Intl	11740eu	
1700 1800	Anguilla, University Network	11775na	
1700 1800	Australia, ABC NT Alice Springs	2310do	
1700 1800	Australia, ABC NT Katherine	2485do	
1700 1800	Australia, ABC/R Australia	5995pa	9475as
	9500pa	9580pa	11880pa
1700 1800	Bahrain, R Bahrain	6010me	
1700 1800asm	Canada, Bible Voice Broadcasting	15215me	
1700 1800	Canada, CFRX Toronto ON	6070na	
1700 1800	Canada, CFVP Calgary AB	6030na	
1700 1800	Canada, CKZN St Johns NF	6160na	
1700 1800	Canada, CKZU Vancouver BC	6160na	
1700 1800	China, China R International	6090as	
	6140as	6145eu	6165me
	7235as	7265af	7410as
	7420as	9570af	9695eu
	11900af	13760eu	
1700 1800	Egypt, R Cairo	15345af	
1700 1800	Eqt Guinea, Pan Am BC/R Africa	15190af	
1700 1800	Malaysia, RTM Kajang/Traxx FM	7295do	
1700 1800	Poland, Polish Radio/External Svc	9955na	
1700 1800 DRM	Russia, Voice of Russia	7370eu	
1700 1800	Russia, Voice of Russia	4975va	7285va
	11985af	12040eu	
1700 1800	Swaziland, TWR Africa	3200af	
1700 1800	Taiwan, R Taiwan Intl	15690af	
1700 1800	UK, BBC World Service	3255af	5845as
	5975as	6190af	7565as
	9410as	12095af	15400af
	15420af	17640af	17795af
	17830af		
1700 1800	USA, Amer Forces Network/AFRTS	4319usb	
	5446usb	5765usb	7811usb
	12133usb	12759usb	13362usb
1700 1800	USA, BBG/Voice of America	11795af	
	15580af		
1700 1800	USA, FBN/WTJC Newport NC	9370na	
1700 1800	USA, Overcomer Ministry	15425as	
1700 1800	USA, WBCQ Monticello ME	9330am	15420am
1700 1800	USA, WEWN/EWTN Irondale AL	15610eu	
1700 1800	USA, WHRI Cypress Creek SC	9840na	
	21630af		
1700 1800	USA, WINB Red Lion PA	13570am	
1700 1800	USA, WJHR Intl Milton FL	15550usb	
1700 1800	USA, WTWW Lebanon TN	9479va	
1700 1800	USA, WWCR Nashville TN	9980af	12160af
	13845eu	15825eu	
1700 1800	USA, WWRB Manchester TN	9385na	
1700 1800	USA, WYFR/Family R Worldwide	7395af	
	17545af		
1700 1800	Zambia, Christian Voice	4965as	
1700 1800	Zambia, CVC Intl/1 Africa	13590af	
1720 1740 Sat/Sun	USA, BBG/Voice of America/Studio 7	4930af	
	7210af	9725af	
1730 1745 h	Canada, Bible Voice Broadcasting	15215me	
1730 1745	India, AIR/Bhopal	4810do	7430do
1730 1745	India, AIR/Chennai	4920do	
1730 1745	India, AIR/Guwahati	4940do	
1730 1745	India, AIR/Hyderbad	4800do	
1730 1745	India, AIR/Imphal	4775do	
1730 1745	India, AIR/Jaipur	4910do	7325do
1730 1745	India, AIR/Kuresong	4895do	
1730 1745	India, AIR/Lucknow	4880do	7440do
1730 1745	India, AIR/Shimla	4965do	6020do
1730 1745	India, AIR/Thiruvananthapuram	5010do	
1730 1745	India/AIR/R Kashmir	4950do	
1730 1800	Australia, ABC/R Australia	6080pa	
1730 1800 Sun	Italy, IRRS SW	7290va	
1730 1800 m	South Africa, R Mirror Intl	3230af	
1730 1800	USA, BBG/Voice of America	6080af	
	12015va	17895af	
1730 1800 mtwh	USA, BBG/Voice of America/Studio 7	4930af	
	7210af	9725af	
1730 1800	Vatican City State, Vatican R	11625af	13765af
	15570af		
1745 1800 Sat	Canada, Bible Voice Broadcasting	17515af	
1745 1800 DRM	India/AIR/External Service	9950eu	
1745 1800	India/AIR/External Service	7400af	7550eu
	9415af	11580af	11670as
	11935af	13695af	

1751 1800 New Zealand, R New Zealand Intl 9615pa
1751 1800 DRM New Zealand, R New Zealand Intl 7440pa

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

1800 1830 w Austria, AWR Europe 15325af
1800 1830 Japan, R Japan NHK World 15720af
1800 1830 South Africa, AWR Africa 3215af 3345af
1800 1830 m South Africa, R Mirror Intl 3230af
1800 1830 Tanzania, Zanzibar BC/VO Tanzania 11735do
1800 1830 UK, BBC World Service 5850as 5975as
1800 1830 USA, BBG/Voice of America 6080af 17895af
1800 1830 Sat/Sun USA, BBG/Voice of America 4930af
1800 1830 USA, BBG/Voice of America 9850af
1800 1836 DRM New Zealand, R New Zealand Intl 7440pa
1800 1836 New Zealand, R New Zealand Intl 9615pa
1800 1857 North Korea, Voice of Korea 13760eu 15245eu
1800 1900 Anguilla, University Network 11775na
1800 1900 mtwhf Argentina, RAE 15345eu
1800 1900 Australia, ABC NT Alice Springs 2310do
1800 1900 Australia, ABC NT Katherine 2485do
1800 1900 Australia, ABC/R Australia 6080pa 9500pa 9580pa 9710pa 11880pa
1800 1900 Bahrain, R Bahrain 6010me
1800 1900 Sat Canada, Bible Voice Broadcasting 9430me
1800 1900 Sun Canada, Bible Voice Broadcasting 6130eu 15215me
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 China, China R International 6175eu 9600eu 13760eu
1800 1900 mtwhfa Ecuador, HCJB/LV de los Andes 3995eu
1800 1900 Eqt Guinea, Pan Am BC/R Africa 15190af
1800 1900 DRM India/AIR/External Service 9950eu
1800 1900 India/AIR/External Service 7400af 7550as 9415af 9445af 11580af 11670eu 11935af 13695af
1800 1900 fa Italy, IRRS SW 7290va
1800 1900 Kuwait, R Kuwait 15540eu
1800 1900 Malaysia, RTM Kajang/Traxx FM 7295do
1800 1900 DRM Russia, Voice of Russia 7370eu 9880eu
1800 1900 Russia, Voice of Russia 4975me 9900va 12040eu
1800 1900 South Korea, KBS World R 7275eu
1800 1900 Swaziland, TWR Africa 3200af 9500af
1800 1900 Taiwan, R Taiwan Intl 6155eu
1800 1900 UK, BBC World Service 3255af 5875me 5950as 6190af 11810af 12095af 15400af 15420af 17795af
1800 1900 USA, Amer Forces Network/AFRTS 4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
1800 1900 USA, BBG/Voice of America 12015af 15580af
1800 1900 USA, FBN/WTJC Newport NC 9370na
1800 1900 USA, KJES Vado NM 15385na
1800 1900 USA, WBCQ Monticello ME 9330am 15420am
1800 1900 USA, WEWN/EWTN Irondale AL 15610af
1800 1900 USA, WHRI Cypress Creek SC 9840na 21630af
1800 1900 USA, WINB Red Lion PA 13570am
1800 1900 USA, WJHR Intl Milton FL 15550usb
1800 1900 USA, WTWW Lebanon TN 9479va
1800 1900 USA, WWCR Nashville TN 9980af 12160af 13845eu 15825eu
1800 1900 USA, WWRB Manchester TN 9385na
1800 1900 USA, WYFR/Family R Worldwide 5905af 9610af 9925af 13750af
1800 1900 Zambia, Christian Voice 4965af
1800 1900 Zambia, CVC Intl/1 Africa 13590af
1815 1845 Sun Canada, Bible Voice Broadcasting 6130eu 9430me
1830 1900 f Canada, Bible Voice Broadcasting 17515af
1830 1900 Sun Italy, IRRS SW 7290va
1830 1900 mtwhf Moldova, R PMR/Pridnestrovye 9665eu
1830 1900 DRM/mtwhf Nigeria, Voice of Nigeria 15120af
1830 1900 Serbia, International R Serbia 6100eu
1830 1900 South Africa, AWR Africa 11840af
1830 1900 Turkey, Voice of Turkey 9785va
1830 1900 UK, BBC World Service 9410af
1830 1900 USA, BBG/Voice of America 4930af 6080af 9850af
1837 1900 New Zealand, R New Zealand Intl 9615pa
1837 1900 DRM New Zealand, R New Zealand Intl 9890pa

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

1900 1925 Turkey, Voice of Turkey 9785va
1900 1927 Germany, Deutsche Welle 9735af
1900 1930 f Canada, Bible Voice Broadcasting 17515af
1900 1930 Germany, Deutsche Welle 7365af 11800af
1900 1930 USA, BBG/Voice of America 9850af
1900 1930 Vietnam, VO Vietnam/Overseas Svc 7280eu 9730eu
1900 1945 DRM India/AIR/External Service 9950eu
1900 1945 India/AIR/External Service 7400af 7550eu 9415af 9445af 11580af 11670eu 11935af 13695af
1900 1950 DRM New Zealand, R New Zealand Intl 9890pa
1900 1950 New Zealand, R New Zealand Intl 9615pa
1900 1957 North Korea, Voice of Korea 3560eu 7210af 9975va 11535va 11910af
1900 2000 Anguilla, University Network 11775na
1900 2000 Australia, ABC NT Alice Springs 2310do
1900 2000 Australia, ABC NT Katherine 2485do
1900 2000 Australia, ABC/R Australia 6080pa 9475as 9500pa 9580pa 9710pa 11660pa 11880pa
1900 2000 Bahrain, R Bahrain 6010me
1900 2000 Canada, CFRX Toronto ON 6070na
1900 2000 Canada, CFVP Calgary AB 6030na
1900 2000 Canada, CKZN St Johns NF 6160na
1900 2000 Canada, CKZU Vancouver BC 6160na
1900 2000 China, China R International 7295va 9435af 9440af
1900 2000 Cuba, R Havana Cuba 11760am
1900 2000 Egypt, R Cairo 15290af
1900 2000 Eqt Guinea, Pan Am BC/R Africa 15190af
1900 2000 Indonesia, VO Indonesia 9526va
1900 2000 Kuwait, R Kuwait 15540eu
1900 2000 Malaysia, RTM Kajang/Traxx FM 7295do
1900 2000 Micronesia, V6MP/Cross R/Pohnpei 4755as
1900 2000 DRM/mtwhf Nigeria, Voice of Nigeria 15120af
1900 2000 DRM Russia, Voice of Russia 6155eu
1900 2000 Russia, Voice of Russia 12040eu
1900 2000 mtwhf Spain, R Exterior de Espana 9665af 11620af
1900 2000 Swaziland, TWR Africa 3200af
1900 2000 Thailand, R Thailand World Svc 7205eu
1900 2000 UK, BBC World Service 3255af 5875me 5950as 6005af 6190af 9410af 11810af 12095af 15400af 17795as
1900 2000 USA, Amer Forces Network/AFRTS 4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
1900 2000 USA, BBG/Voice of America 4930af 4940af 6080af 7485me 9490me 15580af
1900 2000 USA, FBN/WTJC Newport NC 9370na
1900 2000 USA, Overcomer Ministry 9400eu
1900 2000 USA, WBCQ Monticello ME 9330am 15420am
1900 2000 USA, WEWN/EWTN Irondale AL 15610af
1900 2000 USA, WHRI Cypress Creek SC 9840na 21630af
1900 2000 USA, WINB Red Lion PA 13570am
1900 2000 USA, WJHR Intl Milton FL 15550usb
1900 2000 USA, WTWW Lebanon TN 9479va
1900 2000 USA, WWCR Nashville TN 9980af 12160af 13845eu 15825eu
1900 2000 USA, WWRB Manchester TN 9385na
1900 2000 USA, WYFR/Family R Worldwide 9775af 9925af
1900 2000 Zambia, Christian Voice 4965af
1900 2000 Zambia, CVC Intl/1 Africa 13590af
1905 1920 Sat Mali, ORTM/R Mali 9635do

1930 1957	Germany, Deutsche Welle	7365af
1930 2000	Germany, Deutsche Welle	11800af
1930 2000	Iran, VO Islamic Rep of Iran	9540eu 9800eu 11750af 11885af
1930 2000 Sat	USA, Pan Amer Broadcasting	9515af
1951 2000	New Zealand, R New Zealand Intl	11725pa
1951 2000 DRM	New Zealand, R New Zealand Intl	15720pa

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

2000 2027	Iran, VO Islamic Rep of Iran	9540eu 9800eu 11750af 11885af
2000 2030 mtwhfa	Albania, R Tirana	7465eu
2000 2030	Australia, ABC/R Australia	6080pa 9500pa
2000 2030	Egypt, R Cairo	15290af
2000 2030 Sat	Swaziland, TWR Africa	3200af
2000 2030	USA, BBG/Voice of America	4930af 6080af
2000 2030	Vatican City State, Vatican R	9755af 11625af
2000 2057	Germany, Deutsche Welle	9490af
2000 2100	Anguilla, University Network	11775na
2000 2100	Australia, ABC NT Alice Springs	2310do
2000 2100	Australia, ABC NT Katherine	2485do
2000 2100	Australia, ABC NT Tennant Creek	2325do
2000 2100	Australia, ABC/R Australia	9580pa 11650pa 11660pa 12080pa 15515pa
2000 2100	Bahrain, R Bahrain	6010me
2000 2100	Belarus, R Belarus	7255eu 11730eu
2000 2100 DRM	Belgium, The Disco Palace	17875na
2000 2100	Canada, CFRX Toronto ON	6070na
2000 2100	Canada, CFVP Calgary AB	6030na
2000 2100	Canada, CKZN St Johns NF	6160na
2000 2100	Canada, CKZU Vancouver BC	6160na
2000 2100	China, China R International	5960eu 5985af 7285eu 7295va 7415eu 9440af 9600eu
2000 2100 f	Clandestine, JSR/Shiokaze/Sea Breeze	5910as
2000 2100	Eqt Guinea, Pan Am BC/R Africa	15190af
2000 2100	Germany, Deutsche Welle	6150af 11800af
2000 2100	Kuwait, R Kuwait	15540eu
2000 2100	Malaysia, RTM Kajang/Traxx FM	7295do
2000 2100	Micronesia, V6MP/Cross R/Pohnpei	4755as
2000 2100 DRM	New Zealand, R New Zealand Intl	15720pa
2000 2100	New Zealand, R New Zealand Intl	11725pa
2000 2100 DRM	Russia, Voice of Russia	6155eu
2000 2100	Russia, Voice of Russia	12040eu
2000 2100	South Africa, CVC 1 Africa R	9505af 13590af
2000 2100	UK, BBC World Service	3255af 6005af 6190af 9410af 9855af 11810af 12095af 15400af
2000 2100	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
2000 2100	USA, BBG/Voice of America	4930af 7485me 15580af
2000 2100 mtwhf	USA, BBG/Voice of America	9480me
2000 2100	USA, FBN/WTJC Newport NC	9370na
2000 2100	USA, Overcomer Ministry	9400eu
2000 2100	USA, WBCQ Monticello ME	7490am 9330am 15420am
2000 2100	USA, WEWN/EWTN Irondale AL	15610af
2000 2100 mtwhfa	USA, WHRI Cypress Creek SC	21630af
2000 2100	USA, WHRI Cypress Creek SC	17510va
2000 2100	USA, WINB Red Lion PA	13570am
2000 2100	USA, WJHR Intl Milton FL	15550usb
2000 2100	USA, WTWW Lebanon TN	9479va
2000 2100	USA, WWCR Nashville TN	9980af 12160af 13845eu 15825eu
2000 2100	USA, WWRB Manchester TN	9385na
2000 2100	USA, WYFR/Family R Worldwide	15195af
2000 2100	Zambia, Christian Voice	4965af
2000 2100	Zambia, CVC Intl/1 Africa	9505as
2030 2045	Thailand, R Thailand World Svc	9680eu
2030 2056 DRM	Romania, R Romania Intl	9700eu
2030 2056	Romania, R Romania Intl	11880na 13800na 15220na
2030 2100	Australia, ABC/R Australia	9500pa 11695as 12080pa
2030 2100 mtwhf	Moldova, R PMR/Pridnestrovye	9665eu
2030 2100	Turkey, Voice of Turkey	7205va
2030 2100	USA, BBG/Voice of America	6080af 7555as
2030 2100 Sat/Sun	USA, BBG/Voice of America	4940af
2030 2100	Vietnam, VO Vietnam/Overseas Svc	7220me 7280eu 9730me 9730eu
2045 2100	India/AIR/External Service	7550eu 9445eu 9910pa 11620pa 11670eu 11715pa
2045 2100 DRM	India/AIR/External Service	9950eu

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

2100 2125	Turkey, Voice of Turkey	7205va
2100 2130	Australia, ABC NT Alice Springs	2310do
2100 2130	Australia, ABC NT Katherine	2485do
2100 2130	Australia, ABC NT Tennant Creek	2325do
2100 2130	Austria, AWR Europe	11955af
2100 2130	Serbia, International R Serbia	6100eu
2100 2130	South Korea, KBS World R	3955eu
2100 2150	New Zealand, R New Zealand Intl	11725pa
2100 2150 DRM	New Zealand, R New Zealand Intl	15720pa
2100 2157	North Korea, Voice of Korea	13760eu 15245eu
2100 2200	Angola, Angolan National R	7217af
2100 2200	Anguilla, University Network	11775na
2100 2200	Australia, ABC/R Australia	9500pa 11695as 13630pa 15515pa 11650pa 12080pa 21740pa
2100 2200	Bahrain, R Bahrain	6010me
2100 2200	Belarus, R Belarus	7255eu 11730eu
2100 2200	Canada, CFRX Toronto ON	6070na
2100 2200	Canada, CFVP Calgary AB	6030na
2100 2200	Canada, CKZN St Johns NF	6160na
2100 2200	Canada, CKZU Vancouver BC	6160na
2100 2200	China, China R International	5960eu 7205af 7285eu 7325af 7415eu 9600eu

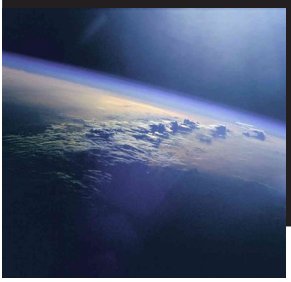
2100 2200	Eqt Guinea, Pan Am BC/R Africa	15190af
2100 2200	Germany, Deutsche Welle	11800af 11830af 11865af
2100 2200	India/AIR/External Service	7550eu 9445eu 9910pa 11620pa 11670eu 11715pa
2100 2200 DRM	India/AIR/External Service	9950eu
2100 2200	Malaysia, RTM Kajang/Traxx FM	7295do
2100 2200	Micronesia, V6MP/Cross R/Pohnpei	4755 as
2100 2200 DRM	Russia, Voice of Russia	6155eu
2100 2200	South Africa, CVC 1 Africa R	9505af 13590af
2100 2200 Sat/Sun	Spain, R Exterior de Espana	9650eu
2100 2200	Syria, R Damascus	9330va
2100 2200	UK, BBC World Service	3255af 3915as 5875as 5905af 6005af 6190af 6195va 9410af 12095af
2100 2200	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
2100 2200	USA, BBG/Voice of America	6080af 7555as 15580af
2100 2200	USA, FBN/WTJC Newport NC	9370na
2100 2200	USA, Overcomer Ministry	9400eu
2100 2200	USA, WBCQ Monticello ME	7490am 9330am
2100 2200	USA, WEWN/EWTN Irondale AL	15610af
2100 2200	USA, WHRI Cypress Creek SC	17510va
2100 2200	USA, WINB Red Lion PA	9265am
2100 2200	USA, WJHR Intl Milton FL	15550usb
2100 2200	USA, WTWW Lebanon TN	9479va
2100 2200	USA, WWCR Nashville TN	6875eu 9350af 9980af 13845eu
2100 2200	USA, WWRB Manchester TN	9385na
2100 2200	USA, WYFR/Family R Worldwide	12070af
2100 2200	Zambia, Christian Voice	4965af
2100 2200	Zambia, CVC Intl/1 Africa	9505as
2115 2200	Egypt, R Cairo	11890eu
2130 2200	Australia, ABC NT Alice Springs	4835do
2130 2200	Australia, ABC NT Katherine	5025do
2145 2200	India/AIR/R Kashmir	4950do
2151 2200	New Zealand, R New Zealand Intl	15720pa
2151 2200 DRM	New Zealand, R New Zealand Intl	17675pa

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

2200 2230	India/AIR/External Service	7550eu 9445eu 9910pa 11620pa 11670eu 11715pa
2200 2230 DRM	India/AIR/External Service	9950as
2200 2245	Egypt, R Cairo	11890eu
2200 2255	Turkey, Voice of Turkey	9830va
2200 2256	Romania, R Romania Intl	7435eu 9540eu 9790eu 11940eu
2200 2300	Anguilla, University Network	6090na
2200 2300	Australia, ABC NT Alice Springs	4835do
2200 2300	Australia, ABC NT Katherine	5025do
2200 2300	Australia, ABC/R Australia	9855as 12080pa 13630pa 15230pa 15240as 15415pa 15515pa 21740pa
2200 2300	Bahrain, R Bahrain	6010me
2200 2300	Canada, CFRX Toronto ON	6070na
2200 2300	Canada, CFVP Calgary AB	6030na
2200 2300	Canada, CKZN St Johns NF	6160na
2200 2300	Canada, CKZU Vancouver BC	6160na
2200 2300	China, China R International	9590as
2200 2300	Eqt Guinea, Pan Am BC/R Africa	15190af
2200 2300	Malaysia, RTM Kajang/Traxx FM	7295do
2200 2300	Micronesia, V6MP/Cross R/Pohnpei	4755 as
2200 2300	New Zealand, R New Zealand Intl	15720pa
2200 2300 DRM	New Zealand, R New Zealand Intl	17675pa
2200 2300 Sat	Palau, T8WH/World Harvest R	9930as
2200 2300	Russia, Voice of Russia	9800va
2200 2300	UK, BBC World Service	3915as 5875as 5905as 6195as 7490as 9580as 9730af 9740as 12095af
2200 2300	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
2200 2300	USA, BBG/Voice of America	5755as
2200 2300 mtwhs	USA, BBG/Voice of America	5895as 5915as 7480as 7575as 12150as
2200 2300	USA, FBN/WTJC Newport NC	9370na
2200 2300	USA, Overcomre Ministry	9400as
2200 2300	USA, WBCQ Monticello ME	7490am 9330am
2200 2300	USA, WEWN/EWTN Irondale AL	15610me
2200 2300	USA, WHRI Cypress Creek SC	11775va 13620na 17510va
2200 2300 twhfas	USA, WINB Red Lion PA	9265am
2200 2300	USA, WTWW Lebanon TN	9479va
2200 2300	USA, WWCR Nashville TN	6875eu 9350af 9980af 13845eu
2200 2300	USA, WWRB Manchester TN	9385na
2200 2300	USA, WYFR/Family R Worldwide	6115na
2200 2300	Zambia, Christian Voice	4965af
2230 2300	Indonesia, AWR Asia/Pacific	9730as
2230 2300 mtwhf	Moldova, R PMR/Pridnestrovye	9665eu
2230 2300	USA, BBG/Voice of America	7460as 9570as 11840as 15340as
2230 2300	USA, WYFR/Family R Worldwide	6115af 11580af 15255af
2245 2300	India/AIR/External Service	6055as 9705as 9950as 11670as 13605as
2245 2300 DRM	India/AIR/External Service	11645as
2245 2300	India/AIR/R Kashmir	4950do

