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Vintage Radio Special

60 Years of Lafayette Radio

In this issue:

- Rise of Seed-Selling Radio Stations
- The Antique Wireless Association Museum
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Monitoring Times

Vol. 31 No. 12 December 2012

Sixty Years of Lafayette Radio

By Richard Post KB8TAD

If you're new to the radio hobby you might not have heard much about Lafayette Radio and Electronics, a company that gave better known Allied Radio and their Knight-Kit products a run for their money throughout the decades of radio's golden years.

From its inception in the early 1920s as Wholesale Radio Service Company, what would later be known as Lafayette Radio led the catalog radio retail business even through the depths of the Great Depression.

Lafayette had a knack for anticipating home electronics fads while pioneering the mail-order electronics business, dodging accusations from the Federal Trade Commission and coping with company in-fighting.

Rich Post KB8TAD, a lifelong collector of Lafayette brand radios, among many others, shares the inside story of the remarkable rise and fall of this important company in radio's long and colorful history.

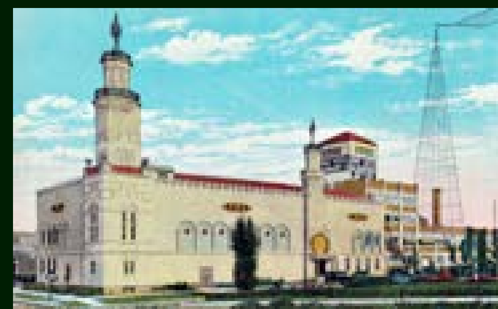
On Our Cover

An impressive array of seven Lafayette Radio shortwave receivers. Bottom row left to right: HA-350, KT-200, and HA-800B. Middle row: KT-320, HE-30 and Explor-Air Mark V. Top: HE-60. (Photo by Richard Post KB8TAD)

C O N T E N T S

By John F. Schneider W9FGH

There's no better illustration of the magic of emerging technology than the story of a handful of Midwestern, low-power, AM radio stations from the 1920s and 30s. John Schneider W9FGH follows the birth and astonishing growth of competing seed companies that were among the first to understand early radio's powers of entertainment and persuasion.



Just as radio was taking hold in American households, companies were trying to figure out how to make the new medium work for them. Amid regulatory hurdles and the challenges of a new technology, the great seed-barons of Shenandoah, Iowa battled it out on the airways across the entire Midwest from studios that were just blocks apart.

Millions tuned in to hear fiddle contests, gospel tunes, preaching and a pitch from the owners of the seed companies themselves. The result was a phenomenon that brought hundreds of thousands of curious radio fans to the small Iowa town just to see what it was all about.

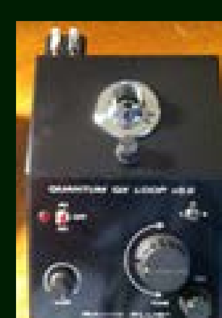
By Marc Ellis N9EWJ

*MT*s Radio Restorations columnist, Marc Ellis N9EWJ, invites readers to learn about the Antique Wireless Association, the premier vintage radio club in America. The organization, which began in 1952, publishes the quarterly publication *AWA Journal*, and will open a new, expanded museum next summer. Marc explains all the activities of this energetic group that includes auctions, swap-meets and on-air amateur radio contests featuring vintage radio gear.

R E V I E W S

By Loyd Van Horn W4LVH

As has been well documented in this magazine AM DX has been harder and harder to chase. Is there anything that might help? Yes, says Loyd Van Horn. Find out why he likes the Quantum QX v3.0 amplified loop that pulls in the stations you want and nulls the ones you don't.



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to the editors

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This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!

Ken Reitz, Editor

OPERATING SDR ON LINUX OS

Dan Ramos from Huntington Beach, California writes:

I just read the article "Shortwave Listening: The State of The Industry" in the October issue of *Monitoring Times*. I think there is plenty of stuff to listen to and monitor on our shortwave bands. Some listeners will have to get used to the fact that many of their favorite listening targets of the past are going away and not coming back. They will have to look around and see if they can develop an interest in other users of the bands. I listen to ham operators all the time at my home and they are always up to something on the bands.

Regarding software defined radio (SDR), I have read several articles about it and I am interested in taking advantage of this new technology. My problem is that all of the computers I am using are run by Linux (Ubuntu OS), not Microsoft Windows. The specs for these radios call for Windows to be installed in the user machine. Until I find a way to run SDR through a Linux machine (an installation program on a DVD disc would be nice), I will be leery of buying any new SDR units on the market.

Kirk Kleinschmidt responds:

For amateur radio builders and experimenters (using Softrock-style hardware) there are plenty of Linux-friendly SDR packages: ***http://radio.linux.org.au/?sectpat=SDR****, for example.*

For slick commercial products such as those from FlexRadio and Genisys, it's a Windows world. There are more opportunities for RX-only Linux users, especially with the QS1R and the Perseus RXs, etc. And if you make your own or buy a Gen-1 QSD/QSE rig (like a Softrock), there are packages available. It's still frustrating, though.

Hugh Stegman responds:

The Excalibur is right now for Windows only, however, WiNRADiO makes a line of products for Linux, called LINradio: ***www.linradio.com/index.htm****. Perseus software is only for Windows, but others have written libraries to use the Perseus with Linux. Linrad is available for several SDRs. I don't know much about it, but it's here:****www.sm5bsz.com/linuxdsp/linrad.htm****.*

Linrad can operate with any soundcard for which the operating system on the PC has drive routines. Linrad has support for the following hardware that use PC soundcards: WSE converters ***www.sm5bsz.com/linuxdsp/optrx.htm****, Si570 (Softrock, IQ+ and others as well as the Soft66 series).*

Linrad can also operate with the following direct sampling receivers: SDR-14, SDR-IQ and SDR-IP from RFSpace ***www.rfspace.com/RFSPACE/Home.html*** *and Perseus HF Receiver from Microtelecom s.r.l.* ***www.microtelecom.it****. Any of those other boxes are good SDRs and some are relatively inexpensive.*

ANTENNA MYSTERY SOLVED

Jeff Rehm from St. Louis, Missouri writes:

Attached you will find pictures of an antenna my father has on his mobile home in Southwest Missouri about 50 miles Northeast of Springfield. The antenna came already attached with the purchase of the mobile home and there were no papers identifying it.

There are quite a few of the same antenna around the area of both Dallas and Laclede counties including one on the area's volunteer fire station. However, no one that I have asked has a clue as to who manufactured it. As you can tell it has seen some better days; ice storms, severe thunderstorms and even a nearby tornado.

Can any of you identify this antenna and tell me if it is still available for purchase? It works fantastic as I can monitor all seven weather frequencies (multiple stations on some frequencies) and on a good night hear eight of the nine Missouri highway patrol 42 MHz stations from around the entire state.

Any help would be great. It is obvious it is a well liked antenna around Southwest Missouri by the shear number of them.

Kent Britain WA5VJB Responds:

Looks much like a TV antenna I developed for RDI, Inc. some years ago. The long element is for TV channels 2-6, so probably does work fairly well with 40-50 MHz VHF Lo services. The two smaller elements are forming a two-element Yagi. The wide spacing and extra long reflector element costs some gain, but gives it a lot of bandwidth. This is for TV CH 7-13 so probably makes a pretty good VHF-Hi antenna.

It will be a bit directional on your weather channels. The small element should be pointed in the desired direction. The element mounting and insulators are typical of Channel Master, but I must say I have never seen one of this model before. It would probably be listed as an "Area Special" since there are no dedicated UHF elements.

With virtually all the new digital TV channels in the UHF band these days, not many companies are still making outdoor VHF Antennas. Your best bet might be look at old TV repair shops or hardware stores. They often sell TV antennas and might have some old ones in stock. Plan B sounds like it might make a good construction article for a future column! Good luck with your monitoring.

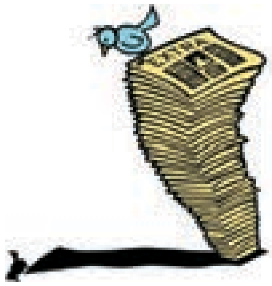
RF INTERFERENCE ISSUES UPDATED

Irv Sanders K3IUY updates his digital cable-TV interference issues from last month:

Well, we finally got some action from Comcast via ARRL. Last Friday the Comcast serviceman in charge of problems knocked on my door and asked if I was the guy who has a noise problem. Of course, the answer was an excited YES. We talked a while about the problem, I displayed the noise on widely separated frequencies, on several receivers which netted a HUMMMMMMMMMMM . After which he said he had a technician standing by down the road to shut down the system and that should prove the noise wasn't coming from Comcast. He asked me if I agreed, which seemed to make sense to me. I suggested I turn on my computer and a TV receiver, he agreed and gave his buddy the "shut-er down" command and bingo, a blue screen on the TV and a message saying "no signal" and a screen on the computer saying "you have been disconnected from the Iinternet" with an apology message on both. The noise remained while the system was shut down which surprised me.

The Comcast serviceman suggested there is probably a few switching "wall warts" in the building which are defective. I took that with a grain of salt, because during one of my trips around all the halls of the building I was listening for spots and watching the "S" meter for areas where the signal was attenuated: Not a waver.

I haven't heard from the FCC but from what I understand it is simply too soon, so I'll wait a while.



COMMUNICATIONS

by Ken Reitz KS4ZR

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

GRE-JAPAN FUTURE UNCERTAIN

In a statement released October 23, GRE America Director of Sales, Raj Gounder, said, "Due to circumstances beyond its control, General Research of Electronics of Japan (GRE) is temporarily not able to manufacture the GRECOM and Radio Shack branded radio scanners. The Chinese Government's plan to redevelop the area where the GRE factory had been in operation for over ten years finally forced its closure. Anticipating this eventuality, GRE was in the process of building a new factory but unfortunately the cost of raw materials, labor and increased taxes created a heavy financial investment burden that could not be effectively recovered.

"GRE America continues to market, support and service the GRECOM branded scanners and is contractually committed to keep the Library Database updated and current. GRE America will continue to market, service and support Alinco's radio products without any interruption.

