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

Monitoring Times®

A Publication of Grove Enterprises

RADIO TAKES A HOLIDAY

7 25274 74654 5
06

AR2300 "Black Box" Professional Grade Communications Receiver

Introducing a new generation of software controlled "black box" receivers!

Discover exceptional performance, state of the art specifications and a receiver with a menu of optional extras that can be configured to your own needs and specifications.

- Receives AM, wide and narrow FM, upper and lower sideband, CW modes, and optional APCO-25
- Up to 2000 memory channels (50 channels X 40 banks) can be stored in the receiver
- Alphanumeric channel labels
- Fast Fourier Transform algorithms
- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all receiver functions
- An I/Q output port that allows the user to capture up to 1 MHz of bandwidth onto a computer hard drive or external storage device
- An SD memory card port that can be used to store recorded audio
- Analog composite video output connector
- CTCSS and DCS squelch operation
- Two selectable Type N antenna input ports
- Adjustable analog 45 MHz IF output with 15 MHz bandwidth
- Optional AR-I/Q Windows software facilitates the easy storage and playback of transmissions captured within up to 1 MHz bandwidth or, signals can be subjected to further analysis.
- An optional GPS board can be used for an accurate time base and for time stamping digital I/Q data.
- The triple-conversion receiver exhibits excellent sensitivity across its tuning range.
- Powered by 12 volts DC (AC Adapter included), it may be operated as a base or mobile unit.
- Software-driven operating selections include IF bandwidth, frequency, mode, filters, a screen-displayed graphical "S-meter," memory inputs, volume and squelch settings and more
- Professional (government) version is equipped with a standard voice-inversion monitoring feature

Available in professional and consumer versions, the AR2300 covers 40 KHz to 3.15 GHz*

With the new AR2300 "black box" receiver from AOR, up to three channels can be monitored simultaneously. Fast Fourier Transform algorithms provide a very fast and high level of signal processing, allowing the receiver to scan through large frequency segments quickly and accurately. All functions can be controlled through a PC running Windows XP or higher. The AR2300 features advanced signal detection capabilities which can detect hidden transmitters. An optional external IP control unit enables the AR2300 to be fully controlled from a remote location and send received signals to the control point via the internet. It can also be used for unattended long-term monitoring by an internal SD audio recorder or spectrum recording with optional AR-IQ software for laboratory signal analysis. The AR2300 appeals to federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.

*Cellular blocked for US consumer version. Unblocked version available to qualified purchasers with documentation. Specifications subject to change without notice or obligation.

WV Museum of Radio and Technology

By David Payne KB8NNT

This month *MT* wants to take you on vacation. Our first stop is the Museum of Radio and Technology in Huntington, West Virginia where you'll learn how a local radio club found a use for a disused school and, with a lot of local effort, turned it into a tourist attraction. There wasn't anything easy about it, but once this project got started it took on a life of its own. David Payne KB8NNT tells how the vintage radios are pouring into the museum and there's plenty to do sorting out and restoring the best gear for display.

In the process of building this museum, West Virginians are also learning about their own contributions to the beginning of the electronic age. There's a special section for commercially built radios of West Virginia origin and the museum now houses the West Virginia Broadcasting Hall of Fame. When you head out this summer, make this a stop along the way.

On Our Cover
Close-ups of two displays found at the Museum of Radio and Technology in Huntington, West Virginia. The tubes are from a 1930s vintage 5 kW AM transmitter and are lit only for show. The early three dial radio is an Atwater Kent model 10C from 1923. The museum also houses the West Virginia Broadcasting Hall of Fame. (Photos by David Payne KB8NNT)

C O N T E N T S

By Ken Reitz KS4ZR

Before you make your plans for a summer getaway, check to see if one of these radio museums is nearby. If not, think about rerouting your trip!

By Steve Goulart AC2AS

The early part of the last century was the dawn of the Information Age and few places exemplify that better than Belmar, New Jersey. Before WWI, the vast unpopulated area was perfect for what early wireless stations required: room for mile long receiving antennas, 300 thousand watt transmitters and a straight shot at England.

And, as InfoAge Chief Engineer Steve Goulart AC2AS, tells us, the early radio pioneers had massive egos to match. In this article he recounts the historic time that early radio giants David Sarnoff and Edwin Armstrong put Armstrong's regenerative receiver circuit to the test at Belmar.

By Dave Granoff K3AS

Just because you're on vacation doesn't mean you have to leave your well-equipped ham station or shortwave listening post behind. As Dave Granoff K3AS tells us, you can take it with you without packing one thing in the car. All you need is your laptop, iPhone or iPad; some easily available and mostly free software; a good Internet connection, and you can be working DX while working on your tan.

By Eric Beheim

Planning to visit a zoo this summer? If so, better take along your scanner. As Eric Beheim discovered, scanning the activities throughout the zoo can make you appreciate what it takes to care for exotic animals as well as the role radio plays in tracking species in the wild and learning more about their habitats and lives.

R E V I E W S

Amazon Kindle Fire:

By Loyd Van Horn W4LVH

It looks a lot like the fabled iPad but at $300 less, just how does the Kindle Fire perform? *MT*'s Global Net columnist takes one for a test drive. Find out why Loyd says, "This is a fantastic entry-level tablet!"
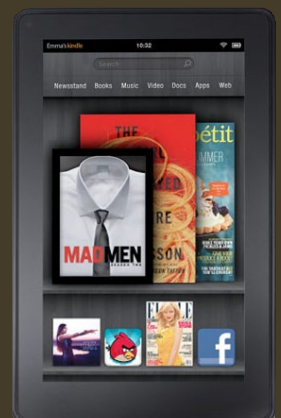
GR🌐VE

Your Source for Radio Scanners, Receivers, Accessories, and Publications

AOR

AR-8600II	RCV11	$989.95
AOR SR2000A (B)	RCV36	$3,199.95
AR2300B	RCV60	$3,809.95
AR5001D (B)	RCV68	$4,499.95

KAITO

KAITO	KA801	RCV61	$79.95
	KA1103	RCV55	$89.95
	KA1121	RCV37	$149.95

SANGEAN

ATS-909X (Black)	RCV67-BK	$259.95
ATS-505P	RCV7	$109.95
ATS-909X	RCV67	$259.95
WFR-20	RCV40	$239.95
WFR-1	RCV56	$279.95

GRUNDIG

S450DLX Field Radio	RCV70	$99.95
G3	RCV65	$99.95
G6	RCV59	$89.95
Satellit 750	RCV58	$299.95

ICOM

R75	RCV32	$719.95
R2500	RCV52	$929.95

PERSEUS RCV57 $1199.00

WiNRADiO

WR-G33EM	RCV16	$949.95
WR-G33EM/GPS	RCV16/GPS	$999.95
WR-G33WSM	RCV28	$949.95
WR-G303i w/ pro demodulator	RCV46-P	$429.95
WR-G313 (Internal)	RCV31	$1149.95
WR-G313 (External)	RCV31-E	$1149.95
WR-G313i/180	RCV31/MOD04	$1,399.90
WR-G313e/180	RCV31E/MOD04	$1,399.90
WR-G305e/WFM/PD	RCV63P/MOD09	$899.95
WR-G305i	RCV53	$699.95
WR-G305i w/pro demodulator	RCV53P	$799.95
WR-G305e	RCV63	$699.95
WR-G305e w/pro demodulator	RCV63P	$799.95
WR-G315 (Internal)	RCV54	$CALL
WR-G315 (External)	RCV64	$CALL
WR-G31DDC Excalibur	RCV66	$899.95
WR-G33DDC Excalibur Pro	RCV62	$1649.95
G39DDCi Excelsior (Internal)	RCV69	$CALL
G39DDCe Excelsior (External)	RCV69E	$CALL

Grove means service. You won't find better customer service anywhere. BUY TODAY!

Established in 1979 by well-known communications expert Bob Grove, Grove Enterprises has become a world leader in radio monitoring equipment, accessories, and publications.

If you decide you don't like a product, Grove Enterprises doesn't penalize you for it. There is NO restocking fee so long as you call our toll free number for a return authorization within fifteen days of shipment and the item is returned in new condition. Once the item is received we will give you credit toward another item or issue a full refund (less shipping charges). Software cannot be returned if opened.

That's it! No hassle! No negotiations! Just call 1-800-438-8155 and our friendly staff will assist you with a return authorization number.

WiNRADiO Accessories

USB Adaptor	ACC 2	$29.95
PCMCIA PC Card	ACC 28	$74.95
WR-BT-3500 VHF/UHF Power Injector (BIAS T)	ACC29	$99.95
Client Server Option-G313 Series	ACC14D	$109.95
Mounting Clamps for AX-71C	ACC71	$18.95
WR-LWA-0130 long-wire antenna adaptor	ADP35	$39.95
AX-71C discone antenna	ANT01	$89.95
AX-37A wide-band log-periodic antenna	ANT28	$389.95
AX-37AM wide-band log-periodic antenna	ANT29	$499.95
AX-07B flexible VHF/UHF antenna	ANT47	$27.95
AX-91M magnetic antenna base	ANT48	$27.95
AX-81S active HF antenna	ANT51	$189.95
WR-AX-31C	ANT58	$189.95
AX-17C indoor active HF antenna	ANT60	$189.95
AX-24B discone antenna	ANT63	$319.95
WR-G3E-WMB Wall-mount Bracket for G3	BRK02	$17.95
WR-DNC-3500 Frequency downconverter	CVR02	$219.95
FSK Decoder	DEC01	$449.95
WR-LNA-3500 low noise amplifier	PRE03	$189.95
WR-PPS-G3 portable power supply for G3	PWR09	$189.95
Trunking Software	SFT 23	$74.95
G305 Advanced Trunking Option	SFT56	$99.95
WaveBase 3	SFT60	$74.95
ERD-1500 RF Sniffer	TST06	$49.95

Shipping/Handling Charges (UPS Ground)

Total Order	Shipping Charges
$1-$19.99	$7.95
$20-$99.99	$17.95
$100-$399.99	$19.95
$400-$899.99	$22.95
$900-$1499.99	$25.95
$1500-$1999.99	$26.95
$2000-$2499.99	$28.95
$2500+	$32.95

Make sure to visit us on the web to get the latest and greatest deals!

GR🌐VE

(800) 438-8155

Grove Enterprises, Inc. - www.grove-ent.com

(800) 438-8155; (828) 837-9200; fax: (828) 837-2216

7540 Hwy 64 W; Brasstown, NC 28902 - email: order@grove-ent.com

TABLE OF CONTENTS

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

COMMUNICATIONS

by Ken Reitz

Fred Maia W5YI SK

In a special bulletin, the ARRL reported March 30 the passing of Fred Maia W5YI, amateur radio journalist for 35 years, the first Volunteer Examiner Coordinator appointed by the FCC (1985), publisher of the *W5YI Report* (1978-2003), and a contributing editor for *CQ Magazine* since 1985 whose last column appeared in the May 2012 issue. A resident of Arlington, Texas, he died of cancer at the age of 76. According to the ARRL bulletin, "Maia served as president of the W5YI-VEC until October 2000 when he sold the W5YI Group study material products to Master Publishing, Inc." Fred also wrote the *Washington Whispers* column for *Monitoring Times* for several years.

AMSAT Fox-1 Next to Fly

NASA announced the third round of 33 Cubesat Space Mission candidates in mid-February that are to be sent into orbit throughout 2013-14. Among the list was AMSAT's Fox-1, a follow-on satellite based on the success of ARRISat-1which was in orbit from August 2011 into January of this year.

According to AMSAT, "This will provide a launch opportunity for AMSAT's next generation of FM repeater satellites with features and operation beyond the experience of AO-51... Fox-1 is designed to operate in sunlight without batteries once the battery system fails." AMSAT noted that the same FM radio equipment used for AO-51 may be used for Fox-1.

Being picked to fly doesn't necessarily guarantee the project will actually end up in orbit. In an AMSAT press release president Barry Baines WD4ASW said, "We need to get the flight Fox-1, along with an operational flight backup satellite, built, integrated, tested, and delivered. Our ability to provide a spacecraft and get launched is dependent upon the active support of our donors who wish to see Fox-1 fly." Anyone may make a donation to help this effort by visiting the **www.amsat.org** and the donor box on that page.

Other organizations picked to have their missions launched include 16 universities, the Air Force Academy, Naval Postgraduate School, and four NASA centers including Kennedy Space Center, JPL, Goddard Spaceflight Center and Ames Research Center. There was no launch schedule available as this is written but you'll be able to follow Fox-1 progress on the AMSAT home page.

Blonder-Tongue Buys R. L. Drake Co.

Blonder-Tongue announced in February the purchase of the R. L. Drake Company. Both companies are suppliers for cable and satellite TV signal processing and distribution equipment. Ohio-based Drake has a 65 year history in electronics manufacturing beginning with the manufacture of high and low pass filters following WWII. Throughout the 1950s, 60s and 70s Drake was a major player in the production of amateur radio gear. R. L. Drake was purchased for $6.5 million.

Drake R-8B last of the R. L. Drake Co. shortwave products from 1991 to 2005. (Courtesy: Universal Radio)

Many Drake transmitters and transceivers are still on the air today. The company's last effort was the R-8 shortwave receiver introduced in 1991 and discontinued in 2005. Drake equipment is still well thought of by hams and SWLers. According to Universal Radio, an R8B receiver (100 kHz to 30 MHz) recently sold for just under $900. Other R8Bs with VHF converter built-in have sold for $1,300.

WA Radio System under Fire (Again)

Seattle, Washington public radio station KPLU, in an on-air piece from March 27, noted the complicated technical, legal and political issues with Washington's $26 million no-bid contract to Motorola Solutions to upgrade that state's police radios.

The contract was criticized by a state legislator who has a background in wireless technology and who asked for a study to review the upgrade. The governor, whose former chief of

Motorola APX 6000 P25 portable two-way radio. (Courtesy: Motorola)

staff is now the lobbyist for Motorola in Washington State, vetoed the study.

The story noted the audit published earlier this year by the U.S. Department of Justice Inspector General's office that was critical of the Integrated Wireless System with which the state police system is supposed to be interoperable. The KPLU report said, "the system in place here in the Northwest – with its reliance on a single vendor, Motorola – is not equipped to adapt to significant advances in new technologies."

Sirius/XM Savior now Stalker

Just three years ago satellite radio monopoly Sirius/XM was on the verge of bankruptcy. To the rescue came John Malone, media mogul and sweet-talking suitor, whose Liberty Media money snatched Sirius/XM from the brink. *Radio Business Report,* in an article from March 30 titled "Liberty Media may be launching hostile takeover of Sirius/XM," noted that as part of its $530 million bailout Liberty picked up a 40 percent share of the company. Now, with the satellite radio giant basking in rising subscriber rolls, increased subscription fees and a two year stock price high, Liberty would like just a little more of the action.

FCC Report: Cable-TV Prices Up

In its annual report on cable-TV prices, the FCC reports that cable-TV subscription fees jumped 3.7 percent last year out-pacing inflation which was said to be 2.5 percent. The report noted that over the last 15 years basic cable prices climbed by 144 percent. It found that the average monthly price for "expanded basic service," excluding taxes, fees and equipment charges, is $54.44.

Cable, OTA-TV Viewing Puzzle

Industry experts are puzzled over a continued decline in cable-TV viewership, down 8 percent year on year in March for the seventh consecutive monthly drop. But, over-the-air (OTA) TV viewership hasn't fared much better; down 7 percent year on year during primetime viewing slots. The biggest broadcast loser was Fox network (down 24 percent), while the biggest cable winner was Discovery's Investigation Discovery (up 37 percent) according to industry sources.

One industry analyst credits an improved economy for the down numbers even though a declining economy was credited with the decrease last year. Just a guess here, but it could be the content.

FCC Set to OK New LPFM Permits

The Prometheus Radio Project, a Philadelphia-based non-profit organization, lobbying the FCC for changes in Low Power FM (LPFM) radio law, announced March 19 new FCC rules creating the chance for hundreds of new LPFM stations across the U.S. to apply for licenses. To do so, the FCC had to toss hundreds of pending FM translator applications which would have been awarded those slots on the FM band.

Prometheus said in a press release, "The announcement concludes the first hurdle in implementing the Local Community Radio Act, passed by Congress in 2010 after a decade-long grassroots campaign. The FCC is on track to accept applications for the new LPFM stations nationwide as early as fall of 2012." New LPFM licenses will be made available only to locally based non-profit organizations.

TV on iPad: "Data & Money Guzzler"

The country's telecom companies' wildest dreams came true this spring as video-on-demand (VOD) junkies across the nation fired up their shiny new iPads at the end of March to take advantage of superhighway 4G wireless streaming. Much to the sheer delight of Verizon and AT&T stockholders, the VOD meters were spinning like turbo-fired tops as consumers signed up for $30-80 per month data plans. But, many woke up just days later with data hang-overages.

An article in the *Wall Street Journal* from March 22 headlined, "Video Speed Trap Lurks in new iPad," explained how one unhappy customer, who bought his iPad on a Friday to watch live action during the NCAA's Final Four, had run out of time on his 2 Gigabyte per month plan by Saturday.

On the same day, an article in the *Washington Post* reported on the experiences of one new customer whose eye-popping iPad display soaked up one-third of his monthly allotment just watching one 15 minute YouTube video. While cash-rich subscribers can buy additional GBs ($10/GB for additional data from both Verizon and AT&T's 4G networks), the article points out, broadband service providers will end up slowing down streams to heavy users.

Post technology writer Celia Kang quoted industry analysts as saying, "Connecting to 4G networks has become akin to jamming too many 18-wheelers on a highway with too few lanes." Still, the appetite for streaming content is expected to increase 18-fold in the next five years, according to a study by Cisco, quoted in the article. The study, as quoted on CNET.com, says that 18-fold increase will result in 10.8 exobytes usage per month or 130 exobytes per year in just four years. That's the equivalent data of 33 *billion* DVDs.

FCC ENFORCEMENT

Jersey Crackdown

FCC field agents swept into Passaic, New Jersey and closed down four pirate FM stations in late February. One, operating on 91.9 MHz, was putting out 4,334 microvolts/meter at 469 meters; another on 107.7 MHz was putting out 4,176 microvolts/meter at 408 meters. A third station was operating on 95.3 MHz with an output of 4,300 microvolts/meter at 628 meters. A fourth was operating on 99.9 MHz with an output of 2,359 microvolts/meter at 615 meters.

Additional FM pirates were nabbed in New Castle, Delaware (99.9 MHz), Brooklyn, New York (99.9 MHz), and Bronx, New York (106.7 MHz). That station was found to be interfering with FAA frequencies. One AM pirate in Fullerton, California operating on 1680 kHz was putting out 15,900 microvolts per meter at 60 meters. Maximum allowed for AM Part 15 operation is 14.3 microvolts per meter at 30 meters. A couple in Lurgan, Pennsylvania were found to be operating a radio jamming device at their home in the 400 MHz range.

This month's QRO (high power) pirate award goes to a Boulder, Colorado operator whose station on 95.3 MHz was putting out better than 450,000 microvolts per meter at 3 meters. A close second was a Hot Springs, California operator whose station on 103.7 MHz put out more than 352,000 microvolts/meter at 3 meters. Maximum allowed under Part 15 FM rules is 250 microvolts/meter at 3 meters.

Break 1-9 for Tacos in Texas

FCC field agents operating out of the Houston, Texas office found themselves in New Braunfels where they came across Johnnie Mac's Truck Wash and Taco Shop in that city. Naturally, they had their CB set on and, according to the Notice of Violation, "determined that you were using your CB station to advertise the goods and services available at your truck wash and taco shop." Well, at least Johnnie Mac wasn't caught using a linear!

Tennessee FM Pirate: $22k Fine

And, finally, last year FCC field agents operating out of Atlanta visited a home near Knoxville, Tennessee where direction finding equipment led them to a pirate FM radio station operating on 87.9 MHz. A man who admitted to owning the device then relinquished it to the agents. Later they sent a letter ordering him not to do it again.

One year later an agent was back in town with direction finding gear and discovered the man was at it again. He and his wife met with the agent outside their home but the man refused to speak. His wife, however, acknowledged that her husband was operating an illegal FM station in their home. When asked if the agent could inspect the station, the man said, "No," and walked away.

The agent explained that refusal to allow an inspection was a separate violation. The bill from the FCC: $10,000 for unlicensed operation; $7,000 for failure to allow an inspection and $5,000 for "deliberate disregard." Total due: $22,000. But, can the marriage be saved?

Communications is compiled 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.

A West Virginia-made 1925 Justrite "one knob" receiver.

WV Museum of Radio and Technology

By David Payne Sr. KB8NNT
(All photos are courtesy of the author)

When I arrived at the Museum of Radio and Technology in Huntington, West Virginia, I found Geoff Bourne, museum curator, on a ladder in a small room, swabbing a paint brush up and down.

"I'll be right down," he said, "as soon as I finish this corner."

The little room was to be the museum's new workshop; it had to be moved to make room for something else. The museum is in a perpetual state of flux. The current workbench is across the hall, piled high with parts and various radios in various stages of restoration, the walls were covered with components. Some of those components seemed quite hopeless; humidity and water-damaged AM broadcast radios had peeling veneer and peeling or splintering wood cabinets. Decades of storage haven't been kind to some of the old radios that have found their way to the museum – although you'd never know it by the prime specimens on display.

The museum is now setting up a complete woodworking and metalworking shop to create impossible-to-find components. Modern replacement components have little use here.

"The whole idea," Geoff said, "is we try to preserve the technology to show what these radios were like. When we open up a radio from the 1930s, we can show you exactly what the
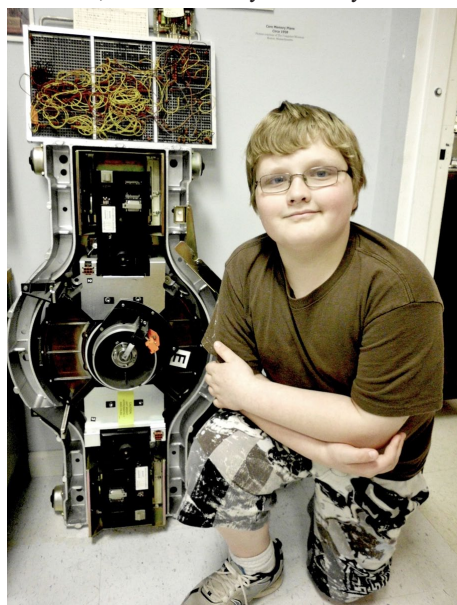
This 1980s IBM hard drive, shown with my son David Payne II, holds two gigabytes of information. Today, a memory card no bigger than a postage stamp can hold more information.

The 1920s-1930s radio room boasts a recreation of a well-stocked radio shop of that era, complete with a plastic salesman.

technology was. If you put new parts – modern parts – in it, you lose that experience.

"People today, especially young people, don't think anything of throwing away an old cell phone or some other electronic device. These old radios were built to last a lifetime and all are repairable, even today. One thing we stress to young people: *all* of this was repairable – these were not throwaway items," he said.

As soon as Geoff finished painting his corner, we started my tour. That's what life is like for the dedicated volunteers who make this one-of-a-kind experience possible – painting, cleaning, fixing, moving, and then stopping in the middle of a project to lead a guided tour or answer questions that they've heard a million times – with a smile.

I can hardly discuss even the highlights of this incredible museum in a simple magazine article. It's also difficult to soak in the magnitude of this place, even when spending an entire day there. You could certainly spend a lifetime sifting through its library, which consists of thousands of volumes.

From Humble Beginnings

It all started with the Charleston, West Virginia Chapter of the Antique Radio Club of America, whose members wanted to start a

little museum, but they couldn't find a suitable location in Charleston.

However, in the early 1990s a member who lived in Huntington heard that Cabell County Schools were auctioning off the old Harveytown School building. The members submitted the only bid. The school system refused it and put it back on the auctioning block. Again, nobody else bid and their second bid was rejected for being too low.

"Nobody else wanted it," said museum Vice President David Bond, "We finally had to say, 'OK, just tell us how much you want for it?'"

Once a price was negotiated, they secured a loan and it was theirs. While immediately adjacent to an old graveyard, the building was still the perfect place for a radio museum. It offered 10,000 square feet of space, including a 133-foot-long attic to hang antennas in, plus space outside for more antennas and lovely hardwood floors. Soon they started working on renovating the building.

"We were like a little dog that had been chasing cars for years and finally caught one," Geoff said. "We were all wondering 'Oh my God, now what are we going to do with it?'"

During that first winter, they received a $2,000 heating bill. With help from grants, they were able to install a new heating and cooling system and insulate the building. At first they started bringing in items from their personal collections, but once they obtained non-profit status, museum pieces started pouring in and eventually filled the entire 10,000 square-foot space.

The museum receives donations from all over the country. When I spoke with them they were planning to pick up a donated collection from an estate in South Carolina. If an item is donated and the museum already has one, the museum selects the best one for display. If the other is on loan, it goes back to its owner. If not, the radio is auctioned off to raise much-needed cash to keep the museum operating.

The museum holds its auctions three times a year. The events begin with a trader's show, where people buy, sell and trade old radios and components in a hamfest-type atmosphere, followed by the actual auction on Saturday afternoons. The next auctions are slated for July 13-14 and October 12-13.

The museum is staffed by a dedicated crew of volunteers, all with a love of radio and most with a background in some type of technology featured there. For instance, besides collecting radios for 50 years, Geoff owned his own

computer business, which he started in 1981. David began his career in television-broadcast engineering in the early 1950s.

Early Days of Radio

The tour begins in the 1920s-1930s radio room. It features some of the museum's oldest pieces – phonograph technology from the late 1800s – but the main attraction is the radio shop, which is presented as if you were walking into a radio store from the 1920s or 1930s. There are floor models on the floor, early breadboard models on the tables, glass counters teeming with components and the walls are lined with advertising and vast shelves of vacuum tubes. Horn speakers and tabletop-loop antennas are everywhere. There's even an appropriately-dressed mannequin salesman.

Behind the counter, you'll find the museum's oldest radio component. It's a French-made spark-gap condenser from 1908. The piece is cylindrical and so large it wouldn't even remotely fit in a five-gallon bucket.

"You know what this does? Same thing as this," Geoff said, holding a variable capacitor in the palm of his hand. "We're talking pre-*Titanic* technology here."

If you've ever wondered what broadcast-radio listening was like in its earliest days, when listeners built their own receivers, the museum has a working cat-whisker three-knob crystal set.

Visitors are encouraged to use the museum's reproduction World War I-era radio to listen to any station they want, as long as it's WRVC-AM 930, which pops up in numerous arrangements of the three tuning dials, although you can hear a couple of other stations if you tune around enough.

What really struck me about this crystal set was how loud it was. I mean *loud*. It's not hooked to any dinky wire taped to window glass – the set is hooked to a 120-foot attic longwire and a *solid* ground.

The most interesting piece in the room, however, is the spark-gap demonstrator, which museum volunteers built to show how the earliest amateur radio transmitters worked.

Despite its large size, the radio room isn't big enough to show off all the early radios they would like you to see. Some of that spills over into the large hallway, its walls lined with floor models, which runs the length of the building and into the radio classroom, where there is a display of radios made by West Virginia companies.

Among those hallway floor models is a 1936 Scott Radio with a whopping 23 tubes. As a boy, David wasn't allowed to touch it. After all, it had cost his father $219 of his World War I bonus. Adjusting for inflation, that radio would cost over $3,500 today.

On the Short Waves

The shortwave room is filled with wall-to-floor examples of shortwave receivers and ham radios dating back to the 1930s, but it's hard to miss the elephant in the room – the monolithic homebrew receiver, built in 1953 by Bernard Clark W8PNR, using a refrigerator as his project enclosure.

Another interesting holding that is easier

Curator Geoff Bourne holds the trophy Al Hix W8AH was awarded for being the third person ever to confirm 300 DXCC countries.

to miss is a simple handheld receiver. It bears no markings of maker or frequency whatsoever. *Nothing*. It has one simple switch marked "ground to ground" and another marked "air to ground." Geoff explained that it was Vietnam-era technology, built by Hallicrafters for the CIA. It could be easily dropped to operatives behind enemy lines. "Ground to ground" transmits around 35 MHz, while "air to ground" transmits around 120 MHz.

The museum also has an impressive collection of military radios, including the old World-War-II-era handhelds, which my grandfather used as a communications man in the Korean War and had nothing but complaints about. One of the most interesting artifacts is a Luftwaffe shortwave receiver which was intended to boost morale in military barracks. It's one of those radios that are in the process of restoration,

This Vietnam-era receiver, which bears virtually no markings, was made by Hallicrafters for the CIA.

temporarily halted as they try to find a correct dial and glass for it.

Al Hix W8AH (SK)

Nothing at the museum was more special to me than the Al Hix display in the ham-radio room. Al, better known as W8PQQ, W8BT and finally W8AH, was one of the world's top DX-ers.

Many remember Al (1917 – 2003) as one of the guys always blasting through pileups. I never once talked to Al on the radio. When I knew him, I was a teenage novice-class operator and he was on those forbidden lower bands – but I remember him as a kind old man who kindled my interest in DX.

I first met Al at a Kanawha Amateur Radio Club meeting in Charleston, and I remember vividly my father and several others privately pointing out to me who he was and that he was somebody very, very important. I got to know Al, on an acquaintance level at least, over the next couple of years.

When you talked to Al, he wasn't the kind of guy to say "hey, I'm the Babe Ruth of DX," or anything that might point to a well-deserved ego. He didn't talk about ham radio as a contest, despite his being the ultimate contester; he spoke of his deep love for radio and what it had to offer.

During his lifetime, Al spent decades at the top of any DXCC list imaginable, especially on the lower bands. He was also a dedicated DX-pedition enthusiast and was the first ham known to get on the air in the country of Andorra, a tiny country between Spain and France.

When Al died, he left numerous footlockers full of QSL cards. There were so many cards that I don't think anybody knows exactly how many, but it's estimated to be just under a quarter-million.

Of those cards, the museum accepted 362 of them to prove his record of 362 DXCC countries on 40 meters, single-sideband voice. It should be noted that there are currently only 340 DXCC countries. The remainder of his card collection was donated to a QSL museum.

They also have one of Al's trophies on display, a rather large, very tarnished trophy that was given to Al by *CQ* magazine for being the third person to work and confirm 300 DXCC countries.

Talk to the World

The museum's ham shack has been a working station for quite some time. The Tri-State Amateur Radio Association meets there and uses it for contests and club events (ham radio license classes are also occasionally taught there).

Geoff said the museum plans to make some of its ham radio rigs available for appropriately licensed visitors who call ahead and arrange for some air time on the vintage rigs.

"The idea is if you want to actually operate a vintage station you can; we've got five or six rigs that can be used and we've already got the antennas," he said.

Those antennas include a 160-meter dipole which the museum has some very special plans for. Among the projects in the works is the modification of a 1939 Collins AM broadcast

transmitter, originally used by WPAR in Parkersburg, West Virginia, for hams to transmit on the 160-meter band. When WPAR increased its power to 250 watts in 1941, it was with that very transmitter.

"The idea is that hams can come in and transmit on 160 meters with AM broadcast station quality," Geoff said. Wouldn't *that* be something?

Computers

There aren't many places where the march of technology appears as obvious as with the museum's computer collection. I was particularly awestruck by a large, early 1980s IBM hard drive, which stands about three feet tall. Interestingly, the digital camera I used to photograph it has a memory card that stores precisely the same amount of information as the hard drive, two gigabytes, despite being not much larger than a postage stamp.

Among the computers on display is an Apple Lisa, the first personal computer with a Graphical User Interface. They even go as far back as a built-it-yourself, vacuum-tube Heathkit computer from the 1960s that displayed its image on an oscilloscope. As I understand it, you could program it to calculate equations, much like the earliest computers did, to figure out artillery trajectories. In a nutshell, you could make a ball bounce in different ways on an oscilloscope screen.

Despite their limitations, those Heathkit computers greatly influenced a generation, including Steve Jobs, who would help create the modern personal-computer revolution.

The Original Internet

While the museum has a vast collection of electronics, its greatest resource perhaps are the experts who give the guided tours. As they take visitors through the museum's vast holdings, they piece together a story of just how advanced and modern the technology of the past could be. Radio was to the early Twentieth Century what the Internet is to Twenty-first Century, a way to easily send or receive information over distances. Once radio amateurs figured out how to make transatlantic communications possible, real-time global communication at anyone's fingertips became a reality, something that had never before been achieved.

By the 1930s, radio was poised to fill a role that wouldn't come to full fruition until the birth of the Internet itself – the ability to download news, weather, sports (and most importantly, advertising) that you could actually *read* at your leisure. Enter the Crosley Reado, one of those radio novelties that even the folks at gargantuan museums full of rarities salivate over, but only wish they had. The lack of an example, however, certainly doesn't prevent them from telling visitors about it.

"It was so ahead of its time, it never took off, and there's only two known in existence," Geoff said. "They would scan a newspaper with a scanner that would look for light or dark areas, that was translated into a radio signal that was sent out at night when nobody was listening and the station would otherwise be

The tubes are kept glowing for visitors in the power supply for the museum's 5 kW AM broadcast transmitter from the 1930s.

off the air. If you listened to it, all you would hear would be a buzzing sound, but the Reado would print it and it would be waiting for you on this continuous roll of paper."* The Reado was basically a fax machine. While the fax itself might be considered a modern convenience, the technology is so old that as the first experimental faxes were being sent in Europe, wagons had just started heading west on the Oregon Trail and the Mexican War hadn't even been fought yet.

"There were some rudimentary fax technology they tried to send over phone wires and back in the 1870s; they were trying to send pictures, but there were bandwidth problems and without (the invention of) vacuum tubes and amplification, it didn't work very well. Over any distance the signal would degrade so much, it wasn't practical," Geoff said.

However, practical fax technology wasn't that far off. "Here at the museum, we actually have a U.S. Navy fax machine from World War II with vacuum tubes. You put in a sheet of thermal paper and it would slowly print out a picture. They used it to get information they needed, like weather maps and fleet orders," he said.

This ham radio transceiver was built by Bernard Clark W8PNR in 1953, using a refrigerator as a project enclosure.

Broadcasting

A large portion of the museum is dedicated to radio and television broadcasting and, in fact, the West Virginia Broadcasting Hall of Fame is located there. The last stop on the tour is lined with pictures of the hall's inductees, many of them familiar faces. Some, such as Herbert Morrison, whose "Oh the humanity!" radio broadcast of the 1937 Hindenburg disaster is engrained in the American conscience. I had no idea some of these folks were West Virginians.

The museum also has a 1930s vintage 5,000-watt Western Electric AM Broadcast transmitter, conveniently located next to a radio station broadcast studio recreation, as well as broadcast television equipment, including cameras. It has one of the last black-and-white cameras RCA made (1960s), but more importantly, it has an experimental-television camera that was a curiosity at the 1939 World's Fair.

"It's the only camera used at the World's Fair that we know of," Geoff said. "People got to see themselves on television and they got a card that says 'I was televised at the World's Fair' (the museum also has some of those cards), but then World War II started and television was put on hold."

The museum also has a number of television sets on display. Geoff is now restoring a mechanical television from the 1920s – I can't wait for that one to go on display.

Monster Tube

The museum has quite an impressive collection of vacuum tubes in the 1920s-1930s radio shop that would have been the envy of any store of that time. Some tubes are quite small, some are quite large, some are water-cooled and some large tubes you can even see glow in an AM Broadcast transmitter. But no tube is quite as daunting as the mercury-arc rectifier, which looks like a giant vacuum-tube octopus.

The tube is nearly four feet high and about 20 inches in diameter; that's just an estimate because it is safely ensconced in its own windowed containment area (these rectifiers had to be kept in a precise temperature environment) so you can see in easily, but it's nearly impossible to photograph well. It was built in the 1940s and was used to convert high-voltage AC to DC current used to power lighting and equipment deep inside a West Virginia coal mine.

Geoff told me the museum was given the option to accept 50 of them. They only chose to keep one for display. Naturally, I asked why they only wanted one. It was, after all, the coolest tube I'd ever seen.

"The reason," Geoff said with a smile, "is that it's got 23 pounds of toxic mercury in it!"

For more information on the Museum of Radio and Technology located at 1640 Florence Ave, Huntington, WV, go to the museum's web site at **www.ohio.edu/people/postr/mrt/** or call (304) 525-8890.

* *A full account of early radio facsimile may be read in the February 2011 issue of MT, "The Newspapers of the Air: Early experiments with radio facsimile" by John Schneider W9FGH pages 12-15.*

MT

MT's 2012 Annual Radio Museum List

List compiled by Ken Reitz KS4ZR. Please send additions or corrections to: kenreitz@monitoringtimes.com

Alabama Historical Radio Society
Don Kresge Memorial Museum located in the Alabama Power Building
600 North 18th Street
Birmingham, Alabama
www.alabamahistoricalradiosociety.org
The museum is open during normal business days and hours. Society meetings are each Saturday at 9:00 am. Parking at the Alabama Power Building is free.

American Radio Relay League
225 Main Street
Newington, CT
Phone: 860-594-0200
www.arrl.org/visit-us
Tours of ARRL HQ, including vintage W1AW station, are given several times daily. Licensed hams may operate W1AW from three studios.

Antique Wireless Association Museum
2 South Avenue (on Route 5 and Route 20)
Bloomfield, NY 14443
http://www.antiquewireless.org/museum/museum.htm
Open May through September Saturdays 2-4 PM and Sundays 2-5 PM. According to their web site, admission is free.
Membership ($25) includes subscription to *AWA Journal*, a quarterly publication about radio history. For information about the AWA museum contact museum curator Bruce Roloson: *broloson@stny.rr.com*

Arizona's Radio and Television Museum
(House of Broadcasting)
7150 East 5th Street
Scottsdale, AZ
Phone: 602-944-1997
www.houseofbroadcasting.com/
Monday through Saturday 10:00 am- 6:00 pm. Open Sundays 10:00 am-5:00 pm. Admission is free.

California Historical Radio Society (CHRS)
Bay Area Radio Museum- KRE-AM
At press time the main CHRS web site was down but most information can be found here:
http://www.bayarearadio.org/

College of Charleston
John Rivers Communications Museum
58 George Street
Charleston, SC
Phone: 843-953-5810
http://jrmuseum.cofc.edu/
Open Monday through Friday 12:00 Noon - 4:00 pm except College of Charleston holidays.

Hammond Museum of Radio
295 Southgate Road
Guelph, Ontario Canada
Phone: 519-822-2441 ext. 590
www.hammondmuseumofradio.org
The Hammond Company began building radios in 1920 and is still in business, though not in manufacturing radios. Fred Hammond VE3HC, one of the founder's sons now deceased, maintained a radio connection throughout the decades.
Open normal business hours Monday through Friday and weekends by request. Houses one of the largest collections of Collins amateur radio equipment anywhere. Listen for VE3HC on the ham bands and collect their QSL card. Nori Irwin VE3AQZ, curator.

InfoAge Museum of Radio Technology
[See article on page 12]
Science History Learning Center and Museum at Historic Camp Evans
2201 Marconi Road
Wall Township, New Jersey 07719
Phone: 732-280-3000
http://infoage.org/exhibits/radio-technology-museum
Open every Sunday 1-5 PM or by appointment.

Marconi National Historic Site of Canada
Table Head on Timmerman Street
Glace Bay, Nova Scotia
www.pc.gc.ca/lhn-nhs/ns/marconi/natcul.aspx
Open daily, 10:00 a.m. to 6:00 p.m. from June 1 to September 15. No admission fee.

Military Communications and Electronics Museum
[See article in MT June 2010 page 8]
Canadian Forces Base
Kingston, Ontario Canada
Phone: 613-541-4675

www.c-and-e-museum.org/
8:00 am-4:00 pm Monday-Friday
11:00 am-4:00 pm Weekends and Holidays
Open first weekend in May until first weekend in September (Labor Day). Admission is voluntary donation.

Museum of Broadcasting
3517 Raleigh Avenue
St. Louis Park, MN 55416
Phone: 952-926-8198
www.museumofbroadcasting.org/index.html
Hours: Wednesday through Saturday 10:00 am-5:00 pm. Closed Tuesday and holidays. Admission: Adults: $6, Seniors and students: $5.
Begun in 1988 and encompassing 12,000 square feet of antique radios, televisions and broadcast equipment, the exhibits are based on the Joe Pavek W0OEP collections of hundreds of vintage radios. The museum also houses the Museum of Broadcasting Hall of Fame featuring Minnesota radio and television broadcasters.

Museum of Broadcast Communications
State and Kinzie
Chicago, Illinois
Phone: 312-245-8200
www.museum.tv/
Offers on-line and in-person history of TV broadcasting.

Museum of Radio and Technology
[See feature article on page 8]
1640 Florence Ave
Huntington, WV 25701
Phone: 304-525-8890
www.ohio.edu/people/postr/MRT
The museum is open from 10:00 am until 4:00 pm Saturdays and 1:00-4:00 pm Sundays all-year around except certain holidays. The Museum is also open from 10:00 am until 4:00 pm on most Fridays from mid-April through October. There is no charge for admission, but a voluntary donation box is located in the hallway.

National Cryptologic Museum
Phone: 301-688-5849
You'll need a map: **www.nsa.gov/about/cryptologic_heritage/museum/map/index.shtml**
www.nsa.gov/about/cryptologic_heritage/museum/index.shtml
Part of National Security Agency (NSA). Open Monday through Friday 9:00 am-4:00 pm. Admission is free. Free parking.

National Electronics Museum
(History of the Nation's Defense Electronics)
1745 West Nursery Road
Linthicum, MD
Phone: 410-765-0230
www.nationalelectronicsmuseum.org/
Open from 9:00 am-4:00 pm Monday through Friday, and 10:00 am-2:00 pm on Saturdays. Admission is $3 for adults, $1 for students and seniors. Children 5 and under are free. Free parking.

New England Wireless and Steam Museum
1300 Frenchtown Road
East Greenwich, RI
Phone: 401-885-0545
www.newsm.org
Extensive collection of early amateur radio and commercial wireless transmitting and receiving equipment. Open Thursdays 9:00 am - 4:30 pm.

Paley Center for Media
(formerly Museum of Radio and Television)
25 West 52 Street
New York, NY 10019
Phone: 212-621-6600
Also:
465 N. Beverly Drive, Beverly Hills, CA
Phone: 310-786-1000 or 786-1025
www.paleycenter.org
Hours: Wednesday-Sunday from Noon-6:00 pm, Thursday from Noon-8:00 pm. Closed Mondays and Tuesdays. Admission: General $10, Student/Senior $8, children under 14 $5.

Pikes Peak Radio Museum
6735 Earl Drive
Colorado Springs, CO
Phone: 719-550-5810
www.pikespeakradiomuseum.com
Open 10:00 am - 5:00 pm Monday through Friday. Admission is free.

The museum is part of Norbern Electronics which offers a repair service on a wide variety of radio and electronic products from tubes to transistors. **www.norbern.com/**

National Capital Radio and Television Museum
2608 Mitchellville Rd
Bowie, Maryland
Phone: 301-390-1020
http://radiohistory.org/
Email: radiotvmuseum@verizon.net
Open Friday from 10:00 am-5:00 pm as well as Saturday and Sunday from 1:00 pm-5:00 pm.
Includes Harmel House Annex, not normally part of their tour (though hams are welcome), which houses W3R and features a 1940s Collins AM station.

Society for the Preservations of Antique Radio in Canada
Kerria Drive
Riverview Hospital
Coquitlam, B.C., Canada
Phone: 604-777-1885 (Sundays)
www3.telus.net/radiomuseum/
Open most Sundays, 10:00 am-4:00 pm
Location is around the Riverview Hospital grounds, check their web site for exact directions to the museum. Free parking.

Sacramento Rock and Radio Museum
911 20th Street
Sacramento, CA 95814
This museum dedicated to the celebration of the Sacramento/Davis area rock music and the radio stations that played the music from the 1950s to the present is still getting started. Tours are by appointment. Contact: sacrockmuseum@gmail.com

Southern Appalachian Radio Museum
Room 315 of the Elm Building
Ashville-Buncombe Technical Community College
Asheville, NC
www.saradiomuseum.org/index.html
Open February through November Fridays from 1 pm to 3 pm. Tour is $5 per person, children under 13 are free. Contact information is on the home page.

SPARK Museum of Electrical Invention
1312 Bay Street
Bellingham, WA 98225
Phone: 360-738-3886
http://www.sparkmuseum.org
Open Wednesday through Saturdays 1:00-4:00 PM; Sundays Noon-4:00 PM and by appointment. Admission: $6 (Adult) $3 (Children 11 and under)
Listen to KMRE-LP 102.3 FM live on **www.sparkmuseum.org/listen**

Sunshine Radio Museum
8 East Main Street
Sodus, NY 14551
Phone: 315-483-8451
http://sunshineradiomuseum.org/index.html
Open 9:00 to 5:00 Mon. through Fri. and 9:00 to 1:00 on Saturday. Museum tours are by appointment only.

U.S. Army Signal Corps and Ft. Gordon Museum
Building 29807
Fort Gordon, GA 30905-5293
Phone: 706-791-2818/3856
www.signal.army.mil/ocos/museum
Open Tuesday-Friday 8:00 am-4:00 pm. Closed on federal holidays.

Vintage Radio and Communications Museum of Connecticut
115 Pierson Lane
Windsor, CT 06095
Phone: 860-863-2903
www.vrcmct.org
Open Thursday and Friday 10:00 am-3:00 pm, Saturday: 10:00 am-5:00 pm, Sunday: 1:00 pm-4:00 pm. Admission to the museum is free to supporting members, otherwise: Adults: $7, Seniors over 60: $6, Students: $5.

Western Historic Radio Museum
Parish House
109 South F Street
Virginia City, NV
Open May through October 11:00 am to 5:00 pm on a "by chance" or "by appointment" schedule. E-mail (w7ybs@att.net) to confirm that they will be open on the day you plan to visit. Admission: $5 for adults and $2 for children under 15 years old.

Belmar, New Jersey: Land of Radio Giants

By Steve Goulart AC2AS
Chief Engineer, InfoAge Science/History Learning Center and Museum

On the night of Jan. 30-31, 1954, Edwin Howard Armstrong put on his overcoat, gloves and scarf. He removed the air conditioner from the window of his 13th floor apartment in New York City and stepped into eternity. The greatest radio engineer of the twentieth century, creator of the regenerative, super regenerative, the superhetrodyne receivers, innovator in Doppler radar and the inventor of FM radio was dead.

In failing health, estranged from his wife Marion, and mostly worn out by his long bitter frequency modulation patent lawsuit against David Sarnoff and RCA, he felt he had failed. David Sarnoff attended his old friend's funeral and mourned. He told a friend that he had not killed Armstrong: many felt otherwise.

Armstrong's death was forty years to the night that he and Professor Morecort from Columbia University, as well as two Marconi America Wireless Company men, David Sarnoff and R. A. Weagant, spent the night at Belmar, New Jersey, testing the first practical electronic radio receiver. It would seem to be no coincidence.

That night Belmar became an historic landmark, despite the fact that the Marconi Company headquarters in England decided not to buy the patent for the device. The significance to Armstrong seemed clear. The tests were conducted using the aerials at the site, one almost a mile long. The receiver building was not completed, so the men used a nearby construction shack for their experiment. Everyone involved remembered that it was very cold. David Sarnoff and Edwin Armstrong's friendship began with the trial of Armstrong's regenerative circuit that night in January of 1914.

Sarnoff, Armstrong, and Dunn

Development of the circuit from 1912 consisted of the controlled use of feedback to make the vacuum tube the first usable active component. This made both electronic receivers and transmitters possible and led, after World War I, to the use of radio for the broadcast of voice and music. Although others had attempted to use vacuum tubes for amplification, they were unsuccessful for a variety of reasons. Edwin Armstrong's research and invention marks the first step into our world of electronics. Suddenly, the old world of spark transmission and wireless Morse code became *Radio*.

David Sarnoff was a visionary as well as a tough business man. He played a key role in radio broadcasting, particularly in the creation of radio and television networks. Sarnoff was a legend in his time, much of it embellished by the RCA publicity people. Because of this, many feel that he was a useless buffoon, but he wasn't. One of the interesting things about his 1914 Belmar report to the head office is that it gives the reader a feel as to how good a wireless operator he was and that he also had a good grasp of the current state of the technology. Mr. Weagant, the Marconi Engineer, in his report mentions that "At one time San Francisco was transmitting at the rate of about forty words a minute, all of which was copied by Mr. Sarnoff."

As the Marconi chief radio inspector, Sarnoff wrote the following conclusion to his report, "I would state that the results obtained with Mr. Armstrong's receiver are sufficiently convincing to warrant our most careful investigation of his patents and circuits, etc., for I believe that his device has tremendous advantages and unless there be other systems of equal merits which are unknown to me, I am of the opinion that he has the most remarkable receiving system in existence." But, Marconi headquarters in London disagreed, stating that they had investigated the use of vacuum tube detectors and that they provided "no advantage." They were also very unhappy about the use of the Belmar site by non-company visitors.

Earlier crystal sets in use at the time depended on the high power transmitted from the sending station and large receiving antennas which produced barely enough signal to drive sensitive headsets. This included the state of the art Marconi High Power Stations like Belmar.

The regenerative receiver produced gain, a lot of gain, around 4000 fold: you could put your headset on the desk and hear the sound across the room. As a matter of fact, this is one of the tests mentioned in the reports to the Marconi Company on the Belmar tests conducted the night of January 31, 1914. During the course of the night most of the important wireless stations in the world were heard.

The Marconi Belmar Station was both the site for the demonstration and, strangely, the cause of the meeting of Sarnoff and Armstrong. Armstrong, still a student at Columbia, had no contacts in the real world of business and industry. He is referred to in Marconi correspondence regarding the Belmar tests as "a boy not much over twenty-one."

There was one person who became interested in Armstrong and the regenerative receiver who did have the contacts. Gano Dunn was an 1891 graduate of Columbia University's first electrical engineering class and, being first alphabetically, was America's first electrical engineer. By 1914 Dunn was the head of J.G. White Engineering Corporation, the company busy building the American terminals of the transoceanic wireless systems for Marconi. The Marconi chief of construction at that time was the twenty-two year old David Sarnoff.

Dunn had worked his way though college as a telegrapher and eventually earned a first class radio license. He had worked first designing electrical generators and held many patents of his own, but most of his career was as the president of J.G. White Engineering, a very large

Operating house at Belmar, New Jersey, site of the Armstrong Regenerative Circuit test January 1 through February 2, 1914. Photo taken in 1914 by Mr. Edward Henderson used by permission of the family of Edward Henderson.

construction engineering company.

Officially, Gano Dunn is reported to have told either Marconi America's President Edward Nally or F.M. Sammis, the engineering manager, they would do well to take a look at the work Armstrong was doing at Columbia; both are mentioned in different accounts. The fact that Sarnoff was working with Gano Dunn as the Marconi Construction manager makes one wonder who actually got things rolling. In any event, Dunn was important to both men and continued to be associated with them.

In a 1941 *Saturday Evening Post* article, both are quoted on their relationship at this critical point in their early careers. At some point Dunn made an appearance in the Columbia electrical engineering lab to ask about the "feed-back" circuit. At this time, before he sold the patent, Armstrong was not showing many people how it worked, but he seemed at the least to know who Gano Dunn was.

Armstrong offered to build him his own set, but Dunn refused, saying he would understand the circuit better if he built his own. Armstrong gave him the circuit and Dunn then found the necessary parts, impressing Armstrong by cutting his own coil form out of stock.

Sarnoff in the same article relates that Dunn showed him great kindness as a mentor. "He was the Pope in my realm, he first taught me to see the engineer as an organizer. He showed me how important it was for the technician to understand the applications and implications of what he knew. And, without patronizing me, he gave me advice about my career. It's only fair to say that he was the first person of importance who took any interest at all in what was to become of me, personally."

Promoting History at InfoAge

Seen in this context, the Belmar Station played a key part in the Armstrong, Sarnoff story. At the Radio Technology Museum at InfoAge, we find that most of our visitors who have an interest in antique or amateur radio have been aware of this feud, but are unaware of the pair's history as friends and supporters. The depth of the friendship was such that Armstrong would later stop at Sarnoff's apartment many mornings to tell him his latest ideas. The Sarnoff children knew Armstrong as the coffee man. Since both men are so associated with our site, we try to

Five Completed Marconi High-Power Stations

Circuit No. 1
| Glace Bay, Nova Scotia | transmits to | Letterfrack, Ireland |
| Louisburg, Nova Scotia | receives from | Clifden, Ireland |

Circuit No. 2
| New Brunswick, NJ | transmits to | Towyne, Wales, Great Britain |
| Belmar, NJ | receives from | Carnarvon, Wales, Great Britain |

Circuit No. 3
| Marion, MA | transmits to | Naerboe, Norway |
| Chatham, MA | receives from | Stavanger, Norway |

Circuit No.4
| Bolinas, CA | transmits to | Koko Head, HI |
| Marshalls, CA | receives from | Kahuku, HI |

Circuit No. 5 (Simplex system)
| Kahuka, HI | transmits to | Funabashi, Japan |
| Koko Head, HI | receives from | Funabashi, Japan |

View of the main aerial system with horse and wagon near the base of one mast, human figure in Jacob's seat about half way up the mast. Flanges on the mast foundations were almost 6 feet wide. Photo taken in 1914 by Mr. Edward Henderson used by permission of the family of Edward Henderson.

take a more balanced view of the two.

InfoAge Science History Learning Center is located in Wall, New Jersey at the former Marconi Belmar Station, the receiver and control site for "Circuit 2," the London-to-New York Transoceanic communications system, completed in 1914.

A chapter with the complete description of the five completed circuits may be found in the textbook, *Practical Wireless Telegraphy* by Elmer Bucher, the Marconi Instructing Engineer. The book is available for free download on the Internet and is a great view into radio's historic past.

InfoAge has five remaining Marconi Belmar station buildings which we are working to preserve, as well as the historic core of the U.S. Army's Radar Laboratories which was developed at the same location at the beginning of WWII. We hope at some point to get a team of archeologists to do an excavation at the site of the construction shack near the receiver building where the actual Belmar tests were conducted.

The key feature of the Marconi High Power system stations were the capability to send and receive up to 100 words per minute full duplex, 24 hours a day, 7 days a week. A telegram from New York to London cost about 25 cents per word ($5.73 per word in today's money). Several technological developments were needed in order to make the service reliable. The first was to raise the power of the transmitters to 100-300 thousand watts. Second, was to develop mechanical methods of keying and receiving at 100 words per minute. The other improvement that allowed the system to work was the aerial system.

Large arrays were built with the transmit aerials carried on six parallel sets of six 400 foot masts. The receiver aerial consisted of a pair of one mile wires spaced about 10 feet apart on a single set of six 400 foot masts. The major technology improvement was the balancing

out aerial which was designed at right angles to the main aerial and pointed toward the New Brunswick transmitter site about 40 miles distant. The signal from this aerial was inductively decoupled from the main aerial to prevent the New Brunswick signal jamming the weak receive signal from England. This was necessary due to the primitive state of technology in 1914, even though the two systems operated on different frequencies and were about 50 miles apart.

Prior to World War I, the Marconi High Power Stations were worldwide scientific sensations with news articles about them on the front page of the *New York Times*. The stations operated in the VLF range with receive frequencies mentioned at Belmar including 30 and 24.1 kHz. The station opened in 1914 but was not operated as the transoceanic system due to the war in Europe; it instead did research into wireless interference and static (a problem later solved by Armstrong's FM system).