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

2300 0000	Anguilla, University Network	6090na
2300 0000	Australia, ABC NT Alice Springs	4835do
2300 0000	Australia, ABC NT Katherine	5025do
2300 0000	Australia, ABC/R Australia	9855as 12080pa 13630pa 15230pa 15415pa 15515pa 17795pa 19000pa 21740pa
2300 0000	Bahrain, R Bahrain	6010me
2300 0000	Canada, CFRX Toronto ON	6070na
2300 0000	Canada, CFVP Calgary AB	6030na
2300 0000	Canada, CKZN St Johns NF	6160na
2300 0000	Canada, CKZU Vancouver BC	6160na
2300 0000	China, China R International	5915as 5990ca 6145na 7350eu 7410as 9610as 11690as 11790as 11840na
2300 0000	Cuba, R Havana Cuba	5040va
2300 0000	Egypt, R Cairo	9965na
2300 0000	India/AIR/External Service	6055as 9705as 9950as 11670as 13605as
2300 0000 DRM	India/AIR/External Service	11645as
2300 0000	Malaysia, RTM Kajang/Traxx FM	7295do
2300 0000	Micronesia, V6MP/Cross R/Pohnpei	4755 as
2300 0000	New Zealand, R New Zealand Intl	15720pa
2300 0000 DRM	New Zealand, R New Zealand Intl	17675pa
2300 0000	Russia, Voice of Russia	9665va 9800va
2300 0000	UK, BBC World Service	3915as 6195as 7490as 9580as 9740as 9890as 11850as 12010as
2300 0000	USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
2300 0000	USA, BBG/Voice of America	5895as 5910as 7460as 7555as 7575as 9570as 11840as 12150as 15340as
2300 0000	USA, FBN/WTJC Newport NC	9370na
2300 0000	USA, WBCQ Monticello ME	7490am 9330am
2300 0000 Sat/Sun	USA, WBCQ Monticello ME	5110am
2300 0000	USA, WEWN/EWTN Irondale AL	15610me
2300 0000	USA, WHRI Cypress Creek SC	13620na 17510va
2300 0000 Sun	USA, WHRI Cypress Creek SC	11775va
2300 0000 mtwhfs	USA, WHRI Cypress Creek SC	7315ca
2300 0000	USA, WINB Red Lion PA	9265am
2300 0000	USA, WTWW Lebanon TN	9479va
2300 0000	USA, WWCR Nashville TN	6875eu 9350af 9980af 13845eu
2300 0000	USA, WWRB Manchester TN	5050na
2300 0000	USA, WYFR/Family R Worldwide	15255ca 11580sa
2300 0000	Zambia, Christian Voice	4965af
2300 2330	Australia, ABC/R Australia	15240as
2330 0000	Australia, ABC/R Australia	17750as
2330 0000	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as



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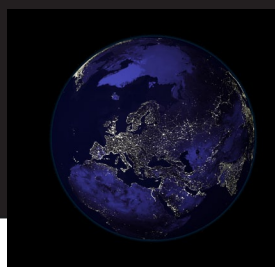
Shortwave Broadcast Guide

CHINESE/SPANISH



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

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

1200 1230	Australia, HCJB Global Australia			15400as
1200 1230	Clandestine, VO Tibet	15443as		
1200 1230	Guam, KTWR/TWR Asia	9910as		
1200 1230	Japan, R Japan NHK World			6090as
1200 1230	South Korea, KBS World R	6095as		9770as
1200 1230	Taiwan, R Taiwan Intl	6105as		11915as
1200 1230	Vietnam, VO Vietnam/Overseas Svc			7220as
	12000as			
1200 1257	Iran, VO Islamic Rep of Iran	17610as		17670as
	21500as	21650as		
1200 1300	China, China Huayi BC	6185do		
1200 1300	China, China R International			9570na
	11850na			
1200 1300	China, China R International			7390as
	7440as	9540as	9855as	11640as
	11790va	13610as	13755as	13810va
	15110me	17650eu		
1200 1300	China, CNR/VO Pujiang	3280do		4950do
	5075do			
1200 1300	China, CNR/VO Shenzhou/CNR6			6165do
	9170do			
1200 1300	China, CNR/VO Zhonghua/CNR5			5925do
	9410do			
1200 1300	China, Gannan PBS	3990do		5970do
1200 1300	China, Haixa zhi Sheng/VO Strait			6115do
1200 1300	China, Nei Menggu PBS	7420do		9520do
1200 1300	China, Sichuan PBS2	6060do		7225do
1200 1300	China, Tibet PBS	4820do	5935do	6050do
	7240do	7450do		
1200 1300	China, Xinjiang PBS	3950do		5060do
	5960do	7310do		
1200 1300	China, Yunnan PBS/Minority Svc			7210do
1200 1300	Clandestine, Sound of Hope R Intl			7280as
	11970as	12980as	13270as	13350as
	13880as	14700as	14950as	16100as
1200 1300	Guam, KTWR/TWR Asia	9975as		
1200 1300	India, All India R/External Svc			11840as
	15795as	17705as		
1200 1300	Indonesia, AWR Asia/Pacific			9800as
	15490as			
1200 1300	Pakistan, PBC/R Pakistan	15700as		17725as
1200 1300	Philippines, FEBC Philippines			9400as
	9430as			
1200 1300	Russia, Voice of Russia	6075as		
1200 1300	Taiwan, R Taiwan Intl	9465as		
1200 1300	Taiwan, R Taiwan Intl	6085as		6150as
	7385as	9665as	9680as	9780as
	11710as			
1200 1300	USA, BBG/Voice of America			6110as
	9840as	11785as	11825as	11990as
	12040as	15115as	15250as	
1225 1300	Vatican City State, Vatican R	9900as		11890as
	17590as			
1230 1240 Sat	Vatican City State, Vatican R	9900as		11890as
	17590as			
1230 1300	Clandestine, Sound of Hope R Intl			9375as

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

1300 1315	India, All India R/External Svc			11840as
	15795as	17705as		
1300 1315	Vatican City State, Vatican R	9900as		11890as
	17590as			
1300 1326	Romania, R Romania Intl	15435as		17850as
1300 1330	Clandestine, Sound of Hope R Intl			15750as
1300 1330	Clandestine, VO Tibet	15497as		
1300 1330 mtwhf	Indonesia, AWR Asia/Pacific			15320as
1300 1330	Japan, R Japan NHK World			6190as
1300 1330	Vietnam, VO Vietnam/Overseas Svc			7220as
	12000as			
1300 1357	North Korea, Voice of Korea			11735as
	13650as			
1300 1400	Australia, ABC/R Australia	9475as		9965as
	11660as	11760as		
1300 1400	China, China Huayi BC	6185do		
1300 1400	China, China R International			7205as
	7215as	7440as	9540as	9855as
	13650me	13670eu		
1300 1400	China, CNR/VO Pujiang	3280do		4950do
	5075do			
1300 1400	China, CNR/VO Shenzhou/CNR6			6165do
	9170do			
1300 1400	China, CNR/VO Zhonghua/CNR5			5925do
	9410do			
1300 1400	China, Gannan PBS	3990do		5970do
1300 1400	China, Nei Menggu PBS	7420do		9520do
1300 1400	China, Sichuan PBS2	6060do		7225do
1300 1400	China, Tibet PBS	4820do	5935do	6050do
	7240do	7450do		
1300 1400	China, Xinjiang PBS	3950do		5060do
	5960do	7310do		
1300 1400	China, Yunnan PBS/Minority Svc			7210do
1300 1400	China, Yunnan PBS/VO Shangri-La			6035do
1300 1400	Clandestine, Minghui R	6030as		
1300 1400	Clandestine, Sound of Hope R Intl			7310as
	11970as	12980as	13130as	13350as
	13880as	14950as	15900as	16100as
1300 1400	Germany, Deutsche Welle	11965as		17770af
1300 1400 smtwhf	Guam, KTWR/TWR Asia	9975as		
1300 1400	Philippines, FEBC Philippines			9400as
	9430as			
1300 1400	Russia, Voice of Russia	9560as		
1300 1400	South Korea, KBS World R	7275as		
1300 1400	Taiwan, R Taiwan Intl	11625as		
1300 1400	Taiwan, R Taiwan Intl	6085as		6150as
	7385as	7445as	9680as	9780as
	15265as			
1300 1400	USA, BBG/Voice of America			7365as
	9355as			
1300 1400	USA, BBG/Voice of America			6110as
	9845as	11785as	11805as	11990as
	12040as	15115as	15250as	
1315 1330	Thailand, R Thailand World Svc			9795as
1330 1400	Clandestine, Sound of Hope R Intl			11550as
1330 1400	Clandestine, VO Tibet	15487as		
1330 1400	Indonesia, AWR Asia/Pacific			15320as

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

1400 1430	Australia, ABC/R Australia	9475as		9965as
	11660as	11760as		
1400 1430	Clandestine, Sound of Hope R Intl			9995as
	11970as	12980as		
1400 1430 mtwhf	Guam, KTWR/TWR Asia	9955as		
1400 1445 smtwhf	Guam, KTWR/TWR Asia	9975as		
1400 1500	China, China Huayi BC	6185do		
1400 1500	China, China R International			9655as
	11650as			
1400 1500	China, China R International			6040as
	7210as	7235as	7400as	9430me
	9730as	11610as	11785eu	15220na
1400 1500	China, CNR/VO Pujiang	3280do		4950do
	5075do			

1400 1500		China, CNR/VO Shenzhou/CNR6			6165do
		9170do			
1400 1500		China, CNR/VO Zhonghua/CNR5			5925do
		9410do			
1400 1500		China, Nei Menggu PBS	7420do		9520do
1400 1500		China, Sichuan PBS2	6060do		7225do
1400 1500		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
1400 1500		China, Xinjiang PBS	3950do		5060do
		5960do	7310do		
1400 1500		China, Yunnan PBS/Minority Svc			7210do
1400 1500		Clandestine, Sound of Hope R Intl			9450as
		11970as	12980as	13130as	13350as
		13880as	14950as	15900as	16100as
1400 1500		Clandestine, VO China	7270as		
1400 1500		Indonesia, AWR Asia/Pacific			13575as
		15320as			
1400 1500		Philippines, FEBC Philippines			9345as
		9430as			
1400 1500		Taiwan, R Taiwan Intl	6075as		6085as
		6145as	7385as	7445as	9680as
1400 1500		USA, BBG/R Free Asia	12135as		
1400 1500		USA, BBG/Voice of America			7365as
		9355as			
1400 1500		USA, BBG/Voice of America			6110as
		9845as	11615as	11785as	11805as
		15115as	15250as		
1405 1420	twhf	Canada, Bible Voice Broadcasting			15270as
1430 1500		Clandestine, Sound of Hope R Intl			15780as
1430 1500		Clandestine, Sound of Hope R Intl			15780as
1430 1500		Japan, R Japan NHK World			6190as
1430 1500		Mongolia, Voice of Mongolia			12015as
1430 1500		USA, BBG/R Free Asia	7280as		9605as

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

1500 1515		China, Sichuan PBS2	6060do		7225do
1500 1530		Taiwan, R Taiwan Intl	11605as		
1500 1600		China, China Huayi BC	6185do		
1500 1600		China, China R International			5910as
		7255as	7265as	9455as	9560as
		13680eu	13755eu		
1500 1600		China, CNR/VO Pujiang	3280do		4950do
		5075do			
1500 1600		China, CNR/VO Shenzhou/CNR6			6165do
		9170do			
1500 1600		China, CNR/VO Zhonghua/CNR5			5925do
		9410do			
1500 1600		China, Nei Menggu PBS	7420do		9520do
1500 1600		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
1500 1600		China, Xinjiang PBS	3950do		5060do
		5960do	7310do		
1500 1600		Clandestine, Sound of Hope R Intl			7550as
		9450as	11970as	12980as	13130as
		13350as	13850as	14950as	16100as
1500 1600		Guam, KTWR/TWR Asia	12105as		
1500 1600		Philippines, FEBC Philippines			9345as
		9430as			
1500 1600	Sat/Sun	Taiwan, R Taiwan Intl	7380as		
1500 1600		Taiwan, R Taiwan Intl	6075as		6145as
		7365as	7380as	7385as	9680as
		11665as			

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

1600 1605		China, CNR/VO Shenzhou/CNR6			6165do
		9170do			
1600 1630		Clandestine, Sound of Hope R Intl			7550as
1600 1630		Japan, R Japan NHK World			9720as
1600 1700		China, CNR/VO Zhonghua/CNR5			5925do
		9410do			
1600 1700		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
1600 1700		China, Xinjiang PBS	3950do		4850do
		5960do	7310do		
1600 1700		Clandestine, Sound of Hope R Intl			11970as
		12980as	13130as	13350as	13850as
		14700as	15900as	15940as	16100as
1600 1700		Philippines, FEBC Philippines			9345as
		9430as			
1600 1700		Taiwan, R Taiwan Intl	6075as		6145as
		7365as	7385as	9680as	11665as
1605 1700		China, Nei Menggu PBS	7420do		9520do
1630 1645		Serbia, International R Serbia			9635eu

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

1700 1705		China, CNR/VO Zhonghua/CNR5			5925do
		9410do			
1700 1800		China, China R International			9435af
		9770af			
1700 1800		China, Nei Menggu PBS	7420do		9520do
1700 1800		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
1700 1800		China, Xinjiang PBS	3950do		4850do
		5960do	7310do		
1700 1800		Taiwan, R Taiwan Intl	6075as		6145as
1730 1800		China, China R International			7315me
		7385me	9685eu	9745va	11660eu

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

1800 1805		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
1800 1830		China, China R International			7315me
		7385me	9685eu	9745va	11660eu
1800 1900		China, China R International			11895eu
		13700eu			
1800 1900		China, Nei Menggu PBS	7420do		9520do
1800 1900		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		

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

1900 2000		China, China R International			7235eu
		11895eu			
1900 2000		China, Nei Menggu PBS	7420do		9520do
1900 2000		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		

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

2000 2100		China, China R International			7245eu
		7335eu	7405af	7440eu	9865me
2000 2100		China, Nei Menggu PBS	7420do		9520do
2000 2100		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
2000 2100		Clandestine, Sound of Hope R Intl			11970as
		12980as	13130as	13350as	13850as
		14700as	15900as	15940as	16100as
2055 2100		China, CNR/VO Zhonghua/CNR5			5925do
		7620do	9665do		

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

2100 2157		North Korea, Voice of Korea			7235as
		9345as	9975as	11535as	
2100 2200		China, CNR/VO Zhonghua/CNR5			5925do
		7620do	9665do		
2100 2200		China, Nei Menggu PBS	7420do		9520do
2100 2200		China, Tibet PBS	4820do	5935do	6050do
		7240do	7450do		
2100 2200		Clandestine, Sound of Hope R Intl			11970as
		12980as	13130as	13350as	13850as
		14700as	15900as	15940as	16100as
2100 2200	Sat	Indonesia, AWR Asia/Pacific			11750as
2100 2200	Sun	Indonesia, AWR Asia/Pacific			15420as
2100 2200	mtwhfs	Indonesia, AWR Asia/Pacific			11750as
		15420as			
2130 2200		China, Hulun Buir PBS	3900do		
2155 2200		China, CNR/VO Shenzhou/CNR6			6165do
		9170do			
2155 2200		China, Sichuan PBS2	6060do		7225do

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

2200 2230		Australia, HCJB Global Australia			15525as
2200 2230		Vietnam, VO Vietnam/Overseas Svc			7220as
		12000as			

2200 2245 Vatican City State, Vatican R 9600as 12035as 15460as
2200 2257 North Korea, Voice of Korea 7235as 9345as 9975as 11535as
2200 2300 China, China R International 5975af 6100as 6140af 7215as 7265af 7325as 7395as 7430af 9460pa 9675as
2200 2300 China, CNR/VO Shenzhou/CNR6 6165do 9170do
2200 2300 China, CNR/VO Zhonghua/CNR5 5925do 7620do 9665do
2200 2300 China, Hulun Buir PBS 3900do
2200 2300 China, Nei Menggu PBS 7420do 9520do
2200 2300 China, Sichuan PBS2 6060do 7225do
2200 2300 China, Tibet PBS 4820do 5935do 6050do 7240do 7450do
2200 2300 Clandestine, Sound of Hope R Intl 11970as 12980as 13130as 13350as 13850as 14700as 15900as 15940as 16100as
2200 2300 Indonesia, AWR Asia/Pacific 12120as 15215as
2200 2300 South Korea, KBS World R 7275as
2200 2300 Taiwan, R Taiwan Intl 6105as 6150as 11635as 11710as 11885as
2200 2300 USA, BBG/R Free Asia 11785as 15320as
2200 2300 USA, BBG/Voice of America 6135as 7205as 9510as 9845as 11925as 13660as
2220 2300 China, Gannan PBS 3990do 5970do
2230 2250 Japan, R Japan NHK World 9560as
2230 2300 mtwhf Australia, HCJB Global Australia 15525as
2230 2300 China, China Huayi BC 6185do
2230 2300 China, China R International 7295af 7370eu 9865eu 11900as 15505af
2230 2300 China, Haixa zhi Sheng/VO Strait 6115do
2230 2300 China, Haixa zhi Sheng/VO Strait 4940do 7280do
2230 2300 Philippines, FEBC Philippines 9405as
2230 2300 Vietnam, VO Vietnam/Overseas Svc 9840as 12020as
2235 2300 China, CNR/Fujian 5040do
2255 2300 China, Yunnan PBS/Minority Svc 7210do

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

2300 0000 Australia, HCJB Global Australia 15525as
2300 0000 China, China Huayi BC 6185do
2300 0000 China, China R International 6140as 7325as 9460as 11945as 15100as
2300 0000 China, CNR/VO Shenzhou/CNR6 6165do 9170do
2300 0000 China, CNR/VO Zhonghua/CNR5 5925do 7620do 9665do
2300 0000 China, Gannan PBS 3990do 5970do
2300 0000 China, Haixa zhi Sheng/VO Strait 6115do
2300 0000 China, Haixa zhi Sheng/VO Strait 4940do 7280do
2300 0000 China, Hulun Buir PBS 3900do
2300 0000 China, Nei Menggu PBS 7420do 9520do
2300 0000 China, Sichuan PBS2 6060do 7225do
2300 0000 China, Tibet PBS 4820do 5935do 6050do 7240do 7450do
2300 0000 Sat/Sun China, VO Guangxi/Beibu Bay R 5050do 9820do
2300 0000 China, Yunnan PBS/Minority Svc 7210do
2300 0000 Clandestine, Sound of Hope R Intl 11970as 12980as 13130as 13350as 13850as 14700as 15900as 15940as 16100as
2300 0000 Clandestine, VO China 7270as
2300 0000 France, R France International 9955as 11665as
2300 0000 Indonesia, AWR Asia/Pacific 15370as
2300 0000 Philippines, FEBC Philippines 12070as
2300 0000 South Korea, KBS World R 9805as
2300 0000 Taiwan, R Taiwan Intl 6105as 6150as 9660as 9685as 11635as 11710as 11885as
2300 2325 China, CNR/Fujian 5040do
2330 0000 China, Xinjiang PBS 3950do 5060do 5960do 7310do
2330 0000 Iran, VO Islamic Rep of Iran 13670as 13715as 15470as

MT SPANISH LANGUAGE SHORTWAVE GUIDE

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

0000 0030 Peru, Ondas del Huallaga 3330do
0000 0030 Peru, R San Antonio 3375do 4940do
0000 0100 Sat/Sun Argentina, RAE 6060am 15345eu
0000 0100 Bolivia, R Eco 4409do
0000 0100 Bolivia, R Em Camargo 3390do
0000 0100 twhfa Bolivia, R Fides 6155do
0000 0100 Bolivia, R Illimani/R Patria Nueva 6025do
0000 0100 Bolivia, R Logos 4865do
0000 0100 Bolivia, R Mosoj Chaski 3310do
0000 0100 Bolivia, R Panamericana 5765do 6105do
0000 0100 Bolivia, R Pio XII 5952do 5955al
0000 0100 Bolivia, R San Jose 5580do
0000 0100 Bolivia, R San Miguel 4699do
0000 0100 Bolivia, R Santa Cruz 6135do
0000 0100 Bolivia, R Tacana 4782do
0000 0100 Bolivia, R Virgen de los Remedios 4111do
0000 0100 Bolivia, Yatun Ayllu Yura/R Yura 4717do 4715al
0000 0100 Chile, CVC La Voz 9780sa 11665sa
0000 0100 China, China R International 5990ca 9590va 9800va 15120sa
0000 0100 Sat/Sun Clandestine, R Republica 5954ca
0000 0100 Colombia, La Voz de tu Conciencia 6010do
0000 0100 Colombia, La Voz del Guaviare 6035do
0000 0100 Colombia, R Alcaravan 5910do
0000 0100 Colombia, Salem Stereo 14950do
0000 0100 Cuba, R Havana Cuba 6060na 6120ca 9810ca 11680sa 11760am 15230sa 17705sa
0000 0100 Cuba, R Rebelde 5025na
0000 0100 Dominican Rep, R Amanecer Intl 6025do
0000 0100 Ecuador, La Voz del Napo 3280do
0000 0100 Ecuador, R El Buen Pastor 4815do
0000 0100 Ecuador, R Quito 4919do
0000 0100 Honduras, HRMI/R Misiones Intl 3340do
0000 0100 Mexico, R Educacion 6185do
0000 0100 Mexico, R Mil Onda Corta 6010do
0000 0100 Mexico, R Transcontinental de America 4800do
0000 0100 Mexico, R Universidad 6045do
0000 0100 Peru, La Voz de la Selva 4824do
0000 0100 Peru, La Voz de las Huarinjas 5059do
0000 0100 Peru, R Altura 5014do
0000 0100 Peru, R Ancash 4990do 4992al
0000 0100 Peru, R Andina 4995do
0000 0100 Peru, R Bethel 5921do
0000 0100 Peru, R Bolivar 5460do
0000 0100 Peru, R Cultural Amauta 4955do
0000 0100 Peru, R Cusco 4780do
0000 0100 Peru, R Frecuencia Popular 5485do
0000 0100 Peru, R Genesis 4850do
0000 0100 Peru, R Horizonte 5020do
0000 0100 Peru, R Huanta 2000 4747do 4755al
0000 0100 Peru, R Madre de Dios 4950do
0000 0100 Peru, R Manantial 4987do
0000 0100 Peru, R Maranon 4835do
0000 0100 Peru, R Melodia 5939do
0000 0100 Peru, R Municipal 3173do
0000 0100 Peru, R Ondas del Sur Oriente 5120do
0000 0100 Peru, R Quillabamba 5025do
0000 0100 Peru, R Reina de la Selva 5487do
0000 0100 Peru, R Sicuani 4826do
0000 0100 Peru, R Tarma 4775do
0000 0100 Peru, R Tawantinsuyo 6174do
0000 0100 Peru, R Union 6115do
0000 0100 Peru, R Victoria 6020do 9720do
0000 0100 Peru, R Virgen del Carmen 4887do 4895al
0000 0100 Peru, R Vision 4790do
0000 0100 Spain, R Exterior de Espana 9535ca 9620sa 15160sa
0000 0100 DRM Spain, R Exterior de Espana 9630na 11815sa
0000 0100 USA, BBG/R Marti 6030ca 7365ca 11775ca
0000 0100 USA, BBG/Voice of America 5890ca 12000sa
0000 0100 twhfa USA, BBG/Voice of America 9885ca
0000 0100 USA, WEWN/EWTN Irondale AL 5810ca 11870sa