"We sincerely apologize for this unfortunate turn of events. GRE is proceeding to establish a contract with a new factory and believes it will be able to restart the manufacturing in the near future."

POSTAL RATES GOING UP (WHO KNEW?)

Exchanging paper QSL cards will get more expensive next year. According to the U.S. Postal Service, beginning January 27, 2013 domestic First-Class postage will cost 46 cents; postcards go to 33 cents each and one ounce letters to international addresses will cost $1.10.

Regarding International Reply Coupons (IRCs) there's good news and bad news. The good news is that IRC prices will not be going up. The bad news is the USPS will discontinue offering IRCs. According to a spokesperson for the USPS, "The Postal Service will continue to redeem IRCs under our UPU treaty obligations, but IRCs will not be sold after January 26, 2013."

If you're just starting out in amateur radio and are hunting DX awards you should consider Logbook of the World (LOTW) **www.arrl.org/logbook-of-the-world.** It's the only e-QSL accepted for DXCC and other amateur radio achievement awards. It costs nothing to participate and while not all DX hams you may work use LOTW, most DXpeditions do.

U.S. postal self-service kiosk. (Courtesy: USPS)

If you insist on pursuing actual paper QSLs the cheapest method is via the ARRL QSL bureau **www.arrl.org/outgoing-qsl-service.** It costs nothing to receive DX QSLs sent to you through the bureau other than self-address, stamped envelopes (SASEs) you have to send to the bureau. If you want to use the outgoing bureau, you have to join the ARRL (but you should be doing that anyway). Even so, there is a charge per weight of QSLs sent (details are found on the web site) in addition to the envelope and postage to get the QSLs to the bureau.

QSLing direct to DX hams will require the $1.10 postage and at least two "green stamps," U.S. dollar bills as they are often called by DX stations. Some DX stations ask three dollars. QSLing direct to earn your first DXCC certificate could cost up to $300 (plus the cost of printing your QSLs). Another way to save is to use "stateside managers." Many DX stations and DXpeditions use QSL managers who live in the U.S. to handle U.S. QSL requests. While you will have to pay for postage both ways (using SASEs) total cost using a stateside manager is still under a dollar per DX card received.

NEWBIE SPACE COMPANY LOSES SATELLITE

Space Exploration Technologies, the start-up, private space contractor hired by NASA to haul supplies to the International Space Station, got a jolt of reality in early October when a satellite launched as a secondary payload on the Falcon 9 rocket failed to achieve orbit.

Orbcomm OG2 satellite. (Courtesy: Sierra Nevada Corp.)

According to numerous press reports, the prototype Orbcomm-built satellite was placed in a lower than planned orbit by the launch vehicle thanks to an anomaly during the launch of the Dragon space vehicle, the primary payload. The satellite, which burned up as it fell out of orbit, was insured. Orbcomm plans to use Space-X, as the company is known, to launch 17 more satellites in 2013 and 2014.

ZOMBIE WX-SAT LIVES

Suspiciously close to Halloween, NOAA engineers managed to bring GOES-13, the main satellite used to monitor the Atlantic Ocean, back to life after it mysteriously died in September, at the peak of the Atlantic hurricane season. Things had gone so wrong on GOES-13 that NOAA was moving GOES-14 east to take its place. According to an article in the *Washington Post*, aging lubricant in the sounder of GOES-13 was seen as the culprit for the anomalies that forced NOAA to shut down the bird. Latest word is that it's functioning at 100 per cent.

FLAT ANTENNA REVISITED

A Redmond, Washington, company called Kymeta plans to produce a flat antenna that it hopes will change the way all satellite communications are handled in the future. According to an article in *Bloomberg Businessweek* from October 18, the surface of the 1 foot by 2 foot mTenna is dotted with thousands of circuits that electronically aim the antenna at a target satellite.

Portable Satellite Hotspot flat "dish" antenna. (Courtesy: Kymeta Corp.)

According to a Kymeta press release, the Portable Satellite Hotspot (PSH) can be set up in one or two minutes; uplink data at 1-3 Mbps and downlink data at 1-5 Mbps, and automatically select proper polarization. The company hopes to interest journalists, aid agencies, disaster relief organizations and defense agencies in the product. While the concept of a flat "dish" antenna is not new, Kymeta's design incorporates advances in electronic technology that allows transmission *and* reception with direct attachment to a laptop computer for control.

FCC CRACKDOWN ON CRAIGSLIST

In mid-October the FCC issued citations against six companies advertising on Craigslist the sale of devices used to jam cell phone frequencies. To make this perfectly clear the agency issued this statement:

"The use of 'cell jammers' or similar devices designed to intentionally block, jam, or interfere with authorized radio communications (signal blockers, GPS jammers, or text stoppers, etc.) is a violation of federal law. Also, it is unlawful to advertise, sell, distribute, or otherwise market these devices to consumers in the United States. These devices pose serious risks to critical public safety communications, and can prevent you and others from making 9-1-1 and other emergency calls. Jammers can also interfere with law enforcement communications. Operation of a jammer in the United States may subject you to substantial monetary penalties, seizure of the unlawful equipment, and criminal sanctions including imprisonment."

Even so, retail sellers of non-FCC certified equipment used to operate on amateur radio bands, often listed on Internet sites as "export" radios or 10-Meter radios, continue to be sold without FCC interference.

Sixty Years of Lafayette Radio

By Richard Post KB8TAD
(All graphics courtesy the author)

An all-Lafayette test-bench: Equipment from left: TM-16A field strength meter; LC-4 Capacitor-resistor checker; Model 174 VTVM; KT-208 signal generator and tracer; 30,000 ohm/volt VOM model 99-5004.

The year was 1921. Radio broadcasting was still in its infancy and experimenters were building radio receivers; mostly crystal sets. Those with a bit more money were buying or building radios with vacuum tubes that ran off batteries. All entertainment broadcast stations were assigned to a single frequency of 833 kHz causing stations from different cities to interfere with each other. And, since frequency control was also in its infancy, stations would drift down to 820 or up to 840 or in between, allowing listeners to sometimes hear 3 or 4 stations in one evening.

If there were several stations in a city they would have to agree to share the frequency so most broadcasters were only on the air for an hour or two each day. As a result, the prime-time early evening hours were most in demand. A bigger broadcast band would not come until 1923 when 550 kHz to 1350 kHz would be set aside for broadcast. The "short waves" above 1500 kHz, including what is now part of the broadcast band, were considered relatively useless and were the domain of amateur radio and experimenters.

Growth of Parts Manufacturers

Radio parts and tubes were expensive by 1920s standards, however, manufacturers had sprung up to offer tube sockets, galena crystals, headsets, "amplifying" (interstage) transformers, coils, variable capacitors (called "condensers" back then), and of course, rheostats, to vary the filament voltage on "audions," as an early form of volume control. The term "triode," used to describe the tubes of the day still had not fully caught on.

For the most part, teenagers were the radio experimenters; they were the geeks of their age. It was in this time period that small stores selling radios and parts sprung up in major cities. Wholesale Radio Service Company was founded by 21 year-old Abraham Pletman in New York City. Did Pletman have help setting up Wholesale Radio? That is likely. Just a few years later not only was Wholesale Radio Service doing business as a New York store but it had developed mail-order sales. A 1924 ad in Wireless Age magazine offered a free copy of their catalog, proclaiming "We Sell Retail at Wholesale Prices."

The following year, Wholesale Radio advertised an 80 page catalog in an ad in the April 1925 issue of *Popular Radio*. The full page ad also offered a complete set of parts for a superhet that *Popular Radio's* Technical Editor, Lawrence Cockaday, had designed and written up in the January 1925 issue as the "Cockaday Improved DX Receiver."

In addition to a kit of parts for that particular radio, Wholesale Radio Service also offered a fully-built version complete with tubes and a Korach tuned-loop antenna for $132, serious money in 1925; more than $1700 in today's money. That superhet was an exceptional performer in 1925. The ads for a complete set of parts or a custom-built version avoided the sticky issue of patent royalties. The superhet was a closely-held patent in the 1920s. Wholesale Radio placed more adds in subsequent issues of Popular Radio.

Patents helped create a strong market for parts kits for radios that originated in magazine articles. The experimenter could build a set and avoid the expense of royalties. Cockaday would continue to introduce a radio of his design in *Popular Radio* magazine and its successors for each year. Cockaday's LC-27 and LC-28 bore his initials and the year following the article, a bit like the way automobiles were sold. New radio sets for the following model year were introduced each fall, just in time for the holiday buying season.

Catalog sales for Wholesale Radio Service continued throughout the 1920s although few catalogs seem to have survived from those years. A 1927 catalog flyer was 26 pages and included radios, parts, and kits by well-known names of the era such as Hammarlund, Loftin-White, Remler, Silver-Marshall, and of course, Cockaday.

The Lafayette Brand is Born

Radios sold directly by Wholesale Radio were trademarked "Lafayette" in July of 1931. The company also registered Trutest, Symphonic, and Duo Symphonic as trademarks. The first radios manufactured for or by Wholesale Radio as listed in Volume 1 of *Rider's Perpetual Troubleshooting Manual* are AC-operated screen-grid TRF (Tuned Radio Frequency) types typical of the times.

Lafayette "Music Mates" Hi-Fi amplifier and tuner along with Lafayette LA-23 broadcaster and microphones.

Some radios were manufactured for Lafayette by other companies such as Wells-Gardner. The same chassis was often used for a number of different models. The 1934 *Rider* Volume 4, in its miscellaneous section, makes the first mention of the name Lafayette Radio and Television Corporation. Four superhet models are listed, three of which are the lower-end "hot chassis" AC-DC versions and one a transformer-operated version. Those again were typical sets for the time, in the middle of the Depression.

Wholesale Radio grew during the tough times. An ad in the *New York Sun* in November, 1931 touts "Replacement parts of every description for all model receivers are available at lowest Wholesale prices," adding, "Write for big Tenth Anniversary catalog."