Ernst Alexanderson, of the radio frequency alternator fame, was working in the basement of the main building when he was knocked across the room by a lightning strike on an experimental underground aerial. Harold H. Beverage used Belmar to demonstrate the Beverage antenna in action to *QST* and the amateur radio world.

Visionaries' Paths Diverge

When America entered WWI in 1917, Belmar was taken over by the U.S. Navy along with most other shore wireless stations in America. Most of the Marconi operators were taken into the Navy for the duration as well. By the end of the war, partially due to Armstrong's inventions, the stations became obsolete, and by 1924 the Belmar site was closed.

However, the navy refused to return the wireless stations to the Marconi Company. Although Marconi America was an American company, the navy felt that the parent Marconi Company in London should not get control of the wireless patents involved (including in particular the Alexanderson Alternator). While the navy wanted control of all radio in America, congress thought that was too much, so, as a compromise the Radio Corporation of America (RCA) was formed in 1920. Sarnoff and most of Marconi America's other people went to RCA in the deal and he moved upward to the point where he could influence the company's decisions.

Edwin Howard Armstrong joined the Army during WWI, working in research in a Paris laboratory. One of the problems presented to him was the interception of unusually high frequency German military radio signals, work that would lead to the invention of the superheterodyne receiver. The superhet became and continues to be the most common radio receiving circuit.

By 1920 commercial broadcasting in America had begun. David Sarnoff, an early voice for broadcasting, had reportedly sent a memo to the executives of Marconi America in 1916 suggesting the idea of the "radio music box" and broadcasting to the public. In an age where money was made by sending messages to individuals, the response was, "Why send messages to no one in particular?" Even Sarnoff missed part of the equation because he felt that

manufacturers would pay for broadcasting out of radio sales revenues.

Out of the navy's fears of America losing critical patents and the creation of RCA, there was the creation of a patent pool that included American Telegraph and Telephone, RCA, General Electric, Westinghouse and the United Fruit Company. Portions of the broadcast, distribution and manufacturing segments of the industry were set in place before most players understood what radio would become. Sarnoff, who understood the technologies involved and had the vision to see where the industry was moving, positioned RCA to become the prime player, gaining the use of all of the significant patents and permissions to make and sell their Radiola receivers.

Sarnoff also understood that local programming station by station was too difficult, too low quality and too expensive. With the creation of the National Broadcasting Company, the country could be offered the best programs available in their own homes, as provided by local NBC-affiliated broadcast stations.

Preferring to be called Major (the army rank that he earned during the war), Armstrong created a new circuit: the super regenerative. Sarnoff bought the patent rights for RCA in order to block its potential use by others. This was the weakest of his major inventions but it was the most profitable. It made Armstrong the biggest individual share holder in RCA and, incidentally, rich. Armstrong frequently visited Sarnoff at his office and became smitten by Sarnoff's secretary Marion MacInnis whom he married in 1923. As a wedding present, Armstrong gave her the first portable superheterodyne radio.

Let the Patent Wars Begin

Armstrong was a very complex man. During the World Wars he gave free use of his patents to the U.S. government, thereby losing millions of dollars. But in the patent fights with de Forest and later with RCA, he spent millions following his principles rather than the advice of his attorneys.

At one point in 1923 he had a clear victory against de Forest, who claimed to have created the regenerative circuit prior to Armstrong. But, Armstrong felt that de Forest was a thief and disliked him for his lack of technical ability and insisted on collecting a settlement for court costs owed by de Forest. But de Forest, who was broke, went back to court. The case went on till 1934, with Armstrong losing on a technicality in the U.S. Supreme Court.

Armstrong had been given a gold medal by the Institute of Radio Engineers in 1918 for the invention of the regenerative circuit. At the 1934 annual convention Armstrong attempted to return it to the group, but the board, aware of his plan, had a plan of their own. They declared, "That the present Board of Directors, with full consideration of the great value and outstanding quality of the original scientific work of yourself and of the present high esteem and repute in which you are held by the membership of the Institute of Radio Engineers and themselves,
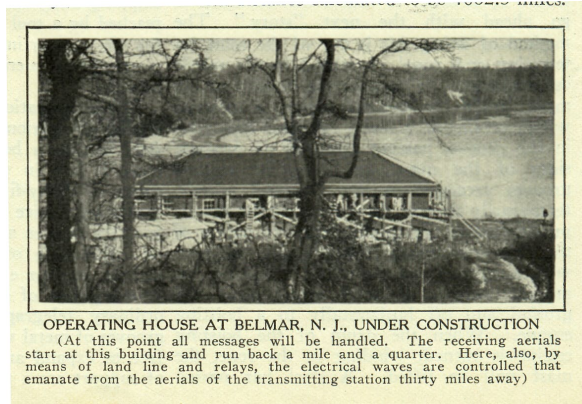
OPERATING HOUSE AT BELMAR, N. J., UNDER CONSTRUCTION
(At this point all messages will be handled. The receiving aerials start at this building and run back a mile and a quarter. Here, also, by means of land line and relays, the electrical waves are controlled that emanate from the aerials of the transmitting station thirty miles away)

Source: The American Review of Reviews, March 1914, page 334 Note Construction shack on left.
This is the site of Famous Armstron Regenerative Circuit test Jan 1 - Feb 2, 1914

hereby strongly reaffirms the sense of what it believes to have been the original citation."

Armstrong replied, "This is the highest honor a radio engineer can hold. I give you my heartfelt thanks, and assure you they come rform the bottom of my heart." To his peers he was still the inventor of regeneration.

Sarnoff and RCA had sided with de Forest's case, because it meant royalties to the corporation which had the use of de Forest's patents. Armstrong believed in principle and his side of the friendship began to fade.

Armstrong received his patents for frequency modulation in 1933 and expected Sarnoff and RCA to buy them since they had been involved; the test system had been using an RCA transmitter in the Empire State Building in New York. Sarnoff had asked for the answer to static and expected Armstrong to produce a magic box to add to AM radios to fix the problem.

Sarnoff became convinced that the future belonged not to radio but to television. He felt that there was only room for one new next technology and it shouldn't be FM radio, which he saw as killing RCA's AM radio production and delaying the introduction of television. Today it seems clear that there was no chance of FM radio, AM radio or television killing one another off, and it's sad that Armstrong died for such an empty threat.

Armstrong began to create a market for FM and teamed with the Yankee Network to link a number of FM stations in New England. As he began to succeed, Sarnoff made one more attempt to make peace. Gano Dunn now an RCA board member, but still a friend of Armstrong, made RCA's best offer in 1939, one million dollars for non-exclusive use of the FM patents. Armstrong was advised to take the offer, but he refused and the court battle began. The RCA courtroom tactic was to extend the case as much as possible and stall till Armstrong quit. He wouldn't. He commented at the time that he would fight till he was broke or dead.

During WWII Sarnoff went into the army and did good work creating the radio communications systems used in Europe after D Day. After the war he received a promotion to the rank of Brigadier General in the army reserve and began using the title General.

Armstrong worked with what was called FM Radar for the Army at Camp Evans, located on the old Belmar Station location. Most of

Armstrong's radar work seems to have been done at his Alpine, New Jersey laboratories and it's not clear if all of his work during the war has actually been declassified.

One portion of his radar work resulted in the Army successfully bouncing a radar pulse off the moon in January 1946 (Project Diana). At the time, there was about a 50-50 split in scientific opinion on whether a radio wave could go through the ionosphere and return. It could, and the event was a front page story in the *New York Times*. If it had been the other way, we would not have satellite television or GPS.

After the war Armstrong had won a victory against RCA, with the FCC setting the standard of using FM modulation for American television. But, the victory turned into a loss when Sarnoff managed to convince the FCC to move FM broadcasting to a new frequency band in the VHF band, which it still uses. The move made every existing FM receiver in the country unusable and slowed the growth of FM for decades.

After Armstrong's death, his wife Marion and his long-time legal team first settled with RCA for $1,050,000. Using this money they went back to court against the eight other companies who challenged the Armstrong FM patents. Marion Armstrong won all of the cases, the last against the Motorola Company in 1965, and ended up quite rich.

InfoAge and the Land of Radio Giants

After Camp Evans was closed by the Army in 1998, it was decided to divide it into sports and recreation areas, providing a local campus for several New Jersey colleges, plus a 37 acre historic district featuring InfoAge – the Science History Learning Center and Museum at Historic Camp Evans. The historic district contains the core of the radar labs, the TIROS and Diana site, and the five surviving Marconi Wireless buildings.

Based on the significant history of scientific and technological development on site, and in New Jersey in general, it's our mission to create a center to inspire kids to learn math and science. InfoAge is located at 2201 Marconi Road Wall, NJ 07719; Phone 732-280-3000. Please check our websites for events and hours – **www.infoage.org** and **www.campevans.org**.

The Museums and Displays at InfoAge
Radio Technology Museum and National Broadcaster's Hall of Fame
The Vintage Computing Museum
The New Jersey Shipwreck Museum
The Military Technology Museum and WWII Memorial
Apollo Lunar Guidance Computer display
Computer Deconstruction Laboratory
WWII toys and models
WWII Electronics
WWII Communications
Electronic Warfare
Fallout Shelter Theater
Nature Center

Monitoring the Wild Side

By Eric Beheim

Like many residents of San Diego County, my wife and I have memberships in the San Diego Zoological Society. Our memberships entitle us to free admission to the San Diego Zoo whenever we like, and we usually try to go there at least two or three times a month. These visits, which normally last between two-and-a-half to three hours each, allow us to range through the zoo's 128 acres of themed animal exhibits – "Elephant Odyssey," "Panda Canyon," "Tiger River Trail," "Polar Bear Rim," "Australian Outback," "Monkey Trail," etc. – at a leisurely pace of perhaps three or four exhibits per visit. (The average zoo visitor must try to see everything in a single grueling day; an impossible task!)

Like other major operations, the San Diego Zoo (and its satellite facility the San Diego Wild Animal Park) uses UHF radios to help carry out its many daily functions. Those zoo staff members observed on the grounds, keepers, veterinarians, tour guides, gardeners and maintenance people, etc., all seem to have radios clipped onto their belts.

The zoo's radio frequencies are listed in the 3rd Edition of Scannerstuff's *Southern California Frequency Directory* and I have all of them entered into a dedicated bank in my trusty BC 100XLT handheld scanner. As a part of our regular visits, we always make it a point to find a bench in one of the zoo's less-frequented areas and take a 30 to 60 minute break. My wife usually brings along a book to read, and I will monitor the zoo's radio frequencies, listening in on what's going on "behind the scenes."

The zoo's two busiest frequencies are 453.3500 MHz (Animal Services) and 461.5000

MHz (Grounds Maintenance). About 30 minutes worth of listening and a general knowledge of the zoo's various animal exhibits were sufficient to make sense of how the radio call signs are organized. Call signs for radios on the Animal Services frequency, for example, include a reference to the animal exhibit that a radio is being used in: Flamingo, Panda, Sun Bear, Reptile, Zebra, Children Zoo, Rhino, Koala, etc. The call sign for the zoo's animal hospital includes the reference Hospital. Call signs for veterinarians include the reference Medical.

Tour guide call signs include the reference Education. On the Grounds Maintenance frequency, the call signs include a reference to the occupational specialty that a radio is being used in: Water, Electric, Plumber, Horticulture, etc. (I've heard well over 50 different call sign references since I first starting monitoring the zoo's radio traffic!) The zoo's radio call signs will also include a number to identify a particular individual: Panda-6, Electric-2, Sun Bear-3, Horticulture-7, Zebra-1, Polar-12, etc. (Individuals whose numerical designation is "1" are apparently the supervisors or senior people, since they seem to be the ones who are most often being summoned to or reminded of staff meetings!)

Increased zoo attendance on weekends and holidays invariably causes an increase in radio traffic on the Security and Transportation frequencies. Many of the Security calls involve lost children or fatigue-related medical cases. The Transportation calls usually involve scheduling extra tour buses or providing shuttle service for handicapped visitors or those too tired to do any more walking.

BUSY DAY AT THE ZOO

As jotted down in my field notebook, here is a typical sampling of the voice communications that were heard while monitoring the San Diego Zoo's radio frequencies:

- An electrician was summoned to turn on the heat at the orangutan exhibit.
- Education-1 informed Eduation-3 that a party of VIPs would be taking a special bus tour of the zoo and that the "Chicken Bus" (so named because of its colorful paint job) would not be needed.
- Security-Base informed all units that a black Labrador "working dog" was on the zoo grounds.
- Someone from Maintenance was summoned to the zoo's main entrance to clean up a "liquid spill" by turnstile 5.
- Someone in Mammals was informed by the Hospital that their porcupine was ready to be picked up.
- Security-Base was informed that an unattended

satchel or bag was observed in the tour bus unloading area. Security-Base responded that someone would check it out immediately.
- Bird-1 identified her location as Flamingos.
- Medical-2 inquired about the status of a koala that had been experiencing some sort of eye ailment. A koala keeper responded that the eye was still a little cloudy, but that the koala was eating well and acting normal.
- Security-3 informed Security-Base that the unidentified bag in the bus unloading area belonged to one of the children who had just taken the Spanish (language) bus tour and that the child was being escorted to Lost & Found to reclaim it.
- Someone from Water was requested to help locate a water line prior the commencement of digging somewhere on the zoo grounds.
- The driver of one of the zoo's express buses reported a lost child by the kangaroo exhibit. Security-Base requested that the driver remain with the child until someone from Security could arrive.
- Someone at the Hospital inquired about the dimensions of a New Guinea Wild Dog shipping crate.
- All units were informed by Security-Base that the lost child had been reunited with its parents.
- Sun Bear-7 scheduled a welder to check on the door to the one of the sun bear "bedrooms" (where the sun bears are kept while their exhibit is being cleaned.)
- A zoo volunteer reported that the Monkey Trail elevator (used to carry visitors down one level to the Tiger River Trail) appeared to be having mechanical problems.
- Security-Base reported this to Garage-Base (which is apparently responsible for maintaining the zoo's mechanical equipment.)
- Panda-3 arranged with Hospital-3 for someone to come by and check on a Musk Deer.
- Medical-2 informed the Hospital that she would be taking an early lunch so that she would be back in time to help with a medical procedure involving one of the pandas.
- Garage-Mobile reported to Garage-Base that the Monkey Trail elevator had been adjusted and was now working properly.
- Rhino-1 asked one of the electricians about borrowing a hot wire tester to check out one of the rhino exhibit's electric fences.
- A tour bus about to ascend the steep and narrow "Polar Hill" located at the back of the zoo was asked to wait for another vehicle that was descending.
- Sun Bear-1 was reminded by Sun Bear-7 about an upcoming meeting at the Mammal Office.
- Giraffe-1 was informed that the ETA of a special tour group would be within 5 minutes.
- Odyssey-12 informed Medical-2 that Cookie (one of the zoo's elephants) was in the special needs enclosure and asked that she stop by to examine one of Cookie's rear toenails.
- Condor-1 informed someone that a truck was needed for an airport run.
- The driver of one of the carts used for special VIP tours asked Bus-Base for permission to load her passengers and then depart via the

- by-pass road used by the tour buses.
- Medical-2 informed Rhino-1 that she had just finished looking at Cookie the elephant and was on her way to look at a rhino as per an earlier request.
- Panda-1 was informed that a bundle of bamboo (used for feeding the pandas) would be delivered shortly.
- Nutrition-1 gave Zebra-1 information regarding a change in diet for one of the zebras.

Zoo and Radio Legacy

San Diego is certainly not the only place where one can monitor zoo radio traffic. Most major U.S. cities including Philadelphia, Cincinnati, Chicago, Detroit, New Orleans and Los Angeles (not to mention Disney's Animal Kingdom in Orlando, Florida) have large, state-of-the-art zoos that attract millions of visitors annually. A little research through the radio frequency directories published for various U. S. cities and geographical areas should provide you with the frequencies used by the zoo closest to you.

If you are one of those people who like to take their scanners along with them while on vacation, chances are that there will be a zoo located close to where you will be staying. Once again, a little research should provide you with its radio frequencies.

The ideal way to monitor zoo radio traffic is to bring your scanner along with you during a family outing to the zoo. But, you don't necessarily have to be inside a zoo's grounds to hear its radio communications. I can monitor the San Diego's Zoo's frequencies, for example, from locations several miles away. One of my alternate zoo "listening posts" is a shopping center five miles or so to the north of the zoo's location. Sometimes while my wife goes shopping, I will bring along my scanner and listen in on the zoo's radio communications to find out what's going on there.

If you are interested in animals, or are considering a career in zoology, biology, veterinary medicine, or even zoo-keeping, monitoring zoo frequencies is a great way to get a feel for the day-to-day operations of a modern zoological facility.

The San Diego Zoo was founded in 1916 largely through the efforts of Harry M. Wegeforth, a local physician who loved animals and who felt that San Diego should have its own zoo. Because of his medical background, Dr. Wegeforth was keenly interested in the health and well being of the zoo's hundreds of birds, mammals and reptiles. In 1927 the zoo opened its own biological research laboratory, to study the nutritional, parasitic and infectious diseases of wild animals.

Today, the San Diego Zoo is recognized as one of the world's leading centers for the research that is helping to conserve dwindling wild animal populations. At present, it has on-going field programs in 35 different countries involving some 235 researchers. VHF radio plays an important part in these projects because of its extensive use in a research methodology referred to as telemetry or the recording of data from a transmitter circuit to study the movements and behavior of animals in the wild.

In the spring of 2011, for example, the San Diego Zoo relocated 36 desert tortoises equipped with VHF radio transmitting devices (referred to as tags) to an area outside of Las Vegas. These tags, as well as similar devices hidden inside tortoise dens, relayed temperature and humidity readings back to the researchers, who are using this data to determine those locations where desert tortoises have the greatest chance of surviving in the wild.

RF-tagged desert tortoise is set free in the desert. (Courtesy: San Diego Zoo)

Telemetry Technology Today

VHF telemetry got its start in the early 1960s when radio transmitters and batteries became small enough so that they could be attached to animals – mammals, birds, reptiles, and even fish – without hindering their natural movements. (This is especially critical for studies involving highly mobile animals.)

Even though newer technologies exist that are superior to the capabilities of VHF telemetry, the equipment remains popular with researchers, since the techniques are well established, the equipment is relatively inexpensive and will work with animals of many different sizes, and because a number of analysis programs already exist that can process the data collected. Another reason VHF radio telemetry remains popular is because the transmitters can remain active for extended periods.

A VHF radio tag consists of a circuit board and crystal oscillator, a transmission antenna, a battery or battery with solar cells, and an attachment device such as a collar or harness. In fitting an animal with a tag (referred to as radio tagging) the standard rule of thumb is that the tag should not exceed three to five percent of the animal's body weight. Today, miniature tags (some no heavier than 0.6 grams) are available for studies involving even the smallest of animals. Much of a tag's weight is usually taken up by the power source. Large animals can be fitted with tags having batteries big enough to last for years, while

small animals must be fitted with tags having a battery that might only last a few weeks.

Mammals are usually fitted with tags mounted into a neck collar. Ducks and larger flying birds are fitted with tags inside backpack-equipped harnesses that minimize contact with their wings. Glue-on tags are also used for some species. Many of these collars, harnesses and adhesive mounts are designed to eventually wear out and drop off the study animal.

VHF telemetry tags used for locating and tracking study animals typically emit simple beeps. In situations where multiple transmitters must share the same frequency, coded tag systems send out a pulse code burst that identifies individual tags. (Such systems require special receivers that can decode and log individual tag detections to memory.)

Some tags also incorporate a chip that can store data, which will later be downloaded to a computer for analysis. VHF telemetry tags with data storage chips were used by the San Diego Zoo during a research project involving owl monkeys from northern Argentina's Gran Chaco rain forest. Not only did the tags allow researchers to track the whereabouts of 110 individual monkeys, but they also recorded each monkey's activities for a period of six months.

Telemetry tags usually have some sort of protective layer referred to as potting. Tags that are susceptible to being chewed will have heavy potting, while the tags used for small birds, for example, will be lightly potted to keep their weight down.

The size and configuration of the VHF antennas used to monitor transmissions from radio tagged animals are usually determined by the need for directional accuracy and the terrain of the study area. First and foremost, the antenna must be tuned to the range of frequencies that are being used in a particular study. For example, a study involving 40 radio tagged animals might have a defined frequency range of from 152.000 MHz to 152.400 MHz to keep a standard 10 kHz spacing between the frequencies of all 40 tags.

The size of the antenna is usually based on the distance between the study animal and the receiver or data-logger. The configuration of an antenna is based on the information that is needed. A basic omni-directional antenna is sufficient for determining if a radio tagged animal is in the vicinity. Multi-pronged and tuned loop antennas (the ones used most frequently) provide information as to the direction of a radio tagged animal. Directional antennas that can be folded up to fit into a backpack are popular with observers who must follow a study animal on foot.

Larger, multi-element antennas, while extremely accurate for determining the direction of a study animal, must usually be mounted on the roofs of vehicles or on towers, making them impractical for certain field situations. Fast-moving and far ranging animals are often tracked using aircraft, which can cover vast amounts of territory in relatively short periods of time.

The VHF receivers used in telemetry include everything from simple hand-held radios to sophisticated devices with built-in computers and automated recording devices. Some telemetry receivers have scanning and logging capabilities so that the movements of several animals can be

tracked for extended periods.

Once again, a prime consideration is that the receiver used by the researcher or observer is tuned to the frequency of the study animal's transmitter. (A tag's frequency is usually assigned at the time of manufacture.)

The transmissions coming from radio-tagged animals can be used in several different ways. Just knowing if an animal is present within the reception range can, for example, be useful for determining migration routes. By listening for a gain in signal strength, field observers can use VHF transmissions to guide them directly to a study animal. Working as a team, two or more field observers can pinpoint the location of a study animal using triangulation – taking multiple bearings on the signal and then mapping the point where those bearings intersect. Software is even available that allow animal locations to be plotted in the field using mobile devices.

Signals sent by VHF telemetry tags can travel great distances, but can also be blocked

VHF transmitter on this kangaroo rat helps scientists study its movements. (Courtesy: San Diego Zoo)

by mountains, hills, and even thick vegetation. Signals can also be reflected off hillsides, cliffs or valleys. (A reflected signal can actually lead an observer *away* from a study animal!) In order to establish "line of sight" radio contact with study animals, observers will often listen for signals from hilltops or observation towers. Aircraft are used for monitoring animals in particularly rugged terrain.

The increased use of personal wireless devices in recent years has made the detecting of VHF telemetry signals increasing difficult in some of the more urbanized areas. To help overcome this, telemetry equipment manufacturers have come up with filtering devices that remove

California condor takes flight with transmitter-tagged wing. (Courtesy: San Diego Zoo)

some of the interference caused by wireless devices.

For those of you who like to use your scanners while in remote wilderness areas, that unidentified VHF signal you might happen to encounter could be coming from some radio-tagged animal! Although I'm unaware of any specific laws regarding the monitoring of VHF telemetry transmissions, common sense (not to mention common courtesy) suggests that they should be treated as one would treat a police, fire or emergency call: listen, but don't try to approach or interfere. Using a gain in signal strength, for example, to search out some unknown radio-tagged animal could very well compromise the scientific integrity of a research project and also put you at personal risk if that animal happens to be a dangerous one.

If you are determined to see wild animals up close, plan on visiting the zoo nearest you, and don't forget to bring along your scanner!

SUGGESTED READING

Life at the Zoo by Phillip T. Robinson. (A former San Diego Zoo veterinarian shares some remarkable and entertaining experiences from a career spent working with zoo animals.)

Wildlife Telemetry: Remote Monitoring and Tracking of Animals by Priede and Swift. (One of the standard reference works on using VHF radio telemetry in wildlife research.)

MT

Remote Digital Mode Operating from (almost) Anywhere!

By Dave Granoff K3AS

One of my favorite radio pastimes is operating the digital modes from remote locations using my radio station at home. I am able to operate the home station remotely from a portable laptop, iPad, or iPhone which has a wireless Internet or Local Area Network (LAN) connection. It is a pleasure to simply power up the device, click the screen's software icon or app, enter a password and spontaneously connect to my home computer. When I am using a proper Internet connection, I can access my home station remotely and get on the air anytime, from almost anywhere, without having to re-adjust Internet connections, configure IP addresses, or attach external equipment.

The concept of remotely controlling a radio station is not new. I got the idea to operate digital modes by remote control several years ago after watching the kids at home texting their friends through smartphones. Even though the SMS technology used for texting is different, the idea was the same. I wondered why we couldn't communicate with the digital modes by entering data into a remote access device that would initiate message exchanges through radios.

My desire became reality. Now, several companies offer remote control apps for smart-devices and software for computers that can be used to control distant devices. It is easy to try out these products and explore individual applications for yourself. And, they are free (for the basic versions) and easy to use.

Fortunately, as in the case of texting, audio is not necessary to decipher the digital modes. Digital audio transmissions sound like many random musical tones. Software is used with a dedicated sound card to encode or decode the tones that carry transmit and receive text. To operate a digital radio program like JT-65HF, you just need to "read" and "write" text in the appropriate boxes, click a few settings, and the digital program will do the rest.

Basic digital mode operations, whether performed at the station or remotely, rely mainly on keyboard entries and cursor clicks to command the radio-software interface. When the radio is turned on and tuned to an appropriate digital mode frequency, it is usually "parked" there for the duration of a session. Some digital software, DM-780 for example, contains a cursor-controlled bandpass tuner that can tune in PSK stations by clicking on characteristic visual tracings displayed on the waterfall.

Some of the remote control challenges that face the amateur for other modes include distor-tions of streaming audio and delays in Internet data delivery. The distortions and delays, or latency, occur because of data volume limitations and slow transfer speeds that are inherent to certain carrier lines. Both can severely hinder CW and SSB copy to the point that two way contacts in these modes may not be possible. Skype and other VOIP platforms are often used separately to handle the audio circuits, but clear sound requires exact settings for each computer's sound card and fast Internet speeds on both ends. Latency is often unpredictable and can become a major distraction during busy Internet volume times or when trying to access the Internet in certain areas.

Almost all of the major amateur radio transceiver manufacturers now offer radios that utilize proprietary remote control software for remote SSB and CW operations. These radios and programs work very well and are reliable. Unfortunately, corresponding smart-device apps for remote control remain rare. Fully functional stand-alone units are also offered by several companies such as Timewave Technology, Inc. (Hamlink Wireless and USB Remote Control) and Remote Rig (1258 MkII-radio) which can be used with various radios. But, in either case, in order to operate the digital modes by remote control, you still have to have visualization of the home station's digital software screen in order to operate.

LogMeIn to the Rescue!

The LogMeIn application is easily capable of visualizing and controlling a station's favorite digital modes software screens from a variety of remote devices. I use it to command my home station's digital programs which include: Ham Radio Deluxe and DM-780 for PSK, RTTY and Olivia; MMSSTV for Slow scan TV; JT-65HF for JT-65A, and UISS software for ISS 2 meter FM packet. With LogMeIn, I can visualize the "host" computer's program, type in transmitting data, and activate CAT buttons, radio Push-To-Talk (PTT), and tuning.

Through a wireless LAN home router, a LogMeIn-enabled device can effectively become a remote digital mode ham station anywhere around the house and will function as if sitting directly in front of the "real" one. Control from a remote device is tethered by the extent of the home router's signal which can extend to a few hundred feet. I can make wireless QSOs while sitting in my kitchen, while watching TV in the living room, and while lounging outside on my deck.
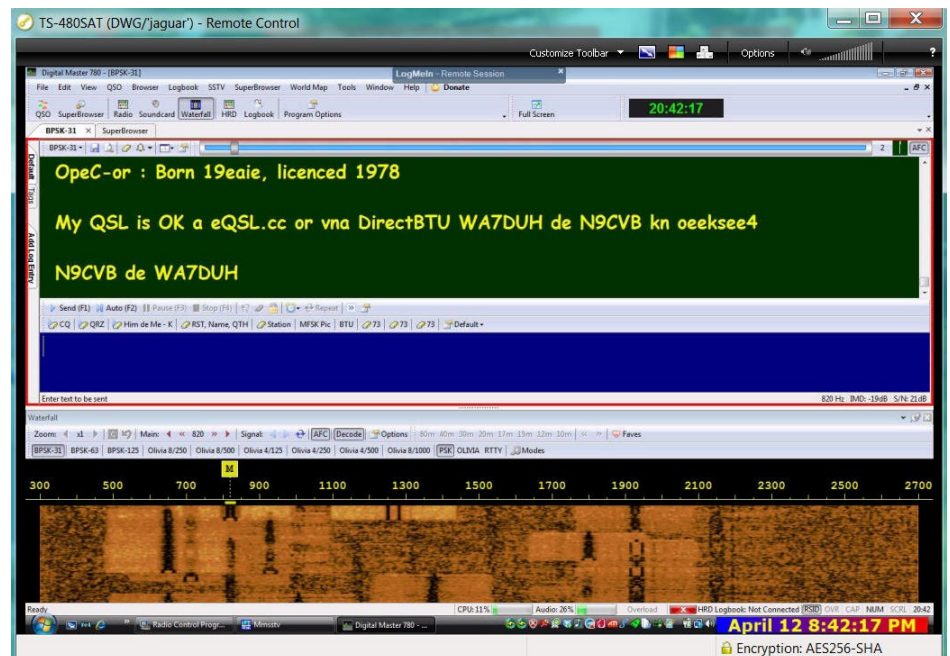
It's hard to tell the difference when operating PSK from the station screen or the remote screen - the images and commands are almost identical. And, when working remotely through a local network around the house, there is very little latency.
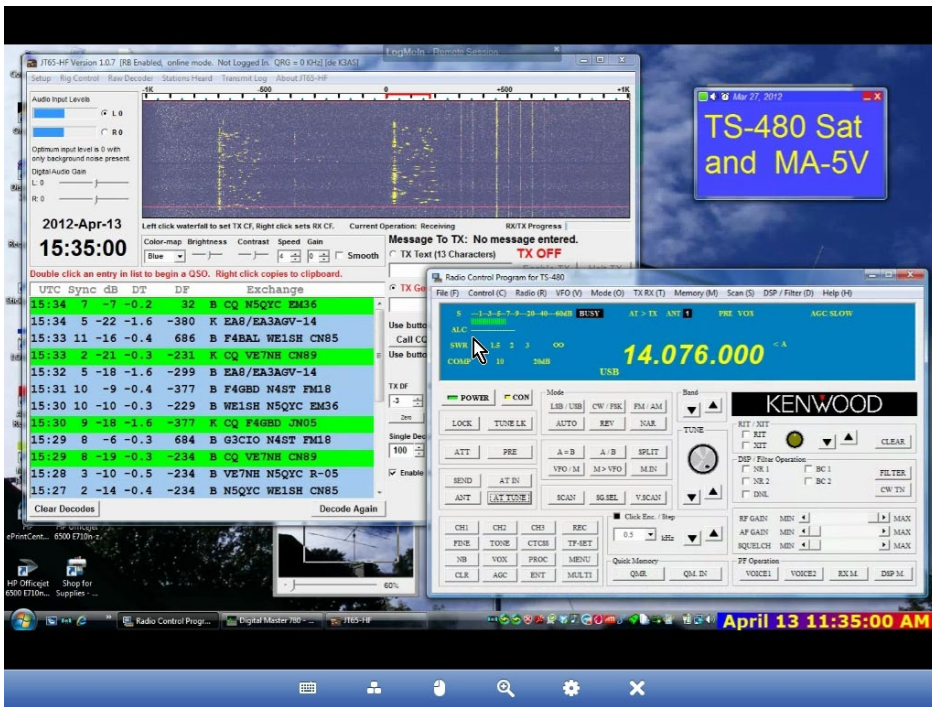
This screenshot shows LogMeIn remotely controlling JT-65HF software which is interfaced to a Kenwood 480 SAT radio and MA5-V antenna. All programs can be run from the iPad's touch screen over a wireless (local) or Internet (distant) connection. Various finger gestures allow the user to zoom in and pan fields of interest, move windows, and emulate right/left cursor commands.

With cable Internet connections I can access my station from faraway places whenever I want. I am able to make digital mode contacts from any location that delivers reliable Internet speed – at the airport, in a hotel, at a restaurant, or while vacationing away from home – even at 5a.m. in the morning and half asleep if I want to!

How is it possible and why do I need to use remote control at five in the morning? Remote control access is quick and mostly automatic, so I don't even have to get out of bed to gather equipment, set it up, or remember complicated pass codes to initiate connections.

I made a 5a.m. remote control contact to the International Space Station (ISS) digipeater several weeks ago while I was out of town on vacation using only my iPhone from a hotel room. There are only a few minutes a day when ISS contacts are possible and the orbital pass times are always changing – so my schedule has to be flexible.

I knew in advance that 5a.m. was the best time of the day to access the ISS from my home station. The message I wanted to send was intended for the digipeater's packet mailbox and would be digitally stored on board for retrieval by a fellow ham in Europe later that day.

I set my alarm, woke up just in time and successfully made the contact to the digipeater. It was accomplished easily and silently while still in bed, using the LogMeIn "Ignition" app. While everyone else was sleeping, my phone was controlling the home computer's UISS packet software screen through its wireless connection. It went through the hotel's local router, crossed the Internet, and successfully engaged the radio.

Enough about the Concept … Let's get Started!

LogMeIn (www.logmein.com) is the program that does all the work. It is used worldwide for business and private applications and enables the user to securely log on and access designated host computer as if you are seated in front of and controlling it directly. I do not own investments in or work for the company, nor do I seek to endorse or promote them, other than to say that their applications work very well for this purpose. Other equally impressive products are available from other reputable software companies including GoToMyPC, Banckle, Teamviewer, and more. Most offer free versions, which are suitable for many users. Paid applications offer additional options such as streaming audio over Internet, FTP, file transfers, etc.

LogMeIn works seamlessly over popular computer platforms (PC/Mac), multiple browsers (Internet Explorer, Firefox, etc) and mobile platforms (iOS, and Android, but not Blackberry – yet). The software is free to download and must be installed in both the remote "client" (in front of you) device and "host" (at home) computer. Instructions are easy to follow and installation is very intuitive. One client device is capable of accessing multiple host computers as long as software is installed in all of them. As with many other software installations, you may be asked to change firewall permissions or make antivirus adjustments during the configuration process. Data access is protected by encryption and a secure password.

Products are offered for the computer, iPad, iPod, iPhone, and Android phones in free and paid versions. "Ignition" software can be purchased by subscription for computers and as a one-time cost

for the app. Ignition supports live audio, and stores passwords automatically for faster computer access. Downloading the ignition version to a USB drive will make the client function available for use on other computers. Tech support is available in all cases if firewall or other connectivity issues arise.

When using the application between computers, the host computer screen (at the radio) looks and behaves as if it is actually in front of the operator. The mouse functions are virtually the same; you'll experience only a slight delay in command implementations. But when using smaller devices like the iPad, iPod, or smart phone, it takes a few minutes of practice to get used to cursor navigations by touch commands instead of a mouse.

Digital modes easily lend themselves to remote operation. I suggest creating a few customized message shortcuts, called "macros," that can be stored in the digital mode's software. They will minimize the need for extra typing and will make data entry faster and more efficient. Messages can be created in the "templates" section for PSK, JT-65A, SSTV, and UISS packet. With a few clicks of the mouse (or finger taps) these macros can be called up and sent. Operating is also made a little easier if you have access to a mini wireless keyboard to make phone or iPad entries.

To get the most out of remote operations, you should plan a strategy before leaving the host station behind. It is a good idea to decide what band or bands will be used to configure the antenna settings. Remote antenna tuning or band changing may not be possible unless your radio has a built-in automatic antenna tuner that can be activated from CAT software. As a safety measure, I prefer to turn my transceiver off between unattended periods and some radios, Kenwood and HRD for example, will support on/off settings through CAT control software.

What else can be controlled remotely?

All of my home's host computer's files and folders can be accessed and controlled by LogMeIn. Data can even be transferred between devices if both the host and remote have installed software versions to support that feature. I use the Ignition version, (which streams audio) and listen to shortwave stations from my home computer. I use my Flex 3000's software receiver at home to tune in activity on the HF frequencies, and watch my home cable-TV's local-only programming. I frequently log-in from my phone to check my computer's wireless videocam which I use for surveillance around the house.

The possibilities are many. Most importantly, though, LogMeIn provides a way for me to operate the digital modes by remote control so that I can enjoy this fantastic aspect of my amateur radio hobby wherever I go.

About the Author:

Dave Granoff K3AS holds an Amateur Extra license and has been a radio amateur for 46 years. He is currently president of the Fulton Amateur Radio Club W2CXV in Fulton, New York, and has written several feature articles for Monitoring Times. His website is www.k3as.com

SCANNING REPORT
THE WORLD ABOVE 30MHZ

Dan Veeneman
danveeneman@monitoringtimes.com
www.signalharbor.com

Responding to Reader Requests

This month we jump right in and answer some questions from the mailbag.

❖ Bayville, New Jersey

Dear Dan, I love to listen to police radios and had done it in the past at home and in the car. I live in Bayville, New Jersey, which may be listed under Berkeley Township, New Jersey. From what I've been told, they have either gone digital or joined the Ocean County, New Jersey trunked system. Can you answer that question and recommend a home scanner that will allow me to listen in again? If possible, I would also like you to include the fire and first aid frequencies as well.

Thank You, John in Bayville

Bayville is an unicorporated area within Ocean County, New Jersey with about 17,000 residents. It is at the northern end of the Pine Barrens, a dense forest in the southern part of the state. Berkeley Township is a 56-square-mile coastal township with more than 40,000 residents located about 60 miles due east of Philadelphia.

The Berkeley Township Police Department can be heard on four frequencies in the 800 MHz band. They have been using APCO Project 25 digital standards since 2007, so you will need a digital-capable scanner to hear them. Note that some activity is encrypted, so even with such a scanner you won't be able to hear everything.

These frequencies are transmitted from two locations in Bayville. The first is at 627 Pinewald Keswick Road next to the township offices, from a tower behind the center parking lot. The other is at 252 Atlantic City Boulevard (U.S. Route 9), set back from the road behind Jersey Rents.

Frequency	Description
854.1125	Berkeley Township Police 4
854.2125	Berkeley Township Police 3
854.3875	Berkeley Township Police 2
854.5125	Berkeley Township Police (Dispatch)

Ocean County operates a Motorola Type II trunked radio system carrying voice activity in both analog and Project 25 (P25) digital formats. The system transmits from a number of locations, including two in Toms River, two in Barnegat, and one each in Jackson Township, Lakewood, New Egypt, Tuckerton and Whiting.

The Federal Communications Commission (FCC) license database shows a number of frequencies licensed to the County for this system, all of them in the old VHF television band. These frequencies are **506.0625 (Lakewood only), 506.6125, 506.6375, 506.6625, 506.6875, 506.7125, 506.7375, 506.7625,** 506.7875, 506.8125, 506.8375, 508.0625, 508.0875, 508.1375, 508.1625, 508.1875 and 508.4375 MHz.

There are also a block of frequencies licensed for use from the Ocean County courthouse complex in Toms River: 509.6125, 509.6375, 509.6875, 509.7125, 509.7375, 509.7625, 509.7875, 509.8125, 509.8375, 511.0625, 511.0875, 511.1375, 511.1625, 511.1875 and 511.4375 MHz.

Talkgroups on the system, nearly all of which have voice activity in analog format, include:

Dec	Hex	Description
32	002	Disaster (Interoperability)
64	004	Public Safety (Interoperability)
96	006	County Public Works
128	008	County Police (Interoperability)
160	00A	County Office of Emergency Management 1
192	00C	County Office of Emergency Management 2
288	012	County Police (Dispatch North)
320	014	County Police (Dispatch South)
352	016	County Police North (Car-to-Car)
384	018	County Police South (Car-to-Car)
416	01A	County Police (Tactical 1)
448	01C	County Police (Tactical 2)
512	020	County Police (Dispatch Central)
544	022	County Police (Dispatch West)
800	032	Sheriff (Dispatch)
832	034	Sheriff 2
864	036	Sheriff 3
896	038	Sheriff 4
928	03A	Monmouth-Ocean Hospital Service Corporation (MONOC)
960	03C	Sheriff (Radio Shop)
992	03E	Sheriff (Car-to-Car)
1312	052	County Prosecutor 1
1344	054	County Prosecutor 2
1376	056	County Prosecutor 3
1408	058	County Prosecutor (Task Force)
1824	072	County Corrections
2336	092	County Parks and Buildings Security
2368	094	County Security (Administration)
5920	172	County Detective 1
5952	174	County Detective 2
9504	252	Roads (North)
9536	254	Road Paving
9568	256	Roads (South)
9600	258	Roads (Administration)
10016	272	Bridges
10528	292	County Engineering
10560	294	County Engineering (Administration)
10624	298	Mail Service
12576	312	County Parks
12608	314	County Parks (Administration)
13088	332	Solid Waste Management
13344	342	County Administration
13600	352	Ocean Ride County Transit
14112	372	County Building and Grounds
16672	412	County Vehicle Services 1
16704	414	County Vehicle Services 2
20512	502	County Fire Zone 1 (North Central)
20544	504	County Fire Zone 2 (South)
20576	506	County Fire Zone 3 (North)
20608	508	County Fire Zone 4 (West)
20640	50A	County Fire Zone 5 (South Central)
20672	50C	County Fireground 1
20704	50E	County Fireground 2
20736	510	County Fireground 3
20768	512	County Fire Coordinators
20800	514	County Fire Marshal
24608	602	County Emergency Medical Services Zone 1
24640	604	County Emergency Medical Services Zone 2
24672	606	County Emergency Medical Services Zone 3
24704	608	County Emergency Medical Services Zone 4
24736	60A	County Emergency Medical Services Operations
24768	60C	County Emergency Medical Services Coordinators
35264	89C	County Prosecutor
35328	8A0	County Prosecutor

Conventional (non-trunked) analog activity in the area includes the following:

Frequency	Description
45.760	Public Works
153.815	Bayville Emergency Medical Services
155.775	Sewer Authority
461.350	School Buses

Although Berkeley Township uses Project 25 digital standards, it is not a so-called "pure" P25 system because it does not use a P25 control channel. What this means for hobbyists is that any scanner with digital capability can monitor this system, not just the latest and greatest. An older, used model with a smaller price tag will work just as well, so the choice may come down to personal preferences as far as handheld versus a larger mobile or base unit, ease of programming, and so on.

❖ Santa Fe, New Mexico

Hello Dan, I have a question about a Uniden scanner model # BC95XLTB. This scanner has 800 MHz to 956 MHz capability but is not trunked. Police frequencies in Santa Fe New Mexico are 855 MHz thru 860 MHz Trunked Motorola Type 2. Will this scanner possibly pick up these frequencies?

Thank you for your time, Ben

The Uniden BC95XLTB is advertised as "NASCAR Bearcat" and is a handheld 200-channel scanner with a retail price of about $120. As Ben says, it can scan in the 800 MHz band but it does not follow trunked conversations. The letter "B" at the end of the model number refers to a packaging option – the hardware is identical to the BC95XLT.

Hidden Feature

The 95XLT model has an interesting hidden capability (technically a test mode) that allows it to operate as a frequency counter. In this mode, the scanner displays the frequency from the "close call" feature.

1. Be sure the scanner is off.
2. Press the [Hold], [0] and [3] keys.
3. While holding those keys, turn on the scanner

The scanner will display the frequency of the strongest signal in a specific band. To change bands, use the [Up] and [Down] arrow keys. To exit this mode, simply turn off the scanner. When you turn it back on it will be back in normal operation.

Santa Fe's Motorola Type II system operates on the following frequencies: 855.2125, 855.4875, 855.9625, 855.9875, 856.2375, 856.9875, 857.2125, 858.2125, 859.2125, 859.2375, 860.2125, 860.4875 and 860.7125 MHz.

Program all of these frequencies into one of the memory banks. You'll want to lock out the channels that carry only control data, most likely 857.2125 and 859.2125 MHz. Keep in mind that the control channel may change from day to day or week to week as the system operator tries to spread the wear and tear of constant operation among transmitters.

If you do manage to get a hold of a trunk-tracking scanner, here are some talkgroups:

Dec	Hex	Description
48	003	Police (Dispatch)
80	005	Police 2
112	007	Police 3
144	009	Police 4
176	00B	Police 5 (Records)
208	00D	Police 6
240	00F	Police 7
272	011	Animal Control
336	015	Santa Fe Police King Tactical
1584	063	Police (All Call)
1616	065	Fire (Dispatch)
1648	067	Fire (Bravo Channel)
1680	069	Fire (Charlie Channel)
1712	06B	Emergency Medical Services
1744	06D	Fire Prevention
7248	1C5	Santa Fe Trails (Transportation)
7280	1C7	Santa Fe Trails (Transportation)

Conventional Scanning

That little NASCAR scanner will tune to the individual system frequencies just fine; it's more a matter of what is on those frequencies when the scanner tunes to them. Because the scanner does not have the ability to understand the instructions flowing on the control channel, all it can do is scan each of the frequencies, in the order in which they are programmed, and stop on one that has activity. When the activity is complete, scanning resumes. This is normal conventional scanning.

Remember that trunking shares the same set of frequencies among a large number of disparate users. A conversation between two users may occur on any of the voice frequencies in the system. Which specific frequency will depend on what other users are doing.

Imagine that Alice wants to communicate with Bob on a trunked system. She presses her push-to-talk switch and the system assigns frequency number 1 to her. When she releases her switch, the system places frequency 1 back in the "available" pool of frequencies. Now imagine that Charlie wants to use the system and he presses his push-to-talk switch. Since frequency 1 is available, the system assigns it to Charlie and he starts talking. In the meantime, Bob finally wants to answer Alice and presses his push-to-talk switch. The system cannot assign frequency 1 to Bob because Charlie is using it, so it assigns frequency

2. Bob then answers Alice on frequency 2 at the same time Charlie is talking on frequency 1.

If you were scanning the system with a conventional scanner, it would be stuck on frequency 1, where you would hear Alice and then Charlie. You would miss Bob's answer because you were listening to Charlie.

So, if you try to scan a trunked system with a non-trunking scanner (like the BC95XLTB), you will probably hear transmissions from several different conversations but miss any sense of continuity. This can be confusing and ultimately frustrating, since you may hear a question but not the response, or vice versa.

I would recommend trying it on a quiet morning sometime, when there is relatively little activity. This will give you an idea of whether you find it interesting and useful.

❖ Eastern Alabama

Hi Dan, I wanted to ask you what I might need to do differently or in addition to make my radio room a more complete listening station. I'm an old newspaper guy and have been listening to scanners since high school. I still have an old crystal controlled Bearcat and it works well if you can believe it.

I enjoy listening to all sorts of voice traffic and have scanners set up to cover different bands. I have a Radio Shack 528 that has about 400 frequencies programmed in to listen to local law enforcement, 2 meters, 440 and 220 ham as well as a few 10 meter repeaters. It runs on an external Radio Shack antenna that works remarkably well mounted on my roof. I have a Yupiteru MVT 7100 that I just keep in search mode throughout its range. I also have some RaceScans that cover a single band in search mode for law enforcement, ham bands and so on. I keep two more for travel. They are inexpensive enough to have several.

This combination allows me to listen to nearly all law enforcement in three counties, Lee, Macon and Chambers in Alabama. Only Opelika has gone to digital trunking. I would also like to listen to Alabama State Troopers but can't find anything on them. Do you have any suggestions? Is it possible to listen in to Fort Benning transmissions or are they all digital and encrypted? I also have all of the local aviation frequencies programmed in all scanners. If possible I'd like to listen in to the feds but suspect they are all encrypted. Maybe Alabama Bureau of Investigation, and other federal agencies that may be operating in the area.

On the transmit side, I have a 10 meter Radio Shack transceiver, several single and dual band HT's and mobile units so I'm covered there except for an HF rig. I enjoy your column in Monitoring Times, one of the first that I read. The number of signals flying around is beyond mind boggling, I don't know how the feds keep up with it all. Thanks for all your good work.

Rick in Auburn

Lee County is located in the east-central part of Alabama, on the border with Georgia. Although the county seat is Opelika, the largest city in Lee County is Auburn, home to Auburn University. All told, the county has about 140,000 people, with

more than a third residing in Auburn. Chambers County is just to the north of Lee County with about 35,000 residents. Macon County is just to the southwest with about 21,000 residents and is home to the town of Tuskegee, made famous by Moton Field where the Tuskegee Airmen of World War II were trained. All three of the counties, each covering roughly 600 square miles, are mostly rural and lightly populated.

Lee County, Alabama

Frequency	Description
151.1150	County Emergency Alert System
152.4050	Sheriff (Tactical West)
152.4350	Auburn University Security
154.0325	Auburn University Security
154.4000	Auburn Fire (Dispatch)
154.5150	Auburn University Coliseum
154.7100	Sheriff (Car-to-Car)
154.7400	Sheriff (Dispatch)
155.0250	Auburn Department of Public Works
155.1450	County Fire (Dispatch East)
155.6100	Auburn Police (Dispatch)
155.7150	Sheriff (Tactical East)
155.7450	Auburn Police (Tactical)
155.8950	County Emergency Medical Services (Dispatch)
156.0000	Auburn Department of Public Works
159.1650	County Fire (Dispatch West)
159.5175	County School Buses
453.1625	Auburn University Facilities
453.3250	Auburn University Athletics Operations
453.4375	Auburn University Facilities
453.6875	Auburn University Facilities
460.0375	Auburn University Facilities
460.1000	Auburn University Facilities
460.2750	Auburn University Facilities
460.6375	Auburn University Facilities
461.9500	Auburn University Airport Operations
463.8750	Auburn University Operations
464.4250	Auburn University Operations
464.6750	Auburn University Operations

Opelika, Alabama

The City of Opelika operates a Motorola Type II system with both analog and digital voice traffic. Frequencies of operation are:

854.0375, 854.3875, 854.4875, 854.6375, 854.7875, 854.9375, 855.0375, 855.1875, 855.4125, 855.4625, 855.7375, 855.9625, 856.1875, 856.2125, 856.4875, 856.7375, 856.9125, 857.0375, 857.2125 and 857.4875 MHz.

Dec	Hex	Description
8400	20D	City Hall (Dispatch
8432	20F	City Hall (Administration
9648	25B	Power Services (Dispatch)
9680	25D	Power Services (Administration)
9712	25F	Power Services
9744	261	Power Services (Command)
11216	2BD	Public Works (Operations)
11248	2BF	Public Works (Dispatch)
11280	2C1	Public Works (Administration)
11312	2C3	Public Works (Groundskeepers)
11344	2C5	Solid Waste
11376	2C7	Street Department
11408	2C9	City Garage
11440	2CB	Building Codes
11472	2CD	Public Works (Maintenance)
12848	323	City Engineer
12880	325	Wastewater Treatment
14512	38B	Utilities (Water Administration)
14576	38F	All City (Interoperability)
16016	3E9	Storm Response 1
16048	3EB	Storm Response 2
16080	3ED	Storm Response 3
25648	643	Police (Dispatch)
25744	649	Police (Detectives)
25776	64B	Police (Vice)
25808	64D	Police (Canine Unit)
25840	64F	Police (SWAT)
25872	651	Police (Tactical 1)
25904	653	Police (Tactical 2)
25936	655	Police (Tactical 3)
25968	657	Police (Special Events)
26000	659	Police (Administration)
27248	6A7	Fire (Dispatch)
27312	6AB	Fire (Training)
27344	6AD	Hazardous Materials Response
27376	6AF	Fireground

Chambers County, Alabama

Local public safety activity in Chambers County takes place on conventional VHF (Very High Frequency) and UHF (Ultra High Frequency) frequencies. Nearly any scanner made in the past 30 years can monitor these frequencies. Even the older crystal-based units, with the correct crystals installed, can be useful here.

Frequency	Description
151.3475	Sheriff (Detectives)
153.9200	Valley City Services
154.1000	Valley Emergency Management
154.1300	Emergency Management 1
154.1600	Sheriff (Dispatch)
154.2500	East Alabama Fire Dispatch
154.3100	Lafayette Police
154.4150	Lafayette Fire (Dispatch)
155.1000	Drug Enforcement Team
155.1225	Valley Public Works
155.4150	Valley Police
155.5950	Valley Police (Dispatch)
155.7900	Valley Emergency Medical Services
155.8800	Lafayette Utilities
155.9700	Law Enforcement (Interoperability)
158.8950	Sheriff (Tactical)
159.1950	Sheriff
453.1500	Local Fire Departments (Dispatch)
453.4000	Emergency Management

Macon County, Alabama

As with Chambers County, local public safety activity in this rural county occurs on VHF and UHF frequencies.

Frequency	Description
154.8750	Sheriff (Dispatch)
154.9800	Tuskegee Utilities
155.3100	Tuskegee Police (Dispatch)
155.6475	County School Buses
155.7000	Tuskegee Police
453.1000	County Fire (Dispatch)

Alabama State Troopers

Although there is a statewide EDACS network, it seems that Alabama State Troopers, who are part of the Department of Public Safety (DPS), still use conventional VHF frequencies. Here are a few to check for the eastern side of Alabama:

Frequency	Description
154.815	Tactical
154.920	Base-to-Car and Car-to-Car
155.010	Statewide Law Enforcement Mutual Aid
155.370	Nationwide Law Enforcement Interoperability
155.445	Car-to-Base
155.475	National Law Enforcement
155.505	Statewide Car-to-Car
158.790	Department of Public Safety

Based on local reports, it appears that the VHF (Very High Frequency) radio system for troopers does not include repeaters. This means that transmissions from patrol cars are received at bases directly but are not rebroadcast, so scanner listeners would have to be fairly close to the trooper in order to hear their side of the conversation. Transmissions from bases are at much higher power and the antenna towers are located on relatively high ground, so hearing the base-to-car side is usually easier.

It also appears that many state and federal agencies use SouthernLINC (Long-range Integrated Network Communications), which is a large communications network that operates much like a cellular telephone system. SouthernLINC has services in Alabama, Florida, Georgia and Mississippi and grew out of a private communications network for local power companies. The system uses a Motorola proprietary wireless technology called iDEN (Integrated Digital Enhanced Network) for which there is no consumer-level scanner. SouthernLINC is the primary system for the Alabama Emergency Management Association (AEMA).

There is a report of the Alabama Bureau of Investigation (ABI) using 155.505 MHz; however, I do not have a confirmation. I'm suspicious this frequency is incorrect, since it is also listed as being used by Alabama State Troopers

Fort Benning, Georgia

Fort Benning is a United States Army installation located just to the southeast of Columbus, Georgia and about 50 miles from Auburn, Alabama. It is home to the Army Infantry School and has recently received the Army Armor School due to the Base Realignment and Closure (BRAC) Commission. About 120,000 warfighters and civilians are based there.