0000 0100 USA, WYFR/Family R Worldwide 5985sa 11530sa 15355sa 15440sa
0030 0045 m USA, FBN/WTJC Newport NC 9370na
0030 0045 m USA, WHRI Cypress Creek SC 7315ca
0030 0100 Iran, VO Islamic Rep of Iran 9860sa 11760sa
0045 0100 Egypt, R Cairo 9720am 13620am 13855am

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

0100 0130 Peru, R Bolivar 5460do
0100 0145 USA, WYFR/Family R Worldwide 11855ca 17725sa
0100 0155 Turkey, Voice of Turkey 9770va 9870va
0100 0200 Sat/Sun Argentina, RAE 6060am 15345eu
0100 0200 Bolivia, R Eco 4409do
0100 0200 Bolivia, R Em Camargo 3390do
0100 0200 twhfa Bolivia, R Fides 6155do
0100 0200 Bolivia, R Illimani/R Patria Nueva 6025do
0100 0200 Bolivia, R Panamericana 5765do 6105do
0100 0200 Bolivia, R Pio XII 5952do 5955al
0100 0200 Bolivia, R San Jose 5580do
0100 0200 Bolivia, R San Miguel 4699do
0100 0200 Bolivia, R Santa Cruz 6135do
0100 0200 Bolivia, R Tacana 4782do
0100 0200 Bolivia, R Virgen de los Remedios 4111do
0100 0200 Bolivia, Yatun Ayllu Yura/R Yura 4717do 4715al
0100 0200 China, China R International 9595sa 9710sa
0100 0200 Sat/Sun Clandestine, R Republica 5954ca
0100 0200 twhfa Clandestine, R Republica 5954ca
0100 0200 Clandestine, R Republica 9490ca
0100 0200 Colombia, La Voz de tu Conciencia 6010do
0100 0200 Colombia, La Voz del Guaviare 6035do
0100 0200 Colombia, R Alcaravan 5910do
0100 0200 Colombia, Salem Stereo 14950do
0100 0200 Cuba, R Havana Cuba 5040va 6060na 9810ca 11680sa 11760am 15230sa 17705sa
0100 0200 Cuba, R Rebelde 5025na
0100 0200 Dominican Rep, R Amanecer Intl 6025do
0100 0200 Ecuador, La Voz del Napo 3280do
0100 0200 Ecuador, R El Buen Pastor 4815do
0100 0200 Ecuador, R Quito 4919do
0100 0200 Egypt, R Cairo 9315am 13620am 13855am
0100 0200 Honduras, HRMI/ R Misiones Intl 3340do
0100 0200 Iran, VO Islamic Rep of Iran 9860sa 11760sa
0100 0200 Mexico, R Educacion 6185do
0100 0200 Mexico, R Mil Onda Corta 6010do
0100 0200 Mexico, R Transcontinental de America 4800do
0100 0200 Mexico, R Universidad 6045do
0100 0200 Peru, La Voz de las Huarinjas 5059do
0100 0200 Peru, R Altura 5014do
0100 0200 Peru, R Ancash 4990do 4992al
0100 0200 Peru, R Andina 4995do
0100 0200 Peru, R Cusco 4780do
0100 0200 Peru, R Frecuencia Popular 5485do
0100 0200 Peru, R Genesis 4850do
0100 0200 Peru, R Horizonte 5020do
0100 0200 Peru, R Madre de Dios 4950do
0100 0200 Peru, R Manantial 4987do
0100 0200 Peru, R Maranon 4835do
0100 0200 Peru, R Melodia 5939do
0100 0200 Peru, R Municipal 3173do
0100 0200 Peru, R Ondas del Sur Oriente 5120do
0100 0200 Peru, R Quillabamba 5025do
0100 0200 Peru, R Reina de la Selva 5487do
0100 0200 Peru, R Sicuani 4826do
0100 0200 Peru, R Tarma 4775do
0100 0200 Peru, R Tawantinsuyo 6174do
0100 0200 Peru, R Union 6115do
0100 0200 Peru, R Victoria 6020do 9720do
0100 0200 Peru, R Virgen del Carmen 4887do 4895al
0100 0200 Peru, R Vision 4790do
0100 0200 South Korea, KBS World R 11810sa
0100 0200 Spain, R Exterior de Espana 5995sa 6055na 9535ca 9620sa 15160sa
0100 0200 DRM Spain, R Exterior de Espana 9630na
0100 0200 USA, BBG/R Marti 6030ca 7365ca 11775ca
0100 0200 USA, WEWN/EWTN Irondale AL 5810ca 11870sa
0100 0200 USA, WYFR/Family R Worldwide 5985sa 7570ca 11580sa 11855ca 15255sa 15440sa 17725sa
0100 0200 Vatican City State, Vatican R 9610ca
0130 0200 mtwhf Ecuador, HCJB/LV de los Andes 6050sa

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

0200 0227 Iran, VO Islamic Rep of Iran 9860sa 11760sa
0200 0230 Bolivia, R Pio XII 5952do 5955al
0200 0230 South Korea, KBS World R 9560na
0200 0230 USA, WRMI/R Prague relay 9955ca
0200 0230 Vatican City State, Vatican R 9610ca
0200 0256 Romania, R Romania Intl 9520ca 9645sa 11795sa 11945sa
0200 0300 Sat/Sun Argentina, RAE 6060am 15345eu
0200 0300 Bolivia, R Eco 4409do
0200 0300 Bolivia, R Em Camargo 3390do
0200 0300 fa Bolivia, R Fides 6155do
0200 0300 Bolivia, R Illimani/R Patria Nueva 6025do
0200 0300 Bolivia, R Panamericana 5765do 6105do
0200 0300 Bolivia, R San Miguel 4699do
0200 0300 Bolivia, R Tacana 4782do
0200 0300 China, China R International 9595sa 9710sa
0200 0300 Colombia, La Voz de tu Conciencia 6010do
0200 0300 Colombia, R Alcaravan 5910do
0200 0300 Colombia, Salem Stereo 14950do
0200 0300 Cuba, R Havana Cuba 5040va 6060na 6120ca 9810ca 11680sa 11760am 15230sa 17705sa
0200 0300 Cuba, R Rebelde 5025na
0200 0300 Dominican Rep, R Amanecer Intl 6025do
0200 0300 mtwhf Ecuador, HCJB/LV de los Andes 6050sa
0200 0300 Ecuador, La Voz del Napo 3280do
0200 0300 Ecuador, R El Buen Pastor 4815do
0200 0300 Ecuador, R Quito 4919do
0200 0300 Honduras, HRMI/ R Misiones Intl 3340do
0200 0300 Mexico, R Educacion 6185do
0200 0300 Mexico, R Mil Onda Corta 6010do
0200 0300 Mexico, R Transcontinental de America 4800do
0200 0300 Mexico, R Universidad 6045do
0200 0300 Peru, R Altura 5014do
0200 0300 Peru, R Maranon 4835do
0200 0300 Peru, R Ondas del Sur Oriente 5120do
0200 0300 Peru, R Reina de la Selva 5487do
0200 0300 Peru, R Sicuani 4826do
0200 0300 Peru, R Tarma 4775do
0200 0300 Peru, R Tawantinsuyo 6174do
0200 0300 Peru, R Union 6115do
0200 0300 Peru, R Victoria 6020do 9720do
0200 0300 Peru, R Virgen del Carmen 4887do 4895al
0200 0300 Peru, R Vision 4790do
0200 0300 Spain, R Exterior de Espana 3350ca 5995sa 6055na 6125ca 9535ca 9620sa 9630na
0200 0300 Taiwan, R Taiwan Intl 7570sa 11995sa
0200 0300 USA, BBG/R Marti 6030ca 7365ca 11775ca
0200 0300 USA, WEWN/EWTN Irondale AL 5810ca 11870sa
0200 0300 USA, WYFR/Family R Worldwide 9385sa 11580sa 11740sa 15255sa
0230 0300 Iran, VO Islamic Rep of Iran 9860sa
0230 0300 USA, WRMI/R Slovakia Intl relay 9955am

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

0300 0327	Iran, VO Islamic Rep of Iran	9860sa
0300 0330	Bolivia, R Eco	4409do
0300 0330	Bolivia, R San Miguel	4699do
0300 0330	Vietnam, VO Vietnam/Overseas Svc	6175na
0300 0345	USA, WYFR/Family R Worldwide	6875sa
0300 0355	Ecuador, R El Buen Pastor	4815do
0300 0357	North Korea, Korean Central BC Sta	11735ca
	13760sa	15180sa
0300 0400 fa	Bolivia, R Fides	6155do
0300 0400	Bolivia, R Panamericana	5765do 6105do
0300 0400	China, China R International	9560sa
0300 0400	Colombia, La Voz de tu Conciencia	6010do
0300 0400	Colombia, R Alcaravan	5910do
0300 0400	Colombia, Salem Stereo	14950do
0300 0400	Cuba, R Havana Cuba	5040va 6060na
	6120ca 9810ca	11680sa 11760am
	15230sa 17705sa	
0300 0400	Cuba, R Rebelde	5025na
0300 0400	Ecuador, HCJB/LV de los Andes	6050sa
0300 0400	Honduras, HRMI/ R Misiones Intl	3340do
0300 0400	Mexico, R Educacion	6185do
0300 0400	Mexico, R Mil Onda Corta	6010do
0300 0400	Mexico, R Transcontinental de America	4800do
0300 0400	Mexico, R Universidad	6045do
0300 0400 DRM	North Korea, Voice of Korea	3560as
0300 0400	Peru, R Tarma	4775do
0300 0400	Peru, R Tawantinsuyo	6174do
0300 0400	Peru, R Union	6115do
0300 0400	Peru, R Victoria	6020do 9720do
0300 0400	Peru, R Vision	4790do
0300 0400	Spain, R Exterior de Espana	3350ca 5995sa
	6055na 6125ca	9535ca 9620sa
	9630na	
0300 0400 mtwhfas	USA, BBG/R Marti	6030ca 7405ca
0300 0400	USA, WEWN/EWTN Irondale AL	5810ca
	11870sa	
0300 0400	USA, WYFR/Family R Worldwide	6875sa
	9385sa	
0320 0400	Vatican City State, Vatican R	7305na

MT SHORTWAVE STATION RESOURCE GUIDE

Afghanistan, RTV Afghanistan	**www.rta.org.af**
Albania, R Tirana	**http://rtsh.sil.at/**
Angola, Angolan National R	**www.rna.ao/**
Anguilla, University Network	**www.worldwideuniversitynetwork.com/**
Argentina, RAE	**www.radionacional.gov.ar**
Australia, ABC NT Alice Springs	**www.abc.net.au/radio/**
Australia, ABC NT Katherine	**www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek	**www.abc.net.au/radio/**
Australia, ABC/R Australia	**www.radioaustralia.net.au**
Australia, HCJB Global Australia	**www.hcjb.org.au**
Austria, AWR Europe	**www.awr2.org**
Austria, TWR Europe	**www.twr.org**
Bahrain, R Bahrain	**www.radiobahrain.fm**
Belgium, TDP Radio	**www.airtime.be/schedule.html**
Canada, Bible Voice Broadcasting	**www.biblevoice.org/**
Canada, CFRX Toronto ON	**www.cfrb.com**
Canada, CFVP Calgary AB	**www.classiccountryam1060.com**
Canada, CKZN St Johns NF	**www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC	**www.cbc.ca/bc**
China, China R International	**www.cri.cn**
China, Haixa zhi Sheng/VO Strait	**www.vos.com.cn**
Clandestine, JSR/Shiokaze/Sea Breeze	**www.chosa-kai.jp**
Clandestine, Sudan R Service	**www.sudanradio.org**
Cuba, R Havana Cuba	**www.radiohc.cu/**
Ecuador, HCJB/LV de los Andes	**www.radiohcjb.org**
Egypt, R Cairo	**www.ertu.org**
Eqt Guinea, Pan Am BC/R Africa	**www.radiopanam.com/**
Ethiopia, R Ethiopia	**www.erta.gov.com**
Ethiopia, R Ethiopia/Natl Pgm	**www.erta.gov.com**
France, R France International	**www.rfi.fr/**
Germany, AWR Europe	**www.awr2.org/**
Germany, Deutsche Welle	**www.dw.de**
Germany, Mighty KBC Radio	**www.kbcradio.eu/**
Germany, TWR Europe	**www.twr.org**
Guam, KTWR/TWR Asia	**http://nea.ktwr.net/**
India, AIR/Aizawl	**www.allindiaradio.org/**
India, AIR/Bhopal	**www.allindiaradio.org/**
India, AIR/Chennai	**www.allindiaradio.org/**
India, AIR/Gangkok	**www.allindiaradio.org/**
India, AIR/Guwahati	**www.allindiaradio.org/**
India, AIR/Hyderbad	**www.allindiaradio.org/**
India, AIR/Imphal	**www.allindiaradio.org/**
India, AIR/Itanagar	**www.allindiaradio.org/**
India, AIR/Jaipur	**www.allindiaradio.org/**
India, AIR/Jeypore	**www.allindiaradio.org/**
India, AIR/Kolkata	**www.allindiaradio.org/**
India, AIR/Kuresong	**www.allindiaradio.org/**
India, AIR/Lucknow	**www.allindiaradio.org/**
India, AIR/Mumbai	**www.allindiaradio.org/**
India, AIR/Port Blair/Andaman & Nicobar	**www.allindiaradio.org/**
India, AIR/Shillong	**www.allindiaradio.org/**
India, AIR/Shimla	**www.allindiaradio.org/**
India, AIR/Thiruvananthapuram	**www.allindiaradio.org/**
India/AIR/External Service	**www.allindiaradio.org/**
India/AIR/R Kashmir	**www.allindiaradio.org/**
Indonesia, AWR Asia/Pacific	**www.awr2.org/**
Indonesia, VO Indonesia	**www.voi.co.id**
Iran, VO Islamic Rep of Iran	**www.irib.ir/English/**
Israel, Kol Israel	**www.intkolisrael.com**
Italy, IRRS SW	**www.nexus.org**
Japan, R Japan NHK World	**www.nhk.or.jp/english/**
Kuwait, R Kuwait	**www.media.gov.kw/**
Mali, ORTM/R Mali	**www.ortm.ml**
Micronesia, V6MP/Cross R/Pohnpei	**www.pmapacific.org/**
Moldova, R PMR/Pridnestrovye	**www.radiopmr.org**
Nepal, R Nepal	**www.radionepal.org/**
Netherlands, XVRB Radio	**www.twr.org**
New Zealand, R New Zealand Intl	**www.rnzi.com**
Nigeria, Voice of Nigeria	**www.voiceofnigeria.org**
North Korea, Voice of Korea	**www.vok.rep.kp**
Oman, R Sultanate of Oman	**www.oman-tv.gov.om**
Pakistan, PBC/R Pakistan	**www.radio.gov.pk**
Palau, T8WH/World Harvest R	**www.whr.org/**
Philippines, R Pilipinas Overseas	**www.pbs.gov.ph/**
Poland, Polish Radio/External Svc	**www.polskieradio.pl**
Romania, R Romania Intl	**www.rri.ro/**
Russia, Voice of Russia	**http://english.ruvr.ru/**
Saudi Arabia, BSKSA/External Svc	**www.saudiradio.net/**
Serbia, International R Serbia	**http://voiceofserbia.org**
South Africa, AWR Africa	**www.awr2.org/**
South Africa, Channel Africa	**www.channelafrica.org**
South Africa, CVC 1 Africa R	**www.1africa.tv**
South Korea, KBS World R	**www.worldkbs.co.kr**
Spain, R Exterior de Espana	**www.ree.rne.es/**
Sri Lanka, SLBC	**www.slbc.lk**
Swaziland, TWR Africa	**www.twrafrica.org/**
Syria, R Damascus	**www.rtv.gov.sy/**
Taiwan, R Taiwan Intl	**http://english.rti.org.tw/**
Thailand, R Thailand World Svc	**www.hsk9.org/**
Turkey, Voice of Turkey	**www.trt-world.com**
Uganda, Dunamis Shortwave	**www.biblevoice.org/stations/east-africa**
UK, BBC World Service	**www.bbc.co.uk/worldservice/**
USA, Amer Forces Network/AFRTS	**http://myafn.dodmedia.osd.mil/**
USA, BBG/Voice of America	**www.voanews.com**
USA, BBG/Voice of America/Studio 7	**www.voanews.com**
USA, FBN/WTJC Newport NC	**www.fbnradio.com/**
USA, KNLS Anchor Point AK	**www.knls.org/**
USA, Overcomer Ministry	**www.overcomerministry.org**
USA, Pan Amer Broadcasting	**www.radiopanam.com/**
USA, WBCQ Monticello ME	**www.wbcq.com/**
USA, WEWN/EWTN Irondale AL	**www.ewtn.com/**
USA, WHRI Cypress Creek SC	**www.whr.org/**
USA, WINB Red Lion PA	**www.winb.com**
USA, WRMI/R Prague relay	**www.wrmi.net/**
USA, WRMI/R Slovakia Intl relay	**www.wrmi.net/**
USA, WTWW Lebanon TN	**www.wtww.us/**
USA, WWCR Nashville TN	**www.wwcr.com**
USA, WWRB Manchester TN	**www.wwrb.org/**
USA, WYFR/Family R Worldwide	**www.familyradio.com/**
Vatican City State, Vatican R	**www.vaticanradio.org/**
Vietnam, VO Vietnam/Overseas Svc	**www.vov.org.vn**
Zambia, Christian Voice	**www.voiceafrica.net**
Zambia, CVC Intl/1 Africa	**www.1africa.tv**

MILCOM
MONITORING MILITARY COMMUNICATIONS

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Twitter: MilcomMP

Is the Cold War Really Over?

During the middle part of this last summer, Bill Gertz on the *Washington Free Beacon* website, published an interesting article regarding Russian military aircraft operating near the West Coast of the United States.

According to Gertz, "Two Russian strategic nuclear bombers entered the U.S. air defense zone near the Pacific coast and were met by U.S. interceptor jets.

"It was the second time Moscow dispatched nuclear-capable bombers into the 200-mile zone surrounding U.S. territory in a two week period.

"An earlier intrusion by two Tu-95 Bear H bombers took place near Alaska as part of arctic war games that a Russian military spokesman said included simulated attacks on 'enemy' air defenses and strategic facilities.

"A defense official said the Pacific coast intrusion came close to the U.S. coast but did not enter the 12-mile area that the U.S. military considers sovereign airspace.

"The bomber flights near the Pacific and earlier flights near Alaska appear to be signs Moscow is practicing the targeting of its long-range air-launched cruise missiles on two strategic missile defense sites, one at Fort Greely, Alaska, and a second site at Vandenberg Air Force Base, California."

If you are new to Milcom monitoring and want to monitor DoD Air Defense action, program the following nationwide frequencies in your scanner:

228.900 232.500 (Canada) 234.600
234.700 (Canada) 235.900 238.400
241.200 252.000 254.200 254.475
260.900 265.400 270.200 271.000
274.400 277.600 278.000 281.600
282.600 288.400 293.600 316.300
320.600 324.000 327.900 328.000
349.550 355.200 360.150 364.200
369.000 386.000 MHz (AM mode)

HF monitors should keep an eye on: 4727.0 5705.0 6736.0 9022.0 13206.0 15046.0 18027.0 kHz USB. These HF frequencies are all tertiary backup frequencies at best between the AWACS and NORAD air defense sectors. They are also shared with other DoD users and are *NOT* dedicated NORTHCOM/USAF/NORAD frequencies.

Don't expect to hear a lot of air defense communications on these HF frequencies compared to years past. Most of the old HF stuff we use to hear has now moved onto a secure UHF milsatcom channel, referred to many times by aircrews on their UHF milair frequencies listed above.

❖ UHF Milsatcom Pirates Still Active

In the June 2009 *MT Milcom* column, I documented that some Brazilian pirates had been chased off of several DoD UHF milsatcom frequencies. Well, the quiet observed shortly after the bust did not last for long, and those milsat pirates and many others are just as active as ever on DoD's milsat downlink frequencies. If you are interested in hearing some of their activity, the frequency list that follows is a list of recent activity observed from here on the East Coast of the United States. Mode is NFM and frequencies are in MHz.

252.050 255.450 255.550 256.850
256.950 257.425 258.550 260.525
261.600 262.200 263.875 263.925
265.550 268.250

Also if you are interested in hearing some clear military voice activity on UHF military satellites, keep an eye on the frequencies listed below for occasional activity in the clear (again this is a US East Coast centric list).

251.850 252.150 253.650 253.650
253.850 255.350 258.650 260.475
260.625 260.725 261.450 261.575
261.675 261.800 261.850 261.875
262.125 263.575 263.875 263.925
263.950 265.250 266.050 267.050
268.150 268.450 269.650 269.950

❖ UHF Milcom Spectrum Holes

I have written a lot over the years in this column and in other media about what I call "spectrum holes" in the 225-400 MHz range.

In brief, a spectrum hole is a legitimate frequency for assignment based on current channel spacing and the DoD bandplan, but it's one on which no activity or current assignment has ever been heard or found. That is a spectrum hole.

If you are interested in exploring the world of 225-400 MHz spectrum holes, here is the latest list for those who want a monitoring challenge. And if you hear something or know something about any of these frequencies, I would appreciate an email at the address in the masthead or via our new email address – **milcommp@gmail.com**.

226.250 234.175 236.925 239.075
244.675 244.925 245.075 248.525
248.775 249.675 249.725 250.375
250.475 250.575 250.875 251.625
251.675 252.375 252.450 252.875
253.175 253.425 254.625 254.875
255.025 255.325 255.475 255.525
255.675 256.425 256.975 258.025
258.475 258.525 259.075 259.625
259.775 264.475 265.375 265.475
265.625 265.875 266.825 266.925
267.025 267.125 267.225 267.325
267.950 267.975 268.325 269.875
269.925 270.075 270.425 270.475
270.925 271.050 271.775 271.925
274.225 274.275 274.925 275.075
275.625 275.725 276.175 276.725
276.775 276.875 277.475 277.575
277.675 277.775 277.875 277.975
278.525 279.325 293.075 293.575
297.925 305.975 306.275 306.475
306.525 306.675 307.825 307.925
308.375 308.675 310.025 310.175
310.275 310.775 310.875 311.075
311.875 316.475 318.425 318.625
318.775 319.075 324.225 326.375
326.425 342.625 346.475 346.575
348.075 349.875 350.175 358.775
360.175 361.525 365.675 365.975
367.575 368.925 369.375 375.975
377.475 377.750 378.075

❖ 380-400 MHz Aero Frequencies?

As most longtime readers of this column are aware (see our *MT Milcom* Jun/Sep/Dec 2004 and Feb/May 2005 columns to name a few with our exclusive coverage), the Department of Defense has carved out of the 225-400 MHz milair band some select frequencies for use by land/shipboard trunk radio systems as well as simplex (Land Mobile Radio) LMR activity. This new subband lies in the 380-400 MHz range and the spacing is 12.5 kHz.

But not all the frequencies in this new subband are being used for LMR activity. There are still some aeronautical frequency assignments in this range. The following frequencies are still being used for aeronautical use (AM mode).