The 1932 catalog claims, "Our business runs into millions of dollars per year," quite a statement during the height of the Depression. A 1934 catalog notes that, "12 years have passed through good times and bad times." During those years some major radio manufacturers went under. Their excess inventory could of course be made available through catalog sales.

Not all investments worked out. In 1932, Pletman and Leonard Welling purchased the CeCo Manufacturing Company from Ernie Kauer. CeCo was a tube manufacturer licensed by RCA. Apparently, the purchase did not prove profitable. According to Henry Davis, author of *Electrical and Electronic Technologies: a Chronology of Events and Inventors*, "they moved their company to France where it was soon taken over by their attorney, leaving them nothing."

Leonard Welling, Pletman's partner in the deal, had in 1930 headed a syndicate that purchased Temple of Chicago, a loudspeaker manufacturer. Welling is described in an April1930 note in *Radio Broadcast* magazine as formerly a New York-based distributor for Majestic Radio.

How long Welling remained in business with Pletman is not clear. However, in 1935 he is not mentioned in an action brought by the Federal Trade Commission (FTC) against Wholesale Radio Service. Apparently the FTC disapproved of advertising radios at "lowest Wholesale prices" for a retail organization.

The FTC Steps in

In the March 22, 1935 issue of Georgia School of Technology's (now Georgia Tech) weekly newspaper, *The Technique*, the Wholesale Radio Service Co. Inc. Atlanta store advertised a "Swell Little 4 tube AC-DC midget. ... List price $18.90. Our wholesale price: $9.45" The ad notes "Wholesale Radio Service Co., the largest Radio Organization of its kind in the world, now has great modern sales rooms in Atlanta. TECH students are invited to avail themselves of the opportunity to buy at our lowest Wholesale Prices – kits, sets, parts and experimental equipment always in stock. Big section devoted to 'Ham Stuff.' All nationally advertised lines. Say, 'I'm from Tech,' and get our wholesale prices."

The FTC brought action against the company in June 1935 for "misrepresentation as to radio prices." Named in the action were Pletman, Samuel Novich and Max Kranzburg. It took Wholesale Radio a while to get the message. A small ad in the February 1937 Boy's Life magazine is headlined, "Buy Wholesale. Free 156 page catalog. Save money on radio sets, electrical appliances, tubes, parts, tools, accessories, etc. Thousands of bargains in our Big, Free radio catalog. Buy from Wholesale and compare."

The FTC action dragged on until May 1941 when the *New York Times* reported "FTC DROPS RADIO CHARGE; Had Accused Wholesale Radio Service of Misrepresentation."

By the time FTC charges were dropped, Wholesale Radio Service had changed its name. A note in *Printer's Ink* in 1939 mentions that "Radio Wire Television Corp. of America is formed at 160 E. 56th St, New York, embracing the former holdings of Wire Broadcasting, Inc., Wholesale Radio Service Co., and other subsidiaries of these enterprises."

An ad in the October 1939 *Popular Science* magazine announced,

"And so today, Wholesale Radio Service becomes Radio Wire Television, Inc. Here is why the name was chosen, word for word. RADIO: With radio broadcasting this company has steadily expanded. It was and is the backbone of our business. Naturally, radio will continue to engage our interests. WIRE: We believe the new technique of broadcasting by wire will one day encompass the transmission of both sight and sound. Every current technological development points toward this end. TELEVISION: Whether tomorrow's televised programs be received by radio or wire, it is our aim to offer the finest services anywhere. Our new name thus embodies those important factors which, in the very nature of things, comprise our business.

"Already several associate enterprises in control of patents relating to the communications field have been merged with this company. Conscious of our great responsibility, plans are even now under way to expand the number of Radio Wire Television Inc. retail outlets."

Author's homebrew Hi-Fi audio amp made with a Lafayette chassis and parts.

The ad lists locations in New York, Chicago, Atlanta, Boston, Newark, Bronx, New York, and Jamaica, New York. Note that "wholesale pricing" is no longer part of the description. The choice of "Wire" as part of the name is interesting. If Pletman were around today, he might have said, "We predicted it. Cable-TV and the Internet now brings 'sight and sound' by wire."

Despite the FTC action, the company continued to grow in the 1930s, keeping up with the electronics industry and typically distributing two catalogs per year, Spring/Summer and Fall/Winter as well as bargain "flyer" catalogs.

The Lafayette-branded radios advertised in the catalogs represented both the low-end, like the four-tube advertised in the Georgia Tech ad, and the very top such as the Wholesale Radio Service 12 tube model L-1 in *Riders* Volume 3, and the 24 tube set shown on the cover of the 1937 catalog and described inside. *Consumers Union Reports* reviews of radios and consoles including those from Lafayette had some "Not acceptable" (due to bolts from the hot-chassis AC-DC set protruding from the bottom of the cabinet) and a couple of "Best buys." This was the norm for Lafayette, marketing sets from the low-cost end up to the much higher quality level.

Lafayette and Amateur Radio

Lafayette developed its own ham radio division. One example is a transmitter that was written up as an article by Frank Lester W2AMJ*, Chief Engineer for the Transmitting Division of Lafayette Manufacturing Co., in the December 1936 *Short Wave Craft* magazine. The article, titled, "The 25 Watt Junior Transmitter," notes that the Trutest transmitter uses the same circuit as the "now-popular Lafayette P46 transmitter. The circuit was chosen for simplicity of construction and operation, as well as its sure-fire performance. The circuit consists of the Les-tet oscillator buffer or doubler..." The "Les-tet" circuit was named after Lester himself. A type 53 tube was used as oscillator, a 56 as buffer/doubler and a parallel pair of 46 tubes for RF output. For more on the Trutest 25 watt Junior, see K2TQN's excellent column in the May 2010 *QST* magazine.

The 1937 catalog has a complete description of both the 25 watt Junior and the larger P46A, a handsome rack-mounted 30 watt output transmitter which sold for $49.50 plus cabinet, tubes and crystals. A matching modulator, the B46, was available for $39.50 plus tubes and an antenna tuner, model 46A sold for $19.95. The catalog notes that the transmitter is conservatively rated and was tested at higher outputs.

For television, the company sold a simple mechanical TV in 1932 called the "See-All" Television Kit advertised as, "The Most Successful Low Priced Televisor on the Market." Just six years later, Wholesale Radio is named as the distributor for the all-electronic, 16 tube TV kit with a 5 inch CRT (cathode ray picture tube) produced by Garod.

Still more Name Changes

The 1933 catalog cover is headlined, "Lafayette radios and Trutest parts." Despite the longer corporate names at the bottom of the catalog covers, the name Lafayette Radio was prominently featured on the top of most of the catalogs. Lafayette Radio Manufacturing Company is listed as the manufacturer of the ham radio transmitters just mentioned. The 1939 Spring/Summer catalog has both Radio Wire Television Co. Inc. and Lafayette Radio Corporation named on the cover.

The New York-area based Lafayette Radio apparently split off from its Chicago and Atlanta partners during World War II. The Atlanta-Chicago part of the organization had the name Lafayette Radio Corporation while the New York area (including Boston) kept the Radio Wire Television name. There were two distinct catalogs in 1942, both numbered 87, one from Radio Wire Television Inc. naming New York, Bronx, Newark and Boston as locations. The other 1942 catalog lists Lafayette Radio Corporation and only the addresses in Chicago and Atlanta.

Things apparently came to a head in 1945 when the Chicago and Atlanta sides of the organization announced they would no longer be named Lafayette Radio Corporation but would be changing their name to Concord Radio Corporation.

Separate catalogs would continue from both until 1948 when the two sides produced a combined catalog under the name "Lafayette-Concord" billing itself as the "world's largest radio supply organization." That continued for a couple of years and then in August 1951, ads for the new 1952 catalog from Lafayette listed only the New York area and Boston addresses. It marked the end of the Chicago and Atlanta as mail-order addresses for Lafayette Radio. Concord Radio, as a separate entity, is listed in the *Sams Photofacts Index* as a manufacturer of radios right into the transistor era.

I personally became acquainted with Lafayette in the late 1950s. The 1959, 60 and 61 catalogs, typical of their catalogs of that era, had attractive futuristic space-age cover art. It was a true dream book for a school kid with an interest in electronics and I pored over the pages.

My first order was for a VOM meter (measuring volts, ohms, and milliamperes) for the price of $9.95 plus postage for shipping. It was Lafayette's Argonne brand that was made in Japan but worked very well.

1937 Lafayette catalog featured their 24 tube premium radio.

I followed that with an order for a small four-speed turntable with plywood mounting board, a radio-phono adapter switch, and the cheapest stereo tone arm offered by Lafayette, also Japanese-made, all so I could listen to records through an old Philco console I had repaired. But I really wanted a separate audio amp.

A few months later, I ordered an aluminum chassis, knobs, a red-jeweled pilot light, some resistors, and a tube. That, along with other parts stripped from a couple of dead radios went into a homebrew hi-fi amp. The push-pull 6V6GT amp came from an article I had seen in a 1958 *Radio-TV Experimenter* magazine. I later built an Eico signal tracer kit ordered through Lafayette. My Lafayette catalog dreams-turned-to-reality were limited by the amount of money I could earn on my paper-route.

Reliance on Japanese Imports

Lafayette relied on Japan for many of their branded offerings, much more so than their competitors such as Allied Radio. All seven of the Lafayette-branded shortwave and ham receivers in my radio collection are made in Japan. Fred Osterman's *Shortwave Receivers Past and Present*, third edition, lists 19 Lafayette radios, all of which were made in Japan with the exception of the KT-135 Explor-Air, a three tube regenerative kit.

My Lafayette KT-195 Wireless Broadcaster kit and 1957 vintage "Music-Mates" LA-40 amplifier and LT-40 tuner were also made in Japan. Even some items that Lafayette manufactured in the U.S. used Japanese parts such as the S-meter on my 1961 vintage HE-20A Citizens Band radio.