Two radio systems are identified for Fort Benning. The first is an EDACS with the following frequencies. Be sure to program these in Logical Channel Number (LCN) order, meaning the frequency must be programmed into the corresponding memory location:

LCN	Frequency
01	406.550
02	407.350
03	408.150
04	408.950
05	409.750
06	406.225
07	406.750
08	408.350
09	409.050
10	409.150

Dec	AFS	Description
1053	08-035	Public Safety (Interoperability)
1069	08-055	Range Control
1105	08-101	Military Police (Dispatch)
1106	08-102	Military Police (Patrol)
1107	08-103	Military Police (Administration)
1108	08-104	Military Police (Administration)
1110	08-106	Military Police (Investigators)
1112	08-110	Search and Rescue Team (SRT)
1113	08-111	Checkpoint Operations
1116	08-114	Canine Teams
1125	08-125	Pioneer Base
1129	08-131	Payton Range
1130	08-132	Bradley Base
1132	08-134	Wagon Base
1189	09-045	Bayonet Base
1190	09-046	Melfort Base
1191	09-047	Patriot Base
1217	09-081	Romeo Base
1275	09-153	Recovery Operations
1276	09-154	Jump Operations
1313	10-041	Hammer Base
1318	10-046	Dragon Base
1329	10-061	Net Control
1394	10-142	Post Fire Control (Dispatch)
1401	10-151	Hazardous Materials
1410	11-002	Emergency Medical Services (Dispatch)
1417	11-011	Martin Hospital
1511	11-127	Transportation Operations
2017	15-121	Lawson Army Airfield Crash (Dispatch)
2018	15-122	Lawson Army Airfield Crash (Fireground)
2047	15-157	498th Medical Evacuation (Medevac)

The second reported Fort Benning system is a fully digital APCO Project 25 system. It operates in the 300 MHz band from several repeater sites located on various hilltops and high points around the installation. Frequencies are:

386.0750, 386.0750, 386.1375, 386.2250, 386.2875, 386.4000, 386.4375, 386.5875, 386.7375, 386.8250, 386.8500, 386.9500, 388.0000, 388.0250, 388.1125, 388.1750, 388.2500, 388.2625, 388.3250, 388.4000, 388.4125, 388.5500, 388.5625, 388.7000, 388.8500 and 389.4875 MHz.

Decimal	Hex	Description
3202	C82	Military Police (Dispatch)
3208	C88	Checkpoint Operations
3442	D72	Post Fire Department (Dispatch)
3443	D73	Post Fire Department
3456	D80	Emergency Medical Services (Dispatch)
3465	D89	Martin Army Community Hospital

Updates to all of these systems and frequencies are most welcome, so please continue to send in those reception reports to me at *danveeneman@monitoringtimes.com*. That's all for this month. Enjoy the summertime and check my website at **www.signalharbor.com** for more radio and scanner-related information.

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *I currently have two VHF/UHF whip antennas on my car in addition to the factory AM/FM antennas. I'd like to install a scanner. Is there a safe way to use one of the VHF/UHF antennas so that when transmitting it won't harm the scanner? (Bill Nolan, N1CHU)*

A. As you might suspect, much has to do with the amount of power your transmitter is putting out. If it's only a watt or two, a conventional TV style VHF/UHF splitter should provide at least 20 dB isolation, inducing only 1/100 of the power into the scanner antenna lead, and allow scanner monitoring while you're transmitting. Still, that's enough signal to overload the scanner, producing images during reception.

Another protective method occasionally used is to place two PIN diodes or even silicon signal diodes (1N918/1N4148 typically) in reverse parallel across the scanner antenna cable, center conductor to shield. The problem with this is that sometimes they act as signal mixers in strong signal areas, providing lots of images! But it's worth a try.

The alternative to be completely safe would be to use a TV antenna switch from Radio Shack or from the shelf of a local thrift shop to switch the scanner in and out of the antenna circuit. While this reduces induced power levels in the scanner antenna circuit to a few milliwatts, it disables the scanner from antenna reception.

If you're using higher power, the antenna switch plus a grounding (antenna shorting) mechanism for the interrupted scanner lead would be precautionary and recommended.

The best bet, other than providing a separate antenna for your scanner, would be a VHF/UHF antenna relay, available on the Internet and from amateur radio dealers.

Q. *I have a discone antenna and a good preamplifier, but I live in a rural area so that some signals are quite weak. Can I get improved scanner reception by adding a second preamp? (Robert Fuller, email)*

A. It's never a good idea to cascade two or more amplifiers. The extra gain causes more background noise and is likely to cause strong-signal overload as well resulting in phantom signals being heard. It may cause desensitiza-tion of the scanner as well, making reception worse rather than better.

Discones are known for their wide frequency coverage, but not for their signal sensitivity – they have no gain. Additionally, their directivity is often upward (above the horizon) on some frequency ranges.

If you already have a good preamp (assuming it's working properly), the only things you can do to improve reception are:
1. Get a better, high-gain antenna like the Grove Scanner Beam and point it in the direction of the most desired, weak signals;
2. Change the coax to RG-6/U (least expensive), RG-8/U foam, or LMR-400;
3. Raise the height of the antenna to be sure it clears interfering objects;
4. Make sure the scanner is OK by substituting another scanner on the same antenna to confirm it has the same reception;
5. Move!

Q. *I recently heard some local hunters illegally using marine channel 72 (156.625 MHz) for communication. The voices seemed very low modulation. Would this be from their narrow-band radios being heard on my wideband scanner? (J.J. Owens, NC)*

A. It could be, since there are many imported handy talkies which can be used in the amateur radio service and also illegally cover VHF mobile bands as well. It's also possible that they were talking quietly as they approached their prey.

Q. *Why don't radio manufacturers make stand-alone DRM (Digital Radio Mondiale) receivers for digital shortwave reception? (James Monagle, KC9QYC)*

A. It's been tried, but with very limited success in the U.S. In order for such a product to be given serious consideration, especially during a period of economic woe, there must be a substantial market waiting, and it must be affordable.

The only model that I'm aware of that made a debut in the U.S. was the UniWave, sold by Universal Radio. It's been discontinued with no replacement.

Very few shortwave broadcasters use DRM and, since it's a licensed system, it raises the cost of the radio. Signals must be strong for its digital content to be decoded and, over the last decade or so, shortwave propagation has been poor. With the ready availability of shortwave stations on the internet – no antenna required – the market for such a product is very limited.

Q. *Will the new computer-operated shortwave receivers work well in an indoor electrical environment? (John Pecoraro, email)*

A. The G305e will work as well as any other shortwave radio in your apartment, and far better than most others if you can put up an outside antenna fed with coax line into your apartment. If you have an indoor antenna, you will suffer the consequences of electrical appliance interference from just about anything that has electronics in it – especially nearby switching power supplies so commonly found now instead of the reliable and noise-free, transformer-type, "linear" power supplies. There are noise cancelling accessories that can be put between the antenna and the receiver which sense and cancel (or at least minimize) the interference before it enters the radio.

Q. *My neighbor is planning to install an electric fence for livestock control. Can these be fatal? What is the liability for electrocution? (Mark Burns, Terre Haute, IN)*

A. A high-powered fence charge may put out as much as 8000 volts DC, but it's at very low current (1 or 2 milliamps). Lethal current is about 6 mA, so the fence may not be lethal, but it sure can sting!

I don't give legal advice since it varies across the country (and I'm not an attorney), but it would be wise to prominently mark the fence at intervals to minimize liability from negligence.

UTILITY WORLD
HF COMMUNICATIONS

Hugh Stegman, NV6H
mtutilityworld@gmail.com
www.ominous-valve.com/uteworld.html
http://mt-utility.blogspot.com

Numbers: The Strangeness Continues

Anyone who thinks "numbers" stations (the shortwave broadcasts of encrypted messages in number or letter code groups presumably aimed at spies) are going away hasn't been paying attention. For every old standby that disappears, a new one pops up.

❖ EV01

EV01 sounds like a prototype electric car, but in this case it's *Numbers & Oddities* editor Ary Boender's name for a new, English-speaking, numbers station. Such informal names come up from time to time, while everyone waits for the "official" one from ENIGMA 2000, the keeper of all numbers designators.

ENIGMA takes these designations seriously, as well they should. There's always a wait to decide whether the source really is an intelligence or military agency, or to find some other reason for inclusion. As we always note, ENIGMA 2000 is the online incarnation of the authoritative European Numbers Information Gathering and Monitoring Association, and they know their stuff.

EV01 appeared sometime in late 2011. It stands for "English Voice number 1." The multiple English voices in question are ominous sounding, even by numbers standards. A good recording is at **www.youtube.com/watch?v=P_jNx0AB9TI**

Not much is known about EV01 or who might be doing it. Unlike most agencies, which meticulously execute the same format for years, this one has used multiple voices, message types, and modes. It has transmitted in upper sideband (USB) and full amplitude modulation (AM). Speakers can be male or female. Some messages are in number groups, others in letter groups. Finally, some callups play classical music, but most don't.

The current format makes its callup as "message for" or "message to" followed by phonetic identifiers such as "November 125, or "Golf Romeo 18." Multiple repeats are made, sometimes for an hour or more.

Frequencies logged are as follows: 10400, 10700, 11000, 13400, and 16000 kilohertz (kHz), AM or USB. No parallels are heard, and the freqs are reused for weeks at a time. Except for two loggings at 0400 and 0542 Coordinated Universal Time (UTC), all schedules have been broadcast between 1400 and 1630. On one occasion, a Windows sound was heard in the audio.

A very tentative guess at the area of origination would be the Ukraine, Kazakhstan, or even Afghanistan. It is heard best in southern Europe, though "Token" has picked up a weak signal at his low-noise antenna farm in the California desert.
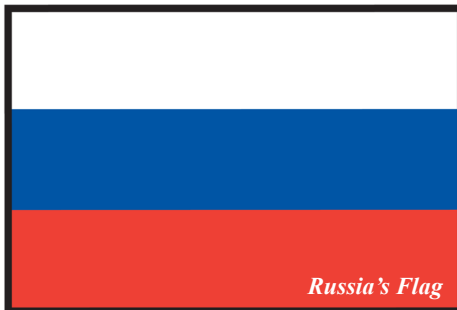
Russia's Flag

Currently, the station has settled into time slots at 1430 and 1530 UTC, on 10700 kHz AM or USB. Most reports are on weekends, but that might be when people are listening. Tuesday and Wednesday have also been reported.

Ary Boender has a good intro at his site. The link is **www.numbersoddities.nl/EV01-profile.pdf** .

❖ The Big Buzz

Recently there's been new interest in the Russian 4625 kHz "Buzzer," also known as UVB-76. Quite a few matters are finally becoming sorted out, which is a good thing, given the misinformation surrounding this station. Even its name is wrong, since the actual identifier on the first voice messages was apparently UZB-76. Since these IDs are likely related to the source or target of the message, it's best to say that the actual station call sign is unknown.

The station's harmonic-rich buzzing marker still stops only rarely for the voices. Not all voice messages have the same identifier, or even the same general sound. On occasion, part or all of a message shows up on other Russian military stations. Sometimes a phone conversation (order wire?) gets on the air.

Ever since the station's fabled 2010 "disappearance" which we now know to be a transmitter move, the identifier used on most messages is "MDZhB." These letters are the closest thing in our English language alphabet to the Cyrillic МДЖБ, which is the callup in the native Russian.

For sure, there's more than one transmitter, though probably in the same general location. Listeners have caught multiple buzzes more than once. All are linked to Russian military high command by satellite, landline, or both.

The mode is typically reported as AM, but technically it isn't. There's always an upper sideband, but the carrier can change level, and the lower sideband can be reduced or gone completely.

Perhaps a better name for the signal is "S28." That was given by ENIGMA 2000 after the voice messages first appeared. The "S" is for Slavic (the Russian language), and the 28 is a serial number in order assigned.

For now, though, this column will stick to UVB-76. It just sounds cool.

What's Up in Povarovo?

The quick answer is, "Very little." There is now plenty of ground truth about the presumed former UVB-76 site. This confirms the creepy stories told in various mass-market magazines. The place is about 99 per cent abandoned.

Good starting coordinates for Google Earth are 56.082635 north by 37.089717 east. These go to the building suspected of housing the original transmitter. It's one of three in a huge, abandoned, rhombic farm in the woods north of Moscow.

The site is no longer guarded, and its exploration has been documented on several Internet sites, in Russian. English speakers will get a good introduction at **bydunai.livejournal.com/749.html** . The captions have translations, while the

stills and videos taken by these two excited young guys speak for themselves.

What they find is striking. Downstairs, floors and tables are strewn with old log books, tech notes, manuals, and a few discarded spare parts. Upstairs, we see unmistakable footprints of high-power transmitting equipment. Outside, walls show distinctive ports for feeder exit, and wires with egg insulators sway in the breeze.

Eventually, they come upon the only facility with any sign of activity. A little pink house has a tower with a small yagi. The paint is relatively fresh, and the guard dog looks lonely and mean. The larger tower shown in *WIRED* magazine last year is nearby. While someone is obviously feeding the dog and fixing the automated equipment, none of the gear could possibly work on 4625 kHz. UVB-76, like Elvis, has left the building.

Recent Activity

The most credible new site for The Buzzer is somewhere along Russia's western border with Estonia, near a place called Pskov. Various

triangulations have all given bearings in this general area. This relocation coincides roughly with changes in the Russian military, and reinforces the idea that the various funny-noise stations (including The Pip and The Squeaky Wheel) serve different parts of Russia.

The Buzzer's mission is almost certainly the clearing of flash-priority strategic traffic, in short coded messages, to assets in western Russia. The buzz itself is a marker, presumably to keep the fishing boats off-channel. Decades of listening, plotting, processing, and analysis of this noise has yielded no known information beyond, "Here I am."

Voice messages, the "S28" aspect of all this, now come in bursts. At press time, the most recent one has been in March, with at least 18 in a few hours. These had the usual brief content of human-spoken number groups and a code word, all in Russian. Most used the MDZhB call. There was also what might have been a very short phone patch. Recordings can be found at all the usual places.

Here are a few web sites that are good for keeping tabs on the Buzzer:

First is a numbers site/blog called **priyom.org/**. "Priyom" is a Russian procedural signal, best translated as "over." Recently, it added a comprehensive and refreshingly hype-free Buzzer Primer with excellent information. It's at **www.priyom.org/blog/the-buzzer-primer.aspx**

This is also linked from Ary Boender's site, **www.numbersoddities. nl/**. He, too, has good information and newsletters concerning the whole numbers scene.

Another essential site/blog is the "UVB-76 Temporary Internet Repeater," at **http://uvb-76.net/**. It's anything but temporary: There's a 24/7 web stream of the Buzzer signal, an archive, and a lot of other solid, fun content.

Finally, one must not forget ENIGMA 2000. They're the smart guys. They have a mailing list, and a web site at **www.brogers.dsl.pipex.com/ enigma2000/**

Buzz away, and see you next month.

ABBREVIATIONS USED IN THIS COLUMN

AFB	Air Force Base
ALE	Automatic Link Establishment
AM	Amplitude Modulation
ARQ	Automatic Repeat reQuest
BEE	Russian synchronous teleprinting mode, 36 & 50 baud
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
FAX	Radiofacsimile
FEMA	US Federal Emergency Management Agency
FSK	Frequency-Shift Keying
HFDL	High-Frequency Data Link
HFGCS	High-Frequency Global Communications System
ID	Station identification
LDOC	Long-Distance Operational Control
M08a	Cuban MCW numbers, cut to ANDUWRIGMT
M51	French military CW training, possible FAV22 relation
MARS	US Military Auxiliary Radio System
MCW	Modulated CW, direct or AM tone
MFA	Ministry of Foreign Affairs
NASA	US National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
Navtex	Navigational Telex
NCS	US National Communications System
PACTOR	Packet Teleprinting Over Radio, modes I-IV
PSK	Phase-Shift Keying
RTTY	Radio Teletype
S06	Russian Man/Lady; Russian Intelligence
S06s	S06 variant with unchanging slow ending
S28	Russian "Buzzer," probably strategic broadcasts
Selcal	Selective Calling
SHARES	SHAred RESources, US Government frequency pool
SIPRNET	US Secure Internet Protocol Routed Network
SITOR	Simplex Telex Over Radio, modes A & B
Stanag 4285	NATO 8-PSK multispeed data mode
UK	United Kingdom
Unid	Unidentified
US	United States
USAF	US Air Force
USCG	US Coast Guard
V02a	Cuban "Atencion," 3x150 group message format
V13	Taiwan "New Star," music and numbers in Chinese
VC01	Robotic "Voice Chip" Chinese numbers
Volmet	Formatted aviation weather broadcast

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 ().

18.1	RDL-Russian military, 3 strategic broadcast messages in BEE, at 1308 (MPJ-UK).
20.3	ICV-Italian Navy, Isola Tavolara, weak FSK at 1422 (MPJ-UK).
51.95	GZL-UK DHFCS, Crimmond, Scotland, FSK at 1251 (MPJ-UK).
135.6	HGA22-EFR (European power ripple control), Hungary, data messages at 1340 (MPJ-UK).
490.0	"D"-Canadian Coast Guard, Rivière-au-Renard, Quebec, SITOR-B Navtex in French, at 0044 (Mario Filippi-NJ).
518.0	"J"-Karlskrona Navtex, Sweden, Navtex bulletins at 1737 (Michel Lacroix-France).
1650.0	Unid-French Coast Guard, Corsen, weather in French at 0405 (PPA-Netherlands).
1727.0	94W224-CW fishing net beacon, ID at 0127 (Filippi-NJ).
1752.0	95R964-CW fishing net beacon, ID every 4 minutes, at 0135 (Filippi-NJ).
1767.0	IC522-CW fishing net beacon, ID every three minutes, weak at 0050 (Filippi-NJ).
1791.0	4OXI-CW fishing net beacon, long dash and ID sent 3 times every 5 minutes, at 0154 (Filippi-NJ).
2226.0	Unid-UK Coast Guard Aberdeen, gale warnings and forecast, at 1933 (PPA-Netherlands).
2628.0	IQA-Augusta Radio, Italy, "female" machine voice with weather in Italian, at 0356 (PPA-Netherlands).
2761.0	OST-Oostende Radio, Belgium, maritime broadcast at 1835 (Lacroix-France).
2833.0	4XZ-Israeli Navy, CW marker; also on 2860, 4331, and 6525; at 2250 (Lacroix-France).
3314.0	Unid-Russian Air Defense, time stamped CW null-message strings padded with "?;" also on 4391, 5752, and 7994; at 2117 (MPJ-UK).
4258.0	C4-Moroccan Army, ALE sounding; also on 5258, 11130, 12160, 14550, and 14570; at 2110 (PPA-Netherlands).
4440.4	FAV22-French CSTEI (Center for Telecommunication and Specialized Data Processing), Vernon, CW drill tra with headers and messages in 5-letter groups; also on 4440.5, 4442.5 (spurious), 4458.1, 5453.1, and 6899; at 2013 (Lacroix-France).
4500.0	OSN-Belgian Navy, Zeebrügg, RTTY channel availability markers at 1858 (Lacroix-France).
4625.0	"MDZhB"-Cyrillic identifier on many Russian messages sent in a few hours from "The Buzzer"/ UVB-76 (S28), starting at 0834 (Ary Boender-Netherlands).
4760.0	KGO-Possible NATO trigraph ID of UK exercise player, mentioned "Kinloss," working "S-5-K" and many others, at 0820 (Lacroix-France).
5000.0	IBF-Presumed special event station for 20th anniversary of closing "real" IBF, Torino, Italy, with time signals and ID in MCW and voice ID in AM, at 2129 (MPJ-UK). *[Still on-air months after announced operation dates. -Hugh]*
5195.0	DRA5-German amateur experimental propagation beacon, RTTY forecast and CW ID, at 2009 (MPJ-UK).
5236.0	NNN0EBC-US Navy/ Marine Corps MARS, taking SHARES Northeast Net check-ins from NCS 042 (NCS); AFA2BC and AFA3WZ (USAF MARS); others; at 0048 (MDMonitor-MD).
5295.0	XSS-Control for UK DHFCS, Forest Moor, ALE sounding; also on 7535, 7548, 11223, and 22571; at 2113 (PPA-Netherlands).
5454.0	Unid-French CW practice (M51), Vernon, possibly FAV22, fast CW practice messages in 5-letter groups, similar on 6949, at 0210 (Filippi-NJ).
5514.0	ZYK-Possible Russian or Commonwealth of Independent States military, asking 4ZYT for a repeat, CW at 2055 (Patrice Privat-France).
5544.0	G-VSHY-Virgin Atlantic A340 "Claudia Nine," flight VS0300, HFDL position for Al-Muharraq, Bahrain, at 0001. G-VBUG-Virgin Atlantic A340 "Lady Bug," flight VS0200, HFDL position for Al-Muharraq at 0005 (MPJ-UK).
5565.0	Dakar-South Atlantic air route control, Senegal, working Lufthansa 510, a B747 reg D-ABVE, at 0321 (PPA-Netherlands).
5680.0	Kinloss-UK Royal Air Force, Scotland, working Sea King helo #177, at 1401 (Lacroix-France).
5702.0	JNR-USAF; Salinas, Puerto Rico, working unknown aircraft MOBD37DAT, ALE at 0013. MOBD40DAT-Unknown USAF, working ADWSPR-USAF SIPRNET gateway, Andrews AFB, MD; and OFFSPR, USAF SIPRNET gateway, Offutt AFB, NE; also on 8968 and 11181; ALE starting at 0238 (Bob Wilczynski-MA).
5708.0	Armor-French Navy, Brest, working Papa Uniform at 1753 (PPA-Netherlands).
5715.4	UN10-Algerian military, calling TD21, similar on 5756 and 7752, ALE at 2023 (PPA-Netherlands).
5720.0	"03"-HFDL ground station, Reykjavik, Iceland, HFDL uplink to G-VGAS, Virgin Atlantic A340 "Vargas Girl," at 0602 (PPA-Netherlands).
5725.0	"W-1-L"-NATO exercise player, tracking net with "U-0-O," at 2030 (PPA-Netherlands).
5732.0	LNT-USCG CAMSLANT Chesapeake, calling J15, a MH-60J helo #6015, COTHEN ALE at 0600 (PPA-Netherlands).
5760.0	EPA-Colombian Navy, calling self in ALE at 0605 (PPA-Netherlands).

5792.0 2002-Moroccan Police, ALE sounding; also on 9200, at 0521 (PPA-Netherlands).

5800.0 Unid-Cuban "Cut Number Station" (M08a), MCW message with callup ADGRN, (13862), at 0600 (PPA-Netherlands).

5802.0 "Chinese Robot"-Unknown station with rapid-fire machine numbers in Chinese (VC01), at 1321 (Boender-Hong Kong remote).

5820.0 13132-French DGSE (General Directorate for External Security), Morocco, also on 10390 and 13499, ALE at 2139 (MPJ-UK).

5883.0 Unid-Cuban "Atencion" AM female voice (V02a), callup 44261 04021 41161, and messages in 5-figure groups, at 0700 (PPA-Netherlands).

6532.0 G-VBLU-Virgin Atlantic A340 "Soul Sister," flight VS0017, HFDL position for Shannon, at 2034 (MPJ-UK).

6556.0 ET-AMG-Ethiopian Airlines B767, answered selcal QS-HK from Calcutta, at 2028 (PPA-Netherlands).

6596.0 UK-32012-Uzbekistan Airways A320 flight XX0303 0010, HFDL log-on with Krasnoyarsk, at 0010 (MPJ-UK).

6679.0 VRK22-Hong Kong Volmet, female machine voice with weather observations, at 2015 (PPA-Netherlands).

6685.0 Korsar-Russian Air Force, Pskov, working Klarnetist, at 1806 (PPA-Netherlands).

6712.0 G-VNAP-Virgin Atlantic A340 "Sleeping Beauty," flight VS0016, HFDL log-on with Reykjavik, at 2130 (MPJ-UK).

6736.0 AAA-Israeli air force Tel Aviv, calling Y36; also on 7961, 7976, and 8063; ALE at 1845 (PPA-Netherlands).

6787.5 Unid-Possible military aircraft, weak signals with fuel and position reports, at 2314 (Jack Metcalfe-KY).

7335.0 Unid-Russian Intelligence slow-ending variant (S06s), numbers callup 729 834 5, message, and ending 00000; similar on 7605, 7795, 9255, 11830, 12140, 12952, 13365, 13515, 13565, and 14505; at 1010 (Boender-Netherlands).

7580.0 "New Star Radio Station"-Music and live Chinese numbers (V13), Taiwan, in progress at 0606 and 1318 (Boender-Hong Kong remote).

7633.5.0 AFA5JC-USAF MARS, OH, morale patches with USAF Air Mobility Command Reach 220" over Maine, came from 13927, at 2254 (Allan Stern-FL).

7830.0 41-African-accented French check-ins with 42, 44, and 46; also operator chat in Arabic, using roger beeps, at 0245 and 1940 (ALF-Germany).

7906.0 XVS-Ho Chi Minh Ville Radio, Viet Nam, fishery navigation warnings in Vietnamese, at 1706 (PPA-Netherlands).

7910.0 KM3-Colombian Navy, calling 201DE, also on 9090, ALE at 0340 (PPA-Netherlands).

7929.0 FJ-French military, male in French calling QH for spelled 5-letter group message, at 0559 (PPA-Netherlands).

7972.0 KLE439-Unknown US Government, ALE sounding at 0515 (PPA-Netherlands).

8123.2 IDN-Italian Navy, Stanag 4285 plaintext channel availability markers, at 0916 (Lacroix-France).

8190.0 DEROSA-Italian Financial Police patrol vessel Salvatore De Rosa (IHLC), working VACCARO, patrol vessel Vaccaro (IGYB), ALE at 1100 (ALF-Germany).

8414.5 005671000-Bangkok Radio, Thailand, DSC call to 636092313, container ship HR Revolution (D5AH2) at 2020 (PPA-Netherlands).

8453.0 FUG8-French Navy, La Régine, Stanag 4285 "Voyez le brick" test loop, at 0931 (Lacroix-France).

8502.0 NMG-USCG, New Orleans, LA, voice weather synopsis for Caribbean and other areas, at 0346 (Filippi-NJ).

8776.0 SVO-Olympia Radio, Greece, rapid female machine Greek voice bulletin, at 1948 (MPJ-UK).

8912.0 ABQPRI-COTHEN remote transmitter, NM, ALE sounding at 1157. Also ALE soundings from ATL, GA, at 1200; CDR, IA, at 1210; FTM, FL, at 1210; MEM, MS, at 1210; OKO, OK, at 1211; and VGS, NV, at 1215 (MDMonitor-MD).

8930.0 Saudia 6621-Saudia Airlines flight working Stockholm LDOC, at 1611 (Lacroix-France).

8942.0 F-WWKX-Test registration of Airbus Industrie A-330 for Air China, using flight numbers 4Y1234 and 4Y5678, HFDL position for Shannon, at 1944 (MPJ-UK).

8968.0 MOBD01DAT-Unknown USAF SIPRNET, calling HQ7D01DAT, also unknown, at 1415 (MDMonitor-MD).

8971.0 Fiddle-US Navy, FL, taking ops-normal and position report from P-3C Cardfile 715, at 1907 (MDMonitor-MD).

8977.0 5A-DMG-Buraq Air (Libya) B737 flight UZ0180, HFDL position for Reykjavik, at 2204 (MPJ-UK).

8992.0 Composer-US military, patch via Offutt HFGCS to Ladybug and Bookstore, sent to of "RF18" (unknown) and "11175 upper" (HFGCS), at 0215 (Dean Delahaut-CA).

9015.5 72-Singapore Navy vessel Stalwart, working CN6, Changi Naval Station, ALE at 2040 (ALF-Germany).

9090.0 EPA-Colombian Navy, ALE link check with self, at 1144 (Eddy Waters-Australia).

10066.0 VT-JWH-Jet Airways India A330, flight 9W0242, HFDL log-on with Hat Yai, Thailand, at 2104 (MPJ-UK).

10075.0 GSH121-Gama Aviation (United Arab Emirates), HFDL position (near Cairo) for Al-Muharraq, at 1520 (Lacroix-France).

10146.0 X9Q-Unknown beacon, CW 10-second dash and ID, in 30-meter band but probably not amateur, at 1745 (ALF-Germany).

10315.0 Magic 81-Back end of a NATO E-3, working DHN66, German Air Force, at 1432 (Lacroix-France).

10651.0 REA4-Russian Air Force, Moscow, short RTTY message at 0922 (Waters-Australia).

10962.0 BABUR-Pakistan Navy vessel Babur, ALE to KW (Karachi Wireless), at 1832 (MPJ-UK).

11175.0 Offutt-USAF HFGCS, Offutt AFB, NE, patch for weather from USAF HC-130 King 15 to unheard station, at 1934. S4JG-US Navy, calling Mainsail (all stations) with no joy, at 2052 (MDMonitor-MD).

11198.4 Unid-North Korean diplomatic, 600/600 ARQ at 1235 (PPA-Netherlands).

11232.0 Trenton Military-Canadian Forces, patching unheard aircraft to Peachtree, US Air National Guard, Robins AFB, GA, at 1422 (MDMonitor-MD).

11345.0 Primera 534-Primera Air Scandinavia B737 reg OY-PSC, patch to Medlink via Stockholm LDOC, at 1550 (ALF-Germany).

11354.0 Airbus Industrie company LDOC, France, trying to selcal unknown aircraft with no joy, at 1341 (Lacroix-France).

12216.0 FC1FEM-FEMA Region 1, MA, calling VT1FEM, Vermont State Emergency Operations Center, at 1518 (MDMonitor-MD).

11297.0 Rostov Volmet-Female operator, weather observations in Russian for Krasnodar and elsewhere, at 1557 (Privat-France).

12362.0 VMW-Australian weather office, Wiluna, gale warnings at 1746 (PPA-Netherlands).

12464.0 RFK99-Unknown Russian Navy vessel, CW signal check with RIW, Moscow, at 0725 (PPA-Netherlands).

12577.0 ONGH-Belgian flag bulker Lowlands Opal, DSC safety test with WLO, Mobile/ShipCom, at 1443 (MPJ-UK). XVG-Haiphong Radio, acknowledging transmission from 356231000, DSC at 1555 (Martin Foltz-CA).

12579.0 NRV-USCG, Guam, SITOR-B typhoon warnings at 1530 (PPA-Netherlands).

12599.5 UAT-Moscow Radio, Russia, SITOR-B traffic list at 1900 (PPA-Netherlands).

12654.0 TAH-Istanbul Radio, Turkey, SITOR-A duplex with unknown vessel, at 1614 (Lacroix-France).

12666.5 FUG12-French Navy, La Régine, Stanag 4285 "Voyez le brick" test loop, at 1617 (Lacroix-France).

12789.9 NMG-USCG New Orleans, very sharp FAX 24 hour surface forecast chart, at 0210 (Filippi-NJ).

13270.0 New York Volmet, weather observations for several airports, at 1932 (Robbie Spain-WY).

13927.0 AFN4PP-USAF MARS, FL, patching RC-135 Snoop 31 to Snoop Ops, Offutt AFB, NE, at 1440. AFA3CU-USAF MARS, VA, sending F-16 Pyrex 02 to 14606, at 1948. AFA5JC, USAF MARS, morale patches for Coast Guard Helo 6023, USCG, at 2145 (Stern-FL).

14392.0 Unid-USAF MARS, said "No stations heard, out" and gone, at 1636 (Metcalfe-KY).

14455.0 KHA908-NASA Ames Research Center, CA, weekly net with KHA925 (Johnson Space Center, Houston, TX), and KHA946 (NASA Michoud Assembly Facility, New Orleans, LA), at 1635 (Metcalfe-KY).

14556.0 RIW-Russian Navy headquarters, Moscow, CW signal check with RFK99, at 0720 (PPA-Netherlands).

14606.0 AFA3CU, came from 13927 for USAF Pyrex 02, then went to 20690, at 1950 (Stern-FL).

14661.0 HKI2-Finnish MFA, Helsinki, working RIA (Riyadh, Jordan embassy); also on 14710, 17418, 17460, and 20510; ALE at 1051 (MPJ-UK).

14776.0 FCSFEM2-FEMA Mt. Weather Emergency Assistance Center, Berryville, VA, calling FC0FEM, ALE at 1807 (PPA-Netherlands).

15000.0 Unid-Unknown military station, encrypted messages in Stanag 4285, WWVH time signals audible in background, at 0904 (Waters-Australia).

15034.0 Canadian Forces Volmet, Toronto, weather observations for Halifax at 1926 (Spain-WY).

16112.0 Unid-Russian military, short encrypted messages in BEE, similar on 16234, at 1131 (Waters-Australia).

16112.0 1001-Mauretanian Police, calling 1007, ALE at 1640 (MPJ-UK).

16240.0 2011-Net control for French DGSE (General Directorate for External Security), Morocco, calling 2418, similar on 17435 and 18765, ALE at 1728 (MPJ-UK).

16348.4 Unid-North Korean diplomatic, undecoded 600/600 ARQ, at 0806 (PPA-Netherlands).

16490.0 BI1SK-Algerian Police, Biskra, working BA1SE, ALE at 1728 (MPJ-UK).

16540.0 Station 1-Unknown, calling Station 5 with no joy, at 1520 (MDMonitor-MD).

16560.0 Unid-Philippine seamen, usual Tagalog chatter at 1802 (PPA-Netherlands).

16898.5 XSG-Shanghai Radio, China, SITOR-B navigation warnings in 4-figure-group codes for Chinese characters, at 2350 (Hugh Stegman-CA).

16915.0 RFVIE-French Navy, Le Port, Réunion Island, STANAG 4285 test loop at 0955 (Waters-Australia).

16976.0 PWZ-Brazilian Navy, Rio de Janeiro, PACTOR weather at 1925 (Lacroix-France).

17055.0 SUDANIT42-Polish Army, working MORTON 25, Warsaw, ALE at 1402 (MPJ-UK).

18031.5 Unid-North Korean MFA, Pyongyang, message in 600/600 ARQ, at 0835 (Waters-Australia).

18032.0 CN5-Singapore Navy, calling 208, ALE at 1120 (Waters-Australia).

18230.0 Unknown Swiss embassy, encrypted messages and link-protected ALE, at 0732 (Waters-Australia).

19415.0 Unid-Russian Man (S06), callup and message in 5-figure groups, ended "00000," at 0834 (Waters-Australia).

20960.0 AFA3CU, came from 14606 for Pyrex 02, finally got a patch through, at 1952 (Stern-FL).

21982.0 TC-JAI-AnadoluJet A320, flight THY45K, HFDL position for Al-Muharraq, Bahrain, at 1336 (MPJ-UK).

28231.5 NP4LW/B-Puerto Rican amateur propagation beacon with CW ID, description, and grid position, at 1943 (Filippi-NJ). [28231.36 here. -Hugh]

DIGITAL DIGEST
DIGITAL MODES ON HF

Mike Chace
mikechace@monitoringtimes.com
www.chace-ortiz.org/umc

Spotlight on Algeria (Part II)

This month we complete coverage of HF digital operations from the North African country of Algeria.

Navy

The Algerians operate one of the largest North African fleets comprised of numerous missile patrol boats, corvettes, frigates and four submarines. The navy operates from bases at the Mediterranean ports of Algiers, Annaba, and Mers-el-Kebir, with lesser ports at Jijel and Tamentfoust, but it's been quite some time since I've heard the Algerian Navy with certainty.

It is interesting to note that the stations heard at that time using standard SITOR-A used the same type of two-letter, two-number format as many of today's Algerian stations. Perhaps there has been an effort to standardize callsign structure across military agencies over the years?

Naval stations were heard on 9115.7 and 11162.7 kHz using the identifiers GF14, KJ85, ML10, PM01, UN46, ZM88.

Railways

The Algerian railway network is run by the state-run SNTF (Société Nationale des Transports Ferroviaires) and encompasses almost 3,000km of track. The main line runs the length of the Mediterranean coast from Tlemcen in the West to Annaba in the East. Trains can be heard most times of the year after dark in the Northeastern US on the frequency of 5390 kHz USB. Codan radios are in use with the familiar +1200Hz PTT release tone "pip." Two-number calls are used for the trains and HQ in Algiers is addressed as "Al Djazair."

There have also been recent reports of 100bd/170Hz selcals on this same frequency, which could be either the Codan version of this selcal or the regular CCIR493-4 type. Whether or not they are related to the trains has not been confirmed, but the identifiers used are of the form 8xxx and 8xxxxxx.

DTN (Direction des Transmissions Nationales)

A number of Algeria's 48 provinces have been monitored using PacTOR-I modems with communications between major cities. The callsigns used correspond to regional capital cities and the central prefecture station usually uses "DTNXXX" where "XXX" is the first three letters of the province. Here are the cities heard thus far:

ABADLA	Abadla, Bechar
AOULEF	Aoulef, Adrar
BELBALA	Tabelbala, Bechar
BEABBES	Beni Abbes, Bechar
BWANIF	Beni Ounif, Bechar
CHAROUIN	Charouin, Adrar
DTNTAM	DTN HQ, Tamanrasset
KERZAZ	Kerzaz, Bechar
KHODEIR	Oulad Khodeir, Bechar
IGLI	Igli, Bechar
INGHAR	In Ghar, Tamanrasset
INGUEZ	In Guezzam, Tamanrasset
INSALAH	In Salah, Tamanrasset
BECHAR	Bechar, Bechar
ELWATA	El Ouata, Bechar
TIMIMOUN	Timimoun, Adrar
TINZA	Tin Zaouatine, Tamanrasset
TAZROUK	Tazrouk, Tamanrasset
ZKOUNTA	Zaouiet Kounta, Adrar

These are the channels used by each of the three prefectures heard so far (center of data):

Bechar	5354.5, 5361.5, 5591.5, 6861.5
Tamanrasset	6631.5, 7841.5
Adrar	4126.5

Oil & Gas

The middle and south of the country is home to some very large oil and gas fields that are operated by SONATRACH, the state-owned oil company. A network of pipelines ferry liquified natural gas and crude oil to Mediterranean ports where it is sent onwards to world export markets via tanker or to Italy and Spain via undersea pipelines.

With the enormous lengths of these pipelines comes the need for compressor stations at regular intervals in order to keep the liquid flowing. Most of these pumping stations, along with the major extraction infrastructure have been connected via an ALE network, probably for command and control purposes.

A few years ago, this network had many more stations on air; however, today only the OZ2 pipeline connecting Haoud el Hamra to Arzew completed in 2005 seems to remain on the (HF) air with regularity. The frequencies used by SONATRACH include the following channels (kHz USB, or LSB where indicated with "L"):

3336L, 3531, 5036L, 5058.5, 5362, 5410L, 5418L, 6970L, 6981, 7739L, 7818, 7975, 9315, 10209.3, 10211L, 10244, 10275L, 10285L, 11466, 11475L

Here are the ALE identifiers associated with this network:

ALG	SONATRACH HQ, Algiers
ALR	Alrar
GAS	Gassi Touil
GASSI30P	Gassi Touil Pumping Station
HAM	Haoud El Hamra
HAMRAGPL	Haoud El Hamra Gas Pipeline
HR	Hassi R'Mel
INAS30P	In Amenas Pumping Station
MEDER30P	Mederba Pumping Station
OHT	Ohanet
OHT30P	Ohanet Pumping Station
RNS	Rhourde Nouss
RNOUSSLR1	Rhourde Nouss LR1 Pipeline
SP1OZ2	OZ2 Pumping Station
SP2OZ2	OZ2 Pumping Station
SP3	OZ2 Pumping Station
SP3OZ2	OZ2 Pumping Station

Police (DGSN)

This ALE and MIL-STD-188-110A high-speed modem network was rumored to be operated by the National Police. The last reports of activity were in mid-2011 so it may be that this network is defunct, has been transitioned to third generation HF standards (for which few hobbyists are equipped) or has moved off-air altogether. In common with many of the Algerian networks, the ALE identifiers are relatively easy to locate. The following DGSN stations have been heard:

AL1GE	Algiers
AK1ID	UNID
BI1SK	Biskra
DP1FA	Djelfa
GH1AR	Ghardaia
GM1RB	Guelma
HH1AR	Haoud El Hamra
IL1LI	Illizi
ME1NA	In Amenas
ME1NI	UNID
OU1RG	Ouargla
SP1FM	UNID
TA1MA	Tamanrasset
TG1RT	Touggourtou

The frequencies used by the DGSN network include (kHz USB):

6500, 6550, 8990, 10430, 11455, 14670, 16490

Customs

With long and often desolate (and unfriendly or war-torn) borders with Morocco, Mali, Mauritania, Niger, Western Sahara, Tunisia and Libya, there is plenty of activity that requires the attention of the Customs service. The DGD (Direction Generale des Douanes) headquartered in Algiers takes care of these activities and has been a long-established presence on HF radio.

Until a few years ago, the French-made Coquelet 8 tone MFSK modem was the staple of the customs network, but these have been gradually replaced by PacTOR-1 modems. Messages are often in the clear in French, but sometimes (especially with the case of some Coquelet traffic) are encrypted. In the case of

Special-Event Certificates:
More Wallpaper for your Shack

In the days before the Internet and digital revolutions, paper – and the stuff printed on it – was a lot more important than it is today. Although it consumes trees by the billions (which are theoretically renewable), there's a special, tactile, feeling associated with the printed page, and we've had a special relationship with the stuff for a few thousand years.

Just ask any archaeologist or historian: Properly preserved, paper is good for several thousand years of archival storage. (Present-day computer hard drives and recordable optical disks actually start failing in only a few months, and although the packaging says the disks should be good for 50 to 100 years, most will be unreadable after only five to ten years. See the sidebar for potentially good news.)

This "digital impermanence" is expected to give future archaeologists (and hams) fits, because most of the stuff that used to be stored on reliable paper will have disappeared into digital dust. Future archaeologists investigating our civilization's transition to the 21st century will face a dearth of "printed stuff" *and* archivally stored "digital stuff."

While scientists work on ever-better ways to store and manage information, in this month's column I'd like to follow up on February's column (about collecting award certificates) and suggest even more ways to accumulate "actual, physical paper" to adorn your ham shack walls. These gloriously printed certificates look good, feel good – and even smell good – and unlike any digital equivalent, when you look at them 20, 30 or 50 years from now, it will be like stepping into a time machine. You will be transported back in time, with full sight and sound, in a manner that no digital representation can conjure.

STONE DVDS THAT LAST A MILLENNIUM?

The first practical long-term data storage technology that's actually available to mom and pop users (like you and me) is an interesting and inexpensive twist on current optical media. Your data will actually be "etched in stone!"

A cooperative venture between Millenniata (a US start-up) and LG (a veteran global electronics and PC hardware manufacturer) has resulted in a new optical disc and reader/writer that can store digital data essentially forever. Better still, the archival DVDs can be read in any conventional DVD or BluRay player. Think of it as a recordable DVD that lasts forever.

Millenniata calls the disks "M-Discs," and the hard-as-rock blanks can't be erased or corrupted without intentionally destroying them. The company demonstrates this rather convincingly in a video that shows an M-disc being dipped into liquid nitrogen, and then boiling water, while suffering no damage! You can see it on **youtube.com**.

To keep costs amazingly low, M-disc compatible recorders use conventional DVD drive mechanisms outfitted with higher-power lasers to etch permanent pits into the disk's rock-like data layer. (Conventional drives merely change the opacity of optical dyes, which makes them ultimately impermanent.)

Blank M-discs store 4.7 GB of data and, at press time, cost less than $3 each from photography outfitter **www.adorama.com** (and may dip below $1 each later this year). M-disc recorders can be purchased for less than $20 from **www.newegg.com**! At a time when conventional optical disc usage is declining because of online storage and low-cost hard drives (neither of which is archival), it will be interesting to see whether the M-disc catches on. Military and government purchasers are already etching important data into stone.

There's a lot more information at **http://millenniata.com**.

The least-expensive way to gain access to M-disc technology is to buy an LG GH22NS90B multi-format DVD recorder from www.newegg.com. The $18 SATA-only drive is inexpensive, highly rated, and reads and writes CDs, DVD, DVD-RAMs and M-Discs. I haven't yet recorded my first "stone disc," but I have recorded several DVD+Rs, and the burn quality numbers are excellent. The drive is quite a bargain, even if you only burn conventional disks. The pair shown here is sunbathing in my shack while I'm waiting for my spindle of M-discs to arrive!–NT0Z

❖ Special Events

Hams typically collect four main types of wallpaper. You undoubtedly know about QSL cards, which commemorate and document individual QSOs for personal or awards-qualification purposes. In February we discussed operating achievement awards such as Worked All States and DXCC.

The two remaining categories are contest achievement or participation certificates (not yet addressed and perhaps the most difficult to achieve) and special-event certificates. The latter, because they're probably the easiest to qualify for, as well as being fun to collect, might even spark interest in spouses and non-hams alike, so collecting Special-Event certificates can even function as a bridge to amateur radio itself. Fun and useful!

What's So Special, Anyway?

Special Events are on-air activities designed to generate interest in specific happenings. They're sort of like on-air "advertisements," promotions, or "open houses." The sponsoring clubs, groups or individuals try to contact as many ops as possible in a given time period (usually the course of a weekend, but sometimes longer), and they produce special QSL cards and/or suitable-for-framing certificates for the operators they work (that'd be you!).

Unlike some contests, Special-Event stations are almost always easy to work, even for beginners, and there are plenty of them on the air each year. And if you become a "Special-Events junkie" you can *actually* wallpaper your shack with the interesting and beautiful certificates you'll receive.

These are year-round happenings, but peak months are often April and May. I suspect that many groups use them as warm ups for Field Day. Typical Special Events – if there are such things – include the on-air commemoration of the 100th anniversary of the sinking of the *Titanic*, a celebration of the history of Morse Code from the estate of Samuel FB Morse, celebrations of the Special Olympics and Earth Day, etc.

Many events are national, but some are regional or even local in scope. Think of town festivals, local historical events, the opening of museums, club anniversaries, or even tongue-in-cheek activities such as operating from Christmas, Florida, in December. Clubs use these opportunities to get on the air in a big way, to publicize these events among hams, and to demonstrate amateur radio to the public. Just

about any reason will do when the SPEV Bug bites!

Their *modi operandi* may vary, but all Special-Events operations have at least one thing in common: They mark the occasion of your QSO with awards, special certificates or collectible QSL cards. You might receive a commemorative color QSL card or a large "suitable for framing" color certificate (or anything in between). Many are truly impressive, and they're available for making *a single contact* with the station(s) involved.

Easy to Find, Easy to Work

Once you've decided that your shack's bare walls do indeed need some covering, finding the details of Special-Event operations is even easier than working them! *QST* and *CQ* magazines list Special-Event operations month to month, as does *WorldRadio Online.* Special-Event listings are brief announcements detailing the sponsoring club, the reason for the event, a frequency or two, and information on how to claim your certificate.

Perhaps the most comprehensive (and free) listing can be found on the internet at **www.arrl.org/special-events-calendar**. The page's new format is rather annoying, but the info is there for the taking. You can also search for specific events and keywords. Here's a typical listing from the ARRL Calendar, this one for June 30, 2012:

06/30/2012
Commemorating the Americas Cup World Series Finals. Photo QSL with SASE.
Jun 30-Jul 1, 1200Z-2200Z, W1SYE, Newport, RI. Newport County Radio Club. 28.400 21.270 14.260 7.250. QSL. NCRC, PO Box 3103, Newport, RI 02840. Commemorating the Americas Cup World Series Finals. Photo QSL with SASE. www.w1sye.org

The listing details the dates, times, call sign and frequencies of the operation, the reason for the Special Event, where to send for your QSL card, that an SASE (self-addressed, stamped envelope) is required, and the web address of the sponsoring organization, where additional information about the event and the sponsoring organization can be found. It's simple! Once you've zeroed in on a Special Event station you'd like to work, note the operation's dates, times and frequencies, get on the air and begin the hunt!

Typical events sport one or two transmitters, and antennas can range from verticals to dipoles to multi-antenna beam arrays (depending on whether the event is an ad-hoc operation set up at a temporary location or is being staffed from an established station). Almost every Special-Event can at least be found on 80, 40 and 20 meters, and many will accommodate a Morse code contact if you ask for

NTØZ, thanks for working WØIBM on 50-MHz SSB

located at IBM, Rochester, Minnesota, USA

during the June 16, 2011,
IBM Centennial Celebration!
73 de WØIBM

I'm not sure whether W0IBM had a presence on HF during the company's centennial celebration in June of 2011, but when I heard the gang on 6 meters, I jumped at the chance to join in the fun. IBM has a huge campus here in Rochester, MN, and an active amateur radio club. Too bad you have to be an employee to become a member. Oh, well, this nifty Special-Event certificate will have to do! Happy hundredth, IBM.–NT0Z

one (if the station isn't already using Morse, that is).

Some Special-Event stations run separate SSB, digital and CW operations! When propagation and the sunspot cycle are cooperative, Special-Event stations can also be found on the higher bands, and sometimes on 6 and 2 meters, especially for more local events. For the most part, though, the lower HF bands see most of the action.

Special-Event operations aren't sanctioned from "on high," so they must behave appropriately, just like any other spectrum user. That means interference and band crowding can force the stations to move up or down a bit in frequency, depending on the bands, so be sure to tune around a bit and don't simply park your VFO on the operation's exact listed frequency. If specific frequencies aren't listed (some sponsoring groups want you to work a bit harder for your rewards!), careful tuning of the General-class subbands should turn up what you're looking for. After all, why would an event designed to commemorate something special – and to work as many hams as possible – show up on the Extra-class subbands?

Even the sneakiest of Special-Event ops can't hide forever, because their operations usually show up on DX spotting services such as the one found at **www.dxsummit.fi**. Click on "DX Spots" on the main menu and then

choose the band you're interested in. Most of the stuff that shows up here is DX-related, but on a weekend afternoon, Special-Event spots do show up.

Getting Your Certificates

Despite being relatively easy to work, the most popular events sometimes generate a lot of interest, and pileups can result, which can spice things up a bit. As with any other amateur radio QSO, standard logging procedures apply. Be sure you carefully mark down all the QSO information in your station log, especially any special procedures required to claim your certificate.

Some stations will give you a contact number to help the operators find your QSO when it's time to confirm your contact. Many groups make 3000 or more contacts in the course of a weekend – and if your information is more than a little off, the log checkers may not find your contact and you'll wind up in the dreaded position of being "not in the log."

After making a Special-Event QSO, take the final steps while the whole thing is fresh in your mind. If you discovered the event in a magazine or an online listing, the information probably detailed what the award was (a special QSL card, a certificate, or both) and how to obtain it. Usually, you send in your QSL card with all of the information about the contact (the day, time, the call sign you worked, the band and the signal report you gave) correctly and accurately filled in. If the op mentioned a contact number, make sure you display it prominently on the card. And make sure you've included a self-addressed, stamped envelope (SASE), if requested.

If a group is offering certificates, it's best to send a 9- x 12-inch SASE. Most certificates are printed on 8-1/2- x 11-inch stock, and this will ensure that yours will not come back folded beyond recognition. And remember, larger envelopes require extra postage.

Some groups want *no QSL cards* or log data at all (an emerging trend, it seems)! These ops will simply send your QSL card or certificate to the address listed in the FCC call sign database or the database used at **www.qrz.com**. In that case it's important that the event ops copy your call sign correctly or you won't ever get your wallpaper. You also have to make sure your address is updated and current in the FCC database, which you should do anyway!

If you follow these basic steps you'll soon have commemorative certificates stacked up like cordwood, with the most interesting covering all of those empty spots on your shack walls. Collecting wallpaper can be somewhat addictive, but what's life without a few compulsions? I'll see you in the pileup for the Americas Cup commemorative QSL!

Resurrecting a 2 Meter HT and Logging TVDX

Recently I found I had a need for something smaller and more versatile than the Kenwood mobile 2 meter set I had been using for years in the car. I needed a full-function handheld transmitter (HT). I did have a 20 year-old Icom IC-2SAT miniature 2 meter HT, but its internal battery needed to be replaced and the unit didn't have nearly the capability I wanted; it was 2 meters only; no CTCSS (continuous tone code squelch system) tone board (a must-have to activate most repeaters); and limited out of band reception. It was so old that Icom advised it had no parts for replacement. It wasn't worth the cost of a new internal battery pack to salvage.

Then I found a newer, 10 year-old, Alinco DJ-V5 in the junk drawer. I remembered vaguely that my wife and I had matching sets before cell phones became small, cheap and indispensible, but I couldn't remember why it was confined to the junk drawer. I pulled it out, found the matching wall transformer adrift in a sea of disused wall transformers, and plugged it in to charge the internal battery. Well, it too needed a battery transplant. (Alinco says the battery pack is good for 500 charge cycles, but who in the world counts?) The prospects for this HT were much better: It's a dual bander, covering 2 meters and 70 centimeters with FM broadcast thrown in.

I had the original owner's manual which showed how, among other things, the HT could be hooked up to a TNC (terminal node controller) and used for packet operations, and the manual claimed it could be used for cross-band operation as well. That brought up interesting possibilities including the potential to work some amateur satellites.

I wanted to learn a little more about the set, so I went online. My first stop was **www.eham.net** where over the last twelve years the little rig earned a rating of 4.4 out of 5 from 93 reviews – pretty amazing. This model has long been out of production and the current replacement, the DJ-V57T (which as this is written is not yet FCC approved for sale but is expected to sell for about $150) doesn't appear to have any optional receive capability.

Looking over the DJ-V5's specs at the Alinco products web site I noticed something really interesting: "Expandable Receive Range, (76 ~ 999 MHz)." It's not uncommon for such older radios to be able to be modified to expand reception capabilities, so I was next off on a Google search to learn how to do it. The search returned a dozen or so web sites that basically showed the same procedure: cut one wire and the receiver tunes from 76 to 999 MHz (cellular blocked). Remember that any such procedure voids any warranty you may have and that you alone are responsible for doing any damage to anything as a result.

Regardless of any potential from modification, in order for the set to be of any use, the battery pack would still have to be replaced. Online I found Batteries America, (**www.batteriesamerica.com**, 800-308-4805), a company in Wisconsin that carries replace-

Yaesu's VX-7R ($370) has 6 and 2 meters as well as 70 centimeters FM plus AM/FM broadcast, AIR/Public Service and the whole HF spectrum (1.8 - 30 MHz). (Courtesy: Universal Radio)

ment and upgrade battery packs for everything from cell phones to laptops and from ham radio HTs to FRS/GMRSs and everything in between. They carry battery replacements for all radio brands including Icom, Kenwood, Yaesu, Wouxan, Radio Shack/Realistic, Uniden, and Standard.

The salesperson at the 800 number was very knowledgeable and steered me to a replacement battery pack that had more than double the capacity of the original pack (1450 mAH vs 600 mAH) for $53. The pack, which comes complete with a heavy duty belt clip attached, arrived in just a few days via USPS ($8 shipping charge). After charging the pack I was ready to see just what the expanded Alinco HT was capable of.

So how did it perform?

A 2 meter HT shouldn't be expected to replace your handheld scanner, but it can provide extra listening options for those long stretches when no one is on the repeater or you just want to hear something different. Like many HTs, the DJ-V5 has three scan functions: scan a particular band, program to scan certain frequencies within a band, or scan the memory channels.

One thing to note is that the modification, while it expands the receive capability of the set, still limits transmissions to the ham bands. Try to key up on anything other than a legal amateur radio frequency and the display reads: OFF.

Now, when the HT is turned on and switched to VFO mode, instead of only going from 2 meters to 70 cm to the FM broadcast band and back again, the HT stops on the 220 ham band; the aircraft band (in AM); the public service band, and 400-999 MHz as well as 2 meters and 70 cm.

My first stop was the air band. Using an outside mounted scanner antenna I was able to hear a local repeater for Washington Center, the
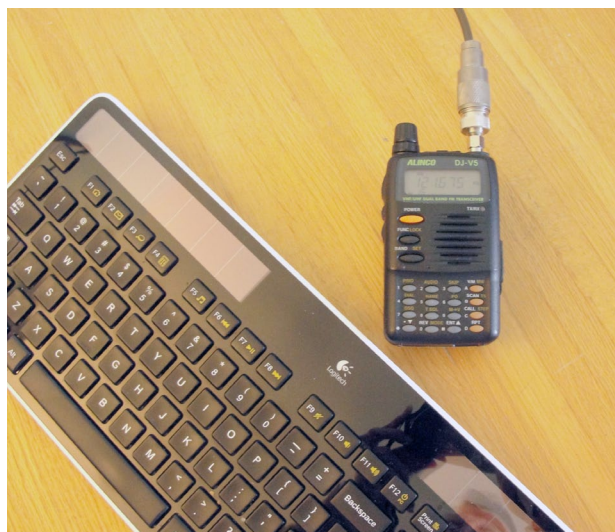
Alinco's DJ-V5 gets a new life as a 2 meter/440 HT/scanner thanks to a battery replacement and a pair of wire cutters; here it's tuned to Washington Center ATC. (Courtesy: Author)

air route traffic control center which delivers nonstop chatter from the endless stream of domestic and foreign flights coming in and out of Washington, D.C.'s two airports. Next stop was the local police frequency, which in my area is still old fashioned analog VHF, though state police agencies are now all digital.