380.000 380.025 380.050 380.100
380.150 380.200 380.225 380.250
380.300 380.350 380.500 380.600
380.700 380.850 380.925 381.000
381.025 381.050 381.100 381.125
381.150 381.225 381.250 381.300
381.350 381.375 381.400 381.450
381.475 381.500 381.525 381.550
381.575 381.600 381.650 382.000
384.400 384.500 385.000 385.050
385.200 385.400 385.425 385.450
385.475 385.500 385.525 385.550
385.575 385.600 385.650 386.000
386.875 387.000 387.025 387.050
387.075 387.100 387.125 388.950
389.000 392.200 395.050 395.150
395.225 395.250 395.375 395.825
396.900 398.100

So give these aero frequencies a listen in your area and let us know what you are hearing.

❖ CAP Aircraft Radios to Encrypt

We have received word that the Civil Air Patrol headquarters at Maxwell AFB, Alabama, recently received the first of four TDFM-136A VHF/FM aircraft radios. This is the new model FM radios that are being considered for use by the CAP and may be phased-in over the next few years if testing proves successful. This new model has several key features, but the most important upgrade with these radios is the ability to support encryption via the P25 digital mode.

Most of the CAP ground LMR equipment nationwide is already encryption-capable, but the aviation radio assets are not. With the introduction of this new Technisonic "A" model, encryption could then be incorporated into their aircraft fleet, thereby enabling the entire CAP LMR radio system to support missions requiring secure communications.

According to information that we received, the first four TDFM-136A model radios were sent to Texas for formal testing at the Lone Star Emergency Services Academy (LESA). The first test radio was installed in a Texas Wing aircraft and the results indicated that the new radios worked exceptionally well. The Texas testers were able to achieve seamless encrypted communications between CAP ground-based LMR radios and the TDFM-136A in the aircraft.

According to another source this is a multi-year plan to upgrade the CAP aircraft fleet. Civil Air Patrol is now flying an increasing number of homeland security related missions requiring secure communications, and up until this point those have been difficult to support due to lack of P25 encryption capability. Once encryption is in wide spread use across all the CAP platforms, CAP will then be able to start accepting some missions that they previously could not, as well as develop new missions that were formerly impossible for them to support.

❖ Milair Nationwide Frequency Updates

Here are the latest milair frequency changes from the Federal Aviation Administration (FAA) and the Department of Defense (DoD). All frequencies are in MHz and mode is AM unless otherwise noted.

32.700	Fort Drum/Wheeler-Sack AAF, NY (KGTB) R-5201 Air-to-Air (ex-71.300)
41.500	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following for all Fort Rucker AOs.
119.675	Alexandria International, LA (KAEX) Ground Controlled Approach paired with 239.000 (ex-125.400).
119.825	Camp Guernsey, WV (KV76) AWOS (ex-118.925)
124.550	Beale AFB, CA (KBAB) VHF ATIS (operational during wing operations)
124.875	Fort Drum/Wheeler-Sack AAF, NY (KGTB) Sack Approach Control (ex-128.250)
126.200	Fort Benning/Lawson AAF, GA (KLSE) Base Operations/Pilot-to-Dispatcher Doughboy Advisory (PTD) (ex-138.525)
128.200	John Murtha Johnstown-Cambria County, PA (KJST) RAPCON West Sector paired with 288.325
135.525	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 2 (HUB North) paired with 324.550 for AO Vanguard North.
135.975	John Murtha Johnstown-Cambria County, PA (KJST) RAPCON East Sector paired with 244.875
139.250	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 1 (HUB Central) paired with 323.750 for AO Bearcat and Vanguard Central.
140.250	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 2 (HUB North) paired with 367.350 for AO Hawk.
141.100	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 3 (HUB South) paired with 310.450/350.075 for AO Vanguard South.
233.700	Fort Drum/Wheeler-Sack AAF, NY (KGTB) SE Operations (ex-280.800)
237.200	Fort Bliss/Biggs AAF, TX (KBIF) Bliss Radio (ex-397.700)
239.000	Alexandria International, LA (KAEX) Ground Controlled Approach paired with 119.675.
244.875	John Murtha Johnstown-Cambria County, PA (KJST) RAPCON East Sector paired with 135.975
254.425	Martin State Airport, MD (KMTN) Tower (ex-297.200)
256.350	MCAGCC Twentynine Palms SELF, CA (KNXP) EAF ATIS (ex-386.350)
269.025	NAS Lemoore (Reeves Field), CA (KNLC) Approach Control Primary
273.500	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) ATIS
275.700	Martin State Airport, MD (KMTN) ACC A-10 Operations (Raven Ops)
276.000	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Approach Control West (Yuma Range)
281.400	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Approach Control Low
288.325	John Murtha Johnstown-Cambria County, PA (KJST) RAPCON West Sector paired with 128.200
293.300	Martin State Airport, MD (KMTN) AMC C-27 Operations Crab Ops
297.900	Eastern WV Regional (Shepherd Field), WV (KMRB) A/G Facility Galaxy
308.000	Fort Rucker/Cairns AAF, AL (KOZR) Tower East UHF Primary (Louisville Stagefield)
308.400	NAS/JRB New Orleans (Alvin Callender Field), LA (KNBG) Ground Control (ex-382.800)
310.450	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 3 (HUB South) paired with 141.100/350.075 for AO Vanguard South.
314.000	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Ground Control
316.000	Fort Rucker/Goldberg Stagefield, AL (12AL) Pilot-to-Dispatcher (PTD)
317.500	Fort Drum/Wheeler-Sack AAF, NY (KGTB) Metro (ex-304.800)
319.250	Fort Drum/Wheeler-Sack AAF, NY (KGTB) R-5201 Flight Following Advisories Drum Radio (ex-397.750)
323.750	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 1 (HUB Central) paired with 139.250 for AO Bearcat and Vanguard Central.
324.100	Minneapolis-St. Paul International (Wold Chamberlain), MN (KMSP) Minneasote Air National Guard Base Operations (ex-252.1000)
324.550	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 2 (HUB North) paired with 135.525 for AO Vanguard North.
327.150	NAS Lemoore (Reeves Field), CA (KNLC) ATIS
349.400	Scott AFB (MidAmerica), IL (KBLV) Command Post
350.075	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 3 (HUB South) paired with 141.100/310.450 for AO Vanguard South.
351.675	NAS/JRB Forth Worth (Carswell Field), TX (KNFW) ATIS (ex-273.575) (Note: This should be a temporary assignment)
360.850	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Secondary Tower
362.950	Hanscom AFB (Laurence G. Hanscom Field), MA (KBED) Hanscom ESD Command Post (ex-397.100)
363.200	Fort Drum/Wheeler-Sack AAF, NY (KGTB) ATIS paired with 119.525 (ex-367.700)
367.350	Fort Rucker/Hanchey AHP, AL (KHEY) Flight Following 2 (HUB North) paired with 140.250 for AO Hawk.
371.900	NAS Lemoore (Reeves Field), CA (KNLC) Clearance Delivery
372.000	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Approach Control High
382.000	MCAS Yuma/Yuma International, AZ (KNYL ex-KYUM) Primary Tower

❖ A Good Friend Has Left Us

I close this month's column with some sad news. Long time milcom monitor Don G. Edwards, N2NUM, has passed away after a brief battle with cancer.

Don was born on April 6, 1954. He was an avid musician playing in many local bands in the Northville, New York area – BlackRiver for 20 plus years and more recently Steel Heart. He was also an accomplished photographer with many military aviation pictures published in this magazine. He enjoyed listening to and taking photos of military aircraft.

Don worked at Coleco industries for many years and at Universal Custom Mill Work. Don was especially active on the Northeast milair list and many of his friends paid tribute to him in the days after his death was announced.

On behalf of the entire *MT* staff I want to pass along my deepest sympathies to Nancy and the family. Don was a great friend and milcom monitor. He will be missed by all of us who knew him. Smoke off, my friend.

Until next month, 73 and good hunting all.

Don G. Edwards Jr. at an air show. (Photo by Kevin Burke)

FED FILES
GOVERNMENT COMMUNICATIONS

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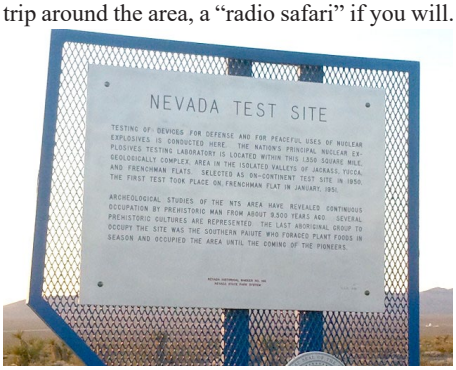
A Fed Files Radio Safari – Southern Nevada

As I have mentioned in some of my previous columns, I am lucky to have a job that calls for a lot of travel all over the country. Most of the time I have some limited time in the hotel room for setting up a scanner or two and monitoring the local radio spectrum, and other times I'm just too busy for any serious monitoring. But occasionally I get really lucky and have some days off work in a really interesting location for radio monitoring. I recently had that luck in Las Vegas, Nevada.

In addition to the tremendous amount of local radio traffic from the many hotels, casinos and entertainment establishments in Las Vegas, there are quite a few interesting federal and military monitoring targets in and around the Las Vegas area. I decided to take advantage of the free time in the area and planned a short road trip around the area, a "radio safari" if you will.



With all the extra potential for monitoring, I decided to bring a few extra radios along with the three hand-held scanners I normally carry along with me on my travels. I normally carry a GRE PSR-500, a Uniden 396T and 396XT, and lots of batteries. In addition, I brought the Radio Shack PRO-197 digital scanner (the same as the GRE PSR-600) and my trusty Uniden BCT-780 XLT. The 780XLT was programmed with many of the VHF & UHF military aircraft channels that have been posted by local listeners.

In addition to the federal land-mobile radio traffic, there is an awful lot of UHF and VHF aircraft traffic to be heard. The Nellis Air Force Base training ranges can be really busy at times and can provide some fascinating radio traffic from the various fighter aircraft and range controllers. I have not yet made the trek to the area during the famous RED FLAG air exercises, but hope to some day.

The 406 - 420 MHz federal band is saturated with radio traffic in southern Nevada, mainly due to several wide-area, federal UHF trunked radio systems in the area. One system, a multi-site Motorola UHF trunked system, belongs to the National Nuclear Security Administration (NNSA) and covers Las Vegas and the 1400 square mile Nevada Nuclear Security Site (formerly known as the Nevada Test Site), the Department of Energy operated testing site for all things nuclear.

Here is the NNSA trunked system information:

Motorola Type II, System ID: 7526 NAC: N264
Site 01 - Mercury
406.5000, 406.7875, 407.1875, 407.3000, 407.5000, 407.8625, 408.1500, 409.1125, 409.5625
Site 02 - Red Mountain, Checkpoint Pass
406.9875, 407.3500, 408.3625, 409.3125, 409.5250, 409.9125, 410.1625
Site 03 - Yucca Pass
406.1375, 407.3625, 408.1875, 409.1250, 409.3500, 409.5500, 409.7875
Site 04 - Las Vegas DOE Facility
406.4000, 406.9875, 407.3625, 408.3625, 409.5250, 409.9250, 410.1625
Site 05 - Skull Mountain
406.1500, 406.9750, 407.5500, 408.1000
Site 06 - Angel Peak
406.1125, 406.5500, 407.4250
Site 07 - Rainier Mesa
407.1625, 407.4000, 407.7875, 408.3875
Site 08 - Shoshone Mountain
407.3875, 407.8125, 408.4250, 409.3750, 410.1750, 410.6500

Next, there is a three-site P-25 UHF system being used by Nellis Air Force Base and its associated base, Creech AFB in Indian Springs, NV. Nellis moved to their own trunked system after being a subscriber to the NSSA trunked system for years. Here is their new trunked system information:

System ID: 00F WACN: 58544 NAC: N00F
Site 01 - Nellis AFB
406.5000, 406.7875, 407.1875, 407.3000, 407.5000, 407.8625, 408.1500, 408.9625, 409.1125, 409.5625, 409.7125, 410.6500
Site 02 - Creech AFB
406.3625, 407.0750, 407.5875, 408.1750, 408.7000
Site 10 - Angel Peak
409.3000, 409.6000, 410.5500

There is also a multi-site EDACS trunked radio system being utilized by the military on what is referred to as the Nevada Test and Training Range (NTTR). This system is using either ProVoice or AEGIS digital mode (depending on who you ask) and cannot be monitored due to encryption. However you can monitor the system activity with EDACS control channel analysis software, such as E TRUNKER. Here are the NTTR sites, with the Logical Channel Numbers (LCN) listed by each frequency:

Site 01 – Tonopah
[1] 406.5625 [2] 409.5625 [3] 410.7000
Site 02 – Antelope Peak
[1] 406.1500 [2] 407.2500 [3] 407.9500 [4] 408.5875 [5] 410.1500
Site 03 – Cedar Peak
[1] 406.9625 [2] 407.5625 [3] 407.7625 [4] 408.1250 [5] 409.1625 [6] 409.8875
Site 04 – Halligan Mesa
[1] 406.7625 [2] 409.3625 [3] 409.7625
Site 05 – Bald Mountain
[1] 406.7750 [2] 407.8875 [3] 408.9625 [4] 410.3500 [5] 410.7625
Site 06 – Papoose Mountain
[1] 406.1875 [2] 408.1625 [3] 408.5625 [4] 409.5875 [5] 410.7000
Site 07 – Angel Peak
[1] 406.5625 [2] 408.0500 [3] 409.0250 [4] 409.9625 [5] 410.9000
Site 08 – Black Mountain
[1] 406.3625 [2] 407.0750 [3] 407.5875 [4] 408.1750 [5] 409.6375
Site 09 – Creech AFB
[1] 406.1500 [2] 407.2500 [3] 407.9500 [4] 408.5875 [5] 410.1500

Some information is floating out on the Internet that the NTTR EDACS trunked system is being supplemented by a new DoD 380 MHz P-25 digital radio system. I did not pick up any of these sites during my expedition, but reportedly there are several sites on the air over on the eastern side of the NTTR (Area 51 territory), though not much traffic has been heard using them. For additional information on this and other southern Nevada military radio subjects, be sure and check out **www.dreamlandresort.com**.

On this trip I also discovered a new UHF P-25 trunked radio system that I had not heard on the air before. It turned out to belong to the Las Vegas VA Medical Center police. It appears to be located at the new VA Medical Center on the north side of town, near Nellis AFB. Some traffic monitored at the time seemed to show that they were still working on getting the new facility built and finished.

System ID: 49D WACN: BEE00 NAC: N490
407.83750 408.23750 409.51250

Once I got the mobile unit set up with radios and antennas, along with cold drinks and snacks, I headed out and found a few places to sit and monitor for a while. I parked at Creech AFB, in Indian Springs, Nevada. There I was able to watch and monitor flight training activity of the MQ-1 and MQ-9 Unmanned Aerial Vehicles

(UAV). Several UAVs were in the pattern at Creech simultaneously and some of the radio traffic indicated that the control tower was keeping very busy coordinating everything.

Later, I moved up to Mercury, Nevada, the headquarters for the Department of Energy operations. Although there is some encryption on the NNSA trunked system, a majority of routine communications can be found in the clear. Some activity seems to be normal day-today maintenance and operational traffic, but I did happen to hear the preparations for the operation to take down the BREN tower on May 23rd, **http://en.wikipedia.org/wiki/BREN_Tower**.

I also parked up near Angel Peak at about 6500 feet and was able to hear traffic from quite distance. One interesting intercept was traffic from Zion National Park in Utah. At the time, I wasn't sure who I was listening to, but there was a tremendous amount of radio traffic regarding a car burning in a tunnel. Oddly, some of the traffic was analog, and some was P-25 digital, so the system is multi-mode. I couldn't figure out where this was at the time I was listening, and couldn't find any information on the local news.

But a week later, I caught an item on an automotive web site that I frequent and found the story behind the fire. It turned out to be an $800,000 1964 Shelby Cobra sports car that had caught fire while in the Zion-Mount Carmel tunnel! More information on the fire can be found here: **http://home.nps.gov/applications/digest/headline.cfm?type=Incidents&id=6168**

Another interesting intercept was 446.2250 MHz, where I caught retired radio broadcaster Art Bell (W6OOB), chatting with other hams in the Pahrump, Nevada area.

So here is a list of what I was able to log during my radio safari in southern Nevada. This list does not include all the trunked system frequencies listed above that were logged and monitored. Although there was plenty of military air traffic going on, I did not get to log all the active frequencies, but did write down a few;

118.3000, AM	Creech AFB Tower
119.6750, AM	DoE Mercury Airstrip AWOS
134.1000, AM	DUDLEY 62 (UAV) inbound Creech 135.1000, AM
138.3750, AM	Air-to-air
139.9250, CSQ	Creech AFB, alarm data
143.8250, AM	Air-to-air
162.7875, N167	FBI
163.1250, N4CE	Hoover Dam Police
163.2125, N100	Unknown agency
163.6250, N169	DHC ICE
163.7000, N169	DHS ICE
163.7500, N300	DHS ICE
163.8125, N167	FBI, input to167.6625?
163.9125, N167	FBI, input to 167.2125
163.9625, N167	FBI
163.9875, N167	FBI
164.4500, 114.8	Possible US Postal Service truck operations
164.6250, 146.2	Unknown agency
164.6500, CSQ	Secret Service TANGO, body wire on someone doing surveillance near my location
165.2375, 100.0	DHS CBP Net 1 - OTAR
165.2875, N650	BATFE NET 1
165.3750, N001	Secret Service CHARLIE
166.2375, 114.8	BLM, Mt. Charleston
166.2875, N002	TSA at LAS airport
166.3000, CSQ	Bureau of Reclamation, Lake Meade
166.3750, 100.0	Unknown agency, mentioned Kingston Wash
166.4625, N001	TSA at LAS airport
166.7875, N293	Unknown dispatch with radio checks
166.9000, CSQ	Lake Meade National Recreation Area
167.1250, 123.0	
167.2125, N167	FBI
167.2625, N167	FBI (repeater on Mandalay Bay Hotel?)
167.3625, CSQ	Open carrier, with some P25 (N167) key ups
167.4375, N167	FBI
167.6625, N167	FBI
167.7625, N167	FBI
168.0875, N002	TSA at LAS airport
168.1625	Unknown agency
168.5250, 107.2	USFS Weather Reports
168.6500, 110.9	USFS National Flight Following
168.4375, 114.8	Unknown agency
168.4875	Unknown agency
168.5250, 107.2	USFS Fire/Weather reports
168.9625, N001	TSA at LAS airport
168.9625, N002	TSA at LAS airport
168.9625, N003	TSA at LAS airport
169.3000, N001	TSA at LAS airport
169.4000, 186.2	USFS / BLM
169.5500, N930	Unknown agency
169.6625	Unknown agency
169.8000, 173.8	BLM
169.8750, 110.9	USFS Mt. Charleston with LAS VEGAS (USFS HQ)
169.9125	Unknown agency
170.0500, CSQ	Lake Meade National Recreation Area
170.0750, D051	
170.1000, N300	Possible ICE operations
170.1000, NC03	Unknown
170.4750, 156.7	BLM, Mt. Charleston
170.6250, N167	FBI
170.6625, N167	FBI
170.6750	Unknown agency
170.7500, N293	US Marshals, Federal Courthouse Security
170.8000, N293	Unknown agency
171.3625, 88.5	Unknown agency
172.3500	
172.6000, 173.8	Lake Meade National Recreation Area
172.6125, 156.7	Zion National Park South (analog)
172.6125, N637	Zion National Park South (digital)
172.7625, N301	Unknown, 14-xx units talking about heading to the office
172.9000, N001	DHS TSA at LAS airport
172.9000, N013	DHS TSA at LAS airport
173.2000, NCA6	Unknown agency
173.6750, N47C	BLM - "700" & "BLM Radio Maintenance" testing on "GRASS" or "BASS"
173.9875, CSQ	Data bursts
234.3250, AM	Air tactical, COYOTE Area
243.2750, AM	Creech AFB, approach?
281.0250, AM	Blackhawk helicopter departing Creech AFB
288.2250, AM	
290.0000, AM	
290.4500, AM	Creech AFB ATIS, mentioned 254.4 & 119.35 for Nellis Control
291.0500, AM	
327.8000, AM	
360.6250, AM	Creech AFB Tower
361.0250, AM	
367.4000, AM	May be UAV Operations
377.8000, AM	UAV operations at Creech AFB
406.9375	Las Vegas VA Medical Center, TRBO digital mode
407.3125, CSQ	Unknown, open microphone with PA in background
407.5250, D023	Unknown, conventional repeater
409.1125	
409.1875, 100.0	Unknown agency
409.4000, N940	Federal Protective Service, Las Vegas
410.1000	
410.3000, CSQ	Data bursts
410.9500, CSQ	Data bursts, LAS airport
413.6000, 103.5	US Postal Service
413.8000, CSQ	Data bursts
414.5250, 103.5	US Postal Service sorting facility
415.2750, 186.2	Unknown agency
415.5750, 186.2	US Postal Service, input to 418.1000
415.6500, CSQ	Possible DoE paging
416.0000	Open carrier
418.6875	
418.1000, 186.2	US Postal Service truck operations
418.7500, 156.7	DEA F3
418.9000, 156.7	DEA F2, OTAR data
419.5000, 156.7	DEA, Las Vegas local operations
446.2250, 156.7	W7HTL amateur repeater - Pahrump area

As with the past logs of my road trips, I will post this on the *Fed Files* blog page and would welcome any corrections or additional information that others can provide.

❖ Scanning the Diplomatic Security Service, Part II

In the July *Fed Files*, I passed along the UHF federal channels that are frequently used by the Department of State Diplomatic Security Service. In addition to the UHF frequencies I published, there are some VHF allocations to the DSS. While I have only encountered them on UHF channels, these could be possibly be used in the US.

These VHF channels can be utilized by other State Department operations as well. I recall hearing reporters from the US Information Agency (The Voice of America) using 166.6125 and 169.6125 MHz while covering some past political conventions.

148.1000	149.7500	163.5250	163.5750
164.7000	165.6125	166.1000	166.2000
166.6125	168.0000	168.0500	168.2250
169.0500	169.1000	169.2000	169.6125
169.6250	169.7000	169.8000	170.4500
170.5750	172.7000	173.7375	173.9625

That's all for this installment of the adventures in federal monitoring. Be sure and see what is in store for the November *Fed Files*.

BOATS, PLANES, AND TRAINS

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Stepping Back

Listening to either the scanner in my car or the hand-held scanner that I carry with me when traveling helps me keep an ear out for railroad activities, even when they are not within visual range.

Yes, the scanners will often alert me to a particular switching move or to an approaching train, but more than that, what I listen to are the patterns that emerge when I listen to a particular railroad over months or even years.

While I enjoy seeing most any train roll by, I've found that over the years, I most enjoy understanding what the train is doing and how it fits into the over-all picture of railroading. Towards that end, I've often found that some of the best train-watching spots are not immediately at trackside, but sometimes some distance away, where it's possible to see more of the train and more of the activity at one time.

You may also find that sometimes stepping back actually lets you see more of what is going on.

❖ More on Multiple Units

In the last column's discussion of multiple units on a train, I ran out of space before running out of concepts I wanted to present. So, let's finish up this discussion.

I mentioned that when there are multiple units on the front of a train, not all may be working. That can be for any number of reasons. The train may not need the tractive effort while in flat terrain or the units may be being delivered to another location for use there in a yard or on local freights. The units may also be on the way to a maintenance base for inspections and work that cannot easily be done in the field.

Non-working locomotives may be moved in one of two ways: isolated (off-line) but with the prime mover running, or "dead in tow" – sometimes abbreviated as DIT. A dead unit is simply another heavy piece of freight.