Lafayette and CB Radio

Lafayette apparently foresaw the growth of CB radio in the 1960s and wanted to spur sales. It even offered free QSL cards for CB users. However, the FCC ruled in July 1964 that "A Citizens radio station shall not be used for engaging in radio communications as a hobby or diversion, i.e., operating the radio station as an activity in and of itself."

Lafayette wanted to sell CBs and petitioned the FCC for a temporary injunction on that rule on the basis of free speech, but in April 1965 the FCC denied the petition.

The 1971 catalog announced Lafayette's Golden Jubilee 50th anniversary. Abraham Pletman in "A Message from our Founder" states, "This year Lafayette has reached an important milestone – our 50th year in business – and we wish to share the celebration of this occasion with you who have helped make our success possible."

In August 1973, the *New York Times* reported the passing of Pletman. His estate held over 325,000 shares of Lafayette Radio Electronics stock. He did not live to see the beginning of the end for the company he founded.

In 1973, the federally-imposed 55 mph speed limit caused a sudden spurt in CB sales that began a national craze. From a total of fewer than one million CB users before 1973, the FCC suddenly saw half a million license applications each month. CB users also started to use "handles" rather than FCC issued call letters to the point where use of a license became unenforceable.

Over 10 million CBs were in use by January 1, 1977 when the FCC expanded the band to 40 channels. Lafayette, which claimed to have the world's largest selection of CB sets, and other manufacturers had made millions prior to that date in 23 channel CB sales. But all that came to an end. Exactly one year later, the FCC banned the sale of any new 23 channel sets that did not meet the tougher type-acceptance standards required for the new 40 channel sets.

Those type-acceptance standards were also not communicated quickly enough. That meant a mad rush in 1977 to sell the 23 channel sets that were already in stock or in the manufacturing pipeline. The FCC-created "perfect storm" resulted in huge numbers of 23 channel sets being sold at well below cost combined with the reluctance of the public to buy the more-expensive-to-manufacture 40 channel sets. A number of CB manufacturers never recovered. Lafayette losses were reported to be in the millions.

A Downward Spiral

During the 1970s Lafayette also invested heavily in 4 channel stereo sound. However, there were competing standards, none of which took hold and Lafayette again lost money. At the same time, a company called Radio Shack was expanding its network of local stores across the nation with electronic offerings very similar to those of Lafayette. In addition, Hi-Fi chain stores sprang up in major cities taking the high-end market share.

Lafayette started opening company-owned local stores but was late getting into that market segment. The summer 1965 catalog shows twelve company owned stores, all in New York, New Jersey, and Massachusetts, except for a new one in Maryland just outside of Washington, D.C. They had the beginning of a national reach with 148 associate store locations in 42 states and Puerto Rico. The 1971 catalog shows 40 company-owned stores. The 1972 catalog shows 53 company-owned stores and notes that there are 260 associate stores, which were individually owned. By 1975 the catalog mentions "over 100" company stores but does not indicate the number of associate stores. In 1965, you needed from $10 to $30,000 to open one and by 1975 the quoted cost increased to $40 to $75,000. In comparison to the few hundred Lafayette company and associate stores, Radio Shack grew to over 7,000 stores. Lafayette filed for Chapter 11 bankruptcy protection in January 1980.

Responding to an inquiry I made via the on-line Antique Radio Forum, Pete WA2CWA, who worked for Lafayette, supplied a first-hand perspective of the end of the company:

"When they went Chapter 11… roughly 60 stores of the now roughly 125 (company owned) stores were closed immediately. At our store, we had 48 hours to tear the entire store down, get everything boxed that had a valid and current stock number, and get it on a truck to take it back to Syosset (Lafayette's Long Island warehouse). Anything that wasn't on the official inventory sheets was to be discarded.

"Shortly after this (1981), Lafayette Syosset had a huge warehouse and tent sale on their property to dispose of all the inventory which included not only Lafayette finished goods, but all the parts and assemblies related to them; test equipment, warehouse equipment, fixtures, etc. Tons of stuff to grab and buy at below cost prices, but hours to wait to pay for the stuff. They were not prepared for their version of the 'electronic Oklahoma land rush.' During this final period, associate stores were not allowed to order or return merchandise back to Lafayette. The bankruptcy actions left them high and dry as far as Lafayette material was concerned."

The year 1981 marked the end of Lafayette Radio in Chapter 11 bankruptcy with subsequent sale of its New York area stores to a company that would soon become known as Circuit City. Now, whenever I see a piece of Lafayette gear, my mind goes back to those earlier years of drooling over their catalogs. Regardless of how good or bad the Lafayette device is, I have this desire to check it out and dream some more.

*For a great read on Frank Lester W2AMJ (later W4AMJ), see his story in the summer 1997 *Quarter Century Wireless Association Journal* available on-line at: **www.qcwa.org/summer97.htm**

About the Author:

Richard Post's interest in electronics and radio started at age six when a friend showed him how to light a bicycle bulb using a worn lantern battery. As a teenager he repaired radios and TV sets. He passed the exam for a First Class FCC license when he was told he needed one to repair his CB. He later received his amateur radio license as KB8TAD. Rich now holds a University Emeritus title having retired from Ohio University as Assistant Dean and Director of the Instructional Media and Technology Services. One of his hobbies is collecting and restoring "boat anchors." He maintains the web site Boat Anchor Pix at ***www.ohio.edu/people/postr/bapix***

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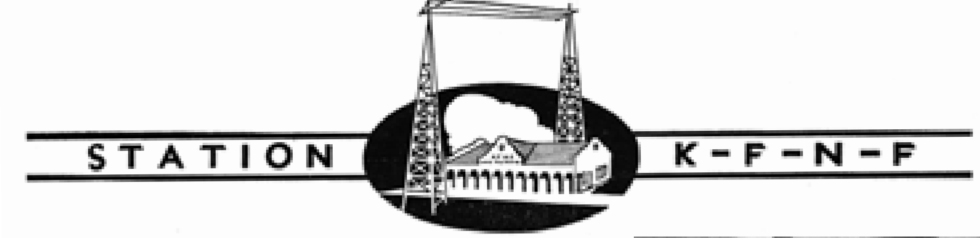
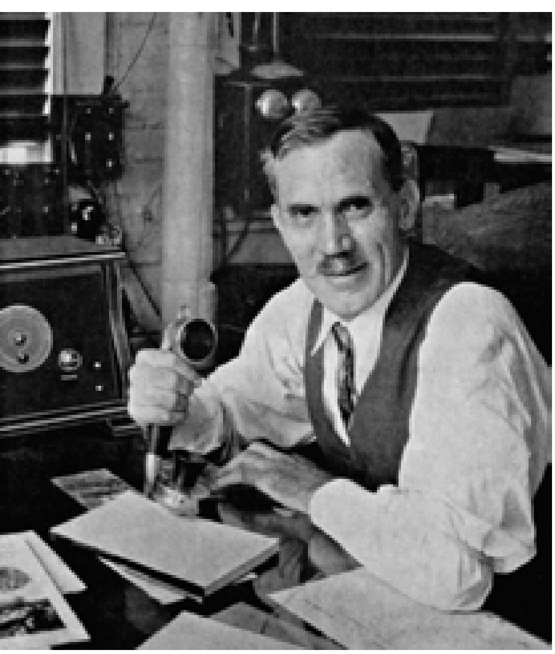


The Rise of Seed-Selling Radio Stations

By John F. Schneider W9FGH
(Photos courtesy of the author)

In the beginning years of radio broadcasting, in the 1920s, the rural Midwest was home to a number of unique and quirky radio stations that enjoyed wide attention and listenership. The story of Doc Brinkley's KFKB in Kansas is one well-known example. Others include Norman Baker's KTNT in Muscatine, Iowa, and WOC at the Palmer School of Chiropractic in Davenport.Then there were the Friendly Farmer stations; KMA and KFNF, of Shenandoah, Iowa.

In the beginning decades of the last century, the small town of Shenandoah (pop. 5,000) was the mail order seed and nursery capital of America. There were more than ten active nursery companies operating from the fertile valleys of southwest Iowa, one of which was the Henry Field Seed Company. Henry Field, the company's owner and namesake, was a plain-spoken, informal area farmer who had developed his burgeoning seed business from scratch, starting in 1899. By 1923 his business had grown to employ 600 people housed in a three story brick building on the north end of Shenandoah.



Henry Field was the owner of the Henry Field Seed Company in Shenandoah, Iowa. He built KFNF in 1924 to publicize his company's products.

In 1923 Field was part of a group of Shenandoah citizens who travelled to nearby Omaha to promote their hometown over radio station WOAW (later WOW). The live program consisted of old time fiddle music, hymns, and a talk by Field about the advantages of living in Shenandoah. It proved to be popular with the WOAW audience, and so the station invited the group to come back, and they made several more trips to Omaha in the ensuing weeks.

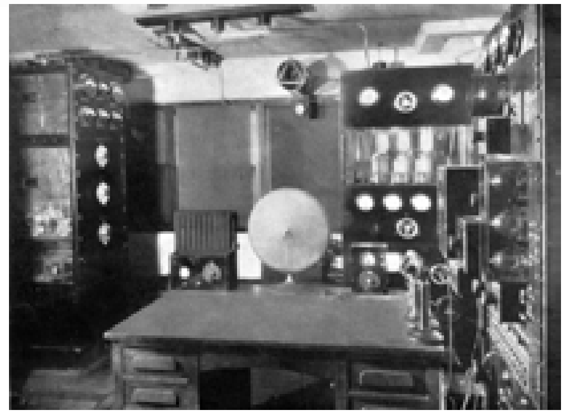
Another one of the participants in the WOAW programs was Field's biggest local competitor, Earl May of the May Seed Company. May moved to Shenandoah in 1919 and bought out the small Armstrong Seed operation. He had a friendly, folksy personality that appealed to the area's farm customers, and he expanded his business by hawking seed, baby chicks, canned and dried fruits and frozen fish.

It didn't take long after broadcasting the weekly programs on WOAW before both Field and May were bitten by the radio bug. They recognized the potential for promoting their own businesses with the wide reach of the amazing new communications medium.