Weighing the Options

Well, they don't make 'em like they used to and, as mentioned, Alinco's replacement for this HT isn't nearly as capable. However, there is one new HT that's worth a closer look: Yaesu's VX-7R ($370 at Universal Radio). While I haven't had the opportunity to use this model, it has some very significant features most hams will appreciate. This HT transmits in FM on 6 meters, 2 meters and 70 centimeters, as well as receiving the AM and FM broadcast bands; HF from 1.8 to 30 MHz; Air Band, and the old VHF and UHF TV bands as well as 800-999 MHz (cellular blocked). You get all these functions (did I mention WeatherRadio Alerts?) without having to do any mods and it comes with a warranty.

Trying to figure out if an older HT is worth salvaging is mostly a matter of economics. If the HT is too old, like my Icom IC-2SAT, there's no choice: without the manufacturer supporting the device with spare parts it has no future. Others, like my DJ-V5, are new enough and versatile enough to warrant an upgrade depending on what's needed. In my case, the addition of a new battery pack was well worth the price.

To help make your decision, call the authorized repair company for your brand and see what their technicians say. Of course, they'll say they can't be precise without looking at the unit, but they'll give you a ballpark price. There will typically be a set diagnostic fee, a dollar per hour bench fee with an estimate as to how much time it will take to do repairs, and you'll be charged for shipping in both directions. That minimal quote on repair expenses may quickly make the decision for you. Repairs on HTs can be expensive; consider spending that amount of money on something new with more features and a warranty.

❖ TVDX Logging Dilemma

Longtime *MT* reader and avid all-band monitor, Judy May W1ORO wrote, "The February issue of *Monitoring Times* had an article about digital TV DXing in the 'On The Bench' column. It brought a question to mind that I would like to pose to you.

"One of my digital TV converter boxes is a DTV PAL PLUS made by DISH Network. (Don't be confused by the name: I have never had satellite TV; they just made the box and I bought it retail.) An unusual feature of this box is that it periodically powers itself up and scans for new channels. Sometimes when I turn it on, it displays a message that it 'found xx new channels.' Some of these stations are far away, and I NEVER see any image from them whatsoever.

"My question is whether I can legitimately count these captures as true DX reception, and

Judy May's screen shot shows WKRN-TV (232 miles away) was received in the middle of the night during an automatic channel scan. Put it in the log? Maybe yes, maybe no. (Courtesy: Judy May W1ORO)

enter them into my log. As you can see from the attached photograph, the reception includes two separate pieces of information: the station call sign, and the digital TV channel number (which is different from the frequency, and may or may not be different from the actual TV channel on which the transmission occurred). In this case, I am looking at WKRN in Nashville, Tennessee. Looking up the FCC data on where their antenna is located, and plugging those coordinates into my old GPS receiver, it tells me the distance is 232 miles. That's a new record for me. What is your opinion – is the catch valid?"

What a great question! I'm no stickler for rules governing personal achievement awards in radio or TV monitoring, so my initial answer is: Yes! You can put it in the log, as they say on the DX nets. But, on the other hand, you didn't actually see the channel to verify that there was any more than just enough data coming in to allow the ID to be displayed indicating that the station had been received. And, anyway, is it fair to log stations that came and went while you were happily asleep? The answer is: No!

TVDX achievements are meant to be grueling efforts made possible only by swilling gallons of coffee and enduring countless commercials to get to a station ID so you can photograph the screen as proof. I'm afraid that serious TV DXers would require a screen shot with actual video imagery as proof of ID before they would allow you to log it. Even then, a question arises: How much video? A couple of pixels? Most of the screen? The answer is obvious: enough video to clearly see a logo that IDs the station, besides the data strip that ends up in your guide that you can photograph. But, what if the DX path closes down before a proper image forms for you to make a clear ID? Too bad! Better luck next time.

I have recently started a new personal DX challenge: logging AM HD-Radio DX. This is a pretty arcane niche, so I've written my own rules. To be a confirmed catch, a photograph of the receiver's LCD display must show the

HD icon with at least one of the three bars lit; the station's call sign must be displayed as well as the station's slogan or website. I don't need QSL cards because, like the DTV screen, the radio display is confirmation. So far I've logged three stations: WCBS, WBZ, and WLW. I have a partial on WFAN (HD icon is lit but no bars; call sign is displayed but no logo), so it won't count. I'm really going to have to sweat to get WFAN confirmed. And, that's what it's all about!

Radio Canada International's Last Hurrah?

Welcome to the June 2012 edition of *Programming Spotlight*. This month we shine the Spotlight on **Radio Canada International**, the latest international broadcaster to announce it is leaving shortwave, and the venerable CBC Northern Quebec Shortwave Service, which is also on the chopping block. Then we'll check out Keith Perron's PCJ Media website, and look at some of the programs PCJ is making these days. Finally, we'll note the return of a popular BBC 4 radio program, and mark 20 years of EWTN and its shortwave station WEWN.

In the 1970s, when I first got into the shortwave listening hobby, Radio Canada International was one of the most easily heard world band stations, broadcasting for many hours of the day. RCI was heard in many languages, around the clock, with a wide and eclectic variety of programming. I used to like to practice my Russian by listening to the RCI Russian Service. Ian McFarland was a household name (among SWLs and DXers, anyway) and programs like *SWL Digest, Listeners Corner* and *Innovation Canada* proved very popular. Many domestic CBC programs such as *As It Happens, Royal Canadian Air Farce* and *Sunday Morning* were also heard via the RCI shortwave transmissions. Then in the 1991 round of budget cuts, many of these programs were sacrificed along with a number of language services.

A few years ago, RCI again changed its focus, appealing to new Canadians and potential immigrants. The English service, such as it is, consists of a daily magazine called *The Link* on weekdays. On weekends, one can hear *The Maple Leaf Mailbag* and *Masala Canada*, an "eclectic Canadian radio program with a South Asian flavour."

As the deadline for this column approaches, Radio Canada International, the CBC Northern Quebec Shortwave Service, and the Sackville shortwave transmitter site itself all appear destined to be closed as a result of cuts to the Canadian Broadcasting Corporation in the recent federal budget. The RCI website indicates that, "Spending cuts announced last week in Canada's latest federal budget have reached Radio Canada International. Speaking to employees at RCI's headquarters in Montreal on Wednesday, RCI director Helene Parent declared that two out of three RCI employees – about 40 people – will lose their jobs by the end of July. RCI's Russian and Portugueuse (sic) sections will be closed along with the English and French-language newsrooms. All shortwave broadcasts will cease as well. RCI will continue to exist solely on the Internet in five languages – English, French, Arabic, Spanish and Mandarin." (rcinet.ca)

Reportedly, all RCI short-wave programming will end on June 26. It is also reported that the Sackville shortwave transmitters will be closed, resulting in the end of the CBC Northern Quebec Shortwave Service. The CBCNQSWS has been available on 9625 kHz for years, carrying a variety of CBC Radio One, Radio-Canada (French) and CBC North (Aboriginal languages) programming. There are also cutbacks coming to other domestic services.

It seems that every time CBC faces a budget cut, Radio Canada International takes a hit. It is much easier to slash a service that doesn't serve a domestic audience. This time RCI loses about 80% of its budget and two thirds of its staff. As a strictly Internet based operation, with a minimal staff, one wonders how much relevance it will have. Will people listen to Radio Canada International online when they can just go directly to CBC Radio One or Radio-Canada (or any Canadian radio station that happens to stream online)?

Also threatened by this development are the rebroadcasts of other shortwave broadcasters via Sackville, such as the Voice of Vietnam, Radio Japan, China Radio International and KBS Radio Korea. It is unclear at the time of this writing how these rebroadcasts might continue. Perhaps if the Sackville site is sold or rented to another broadcaster, they may yet continue.

If RCI and the Sackville transmitter site close down, one also wonders how long the 1kW CBC transmitters in St. John's, Newfoundland, and Vancouver, BC will survive. Canada as a challenging DX target – who would have thought that could happen?!

RCI programming will continue online at **www.rcinet.ca.** Now is the time to log the Sackville transmitter, before shortwave broadcasts cease.

The broadcasts of the CBC Northern Quebec Service on 9625 kHz give one the opportunity to hear a good cross section of CBC programming in English, French, Cree and Inuktitut. It is perhaps the last opportunity to hear the latter languages on shortwave. A few of the programs which continue to be heard on 9625 kHz, for now, include:

The World At Six/As It Happens – heard weekdays at 2200 UTC, this is probably the CBC's flagship current affairs block of programming. *The World at Six* is the CBC's authoritative newscast of the day, and then *As It Happens* talks to newsmakers around the world, as well as touching on the lighter side of the news. (One running gag on the show has been going on for almost 40 years. In the 1970s Barbara Frum was conducting an interview with a farmer in the UK. She asked where his farm was. He replied that it was a certain number of miles from Reading, which was clear enough to him but meaningless to a Canadian audience. To this day, they often conclude an interview with someone by mentioning that the person was x miles from Reading).

Saturday nights, one can hear some fantastic music programming from CBC Radio One. These programs include Randy Bachman's *Vinyl Tap*, in which Randy talks about his career and music and spins a lot of great tunes. This can be heard at 2300 UTC Saturdays. This is followed by *Saturday Night Blues* at 0100 UTC Sunday and *A Propos* at 0300, a program featuring the best music of French Canada. *A Propos* is hosted by Jim Corcoran, a leading Quebec singer-songwriter. It's a nice change to hear this music from the francophone world. It has introduced me to many artists I might not have come across otherwise.

The CBCNQSWS is also home to such CBC Radio One staples as *Quirks and Quarks* at 1600 UTC Saturdays, and *Cross Canada Checkup* hosted by the one and only Rex Murphy, perhaps the most erudite (and nicest) talk show host on the planet! Listen to *Cross Canada Checkup* at 2000 UTC Sundays.

Give these programs from Sackville a listen while you still can. And by the way…Sackville is 2833.4 miles from Reading.

❖ PCJ Media

Keith Perron's **PCJ Media** has certainly come a long way in just a few years. Initially reviving the long-running and fondly remembered Radio Netherlands *Happy Station* program, many new programs have been added in the past few years.

Some of these include:

Jazz For The Asking – I really dig this program. It offers music from the past century covering all facets of jazz. Classic recordings such as *A Tisket, A Tasket* that launched the career of The Lady Ella (Ella Fitzgerald) mesh with more modern recordings, creating a very interesting and entertaining mix. The program is hosted by Keith Perron, who really knows his stuff when it comes to this type of music. But he doesn't get in the way of the music. There's not a lot of extraneous chatter, the focus is on the music. And in a typical two hour program, Keith squeezes in an awful lot of music. *Jazz For The Asking* can be heard on stations throughout the world, such as World FM in New Zealand and South Herts Radio in the UK. One can also subscribe to the program via iTunes, and listen online to a number of past editions via the PCJ website. Check it out at: **www.pcjmedia.com/jfta**

Another program revived by PCJ is Radio Netherlands' iconic **Media Network** program, a show that ran for over twenty years on shortwave. For all of those years, beginning in 1981, the *Media Network* program hosted by Jonathan Marks was a must-hear every week, bringing news of the media world to SWLs and DXers, largely before the advent of the internet. In those primitive times, shortwave radio WAS the internet.

PCJ has two programs, **Classic Media Network** and **Media Network Plus**. As the name suggests, *Classic Media Network* consists of archived programs from the original twenty year run of the program. It's an interesting opportunity to listen to these historic programs. Back in the day, I would record these shows on cassette tapes (which I still have boxes of). Today, one can listen online, download them from the PCJ website, or subscribe to them using iTunes.

Media Network Plus is a modern version of the same great program. This new version is co-hosted by Keith Perron and Paulette MacQuarrie. At the end of March, the communications magazine covered the Winter SWL Fest in Pennsylvania (which Keith attended) among many other topics. Keith recorded some really great reports at the Fest, including a pretty comprehensive one on the pirate radio activity at the Fest. It was almost like being there yourself. Almost…

One can listen to every edition of *Media Network Plus* from the first edition in October 2010 on the PCJ Website, and it can be heard on shortwave via WRMI, Radio Miami International at the following times: UTC Fridays at 0100 (a 55 min version on the last Friday of the month), at 2200 UTC Saturdays one can hear the weekly 30 min version, and there is a version beamed to Europe at 1830 UTC Saturdays on 7590 kHz DRM. Check out the *Media Network Plus* website at **www.pcjmedia.com/medianetworkplus** and while you are there explore the whole PCJ website. It's evolved into quite a useful site for fans of good radio.

Long-time listeners (as well as novices) will get a kick out of the "Classic Radio Archives" page at **www.pcjmedia.com/archives** Here you will find lots of recordings of radio programs from the past from Herbert Morrison's famous broadcast of the Hindenburg Disaster, to Cold War Era programs from Radio Moscow, to CRI coverage of the September 11, 2001 terrorist attacks. And, if you fancy some good old Stalinist propaganda, listen to Radio Pyongyang recorded in 1994, just a few weeks after the death of "The Great Leader" Kim Il-Sung. If you like these types of historical broadcasts, you'll spend hours here.

❖ Speaking of History…

BBC Radio 4's *Making History* program has returned for another series during April, May and June. This is a really fascinating program, exploring "ordinary people's links with the past." Listeners will call or write the program with a question about a person in their family tree, or an historical event which took place in their community, and the *Making History* team will investigate and do a report.

The program has been hosted for many years by Vanessa Collingridge (PBS viewers will recall her from a documentary on Captain Cook) and more recently by Tom Holland.

While some might find history "dry," this 30-minute program is always packed with interesting and entertaining content. For instance, in April, in honor of the centenary of the sinking of the *Titanic*, the program investigated the understanding of icebergs in 1912, and asked if the ship's designers could really be blamed for not knowing what we know now. It also looked at the little-known, but vital work of the men who manned weather ships in the North Atlantic during World War II, who not only battled the elements, but also the threat of enemy U-Boats, to get this crucial information back to the military planners in London. The program wrapped up with a listener in Dorset looking for help with a project which marks the impact of black GIs during WWII. That's just *one* episode.

Not enough? There are over 80 past programs going back to 2009 available on the program archive, and dozens more from even earlier at another archive page. If you like history, this program is definitely for you! The program is heard live on Tuesdays at 1500 GMT, and for 7 days thereafter on the BBC archive. It is also available as a podcast. There is even a *Making History* Facebook page. You can access all of this programming and other related information at **www.bbc.co.uk/programmes/b006qxrc**

❖ WEWN Marks 20 years of broadcasting

In March, the EWTN Global Catholic Radio Network marked its 20th year on the air. Shortwave radio listeners will know that WEWN on shortwave is a key part of this network. In the words of Archbishop Joseph Naumann of Kansas City, MO:

"Catholic radio is a bishop's best friend, as far as I'm concerned, because it gives us an opportunity to get our message to our people unfiltered.

"I think the Lord is providing us at this moment with this very powerful and effective tool to educate our people. I look at Catholic radio as the most effective adult-education formation tool that I have."

Catholic radio, he added, "is a very non-threatening way for someone who isn't Catholic to become acquainted with the faith, and it is bearing this fruit that Mother Angelica foresaw."

I am not Catholic, but one doesn't have to be one to realize that Mother Angelica is a really remarkable woman, who has accomplished much. For many years I would listen to WEWN broadcasts on shortwave and found her to be most interesting and knowledgeable. Last year when I upgraded my cable television package, two perks for me were the addition of BBC World and EWTN. Some very thoughtful discussion programs, Catholic history, and of course, recordings of Mother Angelica (she has been ill in recent years, so she is on the air via archived programs) air throughout the day.

In 2010, I attended the NASB Annual Meeting as an observer when it was held in Hamilton, Ontario and had a chance to chat very briefly with Glen Tapley of WEWN who did a presentation on that station. He confirmed my opinion of Mother Angelica. She is one of the more unusual faith broadcasters with a dry wit and a no nonsense approach. She talks to her audience, not down to them. She is an interesting, charismatic lady indeed!

One can hear **Mother Angelica Live Classics** on UTC Wednesdays at 0000 UTC on 11520 kHz. She can also be heard on UTC Mondays at 0100, UTC Sundays at 2100 on 15610 kHz. One can also listen online via the Internet, of course, at www.ewtn.com

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

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

Anniversary and Field Day QSLing

You saw it first on my *Shortwave Central* blog, but here's a reminder that WINB is celebrating their 50th Anniversary in 2012. The station is offering a new QSL card featuring a vintage view of their control room. Listeners may send their program details or audio recep-

tion to *winb40th@yahoo.com* or postal report to: 2900 Windsor Rd., Red Lion, PA 17356 USA.
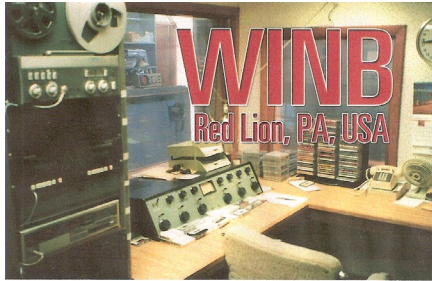
For last minute tips on QSLing, Blogs, Logs, and the global short-wave scene, please visit *Shortwave Central* at **http://mt-shortwave. blogspot.com/**, a division of Teak Publishing. Correspondence or contributions may be sent to *teakpub@ brmemc.net* For quick shortwave tweets "as it happens," you may follow me online at Twitter **www.twitter.com** at **QSLRptMT.**

Don't forget to mark Saturday, June 25th on your DX calendar. Amateur radio operators in the U.S. and Canada will be on the air to celebrate Field Day, a 24 hour period of making as many

radio contacts as possible. The club field day operations are usually excellent verifiers.

Many shortwave listeners work all 50 states and Canadian provinces during an ARRL (American Radio Relay League) Field Day weekend. Note the call sign, frequency, time, date and who they worked, and the reception quality description. Include a self-addressed stamped envelope (SASE) with your details. Searchable calls for postal address info should go to **www. qrz.com**. Consult the ARRL website at **www. arrl.org** for upcoming news and rules about Amateur Radio Field Day.

AMATEUR RADIO

United States-W9H/HCJB Special Event Station. Full data mic/map card signed by Wayne W8GXB. Received in 64 days for SWL report and SASE (used for reply). Also received brochure about HCJB technology center. QSL address: Box 9, Elkhart, IN 46515 (Bill Wilkins, Springfield, MO).

MEDIUM WAVE

Canada-CINA,1650 kHz AM, Mississauga, Ontario. *Alltime Bollywood Hits.* Returned my report with "we find authentic" written across the top and signed by Neeti Prakash Ray, President. Received in 47 days for an English report and one IRC. Station address: 1515 Britannia Rd., East, Suite 315, Mississauga, ON L4W 4K1 Canada (Al Muick, Whitehall, PA). 🔊 Streaming audio **www.cinaradio.com** Email: *cinaradio@gmail.com* Veri-signer *neetiray@gmail.com*

Cuba-Radio Rebelde, 600 kHz AM San Germán. No data Rebels scenery card, signed by Osana Osoris, Editora. Received in 31 days for Spanish report to: *web@radiorebelde.icrt. cu* (Muick). Postal address: Radio Rebelde, Apartado 6277, La Habana 10600 Cuba (or) Edif. Del ICRT, Av. 23 N° 258, Vedado, La Habana 10400, Cuba. 🔊 Streaming/on demand audio **www.radiorebelde.cu/#**

KBCV 1570 kHz AM, Hollister, Missouri. Verification on station letterhead, signed by Paul Schneider-Operations Manager, and bumper sticker. Mentions KBCV runs 1,000 watts daytime/5,000 nighttime. Received for an AM report and SASE. Station address: Bott Radio Network, 1111 S. Glenstone Ave., Suite 3-102, Springfield, MO 65804 (Patrick Martin, Seaside, OR).

KDDR, 1220 kHz AM. Oakes, North Dakota. Received after several follow ups and emails. Half-page note from Wade Fossum, KDDR News with "it was them per my CD." Station runs 327 watts nighttime. Received for a CD and used my enclosed SASE. Station address:

136 Central Ave., North, Valley City, ND 58072 (Martin).

SÃO TOMÉ

Voice of America relay via Pinheira, 15775 kHz. Electronic verification letter for Studio 7 program from Helena Menezes and E-QSL of sites/BBG logos from Victor Guadelape, Transmitter Plant Assistant Supervisor. Received in one week for email report to: *HMenezes@ sto.ibb.gov* (Wendel Craighead, Prairie Village, KS).

UTILITY

Canadian Forces Weather Broadcast Station, 6754 kHz. No-data thank you letter showing station photos, signed by MCPL Jonathan Perreault. Received in 153 days for an English utility report and $2.00 US for return postage. QSL address: 8 Wing Telecommunications and Information Services Squadron, Military Aeronautical Communications System (MACS), P.O. Box 1000, Stn Forces Astra, ON K0K 3W0 Canada (Albert Muick, Whitehall, PA/HCDX). Partial data verification on 8 Wing/Military Comm. letterhead, 15034 kHz. Received in 42 days for a utility report and mint postage (used on reply) (Wilkins).

Germany-DHN66-NATO Air Base Geilenkirchen, 6690 kHz. Full data prepared QSL verified, plus sticker, bookmark and station information sheet. Received in 18 days. Station address: NATO Airborne Early Warning & Control Force, E-3A Component, Public Affairs Office, Postfach 433007, 52511 Geilenkirchen, Germany (Patrick Robic, Austria/UDXF).

WHL-St. Augustine Radio, 8687.5 kHz. Full data station QSL card, signed by Harry F. Wetzel. Received in 14 days for a utility report. Station address: AugTec LLC, 948 Colonial Dr., St. Augustine, FL 32806 (Robic).

WHO-Mobile Radio, 8419 kHz. Full data E-QSL from Rene Stiegler. Received in 18 minutes for email details to: *info@shipcom.com*. Postal address: ShipCom LLC, 7700 Rinla Avenue,

Mobile, AL 36619 USA (Ivan Dias Jr, Sorocaba, Spain/playdx).

USA

VOA-Greenville, NC, 7465 kHz. Full data antenna field QSL card, signed by Marvin M. Dail, Jr, Chief Engineer. Report sent direct to site. Received in 32 days for an English report. Station address: 3919 VOA Site B Rd., Grimesland, NC 27837 (Bill Wilkins, Springfield, MO).

JUNE SPECIAL EVENTS CALENDAR

Museum Ships Weekend
June 2-3, 0000-2359 UTC. W1T, Shelburne, VT. Radio Amateurs of Northern Vermont. Operating on 28.500, 21.300, 14.250, 7.200 MHz. Certificate. Bob Brown, 5 Repa Dr, Essex Junction, VT 05452. Club will operate SSB from the Steamboat *Ticonderoga* at the Shelburne Museum during the Museum Ships Weekend. Send 9x12 SASE. *w4yfj@ comcast.net*

WWII Submarine USS Cobia AGSS-245
Jun 2-3, 1400-2100 UTC. NB9QV, Manitowoc, WI. USS Cobia Amateur Radio Club. Operating on 14.250, 7.240 MHz. Certificate & QSL. Fred Neuenfeldt, 4932 S 10th St, Manitowoc, WI 54220. Certificate $1.00 to Vernon McNulty, K0EFV, 4015 Independence Ave, Waterloo, IA 50703; **www.qrz.com/ db/nb9qv**

International Museum Ships Radio Event, D Day Normandy 1944, Navy Hospital Corps Established 1898
Jun 9, 1600-2359 UTC, and…

ARRL Radio Field Day
June 25, 1600-2359 UTC. NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. Operating on SSB 14.320, 7.250 MHz, PSK31 14.070, D-STAR 012C and 2 meters/70 cm SOCAL reports. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. *kk6fz@ arrl.net*

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

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

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

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

SHORTWAVE GUIDE

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

0000	0030		Egypt, R Cairo	6270na	
0000	0030		USA, BBG/Voice of America	7555as	
0000	0045		India, All India R/External Svc		
			9705as	9950as	11670as 13605as
0000	0045	DRM	India, All India R/External Svc	9950eu	
0000	0045		USA, WYFR/Family R Worldwide	7520na	
0000	0056		Romania, R Romania Intl	9700na	11965na
0000	0057		Canada, R Canada International	11700as	
0000	0057		China, China R International		
			6005as		
			6020na	6180as	7350eu 7425as
			9425as	9570as	11650as 11790as
			11885as		
0000	0100		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
0000	0100		Australia, ABC NT Alice Springs	4835do	
0000	0100		Australia, ABC NT Katherine	5025do	
0000	0100		Australia, ABC NT Tennant Creek	4910do	
0000	0100		Australia, ABC/R Australia	9660pa	12080pa
			13690va	15240va	17715va 17750va
			17795va		
0000	0100		Bahrain, R Bahrain	6010me	
0000	0100		Canada, CFRX Toronto ON	6070na	
0000	0100		Canada, CFVP Calgary AB	6030na	
0000	0100		Canada, CKZN St Johns NF	6160na	
0000	0100		Canada, CKZU Vancouver BC	6160na	
0000	0100		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	13745na	
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	7812usb 12133usb
			12759usb	13362usb	
0000	0100		USA, EWTN/WEWN Irondale AL	11520me	
0000	0100		USA, FBN/WTJC Newport NC	9370na	
0000	0100	sm	USA, WBCQ Monticello ME	5110am	
0000	0100		USA, WBCQ Monticello ME	9330am	
0000	0100	mtwhfa	USA, WBCQ Monticello ME	7490am	
0000	0100	sm	USA, WHRI Cypress Creek SC	7385ca	
0000	0100		USA, WINB Red Lion PA	9265ca	
0000	0100		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
0000	0100		USA, WWCR Nashville TN	4840eu	5935af
			6875af	9980eu	
0000	0100		USA, WWRB Manchester TN	3185na	3215na
			5050na	5745va	
0000	0100		USA, WYFR/Family R Worldwide	17580as	
0000	0100		Zambia, CVC/R Christian Voice	4965af	
0030	0100		Australia, ABC/R Australia	15415va	
0030	0100	asf	Canada, Bible Voice Broadcasting	9490as	
0030	0100	Sun	Palau, T8WH/WHRI	15700as	
0030	0100	twhfa	Serbia, International R Serbia	9685va	
0030	0100		USA, BBG/Voice of America/Special English		
			6170va	9325va	9490va 9715va
			11695va	11730va	12005va 15185va
			15205va	15290va	
0035	0045		India, All India R/Aizawl	5050do	
0035	0045		India, All India R/Chennai	4920do	
0035	0045		India, All India R/Guwahati	4940do	
0035	0045		India, All India R/Hyderbad	4800do	
0035	0045		India, All India R/Imphal	4775do	
0035	0045		India, All India R/Port Blair	4760do	
0035	0045		India, All India R/Shillong	4970do	
0035	0045		India, All India R/Shimla	4965do	
0035	0045		India, All India R/Thiruvananthapuram	5010do	

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

0100	0115	Sat	Canada, Bible Voice Broadcasting	9490as	
0100	0128		Vietnam, VO Vietnam/Overseas Svc	6175na	
0100	0157		China, China R International	6005na	
			6020na	6075as	6175na 7350eu
			9410eu	9420as	9570na 9580na
			11650as	11885as	

0100	0200		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
0100	0200		Australia, ABC NT Alice Springs	4835do	
0100	0200		Australia, ABC NT Katherine	5025do	
0100	0200		Australia, ABC NT Tennant Creek	4910do	
0100	0200		Australia, ABC/R Australia	9660pa	12080va
			13690va	15240va	15415va 17715va
			17750va	17795va	
0100	0200		Bahrain, R Bahrain	6010me	
0100	0200		Canada, CFRX Toronto ON	6070na	
0100	0200		Canada, CFVP Calgary AB	6030na	
0100	0200		Canada, CKZN St Johns NF	6160na	
0100	0200		Canada, CKZU Vancouver BC	6160na	
0100	0200		Cuba, R Havana Cuba	6000na	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		North Korea, Voice of Korea	4405as	
			7220as	9345as	9730as 11735as
			13760as	15180as	
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	7812usb 12133usb
			12759usb	13362usb	
0100	0200		USA, BBG/Voice of America	7430va	11705va
0100	0200		USA, EWTN/WEWN Irondale AL	11520me	
0100	0200		USA, FBN/WTJC Newport NC	9370na	
0100	0200	mtwhfa	USA, WBCQ Monticello ME	7490am	
0100	0200		USA, WBCQ Monticello ME	9330am	
0100	0200	twhfa	USA, WHRI Cypress Creek SC	5920na	
0100	0200		USA, WINB Red Lion PA	9265ca	
0100	0200		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
0100	0200		USA, WWCR Nashville TN	3215eu	4840na
			5890af	5935af	
0100	0200		USA, WWRB Manchester TN	3185na	3215na
			5050na	5745va	
0100	0200		Zambia, CVC/R Christian Voice	4965af	
0120	0200	mtwhfa	Sri Lanka, SLBC	6005as	9770as 15745as
0130	0200		Myanmar, Thazin BC Sta	6030do	
0130	0200	Sun	Palau, T8WH/WHRI	15700as	
0130	0200	twhfa	USA, BBG/Voice of America/Special English		
			5960va	7465va	
0130	0200	twhfa	USA, WRMI/R Slovakia Intl relay	9955am	

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

0200	0230		Thailand, R Thailand World Svc	15275na	
0200	0257		China, China R International	11785as	
			13640as		
0200	0300		Anguilla/Caribbean Beacon/Univ 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	9660pa	12080va
			13690va	15240va	15415va 15515pa
			17750va	21725as	
0200	0300		Bahrain, R Bahrain	6010me	
0200	0300		Canada, CFRX Toronto ON	6070na	
0200	0300		Canada, CFVP Calgary AB	6030na	
0200	0300		Canada, CKZN St Johns NF	6160na	
0200	0300		Canada, CKZU Vancouver BC	6160na	
0200	0300		Cuba, R Havana Cuba	6000na	6050na
0200	0300		Egypt, R Cairo	9315na	
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		North Korea, Voice of Korea	3560as	
			13650va	15100as	
0200	0300	Sun	Palau, T8WH/WHRI	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	7812usb	12133usb
			12759usb	13362usb		
0200	0300		USA, EWTN/WEWN Irondale AL	11520me		
0200	0300		USA, FBN/WTJC Newport NC	9370na		
0200	0300	mtwhfa	USA, WBCQ Monticello ME	7490am		
0200	0300		USA, WBCQ Monticello ME	9330am		
0200	0300	twhfa	USA, WHRI Cypress Creek SC	5920na		
			7385na			
0200	0300		USA, WINB Red Lion PA	9265ca		
0200	0300		USA, WTWW Lebanon TN	5080am	5755am	
			12105na			
0200	0300		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0200	0300		USA, WWRB Manchester TN	3195na	5050na	
			5745va			
0200	0300		USA, WYFR/Family R Worldwide	5985ca		
			6115na			
0200	0300		Zambia, CVC/R Christian Voice	4965af		
0215	0225		Nepal, R Nepal	5005as		
0230	0257		China, China R International	15435as		
0230	0300	twhfas	Albania, R Tirana	7425na		
0230	0300		Myanmar, Myanma R/Yangon	9731do		
0230	0300		Vatican City State, Vatican R	7360af		
0230	0300		Vietnam, VO Vietnam/Overseas Svc	6175na		
0245	0300		India, All India R/Bhopal	7430do		
0245	0300		India, All India R/Delhi	4860do	6030do	
			7235do	11830do	15135do	
0245	0300		India, All India R/Gorakhpur	3945do		
			6030do	7235do	11830do	15135do
0245	0300		India, All India R/Guwahati	4940do		
0245	0300		India, All India R/Hyderbad	7420do		
0245	0300		India, All India R/Imphal	7335do		
0245	0300		India, All India R/Itanagar	4990do		
0245	0300		India, All India R/Jaipur	4910do		
0245	0300		India, All India R/Kolkata	7210do		
0245	0300		India, All India R/Kurseong	4895do		
0245	0300		India, All India R/Lucknow	4880do		
0245	0300		India, All India R/R Kashmir	4760do		
0245	0300		India, All India R/Shillong	4970do		
0245	0300		India, All India R/Shimla	6020do		
0245	0300		India, All India R/Thiruvananthapuram	7290do		
0250	0300		Vatican City State, Vatican R	6040am	7305am	
			9610am			
0255	0300	Sun	Swaziland, TWR Africa	3200af		

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

0300	0315		Croatia, Voice of Croatia	3985am	7375am	
0300	0315		India, All India R/Imphal	7335do		
0300	0315		India, All India R/Itanagar	4990do		
0300	0315		India, All India R/Shillong	4970do		
0300	0325	Sun	Swaziland, TWR Africa	3200af		
0300	0330		Egypt, R Cairo	9315na		
0300	0330		Myanmar, Myanma R/Yangon	9731do		
0300	0330		Philippines, R Pilipinas Overseas	11880me		
			15285me	17700me		
0300	0330		Vatican City State, Vatican R	7360af	9660af	
0300	0356		Romania, R Romania Intl	9645na	11795na	
			11895as	15340as		
0300	0357		China, China R International	6190na		
			9460as	9690na	9790na	13620na
			15120as			
0300	0359		South Africa, Channel Africa	3345af		
0300	0400		Anguilla/Caribbean Beacon/Univ Network			
			6090na			
0300	0400		Australia, ABC NT Alice Springs	4835do		
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek	4910do		
0300	0400		Australia, ABC/R Australia	9660pa	12080va	
			13690va	15240va	15415va	15515pa
			17750va	21725as		
0300	0400		Bahrain, R Bahrain	6010me		
0300	0400	twhfas	Canada, CBC Northern Quebec Svc	9625na		
0300	0400		Canada, CFRX Toronto ON	6070na		

0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St Johns NF	6160na		
0300	0400		Canada, CKZU Vancouver BC		6160na	
0300	0400		Cuba, R Havana Cuba	6000na	6050na	
0300	0400		Malaysia, RTM Kajang/Traxx FM	7295do		
0300	0400		Micronesia, V6MP/Cross R/Pohnpei	4755 as		
0300	0400		New Zealand, R New Zealand Intl	15720pa		
0300	0400	DRM	New Zealand, R New Zealand Intl	17675pa		
0300	0400		North Korea, Voice of Korea	4405as		
			7220as	9345as	9730as	
0300	0400		Oman, R Sultanate of Oman	15355af		
0300	0400	Sun	Palau, T8WH/WHRI	17800as		
0300	0400	mtwhf	Palau, T8WH/WHRI	17800as		
0300	0400		Russia, Voice of Russia	9665va	15424na	
0300	0400		South Africa, Channel Africa	6155af		
0300	0400	Sat	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	7812usb	12133usb
			12759usb	13362usb		
0300	0400		USA, BBG/Voice of America	4930af	6080af	
			9855af	15580af		
0300	0400		USA, EWTN/WEWN Irondale AL	11520me		
0300	0400		USA, FBN/WTJC Newport NC	9370na		
0300	0400	mtwhfa	USA, WBCQ Monticello ME	7490am		
0300	0400		USA, WBCQ Monticello ME	9330am		
0300	0400	Sat	USA, WHRI Cypress Creek SC	7520va		
0300	0400		USA, WINB Red Lion PA	9265ca		
0300	0400		USA, WTWW Lebanon TN	5080am	5755am	
			12105na			
0300	0400		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0300	0400		USA, WWRB Manchester TN	3195na	5050na	
			5745va			
0300	0400		USA, WYFR/Family R Worldwide	11740ca		
0300	0400		Zambia, CVC/R Christian Voice	4965af		
0330	0400		Iran, IRIB/VOIRI	11920eu	13650eu	
0330	0400		Vietnam, VO Vietnam/Overseas Svc	6175na		
0335	0345		India, All India R/Aizawl	5050do		
0335	0345		India, All India R/Delhi	7235do	11830do	
			15135do			
0335	0345		India, All India R/Kolkata	7210do		

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

0400	0430		Iran, IRIB/VOIRI	11920eu	13650eu	
0400	0430		USA, BBG/Voice of America	4930af	6080af	
			9855af	12025af	15580af	
0400	0457		China, China R International	6190na		
			9460as	13620as	15120as	17725as
			17855as			
0400	0457		Germany, Deutsche Welle	6180af	7240af	
			9470af	12045af		
0400	0458		New Zealand, R New Zealand Intl	15720pa		
0400	0458	DRM	New Zealand, R New Zealand Intl	17675pa		
0400	0500		Anguilla/Caribbean Beacon/Univ Network			
			6090na			
0400	0500		Australia, ABC NT Alice Springs	4835do		
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek	4910do		
0400	0500		Australia, ABC/R Australia	9660pa	12080va	
			13690va	15240va	15515pa	17750va
			21725as			
0400	0500		Bahrain, R Bahrain	6010me		
0400	0500	twhfas	Canada, CBC Northern Quebec Svc	9625na		
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St Johns NF	6160na		
0400	0500		Canada, CKZU Vancouver BC	6160na		
0400	0500		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	7230af		
0400	0500	Sat	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		Turkey, Voice of Turkey	7240as	9655va	

Start	End	Days	Station	Freq	Freq	Freq	Freq
0400	0500		UK, BBC World Service	3255af	3955eu		
				5875af	6005af	6190af	7310af
				11945af	12035af	12095me	15310as
				15365as	17790as		
0400	0500		USA, Amer Forces Network/AFRTS	4319usb			
				5446usb	5765usb	7812usb	12133usb
				12759usb	13362usb		
0400	0500		USA, EWTN/WEWN Irondale AL	11520me			
0400	0500		USA, FBN/WTJC Newport NC	9370na			
0400	0500	mtwhfa	USA, WBCQ Monticello ME 7490am				
0400	0500		USA, WBCQ Monticello ME 9330am				
0400	0500	m	USA, WBCQ Monticello ME 5110am				
0400	0500	hf	USA, WHRI Cypress Creek SC	7385na			
0400	0500	Sun	USA, WHRI Cypress Creek SC	7465eu			
0400	0500	Sat	USA, WHRI Cypress Creek SC	9640me			
0400	0500		USA, WTWW Lebanon TN	5080am	5755am		
				12105na			
0400	0500		USA, WWCR Nashville TN	3215eu	4840na		
				5890af	5935af		
0400	0500		USA, WWRB Manchester TN	3195na	5050na		
				5745va			
0400	0500		Zambia, CVC/R Christian Voice	4965af			
0430	0500		Australia, ABC/R Australia	15415va			
0430	0500		Myanmar, Thazin BC Sta	6030do			
0430	0500	Sun	Palau, T8WH/WHRI	17800as			
0430	0500	mtwhf	Swaziland, TWR Africa	3200af			
0430	0500		USA, BBG/Voice of America 4930af	4960af			
				6080af	12025af	15580af	
0430	0500		Vatican City State, Vatican R 9660af	11625af			
0435	0445		India, All India R/Delhi	4860do			
0459	0500		New Zealand, R New Zealand Intl	11725pa			
0459	0500	DRM	New Zealand, R New Zealand Intl	11675pa			

Start	End	Days	Station	Freq	Freq	Freq	Freq
0500	0507	twhfas	Canada, CBC Northern Quebec Svc	9625na			
0500	0527		Germany, Deutsche Welle	6075af			
0500	0530		Germany, Deutsche Welle	9470va	9800af		
				9850va			
0500	0530		Japan, R Japan NHK World	5975va	6110na		
				11970va			
0500	0530		Vatican City State, Vatican R	3975eu	6075eu		
				7250eu	9645eu	11625af	13765af
0500	0557		China, China R International	5960na			
				6190na	7220af	7295af	9440af
				11880as	15350as	17505va	17540as
				17725as	17855as		
0500	0600		Anguilla/Caribbean Beacon/Univ Network				
				6090na			
0500	0600		Australia, ABC NT Alice Springs	4835do			
0500	0600		Australia, ABC NT Katherine	5025do			
0500	0600		Australia, ABC NT Tennant Creek	4910do			
0500	0600		Australia, ABC/R Australia	9660pa	12080va		
				13630va	13690va	15160va	15240va
				17750va	21725va		
0500	0600		Bahrain, R Bahrain	6010me			
0500	0600		Bhutan, Bhutan Broadcasting Svc	6035do			
0500	0600		Canada, CFRX Toronto ON 6070na				
0500	0600		Canada, CKZN St Johns NF 6160na				
0500	0600		Canada, CKZU Vancouver BC	6160na			
0500	0600		Cuba, R Havana Cuba	6010na	6050na		
				6060ca	6125am		
0500	0600	mtwhf	Eqt Guinea, R Africa 2	15190af			
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	15120af			
0500	0600		Russia, Voice of Russia	13755na			
0500	0600		South Africa, Channel Africa	7230af			
0500	0600		Swaziland, TWR Africa	3200af	9500af		
0500	0600		Taiwan, R Taiwan Intl	5950na			
0500	0600		UK, BBC World Service	3255af	3955eu		
				5875af	6005af	6190af	9410af
				11945af	12095me	15310as	15365as
				15420af	17640as	17790as	

Start	End	Days	Station	Freq	Freq	Freq	Freq
0500	0600		USA, Amer Forces Network/AFRTS	4319usb			
				5446usb	5765usb	7812usb	12133usb
				12759usb	13362usb		
0500	0600		USA, BBG/Voice of America 4930af	6080af			
				12025af	15580af		
0500	0600		USA, EWTN/WEWN Irondale AL	11520me			
0500	0600		USA, FBN/WTJC Newport NC	9370na			
0500	0600		USA, WBCQ Monticello ME 9330am				
0500	0600	Sun	USA, WHRI Cypress Creek SC	11565pa			
0500	0600		USA, WTWW Lebanon TN	5080am	5755am		
				12105na			
0500	0600		USA, WWCR Nashville TN	3215eu	4840na		
				5890af	5935af		
0500	0600		USA, WWRB Manchester TN	3195na	5050na		
				5745va			
0500	0600		Zambia, CVC/R Christian Voice	6065af			
0530	0556	DRM	Romania, R Romania Intl	11875eu			
0530	0556		Romania, R Romania Intl	9700eu	17760eu		
				21500eu			
0530	0557		Germany, Deutsche Welle	9800af			
0530	0600		Australia, ABC/R Australia	15415va			
0530	0600		Germany, Deutsche Welle	9850va			
0530	0600	Sun	Palau, T8WH/WHRI	17800as			
0530	0600		Thailand, R Thailand World Svc	12015eu			

Start	End	Days	Station	Freq	Freq	Freq	Freq
0600	0630		Australia, ABC/R Australia	15290as			
0600	0630		Germany, Deutsche Welle	9470af	13780af		
				17820af			
0600	0630		Myanmar, Thazin BC Sta	6030do			
0600	0630		Vatican City State, Vatican R	11625af	13765af		
0600	0650	DRM	New Zealand, R New Zealand Intl	11675pa			
0600	0655		South Africa, Channel Africa	15255af			
0600	0657		China, China R International	6115au			
				11750af	11770as	11880as	13645as
				15145as	15350as	15465as	17505va
				17540as	17710as		
0600	0659		South Africa, Channel Africa	7230af			
0600	0700		Anguilla/Caribbean Beacon/Univ Network				
				6090na			
0600	0700		Australia, ABC NT Alice Springs	4835do			
0600	0700		Australia, ABC NT Katherine	5025do			
0600	0700		Australia, ABC NT Tennant Creek	4910do			
0600	0700		Australia, ABC/R Australia	9660pa	12080va		
				13630va	13690va	15160va	15240va
				15415va	17750va	21725va	
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		Cuba, R Havana Cuba	6010na	6050na		
				6060ca	6125am		
0600	0700	mtwhf	Eqt Guinea, R Africa 2	15190af			
0600	0700		Malaysia, RTM Kajang/Traxx FM	7295do			
0600	0700		Micronesia, V6MP/Cross R/Pohnpei	4755 as			
0600	0700		New Zealand, R New Zealand Intl	11725pa			
0600	0700		Nigeria, Voice of Nigeria	15120af			
0600	0700	Sun	Palau, T8WH/WHRI	17800as			
0600	0700		Papua New Guinea, R Fly	5960do			
0600	0700		Russia, Voice of Russia	21800pa			
0600	0700	DRM	Russia, Voice of Russia	11830eu			
0600	0700		Swaziland, TWR Africa	3200af	9500af		
0600	0700		UK, BBC World Service	5875eu	6005af		
				6190af	7355eu	9410af	12095af
				15105af	15310as	17640af	17790as
0600	0700	mtwhf	UK, BBC World Service	15420af			
0600	0700		USA, Amer Forces Network/AFRTS	4319usb			
				5446usb	5765usb	7812usb	12133usb
				12759usb	13362usb		
0600	0700		USA, BBG/Voice of America 6080af	12025af			
				15580af			
0600	0700		USA, EWTN/WEWN Irondale AL	11520af			
0600	0700		USA, FBN/WTJC Newport NC	9370na			
0600	0700		USA, WBCQ Monticello ME 9330am				
0600	0700	Sat	USA, WHRI Cypress Creek SC	9615me			
0600	0700		USA, WTWW Lebanon TN	5080am	5755am		
				12105na			

Start	End		Country, Station	Freq 1	Freq 2
0600	0700		USA, WWCR Nashville TN	3215eu	4840na
			5890af	5935af	
0600	0700		USA, WWRB Manchester TN	3185na	5050na
			5745va		
0600	0700		Zambia, CVC/R Christian Voice		6065af
			17695af		
0602	0700		Swaziland, TWR Africa	6120af	
0630	0645		India, All India R/Guwahati	7280do	
0630	0645		India, All India R/Hyderbad	7420do	
0630	0645		India, All India R/Kurseong	7230do	
0630	0645		India, All India R/Mumbai	7240do	
0630	0645		India, All India R/Thiruvananthapuram	7290do	
0630	0700		Germany, Deutsche Welle	13780af	17820af
0630	0700		Vatican City State, Vatican R	11625af	13765af
			15570af		
0651	0700	DRM	New Zealand, R New Zealand Intl		11675pa

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

Start	End		Country, Station	Freq 1	Freq 2
0700	0730		Myanmar, Myanma R/Yangon		9731do
0700	0750		Austria, TWR Europe	7400eu	
0700	0750		Germany, TWR Europe	6105eu	
0700	0757		China, China R International		11785eu
			11880as	13645as	15125va 15350as
			15465as	17540as	17490eu 17710as
0700	0758		New Zealand, R New Zealand Intl		11725pa
0700	0758	DRM	New Zealand, R New Zealand Intl		11675pa
0700	0800		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
0700	0800		Australia, ABC NT Alice Springs		4835do
0700	0800		Australia, ABC NT Katherine	5025do	
0700	0800		Australia, ABC NT Tennant Creek		4910do
0700	0800		Australia, ABC/R Australia	9475as	9660pa
			9710as	11945as	12080va 13630va
			15160va	15240va	21725va
0700	0800		Bahrain, R Bahrain	6010me	
0700	0800	m/DRM	Belgium, TDP Radio	6015eu	
0700	0800		Canada, CFRX Toronto ON	6070na	
0700	0800		Canada, CFVP Calgary AB	6030na	
0700	0800		Canada, CKZN St Johns NF	6160na	
0700	0800		Canada, CKZU Vancouver BC		6160na
0700	0800	mtwhf	Eqt Guinea, R Africa 2	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	5960do	
0700	0800		Russia, Voice of Russia	21800va	
0700	0800	DRM	Russia, Voice of Russia	11830eu	
0700	0800		Swaziland, TWR Africa	3200af	6120af
			9500af		
0700	0800		UK, BBC World Service	5875eu	6190af
			7355eu	11760me	11770af 12095af
			15310as	15400af	15575me 17640af
			17790as	17830af	
0700	0800		USA, Amer Forces Network/AFRTS		4319usb
			5446usb	5765usb	7812usb 12133usb
			12759usb	13362usb	
0700	0800		USA, EWTN/WEWN Irondale AL		11520af
0700	0800		USA, FBN/WTJC Newport NC		9370na
0700	0800		USA, WBCQ Monticello ME	9330am	
0700	0800	Sun	USA, WHRI Cypress Creek SC		11565pa
0700	0800		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
0700	0800		USA, WWCR Nashville TN	3215eu	4840na
			5890af	5935af	
0700	0800		USA, WWRB Manchester TN	3185na	
0700	0800		Zambia, CVC/R Christian Voice		6065af
			17695af		
0730	0745		India, All India R/Aizawl	5050do	
0730	0745		India, All India R/Delhi	6190do	11710do
			15185do	15260do	
0730	0745		India, All India R/Guwahati	7280do	
0730	0745		India, All India R/Imphal	7335do	
0730	0745		India, All India R/Jaipur	7325do	
0730	0745		India, All India R/Kolkata	7210do	
0730	0745		India, All India R/Kurseong	7230do	
0730	0745		India, All India R/Shimla	6020do	
0730	0800		Australia, HCJB Global Australia		11750as
0730	0800		India, All India R/Chennai	4920do	
0759	0800		New Zealand, R New Zealand Intl		6170pa
0759	0800	DRM	New Zealand, R New Zealand Intl		7285pa

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

Start	End		Country, Station	Freq 1	Freq 2
0800	0815		Nepal, R Nepal	5005as	
0800	0815	w	Romania, IRRS	11910va	
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	0845	Sat	Canada, Bible Voice Broadcasting		5945eu
0800	0857		China, China R International		9415as
			11785eu	11880eu	13350as 15465as
			15625va	17490eu	17540as
0800	0900		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
0800	0900		Australia, ABC/R Australia	5995va	9475as
			9580va	9590pa	9710as 11945as
			12080va	13630va	
0800	0900		Bahrain, R Bahrain	6010me	
0800	0900	t/DRM	Belgium, TDP Radio	6015eu	
0800	0900		Bhutan, Bhutan Broadcasting Svc		6035do
0800	0900		Canada, CFRX Toronto ON	6070na	
0800	0900		Canada, CFVP Calgary AB	6030na	
0800	0900		Canada, CKZN St Johns NF	6160na	
0800	0900		Canada, CKZU Vancouver BC		6160na
0800	0900	mtwhfa	Ecuador, HCJB/LV de los Andes		3995eu
0800	0900	mtwhf	Eqt Guinea, R Africa 2	15190af	
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		7285pa
0800	0900		Palau, T8WH/WHRI	9930as	
0800	0900	Sun	Palau, T8WH/WHRI	9930as	
0800	0900		Papua New Guinea, R Fly	5960do	
0800	0900	Sat	Romania, IRRS	9510va	
0800	0900		Russia, Voice of Russia		21800va
0800	0900	DRM	Russia, Voice of Russia	9850eu	11830eu
0800	0900	Sun	South Africa, Amateur R Mirror Intl		7205af
			17760af		
0800	0900		South Africa, Channel Africa		9625af
0800	0900		South Africa, CVC 1 Africa R		13590af
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	7812usb 12133usb
			12759usb	13362usb	
0800	0900		USA, EWTN/WEWN Irondale AL		11520af
0800	0900		USA, FBN/WTJC Newport NC		9370na
0800	0900		USA, KNLS Anchor Point AK	11870as	
0800	0900		USA, WBCQ Monticello ME	9330am	
0800	0900	smtwhf	USA, WHRI Cypress Creek SC		11565pa
0800	0900		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
0800	0900		USA, WWCR Nashville TN	3215eu	4840na
			5890af	5935af	
0800	0900		USA, WWRB Manchester TN	3185na	
0800	0900		Zambia, CVC/R Christian Voice		6065af
			17695af		
0820	0900	smtwhf	Guam, TWR Asia/KTWR	15170as	
0830	0845		India, All India R/Aizawl	5050do	
0830	0845		India, All India R/Chennai	4920do	
0830	0845		India, All India R/Delhi	6190do	11710do
			15185do	15260do	
0830	0845		India, All India R/Hyderbad	7420do	
0830	0845		India, All India R/Imphal	7335do	
0830	0845		India, All India R/Itanagar	4990do	
0830	0845		India, All India R/Kolkata	7210do	
0830	0845		India, All India R/Shillong	7315do	
0830	0845		India, All India R/Thiruvananthapuram	7290do	
0830	0900		Australia, ABC NT Alice Springs		2310do
0830	0900		Australia, ABC NT Katherine	2485do	
0830	0900		Australia, ABC NT Tennant Creek		2325do
0830	0900	mtwhfa	Guam, TWR Asia/KTWR	11840pa	

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

Start	End		Country, Station	Freq 1
0900	0910	mtwhfa	Guam, TWR Asia/KTWR	11840as
0900	0930	mtwhf	Palau, T8WH/WHRI	9930as
0900	0930	Sun	Palau, T8WH/WHRI	9930as

0900	0957		China, China R International	9415as	
			15210pa	15270eu	15350as	17490eu
			17570eu	17690pa	17750as
0900	1000		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
0900	1000		Australia, ABC NT Alice Springs	2310do	
0900	1000		Australia, ABC NT Katherine	2485do	
0900	1000		Australia, ABC NT Tennant Creek	2325do	
0900	1000		Australia, ABC/R Australia	9475as	9580pa
			9590pa	11945as	12080va
0900	1000		Bahrain, R Bahrain	6010me	
0900	1000	w/DRM	Belgium, TDP Radio	6015eu	
0900	1000		Canada, CFRX Toronto ON 6070na		
0900	1000		Canada, CFVP Calgary AB 6030na		
0900	1000		Canada, CKZN St Johns NF 6160na		
0900	1000		Canada, CKZU Vancouver BC	6160na	
0900	1000	3rd Sun	Germany, XVRB Radio	6045va	
0900	1000		Malaysia, RTM Kajang/Traxx FM	7295do	
0900	1000		Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0900	1000	DRM	New Zealand, R New Zealand Intl	7285pa	
0900	1000		New Zealand, R New Zealand Intl	6170pa	
0900	1000		Nigeria, Voice of Nigeria	9690af	
0900	1000	Sat	Palau, T8WH/WHRI	9930as	15700as
0900	1000		Papua New Guinea, R Fly	5960do	
0900	1000		Russia, Voice of Russia	9560as	15170as
			21800va		
0900	1000	DRM	Russia, Voice of Russia	9850eu	11830eu
0900	1000		South Africa, Channel Africa	9625af	
0900	1000		South Africa, CVC 1 Africa R	13590af	
0900	1000		UK, BBC World Service	6190af	6195as
			9740as	11760me	12095af	15285as
			15310as	15575me	17640af	17760as
			17790as	17830af	21470af	21660as
0900	1000		USA, Amer Forces Network/AFRTS	4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb	
0900	1000		USA, EWTN/WEWN Irondale AL	9390as	
0900	1000		USA, FBN/WTJC Newport NC	9370na	
0900	1000		USA, WBCQ Monticello ME 9330am		
0900	1000	Sun	USA, WHRI Cypress Creek SC	11565pa	
0900	1000		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
0900	1000		USA, 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, CVC/R Christian Voice	6065af	
			17695af		
0905	0910		Pakistan, PBC/R Pakistan	15725as	17720as
0915	0930	mtwhf	Palau, T8WH/WHRI	9930as	
0930	1000	w	Palau, T8WH/WHRI	9930as	
0930	1000	Sun	Romania, IRRS	9510va	
0945	1000	m	Palau, T8WH/WHRI	9930as	
0945	1000	hf	Palau, T8WH/WHRI	9930as	
0945	1000	mtwhf	Palau, T8WH/WHRI	15700as	
0959	1000		Netherlands, R Netherlands Worldwide		
			15110as		