Starting a large diesel engine is not a simple procedure, so, more often than not, if a unit does not have a problem that would keep the prime mover (diesel engine) from running, it is moved with the prime mover idling. (Railroads use "prime mover" to reference the diesel motor itself, to differentiate from the term diesel engine, which can also refer to the entire locomotive.)

Diesel locomotives have a control switch on the back of their cab that has two positions, "Start/isolate" and "Run." The switch has to be in the start/isolate position during that start-up procedure. In that position, the locomotive ignores commands from other units in the consist (sequence of rail cars), even if it is connected by MU (multiple unit cable). In the run position the locomotive works together with the other units.

A locomotive can be isolated at any time for fuel savings, for mechanical problems, or other reasons. A locomotive that has shut down can also be isolated, restarted, and then put back online even when a train is moving.

Three large modern Norfolk Southern diesel locomotives are working hard to get a relatively short freight train of only about 50 cars up the major grade on the NS "S" line between Old Fort and Asheville, N.C. This view is from a backcountry road near the community of Graphite. In flat country, those same three engines would be able to move a train of up to 150 freight cars. This section of the S line is known as "The Loops" because the tracks twist back and forth through several valleys to gain altitude.

❖ Doubling and Tripling a Hill

We also looked at how helpers and DPUs (distributed power units or remote controlled locomotives elsewhere in the train) help get heavy trains up major grades. There is another old train handling technique that is still used on secondary lines. That is "doubling" or "tripling a hill."

If the train does not have sufficient power to make it up the grade, the train simply leaves half or a third of its cars at the bottom of the grade and proceeds up the grade with the remaining cars. When it gets to the crest of the grade, the first group of cars are left in a siding and "tied down" with hand brakes. The engines and crew then run light back to the bottom of the grade to pick up the next or remaining group of cars and then head back up again.

At the top of the grade, the train is then put back together to its original length and proceeds on to its destination.

Splitting and recombining the train as well as the multiple runs up and down the grade take a lot of time, which is why you would not normally see these operations on a busy main line. Doubling or tripling a hill also only makes sense if there is a relatively short major grade of a few miles. For much longer grades or a successive series of grades, it makes more sense to simply run shorter trains where the motive power can be matched to weight of the train and the grade.

❖ PTC Update

Major railroads are continuing to invest huge amounts of money to begin implementing the federal mandate requiring positive train control (PTC) on major lines that carry either passenger trains or hazardous materials.

But, the railroads are not happy. Every time I get a chance to talk to railroad officials involved in operations or technology management, I hear much of the same story, though usually off the

record. The story they tell is that the technology still has lots of problems and costs way too much for what it *may* accomplish.

The PTC being installed by railroads is based in part on global positioning satellite (GPS) data. If you've ever tried to use a GPS-based navigation device, you know that there are areas where reception is a problem.

Another factor seldom discussed outside the railroad community is the fact that for parallel tracks, GPS is right at the limits of the system's level of resolution. On older lines, parallel tracks were often built on 15-foot centers. (That means that it's 15 feet from the center of the rails of one track to the center of the rails on the other track.)

Yes, railroads are aware that 15-foot center distances provide other problems for modern operations. Newer lines, where double-track is being installed for the first time, are built on 25-foot centers, where feasible.

A non-GPS related problem with 15-foot centers is that when maintenance work is being done on one of multiple parallel tracks, the adjoining track or tracks need to be shut down, too, for the safety of the track workers. Some of the track machinery (particularly the booms and counterweights of cranes, when they are turned) overhangs the outside rail by more than typical railroad rolling stock. When tracks are built on 25-foot centers, operations on parallel tracks can usually continue uninterrupted.

But, as you can imagine, any safety system that cannot tell on which of two parallel tracks a train is on is not particularly useful.

On the other hand, communicating the status of lineside signals to the engine of a train is a lot simpler. And, you will see PTC-related antennas being installed at many control points. (For routes that already use radio code line [RCL] with antennas at each control point, the new antennas may either be added to existing masts or installed on separate masts, depending on local conditions.)

The PTC system needs the GPS component of the system to tell where the train is in relation to a particular signal, to interpret what that signal means to the train. If the train is nearing (within a mile) an absolute stop signal, it needs to be slowing down or operating at very slow speed. If it is within a hundred yards of the stop signal, it needs to be stopped, or the system will enforce a stop and will not allow it to proceed until the signal has changed.

Under current operating rules, trains can normally move right up to a stop signal and stop there. But, crews also have latitude to stop well short of that signal, if local conditions warrant. That may include a road grade crossing right before or right past the signal. In the first case, the train will avoid fouling the crossing if it will have to wait at that location. In the second case, the train will try to avoid activating the crossing protection at the grade crossing past the signal.

Most modern grade crossings have "approach circuits" which not only detect approaching trains, but also the speed at which they are approaching. If the train stops short of the crossing, the circuit will time out and the grade crossing protection will clear. But, as all these systems are set to operate on the safe side, the grade crossing may still activate briefly before timing out and releasing.

A few minutes later this same slow-moving NS freight is now high above the same back country road, on a kudzu-covered hillside, still working its way uphill. The photos were made on the way back from attending an Operation Lifesaver railroad safety meeting in Asheville earlier this year. My scanner alerted me to the approaching train (NS road channel, 160.950), making it worthwhile to pull off Interstate 40. I had made photos in this area over many years and already knew my way around the back roads.

Let's say that train A, which is to meet train B at a given location, is nearly as long as the siding at that location. The dispatcher has set up the meet so that train A heads into the siding and stops there, while train B will pass it on the mainline, once train A is completely in the clear.

Let's say that train A arrives at the meet location well ahead of train B, and has one of the grade crossing situations outlined above. It stops well short of the absolute stop signal, which leaves the back end of its train hanging out on the main line.

When it knows that train B is approaching, it pulls the last few hundred yards up to the signal, getting its rear in the clear, allowing the dispatcher to throw the switch at the other end of the siding and to clear the main line signal for train B. This type of situation happens more often than you might think.

But, under PTC, it raises all sorts of questions: Will the PTC system allow the crew of train A to restart their train and move it up those last few hundred yards? Or, will it require the crew to do some kind of override of the PTC system?

❖ Override

Any PTC system has to have some capability for an override, because there are situations where a signal system failure would otherwise totally tie up a railroad. In July of this year, I was on an Amtrak train that received verbal permission from the dispatcher to pass a problematic stop signal. The crew had to proceed at restricted speed until it encountered the next clear (green) signal. The dispatcher knew that there was a problem with the signal and that there were no trains in the block ahead. But, the train still had to operate "on sight" at slow speed through that block.

I've also traveled on engines in Europe on lines equipped with automatic train stop (ATS), a simple form of PTC. To avoid a penalty emergency brake application, the engineer has to acknowledge all restrictive signals – even signals that allow him to proceed, but at less than full authorized speed. And, of course, passing an absolute stop signal would immediately trigger a penalty application.

However, on these trips I've also seen situations where the engineer had to do an override of the ATS system to pass a stop signal – with authorization, of course. These overrides are documented on the locomotive's event recorder. And, whenever you can override or bypass a safety system, there is still the potential for human error.

Therefore, I am always troubled when news reports state absolutely that a given accident would have been prevented by a PTC system. A better way to put it would be that the accident *might* have been prevented by a PTC system. Even accidents in other modes of transportation often demonstrate that no safety system is absolutely foolproof.

❖ PTC Mapping

To implement a system with the complexity of what the government wants, not only does every foot of every track covered by that system have to be mapped for GPS location, but an enormous amount of programming has to be done to help the dispatching system apply that GPS data. The system has to be able to decide what train movements will or will not be allowed under a wide range of conditions. And all that programming is very expensive.

Next time: A look at more sources of railroad information, particularly on the Internet.

GLOBALNET

Exploring the World of Internet Radio and Television

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The Future of Internet Radio

Could it one day come at a cost?

I remember when I first started getting interested in Internet radio; it felt very wide open and free. It reminded me a lot of the days in our house before companies like DISH Network or DirectTV came along, when we moved between satellites with our large Ku and C-band dish to tune in programming.

Not just standard programming, mind you, from networks like TBS or HBO. No, I am talking all of the little minutiae of satellite programming that was at our disposal. Direct feeds from satellite trucks of news teams were readily available to anyone who knew where to look. You could watch reporters fix their makeup, rehearse lines and cut-up with the camera crew well before they went "live."

Then, everyone started falling into neat little lines of organization. You had your big companies such as DISH and DirectTV that controlled the funnel of what channels you could access according to what you were willing to pay. It was inevitable, really. But I always missed that free-form feel of satellite programming.

Internet radio has had a similar feel up to this point. All you had to do was grab a streaming radio app or go to a web site and you too could tune in any stream you wanted to.

Now, broadcasters are lining up with specific partners in the industry, and before you know it, there will be subscription plans and other ways of controlling the content you can access.

Take for instance the announcement of a deal between Yahoo and Clear Channel Entertainment and Media (formerly known as simply Clear Channel Radio). Clear Channel has agreed to provide content from its "iHeartRadio" service to Yahoo's digital radio service. Likewise, streaming service and smartphone app provider, TuneIn, has struck similar deals with Cox, Emmis and Entercom.

While there aren't any changes happening because of this shifting just yet (you can still access Clear Channel stations through TuneIn, as an example), the writing is on the wall. Whether it be through exclusive content to certain providers (like NFL *Sunday Ticket* and DirecTV), audio quality, streaming data allotment or station availability subscription packages (imagine paying a premium to hear ESPN radio stations, as an example), there will most likely come a day when you will have to pay to experience Internet radio in the free-form and wide-open method you do now.

These media giants are still trying to figure out how to earn sustainable and significant revenue from streaming content. Advertising revenue is starting to creep up for online streams. In my market of Upstate South Carolina, I am hearing local advertisements on Pandora now. But don't think for a second that radio companies or streaming providers won't take a page from the book of cable TV or satellite radio. Expect to see subscription-based Internet radio in the not too distant future.

I can see something like a subscription-based sports package that also incorporates text message alerts with scoring updates and news. How about news coverage? How about music formats? Would you pay $5 per month to be able to hear only stations of a certain music genre you enjoy? How about $10 per month for unlimited music streaming? How about an extra $5 per month to tune in international stations, or for high-quality audio?

If I have learned anything about technology over the years, is that at first, it is great. It is open and free and carries unlimited potential. But once people figure out how to make money off of it, access becomes more limited and measures of control increase. One need only look at the data plan offerings of cellular providers to see what I am talking about.

I really hope that none of that comes to pass. I am hoping the Internet makes streaming radio immune to the ability for this type of business model. But, the more I see companies maneuver and align, the more clearly the writing appears on the wall. So, enjoy the freedom and opportunities of choice while you can. Tuning in your favorite stations may someday mean digging a little deeper in your wallet.

❖ Clear Channel agrees to Performance Royalty?

In more Clear Channel news, they have reached a deal with Big Machine Records – the country music label that includes artists such as Tim McGraw and Taylor Swift – to pay out royalties on a per-performance basis.

After the National Association of Broadcasters fought pretty strongly against these performance royalties when the Recording Industry Association of America made a push for them to be implemented industry-wide a few years ago, now Clear Channel has gone out on their own and brokered this deal.

At first, I was puzzled why Clear Channel finally caved in and agreed to performance royalties after claiming for so long that the extra costs of doing so would put an already strained industry on the verge of complete collapse. But after reading the rest of the article and giving it some thought, I realized what they were trying to do. Basically, it all comes down to Internet radio.

Sometime in the last few years, Clear Channel finally realized that the Internet wasn't going away. They realized that as smartphone usage and broadband accessibility increases, more and more people want to use the Internet to take their radio stations and music with them wherever they go.

As they are making a strong push right now to expand and move towards an ever increasing online presence, they saw this deal with Big Machine Records as a chance to give their online presence a chance to grow by reducing the royalty burden for online streams.

❖ How? Let's take a look

Remember when the recording industry brokered the performance royalty for Internet radio stations? Instantly, Clear Channel and other broadcasters had to start paying a per-song royalty for all stations streamed online – but not for their over the air broadcasts.

When the recording industry (and Internet-only folks like Pandora) started screaming for broadcasters to pay performance royalties for over-the-air broadcasts as well, the broadcasters fought back. Under that setup, they would be paying performance royalties twice for playing a song once (once for over-the-air and once for the stream).

With that model, there is no cost benefit for doing anything online. Under this new deal, however, Clear Channel has negotiated that, rather than pay a per-performance royalty for online streams to artists on this label, they will pay a percentage of their revenue from the streams. So, they pay the standard ASCAP/BMI royalty payments for copyright holders, per-performance royalty for the over-the-air broadcast, and then a percentage of their advertising revenue from streaming and that's it.

Under this model, online streaming suddenly becomes a much more lucrative avenue to explore. Clear Channel basically met the record label in the middle.

Will this type of royalty deal become standard across the industry? If it is negotiated on a per-label basis with each broadcasting company, I doubt it. Big Machine Records has some pretty big names on their bill. A smaller record company likely won't even get a second glance from the broadcasters.

That is exactly what Tim Westergen at Pandora and members of the record industry are saying. They want Congress to step in and create a uniform royalty system that forces broadcasters to apply this type of royalty deal across the board.

Will it happen? I think it is certainly more likely, now that Clear Channel, the largest radio company in the world, has agreed to it with one label. It will bear watching over the next couple of years, to see how this pans out. In the end, though, all of this should be a great way to even the playing field for Internet radio, which is always a good thing.

❖ Shortwave Ver. 2.0?

I stumbled upon a short UPI article recently that made me rethink my stance on the exodus of broadcasters from shortwave to the Internet.

So many people are lamenting the loss of shortwave broadcasters to the Internet and bemoaning that the radio hobby is dying, that it has almost become a cliché. I haven't bought into the second myth, because I know that there will always be a need for someone to broadcast information to remote areas of the world via radio waves.

My original stance was that if you are someone who turns to shortwave radio for the programming content, you should actually be thrilled to hear it streamed. No more poor conditions ruining your chances of hearing that content. Now, through the Internet, you have access to crystal-clear signals no matter what the atmosphere is doing.

If you are someone who is more interested in the thrill of the chase of rare signals and DX, my response has always been, "get your amateur radio license; there is far more you can chase down as a ham than you ever could as a pure shortwave listener."

Growing up in the Van Horn household, I have heard countless times my shortwave DXing mother being disgruntled when my father – a QSL-hunting ham – had snagged yet another country that was unavailable on shortwave radio. So, I have always looked at ham radio as a DX option with far more potential – even before there was an Internet. So perhaps I actually did buy into the notion that the Internet had killed shortwave DXing, even though I hadn't come right out and said it. But now, I see the error of my ways.

Rather than killing shortwave DX, I think that the Internet will help shortwave radio go through a "reboot," so to speak. To illustrate, let me give you an example from my favorite form of DXing, mediumwave.

❖ Sometimes Less is More

When I was hot and heavy into nightly forays of mediumwave DXing, I would often find myself parked on a frequency occupied by a large "clear channel" (not the company) 50,000-watt behemoth. These, for me in my location, were usually flamethrowers on the East Coast such as 770-WABC, or 720-WGN or 1030-WBZ. The frustrating part was that on the opposite side of the country – on the same frequency – was another flame-thrower of a station that I would never be able to hear because of the monster on the East Coast.

My father used to tell me stories about when he would DX the AM bands in the '70s, and these large stations would go off-air at times on late Sunday nights/Monday mornings for transmitter maintenance. He told me that is when he was able to snag so many stations he otherwise never could.

So, night after night, I would stop by these frequencies, hoping against hope that maybe they would be taking a break from broadcasting so I could pull in the faint signals of stations like 770-KKOB in Albuquerque; 1030-KTWO in Casper, Wyoming or 720-KDWN in Las Vegas.

Circling back now to the article that spawned all of this: The UPI article discusses how, as major international broadcasters are abandoning shortwave in favor of the Internet, the gap is being filled in with smaller broadcasters trying to reach remote parts of Africa and other parts of the globe.

Think about it. The Internet isn't available everywhere across the globe yet. Even in some of these remote places where it is available, the connection isn't reliable, the electrical grid is even less so, and many of these countries censor what their citizens can access through the Web.

So, what alternative do they have for accessing information? That's right, they are pulling out their old battery-powered shortwave radios and – surprise, surprise – still finding stations to tune into.

My favorite form of shortwave DXing was always hunting down "the tropics." Trying to pull in smaller stations on the low bands from Africa, South America and the South Pacific was far more challenging and gratifying than pulling in a QSL from BBC or Radio Netherlands. Anyone can do that.

Now, with those flamethrowers disappearing, there is more room for the real gems of DX to shine through.

If you want to hear Radio Canada or Deutsche Welle, they are still there waiting for you online. But if you want to get your hands dirty with some really good DX, don't throw away your shortwave radio just yet!

I think we are in the middle of a reboot and renaissance for shortwave radio version 2.0, which will give DXers a whole slew of new DX targets to choose from.

Until next month, 73 and happy listening!

GLOBALNET LINKS

Clear Channel First to Pay Royalties for Music On-Air - **www.npr.org/blogs/therecord/2012/06/13/154871444/clear-channel-will-be-the-first-to-pay-royalties-for-music-on-its-air**

Radio Royalty Deal Offers Hope for Industry-wide Pact - **www.nytimes.com/2012/06/11/business/media/radio-royalty-deal-offers-hope-for-industrywide-pact.html**

Shortwave Radio Not Lost to Internet - **www.upi.com/Entertainment_News/TV/2012/07/07/Short-wave-radio-not-lost-to-Internet/UPI-86811341670760/**

BELOW 500 kHz

DXING THE BASEMENT BAND

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Summertime, Summertime

Welcome to another issue of *Below 500 kHz*. I trust that readers in the northern hemisphere are enjoying a warm summer season. Longwave conditions are typically not at their best during the warmer months, as static crashes often win out over desired signals. However, there are still days that can surprise us, and if you're willing to do some listening before 10 a.m. local time, things can be especially productive. At these times, there is still some nighttime skip in effect, and static levels have not yet had a chance to build up. Soon, fall will be on its way with lower static levels, but for now, coping strategies are the key to success.

If chasing beacons is your thing, but you don't want to battle with static, consider taking a respite and hunting for beacons elsewhere in the radio spectrum. Both 10 and 6 meters are favorite bands of mine and have been fairly productive this summer at my location in Western NY. An online search for beacons on these bands will give you plenty of targets to try for.

A few years ago we had a new roof put on our house, and most of my antennas had to come down. It has taken me until this summer to finally get them re-installed with proper grounding, cable routing, rotor control, etc. It didn't help that when lowering my 6m beam to the ground, the roofers dropped it from about 15 feet up, damaging several elements. To fix it, I slid pieces of slightly larger aluminum tubing over the broken pieces, forming a sort of "splint" to hold things together. This, along with a few sheet metal screws got things back in order. It's good to be back on 6.

❖ Summer Mailbag

John Leonardelli, VE3IPS (ON) writes: "Hi Kevin, I plan to build the VLF Natural Radio receiver featured in your March 2006 in your column. Was there any erratum to the design? I thought perhaps there was a mistake in the schematic but can't find the issue denoting it.

Hello John, the March 2006 issue described the construction of the Bare Bones Basic BBB-4 receiver, and the April 2006 issue had the conclusion. There are some useful tidbits in the second column on buttoning up and using the receiver for the first time, so I recommend reviewing that, as well.

There are no error corrections on the published circuit, but I do describe a wiring error I made in my own construction. I accidentally hooked C8, the output coupling capacitor, to a ground point instead of Q2's collector. It was an easy mistake to make, but the circuit definitely would not have worked this way. The moral: double-check everything! Good luck in building the BBB-4, and please let us know how it works.

Most readers have heard of the interesting work being done by the Maritime Radio Historical Society (MRHS) in California, including the reactivation of longwave and HF transmitters for ship-to-shore communication. John was kind enough to send along some photos he took of the station during a visit there. They are shown below. For more information on MRHS, visit their interesting website at: **www.radiomarine.org**.

Cary Norman, N6SQ, writes: "I am puzzled in that although I have several 60 kHz WWVB clocks that sync up just fine, I am unable to detect the carrier at 60 kHz on a receiver. My receiver is an Icom IC-746 which tunes down to 30 kHz and works well. I use a 100-foot long wire for LF and I can receive many LF beacons. I would think that in CW mode I should at least hear the carrier being broadcast. Do you have any thoughts on this? Thanks, and by the way, I read and enjoy your column in *MT*."

Hi Cary, and thanks for writing to *Below 500 kHz*. I'm at a loss to explain why you wouldn't be able to hear the WWVB carrier at 60 kHz. It's moderately strong here in NY, and I assume from your "N6" callsign that you are closer to the station than I am. Are you seeing any signal at 60 kHz (even static) that registers on your S-meter?

My only guess is that ambient static is covering up the time signal when using a wire antenna, while the small ferrite antennas inside your clocks are less responsive to ambient noise and tuned specifically to the 60 kHz signal. Please keep us posted on your progress.

Views of the station and antenna farm at the Maritime Radio Historical Society (MRHS) station at Point Reyes, CA. (Photos courtesy of John Leonardelli, VE3IPS)

Jim Moodie, KA7CIC (OR) writes: "Hi Kevin, in the next few months I would like to search the area hamfests for a good older ham transceiver – one with above average specs for longwave. I want to start chasing NDB's with better equipment than I presently have. Can you help me out with any model number suggestions?"

Hello Jim, Glad to hear of your interest in "taking things to the next level" in chasing beacons! While you can get started with just about any old receiver, you soon see how much better you could do with more advanced gear. The trouble with older ham transceivers is that many do not cover much below 1.8 MHz.

One older rig that does cover longwave is the Kenwood TS-430/440 series, which goes down to 150 kHz on receive. I have known several LW DXers who use these sets with good success.

Another option is to use a *receiving converter* in front of a ham transceiver. You get all the features of the ham rig (filters, noise blanker, S-meter, digital readout, etc.), but the converter moves the LW band to a range the rig can tune, such as 3.5 to 4 MHz. Just be certain you never *transmit* into

the converter or it will probably be damaged. Whenever I have used one, I disconnect the mic and key just to be extra safe.

Hope this gives you a few pointers and good luck in hunting for that special rig!

Kriss Larson, KR6ISS, enjoys traveling to interesting destinations worldwide, and he usually manages to work in some time to visit radio sites – specifically longwave sites. We are pleased to hear from Kriss once again, this time with a summary of his trip to New Zealand…

"Just came back from another foreign trip, this time to North Island, New Zealand and Norfolk Island, primarily out of my interest in oceanic island botany. Visited several rainforests-complete with rain – it has been an unusually rainy summer down there, good for farmers, but not for tourists.

"I did my usual band scans from 0-500 kHz in a few places. One especially good scan was done on Norfolk Island, which is 800 miles north of New Zealand; about 5 miles square, and is famous for its Norfolk Island Pines and home of some *Mutiny on the Bounty* descendants. On Norfolk, since it is an official DXCC radio country, I made an effort to find a resident ham to get a chance to make contacts on the air, sort of a pseudo DXpedition from a remote island.

"I did find such a person on Norfolk – John Anderson, VK9JA – who has been on the island for 65 years, but not that active a ham. The well-known ham of Norfolk, Jim Smith, VK9NS, died in 2009 and the island has had little traffic since.

"We did get on the air on John's limited equipment for a few sessions. The most distant QSO was a guy in the Ukraine 9700 miles away, and the other direction to a guy in Pennsylvania at 8500 miles. We also talked to a couple of guys in Southern California near my home. It was fun to be on the receiving end of a DX pileup for a change!