Field was the first to take action by constructing his own radio station in Shenandoah. He raised two 218 foot towers adjoining the Field seed house to support a horizontal wire antenna, and installed a new 500 watt transmitter in the building. On February 24, 1924, the first broadcasts were heard from KFNF, the "Friendly Farmer Station." Field's programs featured talks on agriculture and poultry, old-time music, religion and folksy homespun philosophy with Field himself as KFNF's main announcer.

With the relatively uncrowded AM band and static-free nights of radio's early years, KFNF's signals were heard clearly throughout Iowa and the adjoining states. Midwest farmers liked his homey "Missouri English" colloquialisms and friendly manner; they felt comfortable ordering merchandise from a radio voice they felt they could trust. The result was that his mail order business grew quickly, stimulated by its newfound radio fame.

Three blocks away, Earl May sat in his office contemplating his competitor's success. He was still making the long and sometimes arduous trip to Omaha for the WOAW broadcasts each week, but he needed a physical radio presence in Shenandoah. So, in June of 1924 he installed a remote studio in the May Company building as an origination point for his weekly WOAW broadcasts, connected with Omaha over a 66 mile telephone line.



A view of the KMA transmitter room in the Mayfair building in Shenandoah, 1928. A Western Electric 1-B 500-watt transmitter is at the left rear and a home-brew standby transmitter is at the right rear. The audio control panel is at the immediate right, adjoining the operator's desk.

With the expanded schedule of Shenandoah programs on both stations, the musical and speaking talents of as many of Shenandoah's citizens as possible were paraded in front of the microphones. There were fiddling contests, religious services, talks on agricultural topics, and live music by such groups as the "Cornfield Canaries" and the "Seed-House Girls." In reality most of the performers were drawn from the staff of the seed companies themselves.

Earl May, owner of the May Seed Company in Shenandoah, was Henry Field's biggest competitor. He built his own station, KMA, just three blocks away from KFNF. May's descendants still operate KMA, providing a full-service radio voice for southwest Iowa.

A 1929 postcard view of the Gurney Seed and Nursery Company in Yankton, South Dakota. The WNAX studios were located on the third floor of this building.

The mail order seed and poultry business of both companies quickly grew as a result of their new radio publicity. With his own station, Field was the biggest benefactor. Tourists from the area started arriving in Shenandoah to see the radio station and meet the people behind the voices they heard nightly through the clear Midwest air, and so Field began conducting regular tours of KFNF and his seed company.

All the while his business boomed. In 1927, his company sold 55 carloads of tires, 60 carloads of paint, 490,000 pounds of coffee, 20 carloads of dried fruit, 51,000 radio tubes, 204,000 yards of dress goods, 60,000 pairs of ladies stockings and 21,000 suits. He even started selling his own brand of "Henry Field's Shenandoah Super Six" radio receivers.

Finally, upstaged by the greater success of his competitor's fully functioning broadcast station, Earl May decided that his remote broadcasts were no longer good enough. In the spring of 1925, he applied for and received a license to build his own 500 watt station. The first broadcast over KMA was heard on September 1, 1925, and in the week that followed, 175 people performed in front of the KMA microphones for the dedicatory broadcasts.

Initially May broadcast for only a few hours a day, sharing his frequency with another station in Le Mars. (KMA and KFKN later shared time on the same frequency before each receivedits own full-time channel.) Nonetheless, in its first few months, KMA received reception reports and telegrams from all 48 states, Hawaii, New Zealand and Australia. KMA called itself "The Corn Belt Station in the Heart of the Nation." And the radio formula that had been so successful for Henry Field quickly worked its magic on Earl May. The distribution of his mail order seed catalogs increased by a million names in KMA's first year on the air, and his business soon grew to over a million dollars a year.

The two little radio stations were turning Field and May into well-to-do businessmen, and the two seed companies were putting Shenandoah on the map. Both stations were being operated as publicity organs for the seed companies, and they carried little or no direct advertising. All programs were live, featuring homespun, country entertainment and information.

The Mayflower Trio was one of the many local musical groups that performed daily on KMA, as seen in this 1926 studio view. Most of the KMA and KFNF musicians and singers were in reality employees recruited from the staffs of the two seed companies.

Both nighttime signals reach out across the Midwest and the stations developed a huge following. In fact, in 1925 Henry Field won Radio Digest magazine's popularity contest that declared him the "World's most popular announcer," beating out big city names like Graham McNamee for the honor. Earl May won the same award the following year.

About 1926 the dirt highways leading to Shenandoah were finally paved, making it possible for more people to drive to the tiny Iowa community to do business in person with the famous seed houses. Both stations were now conducting tours on a regular basis and in that year the stations recorded a combined total of 40,000 visitors.

This is an interior view of the elaborate KMA Mayfair auditorium. It seated an audience of 1,000 people, who could watch the broadcasts through the three-ton plate glass window separating the theater from the on-stage studio

Henry Field's response to this new throng of visitors was to build his own KFNF studio building, a one-story Spanish stucco building at the south side of Henry Field Seed House Number 1. The new KFNF building featured an auditorium where visitors could sit in pew-style benches and view the broadcasts in the large draped studio through a plate glass window. A dining room and kitchen in the rear was used for serving coffee and sandwiches to visitors. Both stations soon installed grand pianos and large pipe organs in their studios for live music broadcasts.

Not to be outdone by his competitor, Earl May constructed an even larger and more elaborate auditorium studio across the street from his seed company headquarters. The massive Mayfair auditorium was decorated in a Moorish motif with two minaret towers. The auditorium seated 1,000 people, and the studio/stage was separated from the audience by a 7 x 22 ft. sheet of glass weighing three tons that could be lowered into place to provide sound isolation. It was thought at the time to be the largest single sheet of glass ever made. The theatre was decorated in the style of a Moorish garden, with miniature electric lights in the blue ceiling canopy giving the impression of a starry night sky. May's investment in KMA now totaled $90,000 for the station and another $100,000 for the auditorium. His operating costs exceeded $1,000 a month with no advertising revenue. All of this was supported by his booming catalog seed business.

Visitors were now flocking to Shenandoah by the thousands every week to see the live broadcasts, tour the radio stations and seed company warehouses. They left carrying souvenirs, catalogs and lots of merchandise. The few hotels in town soon filled to capacity, and so Field built a row of cabins to provide additional housing for the visitors. Field also constructed an arcade shop, soda fountain, and even a KFNF filling station to accommodate the visitors.

Meanwhile, May built a miniature golf course called May fairways. Both companies established branch trading post stores in Shenandoah and many other communities around the Midwest. They sold seed, poultry, cream, eggs, and general merchandise of all kinds. Earl May opened thirteen "Trading Post" stores around the Midwest, while Field opened seven stores in other cities. And all of this thriving business was being driven by radio.

Each station also celebrated a Shenandoah fall "Jubilee" weekend, which drew huge crowds to watch the live radio broadcasts and eat free pancakes. The KMA Radio Jubilee

D.B.Gurney's brother, Ed Gurney, broadcasts over WNAX from the Gurney Seed and Nursery Company studio in 1929.

started in 1925 and took place every year into the early 40s. Its first jubilee drew 25,000 visitors, and the following year the Earl May Seed and Nursery Company's business quadrupled. KFNF frequently held its Jubilee on the same weekend as KMA, which grew into a super festival with carnival rides and exhibits. By 1930, the attendance had grown to 439,200.

Radio in the 1920s had turned this small Iowa village into a boomtown, but the 1930s were another story as the Great Depression began to weigh on Midwest farmers' businesses.

The Jubilee attendance fell to 85,000 in 1933, and it remained at that level for the remainder of the decade. Henry Field's large stocks of merchandise became devalued, and his radio catalog orders fell precipitously. Unlike the early years, the radio dial was now full of stations hawking products of all kinds, and the Shenandoah stations were no longer a novelty.

Bonds which Field's company had issued in 1930 to finance his business were foreclosed on in 1933. He lost control of the seed company, which was reorganized as the Henry Field Seed and Nursery Company, but continued in the role of president of the seed company and radio station even after his retirement in 1938. For his part, also needing new capital, Earl May sold 25 percent of KMA in 1939 to the Central Broadcasting Company, which owned WHO in Des Moines and WOC in Davenport, Iowa. A new corporation was formed, May Broadcasting Company, to separate the radio and seed businesses.

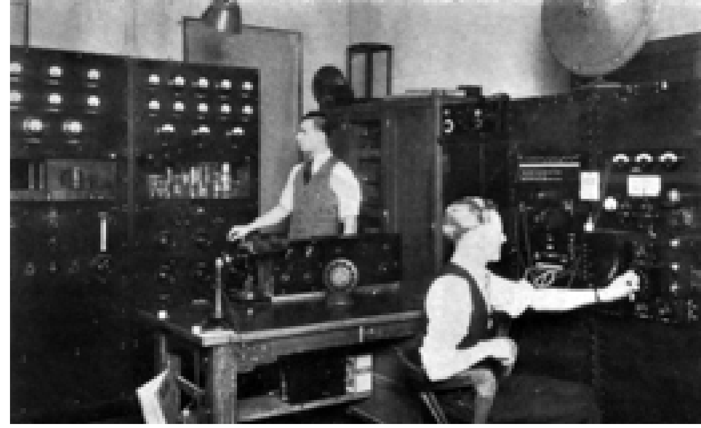
Earl May died in 1946, and the operation of KMA was turned over to other May family members. Their descendants continue to successfully operate both the radio station and nursery to this day. Henry Field died in 1949. At the time of his death, his company had regained its prominence and grown to annual sales of over $3 million a year. It was sold and merged several times in succeeding years, but still operates today under the same name as a part of Scarlet Tanager Holdings in Indiana. KFNF is now known as KYFR 920, and the KFNF call letters belong to an FM station in Kansas.

In 1963 the May family moved KMA out of the drafty Mayfair auditorium into a smaller, more modern radio facility across the street. The auditorium had become an expensive white elephant and it was finally demolished in 1966. KMA continues to operate as a successful regional broadcaster; a 5 kW station on 970 kHz with a 100 kW FM sister station, KMA-FM.