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

1000	1030		Japan, R Japan NHK World 9605as	9625pa	
			9695pa		
1000	1030		Vietnam, VO Vietnam/Overseas Svc	9840as	
			12020as		
1000	1057		China, China R International	5955as	
			7215as	11640as	13590as	13720as
			15190as	15210pa	15350as	17490eu
			17690as		
1000	1057		Netherlands, R Netherlands Worldwide		
			15110as		
1000	1058		New Zealand, R New Zealand Intl	6170pa	
1000	1100		Anguilla/Caribbean Beacon/Univ Network		
			11775na		
1000	1100		Australia, ABC NT Alice Springs	2310do	
1000	1100		Australia, ABC NT Katherine	2485do	
1000	1100		Australia, ABC NT Tennant Creek	2325do	
1000	1100		Australia, ABC/R Australia	9580pa	9590pa
			11945as	12080va	
1000	1100		Bahrain, R Bahrain	6010me	
1000	1100	h/DRM	Belgium, TDP Radio	6015eu	

Right column:

1000	1100		Canada, CFRX Toronto ON 6070na		
1000	1100		Canada, CFVP Calgary AB 6030na		
1000	1100		Canada, CKZN St Johns NF 6160na		
1000	1100		Canada, CKZU Vancouver BC	6160na	
1000	1100		India, All India R/External Svc	7270as	
			13695pa	15020as	15410as	17510pa
			17800as	17895pa	
1000	1100		Indonesia, Voice of Indonesia	9525va	
1000	1100		Malaysia, RTM Kajang/Traxx FM	7295do	
1000	1100		Micronesia, V6MP/Cross R/Pohnpei	4755as	
1000	1100	DRM	New Zealand, R New Zealand Intl	7285pa	
1000	1100		Nigeria, Voice of Nigeria	9690af	
1000	1100		North Korea, Voice of Korea	6185as	
			6285sa	9335sa	9850as
1000	1100	fa	Palau, T8WH/WHRI	9930as	
1000	1100	Sun	Romania, IRRS	9510va	
1000	1100		Russia, Voice of Russia	9560as	11500as
			15170as		
1000	1100		South Africa, Channel Africa	9625af	
1000	1100		South Africa, CVC 1 Africa R	13590af	
1000	1100		UK, BBC World Service	6190as	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	7812usb	12133usb
			12759usb	13362usb	
1000	1100		USA, EWTN/WEWN Irondale AL	9390as	
1000	1100		USA, FBN/WTJC Newport NC	9370na	
1000	1100		USA, KNLS Anchor Point AK 11870as		
1000	1100		USA, WBCQ Monticello ME 9330am		
1000	1100	Sun	USA, WHRI Cypress Creek SC	11565pa	
1000	1100		USA, WTWW Lebanon TN	5080am	5755am
			12105na		
1000	1100		USA, 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, CVC/R Christian Voice	6065af	
			17695af		
1015	1100	Sun	Palau, T8WH/WHRI	9930as	
1030	1030	mtwhfa	USA, WRMI/R Prague relay 9955am		
1030	1100		Iran, IRIB/VOIRI 21590va	21640va	
1030	1100		Mongolia, Voice of Mongolia	12085as	
1030	1100	mtwhf	Palau, T8WH/WHRI	9930as	
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, IRIB/VOIRI 21590va	21640va	
1100	1130	f/ DRM	Japan, R Japan NHK World 9760eu		
1100	1130	Sat/DRM	South Korea, KBS World R 9760eu		
1100	1130		UK, BBC World Service	15400af	
1100	1130		Vietnam, VO Vietnam/Overseas Svc	7285as	
1100	1156		Romania, R Romania Intl	15210eu	15430eu
			17510af	17670af	
1100	1157		China, China R International	5955as	
			5960na	9570as	11650as	11795as
			13645as	13665eu	13590as	13720as
			15110as	17490as	
1100	1158	DRM	New Zealand, R New Zealand Intl	7285pa	
1100	1200		Anguilla/Caribbean Beacon/Univ Network		
			11775na		
1100	1200		Australia, ABC NT Alice Springs	2310do	
1100	1200		Australia, ABC NT Katherine	2485do	
1100	1200		Australia, ABC NT Tennant Creek	2325do	
1100	1200		Australia, ABC/R Australia	5995va	6020va
			6140as	9475as	9560as	9580pa
			9590pa	11945as	
1100	1200	DRM	Australia, ABC/R Australia	12080pa	
1100	1200		Bahrain, R Bahrain	6010me	
1100	1200	f/DRM	Belgium, TDP Radio	6015eu	
1100	1200	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na	
1100	1200		Canada, CFRX Toronto ON 6070na		
1100	1200		Canada, CFVP Calgary AB 6030na		
1100	1200		Canada, CKZN St Johns NF 6160na		
1100	1200		Canada, CKZU Vancouver BC	6160na	
1100	1200		Malaysia, RTM Kajang/Traxx FM	7295do	
1100	1200		New Zealand, R New Zealand Intl	9655pa	
1100	1200		Nigeria, Voice of Nigeria	9690af	

1100	1200	Sun	Romania, IRRS	9510va	
1100	1200	DRM	Russia, Voice of Russia	12030as	
1100	1200		Russia, Voice of Russia	9560as	11500as
			12065as		
1100	1200		Saudi Arabia, BSKSA/External Svc	15250af	
1100	1200		South Africa, Channel Africa	9625af	
1100	1200		South Africa, CVC 1 Africa R	13590af	
1100	1200		Taiwan, R Taiwan Intl	7445as	9465as
1100	1200		UK, BBC World Service	6190af	6195as
			9740as	11760me 12095as	15285as
			15310as	15575me 17640af	17790as
			17830af	21470af	
1100	1200		USA, Amer Forces Network/AFRTS	4319usb	
			5446usb	5765usb 7812usb	12133usb
			12759usb	13362usb	
1100	1200		USA, EWTN/WEWN Irondale AL	9390as	
1100	1200		USA, FBN/WTJC Newport NC	9370na	
1100	1200		USA, WBCQ Monticello ME 9330am		
1100	1200	Sat/Sun	USA, WHRI Cypress Creek SC	7315ca	
1100	1200		USA, WTWW Lebanon TN	5755am	9990am
			12105na		
1100	1200		USA, WWCR Nashville TN	4840na	5890af
			5935af	15825eu	
1100	1200		USA, WWRB Manchester TN3185na		
1100	1200		Zambia, CVC/R Christian Voice	6065af	
			17695af		
1130	1200	f	Vatican City State, Vatican R 15595as	17590as	
1130	1200		Vietnam, VO Vietnam/Overseas Svc	9840as	
			12020as		
1135	1145		India, All India R/Aizawl	5050do	
1135	1145		India, All India R/Delhi	9595do	11710do
			15185do		
1135	1145		India, All India R/Shillong	4970do	

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

1200	1215		Nepal, R Nepal 5005as		
1200	1230		Germany, AWR Europe	17535as	
1200	1230		Japan, R Japan NHK World 6120na	9695as	
1200	1230		Saudi Arabia, BSKSA/External Svc	15250af	
1200	1230		Vatican City State, Vatican R 13750am		
1200	1257		China, China R International	5955as	
			7250as	9460as 9660as	9645as
			9730as	9760 oa	11650as
			11690as	11760pa 12015as	13665eu
			13790eu	13980as 17490eu	
1200	1258		New Zealand, R New Zealand Intl	9655pa	
1200	1300		Anguilla/Caribbean Beacon/Univ Network		
			11775na		
1200	1300		Australia, ABC NT Alice Springs	2310do	
1200	1300		Australia, ABC NT Katherine2485do		
1200	1300		Australia, ABC NT Tennant Creek	2325do	
1200	1300		Australia, ABC/R Australia	6020va	6140as
			9475as	9560as 9580pa	9590pa
1200	1300	DRM	Australia, ABC/R Australia	5995va	
1200	1300		Bahrain, R Bahrain	6010me	
1200	1300	Sat/DRM	Belgium, TDP Radio	6015eu	
1200	1300	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na	
1200	1300		Canada, CFRX Toronto ON 6070na		
1200	1300		Canada, CFVP Calgary AB 6030na		
1200	1300		Canada, CKZN St Johns NF 6160na		
1200	1300		Canada, CKZU Vancouver BC	6160na	
1200	1300		Ethiopia, R Ethiopia/Natl Pgm	9705do	
1200	1300		Malaysia, RTM Kajang/Traxx FM	7295do	
1200	1300		Nigeria, Voice of Nigeria	9690af	
1200	1300	Sat/Sun	Palau, T8WH/WHRI	9930as	
1200	1300	DRM	Russia, Voice of Russia	9850eu	9445as
			12030as		
1200	1300		Russia, Voice of Russia	9560as	11500as
1200	1300		South Africa, CVC 1 Africa R	13590af	
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 7812usb	12133usb
			12759usb	13362usb	
1200	1300		USA, BBG/Voice of America 7575va	9510va	
			12075va	12150va	
1200	1300		USA, EWTN/WEWN Irondale AL	14610eu	
1200	1300		USA, FBN/WTJC Newport NC	9370na	

1200	1300		USA, KNLS Anchor Point AK 7355as	11870as	
1200	1300		USA, WBCQ Monticello ME 9330am		
1200	1300	smtwhf	USA, WHRI Cypress Creek SC	7385na	
1200	1300		USA, WTWW Lebanon TN	5755am	9990am
			12105na		
1200	1300		USA, WWCR Nashville TN	7490na	9980af
			13845af	15825eu	
1200	1300		USA, WWRB Manchester TN9385na		
1200	1300		Zambia, CVC/R Christian Voice	6065af	
			17695af		
1215	1300		Egypt, R Cairo	17870as	
1230	1245		India, All India R/Aizawl	5050do	
1230	1245		India, All India R/Chennai	4920do	
1230	1245		India, All India R/Delhi	4860do	6085do
1230	1245		India, All India R/Hyderbad	4800do	
1230	1245		India, All India R/Jeypore	5040do	
1230	1245		India, All India R/Kurseong	4895do	
1230	1245		India, All India R/Port Blair	4760do	
1230	1245		India, All India R/R Kashmir	4950do	
1230	1245		India, All India R/Shillong	4970do	
1230	1245		India, All India R/Thiruvananthapuram5010do		
1230	1300		Thailand, R Thailand World Svc	9720va	
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	1330		Egypt, R Cairo	17870as	
1300	1330		Japan, R Japan NHK World 15735as		
1300	1330		Serbia, International R Serbia	9640eu	
1300	1357		China, China R International	5995as	
			7300as	9570na 9655as	9730as
			9765as	9870as 11760pa	11885na
			11900pa	11980as 13670eu	13790eu
			15230na		
1300	1400		Anguilla/Caribbean Beacon/Univ Network		
			11775na		
1300	1400		Australia, ABC NT Alice Springs	2310do	
1300	1400		Australia, ABC NT Katherine2485do		
1300	1400	DRM	Australia, ABC/R Australia	5995va	
1300	1400		Bahrain, R Bahrain	6010me	
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na	
1300	1400	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na	
1300	1400		Canada, CFRX Toronto ON 6070na		
1300	1400		Canada, CFVP Calgary AB 6030na		
1300	1400		Canada, CKZN St Johns NF 6160na		
1300	1400		Canada, CKZU Vancouver BC	6160na	
1300	1400		Indonesia, Voice of Indonesia	9525va	
1300	1400		Malaysia, RTM Kajang/Traxx FM	7295do	
1300	1400		New Zealand, R New Zealand Intl	6170pa	
1300	1400		Nigeria, Voice of Nigeria	9690af	
1300	1400		North Korea, Voice of Korea	3560as	
			7570eu	9335na 11710na	12015eu
1300	1400	Sat/Sun	Palau, T8WH/WHRI	9930as	
1300	1400	DRM	Russia, Voice of Russia	9850eu	12095as
1300	1400		Russia, Voice of Russia	12065as	
1300	1400		South Africa, CVC 1 Africa R	13590af	
1300	1400		South Korea, KBS World R 9570as		
1300	1400		Tajikistan, Voice of 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 7812usb	12133usb
			12759usb	13362usb	
1300	1400	Sat/Sun	USA, BBG/Voice of America 7575va	9510va	
			9610va	12150va	
1300	1400		USA, EWTN/WEWN Irondale AL	15610eu	
1300	1400		USA, FBN/WTJC Newport NC	9370na	
1300	1400		USA, WBCQ Monticello ME 9330am		
1300	1400	Sun	USA, WHRI Cypress Creek SC	9840na	
1300	1400		USA, WTWW Lebanon TN	9480na	9990am
			12105na		
1300	1400		USA, WWCR Nashville TN	7490af	9980af
			13845eu	15825eu	
1300	1400		USA, WWRB Manchester TN9385na		
1300	1400		USA, WYFR/Family R Worldwide	11540as	
1300	1400		Zambia, CVC/R Christian Voice	6065af	
			17695af		
1330	1345		India, All India R/Delhi	6085do	

Start	End	Days	Station	Frequencies
1330	1400		India, All India R/External Svc	9690as 11620as 13710as
1330	1400		Vietnam, VO Vietnam/Overseas Svc	9840as 12020as
1359	1400		Netherlands, R Netherlands Worldwide	9800as

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

Start	End	Days	Station	Frequencies
1400	1430	Sun	Germany, Pan American Broadcasting	15205as
1400	1430		Japan, R Japan NHK World	11705as 15735as
1400	1430		Thailand, R Thailand World Svc	9725va
1400	1430		Turkey, Voice of Turkey	12035va
1400	1455		Swaziland, TWR Africa	4760af
1400	1457		China, China R International	5955as 7300as 9460as 9700eu 9765eu 9870as 11665as 13675na 13740na 15230na 17630af
1400	1457		Netherlands, R Netherlands Worldwide	9800as
1400	1500		Anguilla/Caribbean Beacon/Univ Network	11775na
1400	1500		Australia, ABC NT Alice Springs	2310do
1400	1500		Australia, ABC NT Katherine	2485do
1400	1500		Australia, ABC NT Tennant Creek	2325do
1400	1500		Australia, ABC/R Australia	5995va 6080as 7240pa 9590pa 11660as
1400	1500		Bahrain, R Bahrain	6010me
1400	1500	Sun	Canada, Bible Voice Broadcasting	17495as
1400	1500	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na
1400	1500		Canada, CFRX Toronto ON	6070na
1400	1500		Canada, CFVP Calgary AB	6030na
1400	1500		Canada, CKZN St Johns NF	6160na
1400	1500		Canada, CKZU Vancouver BC	6160na
1400	1500		India, All India R/External Svc	9690as 11620as 13710as
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	Sat	Palau, T8WH/WHRI	9930as
1400	1500	DRM	Russia, Voice of Russia	12095eu
1400	1500		Russia, Voice of Russia	4975va 9560as 11500as 11840as
1400	1500		South Africa, CVC 1 Africa R	13590af
1400	1500		UK, BBC World Service	5845as 5875as 6190af 6195as 9740as 11890as 12095af 13820me 15310as 17640af 17830af 21470af
1400	1500		USA, Amer Forces Network/AFRTS	4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
1400	1500		USA, BBG/Voice of America	4930af 6080af 12080af 15580af 17530af
1400	1500	mtwhf	USA, BBG/Voice of America	7540va 7575va 12150va
1400	1500		USA, EWTN/WEWN Irondale AL	15610eu
1400	1500		USA, FBN/WTJC Newport NC	9370na
1400	1500		USA, KNLS Anchor Point AK	11765as
1400	1500		USA, The Overcomer Ministry	9460eu
1400	1500		USA, WBCQ Monticello ME	9330am
1400	1500	Sun	USA, WHRI Cypress Creek SC	21600af
1400	1500	Sat	USA, WHRI Cypress Creek SC	9680na
1400	1500		USA, WJHR Intl Milton FL	15550na
1400	1500		USA, WTWW Lebanon TN	9480na 9990am 12105na
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, CVC/R Christian Voice	6065af 17695af
1405	1435	Sat/Sun	Canada, Bible Voice Broadcasting	15270as
1415	1430	mtwhfa	Germany, Pan American Broadcasting	15205as
1415	1430		Nepal, R Nepal	5005as
1420	1440		India, All India R/Itanagar	4990do
1430	1445	Sun	Germany, Pan American Broadcasting	15205as
1430	1445		India, All India R/Aizawl	5050do
1430	1445		India, All India R/Delhi	6085do 9575do 9835do
1430	1445		India, All India R/Jeypore	5040do
1430	1445		India, All India R/Mumbai	4840do
1430	1500		Australia, ABC/R Australia	9475as
1430	1500	Sat	Canada, Bible Voice Broadcasting	17495as
1430	1500	Sat	India, All India R/Gangtok	4835do
1445	1500		Australia, HCJB Global Australia	15340as
1450	1500		India, All India R/Itanagar	4990do
1450	1500		India, All India R/Kurseong	4895do

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

Start	End	Days	Station	Frequencies
1500	1515	Sun	Canada, Bible Voice Broadcasting	21460as
1500	1525	Sun	China, Haixa zhi Sheng/VO Strait	4940do 9505do
1500	1525	mhf	Guam, TWR Asia/KTWR	15200as
1500	1529	DRM	Canada, R Canada International	17815as
1500	1530		Australia, HCJB Global Australia	15340as
1500	1530		India, All India R/Jeypore	5040do
1500	1530	Sun	USA, The Overcomer Ministry	15190va
1500	1530		USA, WRMI/R Prague relay	9955am
1500	1530		Vietnam, VO Vietnam/Overseas Svc	7285as 9840as 12020as
1500	1535	twas	Guam, TWR Asia/KTWR	15200as
1500	1550		New Zealand, R New Zealand Intl	6170pa
1500	1557		Canada, R Canada International	11675as 15125as
1500	1557		China, China R International	5955as 6095va 7325as 7405as 9435eu 9525eu 9720va 9785va 9870as 13740na 17630af
1500	1559		South Africa, Channel Africa	9625af
1500	1600		Anguilla/Caribbean Beacon/Univ Network	11775na
1500	1600		Australia, ABC NT Alice Springs	2310do
1500	1600		Australia, ABC NT Katherine	2485do
1500	1600		Australia, ABC/R Australia	5995va 6080as 7240pa 9475as 9590pa 11660as
1500	1600		Bahrain, R Bahrain	6010me
1500	1600		Bhutan, Bhutan Broadcasting Svc	6035do
1500	1600	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na
1500	1600		Canada, CFRX Toronto ON	6070na
1500	1600		Canada, CFVP Calgary AB	6030na
1500	1600		Canada, CKZN St Johns NF	6160na
1500	1600		Canada, CKZU Vancouver BC	6160na
1500	1600	Sat	Clandestine, Sudan R Service	17745af
1500	1600		Malaysia, RTM Kajang/Traxx FM	7295do
1500	1600		Nigeria, Voice of Nigeria	15120af
1500	1600		North Korea, Voice of Korea	3560as 7570eu 9335na 11710na 12015eu
1500	1600	DRM	Russia, Voice of Russia	6070as 7370as
1500	1600		Russia, Voice of Russia	4975va 9560as 11840as 15640me
1500	1600		South Africa, CVC 1 Africa R	13590af
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 7812usb 12133usb 12759usb 13362usb
1500	1600		USA, BBG/Voice of America	4930af 6080af 7540va 7575va 12150va 15580af 17895af
1500	1600		USA, BBG/Voice of America/Special English	6140va 7465va 7520va 9760va 9945va
1500	1600		USA, EWTN/WEWN Irondale AL	15610eu
1500	1600		USA, FBN/WTJC Newport NC	9370na
1500	1600	Sat	USA, The Overcomer Ministry	15190va
1500	1600		USA, The Overcomer Ministry	13810me
1500	1600		USA, WBCQ Monticello ME	9330am
1500	1600	Sat	USA, WBCQ Monticello ME	15420am
1500	1600	Sun	USA, WHRI Cypress Creek SC	17570va
1500	1600	Sat	USA, WHRI Cypress Creek SC	21630af
1500	1600		USA, WINB Red Lion PA	13570ca
1500	1600		USA, WJHR Intl Milton FL	15550na
1500	1600		USA, WTWW Lebanon TN	9480na 9990am 12105na

Start	End	Day	Station	Freq	Freq	Freq	Freq
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		
			11605as	15520as			
1500	1600		Zambia, CVC/R Christian Voice	6065af			
			17695af				
1515	1530	f	Canada, Bible Voice Broadcasting	15275as			
1525	1555	Sat/Sun	Swaziland, TWR Africa	4760af			
1530	1545		India, All India R/Aizawl	5050af			
1530	1545		India, All India R/Bengaluru	9425do			
1530	1545		India, All India R/Bhopal	4810do			
1530	1545		India, All India R/Chennai	4920do			
1530	1545		India, All India R/Delhi	5015do			
1530	1545		India, All India R/Guwahati	4940do			
1530	1545		India, All India R/Hyderbad	4800do			
1530	1545		India, All India R/Itanagar	4990do			
1530	1545		India, All India R/Jaipur	4910do			
1530	1545		India, All India R/Kolkata	4820do			
1530	1545		India, All India R/Kurseong	4895do			
1530	1545		India, All India R/Lucknow	4880do			
1530	1545		India, All India R/Panaji (Goa)	9820do			
1530	1545		India, All India R/Port Blair	4760do			
1530	1545		India, All India R/R Kashmir	4950do			
1530	1545		India, All India R/Shillong	4970do			
1530	1545		India, All India R/Shimla	4965do			
1530	1545		India, All India R/Thiruvananthapuram	5010do			
1530	1600		Afghanistan, R Afghanistan	7200as			
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		Iran, IRIB/VOIRI	11945va	13780va	13720al	
1530	1600		Mongolia, Voice of Mongolia	12015as			
1530	1600	Sat	Vatican City State, Vatican R	11850as	13765as		
			17520as				
1530	1600	Sat/DRM	Vatican City State, Vatican R	17815as			
1551	1600		New Zealand, R New Zealand Intl	7285pa			
1551	1600	DRM	New Zealand, R New Zealand Intl	6170pa			

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

Start	End	Day	Station	Freq	Freq	Freq	Freq
1600	1627		Iran, IRIB/VOIRI	11945va	13780va	13720al	
1600	1630		Australia, ABC/R Australia	9540as			
1600	1630	DRM	Belgium, The Disco Palace	15775as			
1600	1630		Guam, AWR/KSDA	11825as	15360as		
1600	1630		Vietnam, VO Vietnam/Overseas Svc	7220me			
			7280eu	9550me	9730eu		
1600	1650	DRM	New Zealand, R New Zealand Intl	6170pa			
1600	1650		New Zealand, R New Zealand Intl	7285pa			
1600	1657		China, China R International	6060as			
			7235as	7255eu	7420af	7435af
			9435eu	9570af	9875eu	
1600	1700		Anguilla/Caribbean Beacon/Univ Network				
			11775na				
1600	1700		Australia, ABC NT Alice Springs	2310do			
1600	1700		Australia, ABC NT Katherine	2485do			
1600	1700		Australia, ABC/R Australia	5995va	6080as		
			7240pa	9475as	9710as	11660as
1600	1700		Bahrain, R Bahrain	6010me			
1600	1700	Sat	Canada, CBC Northern Quebec Svc	9625na			
1600	1700		Canada, CFRX Toronto ON	6070na			
1600	1700		Canada, CFVP Calgary AB	6030na			
1600	1700		Canada, CKZN St Johns NF	6160na			
1600	1700		Canada, CKZU Vancouver BC	6160na			
1600	1700		Egypt, R Cairo	15345af			
1600	1700		Ethiopia, R Ethiopia	7235va	9560va		
1600	1700		Malaysia, RTM Kajang/Traxx FM	7295do			
1600	1700		North Korea, Voice of Korea	9990me			
			11545af				
1600	1700	DRM	Russia, Voice of Russia	6070as	7370eu		
1600	1700		Russia, Voice of Russia	4975as	7285me		
			11985me				
1600	1700		South Africa, CVC 1 Africa R	13590af			
1600	1700		South Korea, KBS World R	9515eu	9640as		
1600	1700		Taiwan, R Taiwan Intl	9440as	15485as		
1600	1700		Uganda, Dunamis Shortwave	4750do			
1600	1700		UK, BBC World Service	3255af	5845af		
			5975as	6190af	9410as	11890as
			12095af	13820me	15400af	17795af
			17830af	21470af			

Start	End	Day	Station	Freq	Freq	Freq	Freq
1600	1700		USA, Amer Forces Network/AFRTS	4319usb			
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb			
1600	1700		USA, BBG/Voice of America	4930af	6080af		
			15580af				
1600	1700		USA, BBG/Voice of America/Special English				
			13600va	15470va			
1600	1700		USA, EWTN/WEWN Irondale AL	15610eu			
1600	1700		USA, FBN/WTJC Newport NC	9370na			
1600	1700	Sat	USA, The Overcomer Ministry	15190va			
1600	1700		USA, WBCQ Monticello ME	9330am			
1600	1700	Sat	USA, WBCQ Monticello ME	15420am			
1600	1700	Sun	USA, WHRI Cypress Creek SC	9840na			
1600	1700		USA, WHRI Cypress Creek SC	11630af			
1600	1700		USA, WINB Red Lion PA	13570ca			
1600	1700		USA, WJHR Intl Milton FL	15550na			
1600	1700		USA, WTWW Lebanon TN	9480na	9990am		
			12105na				
1600	1700		USA, 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, CVC/R Christian Voice	6065af			
			17695af				
1630	1700		Clandestine, Sudan R Service	17745af			
1630	1700		Sri Lanka, AWR Asia	11740as			
1645	1700		Canada, Bible Voice Broadcasting	15215me			
1651	1700		New Zealand, R New Zealand Intl	9615pa			
1651	1700	DRM	New Zealand, R New Zealand Intl	9890pa			

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

Start	End	Day	Station	Freq	Freq	Freq	Freq
1700	1715	mf	Canada, Bible Voice Broadcasting	15215me			
1700	1720	h	Canada, Bible Voice Broadcasting	15215me			
1700	1730		Vietnam, VO Vietnam/Overseas Svc	9625eu			
1700	1750	DRM	New Zealand, R New Zealand Intl	9890pa			
1700	1755		South Africa, Channel Africa	15235af			
1700	1756	DRM	Romania, R Romania Intl	9535eu			
1700	1756		Romania, R Romania Intl	11740eu			
1700	1757		China, China R International	6090as			
			6100eu	6140as	7205as	7255eu
			7410as	7420as	7425as	9570af
			9600as	13685af			
1700	1800		Anguilla/Caribbean Beacon/Univ Network				
			11775na				
1700	1800		Australia, ABC NT Alice Springs	2310do			
1700	1800		Australia, ABC NT Katherine	2485do			
1700	1800		Australia, ABC/R Australia	5995va	6080as		
			9475as	9580pa	9710as	11880pa
1700	1800		Bahrain, R Bahrain	6010me			
1700	1800	asm	Canada, Bible Voice Broadcasting	15215me			
1700	1800	Sat	Canada, CBC Northern Quebec Svc	9625na			
1700	1800		Canada, CFRX Toronto ON	6070na			
1700	1800		Canada, CFVP Calgary AB	6030na			
1700	1800		Canada, CKZN St Johns NF	6160na			
1700	1800		Canada, CKZU Vancouver BC	6160na			
1700	1800		Egypt, R Cairo	15345af			
1700	1800		Malaysia, RTM Kajang/Traxx FM	7295do			
1700	1800		New Zealand, R New Zealand Intl	9615pa			
1700	1800	DRM	Russia, Voice of Russia	7370eu			
1700	1800		Russia, Voice of Russia	4975va	7285va		
			11985af	12040eu			
1700	1800		South Africa, CVC 1 Africa R	4965af			
			13590af	17695af			
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	7812usb	12133usb
			12759usb	13362usb			
1700	1800		USA, BBG/Voice of America	6080af	12015af		
			15580af	17895af			
1700	1800		USA, EWTN/WEWN Irondale AL	15610eu			
1700	1800		USA, FBN/WTJC Newport NC	9370na			
1700	1800		USA, WBCQ Monticello ME	9330am			
1700	1800	Sat	USA, WBCQ Monticello ME	15420am			
1700	1800		USA, WHRI Cypress Creek SC	21630af			
1700	1800	Sun	USA, WHRI Cypress Creek SC	9840na			

Start	Stop		Station	Freq			
1700	1800		USA, WINB Red Lion PA	13570ca			
1700	1800		USA, WJHR Intl Milton FL	15550na			
1700	1800		USA, WTWW Lebanon TN	9480na	9990am		
			12105na				
1700	1800		USA, 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, CVC/R Christian Voice		4965af		
			17695af				
1730	1745	h	Canada, Bible Voice Broadcasting	15215me			
1730	1745		India, All India R/Bhopal	4810do			
1730	1745		India, All India R/Delhi	5015do	7370do		
			9575do	9835do			
1730	1745		India, All India R/Guwahati	4940do			
1730	1745		India, All India R/Hyderbad	4800do			
1730	1745		India, All India R/Jaipur	4910do			
1730	1745		India, All India R/Kolkata	4820do			
1730	1745		India, All India R/Kurseong	4895do			
1730	1745		India, All India R/Lucknow	4880do			
1730	1745		India, All India R/R Kashmir	4950do			
1730	1745		India, All India R/Shimla	4965do			
1730	1745		India, All India R/Thiruvananthapuram	5010do			
1730	1800	Sun	Romania, IRRS	7290va			
1730	1800	m	South Africa, Amateur R Mirror Intl	4895af			
1730	1800		Turkey, Voice of Turkey	11735as			
1730	1800		Vatican City State, Vatican R	11625af	13765af		
			15570af				
1740	1745		India, All India R/Chennai	4920do			
1745	1800	Sat	Canada, Bible Voice Broadcasting	17515af			
1745	1800	DRM	India, All India R/External Svc	9950eu			
1745	1800		India, All India R/External Svc	7400af			
			7550eu	9415af	11580af	11670as	
			11935af	13695af			
1751	1800	DRM	New Zealand, R New Zealand Intl	9890pa			

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

Start	Stop		Station	Freq			
1800	1830	w	Austria, AWR Europe	15325af			
1800	1830		Japan, R Japan NHK World	15720af			
1800	1830	m	South Africa, Amateur R Mirror Intl	3230af			
1800	1830		South Africa, AWR Africa	3215af	3345af		
1800	1830		Turkey, Voice of Turkey	11735as			
1800	1830		UK, BBC World Service	5850as	5975as		
1800	1830		USA, BBG/Voice of America	6080af	12015af		
			15580af				
1800	1836	DRM	New Zealand, R New Zealand Intl	9890pa			
1800	1850		New Zealand, R New Zealand Intl	9615pa			
1800	1857		China, China R International	6100eu			
			6165as	7405eu	13685af		
1800	1900		Anguilla/Caribbean Beacon/Univ Network				
			11775na				
1800	1900	mtwhf	Argentina, RAE	15345eu			
1800	1900		Australia, ABC NT Alice Springs	2310do			
1800	1900		Australia, ABC NT Katherine	2485do			
1800	1900		Australia, ABC/R Australia	6080as	7240pa		
			9475as	9580pa	9710as	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	DRM	India, All India R/External Svc	9950eu			
1800	1900		India, All India R/External Svc	7400af			
			7550as	9415af	9445af	11580af	
			11670eu	11935af	13695af		
1800	1900		Kuwait, R Kuwait	15540eu			
1800	1900		Malaysia, RTM Kajang/Traxx FM	7295do			
1800	1900		Nigeria, Voice of Nigeria	15120af			
1800	1900		North Korea, Voice of Korea	3560as			
			7570eu	12015eu			
1800	1900	fas	Romania, IRRS	7290va			
1800	1900	DRM	Russia, Voice of Russia	7370eu	9880eu		
1800	1900		Russia, Voice of Russia	4975me	9900va		
			12040eu				
1800	1900		South Africa, CVC 1 Africa R		4965af		
			13590af	17695af			

Start	Stop		Station	Freq			
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	7812usb	12133usb	
			12759usb	13362usb			
1800	1900	Sat/Sun	USA, BBG/Voice of America	4930af			
1800	1900		USA, EWTN/WEWN Irondale AL	15610af			
1800	1900		USA, FBN/WTJC Newport NC	9370na			
1800	1900		USA, WBCQ Monticello ME	9330am			
1800	1900	fas	USA, WHRI Cypress Creek SC	21630af			
1800	1900	Sat/Sun	USA, WHRI Cypress Creek SC	9840na			
1800	1900		USA, WINB Red Lion PA	13570ca			
1800	1900		USA, WJHR Intl Milton FL	15550na			
1800	1900		USA, WTWW Lebanon TN	9480na	9990am		
			12105na				
1800	1900		USA, WWCR Nashville TN	9980af	12160af		
			13845eu	15825eu			
1800	1900		USA, WWRB Manchester TN	9385na			
1800	1900		USA, WYFR/Family R Worldwide		5905af		
			7395af	9610af	13750af		
1800	1900		Zambia, CVC/R Christian Voice		4965af		
			17695af				
1815	1845	Sun	Canada, Bible Voice Broadcasting		6130eu		
			9430me				
1830	1845		India, All India R/Delhi	5015do			
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	12015af	15580af		
1837	1850	DRM	New Zealand, R New Zealand Intl	11675pa			
1850	1900	DRM	New Zealand, R New Zealand Intl	15720pa			
1851	1900		New Zealand, R New Zealand Intl	11725pa			
1859	1900		Netherlands, R Netherlands Worldwide				
			7425af	11615af	15495af		

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

Start	Stop		Station	Freq			
1900	1930		Germany, Deutsche Welle	9735af	11800af		
1900	1930		Turkey, Voice of Turkey	9785va			
1900	1930		USA, BBG/Voice of America	4930af	4940af		
			6080af	9850af	15580af	17895af	
1900	1930		USA, WRMI/R Prague relay	9955am			
1900	1930		Vietnam, VO Vietnam/Overseas Svc	7280eu			
			9730eu				
1900	1945	DRM	India, All India R/External Svc	9950eu			
1900	1945		India, All India R/External Svc	7400af			
			7550eu	9415af	9445af	11580af	
			11670eu	11935af	13695af		
1900	1950	DRM	New Zealand, R New Zealand Intl	15720pa			
1900	1957		China, China R International		7295as		
			7435 `af	9440as			
1900	1957		Germany, Deutsche Welle	7365af			
1900	2000		Anguilla/Caribbean Beacon/Univ Network				
			11775na				
1900	2000		Australia, ABC NT Alice Springs	2310do			
1900	2000		Australia, ABC NT Katherine	2485do			
1900	2000		Australia, ABC/R Australia	6080as	7240pa		
			9500as	9580pa	9710as	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		Cuba, R Havana Cuba	11760am			
1900	2000	mtwhfa	Ecuador, HCJB/LV de los Andes	3995eu			
1900	2000		Egypt, R Cairo	15290af			
1900	2000		Indonesia, Voice of Indonesia	9525va			
1900	2000		Kuwait, R Kuwait	15540eu			
1900	2000		Malaysia, RTM Kajang/Traxx FM	7295do			
1900	2000		Micronesia, V6MP/Cross R/Pohnpei	4755as			
1900	2000		Netherlands, R Netherlands Worldwide				
			7425af	11615af	15495af		
1900	2000		New Zealand, R New Zealand Intl	11725pa			
1900	2000		North Korea, Voice of Korea	7210af			
			9975me	11535af	11910af		
1900	2000	DRM	Russia, Voice of Russia	6155eu			

1900	2000		Russia, Voice of Russia	12040eu		
1900	2000		South Africa, CVC 1 Africa R		4965af	
			13590af	17695af		
1900	2000	mtwhf	Spain, R Exterior de Espana 9665af	11620af		
1900	2000		Swaziland, TWR Africa	3200af		
1900	2000		Thailand, R Thailand World Svc	9680eu		
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	7812usb	12133usb
			12759usb	13362usb		
1900	2000		USA, BBG/Voice of America/Special English			
			7480va	9590va		
1900	2000		USA, EWTN/WEWN Irondale AL	15610af		
1900	2000		USA, FBN/WTJC Newport NC	9370na		
1900	2000		USA, WBCQ Monticello ME 9330am			
1900	2000		USA, WHRI Cypress Creek SC	9840na		
1900	2000		USA, WINB Red Lion PA	13570ca		
1900	2000		USA, WJHR Intl Milton FL	15550na		
1900	2000		USA, WTWW Lebanon TN	9480na	9990am	
			12105na			
1900	2000		USA, WWCR Nashville TN	9980af	12160af	
			13845eu	15825eu		
1900	2000		USA, WWRB Manchester TN 9385na			
1900	2000		USA, WYFR/Family R Worldwide		7395af	
			9775af	18980af		
1900	2000		Zambia, CVC/R Christian Voice		4965af	
			13590af			
1905	1920	Sat	Mali, ORTM/R Mali	9635do		
1930	2000		Germany, Deutsche Welle	11800af		
1930	2000	Sat	Germany, Pan American Broadcasting 9515af			
1930	2000		Iran, IRIB/VOIRI 5940eu	9540eu	9800eu	
			11750af	11885af		
1930	2000		South Africa, RTE R Worldwide		5820af	
1930	2000		USA, BBG/Voice of America 4930af	4940af		
			6080af	15580af		
1945	2000	DRM	Vatican City State, Vatican R 9800am			
1950	2000		Vatican City State, Vatican R 3975eu	6075eu		
			7250eu	9645eu		
1951	2000	DRM	New Zealand, R New Zealand Intl	15720pa		

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

2000	2027		Iran, IRIB/VOIRI 5940eu	9540eu	9800eu	
			11750af	11885af		
2000	2030	mtwhfa	Albania, R Tirana	7465eu		
2000	2030		Egypt, R Cairo	15290af		
2000	2030	Sat	Swaziland, TWR Africa	3200af		
2000	2030		USA, BBG/Voice of America 4930af	4940af		
			6080af	15580af		
2000	2030		Vatican City State, Vatican R 7365af	9755af		
			11625af			
2000	2050	DRM	New Zealand, R New Zealand Intl	15720pa		
2000	2057		China, China R International	5960eu		
			5985af	7285eu	7295as	7415eu
			9440as	9600eu	11640af	13630af
2000	2057		Netherlands, R Netherlands Worldwide			
			7425af	11615af	15495af	
2000	2100		Anguilla/Caribbean Beacon/Univ Network			
			11775na			
2000	2100		Australia, ABC NT Alice Springs	2310do		
2000	2100		Australia, ABC NT Katherine	2485do		
2000	2100		Australia, ABC NT Tennant Creek	2325do		
2000	2100		Australia, ABC/R Australia	9500as	11650as	
			11660pa	11880pa		
2000	2100	mtwhf	Australia, ABC/R Australia	7240pa		
2000	2100	Sat/Sun	Australia, ABC/R Australia	6080as	7240pa	
			12080va			
2000	2100		Bahrain, R Bahrain	6010me		
2000	2100	mtwhf	Belarus, R Belarus	6155eu	11730eu	
2000	2100	DRM	Belgium, The Disco Palace	17755na		
2000	2100		Canada, CFRX Toronto ON 6070na			
2000	2100		Canada, CFVP Calgary AB 6030na			
2000	2100		Canada, CKZN St Johns NF 6160na			
2000	2100		Canada, CKZU Vancouver BC	6160na		
2000	2100	f	Clandestine, JSR/Shiokaze/Sea Breeze 5965as			
			5910al	6110al		
2000	2100		Germany, Deutsche Welle 6150af	9490af		
			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		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		4965af	
			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	7812usb	12133usb
			12759usb	13362usb		
2000	2100		USA, BBG/Voice of America 7485va	9480va		
2000	2100		USA, EWTN/WEWN Irondale AL	15610af		
2000	2100		USA, FBN/WTJC Newport NC	9370na		
2000	2100		USA, WBCQ Monticello ME 9330am	15420am		
2000	2100	smtwhf	USA, WBCQ Monticello ME 7490am			
2000	2100	Sun	USA, WHRI Cypress Creek SC	9895va		
2000	2100	Sat	USA, WHRI Cypress Creek SC	17520af		
2000	2100		USA, WINB Red Lion PA	13570ca		
2000	2100		USA, WJHR Intl Milton FL	15550na		
2000	2100		USA, WTWW Lebanon TN	9480na	9990am	
			12105na			
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, CVC/R Christian Voice		4965af	
			13590af			
2020	2100	Sat/Sun	Belarus, R Belarus	6155eu	11730eu	
2030	2045		Thailand, R Thailand World Svc	9535eu		
2030	2056	DRM	Romania, R Romania Intl	9700eu		
2030	2056		Romania, R Romania Intl	11880na	13800na	
			15220na			
2030	2100		USA, BBG/Voice of America 4930af	6080af		
			7555as	15580af		
2030	2100	Sat/Sun	USA, BBG/Voice of America 4940af			
2030	2100		Vietnam, VO Vietnam/Overseas Svc	7270me		
			7280eu	9550me	9730eu	
2045	2100		India, All India R/External Svc		7550eu	
			9445eu	9910pa	11620pa	11670eu
			11715pa			
2045	2100	DRM	India, All India R/External Svc		9950eu	
2051	2100	DRM	New Zealand, R New Zealand Intl	15720pa		

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

2100	2127		China, China R International		11640af	
			13630af			
2100	2130		Australia, ABC NT Alice Springs	2310do		
2100	2130		Australia, ABC NT Katherine	2485do		
2100	2130		Australia, ABC NT Tennant Creek	2325do		
2100	2130		Austria, AWR Europe	11955af		
2100	2130	Sat	Canada, CBC Northern Quebec Svc	9625na		
2100	2130		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		China, China R International		5960eu	
			5690eu	7205af	7285eu	7405af
			7415eu	9600eu		
2100	2200		Angola, Angolan National R		7217af	
2100	2200		Anguilla/Caribbean Beacon/Univ Network			
			11775na			
2100	2200		Australia, ABC/R Australia	9500as	9660pa	
			11650as	11660pa	11695va	12080va
			13630va	15515va		
2100	2200		Bahrain, R Bahrain	6010me		
2100	2200		Belarus, R Belarus	6155eu	11730eu	
2100	2200	mtwhf	Belarus, R Belarus	6155eu	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		Germany, Deutsche Welle	11800af	11830af	
			11865af			
2100	2200		India, All India R/External Svc		7550eu	
			9445eu	9910pa	11620pa	11670eu
			11715pa			
2100	2200	DRM	India, All India R/External Svc		9950eu	
2100	2200		Malaysia, RTM Kajang/Traxx FM	7295do		
2100	2200		Micronesia, V6MP/Cross R/Pohnpei	4755 as		

2100	2200		North Korea, Voice of Korea	3560as	
			7570eu	12015eu	
2100	2200	DRM	Russia, Voice of Russia	6155eu	
2100	2200		South Africa, CVC 1 Africa R	4965af	
			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	7812usb	12133usb
			12759usb	13362usb	
2100	2200		USA, BBG/Voice of America	6080af	7555as
			15580af		
2100	2200		USA, EWTN/WEWN Irondale AL	15610af	
2100	2200		USA, FBN/WTJC Newport NC	9370na	
2100	2200		USA, WBCQ Monticello ME 9330am	15420am	
2100	2200	smtwhf	USA, WBCQ Monticello ME 7490am		
2100	2200	Sun	USA, WHRI Cypress Creek SC	9490va	
2100	2200		USA, WINB Red Lion PA	13570ca	
2100	2200		USA, WJHR Intl Milton FL	15550na	
2100	2200		USA, WTWW Lebanon TN	9480na	9990am
			12105na		
2100	2200		USA, WWCR Nashville TN	6875eu	9350af
			9980af	13845eu	
2100	2200		USA, WWRB Manchester TN 3215na	9385na	
2100	2200		USA, WYFR/Family R Worldwide	12070af	
2100	2200		Zambia, CVC/R Christian Voice	4965af	
			13590af		
2115	2200		Egypt, R Cairo	6270eu	
2130	2200		Australia, ABC NT Alice Springs	4835do	
2130	2200		Australia, ABC NT Katherine 5025do		
2130	2200	mtwhfa	Canada, CBC Northern Quebec Svc	9625na	
2130	2200		Turkey, Voice of Turkey	9610va	
2151	2200		New Zealand, R New Zealand Intl	15720pa	
2151	2200	DRM	New Zealand, R New Zealand Intl	17675pa	

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

2200	2215	t	USA, WBCQ Monticello ME 7490am		
2200	2230		India, All India R/External Svc	7550eu	
			9445eu	9910pa	11620pa	11670eu
			11715pa		
2200	2230	DRM	India, All India R/External Svc	9950as	
2200	2230		Turkey, Voice of Turkey	9610va	
2200	2245		Egypt, R Cairo	6270eu	
2200	2256		Romania, R Romania Intl	7435eu	9540eu
			9790eu	11940eu	
2200	2257		China, China R International	5915as	
2200	2300		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
2200	2300		Australia, ABC NT Alice Springs	4835do	
2200	2300		Australia, ABC NT Katherine 5025do		
2200	2300		Australia, ABC/R Australia	9855as	11550as
			12080va	13630va	15230va	15240va
			15515va		
2200	2300	fa	Australia, ABC/R Australia	9660pa	
2200	2300		Bahrain, R Bahrain	6010me	
2200	2300	smtwhf	Canada, CBC Northern Quebec Svc	9625na	
2200	2300		Canada, CFRX Toronto ON	6070na	
2200	2300		Canada, CFVP Calgary AB	6030na	
2200	2300		Canada, CKZN St Johns NF 6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na	
2200	2300		Malaysia, RTM Kajang/Traxx FM	7295do	
2200	2300		Micronesia, V6MP/Cross R/Pohnpei	4755 as	
2200	2300		New Zealand, R New Zealand Intl	15720pa	
2200	2300	DRM	New Zealand, R New Zealand Intl	17675pa	
2200	2300		Russia, Voice of Russia	9800va	
2200	2300		South Africa, CVC 1 Africa R	9505af	
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	7812usb	12133usb
			12759usb	13362usb	
2200	2300	smtwh	USA, BBG/Voice of America 5895va	5915va	
			7480va	7575va	12150va
2200	2300		USA, EWTN/WEWN Irondale AL	15610af	
2200	2300		USA, FBN/WTJC Newport NC	9370na	
2200	2300	smwhf	USA, WBCQ Monticello ME 7490am		
2200	2300		USA, WBCQ Monticello ME 9330am		

2200	2300	Sat	USA, WHRI Cypress Creek SC	9490va	
2200	2300	f	USA, WHRI Cypress Creek SC	15180na	
2200	2300	Sat	USA, WHRI Cypress Creek SC	9505va	
2200	2300		USA, WINB Red Lion PA	9265ca	
2200	2300		USA, WTWW Lebanon TN	9480na	9990am
			12105na		
2200	2300		USA, WWCR Nashville TN	6875eu	9350af
			9980af	13845eu	
2200	2300		USA, WWRB Manchester TN 3215na	5050va	
			5745va	9385va	
2200	2300		USA, WYFR/Family R Worldwide	6115na	
2230	2300	fa	Palau, T8WH/WHRI	9930as	
2230	2300		Sri Lanka, AWR Asia	9730as	
2230	2300		USA, BBG/Voice of America/Special English		
			5810va	7545va	9570va
2230	2300		USA, WYFR/Family R Worldwide	6115af	
			11580af	15255af	
2245	2300		India, All India R/External Svc	6055as	
			9705as	9950as	11670as	13605as
2245	2300	DRM	India, All India R/External Svc	11645as	

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

2300	0000		Anguilla/Caribbean Beacon/Univ Network		
			6090na		
2300	0000		Australia, ABC NT Alice Springs	4835do	
2300	0000		Australia, ABC NT Katherine 5025do		
2300	0000		Australia, ABC/R Australia	9855as	9660pa
			12080va	13690va	15230va	15515pa
			17795pa		
2300	0000		Bahrain, R Bahrain	6010me	
2300	0000	smtwhf	Canada, CBC Northern Quebec Svc	9625na	
2300	0000		Canada, CFRX Toronto ON	6070na	
2300	0000		Canada, CFVP Calgary AB	6030na	
2300	0000		Canada, CKZN St Johns NF 6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na	
2300	0000		Cuba, R Havana Cuba	5040va	
2300	0000		Egypt, R Cairo	6270na	
2300	0000		India, All India R/External Svc	6055as	
			9705as	9950as	11670as	13605as
2300	0000	DRM	India, All India R/External Svc	11645as	
2300	0000		Malaysia, RTM Kajang/Traxx FM	7295do	
2300	0000		Micronesia, V6MP/Cross R/Pohnpei	4755 as	
2300	0000		New Zealand, R New Zealand Intl	15720pa	
2300	0000	DRM	New Zealand, R New Zealand Intl	17675pa	
2300	0000		Russia, Voice of Russia	9665va	9800va
2300	0000		South Africa, CVC 1 Africa R	9505af	
2300	0000		Turkey, Voice of Turkey	5960va	
2300	0000		UK, BBC World Service	3915as	6195as
			7490as	9580as	9740as	9890as
			11850as	12010as	
2300	0000		USA, Amer Forces Network/AFRTS	4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb	
2300	0000		USA, BBG/Voice of America 5895va	5910va	
			7555as	7575as	12150as
2300	0000		USA, EWTN/WEWN Irondale AL	15610af	
2300	0000		USA, FBN/WTJC Newport NC	9370na	
2300	0000	smtwhf	USA, WBCQ Monticello ME 7490am		
2300	0000		USA, WBCQ Monticello ME 9330am		
2300	0000	Sat	USA, WHRI Cypress Creek SC	9505va	
2300	0000	smtwhf	USA, WHRI Cypress Creek SC	7385ca	
2300	0000		USA, WINB Red Lion PA	9265ca	
2300	0000		USA, WTWW Lebanon TN	9480na	9990am
			12105na		
2300	0000		USA, WWCR Nashville TN	6875eu	9350af
			9980af	13845eu	
2300	0000		USA, WWRB Manchester TN 3185na	5050na	
			5745va	9395na	
2300	0000		USA, WYFR/Family R Worldwide	15255ca	
			11580sa		
2300	0000	DRM	Vatican City State, Vatican R 9755am		
2300	2330		Australia, ABC/R Australia	15240as	
2300	2357		China, China R International	5915as	
			5990me	6040na	6145as	7350eu
			7415as	9535as	11790as	11970va
2315	2330		Croatia, Voice of Croatia	3985ca	7375eu
2330	0000		Australia, ABC/R Australia	15415va	17750va
2330	0000		Vietnam, VO Vietnam/Overseas Svc	9840as	
			12020as		
2330	2345		India, All India R/Aligarh	9470do	

PORTUGUESE

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

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

1200	1300		Brazil, Educadora/Braganca	4825do	
1200	1300		Brazil, R Alvorada/Londrina	4865do	
1200	1300		Brazil, R Anhanguera	4905do	
1200	1300		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1200	1300		Brazil, R Bandeirantes	6090do	9645do
1200	1300		Brazil, R Boa Vontade	6160do	9550do
			11895do		
1200	1300		Brazil, R Brasil Central	4985do	11815do
1200	1300		Brazil, R Cancao Nova	4825do	6105do
			9675do		
1200	1300		Brazil, R Capital 6070do		
1200	1300		Brazil, R Capixaba	4935do	
1200	1300		Brazil, R Clube do Para	4885do	
1200	1300		Brazil, R Congonhas	4775do	
1200	1300		Brazil, R Cultura do Para	5045do	
1200	1300		Brazil, R Cultura Filadelfia	6105do	
1200	1300		Brazil, R Cultura/Araraquara		3365do
1200	1300		Brazil, R Cultura/Manaus	4845do	
1200	1300		Brazil, R Daqui 4915do	6080do	11830do
1200	1300		Brazil, R Difusora Acreana	4885do	
1200	1300		Brazil, R Difusora do Amazonas		4805do
1200	1300		Brazil, R Difusora Roraima	4875do	
1200	1300		Brazil, R Difusora/Caceres	5055do	
1200	1300		Brazil, R Difusora/Londrina	4815do	
1200	1300		Brazil, R Difusora/Macapa	4915do	
1200	1300		Brazil, R Educacao Rural/Coari		5035do
1200	1300		Brazil, R Educadora 6 de Agosto		3355do
1200	1300		Brazil, R Educadora Rural/Tefe		4925do
1200	1300		Brazil, R Educadora/Guajara Mirim		3375do
1200	1300		Brazil, R Educadora/Limeira 2380do		
1200	1300		Brazil, R Gaucha 6020do	11915do	
1200	1300		Brazil, R Gazeta 5955do	9685do	
1200	1300		Brazil, R Guaiba 6000do	11785do	
1200	1300		Brazil, R Guaruja Paulista	5045do	
1200	1300		Brazil, R Imaculada Conceicao		4755do
1200	1300		Brazil, R Inconfidencia	6010do	15190do
1200	1300		Brazil, R Itatiaia 5970do		
1200	1300		Brazil, R Maria 4885do		
1200	1300		Brazil, R Marumby	6080do	9515do
			11725do		
1200	1300		Brazil, R Meteorologia Paulista		4845do
1200	1300		Brazil, R Mundial 3325do		
1200	1300		Brazil, R Municipal	3375do	
1200	1300		Brazil, R Nacional da Amazonia		6185do
			11780do		
1200	1300		Brazil, R Nove de Julho	9820do	
1200	1300		Brazil, R Novo Tempo	4895do	
1200	1300		Brazil, R Record 6150do	9505do	
1200	1300		Brazil, R Rio Mar 6160do	9695do	
1200	1300		Brazil, R Senado Federal	5990do	
1200	1300		Brazil, R Trans Mundial	9530do	11735do
1200	1300		Brazil, R Verdes Florestas	4865do	
1200	1300		Brazil, R Voz Missionario	5940do	9665do
			11750do		
1200	1300		Brazil, Super R Alvorada	2460do	
1200	1300		Brazil, Super R Deus e Amor/Curitiba	6060do	
			9565do	11765do	
1200	1300		Brazil, Super R Deus e Amor/Rio de Janeiro		
			11805do		

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

1300	1330		Brazil, R Difusora do Amazonas		4805do
1300	1400		Brazil, Educadora/Braganca	4825do	