TABLE 1. SELECTED NDB LOGS FROM NJ

kHz	ID	St/Prov	City
391	OGY	NY	NEW YORK
390	FR	NY	FARMINGDALE
396	NEL	NJ	LAKEHURST
363	RNB	NJ	MILLVILLE
275	BBN	NY	BABYLON
254	CAT*	NJ	CHATHAM
254	EUD	PA	YORK
248	IL	DE	WILMINGTON
349	APG	MD	ABERDEEN PVG GNDS
216	CLB	NC	CAROLINA BEACH
208	UKT	PA	QUAKERTOWN
369	TT	NJ	TRENTON
328	BZJ	PA	INDIANTOWN GAP
335	SW	NY	NEWBURGH
388	RNW	NC	CHOCOWINITY
379	BRA	NC	ASHEVILLE
366	YMW	QC	MANIWAKI
360	PN	QC	PORT MEYER
340	YY	QC	MONT JOLI
281	HP	NY	WHITE PLAINS

** Occasionally miskeying with variations on this ID.*

"Anyway, I found John, who is 74, to be an interesting guy – he was the radio technician on the island for many years. One of his many assorted duties was maintaining the NDB, which he said used to be 3000 watts. The present one was no slouch either – I heard it strong in broad daylight 1000 miles away in the west coast of North Island, New Zealand.

"What was off the air was Lord Howe Island's beacon – I visited that island in 2006 – another barn-burner transoceanic. The big catch from Norfolk was Majuro Atoll in the Marshall Islands in the North Pacific-2500 miles away (MAJ/316 kHz). That must be a particularly strong transmitter.

"Australia has a string of DGPS beacons, while New Zealand has none. Neither New Zealand nor Australia supports 518 kHz NAVTEX for some reason. Even though it was summer down there and there was a full-strength hurricane going on in Fiji while I was on Norfolk, static noise was not strong – very different from the US in the summer. Anyway, it was another successful trip – although a bit wet. My next trip in July is Croatia-Slovenia. A folklore trip that time – but the radio gear will also be in the suitcase!"

❖ Loggings

Our loggings this month are from Mario Filippi, N2HUN (NJ). He uses a Ten Tec RX 320D and a Yaesu FT101 ZD receiver with a Palomar VLF converter. His antenna is an S9 43-foot vertical with 53 ground radials.

Mario reports that some of these stations were readable for only a minute or two, before fading into the noise, so it paid to keep the headphones on and keep spinning the dial! Mario made three entirely new loggings in this way: BBN, SW and PN. The loggings are shown in Table 1.

That's it for this month. See you in October!

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
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Finishing up the Arvin Project

❖ Last Month's Impasse

We concluded last month's column with an impasse. Normally I would have started the Arvin restoration with a complete recapping. However, one look at the crowded wiring under the tiny chassis convinced me not to make the attempt. The set must have been originally wired in layers and it looked like I might have to remove several capacitors and other components to begin changing out the capacitors in the bottom layer. This would be tantamount to inviting Murphy's Law into the project and giving it free rein!

I decided, instead, to proceed as a radio service tech would have done back in the day. In other words, turn the set on, look at the symptoms, and make only the specific repairs called for in the diagnosis. However, in view of the fact that we are dealing with a radio over 60 years old, I would start up the set gently using an autotransformer power supply that would allow me to increase the line voltage in four gradual steps.

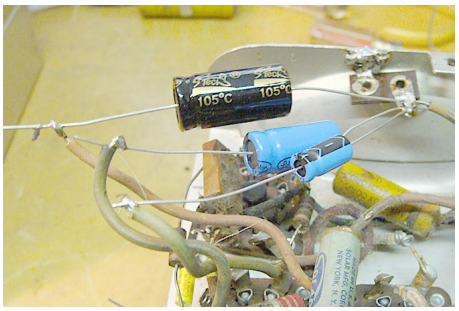
While increasing the line voltage, I made sure there were no serious shorts by continuously monitoring the set's B plus to make sure it was rising to the expected value. There were no problems with the B plus, nor did I spot any smoke or notice the smell of something overheating. However, as soon as the voltage had risen to the point where the set could begin functioning, a problem became apparent. It was a loud raspy hum unaffected by the volume control – the typical symptom of an open filter capacitor.

The Arvin was equipped with the usual multi-section electrolytic capacitor containing two sections for filtering (40 uf and 20 uf at 150 volts) and a third (20 uf at 25 volt) as the cathode bypass for the 50L6 power amplifier.

I didn't have a multi-section with the right electrical specs that would fit into the small space available, nor did I see anything suitable available new. So, I ordered three individual electrolytics with the proper specs. Given the compact size of modern capacitors, I was reasonably sure that I would be able to find enough space for them under the chassis. Further work on the Arvin would have to await their arrival.

❖ Installing the Electrolytics

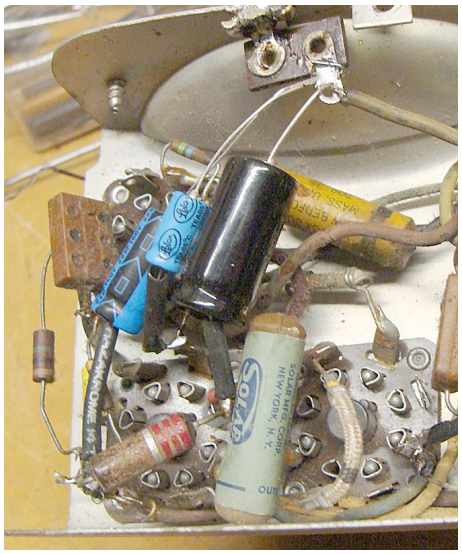
Installing three individual electrolytics in place of a single multisection unit presented an immediate logistical problem. The multisection capacitor had a single common negative lead, but



Temporary installation of electrolytics allowed room for possible additional diagnosis and component replacement.

now we had to deal with three separate leads. Ordinarily, this would be no problem. In most receivers, the leads would be grounded to the chassis, where there are usually plenty of available ground points.

However, this radio (see July column) has a "floating ground" for protection against electric shock – as would be mandatory for a metal-cased a.c.-d.c. radio. Opportunities to hook up to it are limited, particularly in the tight wiring of this midget receiver. The solution was to solder-mount a single-terminal lug to the stub of the metal strap that had once held the original electrolytic. The original common negative lead, still wired to the floating ground, was then clipped off close to the electrolytic and wired to the lug – leaving plenty of room for the negative leads from the three new capacitors.



Once proper operation of the radio was verified, the electrolytics were installed permanently.

However, it was decided not to wire the three new caps permanently in place at this time. The reason: if the replacement capacitors did not entirely solve the problem, further troubleshooting would be required. A tight installation of the three new units would likely block access to components that would need to be tested during additional diagnosis.

Accordingly, the capacitors were installed without cutting their leads. The negative leads were slid partway into the lug that had been prepared for them and tack-soldered without crimping. The positive leads were tack-soldered to the clipped off leads of the original multisection unit, which had been left connected to the circuit at their other ends. This way the new capacitors were properly wired to the radio while leaving plenty of room for testing or component replacement.

Next, I attached a short length (about ten feet) of antenna wire and turned the set on. I had my fingers crossed – hoping that there would be no need for extensive probing and testing in the tangle of under-chassis wiring. And I got lucky! I was now able to pick up stations at several positions of the tuning capacitor.

However, even though hi-fi reception could hardly be expected, I thought I detected an "edge" in the audio quality that shouldn't be there. Suspecting a leaky coupling capacitor (C8 in Figure 1), I measured a bit over a volt of d.c. on the control grid of the 50L6 output tube – confirming at least some leakage. Luckily, C8 was quite accessible and I noticed a small but definite improvement in audio quality after changing it out.

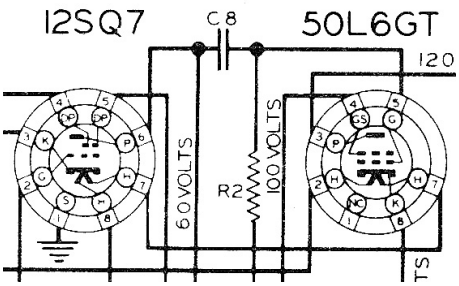


Fig. 1. Leakage through coupling capacitor C8 caused slight deterioration of audio quality.

After that, it looked like no further troubleshooting was going to be necessary, so the leads from the original electrolytic were removed and three new electrolytics were connected directly into the circuit.

❖ Alignment

Alignment of the little Arvin goes quite quickly, because there are a minimum of adjustments to be made. Since there is no i.f. amplifier stage, there is only one i.f. transformer instead of the usual two. The radio is also missing the usual antenna stage trimmer and low-frequency padder.

Alignment begins in the usual way by feeding a 455 kHz signal into the front end of the receiver and adjusting the i.f. trimmers for maximum output. In my case output was measured with a VTVM connected across the speaker voice coil and set to a low volts scale.

Usually with a long-dormant receiver like this, tweaking the i.f. trimmers leads to a dramatic increase in signal strength, requiring more than one reduction of signal generator output to keep from activating the avc circuit. In this case, though I was able to obtain definite peaks, there was no such dramatic increase – probably because of the absence of an i.f. amplifier stage.

With the i.f.s adjusted, the signal generator is reset to 1400 kHz and connected to the receiver's antenna through a .00005 uF capacitor. The main tuning capacitor is also set to 1400 kHz and the oscillator trimmer is adjusted as the tuning capacitor is rocked back and forth on either side of 1400 kHz until maximum output is obtained. This dual adjustment is necessary to obtain good tracking of the antenna and oscillator stages in the absence of a specific antenna trimmer.

Figuring out how to carry out this operation had me briefly scratching my head because the oscillator trimmer is on the main tuning capacitor and is only accessible with the radio out of its cabinet. On the other hand, the tuning dial, which shows the position of a pointer knob attached to the shaft of the main tuning capacitor, is mounted on the cabinet front and is usable only when the set is in its cabinet.

However, the service notes tell us that the pointer knob should be set at 54 with the capacitor fully closed. After securing the knob in that position, it could be turned to the 1400 position and then carefully removed without further turning of the shaft. The set could now be removed from the cabinet and the adjustment could proceed.

After these adjustments were made, I tried the set again and noticed a definite improvement in liveliness as I tuned across the band. There were more stations coming in at higher volume.

❖ Cabinet Cosmetics

I was about to call this section "Cabinet Restoration," and it was my original intent to do something worthy of that name. But in the end I decided not to prepare the cabinet for painting and spray on a new coat. Why? Well, you could certainly call me lazy with some justification, but I also have some solid reasons.

For one thing, I found that going over the surface with some Ajax and a ScotchBrite pad worked wonders in removing the many rusty looking spots that dotted the surface. The treatment dulled the paint, but rubbing with Brasso metal polish restored a nice sheen.

The result was so encouraging that I took

Now in good working condition the Arvin makes a nice appearance despite its scratches.

the cabinet down to the Home Depot paint department, where they color-scanned it and mixed up a sample sized jar (maybe a half-pint) of matching paint. Cost: three bucks!

When I got the paint home and tried it out, I found that, though close in color, it couldn't be used to touch up scratches on prominent flat surfaces. It stuck out like the proverbial sore thumb. On the other hand, it worked very well in corners and half-hidden shaded areas and, of course, on the bottom, which was badly scarred and discolored.

When I had finished with all this, I ended up with a credible-looking cabinet that – to be sure – had some scrapes, but it also had more than 80 percent of its original finish intact. A couple of issues left unresolved are the knobs and back. The knobs are certainly the right color, but they don't match those in any pictures I've seen of these little Arvin sets. As for the back, I had been planning to make a fiberboard replacement, but once I saw a picture of the real back, I gave up the idea.

I'm including the picture with this article, and you can see that the louvered metal design couldn't even be approached in any amateur workshop. The back isn't really needed for safety reasons – so I'm just going to live with the set as is unless I'm lucky enough to come across an exact replacement.

❖ Polarized For Safety

I was just about ready to put the little Arvin away and begin thinking about what might be the next project for the column, when I had a sobering thought. While it's true that the floating ground system prevents dangerous line voltage from appearing on the cabinet and other metal surfaces of the radio, it does happen to be bypassed to the chassis via a .05 uF paper capacitor. Since I had not done a complete recap, the 60-year-old capacitor is still in place and

The Model 444 back as seen on another radio.

could let go at any time. If it did, the chassis and cabinet could easily become hot to ground.

My first thought was to replace the capacitor, but it turned out to be one of the buried ones. So I fell back on plan B. The radio was wired so that one side of the line was connected to the floating ground when the power switch was turned on. Searching through my collection of line cords, I located one with a polarized plug. Removing the line cord I had installed at the beginning of this project, I substituted the polarized version, wiring it so that the wire from the wide blade of the plug was the one that would become connected to the floating ground.

Assuming that the radio is plugged into a properly wired outlet, the wide blade of the plug will be connected to the grounded side of the line rather than the "hot" side, and thus would not present a shock hazard even if connected directly to the Arvin's metal chassis.

❖ From The Readers

Joe Erickson, N8PMF (Cadillac, MI), writes that he really enjoys "Radio Restorations," especially the articles dealing with military gear. He recently acquired an impressive Simpson 315 signal generator at a hamfest, but finds that the modulated r.f. output function does not work. He's looking for a schematic and/or a manual and would appreciate any help he can get. I've tried my usual source "Boat Anchor Manual Archive" (BAMA) at **http://bama.edebris.com**, but the 315 is not listed. Any ideas? Contact Joe through this column c/o Marc Ellis.

Sandy Geiger III (Rogersville, TN) enjoyed the first installment of The Arvin Model 444 restoration (July issue). He has a 4-tube Model 444 like mine, but in chocolate brown and also has examples of 2-tube and 3-tube Arvins. The 2-tube version is a Model 38; the model number of the 3-tuber is unknown. But the Arvins are just a sideline for Sandy. He has a stunning collection of military, ham and commercial boat anchors, as well as antique broadcast receivers and sets in other categories too numerous to mention.

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Dan Farber, AC0LW
danfarber@monitoringtimes.com

Receive-Only Antennas

A Shortwave Listener's Perspective

Welcome back, my friends. This time around, let's take a look at antennas from a non-transmitting perspective – the viewpoint of SWLs and other listeners. Note well that neither club is exclusive of the other: I've been a ham since 1971, but I've been an SWL since 1968! Indeed, many of us started as SWLs, got the bug, and went on to get a license.

I have no doubt that many of you licensed hams still love to just *listen* to your favorite shortwave broadcasters and other services on the HF bands. I know I still do, even though I also operate the HF ham bands frequently. But a lot of other hobbyists are perfectly content to remain SWLs, and derive tremendous enjoyment from it.

When the requirement to be able to transmit is removed, the concept of *antenna* suddenly becomes much more flexible. For example, many a portable shortwave receiver has a short, telescoping whip antenna that is very compact and can serve as an acceptable receiving antenna under the right conditions.

I would not recommend trying to feed 100W from an HF transceiver to it, though – it's far too small for even the best tuner to match it, and the portable's RF circuitry wouldn't like it much either.

Typical whip antenna-equipped portable receiver. (Courtesy Kaito via Grove catalog)

Why the huge dichotomy? Because an antenna system *has* to get fairly close to an impedance match to allow *transmission* – modern rigs simply "fold back" and refuse to make any real power if the mismatch is at all bad, say 2:1 SWR or worse. An unmatched *receiving* antenna, on the other hand, merely generates a smaller *received signal*, which does not affect the radio in any deleterious way. And quite often, a tuner or preselector can maximize the *receiving* results very nicely, even though the antenna in question is too small or short or low to the ground to load up as a *transmitting* antenna.

❖ Overkill for the SWL

Right away this principle imparts freedoms to the SWL that the ham doesn't have. Oh, I suppose the SWL *could* erect a 100 foot tower with a three-band beam cut for his/her three favorite shortwave bands; but the ham is more likely to feel that the beam and tower is a *necessity* to get the great DX, while it would certainly be ostentatious overkill for the SWL. Admit it, fellow hams – we want the beam primarily so we can inject our own transmitted signal into these DX areas, not because we're convinced the beam's *receiving* qualities are indispensable. (I'm sure we hams all have great stories to tell of the rare DX that we could hear fine Stateside, but for some reason they didn't seem to hear us.)

Sure, the beam is an excellent receive antenna – but so are many others that don't begin to require the expense, labor or complexity of the beam on a tower. In fact, the tower and beam are the very antithesis of *stealth*, which is a crucial issue for many nowadays, and is often easier for the SWL to implement since he/she doesn't have to transmit with any given antenna.

❖ Stealthy Listening Solutions

One elegant solution is the ever-popular *active antenna,* which generally takes the form of a small loop or whip antenna integrated with an amplifier and various tuning/preselecting provisions. These usually run on nine volt batteries and/or a wall wart, and are handy enough and effective enough that they have given many SWLs a quite acceptable substitute for the large outdoor antenna that they can't have, due to any number of obstacles, from pesky neighborhood associations (or as I always call them in this column, the Antenna Gestapo), to lack of real estate, to spousal objections.

It's a neat little idea, really, the active antenna – the amplifier greatly boosts the small received signal, while the very small receiving element is, hopefully, too small to pick up excessive noise, and simple turning or repositioning of the loop or whip can often null out a noise source or home in on a desired signal. Grove Enterprises sells a fleet of excellent active antennas, which I invite you to check out at **www.grove-ent.com**. Another perennial antenna solution for the SWL

The AOR LA 390. (Courtesy: AOR via Grove catalog)

is the random wire. Here again, many configurations that would be too short or too low to transmit with work out fine as receiving antennas. (I well recall that many receiver projects I built in the 1960s called for "a wire 25 to 50 feet long, with the far end as high as possible" for the antenna. Definitely not a resonant length!) We can run the wire around corners, into trees, draped across the roof, hung in the attic, across the living room ceiling … and have a workable SWL antenna.

Of course, a tuner will maximize results with this "random random" setup; and it will be seen that, without the requirement to be able to load up and transmit, some really short, low, or obstructed wire lengths will make excellent antennas. It's not the world-beater that the beam and tower is, but it is also nowhere near as expensive – or as visible.

One of the great legends of our hobby is the success folks have had using metal rain guttering as an antenna. It's no fairy tale, folks: I used to live in a three story house where I used the second floor guttering as a random antenna. It got me on the air on every HF band, and I actually worked quite a bit of DX. The trouble with the gutter as a transmitting antenna is that it's hard to rig an effective ground to work it against when your station is on the third floor! A counterpoise wire for each band helped some, but at 100 watts the gutter was often a vicious

Courtesy MFJ Enterprises

Another popular active antenna, the MFJ 1020C.

beast, as stray RF sprayed everywhere, giving me cute little burns every time I touched key, mike, knobs, or table edge.

On receive, however, the gutter worked very well. Apparently, that 100 feet of guttering around the second floor eaves and the four 20 foot downspouts connected to it constituted quite a bit of "capture area" for weak and exotic signals. I well recall the frustration of clearly *hearing* stations in Sudan, Kampuchea, or Antarctica, but being unable to *transmit* to be heard by them, due to loading or stray RF issues. When I would spin the dial on the SW broadcast bands, the gutter pulled in choice DX on every band.

And here's the real beauty of the gutter antenna, friends – it's already been paid for, built, and installed, and it's the ultimate in "stealth in plain sight"! Many have had good results simply attaching a single wire to the guttering at a convenient point; others opt for a run of coaxial cable to the bottom of a downspout, with the center conductor tied to the gutter and the braid tied to ground rods or other grounding provision. Again, pretty "iffy" for transmitting, but likely to work very well as a receive antenna.

❖ Use Your Imagination

Once we free ourselves of the necessity to transmit, we start discovering that just about any metal surface is a potential receive antenna. I have reeled in a ton of great SWL DX over the years with the above-mentioned antennas, and some other really odd things, too, like the metal screen on a large window or patio door, the body of a half-ton pickup, a chain-link fence, a flagpole – all of these were difficult to impossible to load up and feed power to, but they all worked as receive antennas.

And again, notice the stealthiness of all of these ordinary items in plain sight. If you are looking for an SWL antenna solution, I encourage you to try any or all of these ideas, freed from the necessity to get it to load up and take power. Just use some common sense, friends... don't try power lines, or your neighbor's metal rose trellis, or, ahem, your neighbor's guttering...

I hope these few notions get you thinking about alternate antenna notions for the SWL. Remember, without the need to transmit, many "random" antenna ideas that would not work as transmitting antennas work just fine for receive-only – and that's all the SWL needs.

Stay safe, my friends, and keep trying those oddball antenna notions. I'll see you here again in the November issue, as we continue to explore the HF antenna jungle. Until then, happy operating!

Photo by the author

To the neighbors, it's just a gutter. To you, it's the ultimate stealth antenna.

SKY SURFING

RADIO FROM THE OUTER REACHES

Stan Nelson, KB5VL
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Spying on Exoplanets

I occasionally get email from folks who check into our Roswell Astronomy Club web site. We received an interesting request for a good viewing location to test a scope being developed for use in detecting exoplanets. Professor Sara Seager, at MIT, was planning a trip with several students that would bring them through Roswell in late April.

Professor Seager wrote, "I'm a professor at MIT and my team is building a small space telescope (10 cm x 10 cm x 34 cm) called 'ExoplanetSat' to search for small exoplanets that transit sun-like stars. ExoplanetSat is a prototype intended to be launched in 2013 or 2014 as the first of a fleet of nanosatellites with the same unified science goal."

They indeed stopped by Roswell late April and we met with them at our star party on a Saturday evening. They quickly set up their equipment and began calibrating and testing their scope. Sara noted it's hard to find clear skies in the Boston area.

Sara also noted, "Attached is a photo of our set-up (with one of my students in the photo). Inside the box is the camera (lens + CMOS detector + imager electronics board). In fact, the camera is intended to go into a 3U CubeSat (10 cm x 10 cm x 34 cm) and is not too much larger than the box. (The lens diameter is about 7.7 cm)." See pix below.

Photo courtesy Sara Seager

I asked Professor Seager about the communications planned to work with the scope. She offered this information: "A communications project of interest is a current MIT project to convert our WWII-era 6m weather radar radio dish into a satellite communication ground station (SCR-584 if that means anything to you). This antenna is located atop the building I work in at MIT (a ~22 story building at ~300ft AGL) and is based upon a signal corps radar set from the 1940s.

"The current control system consists of amplidyne drive electronics and selsyn position feedback tied together with a 1980s era control computer. We hope to use the existing pedestal that supports the radio dish but outfit it with new motors and modern control electronics so that the dish can track satellites.

"We intend to convert to using the NASA S-band (2.025 to 2.12 GHz uplink and 2.2 to 2.3 GHz downlink). The MIT amateur radio society has recently used the dish for moon bounce; but currently the dish transmits but cannot receive (at about 2.2 GHz). The MIT amateur radio society is part of the team. The goal is to communicate with our own CubeSats and other nanosatellites under development; such projects usually use VHF/UHF, but our high science data needs mean we want more bandwidth."

Here are a couple of pictures I took of their mockup camera and their test setup at Roswell.

The mockup camera

Above, the MIT crew is setting up the exoplanet camera before dark, north of Roswell, NM on the concrete pad on top of an old Atlas missile site. They're using a Linux-platform laptop with custom software for the image acquisition.

They also had a Canadian film crew on site that was working on a documentary on exoplanets. Maybe you'll see a mention of us someday. Best wishes to the MIT team on the success of their project.