WNAX

It's said that the best form of flattery is imitation. If that's true, then Field and May must have been flattered by the new radio activities taking place in neighboring South Dakota in 1927. The Gurney Seed & Nursery Company in Yankton, South Dakota was another important Midwest seed house in the early 1920s. Its owner, Deloss Butler "D. B." Gurney, took note of the fact that his biggest competitors in Shenandoah were having great success because of their use of radio.

His son, John Chandler "Chan" Gurney, convinced him that he should buy WNAX, a defunct Yankton radio station license. After completing the $2,000 purchase, Gurney put WNAX back on the air from his personal residence on February 28, 1927, while new studios were being built on the third floor of the Gurney building. Two 60 foot towers were raised on the seed house property to support the antenna, and a home-made 1,000 watt transmitter on the station's favorable 570 kHz frequency gave WNAX a coverage radius of about 50 miles from 7:00 AM to 6:00 PM daily. The voices heard on WNAX included D.B. Gurney, George W. Gurney, "Chan" Gurney, Phil Gurney and Ed Gurney - it was clearly a family operation.



A view of the WNAX 1,000 watt transmitter and control desk in 1929.

In addition to its seed and nursery business, the Gurney building housed a third floor grocery store, barber shop, clothing store, jewelry store, restaurant, photo studio and a paint and hardware department. The new WNAX studio was located in this third floor mall, enclosed in glass and with seating for a large viewing audience.

Another important Gurney business was their chain of 578 gas stations operating in five states during the Depression. His WNAX "Fair Price" gas stations sold gasoline blended with corn alcohol (known as "Alky" gas) for as little as 17 cents a gallon - well below market prices and a welcome savings to cash-strapped farmers.

In 1936 WNAX built a modern showplace two-story transmitter building and tower five miles east of Yankton. WNAX continues to operate from this building today. In 1943 it added a new 927 ft. tower, which was the country's tallest radio tower at the time. The tall tower, combined with its favorable 570 kHz frequency and excellent ground conductivity, gave WNAX one of the best regional signals in the country.

In 1938, Chan Gurney ran for a seat in the U.S. Senate. He used the WNAX air waves to promote his campaign but denied equal time to his opponent. This resulted in a complaint to the F.C.C., which announced they were not inclined to renew the WNAX license under Gurney ownership. As a result, the station was sold in 1938 for $200,000 to the Des Moines Register and Tribune Company, the owner of three stations in Des Moines and Cedar Rapids, ending the Gurney family's decade-long radio adventure.

In 1936 WNAX built this modern two-story showplace transmitter building and tower five miles east of Yankton, which is still used by WNAX today.

Radio as a business was a conundrum for many in the 1920s. On one hand, the public was enthralled with this latest form of home entertainment, and it clamored for more and better quality radio programs and stations. On the other hand, direct advertising was frowned on by both the public, and the government radio spectrum regulators which made it clear that it would not be tolerated. So the universal question was, "How do you make money with radio?"

The most frequent financial justification for early radio broadcasting was the establishment of stations that served as indirect "goodwill" publicity vehicles for businesses. In the larger cities of this country, that meant radio stations became publicity organs for department stores, newspapers, hotels and automobile dealerships. But the small towns in the wide open spaces of rural America were also entitled to enjoy radio broadcasting, and different kinds of businesses were needed to support these rural stations. The mail-order seed and nursery houses of Shenandoah and elsewhere proved to be one successful solution that helped bring radio into millions of farm homes in the Midwest and Plains states during radio's first decade.

About the Author:

John Schneider W9FGH is a regular contributor to MT on radio history. He previously wrote "G.E.'s Pioneer Broadcast Stations" which appeared in the July 2012 issue of MT.

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Meet the Antique Wireless Association

By Marc F. Ellis N9EWJ

The Antique Wireless Association (AWA) had its beginnings in 1952 when three good friends with life-long interests in radio communications combined their collections and expertise to establish a small museum in Spencerport, New York. The three were Bruce Kelley W2ICE, George Batterson W2GB and Linc Cundall W2QTY. Kelley provided the barn that originally housed the museum and, after relocating to Holcomb, New York, he reestablished the museum in a roomier carriage house on his new property.

In 1975 the association moved its museum into the former Bloomfield Academy building where it shares quarters with the local historical society; Bloomfield is a suburb of Rochester, New York. About ten years later a separate annex building was constructed in East Bloomfield to house the overflowing museum collection.

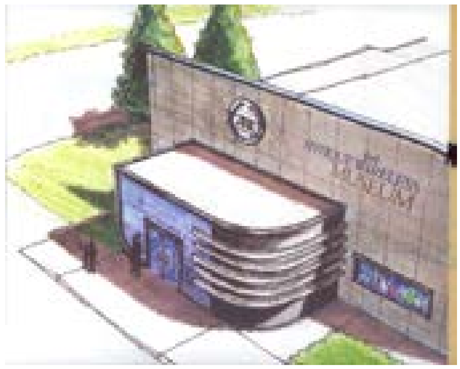
Today the AWA is an international organization of some 2,000 hard core, vintage communications enthusiasts, but its purpose and goals are very much in tune with those of its three founders. The vision of the AWA is to preserve and share the history of the technology used for communications and entertainment from the first telegram to today's wireless text messaging.

The AWA pursues this vision with a variety of initiatives, including operating the world-class museum, maintaining an extensive research library, publishing magazines and books, sponsoring on-the-air ham radio events, in which contacts are made using vintage equipment, and presenting an annual convention. This work is now headquartered in the three building, two acre AWA Museum and Research Campus under development in Bloomfield.

The AWA museum collections have grown exponentially through the generosity of many dedicated collectors. Since space restrictions in the academy building severely limited the percentage of the collection that can be shown at any one time, it became imperative to develop a new, larger, museum facility.

The Museum

Building 1, the new fourth-generation museum building, is being remodeled from a former antique mall with 10,000 square feet of floor space. The initial stage of museum development will open in May 2013 with grand opening ceremonies to be held in conjunction with AWA's annual convention in August



Architect's rendering of the new museum's proposed façade, which was inspired by a Sparton Model 557 radio circa 1936. (Courtesy AWA)

2013. By that time the academy facility, which is now closed, will be completely vacated. Other campus buildings include Building 2, which now houses a library, media center and conference room as well as offices and storage space, and Building 3, which is devoted to repair, restoration, exhibit construction and storage.

The museum collections include thousands of artifacts, many of them rare or one of a kind. The best of these will be shown in the new building. Some exhibits that were popular in the academy are a 1925 radio store; reconstruction of the radio room from the *Titanic;* an early telegraph office; working 1920s amateur spark transmitters; definitive collections of radio tubes, Morse keys and excellent examples of early broadcast radios, TVs, and ham gear.

But the new museum will not be limited to static exhibits. Long range plans for additions to the facility include interactive displays, a theater, and a low-power community FM station that will broadcast vintage programs and news of museum events as well as serving as an educational opportunity for local high schools. For the radio amateurs, there will be working stations of all eras which visitors will be allowed to operate after showing a valid ham license.

Curator Bruce Roloson behind the counter of the museum's 1920s radio store. (Courtesy Richard Neidich)

Library and Media Center

The Max Bodmer Library and Media Center, located in Building 2, is one of the foremost resources for the study of radio and wireless history. Its stacks and filing cabinets contain thousands of books, photos, rare original recordings and A-V materials. The facility is open to researchers by appointment.

Outside the main library area is a multipurpose space that can be set up with chairs and tables in various configurations for such events as board meetings, special classes and meetings of local clubs. A small but well equipped kitchen comes in handy for these events.

The lower level of the building contains a few offices as well as climate-controlled rooms used to house special documents and collections. Among these are the archives of the Radio Club of America, which have been entrusted to AWA through a strategic partnership entered into in 2010. The archives go back to RCA's beginning in 1909 and contain documents and records of great importance in the history of radio.

Publications

The association's print publications include *The AWA Journal* (quarterly) and *The AWA Review* (yearly). These publications offer members the opportunity to share their projects, ideas and research. Both are in 5.5 by 8.5 inch format. The *Journal* is a magazine-style publication averaging 68 pages; the *Review* is a bound book, this year's edition containing 296 pages.

Membership in AWA includes a subscription to *The AWA Journal*. In addition to feature articles submitted by members, a staff of volunteer writers contributes about ten regular columns to each issue of the *Journal*. These run the gamut of member interests, including vacuum tubes, telegraphy book reviews, communication receivers, radio restoration, reproducers, television and transmitters. The *Journal* is also used to communicate with members about the association and the events it sponsors.

The AWA Review contains scholarly articles that are much lengthier than those in the *Journal*. It is edited along academic lines, with all articles validated through a

This vintage Western Union telegraph office was a popular exhibit at the Bloomfield museum facility. (Courtesy Richard Neidich)

peer review process. Thanks to a long-term commitment by an anonymous donor, the review is sent out free of charge each year to all AWA members.

A recent addition to the AWA family of publications is *The AWA Gateway*, a quarterly electronic publication available on line and free to all. This is an outreach publication, containing basic articles intended to stimulate the reader's interest in the field of wireless and radio communications. It averages 15 pages in 8.5 by 11 inch format and contains basic-level articles covering all areas of radio collecting, restoration and history.

Now under study is the establishment of a new publishing initiative: *The AWA Press*. It is anticipated that the *Press* will, from time to time, release full-length books of special interest to the community of vintage communications enthusiasts.

AWA maintains three web sites for publishing information of various kinds:

www.antiquewireless.org provides information about the organization to the general public, serves as a site for the distribution of *The AWA Gateway*, and advises members of upcoming association events. The site includes a printable membership application as well as a PayPal link which can be used to join or renew electronically.

www.antiquewirelessmuseum.com supports AWA's developmental activities and includes information about association goals and ways in which individuals can contribute to them.

www.awaconference.com becomes active a few months in advance of AWA's annual convention and is used to accept on-line registration and release late-breaking news about upcoming convention activities.