1300	1400		Brazil, R Alvorada/Londrina	4865do	
1300	1400		Brazil, R Anhanguera	4905do	
1300	1400		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1300	1400		Brazil, R Bandeirantes	6090do	9645do
1300	1400		Brazil, R Boa Vontade	6160do	9550do
			11895do		
1300	1400		Brazil, R Brasil Central	4985do	11815do
1300	1400		Brazil, R Cancao Nova	4825do	6105do
			9675do		
1300	1400		Brazil, R Capital 6070do		
1300	1400		Brazil, R Capixaba	4935do	
1300	1400		Brazil, R Clube do Para	4885do	
1300	1400		Brazil, R Congonhas	4775do	
1300	1400		Brazil, R Cultura do Para	5045do	
1300	1400		Brazil, R Cultura Filadelfia	6105do	
1300	1400		Brazil, R Cultura/Araraquara		3365do
1300	1400		Brazil, R Cultura/Manaus	4845do	
1300	1400		Brazil, R Daqui 4915do	6080do	11830do
1300	1400		Brazil, R Difusora Acreana	4885do	
1300	1400		Brazil, R Difusora Roraima	4875do	
1300	1400		Brazil, R Difusora/Caceres	5055do	
1300	1400		Brazil, R Difusora/Londrina	4815do	
1300	1400		Brazil, R Difusora/Macapa	4915do	
1300	1400		Brazil, R Educacao Rural/Coari		5035do
1300	1400		Brazil, R Educadora 6 de Agosto		3355do
1300	1400		Brazil, R Educadora Rural/Tefe		4925do
1300	1400		Brazil, R Educadora/Limeira 2380do		
1300	1400		Brazil, R Gaucha 6020do	11915do	
1300	1400		Brazil, R Gazeta 5955do	9685do	
1300	1400		Brazil, R Guaiba 6000do	11785do	
1300	1400		Brazil, R Guaruja Paulista	5045do	
1300	1400		Brazil, R Imaculada Conceicao		4755do
1300	1400		Brazil, R Inconfidencia	6010do	15190do
1300	1400		Brazil, R Itatiaia 5970do		
1300	1400		Brazil, R Maria 4885do		
1300	1400		Brazil, R Marumby	6080do	9515do
			11725do		
1300	1400		Brazil, R Meteorologia Paulista		4845do
1300	1400		Brazil, R Mundial 3325do		
1300	1400		Brazil, R Nacional da Amazonia		6185do
			11780do		
1300	1400		Brazil, R Nove de Julho	9820do	
1300	1400		Brazil, R Novo Tempo	4895do	
1300	1400		Brazil, R Record 6150do	9505do	
1300	1400		Brazil, R Rio Mar 6160do	9695do	
1300	1400		Brazil, R Senado Federal	5990do	
1300	1400		Brazil, R Trans Mundial	9530do	11735do
1300	1400		Brazil, R Verdes Florestas	4865do	
1300	1400		Brazil, R Voz Missionario	5940do	9665do
			11750do		
1300	1400		Brazil, Super R Alvorada	2460do	
1300	1400		Brazil, Super R Deus e Amor/Curitiba	6060do	
			9565do	11765do	
1300	1400		Brazil, Super R Deus e Amor/Rio de Janeiro		
			11805do		
1355	1400	Sun	South Africa, TWR Africa	7315af	

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

1400	1425	Sun	South Africa, TWR Africa	7315af	
1400	1500		Brazil, Educadora/Braganca	4825do	
1400	1500		Brazil, R Alvorada/Londrina	4865do	
1400	1500		Brazil, R Anhanguera	4905do	
1400	1500		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1400	1500		Brazil, R Bandeirantes	6090do	9645do

1400	1500	Brazil, R Boa Vontade	6160do	9550do
		11895do		
1400	1500	Brazil, R Brasil Central	4985do	11815do
1400	1500	Brazil, R Cancao Nova	4825do	6105do
		9675do		
1400	1500	Brazil, R Capital 6070do		
1400	1500	Brazil, R Capixaba	4935do	
1400	1500	Brazil, R Clube do Para	4885do	
1400	1500	Brazil, R Congonhas	4775do	
1400	1500	Brazil, R Cultura do Para	5045do	
1400	1500	Brazil, R Cultura Filadelfia	6105do	
1400	1500	Brazil, R Cultura/Araraquara		3365do
1400	1500	Brazil, R Cultura/Manaus	4845do	
1400	1500	Brazil, R Daqui 4915do	6080do	11830do
1400	1500	Brazil, R Difusora Acreana	4885do	
1400	1500	Brazil, R Difusora Roraima	4875do	
1400	1500	Brazil, R Difusora/Londrina	4815do	
1400	1500	Brazil, R Difusora/Macapa	4915do	
1400	1500	Brazil, R Educacao Rural/Coari		5035do
1400	1500	Brazil, R Educadora 6 de Agosto		3355do
1400	1500	Brazil, R Educadora/Limeira 2380do		
1400	1500	Brazil, R Gaucha 6020do	11915do	
1400	1500	Brazil, R Gazeta 5955do	9685do	
1400	1500	Brazil, R Guaiba 6000do	11785do	
1400	1500	Brazil, R Guaruja Paulista	5045do	
1400	1500	Brazil, R Imaculada Conceicao		4755do
1400	1500	Brazil, R Inconfidencia	6010do	15190do
1400	1500	Brazil, R Itatiaia 5970do		
1400	1500	Brazil, R Maria 4885do		
1400	1500	Brazil, R Marumby	6080do	9515do
		11725do		
1400	1500	Brazil, R Meteorologia Paulista		4845do
1400	1500	Brazil, R Mundial 3325do		
1400	1500	Brazil, R Nacional da Amazonia		6185do
		11780do		
1400	1500	Brazil, R Nove de Julho	9820do	
1400	1500	Brazil, R Novo Tempo	4895do	
1400	1500	Brazil, R Rio Mar 6160do	9695do	
1400	1500	Brazil, R Senado Federal	5990do	
1400	1500	Brazil, R Trans Mundial	9530do	11735do
1400	1500	Brazil, R Verdes Florestas	4865do	
1400	1500	Brazil, R Voz Missionario	5940do	9665do
		11750do		
1400	1500	Brazil, Super R Alvorada	2460do	
1400	1500	Brazil, Super R Deus e Amor/Curitiba 6060do		
		9565do 11765do		
1400	1500	Brazil, Super R Deus e Amor/Rio de Janeiro		
		11805do		
1400	1500	South Africa, Channel Africa		9625af
1415	1500	Vatican City State, Vatican R 7250eu	9645eu	
		11740eu		
1425	1455	South Africa, TWR Africa	7315af	

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

1500	1600	Brazil, Educadora/Braganca 4825do		
1500	1600	Brazil, R Alvorada/Londrina 4865do		
1500	1600	Brazil, R Anhanguera	4905do	
1500	1600	Brazil, R Aparecida	5035do	6135do
		9630do 11855do		
1500	1600	Brazil, R Bandeirantes	6090do	9645do
1500	1600	Brazil, R Boa Vontade	6160do	9550do
		11895do		
1500	1600	Brazil, R Brasil Central	4985do	11815do
1500	1600	Brazil, R Cancao Nova	4825do	6105do
		9675do		
1500	1600	Brazil, R Capital 6070do		
1500	1600	Brazil, R Capixaba	4935do	
1500	1600	Brazil, R Clube do Para	4885do	
1500	1600	Brazil, R Congonhas	4775do	
1500	1600	Brazil, R Cultura do Para	5045do	
1500	1600	Brazil, R Cultura Filadelfia	6105do	
1500	1600	Brazil, R Cultura/Araraquara		3365do
1500	1600	Brazil, R Cultura/Manaus	4845do	
1500	1600	Brazil, R Daqui 4915do	6080do	11830do
1500	1600	Brazil, R Difusora Acreana	4885do	
1500	1600	Brazil, R Difusora do Amazonas		4805do
1500	1600	Brazil, R Difusora Roraima	4875do	
1500	1600	Brazil, R Difusora/Londrina	4815do	
1500	1600	Brazil, R Difusora/Macapa	4915do	
1500	1600	Brazil, R Educacao Rural/Coari		5035do
1500	1600	Brazil, R Educadora 6 de Agosto		3355do

1500	1600	Brazil, R Educadora/Limeira 2380do		
1500	1600	Brazil, R Gaucha 6020do	11915do	
1500	1600	Brazil, R Gazeta 5955do	9685do	
1500	1600	Brazil, R Guaiba 6000do	11785do	
1500	1600	Brazil, R Guaruja Paulista	5045do	
1500	1600	Brazil, R Imaculada Conceicao		4755do
1500	1600	Brazil, R Inconfidencia	6010do	15190do
1500	1600	Brazil, R Itatiaia 5970do		
1500	1600	Brazil, R Maria 4885do		
1500	1600	Brazil, R Marumby	6080do	9515do
		11725do		
1500	1600	Brazil, R Meteorologia Paulista		4845do
1500	1600	Brazil, R Mundial 3325do		
1500	1600	Brazil, R Nacional da Amazonia		6185do
		11780do		
1500	1600	Brazil, R Nove de Julho	9820do	
1500	1600	Brazil, R Novo Tempo	4895do	
1500	1600	Brazil, R Record 6150do	9505do	
1500	1600	Brazil, R Rio Mar 6160do	9695do	
1500	1600	Brazil, R Senado Federal	5990do	
1500	1600	Brazil, R Trans Mundial	9530do	11735do
1500	1600	Brazil, R Verdes Florestas	4865do	
1500	1600	Brazil, R Voz Missionario	5940do	9665do
		11750do		
1500	1600	Brazil, Super R Alvorada	2460do	
1500	1600	Brazil, Super R Deus e Amor/Curitiba 6060do		
		9565do 11765do		
1500	1600	Brazil, Super R Deus e Amor/Rio de Janeiro		
		11805do		

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

1600	1700	Brazil, Educadora/Braganca 4825do		
1600	1700	Brazil, R Alvorada/Londrina 4865do		
1600	1700	Brazil, R Anhanguera	4905do	
1600	1700	Brazil, R Aparecida	5035do	6135do
		9630do 11855do		
1600	1700	Brazil, R Bandeirantes	6090do	9645do
1600	1700	Brazil, R Boa Vontade	6160do	9550do
		11895do		
1600	1700	Brazil, R Brasil Central	4985do	11815do
1600	1700	Brazil, R Cancao Nova	4825do	6105do
		9675do		
1600	1700	Brazil, R Capital 6070do		
1600	1700	Brazil, R Capixaba	4935do	
1600	1700	Brazil, R Clube do Para	4885do	
1600	1700	Brazil, R Congonhas	4775do	
1600	1700	Brazil, R Cultura do Para	5045do	
1600	1700	Brazil, R Cultura Filadelfia	6105do	
1600	1700	Brazil, R Cultura/Araraquara		3365do
1600	1700	Brazil, R Cultura/Manaus	4845do	
1600	1700	Brazil, R Daqui 4915do	6080do	11830do
1600	1700	Brazil, R Difusora Acreana	4885do	
1600	1700	Brazil, R Difusora do Amazonas		4805do
1600	1700	Brazil, R Difusora Roraima	4875do	
1600	1700	Brazil, R Difusora/Londrina	4815do	
1600	1700	Brazil, R Difusora/Macapa	4915do	
1600	1700	Brazil, R Educacao Rural/Coari		5035do
1600	1700	Brazil, R Educadora 6 de Agosto		3355do
1600	1700	Brazil, R Educadora/Limeira 2380do		
1600	1700	Brazil, R Gaucha 6020do	11915do	
1600	1700	Brazil, R Gazeta 5955do	9685do	
1600	1700	Brazil, R Guaiba 6000do	11785do	
1600	1700	Brazil, R Guaruja Paulista	5045do	
1600	1700	Brazil, R Imaculada Conceicao		4755do
1600	1700	Brazil, R Inconfidencia	6010do	15190do
1600	1700	Brazil, R Itatiaia 5970do		
1600	1700	Brazil, R Maria 4885do		
1600	1700	Brazil, R Marumby	6080do	9515do
		11725do		
1600	1700	Brazil, R Meteorologia Paulista		4845do
1600	1700	Brazil, R Mundial 3325do		
1600	1700	Brazil, R Nacional da Amazonia		6185do
		11780do		
1600	1700	Brazil, R Nove de Julho	9820do	
1600	1700	Brazil, R Novo Tempo	4895do	
1600	1700	Brazil, R Record 6150do	9505do	
1600	1700	Brazil, R Rio Mar 6160do	9695do	
1600	1700	Brazil, R Senado Federal	5990do	
1600	1700	Brazil, R Trans Mundial	9530do	11735do
1600	1700	Brazil, R Verdes Florestas	4865do	
1600	1700	Brazil, R Voz Missionario	5940do	9665do
		11750do		

1600	1700		Brazil, Super R Alvorada	2460do	
1600	1700		Brazil, Super R Deus e Amor/Rio de Janeiro		
			11805do		
1630	1645	mh	South Africa, TWR Africa	4760af	
1630	1700	f	USA, BBG/Voice of America	9880af	15670af
			17655af		

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

1700	1730		France, R France International	9910af	
1700	1800		Brazil, Educadora/Braganca	4825do	
1700	1800		Brazil, R Alvorada/Londrina	4865do	
1700	1800		Brazil, R Anhanguera	4905do	
1700	1800		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1700	1800		Brazil, R Boa Vontade	6160do	9550do
			11895do		
1700	1800		Brazil, R Brasil Central	4985do	11815do
1700	1800		Brazil, R Cancao Nova	4825do	6105do
			9675do		
1700	1800		Brazil, R Capital	6070do	
1700	1800		Brazil, R Capixaba	4935do	
1700	1800		Brazil, R Clube do Para	4885do	
1700	1800		Brazil, R Congonhas	4775do	
1700	1800		Brazil, R Cultura do Para	5045do	
1700	1800		Brazil, R Cultura Filadelfia	6105do	
1700	1800		Brazil, R Cultura/Araraquara		3365do
1700	1800		Brazil, R Cultura/Manaus	4845do	
1700	1800		Brazil, R Daqui	4915do	6080do	11830do
1700	1800		Brazil, R Difusora Acreana	4885do	
1700	1800		Brazil, R Difusora do Amazonas		4805do
1700	1800		Brazil, R Difusora Roraima	4875do	
1700	1800		Brazil, R Difusora/Londrina	4815do	
1700	1800		Brazil, R Difusora/Macapa	4915do	
1700	1800		Brazil, R Educacao Rural/Coari		5035do
1700	1800		Brazil, R Educadora 6 de Agosto		3355do
1700	1800		Brazil, R Educadora/Limeira	2380do	
1700	1800		Brazil, R Gaucha	6020do	11915do
1700	1800		Brazil, R Gazeta	5955do	9685do
1700	1800		Brazil, R Guaiba	6000do	11785do
1700	1800		Brazil, R Guaruja Paulista	5045do	
1700	1800		Brazil, R Imaculada Conceicao		4755do
1700	1800		Brazil, R Inconfidencia	6010do	15190do
1700	1800		Brazil, R Itatiaia	5970do	
1700	1800		Brazil, R Maria	4885do	
1700	1800		Brazil, R Marumby	6080do	9515do
			11725do		
1700	1800		Brazil, R Meteorologia Paulista		4845do
1700	1800		Brazil, R Mundial	3325do	
1700	1800		Brazil, R Nacional da Amazonia		6185do
			11780do		
1700	1800		Brazil, R Nove de Julho	9820do	
1700	1800		Brazil, R Novo Tempo	4895do	
1700	1800		Brazil, R Record	6150do	9505do
1700	1800		Brazil, R Rio Mar	6160do	9695do
1700	1800		Brazil, R Senado Federal	5990do	
1700	1800		Brazil, R Trans Mundial	9530do	11735do
1700	1800		Brazil, R Verdes Florestas	4865do	
1700	1800		Brazil, R Voz Missionario	5940do	9665do
			11750do		
1700	1800		Brazil, Super R Alvorada	2460do	
1700	1800		Brazil, Super R Deus e Amor/Curitiba	6060do	
			9565do	11765do	
1700	1800		Brazil, Super R Deus e Amor/Rio de Janeiro		
			11805do		
1700	1800		USA, BBG/Voice of America	9880af	15670af
			17655af		

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

1800	1830	mtwhf	USA, BBG/Voice of America	9880af	15670af
			17655af		
1800	1900		Brazil, Educadora/Braganca	4825do	
1800	1900		Brazil, R Alvorada/Londrina	4865do	
1800	1900		Brazil, R Anhanguera	4905do	
1800	1900		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1800	1900		Brazil, R Bandeirantes	6090do	9645do
1800	1900		Brazil, R Boa Vontade	6160do	9550do
			11895do		
1800	1900		Brazil, R Brasil Central	4985do	11815do

1800	1900		Brazil, R Cancao Nova	4825do	6105do
			9675do		
1800	1900		Brazil, R Capital	6070do	
1800	1900		Brazil, R Capixaba	4935do	
1800	1900		Brazil, R Clube do Para	4885do	
1800	1900		Brazil, R Congonhas	4775do	
1800	1900		Brazil, R Cultura do Para	5045do	
1800	1900		Brazil, R Cultura Filadelfia	6105do	
1800	1900		Brazil, R Cultura/Araraquara		3365do
1800	1900		Brazil, R Cultura/Manaus	4845do	
1800	1900		Brazil, R Daqui	4915do	6080do	11830do
1800	1900		Brazil, R Difusora Acreana	4885do	
1800	1900		Brazil, R Difusora Roraima	4875do	
1800	1900		Brazil, R Difusora/Londrina	4815do	
1800	1900		Brazil, R Difusora/Macapa	4915do	
1800	1900		Brazil, R Educacao Rural/Coari		5035do
1800	1900		Brazil, R Educadora 6 de Agosto		3355do
1800	1900		Brazil, R Educadora/Limeira	2380do	
1800	1900		Brazil, R Gaucha	6020do	11915do
1800	1900		Brazil, R Gazeta	5955do	9685do
1800	1900		Brazil, R Guaiba	6000do	11785do
1800	1900		Brazil, R Guaruja Paulista	5045do	
1800	1900		Brazil, R Imaculada Conceicao		4755do
1800	1900		Brazil, R Inconfidencia	6010do	15190do
1800	1900		Brazil, R Itatiaia	5970do	
1800	1900		Brazil, R Maria	4885do	
1800	1900		Brazil, R Marumby	6080do	9515do
			11725do		
1800	1900		Brazil, R Meteorologia Paulista		4845do
1800	1900		Brazil, R Mundial	3325do	
1800	1900		Brazil, R Nacional da Amazonia		6185do
			11780do		
1800	1900		Brazil, R Nove de Julho	9820do	
1800	1900		Brazil, R Novo Tempo	4895do	
1800	1900		Brazil, R Record	6150do	9505do
1800	1900		Brazil, R Rio Mar	6160do	9695do
1800	1900		Brazil, R Senado Federal	5990do	
1800	1900		Brazil, R Trans Mundial	9530do	11735do
1800	1900		Brazil, R Verdes Florestas	4865do	
1800	1900		Brazil, R Voz Missionario	5940do	9665do
			11750do		
1800	1900		Brazil, Super R Alvorada	2460do	
1800	1900		Brazil, Super R Deus e Amor/Curitiba	6060do	
			9565do	11765do	
1800	1900		Brazil, Super R Deus e Amor/Rio de Janeiro		
			11805do		
1800	1900		Vatican City State, Vatican R	9755af	11625af
			13765af		
1830	1900	mtwhf	Spain, R Exterior de Espana	7275eu	9765ca
			15125sa	17715sa	17755af	17850na
1850	1900	Sat	South Africa, TWR Africa	6130af	

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

1900	1905	Sat	South Africa, TWR Africa	6130af	
1900	1930		France, R France International	5950af	
1900	1957		China, China R International	5985af	
			7335eu	7365af	7405af	9535af
			9730af	11640af	13630af	
1900	2000		Brazil, Educadora/Braganca	4825do	
1900	2000		Brazil, R Alvorada/Londrina	4865do	
1900	2000		Brazil, R Anhanguera	4905do	
1900	2000		Brazil, R Aparecida	5035do	6135do
			9630do	11855do	
1900	2000		Brazil, R Bandeirantes	6090do	9645do
1900	2000		Brazil, R Boa Vontade	6160do	9550do
			11895do		
1900	2000		Brazil, R Brasil Central	4985do	11815do
1900	2000		Brazil, R Cancao Nova	4825do	6105do
			9675do		
1900	2000		Brazil, R Capital	6070do	
1900	2000		Brazil, R Capixaba	4935do	
1900	2000		Brazil, R Clube do Para	4885do	
1900	2000		Brazil, R Congonhas	4775do	
1900	2000		Brazil, R Cultura do Para	5045do	
1900	2000		Brazil, R Cultura Filadelfia	6105do	
1900	2000		Brazil, R Cultura/Araraquara		3365do
1900	2000		Brazil, R Cultura/Manaus	4845do	
1900	2000		Brazil, R Daqui	4915do	6080do	11830do
1900	2000		Brazil, R Difusora Acreana	4885do	
1900	2000		Brazil, R Difusora Roraima	4875do	
1900	2000		Brazil, R Difusora/Londrina	4815do	

Start	End	Days	Station	Freq	Freq
1900	2000		Brazil, R Difusora/Macapa 4915do		
1900	2000		Brazil, R Educacao Rural/Coari	5035do	
1900	2000		Brazil, R Educadora 6 de Agosto	3355do	
1900	2000		Brazil, R Educadora/Limeira 2380do		
1900	2000		Brazil, R Gaucha 6020do 11915do		
1900	2000		Brazil, R Gazeta 5955do 9685do		
1900	2000		Brazil, R Guaiba 6000do 11785do		
1900	2000		Brazil, R Guaruja Paulista 5045do		
1900	2000		Brazil, R Imaculada Conceicao	4755do	
1900	2000		Brazil, R Inconfidencia 6010do 15190do		
1900	2000		Brazil, R Itatiaia 5970do		
1900	2000		Brazil, R Maria 4885do		
1900	2000		Brazil, R Marumby 6080do 9515do 11725do		
1900	2000		Brazil, R Meteorologia Paulista	4845do	
1900	2000		Brazil, R Mundial 3325do		
1900	2000		Brazil, R Nacional da Amazonia 6185do 11780do		
1900	2000		Brazil, R Nove de Julho 9820do		
1900	2000		Brazil, R Novo Tempo 4895do		
1900	2000		Brazil, R Record 6150do 9505do		
1900	2000		Brazil, R Rio Mar 6160do 9695do		
1900	2000		Brazil, R Senado Federal 5990do		
1900	2000		Brazil, R Trans Mundial 9530do		
1900	2000		Brazil, R Verdes Florestas 4865do		
1900	2000		Brazil, R Voz Missionario 5940do 9665do 11750do		
1900	2000		Brazil, Super R Alvorada 2460do		
1900	2000		Brazil, Super R Deus e Amor/Curitiba 6060do 9565do 11765do		
1900	2000		Brazil, Super R Deus e Amor/Rio de Janeiro 11805do		
1900	2000		USA, WYFR/Family R Worldwide 3955af 5935af		
1905	1920	mt	South Africa, TWR Africa 6130af		
1920	1950		South Africa, TWR Africa 6130af		
1930	1957		Germany, Deutsche Welle 6150sa		
1930	2000		Germany, Deutsche Welle 11865af		

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

Start	End	Days	Station	Freq	Freq
2000	2030		Cuba, R Havana Cuba 13640eu		
2000	2100		Brazil, Educadora/Braganca 4825do		
2000	2100		Brazil, R Alvorada/Londrina 4865do		
2000	2100		Brazil, R Anhanguera 4905do		
2000	2100		Brazil, R Aparecida 5035do 6135do 9630do 11855do		
2000	2100		Brazil, R Bandeirantes 6090do 9645do		
2000	2100		Brazil, R Boa Vontade 6160do 9550do 11895do		
2000	2100		Brazil, R Brasil Central 4985do 11815do		
2000	2100		Brazil, R Cancao Nova 4825do 6105do 9675do		
2000	2100		Brazil, R Capital 6070do		
2000	2100		Brazil, R Capixaba 4935do		
2000	2100		Brazil, R Clube do Para 4885do		
2000	2105		Brazil, R Congonhas 4775do		
2000	2100		Brazil, R Cultura do Para 5045do		
2000	2100		Brazil, R Cultura Filadelfia 6105do		
2000	2100		Brazil, R Cultura/Araraquara 3365do		
2000	2100		Brazil, R Cultura/Manaus 4845do		
2000	2100		Brazil, R Daqui 4915do 6080do 11830do		
2000	2100		Brazil, R Difusora Acreana 4885do		
2000	2100		Brazil, R Difusora do Amazonas 4805do		
2000	2100		Brazil, R Difusora Roraima 4875do		
2000	2100		Brazil, R Difusora/Londrina 4815do		
2000	2100		Brazil, R Difusora/Macapa 4915do		
2000	2100		Brazil, R Educacao Rural/Coari 5035do		
2000	2100		Brazil, R Educadora 6 de Agosto 3355do		
2000	2100		Brazil, R Educadora Rural/Tefe 4925do		
2000	2100		Brazil, R Educadora/Limeira 2380do		
2000	2100		Brazil, R Gaucha 6020do 11915do		
2000	2100		Brazil, R Gazeta 5955do 9685do		
2000	2100		Brazil, R Guaiba 6000do 11785do		
2000	2100		Brazil, R Guaruja Paulista 5045do		
2000	2100		Brazil, R Imaculada Conceicao 4755do		
2000	2100		Brazil, R Inconfidencia 6010do 15190do		
2000	2100		Brazil, R Itatiaia 5970do		
2000	2100		Brazil, R Maria 4885do		
2000	2100		Brazil, R Marumby 6080do 9515do 11725do		
2000	2100		Brazil, R Meteorologia Paulista 4845do		

Start	End	Days	Station	Freq	Freq
2000	2100		Brazil, R Mundial 3325do		
2000	2100		Brazil, R Nacional da Amazonia 6185do 11780do		
2000	2100		Brazil, R Nove de Julho 9820do		
2000	2100		Brazil, R Novo Tempo 4895do		
2000	2100		Brazil, R Record 6150do 9505do		
2000	2100		Brazil, R Rio Mar 6160do 9695do		
2000	2100		Brazil, R Senado Federal 5990do		
2000	2100		Brazil, R Verdes Florestas 4865do		
2000	2100		Brazil, R Voz Missionario 5940do 9665do 11750do		
2000	2100		Brazil, Super R Deus e Amor/Curitiba 6060do 9565do 11765do		
2000	2100		Brazil, Super R Deus e Amor/Rio de Janeiro 11805do		
2005	2020	Sun	South Africa, TWR Africa 6130af		

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

Start	End	Days	Station	Freq	Freq
2100	2129	fas	Canada, R Canada International 15455ca 17860sa		
2100	2200		Brazil, Educadora/Braganca 4825do		
2100	2200		Brazil, Iguatemi 4975do		
2100	2200		Brazil, R Alvorada/Londrina 4865do		
2100	2200		Brazil, R Anhanguera 4905do		
2100	2200		Brazil, R Aparecida 5035do 6135do 9630do 11855do		
2100	2200		Brazil, R Bandeirantes 6090do 9645do		
2100	2200		Brazil, R Boa Vontade 6160do 9550do 11895do		
2100	2200		Brazil, R Brasil 4785do		
2100	2200		Brazil, R Brasil Central 4985do 11815do		
2100	2200		Brazil, R Capital 6070do		
2100	2200		Brazil, R Capixaba 4935do		
2100	2200		Brazil, R Clube do Para 4885do		
2100	2200		Brazil, R Congonhas 4775do		
2100	2200		Brazil, R Cultura do Para 5045do		
2100	2200		Brazil, R Cultura Filadelfia 6105do		
2100	2200		Brazil, R Cultura/Araraquara 3365do		
2100	2200		Brazil, R Cultura/Manaus 4845do		
2100	2200		Brazil, R Daqui 4915do 6080do 11830do		
2100	2200		Brazil, R Difusora Acreana 4885do		
2100	2200		Brazil, R Difusora do Amazonas 4805do		
2100	2200		Brazil, R Difusora Roraima 4875do		
2100	2200		Brazil, R Difusora/Caceres 5055do		
2100	2200		Brazil, R Difusora/Londrina 4815do		
2100	2200		Brazil, R Difusora/Macapa 4915do		
2100	2200		Brazil, R Educacao Rural/Coari 5035do		
2100	2200		Brazil, R Educadora Rural/Tefe 4925do		
2100	2200		Brazil, R Educadora/Guajara Mirim 3375do		
2100	2200		Brazil, R Educadora/Limeira 2380do		
2100	2200		Brazil, R Gaucha 6020do 11915do		
2100	2200		Brazil, R Gazeta 5955do 9685do		
2100	2200		Brazil, R Guaiba 6000do 11785do		
2100	2200		Brazil, R Guaruja Paulista 5045do		
2100	2200		Brazil, R Guaruja/Florianopolis 5980do		
2100	2200		Brazil, R Imaculada Conceicao 4755do		
2100	2200		Brazil, R Inconfidencia 6010do 15190do		
2100	2200		Brazil, R Itatiaia 5970do		
2100	2200		Brazil, R Maria 4885do		
2100	2200		Brazil, R Marumby 6080do		
2100	2200		Brazil, R Meteorologia Paulista 4845do		
2100	2200		Brazil, R Mundial 3325do		
2100	2200		Brazil, R Municipal 3375do		
2100	2200		Brazil, R Nacional da Amazonia 6185do 11780do		
2100	2200		Brazil, R Nove de Julho 9820do		
2100	2200		Brazil, R Novo Tempo 4895do		
2100	2200		Brazil, R Record 6150do 9505do		
2100	2200		Brazil, R Senado Federal 5990do		
2100	2200		Brazil, R Verdes Florestas 4865do		
2100	2200		Brazil, R Voz Missionario 5940do 9665do 11750do		
2100	2200		Brazil, Super R Alvorada 2460do		
2100	2200		Brazil, Super R Deus e Amor/Curitiba 6060do 9565do 11765do		
2100	2200		Brazil, Super R Deus e Amor/Rio de Janeiro 11805do		
2100	2200		Russia, Voice of Russia 5940eu 6090eu 6120eu		
2100	2200	mtwhf	Spain, R Exterior de Espana 11680sa		
2130	2200		Japan, R Japan NHK World 11880sa		

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

2200	2229	fas	Canada, R Canada International	17860sa
2200	2257		China, China R International	6175eu
			7260eu 9410eu 9685sa	
2200	2300		Brazil, Educadora/Braganca	4825do
2200	2300		Brazil, Iguatemi 4975do	
2200	2300		Brazil, R Alvorada/Londrina	4865do
2200	2300		Brazil, R Anhanguera	4905do
2200	2300		Brazil, R Aparecida 5035do 6135do	
			9630do 11855do	
2200	2300		Brazil, R Bandeirantes 6090do 9645do	
2200	2300		Brazil, R Boa Vontade 6160do 9550do	
			11895do	
2200	2300		Brazil, R Brasil 4785do	
2200	2300		Brazil, R Brasil Central 4985do 11815do	

2200	2300	Brazil, R Cancao Nova 4825do 6105do	
		9675do	
2200	2300	Brazil, R Capital 6070do	
2200	2300	Brazil, R Capixaba 4935do	
2200	2300	Brazil, R Clube do Para 4885do	
2200	2300	Brazil, R Congonhas 4775do	
2200	2300	Brazil, R Cultura do Para 5045do	
2200	2300	Brazil, R Cultura Filadelfia 6105do	
2200	2300	Brazil, R Cultura/Araraquara 3365do	
2200	2300	Brazil, R Cultura/Manaus 4845do	
2200	2300	Brazil, R Daqui 4915do 6080do 11830do	
2200	2300	Brazil, R Difusora Acreana 4885do	
2200	2300	Brazil, R Difusora do Amazonas 4805do	
2200	2300	Brazil, R Difusora Roraima 4875do	
2200	2300	Brazil, R Difusora/Caceres 5055do	
2200	2300	Brazil, R Difusora/Londrina 4815do	
2200	2300	Brazil, R Difusora/Macapa 4915do	

MT SHORTWAVE STATION RESOURCE GUIDE

Afghanistan, R Afghanistan .... **www.rta.org.af**
Albania, R Tirana .... **http://rtsh.sil.at/**
Angola, Angolan National R   .... **www.rna.ao/**
Anguilla/Caribbean Beacon/Univ Network. **www.worldwideuniversity**
.... **network.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**
Belarus, R Belarus .... **www.radiobelarus.tvr.by/eng**
Belgium, TDP Radio .... **www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Svc .... **www.bbs.com.bt**
Canada, Bible Voice Broadcasting .... **www.biblevoice.org/**
Canada, CBC Northern Quebec Svc .... **www.cbc.ca/north/**
Canada, CFRX Toronto ON .... **www.cfrb.com**
Canada, CFVP Calgary AB .... **www.classiccountryam1060.**
.... **com**
Canada, CKZN St Johns NF .... **www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC .... **www.cbc.ca/bc**
Canada, R Canada International .... **www.rcinet.ca/**
China, China R International .... **www.cri.cn**
China, Haixa zhi Sheng/VO Strait .... **www.vos.com.cn**
Clandestine, JSR/Shiokaze/Sea Breeze .... **www.chosa-kai.jp**
Clandestine, Sudan R Service .... **www.sudanradio.org**
Croatia, Voice of Croatia .... **www.hrt.hr/**
Cuba, R Havana Cuba .... **www.radiohc.cu/**
Ecuador, HCJB/LV de los Andes .... **www.radiohcjb.org**
Egypt, R Cairo .... **www.ertu.org**
Eqt Guinea, R Africa 2 .... **www.radiopanam.com/**
Ethiopia, R Ethiopia .... **www.erta.gov.com**
Ethiopia, R Ethiopia/Natl Pgm .... **www.erta.gov.com**
Germany, AWR Europe **www.awr2.org/**
Germany, Deutsche Welle .... **www.dw.de**
Germany, Pan American Broadcasting .... **www.radiopanam.com/**
Germany, TWR Europe .... **www.twr.org**
Germany, XVRB Radio .... **www.twr.org**
Guam, AWR/KSDA **www.awr2.org/**
Guam, TWR Asia/KTWR .... **http://nea.ktwr.net/**
India, All India R/Aizawl .... **www.allindiaradio.org/**
India, All India R/Aligarh .... **www.allindiaradio.org/**
India, All India R/Bengaluru .... **www.allindiaradio.org/**
India, All India R/Bhopal .... **www.allindiaradio.org/**
India, All India R/Chennai .... **www.allindiaradio.org/**
India, All India R/Delhi .... **www.allindiaradio.org/**
India, All India R/External Svc .... **www.allindiaradio.org/**
India, All India R/Gangtok .... **www.allindiaradio.org/**
India, All India R/Gorakhpur .... **www.allindiaradio.org/**
India, All India R/Guwahati .... **www.allindiaradio.org/**
India, All India R/Hyderbad .... **www.allindiaradio.org/**
India, All India R/Imphal .... **www.allindiaradio.org/**
India, All India R/Itanagar .... **www.allindiaradio.org/**
India, All India R/Jaipur .... **www.allindiaradio.org/**
India, All India R/Jeypore .... **www.allindiaradio.org/**
India, All India R/Kolkata .... **www.allindiaradio.org/**
India, All India R/Kurseong .... **www.allindiaradio.org/**
India, All India R/Lucknow .... **www.allindiaradio.org/**
India, All India R/Mumbai .... **www.allindiaradio.org/**

India, All India R/Panaji (Goa) .... **www.allindiaradio.org/**
India, All India R/Port Blair .... **www.allindiaradio.org/**
India, All India R/R Kashmir .... **www.allindiaradio.org/**
India, All India R/Shillong .... **www.allindiaradio.org/**
India, All India R/Shimla .... **www.allindiaradio.org/**
India, All India R/Thiruvananthapuram ...... **www.allindiaradio.org/**
Indonesia, Voice of Indonesia .... **www.voi.co.id**
Iran, IRIB/VOIRI .... **www.irib.ir/English/**
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/**
Nepal, R Nepal .... **www.radionepal.org/**
Netherlands, R Netherlands Worldwide ...... **www.radionetherlands.nl/**
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/WHRI .... **www.whr.org/**
Philippines, R Pilipinas Overseas .... **www.pbs.gov.ph/**
Romania, IRRS .... **www.nexus.org**
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, Amateur R Mirror Intl .... **www.sarl.org.za**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa .... **www.channelafrica.org**
South Africa, CVC 1 Africa R **www.1africa.tv**
South Africa, RTE R Worldwide **www.rte.ie/radio1/**
South Korea, KBS World R .... **www.worldkbs.co.kr**
Spain, R Exterior de Espana .... **www.ree.rne.es/**
Sri Lanka, AWR Asia **www.awr2.org/**
Sri Lanka, SLBC .... **www.slbc.lk**
Swaziland, TWR Africa .... **www.twrafrica.org/**
Syria, R Damascus .... **www.rtv.gov.sy/**
Taiwan, R Taiwan Intl .... **http://english.rti.org.tw/**
Thailand, R Thailand World Svc **www.hsk9.org/**
Turkey, Voice of Turkey .... **www.trt-world.com**
Uganda, Dunamis Shortwave .... **www.biblevoice.org/stations/**
.... **east-africa**
UK, BBC World Service .... **www.bbc.co.uk/worldservice/**
USA, Amer Forces Network/AFRTS .... **http://myafn.dodmedia.osd.mil/**
USA, BBG/Voice of America .... **www.voanews.com**
USA, BBG/Voice of America/Special English **www.voanews.com**
USA, EWTN/WEWN Irondale AL .... **www.ewtn.com/**
USA, FBN/WTJC Newport NC .... **www.fbnradio.com/**
USA, KNLS Anchor Point AK .... **/www.knls.org/**
USA, The Overcomer Ministry .... **www.overcomerministry.org**
USA, WBCQ Monticello ME .... **www.wbcq.com/**
USA, WHRI Cypress Creek SC .... **www.whr.org/**
USA, WINB Red Lion PA .... **www.winb.com**
USA, WRMI/R Prague relay .... **www.wrmi.net/**
USA, WRMI/R Slovakia Intl relay .... **www.wrmi.net/**
USA, 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, CVC/R Christian Voice .... **www.voiceafrica.net**

MILCOM
MONITORING MILITARY COMMUNICATIONS

Larry Van Horn, N5FPW

larryvanhorn@monitoringtimes.com
Blog: http://mt-milcom.blogspot.com
Twitter: MilcomMP

Requiem for HF at Malabar

Recently a sharp eyed *MT* reader noticed that the HF antennas were gone from the Florida Space Coast Malabar site. I immediately queried the Public Affairs office of the 45 Space Wing at Patrick AFB to flush out the real story about Malabar's demise and received this reply from Mr. Gary R. Kuzara, Civilian USAF:

"As indicated in the attached e-mail (*my initial query to the public affairs office-lvh*) we have in fact removed the antennas and radios at Malabar and Cape Canaveral associated with Legacy HF. We have since migrated HF Operations to the worldwide Global HF network at a significant savings to the AF. We still support a Global HF site at Ascension with HF antennas transmitters and receivers that we refer to as levels. We can operate from any of the Global HF sites worldwide from Global ACAS terminals located at Cape Canaveral. Any telephone can now be used to communicate across the Global HF network. This program was so successful with the Air Force the Navy is now undertaking a major move to Global HF. Some of this program is for official use only so I will have to circumvent to the Global HFGCCS program office should any further information be required on the program."

While the antennas and transmitters may be gone from Malabar, I would imagine that the frequency assignments that were associated with that hardware is probably still in use. Monitoring will certainly bear this out and I hope to have an update sometime in the near future on the East and West Test Range HF frequencies.

❖ Potomac TRACON Frequencies

Until several years ago, there were five separate traffic control approach / departure facilities in the Baltimore-Washington area that guided aircraft in to and out of the nation's fourth busiest airspace.

That all changed on December, 14, 2002, when those five approach/departure control facilities were combined into a new consolidated facility known as the Potomac TRACON (Terminal Radar Approach Control). This new facility located in Warrenton, Virginia consolidated air traffic control facilities located at Andrews Air Force Base; Baltimore/Washington International Airport; Richmond International Airport; Ronald Reagan Washington National Airport and Washington Dulles International Airport.

They also provide approach/departure services to over thirty non-primary airports in a region of over 17,000 square miles.

TRACONs are FAA facilities that house air traffic controllers who use radar displays and radios to guide aircraft approaching and departing airports generally within a 30- to 50-mile radius up to 10,000 feet, as well as aircraft that may be flying over that airspace.

Once an aircraft intending to land is within five miles of an airport and below 2,500 feet, TRACON controllers hand the aircraft off to air traffic controllers in the airport tower.

When a departing aircraft leaves the TRACON's range of control, TRACON controllers hand responsibility for the aircraft off to controllers at FAA Air Route Traffic Control Centers (ARTCC) who guide the aircraft at higher altitudes while it is en route to the next airport.

In other words, while TRACON controllers do not handle landings and takeoffs like airport tower controllers, they are responsible for the safe separation of aircraft flying in the busy areas surrounding airports. See Table One for a comprehensive list of Potomac TRACON frequency pairs.

Washington ADIZ a Permanent SFRA

An Air Defense Identification Zone (ADIZ) has existed since February 10, 2003, around the Baltimore-Washington Metropolitan Area to restrict air traffic near Washington, D.C. This ADIZ was established after the September 11 attacks as a temporary measure to prevent further attacks. It was made permanent in 2008.

The ADIZ (now known collectively as a

Potomac Area PCT-3D Chart (Courtesy FAA)

Flight Restricted Zone and Special Flight Rules Area) was created by the FAA in response to demands by a working group that became formalized as the National Capital Region Coordination Center.

Within the ADIZ is an even more sensitive zone designated as the Washington, D.C. Metropolitan Area Flight Restricted Zone (DC FRZ). The DC FRZ extends approximately 13-15 nautical miles (15-17 statute miles) around the VOR/DME located at the Ronald Reagan Washington National Airport. Flight within the FRZ is restricted to governmental, certain scheduled commercial and a limited set of waivered flights. Three general aviation airports (known as the "Maryland 3" or the "DC 3") are located inside the DC FRZ. The "Maryland 3" are College Park Airport (CGS), Washington Executive/Hyde Field (W32), and Potomac Airport (VKX).

On February 17, 2009, the status of the ADIZ was scheduled to change from a Temporary Flight Restriction to a permanent Special Flight Rules Area. Special VHF/UHF frequencies have been set aside for use by the three Special Flight Rules Areas (SFRA) established in the Washington area as listed below:

125.125 / 291.775	South SFRA Sector
127.325 / 236.775	West SFRA Sector
132.775 / 342.425	East SFRA Sector

Potomac Consolidated TRACON (PCT) Frequencies

There are many operational configurations used at the Potomac TRACON, as sectors often combine or fragment with other sectors. Additionally, controllers often service aircraft in another controller's airspace. Listed in Table One are the more common PCT sector configurations that provide the monitor with a PCT TRACON overview.

Special thanks go to regular *Milcom* reporter Ron Perron in Maryland for his help in preparing this list of Potomac TRACON frequencies.

❖ FAA ARTCC Update

This month we will continue our center tour with Kansas City ARTCC (Table Two). I want to remind regular readers of this column to please be patient and we will get around to the ARTCC covering your area as soon as space and current events allow. Note: All frequencies listed in the tables are in MHz and mode is AM.

And that does it for this month. Until next time, 73 and good hunting.
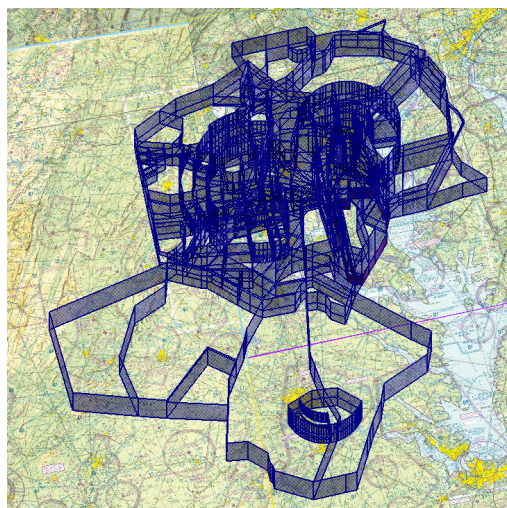
POTOMAC CONSOLIDATED TERMINAL RADAR APPROACH CONTROL

Shenandoah Sector - Washington Dulles International Airport (KIAD)
120.450 / 306.925 MANNE: STAR Arrival – HYPER 3, ROYIL 2 and SHNON 2 (ex-343.775 MHz) and various ILS Approach Procedures
120.825 / 257.875 BRSTO: Approach
124.650 / 306.925 BARIN: STAR Arrival – BARIN 1 and COATT 4 South (ex-343.775 MHz)
125.050 / 350.200 ASPER: North Departure
125.800 / 306.925 IADFE: STAR Arrival – COATT 4 North (ex-343.775 MHz)
126.100 / 338.250 MULRR: STAR Arrival – DELRO 2, LEGGO 2, PHILIPSBURG 2, PRTZL 3 and SELIN-SGROVE 3
126.650 / 350.200 TILLY: South Departure
126.825 / 239.025 LUCKE: West Departure
133.000 / 338.250 BINNS: Arrival High (Maybe replaced by 288.350 MHz)
134.200 / 306.925 IADFW: Final West
135.775 / 306.925 ROCLA: RWY 12 final RCOLA: Also IADFC when landing all three parallels) North/Northwest Approaches, Southern Departures RCOLA

Mount Vernon Sector - Washington National Airport (KDCA)
118.300 / 306.300 DCAFE: Final East and various ILS Approach Procedures
118.675 / 343.700 LURAY: STAR Arrival – ELDEE 5 and WZRRD 2
118.950 / 322.300 TYSON: STAR Arrival – OJAAY 1
118.950 / 257.200 TYSON: Departure – LAZIR 1 and NATNL 2
119.100 / 335.500 ADWAR: Approach
119.850 / 322.300 OJAAY: STAR Arrival West – IRONS 4 (DCA Arrivals Only)
121.050 / 343.700 FLUKY: Approach
124.000 / 279.575 ADWFR: Discrete for Arlington Cemetery Fly-bys
124.200 / 269.000 ENSUE: East Arrival
124.550 / 317.425 STAR Arrival – BILIT 1
124.700 / 338.200 DCAFR: Final West and various ILS Approach Procedures
125.650 / 348.725 KRANT: Departure – LAZIR 1 and NATNL 2
128.350 / 270.275 DEALE: STAR Arrival Southeast – IRONS 4 (ADW Arrivals Only)
128.700 / 307.900 STAR Arrival – CLIPR 1 and SKILS 2

Chesapeake Sector - Baltimore Washington International Airport (KBWI)
119.000 / 282.275 BWIFN: North Final
119.700 / 290.475 BWIFS: Instrument Approach Procedures/South Final
123.525 / 291.625 BELAY: North Approach High
123.825 / 254.250 BUFFR: STAR Arrival – Westminster 5 South Arrival
124.550 / 317.425 GRACO: Approach
126.750 / 291.625 Chesapeake Unknown Approach
128.350/ 270.275 STAR Arrival – Ravnn 3/Nottingham 6
128.700 / 307.900 WOOLY: Approach
133.750 / 254.350 PALEO: Approach

Andrews Air Force Base (KADW)
118.675 / 343.700 LURAY: STAR Arrival – ELDEE 5 and WZRRD 2
118.950 / 257.200 TYSON: Departure – Camp Springs 1
119.300 / 335.500 Various Instrument Approach Procedures
124.000 / 279.575 ADWFR: Discrete for Arlington Cemetery Fly-bys
125.650 / 348.725 KRANT: Departure – Andrews 1/Morningside 1
128.350 / 270.275 DEALE: STAR Arrival Southeast – IRONS 4 (ADW Arrivals Only)

Richmond International Airport (KRIC)
118.200 / 288.275 TICFR: Richmond Final
120.525 / 323.125 CHOEA: East sector (ex-257.750 MHz)
126.400 / 282.375 TAPPA: Approach/Departure (031-170 Degrees) (ex-319.800 MHz) Also Approach for Fort Lee, Middle Peninsula Regional and New Kent County
126.800 / 398.200 FLTRK: Approach (321-030 Degrees) (possible change to 134.750 MHz)
132.850 / 257.750 CHOWE: West sector
134.700 / 307.200 COATT: Approach (171-320 Degrees)
----------/ 323.175 Approach Control (ex-350.275 MHz)

Clearance Delivery (frequencies controlled by Potomac Tracon)
118.550 (Leesburg) 121.600 (Culpepper) 126.150 (Winchester)

NORAD (Air Defense/Intercept)
228.900 (Guard Dog) 234.600 254.200 255.800 260.900 (Guard Dog) 271.000 293.600 320.600 320.900 324.000 360.150 (Guard Dog) 362.300 364.200 (AICC)

Other Possible PCT frequencies:
125.350 (ADW) 125.525 (BWI) 126.550 (ADW) 135.525/350.525 (Shared with ZDC ARTCC) 269.075 (IAD) 269.500 (ADW) 269.525 (RIC) 281.475 (ADW)

TABLE TWO: KANSAS CITY ARTCC RCAG FREQUENCY LIST

RCAG Freq V/U Pair MHz	RCAG Location (ICAO Identifier)	Sector Number/Name:	Notes
118.125/257.850	Edna KS (EDNA/QED)	Sector 97	Hi
118.350/344.800	Anthony KS (ANY)	Sector 67	Lo (ex-370.850 MHz)
118.800/337.400	Hutchinson KS (HUT)	Sector 68	Lo (ex-285.525 MHz)
119.475/279.600	Columbia MO (CBI/COU)	Sector 30	Hi (ex-335.625 MHz)
120.200/323.200	Emporia KS (EMP)	Sector 67	Lo
120.725/257.650	Dodge City KS (DDC)	Sector 21	Hi (Above FL380)
120.825/319.000	Farmington MO (FAM)	Sector 14	Hi
121.650/---------	Independence MAP KS (IDP)	Sector 72	Clearance Delivery Services
121.825/---------	Lawrence KS (LWC)	Sector 44	Lo
123.800/343.700	Topeka KS (TOP)	Sector 44	Lo
124.300/269.150	Decatur IL (DECA)	Sector 58	Lo (ex-335.600 MHz)
124.300/269.150	Effingham IL (EFF)	Sector 58	Lo (ex-335.600 MHz)
124.375/---------	Columbia MO (COU)		Approach/Departure Services
124.400/322.400	Russell KS (RSL)	Sector 68	Lo
124.975/290.425	Emporia KS (EMP)	Sector 03	Hi (Above FL360)
125.175/269.625	Sakina KS (SLN)	Sector 24	Hi
125.200/269.400	Garden City KS (GCK)	Sector 68	Lo/Approach/Departure Services
125.300/269.500	Marion IL (MWA)	Sector 19	Lo
125.425/307.075	Topeka KS (TOP)	Sector 47	Hi (Above FL370)
125.550/327.000	Butler MO (BUM)	Sector 42	Lo
125.675/273.450	Richland MO (QJK)	Sector 31	Hi (Above FL370)
125.725/353.725	Vandalia IL (VLA)	Sector 94	Hi (Above FL350)
125.900/327.100	Saint Charles MO (QIF)	Sector 59	Lo
126.150/323.000	Abraham Lincoln Capital Airport IL (SPI)		Approach/Departure Services
126.950/379.200	Gage OK (GAG)	Sector 68	Lo
126.975/335.625	Hallsville MO (MITBY)	Sector 33	Hi
127.125/360.850	Kansas City MO (MCI)	Sector 26	Lo
127.275/307.100	Jacksonville IL (IJX)	Sector 59	Lo (ex-327.500 MHz)
127.350/257.975	Manhattan KS (MHK)	Sector 66	Lo
127.475/346.275	Farmington MO (FAM)	Sector 54	Lo (ex-269.500/290.325 MHz)
127.475/346.275	Marion IL (MWA)	Sector 54	Lo (ex-269.500/290.325 MHz)
127.500/269.400	Springfield MO (SGF)	Sector 72	Lo
127.700/351.825	Mount Vernon IL (MVN)	Sector 56	Lo
127.725/270.250	Emporia KS (EMP)	Sector 48	Lo
127.725/270.250	Olathe KS (ZKC)	Sector 48	Lo
127.800/319.100	Ponca City (PNC)	Sector 62	Lo
127.900/251.100	Saint Joseph MO (SJY)	Sector 46	Lo
128.300/291.700	Oklahoma City OK (OKC)	Sector 62	Lo
128.350/284.675	Maples MO (MAP)	Sector 53	Lo
128.350/284.675	Richland MO (QJK)	Sector 53	Lo
128.350/284.675	Saint Louis MO (STL)	Sector 53	Lo
128.600/282.325	Edna KS (QED)	Sector 74	Lo
128.800/354.100	Tulsa OK (TUL)	Sector 72	Lo
132.250/285.400	Emporia KS (EMP)	Sector 02	Hi (ex-281.425 MHz)
132.575/235.975	Chillicothe MO (CHT)	Sector 40	Lo
132.650/307.800	Farmington MO (FAM)	Sector 29	Hi
132.825/292.175	Gage OK (GAG)	Sector 07	Hi (Above FL380)
132.850/290.225	University of Illinois Williard Airport (CMI)		Approach/Departure Services
132.875/273.575	Mount Vernon (MVN)	Sector 90	Hi (Above FL350)
132.900/279.500	Chanute KS (CNU)	Sector 72	Lo
133.150/355.600	Saint Louis MO (STL)	Sector 84	Hi (ex-127.225 MHz)
133.200/292.125	Anthony KS (ANY)	Sector 06	Hi
133.225/346.400	Effingham IL (EFF)	Sector 98	Hi (Above FL350)
133.450/281.400	Garden City KS (GCK)	Sector 22	Hi
133.475/277.400	Springfield IL (SGF)	Sector 28	Hi
133.725/290.700	Kirksville MO (IRK)	Sector 92	Hi (Above FL330) (ex-317.675 MHz)
133.925/281.450	Tulsa OK (TUL)	Sector 27	Hi (ex-125.825 MHz)
134.000/290.800	Liberal KS (LBL)	Sector 68	Lo
134.300/273.600	Hutchinson KS (HUT)	Sector 20	Hi
134.500/299.200	Columbia MO (CBI/COU)	Sector 52	Lo (ex-279.600 MHz)
134.625/269.300	Kirksville MO (IRK)	Sector 32	Hi
134.675/387.100	Liberal KS (LBL)	Sector 23	Hi (ex-235.775 MHz)
134.725/327.125	Manhattan KS (MHK)	Sector 41	Hi (Above FL370)
134.900/363.200	Salina KS (SLN)	Sector 66	Lo
135.050/290.400	Effingham IL (EFF)	Sector 12	Hi
135.525/317.775	Quincy IL (UIN)	Sector 50	Lo
135.575/323.150	Holden MO (QIP)	Sector 42	Lo
----------/257.900	Jacksonville IL (IJX)	MOA	Howard MOA Control
----------/269.225	Maples MO (MAP)	MOA	Lindbergh MOA Control
----------/275.200	Saint Louis MO (QMC/MAC)		Channel 10, Flight Test
----------/294.700	Olathe KS (ZKC)	UNK	Unknown usage
----------/299.750	Saint Louis MO (QMC/MAC)		Channel 6, Flight Test
----------/317.600	Ponca City OK (PNC)	TSU	Military TSU
----------/322.550	Decatur IL (DEC)	Sector 25	Lo
----------/351.950	Emporia KS (EMP)	MOA	Eureka MOA Control
----------/353.900	Hutchinson KS (HUT)	MOA	Ada or Bison MOA Control
----------/357.000	Olathe KS (ZKC)	Maintenance	Maintenance Test Only
----------/361.400	Saint Louis MO (QMC/MAC)		Channel 4, Flight Test
----------/373.500	Saint Louis MO (QMC/MAC)		Channel 6, Flight Test
----------/373.525	Saint Louis MO (QMC/MAC)		Channel ?, Flight Test
----------/384.400	Knob Noster MO (SZL)	MOA	Truman MOA Control

When is a Test Not a Test?

Periodically, AM stations run "DX Test" broadcasts. These involve special programming intended to be easy to identify through noise and interference. Some engineers believe a loophole in the FCC regulations allows such tests to be run at increased power, which of course makes them even easier to log.

If you're in Chicago, obviously WGN makes it nearly impossible to log any DX on 720. If WGN were to go off the air, you would have a golden opportunity to log some new DX. If WGN were to provide advance notice of such an outage, DXers across the East could take advantage. I call this a "non-test" – a DX opportunity resulting from a station ordinarily on the air being off (as opposed to an ordinary test where a station normally operating at reduced power is on at full facilities).