❖ GNU Radio for Radio Astronomy

GNU Radio, a free Linux software package, has been around a while but I recently started digging into its possibilities for amateur radio astronomy. The software allows you to "build" a variety of applications by piecing together software modules to create some interesting applications. Radio hardware that can be used with GNURadio can be found at:
Universal Software Radio Peripheral (USRP)
http://bwrc.eecs.berkeley.edu/Research/Cognitive/usrp-family-09-open.pdf

First, I installed Ubuntu 10, a Linux based free OS (Operating System), on a spare PC. Then, I downloaded the free applications necessary to run GNU Radio. You can find a Windows version, but it appears to have to be installed in a not so simple way. (Note: There is an Ubuntu 11 version out there but I could not get 'GNU Radio' to work on it, at least not on my PC. So I went back to a clean Ubuntu 10 install and reloaded GNU Radio.)

The fussy part of getting the system going if you're not a LINUX programmer is launching it. To start up GNU Radio, launch the TERMINAL application, and enter "grc" to launch GNU Radio.

GNU Radio lets you create a chart of various function blocks that let you design pretty much whatever you desire. One expert designer, Marcus Leech, was able to create a SID (Sudden Ionospheric Disturbance) receiver fairly quickly in one afternoon. A quick web search on "GNU radio astronomy" will bring up numerous links for radio astronomy applications.

To help you get started quickly, download and go through some tutorials available at: **www.csun.edu/~skatz/katzpage/sdr_project/sdr/grc_tutorial1.pdf**

There appear to be four tutorials available, and if you use the link above and modify the number after "tutorial" to 2-4, you should be able to download the PDF files. The tutorials walk you through the process step by step to build an AM radio, a SSB radio, etc. Here are a couple of references to help you get an overview of what can be done.
http://gnuradio.org/redmine/projects/gnuradio/wiki/Hardware
http://www.aavso.org/simple-easy-build-sid-receiver

❖ Solar Monitoring in Alaska

Since the Sun is a massive source of energy, it's interesting to note that nobody was quite sure the Sun contributed to radio noise until WW2. Scientists considered it a possibility even back into the late 1800s. And, many tried to detect solar noise with simple antennas and coherers (iron particles in a tube, used for a detector.)

The first solid confirmation the sun was the source was made on February 27-28, 1942 by noting huge noise levels at sun-up and sun-down with WW2 radar that operated in the VHF (55-85 MHz) band. Alarmed and suspecting jamming, they soon realized the sun was the source. It was a major outburst of solar noise which was confirmed with correlation with the occurrence of huge sunspots. The hunt was on. Of course, radar jamming by the Germans was still their primary concern.

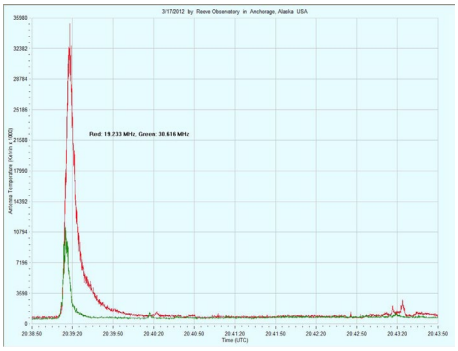
Recently, I saw an image posted by Whitham Reeve from his solar monitoring activities in Anchorage Alaska. I contacted him about his setup and he shared the following details:

Photo by Whitham Reeve

Whit noted: "The antenna is a KMA-1832 log periodic dipole array, which I purchased from KMA Antennas in late 2008. However, it took me until June 2010 to install it. KMA shut down I believe in 2011."

His station is well engineered and he shared the sketch of his system at the bottom of the page.

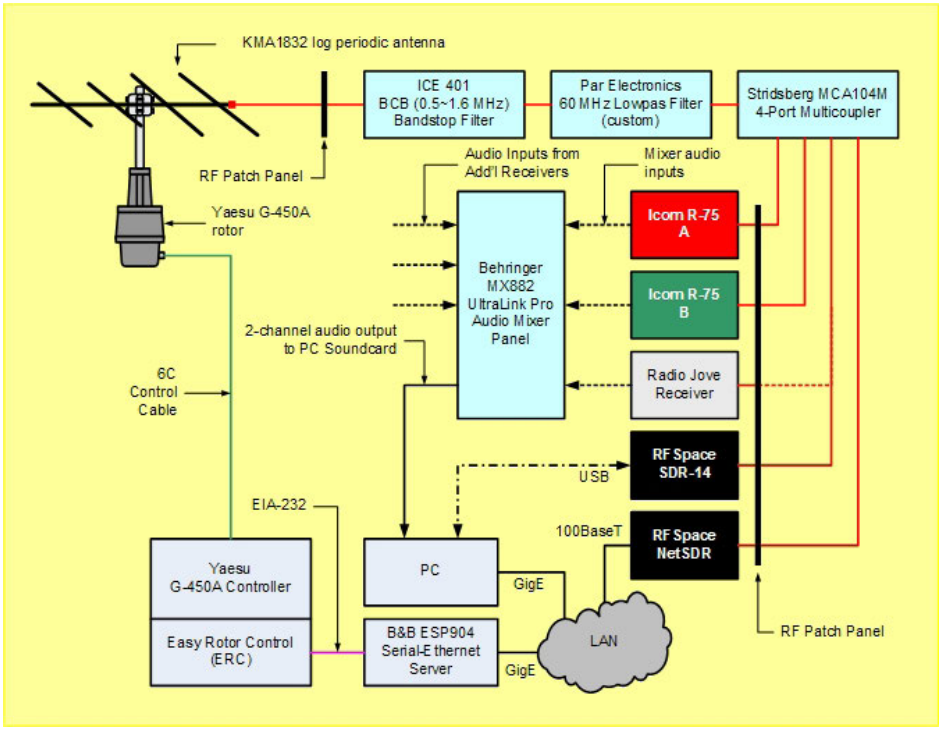
Whitham captured the following solar noise bursts on two HF frequencies on March 17, 2012.



The red or highest trace on the left shows the 19.233 MHz noise level from one receiver. The weaker or green trace noise is from the second receiver, tuned to 30.616 MHz. The times on the chart's horizontal scale are in UT (Universal Time) which allows easy comparison of data from other locations. The vertical trace on his chart peaks out around 34,000,000 kelvin. Note the difference in the noise levels.

A little later, at the right hand side, you can see a weak peak detected on 30.616 MHz. These two traces represent two slices of bandwidth. Note that the sun's outburst can spread over a wider bandwidth that can be captured using a wideband receiver such as the RF Space SDR-14 using a spectrum display program such as Spectraview, a program supplied with the RF Space receivers.

Thanks to Whitham for sharing his details. He regularly contributes images to the Radio Jove observer's list-server. If you wish to join this group, go to: **http://radiojove.gsfc.nasa.gov/office/appform.htm**



❖ Radio Astronomy Workshop

The first-time Radio Astronomy in Education conference is being sponsored by Radio Astronomy Supplies and the Tulsa Community College, 3727 E Apache Street, Tulsa, Oklahoma this coming October 12-14, 2012. The featured guest speaker is Kevin Shoemaker (Shoemaker Labs). For more details, contact Associate Professor of Electronics, Tommy Henderson, TCC. His e-mail is **thenders@tulsacc.edu**. You may also contact Jeffery Lichtman at **jeff@radioastronomysupplies.com**.

❖ Radio Astronomy in the Movies

Hank Newton, a retired electronics engineer and *Monitoring Times* reader, sent me this picture he captured during an unusual configuration of the NRAO's VLA array west of Socorro, New Mexico. He added the caption, "Where did Dr. Arroway say Vega was located?" In case you missed the movie, Dr. Arroway was the astronomer in the movie Contact. I keep a copy of the picture on my bookshelf. Thanks, Hank!

Keep listening up.

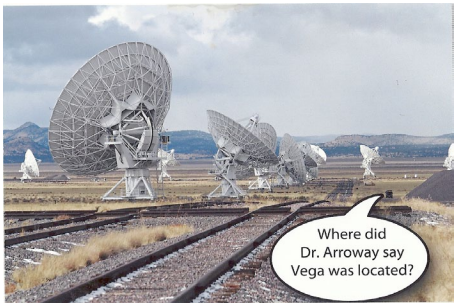


Photo by Hank Newton

Setting Up a Ku-Band FTA Radio System

Story and Photos by Mario Filippi, N2HUN

Of all the times I've experienced in my six decades of life on this earth, this is sure one of the toughest for a lot of us. Paychecks are stagnating or trending downward. Bills keep coming in, and the money goes out. These conditions challenge one to stretch a dollar from every angle. At my QTH, gone are the days of pay TV subscriptions in favor of Over the Air Television (OTA). Yep, my home now sports two old-school TV antennas on the chimney, just like in the olden days.

Then I discovered Free to Air Satellite TV and added that entertainment package to my shack, which requires no subscription fees but provides worldwide listening enjoyment.

The purpose of this month's article will be to introduce the FTA TV enthusiast and interested shortwave listeners to another avenue of entertainment: Free To Air Satellite *Radio*.

❖ Entertainment Media a Constant Change

Technology is rapidly changing the world of entertainment. Just think of the numerous shortwave stations that formerly inhabited the air waves. Some are gone forever from that medium in favor of Internet sites. Others are now on FM radio.

Well, the news is good if you have an FTA dish already set up, as you have access to over 150 radio stations broadcasting music, talk, and news. Some of them may even be familiar if you already listen to shortwave.

For FTA satellite reception I use a WS International *(www.wsidigital.com)* 100 cm dish. **See Photo 1.** Later on in this article you'll find information I have recently gathered on the different Ku band satellites and what's to be heard on them.

Photo 1. Author's Ku band dish aimed at Galaxy 19 (97W), the mother lode of FTA radio fare.

❖ Outfitting the Kitchen for FTA Radio

First off, I'll assume that you already have an FTA dish installed. Now if your LNB has two ports and one is unused, simply run another length of RG/6 coax from the LNB port to an area of the house where you want to set up a receiver for FTA radio reception. **See Photo 2.**

Photo 2. Two-port LNB; one coax goes to my TV, the other goes to the FTA "radio."

If you have many coax cables coming into the house, you might want to make an aesthetically pleasing entry into the house. **See Photo 3.**

Photo 3. Plastic enclosure, purchased from a big-box store, makes a neat entryway for cables.

In my case, I ran a 110 foot length of RG/6 from the dish, into the house, up through the attic, and back down to the kitchen. This would allow me to listen to FTA satellite radio while preparing and partaking of daily meals. Running the cable to the kitchen took several hours of work but was well worth it. **See Photo 4.** When completed, the next step was to assemble the components for the FTA satellite radio.

Photo 4. Wall plate with F connector for attachment to FTA radio. Tidy installation keeps me in the XYL's good graces.

❖ Assembling the Small Footprint Station

Assembling the FTA radio station required a receiver, some type of LCD display, and speakers. The Dynosat 5000 receiver, sold by that great outfit Harmony FTA *(www.harmonyfta.com)* is one of the smallest FTA set top boxes on the market, and its diminutive size lends itself to a minimal-impact installation. A rudimentary no-frills receiver, it measures a mere 10 x 6 x 1.75 inches, and its small size is matched by its price. **See Photo 5.**

Photo 5. Dynosat 5000 receiver, small in size but a good performer.

The Dynosat is designed for both FTA TV and radio reception, just like any other satellite receiver, but in my case it was devoted only to radio reception.

The next item required was some type of visual display, so a seven inch portable TV, purchased several years ago from Radio Shack was connected to the receiver via the supplied A/V cable. Since the TV had a very small speaker, and I have very old ears (hi hi) some type of amplified speaker system would be needed. Fortunately, I had a second-hand Logitech *(www.logitech.com)* amplified audio system that was pressed into service to round out the installation. **See Photo 6.**

Now that the station was assembled, the next mission was to start blind scanning the

Photo 6. FTA radio system assembled from old and new components, in kitchen.

different satellites to see what FTA radio programming was available.

❖ Searching for Radio Channels

Ku band FTA satellites available in my area range from Telstar 11 at 15 West to AMC 21 at 125 West. After three years of experience in this hobby, I had an inkling of which satellites provided radio channels, but nonetheless, for this article I scanned several of them over a period of a month to see what was up. A total of 14 birds were scanned, and those with *no* radio channels were AMC5 (79W), AMC9 (83W), AMC3 (87W), Galaxy17 (91W), Galaxy25 (93W), Galaxy16 (99W), and AMC21 (125W).

Those with radio channels are in **Table 1.** Table 1 pretty much sums up the two major players, namely Galaxy 19 and Hispasat for providing the greatest number of Free To Air channels, so I'll concentrate on those for the remainder of the article.

Table 1. Ku-Band Satellite Radio Lineup

Satellite	Longitude	# of Radio Channels
Telstar 11	15 W	7
Hispasat	30 W	50
Galaxy 3C	95 W	7
Galaxy 19	97 W	85
SES 1	101 W	7
AMC 1	103 W	2
AMC 15	105 W	3

Please note that Table 1 represents my personal scanning experience and results can differ depending on many factors such as: geographical location, dish size, precipitation, obstructions, LNB sensitivity, quality/length of coax used, receiver quality, changes in the specific satellite's programming line up, and one's ability to properly aim a dish.

❖ Hispasat Lineup

Hispasat, at 30W, offers an interesting mix of entertainment from areas of the globe such as Europe, South America, Africa, the Middle East, and Cuba. From Europe you'll hear several stations from Radio France International, and a few from Spain. From South America are ZOE and Radio Cero. Sudan Radio is the one and only station received from Africa. The Middle East is well represented by Oman Radio, Qatar Radio, Emarat FM, and others from Iraq, Kuwait, Syria, and Saudi Arabia.

If hearing Cuba is your goal, then Hispasat is one bird to aim for as there are several cuban stations such as Radio Habana Cuba, Radio Enciclopedia, Radio Rebelde, Radio Progresso, Radio Taino, and Habana Radio. One station familiar to AM DXers is Radio Reloj, which identifies on the minute with"RR" in CW. It can be heard loud and clear on Hispasat.

News, talk radio, ethnic, classical, rock, and religious content can be found in the aforementioned array of stations on Hispasat. Most are in the native language, with little English to be found.

❖ Galaxy 19 Line-up

If one satellite can be said to have it all, it's Galaxy 19 at 97W with 85+ radio stations to choose from. Galaxy 19 reception is the closest thing to shortwave radio that FTA satellite has to offer. If all one did was to erect a stationary dish – even a 30 incher (depending on your location) – and aimed it at 97W, you'd be provided with enough diverse entertainment to keep your ears busy 24/7!

Programming in English can be found on World Radio News, RBN radio, Apostolic Bible Network, Life Talk Radio, The Overcomer, Radio Eden, Star 1 – 5, LRN.FM, KNLB.FM, Access America, and others. My favorite – and one any FTA'er, SWL, and ham should check out – is Access America, with their great lineup of hobby related shows.

Want to travel by airwave to Europe? Well, you can tune in to Radio Romania International, Voice of Croatia, Radio France International, Radio Beograd, Radio Monte Carlo, and Polskie Radio 3 and 1.

The continent of Africa can be heard by tuning into Radio Senegal International, Radio Congo, Sudan Radio, Tunis Radio 1, ORTB Radio (Benin), Radio Omdurman and Ethiopia Radio.

A plethora of stations from the Middle East are on tap, such as Saudi Radio 2, Persian Radio, Kuwait Radio 1 and 2, Syria R1, Emirates FM, Qatar Radio, Persian Radio, Oman Radio, Toloo Radio, and the list goes on and on.

I have left out a lot of miscellaneous stations that show up on a scan – some are from Asia, others are country music oriented, and some even consist of odd sounding beepers. You just have to try it out and be adventurous.

❖ Closing Comments

Well, my goal was to introduce the reader to a new method of listening to world radio. Set-up requires a dish, LNB, coax, an FTA receiver (some cost as little as 39 dollars), display screen (or TV), and some know-how in aiming a satellite dish. By far the most challenging part is properly aiming a dish, and if you have a friend or acquaintance who is knowledgeable, by all means seek help. Additionally you can check your local TV or satellite dealer and pay for the installation. But don't count on them knowing too much about FTA satellite; it's sort of like shortwave radio – something hobbyists enjoy but pretty much unknown by the general public.

Once installed, the receiver does all the work of capturing the stations available on the satellite and stores them into memory, just like a police scanner or shortwave radio does. Channels come and go, so frequent rescanning is required. Change is a constant thing on FTA. Signals do not suffer from QSB (fading) as with shortwave, but you'll definitely lose signals during heavy rains (known as rain fade). Sound quality is very similar to FM radio: crisp, clear, no hiss.

Satellite reception depends on a clear Southern view of the sky, but dishes are easily erected and moved around if you have some obstructions. Dishes don't necessarily have to be elevated above ground, allowing one-man installations with minimal elbow grease. Every dish I have installed was at ground level, so those who are afraid of heights will be delighted at this prospect.

You can check out the many on-line dealers of FTA satellite equipment to become familiarized with what's required to embark on such an installation. A simple stationary dish package can cost as little as $175. But count on buying a decent satellite finder/meter to make the installation easier. And, check out the excellent forums provided by some of the FTA satellite dealers to get hints and tips on successful installations.

Well, at this moment my kitchen is filled with beautiful folk music from Radio Beograd, a perfect companion to my repast of *Schinkenfleckerl* (ham and noodles) and a cold one. Okay… so *Shinkenfleckerl* is actually an Austrian dish: let me blind scan Galaxy 19 and see if perhaps Radio Austria might now be found on Galaxy 19! One never can tell. *Prosit!*

Digital Dave's Delightful Degen DSP Disclosure
– *A Review of the Degen DE321*

By Dave C. Schmarder, N2DS - Photos courtesy of the author

I have to admit it: I'm totally fascinated with these cheap Chinese radios that are available in our current electronic marketplace. After buying a more expensive Tecsun PL390, and being impressed with it, I decided I'd buy yet another one of these Chinese-made radios.

I have a need for a second set in my computer room/ham shack. I had been shuttling my 390 between here and another room daily, so it was time to buy another radio. The 390 has a lot of features that were not necessary for the computer's location. Plus, a radio small enough to put in my pocket and carry around was also desirable.

I saw the neat little Degen DE321 online, and knew this was the one for me. The major attraction besides the price was the DSP feature. DSP or Digital Signal Processing is now the magic word in radios. I wanted to see what the hubbub was all about and this one fit the bill.

❖ The Purchase

The price was a mere $21 including shipping from China from an online seller. At that price, it is hard to go wrong. These radios are so inexpensive that it isn't worth it for any US retailer to bother selling them. I received my radio exactly three weeks after ordering it.

For all intents and purposes, realistically speaking, there is really no warranty on this stuff bought directly from China. With the allotted short return period and the high cost for returning something, it is assumed that you will just keep the unit and hope it works okay. Being so cheap, I'll buy a radio like this directly from China, but I did choose to buy my Tecsun PL-390 from a US short wave radio retailer for the possibility of needing warranty service. American dealers support the products they sell.

❖ First Impressions and Powering Up

The radio was packaged well and in a few minutes I had it up and running. This is a pretty featureless radio. It receives AM, FM and the shortwave broadcast bands. There is an on/off switch as well as volume control, tuning and band switch knobs. The telescoping antenna is for the FM and short wave bands. It's a very simple unit with no bells and whistles.

The accessories include ear buds (for stereo listening on FM), a lanyard that attaches to the corner of the DE321, and a pouch case for keeping the radio clean and sparkling. The manual is

on a mini-CD and is read using your computer's PDF reader. I popped the disc in and had a read, but the radio is so simple that the manual was of little use. Manuals for other Chinese sets are on this disc, too, and it was fun to browse a few of the other models.

Here pictured with my old 1965 General Electric P-965a radio is the DE321 for size comparison. It looks like six of these would fit inside the GE. The DE321 is about 4-3/4 inches long, 3 inches tall and nearly 7/8 inch thick. (120 × 74 × 21 mm)

The FM frequency coverage of the DE321 has two bands, making it a world radio. The first FM position 87.9 to 108 MHz is for the US and much of the rest of the world; the second FM band is the less common 64 to 87.9 MHz. I believe the reason that the two bands are included is so the same dial scale can be used wherever the radio is sold. The MW (AM) band is a single range 522 to 1710 kHz.

There are eight shortwave bands. The ranges are 5.70 to 6.40 MHz (49m), 6.80 to 7.50 MHz (41m), 9.30 to 10.0 MHz (31m), 11.60 to

12.20 MHz (25m), 13.55 to 14.15 MHz (22m), 15.10 to 15.90 MHz (19m), 17.20 to 18.0 MHz (16m), and 21.30 to 21.95 MHz (13m). Missing are the less popular "tropical bands" of 60, 75, and 90 meter bands.

The battery supply consists of two AA cells, either rechargeable or disposable types. I'm using a pair of the "hybrid" or low discharge batteries. I started using these in my camera, rather than the old style NiCad batteries. They are worth the extra money! The DE321 does not have a USB charging jack, so the batteries must be charged externally.

❖ Tuning In with the Degen DE321

The DE321 works fine, but being a cheap and featureless device, you might want to tone down your expectations. First, the audio is very good! The speaker diameter is only two inches or 50mm and they get all they can out of this little transducer. The audio is loud and clear and the sound is clean. The FM sound is even better with the stereo ear buds.

The volume control is the old fashioned potentiometer type, with smooth volume transitions. This is an improvement over the stepped audio control settings in the Tecsun PL390.

❖ Technical Tidbits

The tuning system was a mystery to me until I did some online investigating. Is this a digital or analog radio? Turns out it is both, but mostly digital. I looked at the Silicon Labs website and found that the SI4844 chip appears to match what the Degen DE321 radio has inside.

The rotary tuning control is a simple analog potentiometer. A thumb wheel knob is connected to the pot and the slide rule style dial is moved by a dial cord. Therefore the readout accuracy won't be great, but it will tell you where in the band your are tuned.

The receiving frequency is determined by the voltage sent to the silicon labs chip via a variable resistor voltage divider. The chip then translates this voltage into a specific channel frequency step.

A slide switch on top of the radio selects the band. This switch selects a point on a precision resistor ladder to tell the chip which band you want to use. No RF switching is used.

The chip is externally programmed to establish the exact frequency ranges. The programming is done with precision resistors connected to certain pins. So, if you move to a different part of the world, you will only need to change the resistors. The MW band is set to select 9- or 10-kHz steps. All this is outlined in Silicon Labs PDF files available at the documents tab on their website. Look for the application notes – AN602.pdf.

There is a small LED that indicates when you are tuned correctly. The tuning appears to

have a "frequency locking" effect, but it is just the receiver stepping from one frequency to another. You are either tuned or not tuned to a station. One can't just tune on to a station as with an analog tuned radio.

The DE321 is not a superheterodyne receiver, which has been the radio design norm for the past 70 years. There is no usual intermediate frequency, mixers, or variable analog oscillators. The analog signal comes in and is converted to a digital format. After the processing, the digital signal is converted to analog audio to be amplified. According to the chip spec sheet, there are no coil alignments, and no tracking adjustments. It all just works!

❖ Daytime Reception

I am in a mostly fringe signal level reception area. There are a couple of strong FM stations, but they are not too close. The same is true on the MW (AM) band. The strongest stations are an 800 watt station about 10 miles away and a couple of 5-kw daytimers about 12 miles from me.

The FM section picks up the stronger stations very well. I found the low end of the band has surprisingly good reception. The short telescoping antenna, which usually portends mediocre low end of the band reception, nevertheless received fairly distant NPR stations at the bottom of the dial quite well.

The MW/AM band hears the moderate to strong signal strength stations well. The weaker stations aren't usable. The ferrite antenna coil is not very large and this impacts the receiver sensitivity.

I then switched to shortwave. The first station I heard was Radio Havana. They generally have a good signal here, so it wasn't a surprise. I was able to hear other stations on several of the bands.