The Annual Convention

The AWA annual convention, held near Rochester, New York, is a very special event. It has all of the usual ingredients of a large antique radio meet including talks and presentations, old equipment contest, banquets, an auction and a flea market. At the AWA convention these features have a scope and depth hard to find in any similar meet. This year's convention, the Association's 51st, was a good example. The dual theme of this five day event was an observation of the 100th anniversary of the Titanic disaster and a salute to the Collins Radio Company.

These two themes were picked up by many of the approximately 30 seminars and presentations. Other topics in addition to the dual themes for this year's convention included military radio; radio broadcasting; West Coast radio pioneers; key and telegraph; radio restorations; Lee deForest and talking pictures; development of TV at RCA; pre-1912 apparatus, and amateur radio operations.

The 25 categories specified for the Old Equipment Contest included some special ones related to the Titanic and Collins themes. The Old Equipment Contest is a friendly competition in which members can exhibit their restoration projects, prize acquisitions or historical research. It offers convention attendees an amazing opportunity to see rare and fascinating equipment and ephemera.

The formal members' banquet was only one of the several tempting culinary opportunities spread out over the convention schedule and available at reasonable cost. A special dinner, open to all attendees, honored those attending from other countries. The Ladies' Luncheon was also open to all, as was the Collins Collectors Association banquet, an all-you-can-eat buffet. Finally, the annual pizza party/dance was free to all attendees.

The last few conventions have included a "Movie Night" program where attendees could relax, snack, and watch films related to vintage radio and/or the convention theme. This year's event featured some of the rarest films dealing with the Titanic ever screened. Other regular features, available during the entire convention, included the flea market (which this year operated around the clock); the "Book Fair," in which dealers in both used and new books relating to vintage communications showed their wares, and an operating vintage amateur radio station.

The stacks and filing cabinets at the Max Bodmer Library and Media contain thousands of books, photos, rare original recordings and A-V materials.(Courtesy Richard Neidich)

An intangible, but very real, feature of every AWA convention is the opportunity for fellowship and the sharing of knowledge. Year after year, members return to Rochester to visit with old friends, make new ones and generally immerse themselves in every aspect of the vintage communications hobby.

The Vintage Ham Radio Events

Every year the AWA sponsors four events in which ham radio operators get on the air and contact each other using vintage equipment. Points are awarded to each operator for contacts made and there is a friendly competition to see who can come up with the highest score when the results are published in *The AWA Journal*. The four events are the *Linc Cundall Memorial CW Contest;* the *Amplitude Modulation QSO Party,* the *John Rollins Memorial DX Contest* and the *Bruce Kelley Memorial CW QSO Party*.

The *Cundall* contest takes place on 160, 80 and 40 meters and is designed to favor those with low power and equipment constructed before 1946. Many participants take the opportunity to fire up their World War II surplus equipment for this contest. The AM QSO Party is run on 160, 80, 40 and 20 meters. There is no restriction on the power level or age of the equipment used, but the operating mode must be AM. Extra points are awarded to those who work designated "flagship stations," which are stations using calls or equipment of historical importance.

The *Rollins* contest, which takes place on 40 and 20 meters, is designed to encourage longer-distance contacts and equipment constructed before 1960. The *Bruce Kelley* contest is the original AWA amateur radio event. It was instituted by Bruce Kelley, an AWA founder and the original curator of the museum, and continues as a memorial to him. The contest is run on 160, 80 and 40 meters. It is for those who like to build and operate self-excited transmitters of the 1920s such as the Hartley oscillator. The transmitter design, and the tubes used, must predate 1929. The receiver may be modern.

Share the AWA Vision

The AWA is celebrating its 60th year in 2012 and remains firmly committed to its vision. If you are not already a member, please consider joining us by going to our web site at **www.antiquewireless.org** for a membership application or a PayPal donation. On the site you'll also find interesting general information about AWA and you can browse through all of the *AWA Gateways* that have been released so far. The annual dues are $25 ($30 for international members). Also be sure to mark your calendars for next year's AWA convention and grand opening of the new museum which will take place August 20 to 24, 2013 in Rochester, New York. MT

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

Scanner Terminology

As we grow older, feelings of nostalgia often become more common. We remember successes and accomplishments of the past but tend to forget difficulties and shortcomings. For listeners dealing with the complexities of modern radio systems, the desire for the "good old days" when scanning was simple seems widespread. This month we'll take a look at some of the major developments driving that complexity and see how some of those difficulties and shortcomings have been overcome.

Hello Dan,

My apologies for this "basics" email message. I have probably been monitoring scanners for over 55 years and have an Extra Class amateur radio license, but I have just recently returned to the scanning hobby. Boy, has it changed. I bought a Uniden BCD996XT recently in anticipation of my local county going to P25 trunking soon. I've got it working on conventional frequencies, but I am trying to read and learn the new terms used. Examples, but not all, are LCN, DEC, AFS, FEC AND IMBE. There are more.

I have not discovered any articles or books that explain these terms, meaning and how they all fit in. I believe that I have a general idea of how trunking works, but draw a blank when these type of terms pop up.

I've searched Signal Harbor, Radio Reference, and elsewhere with no luck. I would greatly appreciate it if you can point me to a good source of information.

Thank you,
Jerry in Texas

I have to agree with Jerry that there is currently no good single source that explains all of the terms and acronyms associated with modern scanning. There are a number of resources that touch on many of the concepts, but putting it all together can be quite a challenge. It's a far cry from fifty years ago, when single-channel receivers and crystal-controlled scanners ruled the marketplace.

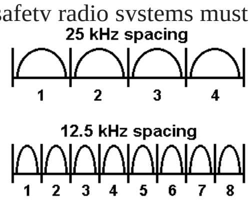
One of the most significant long-term driving forces in public safety radio has been a concept known as *spectral efficiency*. Federal regulators and manufacturers have worked to increase the number of users that can operate over a limited amount of radio spectrum. Putting more conversations into the same amount of bandwidth makes better use of a limited resource. It's as if a restaurant was trying to serve an ever-increasing number of customers in a dining area that had a fixed number of tables. The restaurant manager has to find a way to fit more customers into smaller spaces and devise better strategies to share tables among groups of customers.

❖ Narrowbanding

Fitting more users into smaller radio channels has been underway for some time, although it has occurred in distinct steps. The historic allocation of VHF (Very High Frequency) channels that were 60 kHz in size, common in the 1950s, gave way to 30 kHz channels as radio technology improved, allowing two conversations to take place in the same amount of bandwidth where only one could before. Not so long ago, these 30 kHz channels, in turn, were split into pairs that were 15 kHz wide.

As before, better technology provided an increase in efficiency that led directly to more radio users in the same amount of bandwidth. In the UHF (Ultra High Frequency) band, the old 50 kHz channels were split into two 25 kHz channels, and now the Federal Communications Commission (FCC) is splitting each of them into 12.5 kHz channels. This process is called "narrowbanding" and the FCC is mandating that certain types of users with licenses in the 150 MHz to 174 MHz (VHF) and 421 MHz to 512 MHz (UHF) bands, including public safety agencies, operate on the narrower channels beginning in January 2013.

According to FCC regulations, all equipment that has been certified since 1997 for operation in these bands is capable of functioning within 12.5 kHz channels. Administrators who operate public safety radio systems must program the radios to actually do so, but the process is typically straightforward (although it can be logistically complicated for agencies that have a large number of radios). A bigger problem arises with older equipment that is not certified or technically able to operate within the confines of the narrower channels. Such equipment cannot be used after January 2013, unless the system operator has a legal waiver from the FCC. It will be interesting to see how many agencies still have old, outdated equipment and how lenient the FCC will be when such equipment remains in use.



The FCC also warned license holders that the 12.5 kHz channels are only temporary. In their 2008 order, they stated: "We reiterate, however, that 12.5 kHz is a transitional step in the eventual migration of PLMR (Private Land Mobile Radio) systems to 6.25 kHz technology." So, expect that when the technology improves enough to reliably support conversations in these even more narrow channels, the FCC will make such operation mandatory.

So, over the course of Jerry's radio career, we've gone from one user in a 50 kHz UHF channel to squeezing four users in that same bandwidth. The FCC is expecting to fit eight users there in the not-too-distant future. How we get there is a matter of technology.

❖ Frequency Synthesis

As electronic technology improved in the 1970s, two inventions made their way into public safety radios (and scanners). The first was a device called a frequency synthesizer, which for the first time allowed a radio to be rapidly tuned to any arbitrary frequency within the capability of the synthesizer. Prior to this time, portable radios typically had either adjustable tuning coils, which often drifted out of tune, or they used plug-in piezo-electric crystals, which vibrated at a single, specific frequency. If you wanted to operate on, say, four different frequencies, you needed to have four tuning coils or four crystals, and more importantly, you had to decide on the exact four frequencies beforehand. You could not easily, quickly or accurately change those frequencies in a fleet of radios once they went out into the field. Also, if you wanted to use more channels than you had coils or crystals, you were out of luck.

Once frequency synthesizers became inexpensive enough to put into mass-produced products, manufacturers could sell identical portable radios with the ability to rapidly and accurately tune to any frequency within the coverage band. No coils had to be adjusted and no crystals had to plugged in to make this possible.

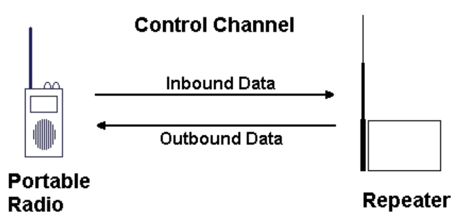
❖ Microprocessors

The second invention from the 1970s was the microprocessor. The synthesizer was great, but it needed something to tell it what frequency to tune to and when to do so. A microprocessor could be programmed to control various parts of the radio hardware. It could also be programmed to execute tasks based on short instructions. By using a data channel between a repeater site and a radio, a computer at a base station could instruct the radio's synthesizer to tune to a specific frequency at the appropriate time. If the controller sent such an instruction to several radios at the same moment, the base station computer (called a "controller") could get all of these radios to operate on the same frequency at the same moment. With the frequency synthesizer and the microprocessor, the fundamental pieces were in place for trunking.