What was probably the mother of all "non-tests" happened early on the morning of March 10th. Between 2 and 5am Central time, all three of Chicago's most powerful AM stations were off the air. WGN-720, WSCR-670, and WBBM-780 all transmit from adjacent sites in the Schaumburg area. We never did learn exactly what kind of maintenance was performed, although I suspect tower matching and ground impedance measurements were being made. The sensitive instruments used to make this kind of measurement would have problems with strong signals from the other two nearby stations.

Given the special opportunity, two other stations on Chicago frequencies scheduled "regular" DX Tests. KOTZ-720 Kotzebue, Alaska and KBOI-670 Boise, Idaho were involved.

Unfortunately, atmospheric conditions were incredibly bad on March 10th. Some listeners (myself included) thought WSCR was off well *before* the test – it turns out the Cuban station on the frequency was so strong it completely swamped WSCR even while WSCR was still operating. The other two frequencies were occupied by strong Mexican signals at my location.

Nobody logged KOTZ. I don't think anyone really expected to, although Pacific Northwest listeners probably would have had an opportunity if conditions had been better. KBOI was logged by listeners in Iowa and Missouri. I sure could have used Idaho in my logs, but there wasn't a peep of KBOI at my location.

On a vaguely similar vein, a Victoria, British Columbia station ran an impromptu DX Test over its last day on the air. CKMO-900 had announced it would go permanently silent on March 4th (the station is now an online-only operation). While there was no advance notice, a DXer in Victoria, listening on the station's

Chicago's three largest stations were off the air for maintenance early on March 10th. (chicago.cbslocal.com; wgnradio.com)

last day, was surprised to hear frequent IDs in Morse Code. A few Northwestern DXers heard the test – unfortunately, again, conditions were not the best and it didn't stretch much further.

CKMO had swapped their low-power FM frequency to a commercial broadcaster, in trade for the commercial station's AM frequency. The commercial station agreed to maintain the AM transmitter for ten years. When that agreement ran out last year, CKMO found they couldn't afford to assume the expense for themselves.

❖ LPFM vs. Translators

What if you had a party and everybody came? The FCC found out back in 2003... Having held the first filing window for LPFM stations in 2000, they held another window for FM translators. These low-powered stations serve to relay the programming of full-power FM stations. They expected considerable interest, but they didn't expect 13,000 translator applications! The Commission realized processing all 13,000 applications would occupy every available frequency, leaving nothing for any future LPFM service. As they tried to find a way to accommodate both the LPFM and translator services, they froze

processing on applications in both services.

In March, a plan was released to break the logjam. Translator applications will be processed if their grant wouldn't preclude LPFM service. Another filing window will be held (sometime this year, most likely) for new LPFM stations. Chances are nobody will be happy.

First, the FCC ran an LPFM spectrum availability study. They ran grid lines through the center of each Arbitron radio market and for 15 minutes of longitude and latitude each side of the center. This created a grid with 961 intersection points. They also ran another grid with only 10 minutes each side of center, with 441 intersection points. They calculated the population within both grids; if the population in the smaller grid exceeded 75% of that in the larger grid, the smaller grid was used for processing.

At each of the 441 or 961 intersection points, the Commission evaluated each of the 100 FM channels to see if an LPFM station would be possible at that location. If so, one LPFM channel was added to the list available in the market. If a minimum number of LPFM channels is available in a market, that market is regarded "Spectrum Available" – if the minimum number is not met, the market is "Spectrum Limited." The minimum number of available channels required to be "Spectrum Available" ranges from 5 to 8 depending on market size.

Translator applications *will* be processed in the 79 "Spectrum Available" markets. The presumption is that, after all applications are processed, there will remain enough available
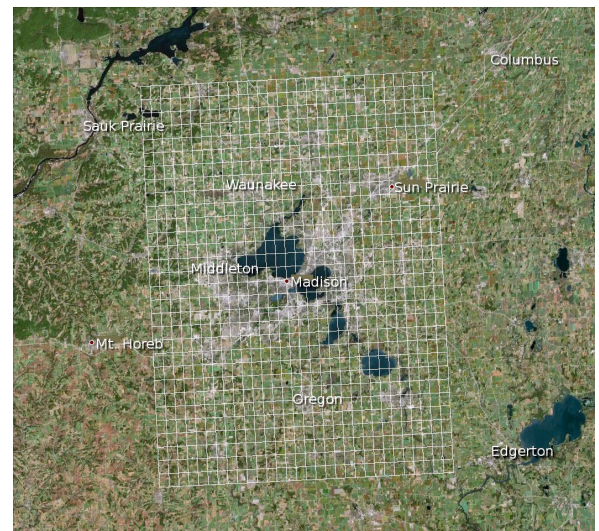
31x31 LPFM channel grid for Madison, Wisconsin. (Google Earth)

channels to authorize a reasonable number of LPFM stations. Among the fifty largest radio markets, those found to be "Spectrum Available" were Charlotte, Riverside (CA), Cincinnati, Orlando, Raleigh, Nashville, Greensboro/Winston-Salem, and Oklahoma City.

Translator applications *may* be processed in the 77 "Spectrum Limited" markets. The applicants will be required to show that granting their applications will not preclude LPFM service. Chances are, most translator applicants in Spectrum Limited markets won't be able to show this and their applications will be dismissed. Translator proposals outside the survey grids will also be required to show they won't preclude LPFM service, although they're more likely to succeed in these rural areas.

The FCC will also limit how many translator applications they'll process for each applicant. No more than fifty will be processed per applicant nationwide, and only one per market. Those who have more than fifty on file may tell the Commission which ones they wish to have processed – if they don't, those that were filed first will be processed. The release notes that one applicant was responsible for 25 of the 27 applications for translators within 20km of Houston; two applicants were responsible for 66 of the 74 applications in the New York market.

FM DXers will, unfortunately, face a more crowded dial.

❖ Tolerance

It amazes me just what some stations think they can get away with, in terms of ignoring the rules and terms of their licenses. A recent case in South Carolina is a good (i.e., bad!) example.

In 1996, a FCC inspector visited the station. They found it on the air – even though their license had expired a year earlier and they'd never bothered to request it be renewed. That, and the transmitter was ten miles from where the (expired) license said it should be. (Hint: your station is going to have a bad day if an FCC inspector hears it on the air but can't find the transmitter!)

A Notice of Violation was issued. The station requested special permission to operate from the new (unauthorized) site; permission was denied. (The site wouldn't cover the city the station was authorized to serve – and it would interfere with three other stations)

Seven years later... after failing to request renewal, the station's license expired *again*. They requested Special Temporary Authority (STA) to operate while the FCC reviewed their tardy renewal application. This authority was routinely granted, but contingent on use of the authorized transmitter site. Special Temporary Authority is usually valid for six months – you probably won't be surprised to learn they forgot to renew the STA...

In 2011, something happened for the first time in 16 years: the station in question actually filed a renewal application on time! However... the FCC learned the station never did return its operation to the authorized site and never received permission to move to the new site.

A station that remains off the air for more than a year automatically loses its license.

The FCC has ruled that unauthorized operation doesn't count as "operation." The station in question has not operated from its authorized site since at least 1996. As far as the rules are concerned, this station has been off the air for fifteen years. Yes, this station no longer has a license.

"Apparently not having remembered the past, Morradio again failed to file a renewal application for the Station." "...engaged in unauthorized operation of the Station, not for 12 consecutive months, but for nearly 12 consecutive *years* after it had received a second forfeiture for that very violation;..." Those are direct quotes from the FCC Public Notices (including the italics). FCC notices are usually rather boring; this text stood out. It sure seems someone in Washington is frustrated; they gave this station every opportunity to save itself, but the station just couldn't do it.

I guess the lesson the DXer should learn here is, don't assume that a station is operating from the site shown in reference material – and don't assume a deleted station is actually dead. As I write, listener reports indicate this station is still operating, despite being unlicensed.

❖ New Toronto FM

Speaking of deleted stations, CKLN-FM 88.1 Toronto lost its license last year. As you might imagine, an open frequency in Canada's largest media market drew a *lot* of applications. You should note that in Canada, FM frequencies below 92 MHz are *not* limited to non-commercial operation. In the U.S., stations below 92 FM must not sell airtime.

Twenty-two applications were filed. Sixteen were for completely new stations. Three were for existing FM stations to move to the more powerful 88.1 frequency (CIRR-103.9, CKFG-98.7, CHOQ-105.1). Two were for "nested relays" to use the FM frequency to relay powerful AM stations (CFZM-740 & CJBC-860). In both cases the AM stations would continue to operate. Finally, CKLN asked for their old frequency back...

❖ Until next time...

Did you catch the big Chicago "non-test" of March 10th? Please write, at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to *dougsmith@monitoringtimes.com*. Good DX!

URLS IN THIS MONTH'S COLUMN:

http://americanbandscan.blogspot.com - My AM DX blog
www.villagenow.net/ - Website of the organization that used to run CKMO-900 Victoria
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-28A1.pdf - FCC proceeding regarding new LPFM and translator stations
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-29A1.pdf
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-29A2.pdf
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-29A3.pdf
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-12-464A1.pdf - FCC proceedings cancelling the licenses of two stations
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-12-463A1.pdf
http://www.crtc.gc.ca/eng/archive/2012/2012-126.htm CRTC notice of hearing on applications for 88.1 Toronto

DPUs Keep the Trains Moving

In response to the last column's mention of frequencies used to control distributed power units (DPUs or remote locomotives) a reader asked me to explain how this system worked for "pushers." As with many good questions, the answer is not all that simple.

Let's step back a little bit in history. As trains grew heavier, railroads looked to larger and stronger (then mostly steam) locomotives to handle their trains. When one large locomotive wasn't available, sometimes two smaller locomotives were put on the head of a train. This was called double-heading. In rare situations in the steam era, trains were even triple-headed.

Of course, back then each locomotive had its own crew, and coordinating throttle settings wasn't always easy, though with all of the locomotives on the front of the train the engineers could, in part, rely on the "feel" of their engines, and engineers could usually see hand signals from crew-members on the ground or wayside signals. Other coordination was done with whistle signals.

When air brakes were introduced, one of the first developments that helped with double-heading was the double-heading valve, a version of which is still used on today's diesel locomotives. The double-heading valve cuts out the brake valve of the second or third locomotives and the lead locomotive controls all brakes.

Mountain grades provided a special problem in the assignment of motive power. The number and size of engines that could move a train in the flatlands was usually not enough to get trains up steep grades. So railroads established "helper districts." These were areas where railroads kept extra locomotives just for the purpose of assisting trains up grades. Some still exist today in the diesel era, and manned helpers are still used by railroads.

The reason that I use the term helpers rather than pushers is that it is more generic. Helpers can be coupled to either the front or back of a train. Particularly for passenger trains, helpers normally go on the front, for safety reasons.

Back when most freight trains had cabooses, many railroads had safety rules prohibiting use of manned helpers behind occupied cabooses. In those cases, the caboose either had to be switched behind the helpers or the crew from the caboose rode on the helper engine.

Crawford Hill Example

To illustrate that helpers are more than just pushers, I can cite an example from one of the more famous helper districts, Crawford Hill on BNSF in far western Nebraska. The line uses helpers based in the town of Crawford at the base of the 1.55 per cent grade. This line sees very heavy coal trains – typically in the 120-plus car range – heading out of the Powder River Basin.

These trains typically have two modern high-horsepower units up front and a remote-controlled DPU unit in the back. (We'll get to DPU controls later.) Helper sets meet trains a few miles northeast of Crawford, where they couple onto the back of the train. Then all engines go to "Run 8" (full throttle) to attack the hill. These helper sets have consisted of four older diesel units or two more modern higher-horsepower units. The helpers uncouple at the crest of the hill and then run light back to Crawford to await their next assignment. At times, several helper sets will couple together for the trip back to Crawford to reduce the number of train movements on this busy double-track line. (Voice road channel is AAR 87, 161.415.)

In one case when I was in the area, an up-bound coal train experienced the failure of one of its head-end engines half-way up the grade. Though the train had both a DPU unit and a set of helpers on the back, the train no longer had enough power to continue. As a helper set was already at the top of the grade, the dispatcher simply sent that set downhill on the same track to couple onto the front of the train to assist it to the top of the hill.

Did I see this in person? No, this happened on an inaccessible part of the line, but I heard the whole drama on my scanner from miles away.

Manned Helpers

Okay, before we get to DPU units and their control, a few more words about manned helpers. Why use them in the first place? Why not just put enough horsepower on a train to get it over its entire route? Well, it doesn't make sense to tie up a large number of locomotives over distances where they are not really needed. And, as outlined in the example above, manned helpers are more flexible in unanticipated situations.

Yes, the use of manned helpers dates back to the steam era, when specific types of locomotives were even designed primarily for helper service. But, manned helpers really found their niche in the second half of the 20th century in the diesel era. It was not only easier for modern diesels to operate bi-directionally (for the light run back to the helper base), but reliable radio communications also made a big difference, not only for coordination between the helpers and the crew at the front, but also between the helpers and the dispatcher. Where trains have to be assisted up both sides of a major grade, the dispatcher can easily send the helpers to where they were needed next.

(Yes, most of these lines are signaled, but for helpers to couple onto a train, they need verbal authority from the dispatcher to pass a stop signal protecting an occupied section of track. And, a brief conversation with the dispatcher gives the helper crew far more information about what needs to be done than can be gained from signal indications.)

How did helpers coordinate with the regular train crew before radio communications? With whistle or horn signals. A few of these still survive in the modern era. Ever notice that as a train gets ready to leave a station or siding, it will sound two short toots of its horn? That's the "preparing to move ahead" signal, called the "shove it" signal by old-time railroaders.

Why? Well, when a train had a helper on the back, the two short toots told it to start pushing on the back of the train.

Three short toots is the "preparing to back up" signal, also still in use.

MU Controls

Before getting to DPU controls, let's look at multiple unit controls. The big breakthrough with diesel locomotives was the introduction of multiple-unit (MU) controls. By having multiple locomotives connected together, a single engineer could operate all these engines as a single engine, called a locomotive consist. MU controls have long been standardized among competing manufacturers, allowing a locomotive consist to include a variety of units from multiple manufacturers, all working together.

In a locomotive consist, one locomotive is set up as the master unit, all the others are set up as slaves. Commands issued by the control stand in the master unit also apply to the slave units. If the master unit increases the throttle setting, all units in the consist increase their throttle settings. If the master unit goes from power (one of the "run" throttle positions) to dynamic braking, all units go into dynamic braking.

In all locomotive consists, on all but the master unit, the double-heading brake valves are set into the double-heading position, meaning the master unit controls the brakes. The MU cable not only sends out commands but also sends back "alarms," such as the fact that one of the secondary units is overheating or has other problems.

Distributing the Power

One lesson that railroads learned from the use of manned helpers, both at the backs of trains and sometimes cut into the middle of trains, was that trains handled better with

the power distributed throughout the train than with all of it at the front end. Putting all the force of the engines on the front of the train puts a tremendous strain on the drawbars and couplers at the front of the train, as they have to bear all the weight of the rest of the train. That's also more likely to lead to derailments in sharp curves.

So, railroads quickly looked at the question of, "If one engineer can operate multiple locomotives coupled together at the front of the train, why can't he also operate – by radio remote control – other locomotives elsewhere in the train?"

Southern Railway (SR), a predecessor of today's Norfolk Southern (NS), was a pioneer of radio remote control of locomotives. SR equipped a small number of locomotives as radio masters and also built a number of radio control cars. These were empty boxcars that were equipped to receive commands from the master units. These cars had no propulsion, but were equipped with an MU cable that could be connected to any locomotive. The advantage of this system was that any locomotives could be used as remote units, as long as they were coupled to a radio control receiver car.

The control equipment on the receiver end was bulky enough in the beginning that it posed problems with being installed directly in locomotives. It would have required a major reconfiguration of existing locomotives.

Today, road locomotives purchased by major railroads are equipped to operate as either master or remote radio units, allowing the railroads flexibility in assigning motive power. Advances in solid state electronics have shrunk communications equipment. And as today's locomotives already have an onboard computer managing operations, it's just a matter of tying the remote control equipment into that computer.

❖ Two-way Communications

As with many obvious ideas, the pioneers of radio remote units found out that operating remote locomotives wasn't as simple as it looked. There were situations where remote control units, having lost communications with the master unit, were still running at full throttle, while the rest of the train was stopped. In these situations the spinning wheels of the remote units ground themselves into the rails – in at least one case, inside of a tunnel. That made the recovery of the remote unit quite difficult.

Today's remote operation not only has full two-way communication between the master and slave units, but also safeguards, such as a timeout feature. With this feature, if the remote unit does not receive updated information from the master unit for a specific amount of time, it immediately sets its throttle to idle.

In some cases, railroads now operate more than one DPU consist back in the train, typically with two to three engines on the head end, a couple of engines in mid-train, and a couple more engines on the rear of the train. For such situations, only one engine in each DPU group needs to be able to receive commands and transmit status information. The other engine(s) in the group get their instructions from the receiving engine via the standard MU cable.

❖ Individual Control

Modern DPU equipment allows the engineer in the lead engine to either have the DPU units echo the commands of the lead units, or to be operated individually. For example, if a long, heavy train is cresting a hill, the engineer will want to reduce the throttle setting of the lead units as they begin moving downhill, or possibly even put them into dynamic braking, while the DPU units in the back of the train are still pushing to get the rest train over the crest.

As noted above, modern DPU setups have many safeguards. Data packets are verified as being complete and correct or they are ignored. Failure to receive valid packets puts remote locomotives off-line. When a DPU train is set up at its originating terminal, tests ensure that the lead locomotive is correctly programmed with the data addresses of its DPU remotes and that communications are working.

Of course, all this technology doesn't help when a remote unit experiences a major problem. If remote commands or diagnostics cannot resolve the problem, a crew member has to walk back the length of the mile-long train to try a restart of the balky unit. Or, if that fails, the call goes out for a set of manned helper units.

Just because you see two or more engines on the front of a train, this doesn't mean that both engines are working all the time. On the state-supported in-state "Piedmont" passenger trains, one engine normally suffices to handle trains of five or six cars. Yet, from time to time, you will see Piedmont trains with two engines. The reason is a "protection" assignment of the second engine. When an engine has undergone major shop work, it usually makes its live road test with a second engine along, just in case the primary unit has any problems. With the two engines connected by an MU cable, the crew can operate either or both engines from the front unit, even if the lead engine fails or has to be shut down.

Eastbound train 74 departs the station in Durham, N.C., with two engines up front.

Westbound train 75 west of Durham, N.C.

Train 74 has arrived in Raleigh, N.C., and discharged all its passengers. It is getting ready to back up into the state maintenance and storage yard.

GLOBALNET
Exploring the World of Internet Radio and Television

Loyd Van Horn, W4LVH
globalnetmt@gmail.com
Twitter: @GlobalnetMT

Island Trippin'!

This time of the year, I find myself daydreaming about the calming effects of a gentle surf lapping on the shores of Sullivan's Island, South Carolina. The daydreams have a soundtrack, of course, usually featuring the sounds of the islands of the Caribbean.

It should be no surprise, then, that once I stir from my daydream, I find I've been listening to a distant station from the heart of the tropics on a nearby Internet radio player.

Now that it is summertime in the Northern hemisphere, the beaches are packed with tourists and those looking to soak up some sun. Forget the crowds: let's take a virtual trip to the world of palm trees, steel drums and drinks with little umbrellas!

❖ Let's get National...

My earliest memories of Caribbean radio stem from my days as an avid AM radio DXer. I got my feet wet by snagging such exotic locales as Trans World Radio in the Netherlands Antilles, or ZNS1 in the Bahamas. Soon, I was tuning in the massive Caribbean Beacon in Anguilla, or straining to hear the faintest of signals from the Virgin Islands.

The good thing for me as a DXer, and indeed for most *Monitoring Times* readers, is that many of the Caribbean stations are programmed in English. You will stumble upon stations in French or Spanish, depending on what country you are listening for, but there are enough for English speaking listeners to find enjoyable content.

So, using the Internet as our DX medium, where should you be looking for the sounds of the islands? Obviously, there isn't one station from "the Caribbean," so we need to look a little deeper at what countries are available and some of the main stations in each.

With hurricane season ready to get into gear in the coming months, these stations should also provide excellent listening should storms bear down on the region.

Anguilla

As a DXer at heart, whenever I hear "Anguilla," my first thoughts automatically turn to the **Caribbean Beacon**. For years, the powerhouse signals on 690 and 1610 kHz were easy stations for many in the Eastern U.S. to tune in. The 690 station is still around, with religious programming 24 hours a day.

Additionally, there is **Radio Anguilla 95.5 FM**, which runs Adult Rock and BBC News content. For that true "sitting on a beach" feel, try

Up Beat Radio 97.7 FM in The Valley, Anguilla. This station plays reggae and top-40 radio. **Klass FM 92.9 FM** is another good bet, with calypso and other island music, mixed with both classic and contemporary hits.

Antigua-Barbuda

There aren't as many stations online as there once were, it seems. Many of the stations I tried to access were offline, but this may have been a function of being past their transmitting hours. I did, though, find a couple that fit the theme of tropical/island music and content.

Hit Radio 99.1 FM in St. Johns, Antigua had a good mix of tropical music during my listening session. There was content in French here, though the TuneIn stream info says the station broadcasts in English, so there may be times when French is not the primary language.

There is also **Observer Radio 91.1 FM**, which carries an eclectic musical selection that sometimes includes island music (there is a dedicated show on their programming line-up each weekday called "Weekday Session in Steel"). However, this "Voice of the People" also provides information on issues facing citizens. During my listening sessions, this was both an entertaining and educational station to listen to.

Aruba

More than just a country mentioned in a Beach Boys song, Aruba hosts some fantastic stations for listening to merengue, salsa, and other Latin-influenced music and top-40 stations. My favorite of the bunch is **Caliente 90.7 FM** in Oranjestad. Programming is in Spanish with a blend of merengue pop style of music. This isn't traditional island merengue music, more of a mixture of current top 40 with a merengue sound. This top-40 sound is prevalent in most of the stations available online from Aruba.

Other good stations to try out are **Hit 94.1 FM, Magic 96.5 FM** and **Radio Carina 97.9 FM**.

Bahamas

Few countries in the Caribbean embody "island" living better than the Bahamas. A great way to experience this is on **Island 102.9** in Nassau. This is one of my favorite Caribbean stations, especially if you are looking for island music and discussions. To be truthful, I have even listened to this station while sitting on the beach at Sullivan's Island streaming through my TuneIn iPhone app, making it a doubly rewarding beach trip.

Barbados

There aren't many stations here, but there are a few promising options for achieving that tropical feel. I found **Q100.7 FM** to be a good place to start. There is a good mix of music, news and local sports updates. You can definitely get a good feel of the islands from this station.

Cayman Islands

Often a target of Atlantic hurricanes coming through the Caribbean on their way to the Gulf of Mexico, the Cayman Islands have a couple of stations that provide enjoyable local and tropical listening. **Radio Cayman 1 89.9 FM**, the self-proclaimed Voice of the Cayman Islands, focuses on local programming. Community issues, sports and news from the BBC provide an interesting glance into this British Overseas Territories daily life. Meanwhile, **Hot 104.1 FM** is another great source of Caribbean music, much of it with a top-40 feel.

Cuba

As an AM DXer, Cuban national networks such as **Radio Rebelde, Radio Progresso** and **Radio Reloj** were long a mainstay of routine DXing sessions. You can find links to stations streaming these networks, as well as **Radio Taino, Radio Enciclopedia** and more. The majority of the programming here is in Spanish.

Dominica

Part of the Lesser Antilles region, this tiny island boasts some great radio stations. The best for hearing Caribbean dance music is **DBS Radio 88.1 FM** in Roaseau. **Wice QFM 95.1 FM** is another good option for music and local culture. Either of these stations provides a great mental picture of life in the Caribbean.

Dominican Republic

Much of what you will find here is in Spanish, with a predominant Latin flair. For great music, try **La N 103.5** or **KV95 (HIKV) 94.7 FM**, both in Santiago de los Caballeros. Also try **Rumba FM 98.5** in Santo Domingo. All of these stations feature a mixture of salsa, merengue and rumba music. Great beach listening!

Grenada

At the Southern end of the Grenadines, Grenada is most famous for the 1983 invasion by U.S. forces. Today, Grenada has a bit more peaceful existence. Great radio stations for soaking this in include **Wee FM 93.3 FM, Boss FM**

Grenada 104.9 FM, and **Hott FM 98.7 FM** all in St. George's.

Guadeloupe

The French island of Guadeloupe is the southernmost of the Leeward Islands. As such, it has seen its fair share of hurricanes over the years. Much of the programming is in French, with some good island music on **Zouk Radio 94.6 FM**.

Haiti

Hurricanes, earthquakes … Haiti has had its share of natural disasters to deal with in recent years. Some great Caribbean music can be found on **Radio Scoop FM 107.7** as well as **Radio One 90.1 FM** and **Radio Kiskeya 88.5 FM**, all in Port-au-Prince.

Jamaica

When you think of the islands of the Caribbean, it is hard to avoid Jamaica as the first image to come to mind. Reggae is obviously king here, with options galore. There is more than just one flavor of reggae, too, so depending on your preference, you can find traditional reggae or a more contemporary style. **Linkz 96 FM** in Kingston, **StylzFM 96.1 FM** in Port Antonio, and **Kool 97FM 97.1 FM** in Kingston are great choices. There are also great news/talk stations here: **PowerFM 106.1 FM, Hot 102 FM** and **NationWide Radio 90FM** all have local news and talk discussions at least for part of their programming schedule.

Martinique

This is another French region, so much of your programming will be in French. But there is some great music here, too. Try **Radio Frequence Caraibes (RFC)** for some excellent Caribbean salsa, or **Ekla 102FM** for a good mix of reggae and other tropical music, including some with a Latin flair.

Montserrat

You pretty much have one option here: **ZJB Radio Montserrat** in Olveston. Much of the country was heavily damaged by a previously dormant volcano in the late 1990s. Even during a recent listening session in the last few months, the discussion on ZJB was dealing with allocation of money to rebuild from the damage. If hurricane season puts Montserrat under the bullseye, or if volcanic activity flares up again, ZJB's English broadcasts should provide interesting listening.

Netherlands Antilles

Trans World Radio is no longer here online, but there are actually a number of radio stations here that you can still tune in. The first to check out for island music might be **Tropixx FM 105.5 FM** in Filipsburg. **Radio Korsou FM 93.9 FM** in Santa Catarina is another good choice.

Puerto Rico

Mostly Spanish-speaking stations here, and some good music for those looking for Latin-flavored island music. Try **La Zeta 93 (WZNT)** in San Juan for a great example of this, with some great salsa music.

Saint Barthelemy

St. Barts has a shortage of online radio stations, but **Tropik FM 97.5** in Colombier is a fantastic choice for Caribbean music.

St. Kitts and Nevis

These two Leeward Islands epitomize the Caribbean and there is some great music to be found here as well as local content. **Freedom FM 106.5** in Basseterre not only features some fantastic Caribbean music, but also some interesting local talk. During my listening session, local callers were calling in to discuss local issue and grievances. Also check out **Kyss FM 102.5** in Sandy Point Town. Of course, you have to mention **VON Radio 860 AM**, "The Caribbean's Power House" with their mixture of news and talk programming.

Saint Lucia

There are quite a few music stations available here, but they all appear to have a pretty eclectic programming schedule and content. Still, it is worth trying **Caribbean Hot FM** in Castries for contemporary island music, **Blazin 99.3** (you may have to access the stream directly through their Web site) or **The Wave FM 93.7**.

St. Vincent

A good choice for Caribbean music here is **Star FM 98.3**. Also give **WE FM 99.9 FM** a try; they, too, have an eclectic mixture of music.

Trinidad-Tobago

The birthplace of the steel drum holds more than just Caribbean culture. A large percentage of the population is Indian, so there are several Bollywood stations here, for a unique twist on island music. For a more traditional feel, **Wack Radio 90.1 FM** in San Fernando is a great starting point, as during several listening sessions steel drum music could be found. **Vibe CT 105.1 FM** in Port of Spain is also a worth a listen. In addition, try out **Red FM 96.7 FM** for great island and reggae music.

Turks and Caicos

This West Indies country was the where John Glenn first touched ground after his three orbits in 1962 and was home to a NASA tracking station. Now, it is home to a handful of radio stations, only a few of which have made it online. **Tropical Vibes 105.5 FM** seems to be the only option from this country to find tropical and island music.

Virgin Island (U.K.)

A couple of stations here to check out for Caribbean music and local content: The first I would look to would be **ZBVI 780 AM** which has both local talk and a mixture that includes Caribbean music. Also, try **ZROD 103.7 FM,** which is mainly top-40 but does feature some island music.

Virgin Islands (U.S.)

Finally, we come to the U.S. Virgin Islands. My first stop for tropical music here is always **WMYP Rumba 98.3** in Frederiksted. Also try **WIUJ 102.9**, and **WSTX 100.3 FM**.

Navigator 420 Wrap-Up

Three issues ago we dug into the Bendix Navigator 420 direction finding receiver with the goal of restoring its appearance and operation. Fortunately, it needed very little in the way of repair, and was actually in working condition when we began. Last month I covered the disassembly of the unit, which was necessary to remove a "cocoon" that had been deposited on the dial plate. This was challenging because of all the fasteners used, but was typical of the intricate construction of Japanese sets at that time. With the cocoon gone, I next focused on polishing the radio's case and dial plate.

Polishing was done with a product called *Novus #2 Fine Scratch Remover*, which, with just a little elbow grease, brought the case back to a glossy black appearance. I also used *Novus #1 Plastic Clean & Shine* on the dial window with excellent results. If you've got anything plastic that has been dulled with age or has fine scratches on it, I heartily recommend these products. (I have also used them on the clear shield of my motorcycle helmet with excellent success.)

Thanks to reader Dick Berry, K8UGL, I now have the Sams Photofact information for the Bendix Navigator set. Although it is technically for the Navigator 410 it appears to be very similar to the model 420 that I have, and it showed me the trimmer capacitor that I needed to adjust to correct a minor dial calibration issue. *MT* readers are the best!

As I do for many radios I plan to keep, I've now assembled a folder containing the set's original instruction manual, the Sams Photofact, and some handwritten notes I made. I will eventually add each of the *MT* articles dealing with the restoration. I call these folders "Data-Packs" and they consist of pocket-style folders that can be purchased at any office supply store in multiple colors. I recommend this approach for new or vintage gear, as it keeps all related papers in one place.

So, the Navigator 420 is now complete, and it looks great. The photo below shows its appearance after polishing. Thanks for sticking with us as we tackled the last two projects. Got a restoration project of your own? Drop me a line to share your challenges and successes. Pictures of completed sets are always welcome!

The completed Navigator 420, with its newly polished case.

❖ Loggings & Mailbag

Below are a portion of the loggings that **Bill Riches, WA2DVU (NJ)** made over two nights of monitoring. He adds that his antenna was pointed north on the first night of monitoring, and then pointed south the next. He reports that conditions were excellent, with no natural static (QRN) on the band.

TABLE 1. SELECTED NDB LOGS

KHz	ID	ST/PV/ITU	City
198	DIW	NC	Dixon
216	CLB	NC	Wilmington
248	IL	DE	Wilmington
248	UL	QC	Dorval
254	EUD	PA	York
254	LLW	NC	Elizabeth City
272	YQA	ON	Muskoka
274	AKQ	VA	Wakefield
278	NM	QC	Matagami
284	PTB	VA	Petersburg
286	9	NJ	Sandy Hook*
289	13	VA	Driver*
291	185	PA	Hawk Run*
292	193	SC	Kensington*
293	7	NY	Moriches*
294	197	NC	New Bern*
295	93	WV	St. Marys*
296	312	QC	St. Jean*
297	137	MS	Bobo*
298	103	MI	Upper Knowlton*
299	163	OK	Sallisaw*
301	59	MD	Annapolis*
303	47	NC	Greensboro*
304	304	TX	Pt. Aransas*
305	191	TN	Dandridge*
306	199	MA	Acushnet*
307	131	MD	Hagerstown*
309	171	DE	Reedy Point*
311	157	IA	Rock Island*
314	17	FL	Card Sound*
315	339	CAN	Cape Race*
316	43	ME	Brunswick*
317	145	TN	Hartsville*
317	CBE	MD	Cumberland*
319	37	GA	Savannah*
322	119	NY	Youngstown*
324	95	NY	Hudson Falls*
326	VV	ON	Wiarton
328	BZJ	PA	Indiantown Gap
329	CH	SC	Charleston
329	YHN	ON	Hornepayne
332	DC	NY	Binghamton
335	ZKF	ON	Wellington
336	BDB	VA	Melfa
341	YYU	ON	Kapuskasing
343	ZBM	QC	Bromont
344	JA	FL	Jacksonville
346	YXL	ON	Sioux
349	APG	MD	Aberdeen
350	DF	NL	Deer Lake
351	YKQ	QC	Waskaganish
352	MG	NY	Montgomery
355	CGE	MD	Cambridge
355	YWP	ON	Webequie
360	PN	QC	Port Menier
362	SB	ON	Sudbury
363	RNB	NJ	Millville
366	YMW	QC	Maniwaki
368	ZYZ	ON	Toronto
370	MQI	NC	Manteo
373	AEA	VA	Mecklenburg
375	7B	ON	St. Thomas
376	ZIN	BAH	Great Inagua
377	YRR	ON	Greely
379	YPQ	ON	Peterborough
382	SJX	MI	Beaver Island
382	YPL	ON	Pickle Lake
383	7P	ON	Iroquois Falls
386	D8	QC	Dolbeau
388	RNW	NC	Chocowinity
391	DDP	PTR	Dorado
392	ML	QC	Charlevoix
397	ZHA	0N	Hamilton
400	PTD	NY	Potsdam
405	YSL	NB	New Brunswick
407	OX	MD	Ocean City
407	ZHU	QC	St. Hubert
409	YTA	ON	Pembroke
419	RYS	MI	Detroit
516	YWA	ON	Petawawa
523	JJH	NY	Johnstown
526	ZLS	BAH	Stella Maris

* Denotes DGPS data station. For a full listing of USCG DGPS stations, visit http://tinyurl.com/DGPS-List.

Jim Frederick, W4LF, writes: "Hi Kevin, I enjoy the *Below 500 kHz* column very much. I have been listening to beacons for about four years, off and on, from Central

Florida. I have an Icom receiver that covers this band, but I prefer to do it the hard way with a true crystal radio. My first set used 6-inch coils wound with Litz wire and my present one uses Ferrite-cored Litz coils in a double-tuned circuit. No amplification is used, only the crystal detector. My regulars are listed below."

"You can see more of my crystal sets for the BC band at **www.hobbytech.com**. Click the Crystal Radio link in the left margin. You will find several true crystal sets plus several that incorporate a FET source follower for additional selectivity. Three or four have an audio amplifier and speaker so I don't have to use earphones."

TABLE 2. NDB LOGS FROM FLORIDA

kHz	ID	City
198	DIW	Dixon, NC
216	CLB	Wilmington, NC
253	RHZ	Zephyrhills, FL
257	SQT	Melbourne, FL
329	CH	Charleston, SC
332	FIS	Key West, FL
335	LEE	Leesburg, FL
344	JA	Jacksonville, FL
379	TL	Tallahassee, FL
388	AM	Tampa, FL

❖ Missed Approach

In April, we covered some commonly asked questions about non-directional beacons (NDBs). In addition to NDBs, we briefly strayed into a discussion of the 75 MHz marker beacons sometimes co-located with NDB sites. Unfortunately, we had it wrong when it comes to these VHF stations. (That'll teach me for straying outside my area of expertise!)

MT reader **Patrick Griffith, NØNNK**, provides a corrected description of the 75 MHz marker, and explains how these stations are actually used. In summary, our description of a single V-beam antenna transmitting the outer, middle, and inner marker signals was *incorrect*. As Patrick explains, "Each marker beacon must have its own antenna located precisely at the point that the beacon is indicated on the approach chart for the airport. A marker beacon co-located with a non-directional beacon, as in the case of CAT/254, is called a *locator outer marker* (LOM). In the most basic terms, if you arrive over this point at a prescribed altitude you will intercept the glide slope and localizer signals which lead you to the end of the runway during an instrument landing system (ILS) approach.

"Looking at the approach plate for Morristown airport it appears that the CAT/254 LOM is 5.5 nautical miles from the end of the runway. But the outer marker can be located anywhere from 3.5 to 6 nautical miles from the end of the runway. The exact distance will be published on the approach charts for the runway. The V-beam antenna array creates a very narrow and precise inverted 'tear drop' pattern aimed straight up from the site. It transmits with low power (3 watts) and emits a 400 cycle per second (cps) tone. An aircraft-mounted receiver only 'hears' this signal when it is directly overhead. The 400 cps tone activates the *blue* outer marker light on the marker beacon display in the cockpit.

"An additional beacon, known as a middle marker, may be located between 0.5 and 0.8 miles from the end of the runway emitting a 1300 cps tone. This tone activates the *amber* light on the marker receiver. This indicates the missed approach point for certain approach categories. Again, in very basic terms, if you can't see the runway at this point you must abandon the landing attempt and climb out. The middle marker is most often a simple 3-element beam aimed straight up.

"There may also be an inner marker. This beacon is usually located within 1,000 feet of the end of the runway. Inner markers emit a 3000 cps tone that activates the *white* light on the marker receiver panel. Again this indicates a certain decision point for certain approach categories. Middle and inner markers are no longer required in the US and many of them are being decommissioned."

Thank you Patrick, for this update. We don't always get it right at *Below 500 kHz*, but we do issue corrections whenever problems are discovered. I apologize for any misinformation that was spread by the April 2012 coverage.

❖ Kindling Some Interest

Did you know that a Kindle edition of *MT* is available for your enjoyment? I've heard from a few readers who are already using it, and they all say it looks great! As for me, I recently ordered a Kindle Fire for my wife's birthday, and after the initial flurry of activity that is expected, I hope to borrow it to check out *MT* for myself!

MTXpress is another reading mode I want to encourage you to check out. Using just your PC, you will get high resolution photos and artwork, hotlinks that you simply click on for web resources, and full text search ability. Also, when you subscribe to MTXpress, there's no waiting for your issue to arrive by postal mail. Full information and a free sample issue are available online at **www.monitoringtimes.com**.

❖ Web Outakes

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. Would you like a virtual tour of the station? Simply visit **http://tinyurl.com/LastMorse** for a 28-minute video that chronicles the special event held on July 12, 2008 called "Night of Nights" and commemorates the 9th anniversary of the last Morse Code message sent in commercial service. For more general information on MRHS, see: **www.radiomarine.org**.
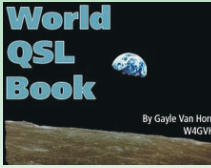
At the recent Winter SWL Fest in Pennsylvania I was pleased to meet **Keith Perron**. Keith is the Director/Producer of *PCJ Media Plus*, a weekly radio program about the radio hobby. Keith interviewed me for the April 7th show, and you can hear the full broadcast at **www.pcjmedia.com/medianetworkplus**. Just scroll down the page to find the April 7th archived show. I encourage you to listen to the entire show, but the longwave coverage begins at the 13:10 mark on the MP3 stream. Turn your sound up!

Troubleshooting Continued: Voltage Checks

❖ Background

In the April issue of this column, we began a series of articles on troubleshooting problems in vintage receivers. In that issue, we discussed a generalized procedure for starting up long-idle sets. At the conclusion of that procedure we assumed that you would be dealing with one of three different conditions: the radio seems to be working normally; the radio is picking up stations, but reception is not satisfactory – perhaps weak or noisy; the radio is producing no sound when powered up, even though any smoking or other obvious signs of trouble have been corrected.

If the radio is operating normally, we suggested that its operation would certainly be enhanced by touching up the alignment. An article covering alignment procedure appeared in the April 2011 issue of this column. In last month's column we reviewed procedures for isolating the problem in the other two cases: unsatisfactory reception or no reception. The procedures were signal tracing and signal injection.

In signal tracing a modulated signal generator is connected to the antenna end of the radio and the receiver dial is tuned to the frequency of the test signal. The signal is then followed through the various stages of the receiver using a detecting device called a signal tracer. The stage after which either the signal disappears or the unsatisfactory reception begins is the stage where the trouble is located.

Using the signal injection method of troubleshooting, one starts at the loudspeaker end of the radio and moves back, stage by stage injecting – as appropriate – an audio signal, a modulated r.f. signal at the i.f. frequency, and a modulated r.f. signal at the frequency to which the radio is tuned. The first stage at which the signal can't be heard in the loudspeaker or at which the unsatisfactory reception begins, is the stage where the trouble is located.

❖ Short Cut Stage Isolation

With sets that are completely dead, a crude but effective variation on the signal injection technique will often lead to a rapid

Fig. 1. The i.f. and detector/first audio stages of our example receiver. See text.
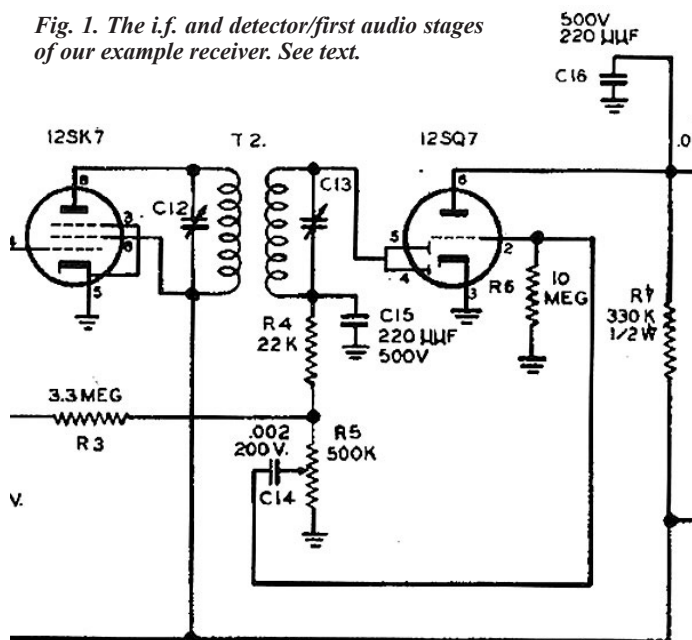
isolation of the problem stage using no equipment at all! It's called the *circuit disturbance* method. Begin by touching the control grid of the power output tube with a metallic object, such as a coin or a key, held in your hand. If you hear a click or a hum, that stage is probably operating properly. Now move toward the front end of the radio, one stage at a time, listening for a hum or click as you touch each control grid. When you reach a stage that remains silent, you know that the trouble is located between that point and the last one that generated a sound.

A quickie technique that might be thought of as a variation of the signal tracing technique, also requiring no equipment, is known as the *stage muting* method. It can be quite useful in identifying the source of oscillation, hum or noise, which can often be quite a problem. This technique involves silencing, or deactivating, the stages of a receiver one by one by grounding their control grids through a capacitor of about 0.2 uf.

Begin by muting the power output stage of the receiver. If the noise, oscillation or hum stops, then it originates either in that stage or the power supply. If not, continue on towards the front end of the set, grounding the grid of each stage in turn, until you find the one where the condition stops. Then you know that the problem lies somewhere between that point and the previous test point.

❖ Voltage Checks

By isolating the problem stage, you have made a lot of progress toward correcting the problem. What might your next move be? Probably to check the voltages on the plates and screens of the tube in the problem stage. Figure 1 shows the i.f. stage (12SK7) and the detector/first audio stage (12SQ7) of the same a.c.-d.c. receiver we used as an example in last month's discussion. Let's say that your analysis has identified the problem stage as the 12SK7.

The voltage chart given on the manufacturer's data sheet is shown as Figure 2. The first thing to notice about this chart is the note at the bottom giving the conditions under which the voltages given were measured and which you should try to duplicate. The line voltage was 117; the radio was tuned to a spot where there was no signal; the volume control was turned all the way down; the measurements were made with a Voltohmyst, which is RCA's brand for a vacuum tube voltmeter; the B minus connection was made to the low end of the volume control.

TUBE	ELEMENT	PIN	VOLTS
12SA7	Plate	3	80-89
	S. Grid	4	80-89
	Grid	5	.7
12SK7	Plate	8	80-89
	S. Grid	6	80-89
	Grid	4	.65
12SQ7	Plate	6	55-65
	Grid	2	.8
50L6	Plate	3	110-118
	S. Grid	4	80-89

NOTE: ALL VOLTAGES MEASURED WITH VOLT-OHMYST TO B MINUS (LOW END OF VOL. CONTROL, PIN 8 OF 12SQ7, etc.) LINE VOLTAGE 117 VOLTS, NO SIGNAL, VOLUME CONTROL FULL OFF.

Fig. 2. Checking actual voltages versus the expected ones given in the manufacturer's chart is a powerful diagnostic procedure.

Well, you won't have much control over the line voltage unless you happen to have a Variac in your shop. And though line voltages are more like 120 these days, that's close enough to 117. Earlier radios were designed for lower line voltages – as low as 110 volts – and

the voltages shown in your particular chart may have been made at that voltage. So if your plate and screen grid measurements turn out to be somewhat higher than those shown, it has no diagnostic significance. Of course there are those who feel that one should not power up a 110-volt radio on today's mains without reducing the voltage – but that's another story entirely.

As far as the no-signal requirement is concerned, you may not be able to verify that if you are diagnosing a dead set (unless you are signal tracing and the earlier stages in the radio are operating). So your only alternative is to tune the radio to a spot on the dial where you know there is no station in your area. Turning down the volume control all the way? That's certainly a no-brainer.

The measuring instrument used will affect your results because different types place different loads on the circuit. If you have a Voltohmyst, other VTVM, or a good DVM, then you can obviously expect results similar to those on the chart unless you have uncovered a problem. These instruments have negligible loads on the plate or screen circuits.

If you are just getting started in radio repair, your measuring instrument may be a VOM (volt-ohm-milliammeter); good ones have a rating of 20,000 ohms per volt (the higher the rating the less load on the circuit being tested). When it comes to plate and screen grid voltages the difference in load between a VTVM or DVM and a good VOM will cause little difference in your readings. Should you need to measure the tiny voltages on the much more sensitive control grid, a VTVM or DVM is a must.

Manufacturer's literature roughly from the period a few years before World War II, through the postwar years, to the end of the vacuum tube era is likely to specify measurement with either a 20,000 ohms per volt meter or, in later model sets, with a VTVM. In the pre-world-war-II years, such sensitive instruments were not generally available to the radio service community, and voltage charts often specified a 1000 ohms per volt meter such as the Weston 697.

This neat, nicely made, palm-sized instrument is still commonly found at radio meets, and every serious radio restorer should have one. The reason: the 697, or instruments with a similar ohms-per-volt rating, put substantially more load on circuits being measured than a good VOM or a VTVM. So if you want the readings you take from a set being repaired to be consistent with the manufacturer's data, you'll need a 697 or equivalent.

The final item to consider in the note at the bottom of the voltage chart is that the

The palm-sized Weston 697 is a great help in diagnosing earlier radios, where voltage specs were given for 1000 ohms-per-volt instruments.

B minus point, or the point where you connect the negative lead of your measuring instrument, is the low end of the volume control or pin 8 of the 12SQ7 (the latter, a heater connection, is not shown in Figure 1). Actually those are merely convenient connection points. Both are grounded to the chassis, and in fact you can connect to any metallic spot on the chassis.

However, it's important to pay attention to the B minus point specified on the voltage chart because – though it's usually at chassis ground – it sometimes is not. For example, as mentioned in an earlier article, in a.c.-d.c. radios B minus is one side of the a.c. line. In the un-safety-conscious era when a.c.-d.c.s were in their heyday, most manufacturers went ahead and connected one side of the line to chassis ground. The result: under certain circumstances, the user who contacted a metal part of the radio would receive a nasty shock.

So, in sets made by some of the more responsible manufacturers, the B minus connections normally made to the chassis were made instead to a ground bus (simply a wire running through the chassis). This wire was connected to the chassis only through a small capacitor. In such a set, using the chassis as B minus would give no readings at all.

❖ Making a Diagnosis

Getting back to the 12SK7 problem, let's say that you've checked the plate and screen voltages and find no plate voltage. The screen voltage, however, falls within the 80-89 range suggested in the voltage chart of Figure 2. (The screen is the middle grid in the 12SK7 diagram.) Studying the schematic, you see that the plate of the 12SK7 derives its voltage from the same source as the grid – which has normal voltage.

The only difference is that the plate voltage must first pass through the primary of i.f. transformer T2. Unplugging the set and shorting the screen connection to ground to discharge the filter capacitors, you check for continuity between the screen grid and plate connections. Sure enough, you read no continuity; the secondary is burned out. In order to repair this radio you'll need to obtain a replacement i.f. transformer.

Now, for a somewhat more subtle example, let's say that the problem stage you had discovered was not the 12SK7 i.f. stage but the 12SQ7 detector/first audio stage. This tube has no screen grid, but checking the plate voltage, you read zero volts where 55-65 volts is expected according to the voltage chart of Fig. 2. You note that the 12SQ7 receives its plate voltage through a 330k resistor.

Since you find that 85 volts are present at the bottom end of this resistor, you begin to believe that the resistor must be open. Should you

replace it? No – not so fast!! After unplugging the set and shorting the bottom of the resistor to ground to discharge the filter capacitors, you connect your ohmmeter across the resistor and read over 100k instead of the expected infinity. However, disconnecting one end of the resistor to remove it from the circuit and checking again, you do find that the resistor is indeed open.

Your focus now shifts to the 220 uuf plate bypass capacitor connected from the top of the resistor to ground. Should it be shorted, grounding the top of the resistor, the resistor would be effectively connected across the B plus supply. That would burn it out, causing it to go open, but would also result in a resistance reading across it, just as would be measured any point in the B plus line to ground.

Checking with your ohmmeter from the plate of the 12SQ7 to ground, you do indeed read a dead short. So if you had replaced the plate resistor immediately on suspecting it, it would have immediately burned out again. But now, after replacing both components, the radio is working perfectly once more.

However, real life is not always as simple as an example cooked up for a discussion! Capacitors have been known to test perfectly well with the radio shut off, but develop shorts with power applied. Watch for it!

Before closing I should mention that manufacturer's data sheets may also include resistance readings from various circuit points to ground. These are especially helpful in making diagnoses in situations where you are unable to power up the radio and are therefore not able to measure voltages.

The techniques that we have discussed in this article and the previous two will not make you an expert repair technician. Far from it! However, the basic steps of isolating the problem stage by signal injection or tracing, then doing a plate and screen grid voltage analysis of the tube involved are a sound way to initiate a troubleshooting process. Frequently, these steps will lead directly to a fix for your radio. If not, they will at least get you started.

NTENNA TOPICS
BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Dan Farber, AC0LW
danfarber@monitoringtimes.com

Chameleon Revisited:
A Little More Height, Better Results

Welcome back, friends. A few issues ago I reviewed the Chameleon V1 vertical, and decided to test the antenna mounted on a three-foot high metal fence that surrounds my back dooryard, reasoning that this might present a "typical" situation for a portable operator. (One of the V1's selling points is that it excels as base *or* portable *or* mobile antenna.)

Let's be honest, though – your trusty antenna columnist isn't, himself personally, a terribly dedicated portable or mobile operator. (Okay, I've *never* operated mobile at all.) He much prefers the comfort of his desk in the basement. It's stayed in the back of my mind, ever since – how about an effective install with the Chameleon raised well above ground that I could leave in place for, oh, weeks or months or years? Yet it could be snatched down and made scarce easily enough if some sort of Antenna Gestapo was to come goose-stepping through my neighborhood? Show us, Dan!

I had wrestled for months with the idea of mounting the V1 to my chimney, which would have raised it well above ground level and allowed for stretching the four radial wires out to the four roof corners. But being fastened to the chimney would make the setup difficult to take down quickly if need arose, and additionally, the position at the chimney would put the vertical in very close proximity to my big dipole and its ladder line feedline. I wasn't too worried about antenna interaction *per se,* but I wanted to get as uncomplicated an idea of the Chameleon's performance as

The V1's mounting bracket, deck-screwed to the end of a treated 1x2 eight feet long.

possible, so I kept looking.

I finally settled on one of the original notions that came to me before I chose to set up on the small fence: Mount the V1 on the back porch railing, using a length of treated lumber to raise the base of the antenna above

the gutter level of the roof. This would make the setup extremely easy to work on or take down quickly, and it should provide a completely different test bed for the Chameleon, since the little vertical would now be at or above roof level and well clear of neighboring obstructions.

After a bit of experimenting, I determined that an eight-foot length of pressure-treated 1x2 would do nicely as a support. The photos show how I deck-screwed the antenna bracket to one end of the 1x2, and deck-screwed the other end to a post on my back porch. This is a test setup; if I decide to make it more permanent, I'll add fancy refinements, like a 1x2 painted white, and silicone to waterproof the coax connections, and some sort of squirrel-proofing of the radials...

A few minutes' work had the four radial wires stretched out and hooked on their "tent stakes," the unun and fifty feet of RG-8 screwed to the V1's base, and the coax far end routed to the rig through my plywood "rig window." Now to sit down at the Yaesu, with paddles and mic and pen and paper ready, to put the little vertical through its paces again, in this new and improved test setup.

❖ Signal vs Noise

First I took a leisurely listening scan of the whole HF territory, all the ham and shortwave bands between 3 and 30 MHz. As before, this hardcore devotee of the ladder line-fed dipole was amazed by how *quiet* the coax-fed V1 is on receive. I made a point of A/B-ing between the little vertical and the big dipole often to compare their qualities as receiving antennas. Often the signal on dipole was no louder or not much louder; and usually the vertical had far less background noise. If you've ever done much DXing as ham or as SWL, you know well that it's the *noise* that fatigues you as a listener, not the effort to dig out a weak signal. Several times the V1 could hear weak signals that were lost in the noise on the big dipole.

The great irony here, of course, is that most folks consider the vertical to be the *noisiest* on receive of all coax-fed antennas.

The 1x2 deck-screwed to a corner post of my back porch balcony.

Makes sense – most of the racket we call QRN is vertically-polarized: Earth's thunderstorms, automobile ignitions, and so forth. But as with anything else, it's all relative; yours truly uses the noisy ladder line-fed dipole constantly, and so found the coax-fed Chameleon to be super-quiet on receive. And let's be fair to the vertical: you can't be totally omnidirectional and not have some drawbacks!

Next I decided to check SWR across the board to see if my results were any closer to coinciding with Chameleon's advertised claims. Of course, with an antenna like this that can be set up in a thousand different ways, it will be hard to duplicate someone else's results. I wasn't interested in splitting hairs; I just wanted to find out, as your trusty antenna columnist, just how *useful* the V1 might be, at least at my QTH.

Once again, I found 80 meters to be difficult to work with. With the tuner bypassed, SWR was a very disappointing 8 to 1, and I was unable to work anyone at all this way. Using the tuner brought the SWR right down, but how much power actually gets to the little vertical this way? Very little, I'm betting. I made a few regional QSOs this way, but I got, and gave, unhappy RST reports. 60 meters presented a similar bleak picture. Good thing I'm not much of a 60 meters operator!

But once I got above 7 MHz the V1 began to shine much more brightly. At a great many ham frequencies between 7 and 29 MHz the SWR was beautiful, 1.3 to 1 or less, and many times dead flat at 1 to 1. Of course, there were oddities, too, like the high (2.5 to 1) SWR at the CW end of 20 meters that became

absolutely flat up in the 'phone segment. As a general rule, though, the tuner became ever more superfluous as I went higher in frequency – and the V1 performed well on every band between 40 and 10 meters.