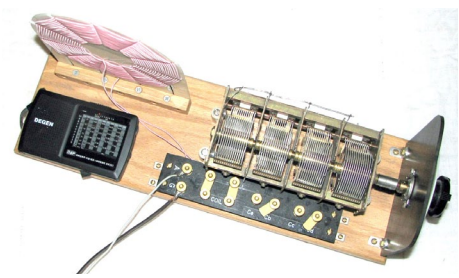
❖ Nighttime Reception

One thing I noticed at night was that as a MW station faded, the radio would quickly cut out and then come back on. By carefully adjusting the tuning control, I was able to minimize this effect.

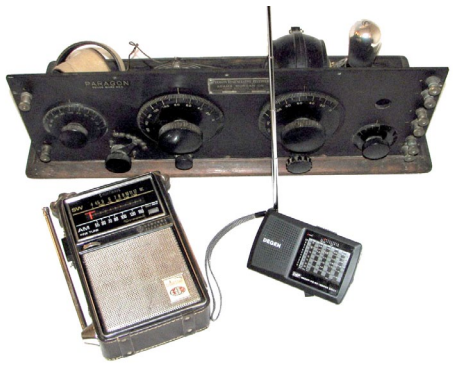
This DE321 will not dig down into the noise for the weak DX (distant stations). It is one of those sets that only gets the low hanging fruit, so plan on listening only to the big signal stations. I did occasionally hear some of the weaker stations, but not regularly.

❖ Some Hot Rodding Tips

I'm not the type of guy who leaves things alone. I'm always thinking about my friends over at the Yahoo! UltralightDX Group and how they might make this radio really sing. Here are a couple of thoughts, but first realize these ideas have not been tested and can possibly result in the destruction of your radio. First, disconnect the 100k ohm tuning pot, and replace it with an external ten turn 100k ohm pot. The radio will be easier to tune. Second, get a big ferrite bar and wind it with Litz wire and then connect it in place of the small internal ferrite bar. That should improve the sensitivity!



If you have an external wire antenna and a ground, the DE321 can be placed near a coil connected to the outside antenna and ground for very good reception, day or night. I use my old 1923 Paragon radio that is connected to the outside antenna. I tried my crystal radio antenna coupler too, and that helped the reception, allowing many stations to overcome my in-room computer noise.



❖ Conclusion

The purchase of the Degen DE321 was pleasant and hassle free. Although it doesn't receive as well as expensive radios, I never expected it to. This leaves open the possibility of DX reception under less than optimum conditions.

Would I buy again? Yes I would.

I will buy more of those little Chinese DSP radios. DSP is the way to go.

Dave is a retired industrial electronics parts seller. He now maintains his hobby crystal radio website ***http://makearadio.com****. He may be reached at dhmr@makearadio.com*

RELATED WEBSITE LINKS

Silicon Labs Si4844 IC: **www.silabs.com/products/audiovideo/amfmreceivers/Pages/Si4840-44.aspx**

Ultralight DX Yahoo! Group: **http://groups.yahoo.com/group/ultralightdx**

1923 Paragon Radio Compared with More Modern Counterparts **http://makearadio.com/restoration/paragon-radio-restoration.php**

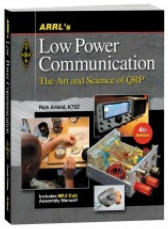
Antenna coupler project as mentioned in the article and shown in the picture **http://makearadio.com/misc-stuff/antennatuner.php**

What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

ARRL's Low Power Communication



"Just a Little RF Power Goes a Long Way!" That is the mantra of former *MT* columnist Rich Arland, K7SZ, who has just released a 4th edition of his new book on QRP communications and amateur radio.

ARRL's Low Power Communication is your guidebook to the fascinating world of low power QRP operating. With only five watts or less – sometimes much less – you can enjoy conversations over hundreds and even thousands of miles.

Some of the topics in this new book include:

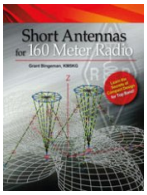
- Tips to Get You Started the Right Way – An introduction to QRP operating, FAQs for newbies and tips that even experienced amateurs will appreciate.
- Equipment and Station Accessories – Off-the-shelf commercial gear, kit building and homebrew, including an all-new homebrew photo gallery.
- Antennas for QRP (Updated and Expanded) – Wire beams, loops, dipoles, portable antennas and a look at the author's new stealth antenna design.
- Operating Strategies – Contesting, awards and advanced techniques for becoming a successful QRP operator.
- Emergency Communications – Training, planning and other factors for utilizing low-power gear during an emergency.
- HF Propagation for the QPRer – An authoritative look at likely propagation conditions for Solar Cycle 24.
- Plus, QRP calling frequencies, manufacturers… and much more!

This new book also includes the complete assembly manual for the MFJ Cub Transceiver Kit (sold separately). Build this tiny, high-performance radio in just a few hours and get countless hours of enjoyment working the world with QRP.

The *ARRL's Low Power Communication*, 4th Edition sells for $27.95.

Short Antennas for 160 Meter Radio

160 meters is known to radio amateurs as "top band." However, 160-meter antennas can be large and difficult to install due to lack of available space.



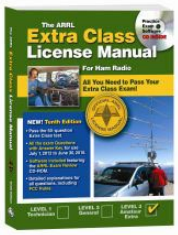
Short Antennas for 160 Meter Radio dares to discuss the possibility of smaller antennas for this intriguing band. Intended for amateurs with advanced skills in antenna modeling, Grant Bingeman, KM5KG, walks you through the theory behind innovative designs for relatively compact antennas. You'll learn how to enhance bandwidth, minimize loss, and employ other techniques to enjoy 160 meters with limited real estate.

Contents of this new ARRL book includes:

- Short Antenna Behavior
- A Better Way to Define Antenna Bandwidth
- Why Top-loading Can Improve Short Antenna Performance
- Top Hat Arrangements
- Inverted Cone Antennas
- Closed Antennas
- Antennas with Two Driven Elements
- T-shaped Antennas
- Inverted L-shaped Antennas
- Antennas with Four Driven Elements
- Spiral Antennas
- Small Horizontal Antennas
- Quadrature Feed Arrangements

This new 64 page soft cover book sells for $22.95.

ARRL Extra Class License Manual



If you want all the privileges available to a licensed U.S. amateur radio operator, you will need to pass your Extra Class written exam. Ask any ham who has taken this test and they will probably tell you it is definitely is no cake walk. You have to have some good reference material in order to pass that 50-question Extra Class test.

Of the best resources in this regard, the new 10th Edition *ARRL Extra Class License Manual* should be part of your study regime. All the Exam Questions with Answer Key (for use from July 1, 2012 to June 30, 2016) are included with practice exam software on CD-ROM. With this guide you will get detailed explanations for all questions, including FCC rules.

The *ARRL Extra Class License Manual* is your ticket to every privilege granted to amateur radio operators. Expert instruction will lead you through all of the knowledge you need to pass the exam: rules, specific operating skills and more advanced electronics theory. As an Extra Class licensee, you will have full privileges on all frequencies authorized by the FCC for amateur radio. To upgrade to Extra Class, you must already hold a General Class license (or have recently passed all of the exams required for a General Class license). Upgrading to an Extra license only requires passing a written examination.

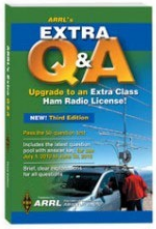
Use this book to study for your Extra Class (Element 4) license exam. Every page presents information you will need to pass the exam and become an effective operator. For study purposes, information is presented in small sections on operating practices, rules and regulations, Electrical principles, components and building blocks, electronic circuits, radio signals and measurements, radio modes and equipment, antennas and feed lines, topics in radio propagation, and safety.

As mentioned above, this book includes the ARRL Exam Review CD-ROM (requires Microsoft Windows). Use it with this book to review the study material and take randomly generated practice exams using questions from the actual examination question pool. You won't have any surprises on exam day!

CD-ROM System Requirements: Microsoft Windows 2000/XP/Vista/Windows 7, a color display, 20 MB free hard drive space. (Please note: the practice exam software is not MAC compatible.)

This ARRL soft cover 496 page book sells for $29.95.

ARRL's Extra Q & A, 3rd Edition



If you are pretty sharp on electronic theory, amateur radio operations, and FCC regulations, then maybe you want to just study all the questions that are part of the amateur radio Extra class question pool.

This new third edition of *ARRL's Extra Q & A* is your authoritative guide to every question in the Extra (Element 4) question pool – everything you need to pass the top-level amateur radio license exam! With more than 700 questions included in the question pool, using *ARRL's Extra Q & A* is the best way to review for your 50-question Extra Class written exam with confidence.

This new book includes the latest question pool with answer key, for use July 1, 2012 to June 30, 2016.

There are even brief explanations that follow each question in the book. This 320 page soft cover book sells for $17.95.

All of these fine ARRL amateur publications mentioned above are all available from the ARRL website (**www.arrl.org**), via their toll free order line at 1-888-277-5289 9 (8 a.m. to 5 p.m. Monday through Friday, except holidays), or via snail mail to ARRL, 225 Main Street, Newington, CT 06111-1494. You should also check your local amateur radio dealer or selected *Monitoring Times* advertisers for these and other ARRL publications.

DX Engineering DXE-UT-KIT-DBR Deburring Kit

The DX Engineering DXE-UT-KIT-DBR, designed and manufactured in the United States, is ideal for reaming and deburring rough-cut tubing edges with minimum effort. This new utility

tool kit is usable on all tubing and pipe sizes from 3/8-inch to 3.5-inches OD, including aluminum, copper, steel, fiberglass, and PVC. The kit includes 2 ¼-inch DXE-UT-2125 and 3 ½-inch DXE-UT-3500 cylindrical deburring tools (also available separately) DXE-22600 adjustable deburring tool and a half-round file, all in custom made case with pre-cut high density foam.

Both cylindrical tools are reversible, ideal for deburring both ID and OD of aluminum antenna tubing prior to telescoping sections together. These tools assure a smooth fit without galling and seizing that can occur with the slightest roughness. Only a couple of revolutions with very light pressure are needed to produce excellent results.

The adjustable deburring tool features a variable length blade holder that extends from ½ inch to 5 inches. This allows access to burrs deep inside tubing or other hard to reach places. Blades can be inserted at 90 degrees for deburring cross holes. It includes one blade for aluminum and steel and one blade for cast iron and brass.

Made from heat-treated carbon steel, the half-round file is especially useful for helping deburr the inside of cut tubing ends. It features a durable rubber handle with plastic inserts for comfort and convenience. The DX Engineering introductory price is $89.95 and for more information or to order, visit **www.dxengineering.com**.

DX Engineering 160 Meter Vertical Antenna

Now you can have a high-performance vertical antenna specifically for the 160 meter band and achieve the strongest possible presence at your power level and be competitive!

The DX Engineering DXE-160VA-1 is a slow taper 55-foot high mono band vertical antenna system. The custom designed capacity hat system allows coverage on 160 meters with unparalleled success in a compact antenna.

The DXE-160VA-1 160 meter band vertical antenna is tunable with an impressive 40 kHz bandwidth. This means that operation on the CW DX frequencies and DX Phone frequencies is within range of most radio internal tuners – no antenna changes are necessary. Power handling capability is 5kW on sideband or CW.

Included with this antenna system is a rugged stainless steel pivot fixture for ease of assembly and adjustments. Engineered with 6061-T8 and 6063-T832 corrosion-resistant aluminum tubing, stainless steel mounting brackets and stainless steel hardware, making this antenna very durable and attractive. Steady-state wind survival is in excess of 50 mph without guys.

Why does this antenna perform so well for its height? The capacity hat is large enough that the current along the radiator is almost constant. Typical shortened vertical antennas for this band, with smaller top-hats have currents that vary along the length and end up producing much less signal strength.

Introductory price for this new antenna is $839.95. An optional DXE-VRW-1 manual winch for easy one-person raising and lowering of this antenna is available for $169.95. For more information or to order, visit **www.dxengineering.com**.

Wavecom Releases New Updates

Wavecom has released new updates for their W-PCIe, W-PCI, W-CODE V8.1.00, W-BV (BitView) V2.5.00, and W-Sat-email-Decoder V2.1.00 products.

These main updates include the following:

- New modes: NXDN with demodulated bitstream (symbol) output
- STANAG-4285 has a demodulated symbol output for further analyze in W-BitView Tool
- STANAG-4285 center frequency search extended to +/- 160 Hz and various significant improvement in decoding quality
- Phase Plane HF for STANAG-4285 (with DPSK demodulator) improved significantly
- W-BV: add on an entry to import demodulated symbols HF STANAG-4285 from W-PCI/e and W-CODE
- W-BV: add on "Generate Pseudo-Noise" function and various custom functions to analyze STANAG-4285 demodulated bit stream output
- Metadata output extended in W-Sat-email-Decoder V2.1.00
- New EasySAT System for W-PCIe and W-PCI decoders V1.0.00
- Various improvements and bug-fixes

A DVD with these new releases can be requested. See the following website for more information (**www.wavecom.ch/softwaredownload.htm**) or contact the company at Wavecom Elektronik AG, Hammerstrasse 8, 8180 Buelach, Switzerland, Tel: +41-44-8727060/ Fax: +41-44-8727066.

New Features for inReach Communicator

DeLorme, a company that specializes in personal satellite messaging, tracking and navigation technology, recently announced the release of a major upgrade for inReach™ two-way satellite communicators.

inReach users can download the latest firmware version to their inReach devices at no cost. Major product improvements and enhancements in the new release include extended battery life and recharging options. In addition, the newly-updated Earthmate app enables world topographic map downloads.

Introduced to the market in November 2011, inReach is the first affordable satellite communicator offering two-way personal text messaging with delivery confirmation, SOS alerting and Follow-Me/Find-Me tracking and location.

inReach operates over the Iridium satellite network for truly global coverage, high network reliability and fast data connections with end-to-end message delivery in less than 60 seconds anywhere on Earth. Two $250 devices are available: one inReach pairs with most popular smart phones and tablets for two-way global messaging in the 90 percent of the world's surface not served by cellular phone networks; the other pairs with the DeLorme PN-60w GPS unit. Both require a $19.95 activation fee and subscription plan, which starts at $9.95 per month for the safety plan, to $25 per month for recreational year round use, or you can also pay a higher rate and purchase four months at a time. More expensive plans are also available for heavy users, but all SOS calls are free.

The ruggedized handheld inReach device has an IP68 waterproof and dustproof rating, is impact resistant and works under extreme high and low temperatures.

inReach users can choose AA-size lithium, alkaline or rechargeable nickel metal hydride (NiMH) batteries to power the device. With the new upgrade, battery life has been doubled from 60 to 125 hours for standard lithium AA batteries, with ten-minute reporting intervals. When running on alkaline batteries, which are lower cost and readily available at retail stores everywhere, battery life is now extended up to 72 hours.

For maximum flexibility and minimal environmental impact, the rechargeable NiMH batteries can run up to 75 hours between charges and can be recharged up to 500 times. When connected to commercially available solar chargers, NiMH batteries provide an extremely cost-effective solution for long trips away from electrical power sources.

The Earthmate app now enables downloading of seamless topographic maps of the world from DeLorme's new Digital Atlas of the Earth (DAE). Users can download and store all the maps they need for travel all around the world. DAE detail includes elevation contours, land cover, place names, major roads as well as connectors and urban streets, railroads, transportation hubs and places of interest including museums, landmarks, dams, stadiums, ports and more. The extensive river and stream detail makes DAE one of the premier hydrography data sources in the world.

"DeLorme is committed to a program of continuous improvement for our products," said Patrick Shay, DeLorme vice president and general manager. "We listen carefully to the voices of our customers when developing upgrades that will enhance the inReach experience."

inReach users can download the new firmware free at **https://explore.delorme.com**. The latest Earthmate app is available at no charge from the companion device's online app store.

For more information on inReach, visit **www.inreachdelorme.com/.**

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

to the editors

editor@monitoringtimes.com

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'S GOT IT ALL!

As a new subscriber, but one that has been into Radio for many years – 25 total as a licensed trans-atlantic Ham – I have to remark how refreshing it is to find a magazine that covers the old and the new, and also the hobbies of SWL and Ham radio.

I was an SWL long before I passed my G0, and a G0 long before my W3 call, but throughout I have listened to shortwave, trying to capture that rare DX, and known stations also. Indeed my station comprises of more shortwave receivers than ham. From my fully restored 1939 Hammarlund HQ-120X, which I use as my main receiver, with its matching 10" speaker, to the 1949 Zenith Transoceanic that happily graces my bench, the majority of my equipment covers the broadcast shortwave bands better than it does the IARU/FCC allocated frequencies.

During the past 5 years having lived primarily stateside, I have longed for the days when I was a young child, listening to the foreign stations from Europe, the Soviet Union, and also the Middle East. While many are still operating, some have alas disappeared. BBC World no longer broadcasts to the U.S, while Deutsche Welle has changed their focus, and now RNW and CBC join the ranks of the Titans no longer with us.

However, there are still many shortwave stations still broadcasting, and I'm not talking about the Reverend Stair. We have Voice of Vietnam, RCI, Slovakia, Slovenia, R. Vatican, R. Taiwan, R. China, RHC, Radio Cairo, VOI, and many more, still operating on shortwave, and still giving insight into their respective cultures, economies, and their sense of nationhood.

After reading your magazine, I was impressed by the shortwave schedules that you publish and the entire content of the magazine in all actuality. Many radio-focused publications, such as those from CQ, and even those from ARRL, leave the shortwave listener behind.

Seemingly gone are the days of radio as a hobby, and it's now being touted in most publications as an Emergency Communications media. Yet *MT* has several heavyweight articles this month alone; the two that really caught my eye were the ones regarding General Electric and their early experimentation, and the article about Navy Communications. From the past to the present, *MT* seemingly has it all, and I am honored to support the magazine, and its publishers.

I am truly looking forward to the next issue, and to seeing your continuing support of all things radio, from past to present, from SWL to Ham.

MT now has my subscription fee instead of ARRL, and will continue to do so. Thank you, *Monitoring Times*.

Darryl, W3DBJ (former G0NNB)

For my money, I think that the *MT's* overall content is better than *QST* these days. The new layout of *QST* seems to have an overabundance of white space, and the articles seem a little truncated with the increasing reliance on their on-line extra content.

MT's content really seems to keep improving, both in breadth and depth. I don't think that an issue goes by without me putting to use something that I've read. Also, your current set of authors seems very "Elmer" oriented to me. All very good stuff!

Roger Swearengen

GE'S PIONEER BC STATIONS

I have subscribed to *MT* for many years. It is the best radio periodical published. I was thrilled to see the above titled story in July's edition. I grew up in Schenectady, NY in the 1950s and '60s and my interest in radio started when I received a crystal radio kit for Christmas when I was eight. We lived about 2 miles from WGY's transmission tower, and with a 50kW station I could hear nothing else, it was so loud that the headphones were also a speaker.

I began to build and improve my own crystal radios and when I was 12 bought a Hallicrafters S-40 from a ham friend of my father.

I received my novice license the next year and have spent the past fifty years enjoying all forms of listening. Your stories and columns have often spurred me into new modes and frequencies. John Schneider's article was interesting and informative. Much of the information in it was new to me and I have shared it with several friends that still live in the Schenectady area. Thanks again and keep up the great work.

Robert Milne W1RMM

I just got my July issue of *MT*, and the cover photo looks great! Thanks for the nice spread for the article. There is one small error in the caption – the building was used from 1924-32, not 1934-40.

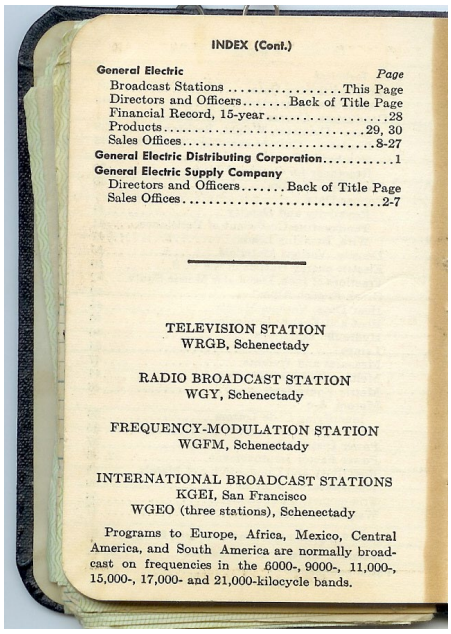
John Schneider, author

In complement to the article on General Electric stations in *Monitoring Times*, I offer the scanned item. It is from a 1954 General Electric Supply Company Diary. In 1954, GE laid claim to the stations in Schenectady.

When the New York Thruway opened, we used it to go to Connecticut from Erie. It was the fastest way. On a map, US6 looked most direct but it was mountainous. In those early days, we had to travel to Williamsville to attain the Thruway. The Erie portion had not yet been built. Of necessity we went past the WGY transmitter, but at that age I did not much pay attention to it.

When I made a trip from Lexington, KY to CT in 1972, my first leg took me to Erie. The next day I drove the Thruway and Mass Tpk to Springfield, MA. That time I paid attention. The WGY tower was next to the Thruway. Its half wavelength antenna was guyed at the waist like WHAS and WLW. Next to that were the antennas for WGEO.

My next trip on that portion of the Thruway was in 2003. The original WGY antenna had been



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TELEVISION STATION
WRGB, Schenectady

RADIO BROADCAST STATION
WGY, Schenectady

FREQUENCY-MODULATION STATION
WGFM, Schenectady

INTERNATIONAL BROADCAST STATIONS
KGEI, San Francisco
WGEO (three stations), Schenectady

Programs to Europe, Africa, Mexico, Central America, and South America are normally broadcast on frequencies in the 6000-, 9000-, 11,000-, 15,000-, 17,000- and 21,000-kilocycle bands.

replaced with one guyed several places (as had the WHAS one after it blew down in 1983). WGEO went the way of WLW-O. WGEO was torn down.

Tim Kuryla, Lexington, KY

RADIO MUSEUMS

June's cover [*close-up of two radios from the Museum of Radio and Technology in Huntington, WV-ed.*] – Now that's a fun cover!

I run a BC-375E and it keeps me warm in the winter. Nowadays, I keep the windows open!

Jim K6FWT, CA

Ken, I read your story on the radio museums, here is one more for your list – the Chatham Marconi Maritime Center located in North Chatham, Mass. The station was built by Marconi in the early l900s. They have a very good set-up.

Rich

Thanks, Rich, for the additional listing. We'll put that in our online version when it goes up. I found it here: **www.chathammarconi.org/**. Thanks, again, Rich!

Ken KS4ZR

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Henry Laviers

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http://americanbandscan.blogspot.com/ - by Doug Smith

ANTENNA TOPICS
www.wa5vjb.com - by Kent Britain

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

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Regards, Barry, UK

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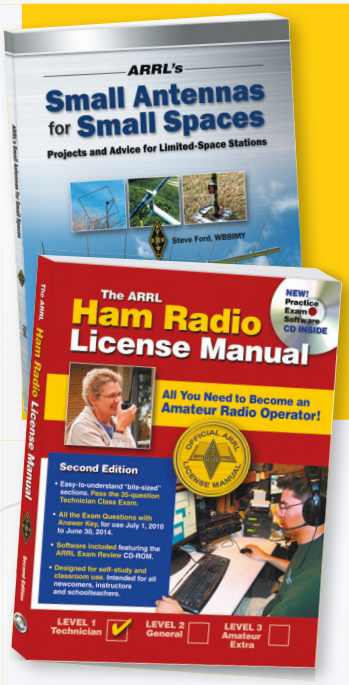

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