Raising the V1 much higher in the air, above my roofline, seems to have improved performance a lot by getting the antenna "in the clear." To be fair, the test six months ago, with the Chameleon mounted on a low fence, probably did suffer from the wall of trees that I pointed out surrounding my back yard. The new position up high on the back balcony certainly puts the V1 in much better relation to any nearby trees, and this might be the most essential factor in the improved performance.

❖ Conclusions

As I said before, the V1 is no world-beater on the low frequencies. If someone has figured out how to actually use this thing as an 80/60 meter antenna please let me know. At 7 MHz and up it is an amazingly effective antenna for its size and simplicity. On 15, 12, and 10 it shows some real promise as a "poor man's DX" antenna (though at $250 it's not exactly cheap).

For the SWL, the V1 is a sweet antenna throughout the bands, often much quieter than my big dipole. Its performance near 6 MHz, where it is *very* short in terms of wavelength, is impressive. If you try out the Chameleon V1, I urge you to consider this balcony or porch-type install, to get a little more height above ground and still keep a stealthy profile. The V1 will definitely get the ham or SWL

View showing the V1's new position above the roofline. The "Big Dipole" can be seen in the background.

on the air quickly, easily, and effectively, and with many mounting options. Its portability and quick set up/tear down will certainly appeal to many as well, both from stealth and convenience viewpoints.

You can check the V1 out for yourself, at **www.chameleonantennas.com**, and also at **www.associatedradio.com**, the folks who sold me my V1.

That's all for this month, my friends. Join me here in August, and we'll delve ever deeper into the world of HF antennas. Until then, happy operating!

Radio Telescope Concepts

This month, I would like to explore the Interferometer Radio Telescope. It is the principle type of radio telescope in use today. There are many variations, of course. The interferometer concept allows astronomers to achieve near optical quality without building a huge radio telescope. Radio wavelengths, longer than visible light's, require larger dishes to achieve resolution or quality of detail in the final image.

In the real world, gravity prohibits building a dish big enough to do it all by itself. So, astronomers figured out they could use one or more dishes connected together in a configuration that combines the individual signals from each dish over a period of time to fill in the blanks. Processors combine those signals to eventually reconstruct a detailed image.

In order to achieve the highest amount of resolution, the farther apart the dishes or antennas are, the greater the resolution by simulating a bigger dish. Today, we have even networked dishes continents apart.

You hear acronyms like VLA (Very Large Array), VLBA (Very Large Baseline Array'), ELBA (Extended Long Baseline Array), etc. They all use the principle of interferometry which synchronizes the signals or data gathered up by the arrays. One of the most important elements in making all of this work is time sync. Dishes located thousands of miles apart can use atomic clocks to achieve accurate sync and date/time the data points. Some even ship the data on discs to be processed later.

Do you want to get a feel for how interferometry works? I recently ran across an on-line simulation written by two Australian folks. At first the application seems a bit complicated. I highly recommend you read or download the instructions and follow through with the example provided. The Java app is launched at **www.narrabri.atnf.csiro.au/astronomy/vri.html.** The "Virtual Radio Interferometer," by D. J. McKay & N. P. F. McKay lets you experiment with the concept by letting you change a variety of parameters.

Again, be sure to print out the documentation and go through the brief tutorial which is at **www.narrabri.atnf.csiro.au/astronomy/vri/guide.html**.

Above, you can see the lower right diagram shows several concentric circles. That represents 12 hours of observation time, each line representing a dish's contribution. The times can be adjusted by changing the "Hour Angle" sliders. I changed the settings from the 6 hour interval.
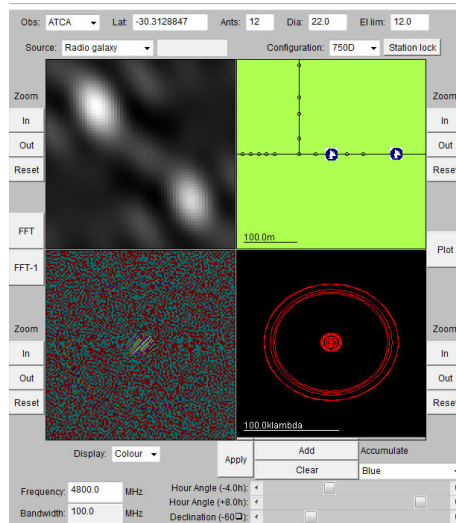
12 hours of operation

Here's another with the dishes realigned and using four hours of time. The scan time represents the drift across the sky as the Earth turns.
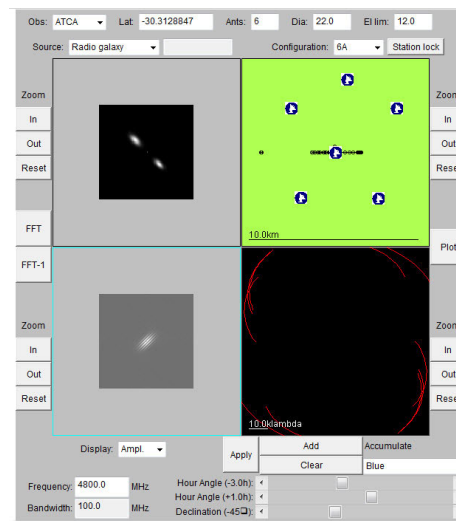
4 hours of operation

Have fun and build your own VLBA on a virtual budget!

Let's return to the basic idea of an interferometer: The fundamental idea is to separate two antennas along a base line that is at least 10 lamdas (wavelengths) apart on an east to west line. At 408 MHz, the distance would be 24.11 feet or 7.35 meters. Antennas can be

beams and equipment operating on various frequencies. The received signals are amplified and merged into what is called a correlator, where the signals' voltages are multiplied, averaged, etc. and delivered to a data logger. The correlator removes most of the noise since noise is not "correlated." There is the need to keep the receivers in sync. Some have tied both receivers to a common LO (Local Oscillator).
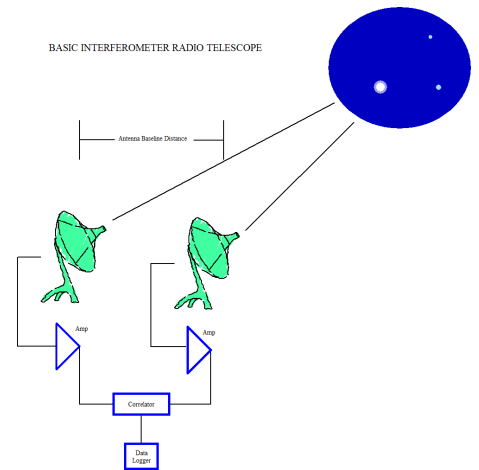
What happens with the dishes at a distance from each other is the source signal is slightly delayed by a phase shift (delay) from each other as the signal arrives at the correlator. As the signal drifts in and out of phase, a fringe pattern develops so you can see a sharper peak. If only one dish is used you will have a broad peak. It does require some math to appreciate the reason.

Here's a link if you want a more technical description of the process: **www.aoc.nrao.edu/events/synthesis/2010/lectures10.html** Here you'll find Power Points and PDFs from various lectures given in 2010. The first one listed on this page, "Fundamentals of Radio Interferometry" by Rick Perley, NRAO/Soccoro, is a great slide show that takes you through the basics of radio astronomy interferometry.

And here's another great resource for understanding radio telescope concepts: **www.nrao.edu/index.php/learn/radioastronomy/radiotelescopes**

❖ The RFSpace SDR-IQ DSP Receiver

I recently purchased an SDR-IQ DSP (Digital Signal Processing) receiver and anticipate using it for some radio astronomy

projects. Setting it up is quick and simple. The small SDR (Software Defined Radio) gets its power via the supplied USB cable plugged into your PC. Specifications for the SDR-IQ show it takes 5 volts at 425 milliamps DC.

You can view and control the radio using the supplied software called *Spectraview.* It is provided by Moetronix. They also have a server program you can run on the PC that supports the SDR-IQ. To use it, you note the IP address of the PC the SDR is plugged into and then load the Spectraview software on another PC on your network. You establish connection by going to the SETUP tab and update the IP address. RF-Space defaults the PORT to 50000.

You could open up the port on your router if you want to access it from the outside world. Multiple SDRs can be accessed provided they are on different IP addresses, of course. My setup works great and it is nice to operate the unit remotely without sitting out in a cold garage.

The specifications of the SDR-IQ are impressive and should lend itself to a wide variety of amateur radio astronomy applications. SIDS (Sudden Ionospheric Enhancement) which allows VLF propagation to extend due to solar bombardment of the ionosphere can be detected with the SDR-IQ using a suitable antenna. The SDR-IQ can operate down to 100 Hz. Yes, that is one-hundred Hertz. And, up to 30 MHz. Depending on the bandwidth used, it is also possible to slice up the band into 0.37 Hz slots.

The bandwidth can be set up to 190 kHz. The radio sends *I/Q* data to the Spectraview software via the USB port, so there is no audio card involved unless you use the demodulator . The radio has numerous demodulation schemes available. Data can be logged and sent to spreadsheets for further analysis. I-Q data refers to the sampled signal's 'I' or in-phase component and 'Q', the quadrature component. With conversion, the data points are used to reconstruct the original wave.

Note the size compared to mouse.

On the next graphic, I hooked up the SDR-IQ to my HF antenna, a B&W all-band, and you can see the trace (dotted and centered) of WWVB being received on 60 kHz. Note the 1 second pulsing. Not sure what the 55 kHz signal is; it's steady and probably local interference. WWVB is about 600 miles north of Roswell, NM in Boulder, Colorado.
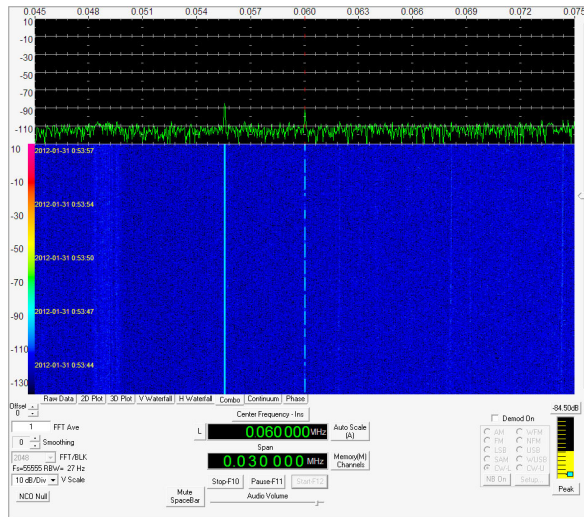
Check out **http://rfspace.com/RF-SPACE/Astronomy.html** for radio astronomy uses of the RFSpace SDRs.

❖ ARGO Weak Signal Software

I was tipped off a few months ago by Carl Lyster, WA4ADG, to a useful free-ware program called ARGO. It was developed for weak-signal operation such as slow Morse code. I am now using it to monitor meteor scatter.

Recently, a longtime *Monitoring Times* reader, Dennis Condron, K0LGI, in Eastern Iowa, emailed me regarding possible reception from the now famous Air Force operated *Space Fence* (originally called NAVSPASUR) in Lake Kickapoo, Texas. This site is the principle transmitter with a narrow high-powered beam that extends along a westerly-easterly direction across the Southern US. Since Carl lives in Tennessee and had captured the ISS using ARGO software, Dennis decided to give it a try, also. He constructed a 12 element Yagi antenna and retuned an existing GasFET

(Gallium- Arsenide Field Effect Transistor) amplifier to listen for the 216.979 MHz CW signals on his ICOM PCR1500 receiver. After lots of patience and effort, he succeeded!

Below is his antenna pointing south at the NAVSPASUR *Space Fence* at a low angle.

The next graphic is his ARGO picture of the Doppler shift as the ISS (International Space Station) moves through the radar beam at Lake Kickapoo. He timed the recording by using Heavens-Above satellite predictions and the iPAD GoSatWatch app.

The strong echo or trace that slopes down is an echo from the ISS. Dennis wasn't sure what caused the other trace. Since there is a reasonable Doppler shift, I suspect it's a satellite going the other way. Thanks to Dennis for the use of his pictures and details that confirm the feasibility of detecting the SPACE FENCE signals further north. Here's the link to find the ARGO freeware: **www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=9139**
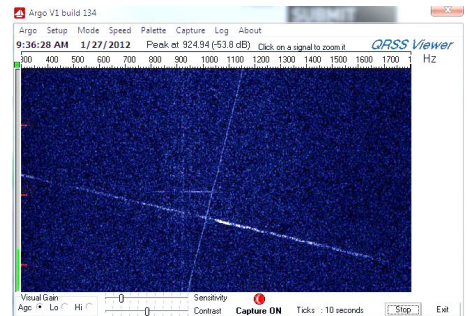
❖ Denver Radio Astronomy Site

Now and then a large radio dish gets my attention, knowing the big ones are not going to fit in my back yard. Nor would my wife permit it. But the folks in Denver, Colorado hit the jack pot. They apparently got rights to use an abandoned radar site up in the hills near Denver. You must see their site. Take a look at **www.deep-space.org/index.shtml** for details**.** It takes your breath away. If any *Monitoring Times* reader is a member of the non-profit organization that runs it, I would like to hear from you.

❖ Radio Astronomy in the Movies

Bet you've seen *Golden Eye*, the James Bond thriller. It was released in 1995. It was Pierce Bronson's first Bond movie with the usual wild action, of course. Near the end of the movie, a giant radio telescope dish rises up out of a lake in Cuba. The dish was built there to avoid detection by spy satellites. Of course, the dish is mostly the Arecibo facility with a lot of license with computer enhancements.

One neat scene shows Bond and his companion, a Russian beauty, sliding down the 1000 ft. diameter dish's surface to its center. There was an earlier scene where a satellite dish at a Russian facility was destroyed. Hollywood really likes to wreck radio dishes. Ha.

Keep Listening Up!

Rechargeable Battery Pack on a Shoestring Budget

By Mario Filippi, N2HUN - All photos by the author and wife

❖ Here today… gone tomorrow

They say that as you age, time slips by faster. Now that I've entered the sixth decade of life, this appears to be true, because it seems like only yesterday I purchased my MFJ-886 frequency counter (**www.mfjenterprises.com**). **See Photo 1.** This counter is one of the most important pieces of equipment in my shack: useful when doing alignments, checking accuracy of my signal generator, checking accuracy of a transmit signal, looking for errant RFI signals, etc.

Recently, however, the internal NiCads would hold a charge for only a day or so. I checked my original sales slip (pack rat that I am) from Grove Enterprises, Inc. (**www.grove-ent.com**), and lo and behold it's been several years since I purchased my MFJ-886. How did all those years go by so quickly?

Photo 1. My trusty MFJ-886 Frequency Counter, a tool that is high on the totem pole of importance in my radio room.

❖ Replacement Options

Our lives are inundated with the ubiquitous rechargeable battery, be it in a cell phone, radio, handie-talkie, vacuum, shaver, tablet, power tool, car, scooter, *ad infinitum*. You can't fall down nowadays without landing on something powered by NiCads or Lithium Ion Cells. Life as we know it would be a lot more inconvenient without them – and a lot less mobile.

So now it has hit home, and I have to replace my frequency counter's rechargeable battery pack. The choice of replacement schemes fall into three categories:

1. Purchase a new pack from the manufacturer,
2. Have the pack rebuilt by a commercial vendor, or
3. Do a tear-down and rebuild on my own.

In this instance the decision was to replace the batteries on my own. Having done this several times before with great success, it was a no-brainer decision, with the added advantage of keeping this OM out of the XYL's hair for a few hours!

Step 1 – Hunt down replacement cells

First thing to do when replacing recharge-ables is to determine the type, so it was time to pull out the Instruction Manual. In this case it indicated the pack consists of four 1.2 Volt NiCad batteries. NiCads can be purchased from many different sources and I chose to procure mine from All Electronics Corporation (**www.allelectronics.com**) out of Van Nuys, California. **See Photo 2.** This company sells a plethora of electronic parts at very reasonable prices and is top notch vendor in my book.

Photo 2. Here are the four brand new virgin NiCad cells, as ordered from All Electronics Corp. I like the bright yellow color!

Once the replacement NiCads were received it was time to get down to business.

Step 2. Time for surgery

Out comes my rolling junk box/surgical

Photo 3. No self-respecting tinkerer's existence would be complete without one of these junk boxes. Author's version is on casters to facilitate movement all around the house.

crash cart, which contains tools and a mind boggling array of parts bought/scavenged/scrounged/dissected over four decades. Anything from jumper wires to semiconductors, connectors, adaptors, ancient crystal radio earphones, ferrite loopsticks, old capacitors, resistors, circuit boards yanked from defunct appliances, and miles of assorted coax types have found a place of rest and refuge in this little electronic haven. **See Photo 3.**

Okay, so let's get going. First I removed the back cover of the unit, exposing the deceased cells. Then, using a putty knife, the pack was gently pried apart from the cover. **See Photo 4.**

Photo 4. Trusty putty knife is used to gently separate pack from housing.

Step 3. Assembly - "Buddying Up the Batteries"

Next, the four new NiCads were placed side by side in series and glued together to keep them steady for future soldering. At my QTH I always have on hand a number of epoxies, glues, and contact adhesives for fix-it jobs around the house. One of my favorites is J-B Weld®, (**www.jbweld.net**) a two-part adhesive that has no odor, holds like steel and can be used to glue or repair many different types of materials such as metal, plastic, wood, etc. **See Photo 5.**

Photo 5. J-B Weld® used to glue the four NiCad cells together.

The batteries were then set aside overnight while the adhesive cured. **See Photo 6.**

Photo 6. Four NiCad cells, glued together, and properly aligned in series and ready for soldering. Shiny gray material between the cells is the adhesive.

Step 4. Soldering Iron frolics

Now on the electronic agenda is soldering. Out comes my little vise, and with the aid of a discarded tube sock bottom, the batteries are put in the tube sock and gently held in place in the vise.

With the aid of my circa 1967 soldering iron purchased way back in my high school years (bulb burned out sometime during the Disco era), the individual battery terminals were connected in series using small lengths of nice, flat Radio Shack (**www.radioshack.com**) desoldering braid. I could have used scrap wire, but this stuff is nice and supple and can be thickened up by flowing additional solder onto it. **See Photo 7.**

Photo 7. This little arrangement allows easy soldering. White tube sock cushions cells while in the vise. "Hands free" gizmo holds soldering wick in place.

Step 5. Wrapping it up

After soldering on the old wiring harness, a few layers of yellow electrical tape were wrapped around the battery terminals to provide insulation, then the whole pack was wrapped with clear cellophane wrapping tape, making a nice solid package. **See Photo 8.**

❖ Conclusion

My XYL always has on hand household staples such as double-sided foam tape, so she provided me with a piece which was used to

Photo 8. The final product: the completed NiCad pack replacement, ready to be installed in the unit. Since the batteries were yellow-colored I felt it only proper to use yellow electrical tape as an insulator.

attach the new NiCad pack to the back cover. The frequency counter was reassembled, and after an overnight charge it is back in action.

Hopefully this little excursion into the Do-It-Yourself world will inspire some of you to perhaps tackle a minor or even a major repair job. In no way do I consider my method of battery replacement, as presented above, to be the best approach; surely there are better ways of tackling it. However, for what it is worth, at best it was a simple, roll-up-your-sleeves, average Joe's foray into the Fix-it world.

Hmm … now according to my calculations, if this battery pack lasts as long as the original one, I'll be retired and on pension next time around. Or maybe not: like the saying goes, the older you get the faster time flies!

Photo 9. The author, with his lucky "flaps up" hat. (Photo courtesy of Edith Filippi)

REFERENCES

MFJ Enterprises, Inc., 300 Industrial Park Rd., Starkville, MS 39759 (662) 323-5869.
Grove Enterprises, Inc., 7540 Highway 64 West, Brasstown, NC 28902-0098, (800) 438-8155.
All Electronics Corporation, 14928 Oxnard St., Van Nuys, CA 91411, 1-800-826-5432.
J-B Weld Company, P.O. Box 483, Sulphur Springs, TX 75483 (903) 885-7696.
Radio Shack Corporation, 300 Radio Shack Circle, Fort Worth, TX 76102.

encrypted Coquelet, text strings like "CODE FE X KGCNYNVRJKKIX H" are sent before the modem switches to crypto.

Customs channels include (.4kHz offsets are Coquelet, .7 or .8kHz offsets are PacTOR):

4801.4, 4912.4, 5070, 5201.7, 5251.7, 5301.7, 5470.4, 5881.4, 6233.5, 6761.8, 6776.4, 6911.4, 7001.7, 7501.7, 7605.4, 7746.4, 7808.6, 7813.4, 8098.3, 8101.5, 8579.4, 8901.7, 8998.3, 9001.5, 9001.7, 10008.3, 10011.4, 10011.7, 10454.3 (10456LSB), 10467.4, 11001.8, 11251.4, 11256.7, 11298.3, 11377.7, 11434.4, 11437.7, 13898.6, 13933.6, 20886.4

In the case of the PacTOR activity, stations appear to call each other and send messages using three-letter routing indicators after the standard ZCZC "start of message" text, like ADA, BEA, BRE, CEA, LAB, EBA, RBE. In this case "LAB" might indicate the link from Laghouat (LA) to Bechar (B) and the reverse being "BEL".

Cities involved in PacTOR activity have included at least: Algiers, Annaba, Bechar, Biskra, Chlef, Constantine, El Oued, Illizi, In Amenas, Oran, Skikda and Tizi Ouzou

State Intelligence Service (DRS)

This ALE-equipped network was rumored to be operated by the Département du Renseignement et de la Sécurité (DRS) or state intelligence service. Like the DGSN network above, its operation was short-lived and little has been heard since late 2010. It may also have moved from HF or onto 3G equipment.

Sometimes their identifiers were shortened to the first 4 characters only. Note the similarity between these identifiers and those of the Army, which may not be surprising since the DRS is part of the Algerian Ministry of Defense. Data was sent using MIL-STD-188-110A high speed modem and employed Harris "CITADEL" encryption. Sometimes the 39 tone version of the high speed modem was used.

Frequencies associated with the DRS include (kHz USB):

3934.4, 4460, 4800, 4970, 5160, 5217, 5254, 5455, 5694.5, 6233, 7604, 7730, 7770, 7954, 7892, 7955, 8010, 9175, 9252, 11218.4, 11415, 12225, 12806

Here are the ALE identifiers associated with this network:

AB14TZ90	BI10BI99
BI13BI99	BI44BI99
HJ50DW90	JL05JL93
LP30LP90	LP90LP30
PA40HM90	PT01JL93
SM50DW90	TS30LP90
VR20VR93	VR21VR93
XS88XS99	ZB40HM90
ZD50DW90	

That's all for this month. As ever, please keep your ideas for future columns coming. Send me an email, regular post or catch me on IRC channel #wunclub where I'm known as "mco".

The Kindle Fire Tablet
Do you get what you pay for?

By Loyd Van Horn, W4LVH

I remember my first exposure to mobile computing. It was a massive, and I do mean massive, Tandy laptop. I am not sure why they called it a laptop: trying to use this thing while resting it in your lap was a futile effort. Thirty minutes of that would likely lead to sore legs and a loss of circulation to your feet. It was a piece of technology you might see in a museum of technology now, or in one of those articles with photos of large, boxy mobile phones and floppy disks.

Fast-forward 20 years. I am sitting here listening to sports-talk radio in Manchester, England, using a device that has more computing power than my first three computers put together. Yet, it fits in the palm of my hand.

Tablets are all the rage right now, but with a flooded market, it is hard to sort out which tablets combine the best of features, function and affordability.

Enter Amazon's Kindle Fire. With most tablets coming in around $500, the Kindle retails for a modest $199. So, do you really get what you pay for?

❖ Out of the Box

If you have any experience using Amazon, you know what to expect in regards to packaging. Well cushioned, securely packaged, the Kindle Fire comes in a single box that efficiently ships the tablet, A/C wall adapter (a small wall-wart, but a wall-wart nonetheless) and a small "getting to know your Kindle" card that instructs you how to charge and power-on the Fire.

That's it! I liked the minimalistic amount of packaging and documentation. You will see later upon powering up the Fire, that your user's guide is actually stored on the Fire. What better way to get acclimated to using the Fire than using it to read how to use it, right?

Button placement is fairly straight-forward – you have a power button at the bottom of the

tablet. That's it! The rest of the controls are all handled by the touch-screen interface. You will also find a headphone jack located near the power button, as well as the plug-in for the A/C adapter. When charging, the power button is lit orange for charging or green for fully charged. At the top of the tablet, are two small speakers.

A bit about the specs as found on Amazon's Web site. It is a 7-inch tablet (a measure of screen size, not actual body size). The display runs at 1024 x 600 at 169 pixels per inch, giving you 16 million colors. Not bad for the price point.

A lot has been made by reviewers at the lack of memory. The Kindle Fire has 8 GB of internal flash memory available. Compared to most tablets that are offering 16 or 32 GB of storage, this seems to be a shortcoming, but it's not really. First, the Fire makes use of Cloud storage, 5 GB in fact, to up the total storage to 13 GB. Admittedly, you must have an Internet connection (the Fire only uses WiFi) to access this Cloud-stored data.

The big thing for me is that, at least with my usage, storage is not a big deal. I have some books stored and a handful of useful apps. That is about it. I already have an iPod and iPhone to store my music. I am more interested in using the Kindle Fire as a streaming source and no storage is needed for that.

Battery life is claimed to be around 8 hours

for continuous reading, or 7.5 hours for video playback with WiFi turned off. I would say this is pretty realistic, as I have been averaging about 5-to-6 hours of use between charges, with WiFi turned on.

❖ On the Downside

There are a couple of downsides, though. Probably my biggest gripe is the lack of volume buttons anywhere on the device. Controlling the volume is done through an icon on the touch-screen interface. It isn't difficult to use, but when you are in the middle of listening to a stream, watching a video or doing some reading, a simple up/down volume button on the top or even side of the device would be more convenient.

One of the huge features missing is a microphone. This obviously has a huge impact for those interested in amateur radio applications of the Kindle Fire, as apps like EchoLink won't be an option on this device. Some have tried to use an external microphone, but since there are no voice-enabled apps in the Kindle app store, you have to hack your Fire to make any use of it. I try to stay away from hacking my devices as much as I possibly can.

I can't believe there is no Bluetooth functionality. I understand Amazon was trying to keep the price down, but I can't imagine this would increase it that much. Once you get used to using Bluetooth on a regular basis, you will see just how handy it is. For example, I am right now typing this review on a Bluetooth keyboard for my iMac. Every once in a while, I will connect this keyboard to my iPhone so I can type emails quickly without having to fight the auto-correct nightmare.

A Bluetooth keyboard would be an absolute perfect addition to the Kindle Fire.

Some will tout the lack of a cellular network connection to be a shortcoming. Depending on how you want to use the Fire, it may be. But for those who have WiFi at home or work and just want something to carry around with them for streaming, the lack of a cellular connection is not a problem.

Those omissions aside, there is still enough here to have some fun with. So, let's get our hands dirty.

❖ Performance Test

While the Kindle Fire has a pretty impressive feature list – including Web browser and eReader capability – my main focus will be on

---

RATINGS

Audio Quality – 3.5 out of 5 stars
It is plenty loud – enough to be able to hear what you want to listen to, but the speakers aren't good enough for serious music listening. It isn't hard to plug in speakers or headphones to fix that quickly, though.

Performance – 4 out of 5 stars
"It just works." You turn on the Kindle Fire, you open your streaming app, and in a short amount of time, you have audio coming out of the speakers. The temperamental keyboard can be a bit frustrating.

Features – 2.5 out of 5 stars
No volume buttons? No microphone? No Bluetooth? The price-point was nice, but I would pay an additional $50-$75 to get a little more "in the box."

Design/Appearance – 4 out of 5 stars
How fancy can you get with a tablet? A tablet is a tablet, right?

★★★⯨☆

Overall Rating – 3.5 out of 5 stars

how this performs as a streaming device for radio enthusiasts.

Powering on the Kindle the first time, there is the required set-up. You have to connect to your WiFi signal, tell it what your name is and what time zone you are in, things like that. It is pretty easy, and a fairly quick set-up.

For those folks with little or no touch-screen experience, you might struggle a bit at first at typing without keys. Even as a daily iPhone user, I still find it takes a bit of getting used to the specific keyboard placement of the Kindle Fire's screen (since I am used to much smaller keys on my iPhone). But, overall, the larger screen size makes typing much easier once you are used to it. You won't be writing a thesis on it anytime soon, but basic emails and Web browsing aren't that bad.

You are automatically given some basic apps to work with, although you still need to download them. Things like The Weather Channel, ESPN and – imagine this – Pandora. Right out of the box, Amazon recognizes that streaming music, as opposed to storing it on your device, might be something that people are interested in doing.

Downloading apps is amazingly easy. No more syncing up from a computer, everything is natively done in the device itself. A quick browse of the in-device app store will give you quite a few options for streaming content, both audio and video. When an update is released for an app, you receive a notification and everything is once again completed on the device itself.

There are a number of apps available for listening to streaming radio content: iHeartRadio, TuneIn, Scanner Radio, Slacker, Stitcher and more. Many of these I have highlighted in my GlobalNet column, as they are used on other devices such as Droids, Blackberries, iPhones and more.

My go-to for listening to streaming radio stations is TuneIn. For streaming scanner listening, I am currently using Scanner Radio, although I would like to see some of the scanner apps from the iOS app store (such as 5-0 Radio) make their way to the Fire.
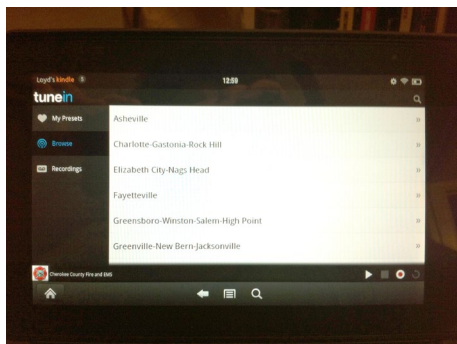
Some of the other audio apps that are popular on other platforms are curiously missing here. Apps like Wunderradio, Reciva Radio and LiveATC are not yet available for the Kindle Fire.

Also missing are some of the popular remote apps such as RecivaRemote, Logitech Squeezebox and the GraceRemote. Just recently added is a remote app for Roku devices that is a dream to use on such a large screen, so hopefully these other apps will find their way to the Fire soon as well.

Streaming video also is represented on the Fire. TVu and Netflix are the big ones so far. As with audio, there are a few popular video apps missing too, such as Crackle, or any of the network specific apps such as HBO, Cinemax, Showtime or TBS. The Amazon Instant Video option (for those signed up for Amazon Prime) has a wide selection if you are willing to spend the money on a subscription ($79 a year, compared to $96 a year on Netflix).
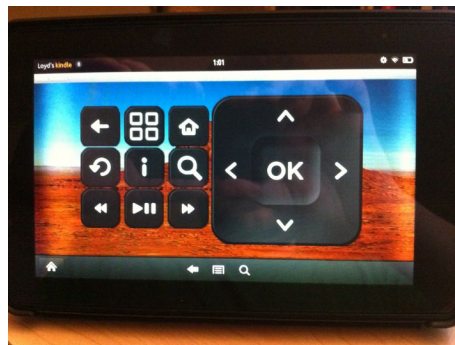
So, what can you expect when you listen to audio on the Kindle Fire? The top-fire speakers are basic and get the job done, but people who are interested in better quality audio may want to use external speakers or a set of headphones.

The line out tends to run a bit loud, though, so familiarize yourself with where the volume icon is and be ready to use it. I always test audio by listening to BBC Radio 1 as it is running at a high-bitrate and the music has a lot of low-end to really push the speakers. I found best audio quality, with little distortion, came from running around 60-70 percent volume.

Video quality is pretty good, especially for the price point. This would make a nice portable video player, as long as you have WiFi access available.

❖ The Final Word

So, what place does the Kindle Fire have in your gadget arsenal?

My iPhone and Kindle Fire rarely travel without each other. They supplement each other very well. The thing that wasn't expected was just how much the Kindle Fire has replaced my home computer for just about everything else. Even my WiFi radios seem to be getting less usage now that I have been using the Kindle Fire more and more.

Obviously, you are tethered to those areas that provide a WiFi signal. Right now, the WiFi-only option means the Fire is really more of an "at-home" mobile option. Outside of home, if you have a coffee house or WiFi at work, the Fire would be a perfect mobile option there, too. Perhaps in subsequent versions of the Fire, we will see a 3G or 4G option available for a little more money.
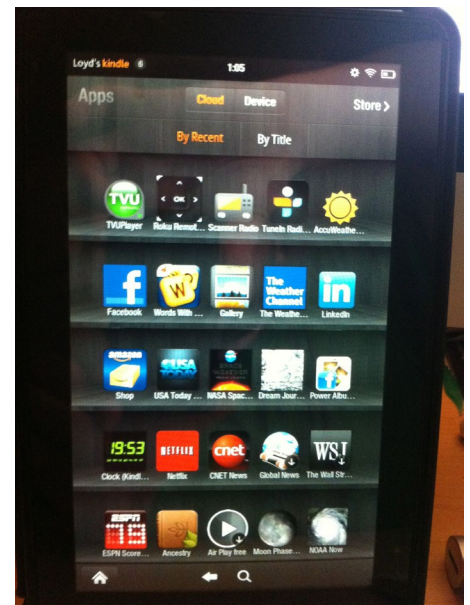
Affordability usually means you have to sacrifice something for the lower price. Usually, those sacrifices make the gadget frustrating or even impossible to use. However, in the case of the Kindle Fire, the missing features are more of a luxury.

The bottom line: It's not perfect, but if you are looking at the Kindle Fire, that's not what you are probably looking for anyway. If you want a glamorous tablet and have the money to afford one, get yourself an iPad. If you just want a functioning tablet device, especially one that comes at an affordable price, you can't miss with the Kindle Fire.

The Amazon Kindle Fire retails for $199 from Amazon.com and other retailers. You can find a link to the Kindle Fire's Amazon page at the end of this review.

My guess is that the second incarnation of the Kindle Fire may solve some of the design, feature and performance shortcomings that have been widely circulated. When most other tablets on the market are hitting around $500, $199 is hard to complain about. This is a fantastic entry-level tablet

Web Sites:
Amazon Kindle Fire Tablet:
http://tinyurl.com/cf49d6v

Larry Van Horn, New Products Editor

Profiles in Amateur Radio

Monitoring Times Features Editor, Ken Reitz KS4ZR, has just released his second Kindle e-book titled *Profiles in Amateur Radio*.

Profiles in Amateur Radio is a collection of nineteen articles taken from the *First Person Radio* series that appeared over the last three years in the pages of *Monitoring Times*. It's a three part look at the inspirational life stories as told in the words of those on whom shortwave and amateur radio has had a lifelong impact.

PROFILES IN AMATEUR RADIO

By Ken Reitz KS4ZR

Reitz has been a freelance writer since 1988, and in addition to his duties as Features Editor for *Monitoring Times*, he authors the *Communications* and *Beginner's Corner* columns which appear monthly in pages of this magazine.

Articles that appear in this *Profiles in Amateur Radio* Kindle e-book include:

• *The Uncommon Life of Charlie Gyenes W6HIQ* by Ken Reitz, KS4ZR
• *In the Right Place at the Right Time* by Bob Heil, K9EID
• *Life's Been Good to WB6ACU* by Ken Reitz, KS4ZR
• *How I Survived Self-Electrocution, Fame, Congress and the Publishing Industry* by Bob Grove, W8JHD
• *Reading, 'Riting and Radio* by Carole Perry, WB2MGP
• *CQ at 51,000 Feet and Mach .85* by Rick Dougherty, NQ4I
• *If You're Old Enough to Read, You're Old Enough to Get Your License* by Mattie Clauson, AE7MC
• *A Life of Service in Amateur Radio* by Harry Dannals, W2HD
• *My Half-Century in Radio* by Ron Walsh, VE3GO
• *A Love of Listening* by Thomas Witherspoon, K4SWL
• *My Lifelong Fight for Free Speech Radio* by Allan Weiner
• *Obsessed by Time and Shortwave Radio* by Myke Dodge Weiskopf
• *Crystal Set Leads to Lifelong Hobby and Career* by Maury Midlo
• *Shortwave from Both Sides of the Microphone* by Jeff White
• *A Most Unlikely Radio Career* by Keith Perron
• *Radio Dreams of a Lifetime* by Jack K. Neal, W8AQ
• *Amateur Radio and Education in America* by Ken Reitz, KS4ZR
• *The LBJ High School Experience* by Ronny Risinger, KC5EES
• *CQ DX from KC7OEK* by Nick Casner, K7CAS, Cole Smith, KF7FXW and Rayann Brown, KF7KEZ

This new Kindle e-book sells for $2.99 from Amazon and it is available from this Internet URL link – **http://tinyurl.com/78xozq7**.

Profiles in Amateur Radio follows closely on the heels of Ken's first successful Kindle e-book missive, *How to Listen to the World* available at **http://tinyurl.com/7w82qw5**. Both books sell for $2.99 via the Amazon Kindle book store.

Air Show Issue in Kindle Format

No other issue of *Monitoring Times* magazine is more popular than our annual air show issue that is released in March of each year.

As a leader in the radio hobby publishing world, Grove Enterprises and the *Monitoring Times* magazine staff are pleased to announce that the March 2012 air show issue is now available in the Kindle reader format from Amazon.com at a price you just cannot beat – $0.99. Now you can take our most popular issue of *MT* with you to the air show as a ready reference.

No need to worry if you do not own a Kindle reader. You can still read our new Kindle electronic reader edition or any Kindle books such as those published by Ken Reitz above anywhere with Amazon's free reading apps.

There are free Kindle reading apps for Smartphones (iPhone & iTouch, Android, Windows Phone 7, and Blackberry); Computer platforms (Windows and Mac); Tablets (iPad and Android Tablet), and of course the Kindle readers, including the new Kindle Fire as reviewed in this issue of *Monitoring Times*. You can get more detail on these apps by checking out this link to the Amazon website at **http://tinyurl.com/84wodbx**.

With the release of this Kindle edition of the magazine, MT Art Director Bill Grove provided the following product description:

"*Monitoring Times Xpress* digital edition, March 2012. *Monitoring Times* magazine is the leader in radio communications for the world of radio. Each issue is packed with shortwave, scanner and other radio reviews, features and columns. Now in our 31st year, *MT* is better than ever offering a print edition, PDF version (full color and graphics) and now the *MT* Digital Reader edition. This is our test of the digital version of the magazine for e-readers. It contains no graphics and no ads. We want to see your response as the reader whether this is worth pursuing as a monthly subscription.

Please give us your thoughts and comments. You can direct your email to **bill@grove-ent.com**."

So, if you are a big time air show enthusiast and want to monitor all the action at these special events, then this is an offer too good to pass up. You can purchase your 99 cent *MT* Annual Air Show edition in Kindle format by visiting this link **http://tinyurl.com/7ol4drq** to the *MT* Kindle Amazon web page.

Images of America-Bay Area Radio

New from Arcadia Publishing's popular *Images of America* series is Bay Area Radio by John F. Schneider, in association with the California Historical Radio Society and its Bay Area Radio Museum. This pictorial history boasts a vast collection of vintage images and provides readers with a unique opportunity to reconnect with the history that shaped their community.

The San Francisco Bay Area was a key national radio-broadcasting center during the first three decades of commercial radio. In 1909, it was home to the very beginnings of the art and science of broadcasting, when Charles "Doc" Herrold began sending out weekly voice and music programs from his radio school in San Jose. Dozens of other radio pioneers soon followed.

In 1926, big broadcasting came to San Francisco when the newly formed National Broadcasting Company (NBC) established its West Coast headquarters on Sutter Street. Other national and regional networks soon set up their own broadcast production centers, and for the next 20 years, thousands of actors, musicians, announcers, and engineers were creating important programs that were heard on the West Coast and nationwide.

During World War II, San Francisco became the key collection center for Pacific war news, and bulletins received in San Francisco were quickly relayed to an anxious nation. Conversely, powerful shortwave stations broadcast war news and propaganda back to the Pacific and entertained American troops overseas.

Some of the highlights from Bay Radio include:

• The first radio broadcast station in the world was on the air in San Francisco in 1912.
• The first shortwave radio station on the West Coast broadcast from Treasure Island during the 1939 Golden Gate Exposition.
• During World War II the forerunner of the
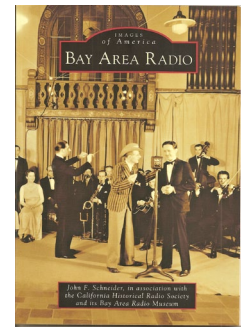
Voice of America (VOA) broadcast to the Pacific from studios in the parking garage of the Mark Hopkins Hotel.

Bay Area Radio retails for $ 21.99 from Arcadia Publishing and is available at local retailers, online bookstores, or through Arcadia Publishing at **www.arcadiapublishing.com** or call (888) 313-2665. – *Gayle Van Horn*

DX Engineering Clamps

DX Engineering is now your radio hobby Clamp Central, providing a wide variety of saddle, block and band clamps for dozens of radio applications.

Unlike typical hardware store clamps, DXE U-bolt saddle clamps are designed to fit tubing. All U-bolts are formed from premium 18-8 stainless, and all saddles are cast from 535 aluminum.

DXE's V-Bolt Saddle clamps are long enough to fit a range of tubing sizes. Saddle material is cast 535 or 319 aluminum, depending on size. U-bolts are fabricated using premium 18-8 stainless.

Super Duty Saddle Clamps are designed for applications where maximum clamping capability is needed. These clamp kits are made from two corrosion-resistant A356-T cast aluminum saddles with a cast stainless reinforcement plate. Accessory bolt and nut sets (sold separately) allow for a customized fit.

The DXE Resin Block Support Clamp is ideal for securing mounting brackets or plates to tubing, while also providing electrical in-sulation. Optional stainless steel reinforcing plates provide additional stiffness and act as hole-drilling templates.

Marine-grade stainless band clamps se-cure telescoping tubing in place for antenna applications. The ECLS series adds threaded studs for electrical connections, mechanical assembly of components, or attachment of brackets.

Prices range from $2.65 to $49.90 depend-ing on size, composition and configuration. For more information or to order, visit DX Engineering's website at **www.dxengineering.com.**

Utility DXing - A Primer

Beside ham radio and broadcasts, many more stations can be found on shortwave: Mari-time, Aero, Non-govenment and Ministries of Foreign Affairs among these. Most of them are transmitting in digital modes, and many of them can be received and read with the help of software decoders. A new *free* 50-page iBook titled *Utility DXing – A Primer* delivers a multimedia introduction into this fascinating world.

It shows how to receive these often brief transmissions, how to recognize their modes and how to decode them. Focusing on a brand new professional decoder, the Krypto500, this iBook shows hands-on examples on how to re-ceive and decode professional communications from New Caledonia to Iraq, from Barbados to South Africa.

The iBook follows up this introduction with a comparison of equipment, showing the performance of decoders ranging from "free of charge" to $10,000 decoders like the Wave-com W-Code, Rohde & Schwarz' GX430 and Hoka's Code3-32P.

This unique book – both an introduction into the interesting field of shortwave listening and a detailed test of decoders – comes in two versions:

- The multimedia iBook will give you full ac-cess to videos, photo galleries and interactive graphics on an iPad.
- If you don't have an iPad, you can download the PDF version of this book with many screen shots, but lacking multimedia content.

You can download both versions free of charge at **http://tinyurl.com/6lvsfrq**.

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

Fred Maia W5YI

As noted in this month's *Communications* column, Fred Maia W5YI died on March 28. Besides having been an *MT* columnist for a brief stint, his life had a special meaning to assistant editor Larry Van Horn, who knew him the longest of us all:

"In the early days of my second time as a licensed ham when we lived in DFW Metroplex (early 1980s), Fred Maia was one of my mentors in amateur radio. My fondest memory of Fred was his weekly voice report on one of the local VHF repeaters – 'the *W5YI Report* by Fred Maia, W5YI.' It was quite obvious that Fred was doing his best to brand his call sign and name as both were prominently mentioned many, many times during each one of his W5YI reports on the local repeater. Of course, it was a honor to have him on the *MT* staff many years later and we had many a phone conversation regarding various issues of concern to the amateur radio community that emanated out of Washington, DC. I will truly miss Fred. He was a real ham's ham and good friend."

Larry Van Horn, N5FPW,
Brasstown, NC USA

ISS Packet

Dave (Granoff), First let me thank you for your article in the February MT; it got me to try International Space Station (ISS) packet. I dug out my FT-857 and hooked it up to my Discone that was connected to my scanner. Didn't think it would work at all, but I've at least been able to hear signals and get some good decodes. Tonight, I got it to digi my APRS location, and I even saw your callsign.

I set up UISS and have been trying to see if I could get a transmission from me to be received, and tonight, finally I got two responses from W9HT and W8KRF. I've no idea yet how to respond to them, and give them a 59 or anything, but at least I'm there. Next step is to build or buy an eggbeater antenna.

Thanks again, I think I'm hooked.
73, Fraser Bonnett, W3UTD

Hi Fraser, That's really *fantastic* that you got your station set up. You are getting through as you will see from a screenshot of your Rx on my UISS screen tonite.

To respond and send a reply is really easy – just highlight the **"Tx test data":** box with your mouse and you can type in any response; say for example you get a reply from me, you would then type in 'K3AS: GE AND TNX UR 59 DE W3UTD FRASER in HARRISBURG, PA' or something like that. The dropdown arrows at the end of the line will 'save' your typed lines so you can easily retrieve and modify them by changing calls, etc. easily. Then, click the Text/data green button above to 'send' your message.

Go to my website at **www.k3as.com** for more info about working the ISS if you want.
Regards, GL, and 73, Dave Granoff K3AS

MT Express on Kindle Fire

Having gotten a Kindle Fire for Christmas I decided to try reading MT Express on it rather than the laptop I have been using. After downloading the February issue I copied the .pdf for both the January (which I hadn't finished reading) and February via USB to the Kindle Fire.

It is a lot more convenient to read on a handheld tablet than on the laptop. However, I'm not going to strain my eyes trying to read from a full page view on the 7" diagonal screen. No problem: just pinch zoom to show one column width and scroll up and down to read the whole column, then move over to the next column. Works wonderfully on the three column arrangement of most pages.

However, there are a few pages formatted as two columns. If I zoom to show the whole column width, the font size is too small for comfortable reading for old eyes. So I have to endure it, or zoom in more and scroll left-right on each line, or rotate the tablet to landscape. This brings me to suggest that an effort be made to use the three column format on all pages. Scrolling to see all of a picture that is 2 or 3 columns wide is not a big problem and the resolution from being zoomed in shows more detail, which is a plus.

Thanks for continuing to produce a quality magazine in a great format!
Ron Biddle

Thanks for your feedback, Ron. You'll be interested to know *Monitoring Times* is continuing to evolve and is beginning to offer a Kindle version of the magazine. It helps to resolve the issue of scrolling left-right when type is enlarged, as the text adjusts to fit your screen as you enlarge the font. Navigation is also a bit more convenient than in the pdf format, though you cannot see the whole page at one time as you can in the pdf.

At the current time illustrations are not included in the Kindle version, which can be critical to a construction article, for example. We're working on it! But the contents are still a real bargain at $1.99 per issue! (Single issue PDFs are now only $2.99.) Just go to **www.monitoringtimes.com** and follow the links to subscribe or go directly to the Grove online catalog at **www.grove-ent.com/MT.html.**

Note from Art Director:

The purpose of the two column layout is due to either the table being too wide for a normal three-column layout or we have a 1/4 page ad that needs to be placed. I, as well, prefer the 3-column layout, but there are times that it simply doesn't work.

As for the Kindle, I'm very happy that you're able to use the PDF for that format. Amazon does offer a way for us to do a Kindle version specifically for the Kindle Fire, but it's still further down on my list. I'm trying to do graphics for the regular Kindle at this point, and that's ending up to be quite a daunting task! We are always pursuing new avenues and new formats for *Monitoring Times*, so who knows where you'll see it next! Thank you for trying the different versions. We sure appreciate the continued support from all of our wonderful customers!

Bill Grove

The Changing Scene in AM

Ken Reitz's article in January's MT (Who is Killing AM Radio?) was dead (pun intended) accurate regarding the many forces at play that are orchestrating the slow downfall of AM radio. Some of these forces are fast-acting and deliberate, while others are slow and subtle.

What especially hit home was the section on car radios. Six months ago I purchased a new automobile that was outfitted with an AM/FM/Satellite radio and a complimentary six month subscription to Sirius XM. Satellite radio was great: lots of channels to choose from, no annoying commercials, excellent audio quality, etc. At the end of the six month trial period I had to cancel due to fiscal belt-tightening.

So, being a dyed-in-the-wool AM radio enthusiast, I pressed the AM button on my console for the first time since the car keys were turned over to me by the saleswoman, and culture shock set in. In short, the AM radio
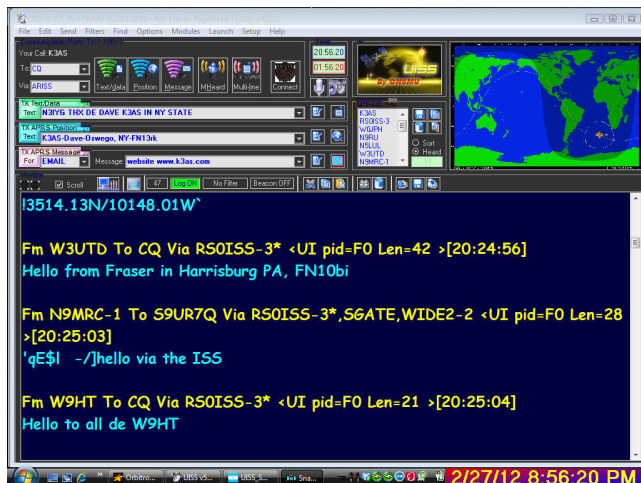
reception was the worst of any car I have ever owned. At that moment my thoughts focused back to Ken's article.

My AM car radio does not pick any radio station without an accompanying amount of white noise, fade, and a cacophony of internally generated interference from the many electronic control systems in the vehicle. At first I was in a denial phase, figuring that it was probably due to my becoming accustomed to satellite radio's clear signal. As the old World War 1 song went "How can you keep 'em down on the farm, after they've seen Paree?"

Then I looked around for the car antenna, and it appears that all three services (AM, FM, and satellite) are fed by one aerodynamically, aesthetically pleasing, banana sized skyhook. Looks like my AM radio is playing second (more like third) fiddle to FM and satellite.

But I'll not give up, AM in my car will live again, even if I have to plug an external AM radio into the auxiliary port of the car's audio system. Maybe a bent coat hanger attached to that poor excuse for an antenna might help.

Thanks Ken for an excellent article and hopefully AM radio will live ad infinitum.

Mario Filippi, N2HUN

My wife and I were sightseeing in the Chattanooga area and I was surprised to find that the number of AM stations that could be heard was very limited during the daylight hours. Those of us in the Great Lakes states are quite spoiled. I counted 5 entertainment quality AM signals on my Buick's radio.

Today, in a similarly populated area near Fort Wayne, I counted 42 using the same radio and reception criteria. My count on the FM broadcast band was 49 stations.

I did not count the FM stations in the Chattanooga area; however, they seemed plentiful. I can understand why some of your readers believe that AM broadcasting is a thing of the past. It is certainly alive and well in this part of the country.

Larry Wheeler, W9QR

ABLE RADIOS for 1962

Personal Portables

MODEL X41 EIGHT TRANSISTOR CHASSIS

TUNED RF STAGE in this model is engineered especially for those people who want extra sensitivity in a portable. X41 is built for superior performance.

140 MILLIWATTS POWER OUTPUT produces sound you can hear, even out-of-doors where ambient noise is a problem with many portables.

Civil Defense Antenna Terminal built in for emergency use in "fall-out" shelters.

Earphone, optional extra • Size: 7½"x4¾"x2⅜" • Colors: X41E, Black; X41N, Brown; X41G, Olive

MODEL X39 SEVEN TRANSISTOR CHASSIS

HIGH FREQUENCY TRANSISTORS incorporated for clear, clean sound. Since these transistors operate with virtually no electronic noise, this same characteristic is contributed to the chassis for crystal clear reception.

2 IF STAGES located just ahead of the detector stage actually double the signal strength as compared with single IF stage chassis.

Earphone, optional extra • Size: 5¾"x4¹³⁄₁₆"x2" • Colors: X39E, Black; X39N, Brown; X39S, Tan.

MODEL X31-1 EIGHT TRANSISTOR CHASSIS

TUNED RF STAGE FOR OUTSTANDING SENSITIVITY. This eight transistor chassis incorporates a tuned RF stage with 3-gang condenser. Performs where long range reception is a must . . . on fishing, hunting trips . . . or it's equally at home on the patio.

DOUBLE DRIVER AUDIO CIRCUIT PRODUCES 170 MILLIWATTS OF POWER OUTPUT. Two transistors are incorporated just ahead of the push-pull audio circuit to drive the speaker for increased output equal to 170 milliwatts. This is more than enough power output to overcome ambient noises apparent when listening out-of-doors.

Earphone, optional extra • Size: 8"x5"x3" • Colors: X31A-1, Grey; X31N-1, Ginger; X31B-1, Blue

Padded Leather cover protects front controls

I was very surprised to see the old Motorola AM radio on page 74 of the March issue. Back in July of 1962, I paid $33.29 for mine.

I am enclosing some information on the X31A, along with a portion of the 'catalog' back then. [Like Doug Robertson's], my radio has not been repaired as well.

Love your magazine,

John Ebeling

Reach new customers with your advertising message in *Monitoring Times*! Contact Judy Grove at **1-800-438-8155** or **email judy@grove-ent.com**

Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

ANTENNA TOPICS
www.wa5vjb.com - by Kent Britain

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

UTILITY WORLD
http://mt-utility.blogspot.com/- by Hugh Stegman
www.ominous-valve.com/uteworld.html

Stock Exchange

For information on Stock Exchange or commercial advertising, contact Judy Grove at 1-800-438-8155 or judy@grove-ent.com

Line Ads $1 per word

Just downloaded the August issue, saved it in iBooks, and have read about half. Looks *great* on the iPad. This is definitely the way to go....

-Scott

Sent from my iPad

Subscribe to *MT* for as little as $17.95 (U.S. Second Class Mail)

7540 Hwy. 64 W.; Brasstown, NC 28902
1-800-438-8155 US and Can.; 828-837-9200; Fax 828- 837-2216
e-mail order@grove-ent.com

	6 months	One Year	Two Years	Three Years
Electronic Subscription		❏ **$19.95**	❏ **$38.90**	❏ **$57.85**
US Second Class Mail	❏ **$17.95**	❏ **$32.95**	❏ **$59.95**	❏ **$89.95**
US 1st Class Mail	❏ **$32.95**	❏ **$59.95**	❏ **$119.00**	❏ **$179.95**
Canada Surface*	❏ **$22.95***	❏ **$42.95***	❏ **$79.95***	❏ **$119.95***
Canada Air*	❏ **$35.95***	❏ **$69.95***	❏ **$125.95***	❏ **$189.95***
Foreign International*	❏ **$30.95***	❏ **$58.95***	❏ **$119.95***	❏ **$179.95***
Foreign Air*	❏ **$62.95***	❏ **$119.95***	❏ **$229.95***	❏ **$349.95***

If you order MT Print Edition AND MTXpress Electronic together, MTXpress is only $11 per year!

* *All payments must be in US funds drawn on a US bank.*

MasterCard, Visa, Discover Cards and Paypal accepted!

PayPal

---

www.dxtreme.com -- Log DXtremely with DXtreme Software!