❖ Trunking

The data link between the radios and the controller is called a "control channel" because it carries instructions that control the operation of the radio. There are actually two control channels, one that is broadcast from the controller out to all of the radios (called the *outbound*) and another that goes from the radio back to the controller (called the *inbound*). In most trunking systems the controller uses the outbound channel on a full-time basis, continuously transmitting instructions and information. Radios take turns sharing the associated inbound channel when they make a digital request or send a response.

Because the signal strength from a repeater site is so much greater than the signal from an individual radio, scanner listeners usually monitor transmissions from repeater sites. This means your scanner is designed to monitor the outbound control channel.

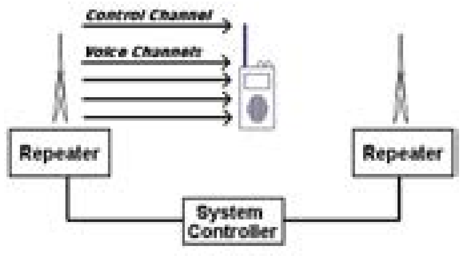


When a public safety radio is idle it is tuned to the outbound control channel, listening for instructions from the controller. The radio's microprocessor examines each instruction coming across the outbound control channel, looking for ones that are directed to it individually or to any of the talkgroups to which the radio is a member.

A typical instruction from a controller will include a talkgroup number and a channel number, telling every radio that a talkgroup is active on a channel. When the radio's microprocessor finds an instruction for a talkgroup to which it is a member, it looks up the channel number in a reference table and sends the corresponding frequency to the synthesizer. This causes the radio to tune to the channel on which the talkgroup conversation is taking place.

Trunk-tracking scanners mimic the operation of the public safety radio, monitoring the outbound channel for instructions that mention talkgroups of interest. When one is found, the scanner uses a similar channel reference table to tune to the proper voice channel.

Astute readers will note that when the radio tunes to the talkgroup channel it is no longer tuned to the control channel and thus cannot monitor instructions from the controller. Nonetheless, the controller still has a data path to the radio. In trunked systems that carry voice in analog format, the controller injects a low speed stream of data using subaudible tones that are not heard by the user. The microprocessor examines the stream for instructions, including ones that command it to tune back to the control channel or to a talkgroup of higher priority. In digital trunked systems, there is already a digital stream of data flowing from the repeater site to the radio, so the controller simply adds instructions to the existing stream.

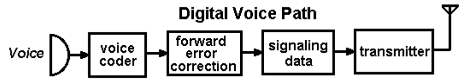


Trunked Radio System

❖ Digital Voice

As the microprocessor evolved and specialized computing circuits like the digital signal processor (DSP) came on the market, it became possible to encode the human voice into a stream of digital information, send that information via radio, and turn it back into sound on the receiving end. Although digitized voice goes back to World War II, the miniaturization of electronics in the past twenty years has made it feasible and affordable to put the capability into handheld, battery-powered devices.

The conversion of human voice into a digital data stream is done with a device called a vocoder (voice encoder-decoder). There have been a number of vocoders developed over the years, newer ones generally being better than older ones, based on two important criteria. The first is *intelligibility*, meaning, how understandable the voice is when it's turned back into sound. The second is *data rate*, indicating how much digital data the vocoder produces to represent a given amount of speech. The two criteria are typically tradeoffs, where better intelligibility comes with a higher data rate. Since the available data rate is always limited in radio systems, there is a great advantage in finding vocoders that produce good intelligibility at relatively low data rates.

Digital Voice Path


APCO Project 25 systems use a vocoder called IMBE, short for Improved Multi-Band Excitation. It was developed by Digital Voice Systems, Inc. (DVSI), a commercial company based in Massachusetts. In the P25 Common Air Interface (CAI), IMBE produces pretty good intelligibility with a data rate of 4,400 bits per second of speech. By comparison, a normal GSM cellular telephone call, which also carries voice in digital form, requires a data rate of 12,200 bits per second.

❖ Error Correction

Radio channels are noisy places. Listening to analog transmissions reveals hiss, pops, crackles and other impediments to clear reception. That same noise has the ability to confuse a digital receiver and cause it to flip some bits in the data stream, mistaking a ‘0’ for a ‘1’ and vice versa. Since the goal of the digital receiver is to produce the exact data stream sent by the transmitter, these potential mistakes must be detected and corrected when they occur.

In human conversations, if we’re listening to someone and we couldn’t hear what he or she said, we typically ask them to repeat themselves. This helps us, but it interrupts the speaker and slows down the conversation for everyone else who is listening.

Radio systems carrying digital voice do not typically have the ability to stop and repeat parts of a data stream that a radio might have missed or received incorrectly. Instead, in order to help a receiver overcome noise in the channel, a common technique is to add *forward error correction* (FEC) to the data stream. Digital error detection and correction grew out of a mathematical field of study called information theory and is essentially a set of specially constructed redundant data that allows the receiver to identify and correct errors that might occur during the reception process.

FEC comes in many forms and is used in daily life. For instance, the barcode on the label of products in the grocery store uses error correction; the 12-digit Universal Product Code (UPC) has one digit set aside just for detecting and correcting potential errors that might occur during scanning. Books have an International Standard Book Number (ISBN) that includes a check digit, again just for the purpose of confirming that the entire number is correct.

FEC algorithms to protect digital voice are much more complicated than these check digit schemes, but it is based on the same idea. The bits from the output of the vocoder are analyzed and a corresponding set of FEC bits is generated. The vocoder bits and the FEC bits are combined into the data stream and transmitted.

At the receiver, the data stream is run through an error correction mechanism where the vocoder and FEC bits are mathematically checked against each other. Any bits that might be in error are fixed and the original vocoder bits are turned back into sound.

Of course, it is possible that there is so much noise in the channel that the digital receiver makes too many mistakes and overwhelms the ability of the FEC to correct them all. The error correction mechanism will recognize this situation and react appropriately, typically blanking the audio to produce silence rather than garbled speech.

❖ Johnson County, Texas

Jerry lives in Johnson County, which is located between the cities of Fort Worth and Waco in northeastern Texas and covers about 730 square miles. The county has a population of about 150,000 and is considered to be part

of the larger Dallas-Fort Worth Metroplex.

Public safety radio in Johnson County provides an excellent example of the modernization process we’ve been discussing. Within the county are traditional, conventional analog radios, a trunked system carrying analog voice traffic, and a new all-digital trunked network. The Johnson County Sheriff’s Office and a number of local police departments use conventional (non-trunked) VHF radios that are dispatched by the Sheriff’s Office on 158.745 MHz. You will find that nearly all of the law enforcement agencies in the county use VHF and have programmed their radios with each other’s dispatch frequencies. This makes mutual aid and interoperability much easier, since officers from one agency can communicate directly with personnel from other agencies.

Frequency	Description
152.9300	Cleburne Public Buses
153.7850	Alvarado Police Department (Dispatch)
153.8900	Alvarado Fire Department (Operations)
154.0550	Keene Police Department
154.0925	Alvarado Fire Department (Dispatch)
154.1450	County Fire (Dispatch)
154.4225	County Fire Operations (Main)
155.0100	Cleburne Police Department (Dispatch)
155.1450	Cleburne Fire Department (Dispatch)
155.2950	County Fire Operations (East)
155.4150	County Fire Operations (North)
155.6400	Rio Vista Police Department
155.6550	Joshua Fire Department
155.6625	County Sheriff (Dispatch East)
155.7150	County Courthouse
155.7450	Cleburne Public Works
155.9625	Keene Police Department (Dispatch)
158.7450	County Sheriff (Dispatch West)
158.9400	Keene Fire Department (Dispatch)
453.9500	County Jail
462.1750	Careflite Emergency Medical Services

❖ Logical Channel Numbers

The town of Burleson, population 36,000, operates a Logic Trunked Radio (LTR) system that provides coverage for parts of both Johnson and Tarrant Counties. Because of the way an LTR control channel sends instructions, system frequencies must be programmed into the scanner in specific locations, called Logical Channel Number (LCN) order. When an LTR system assigns a frequency for use by a talkgroup, the controller transmits a message on the outbound (repeater site to radios) control channel which includes that frequency. However, instead of sending the actual frequency, say “482.5250”, the repeater sites sends the LCN, in this case “05”. When the radio receives the assignment message, it looks up “05” in the channel reference table and finds that it corresponds to 482.5250 MHz.

This numbering technique reduces the amount of information that has to be carried in the control channel, allowing messages to be delivered more quickly. Because the message is shorter, it also reduces the possibility of bit errors during reception. However, this scheme requires that the repeater site and every radio in the system have the same association between the LCN and the actual frequency. In order for your scanner to track the system, it must have that same set of associations.

LCN	Frequency
01	482.9875
02	Not Used
03	Not Used
04	Not Used
05	482.5250
06	Not Used
07	Not Used
08	Not Used
09	482.6750
10	Not Used
11	Not Used
12	Not Used
13	482.6500
14	Not Used
15	Not Used
16	Not Used
17	482.5500

Although the system operates using only five frequencies, they must be programmed into your scanner in the proper memory locations as specified in the list, specifically at locations 1, 5, 9, 13 and 17. The instruction manual for your scanner will explain how to program LTR systems properly.

❖ Johnson County goes Digital

Jerry’s letter refers to a new 700 MHz Project 25 system being built in Johnson County. It came on-line in September and is simulcasting (simultaneously broadcasting) from two repeater sites, one in Cleburne and the other in Alvarado. Each repeater site transmits on the following frequencies: 769.08125, 769.34375, 769.59375, 770.11875, 770.36875, 770.61875, 770.86875 and 771.18125 MHz. A license modification is pending to add a third repeater site to the system, located in Crowley, which will operate on the same eight frequencies.

You can find more information about scanners, trunking and digital radio systems on my web site at **www.signalharbor.com.** I also welcome questions, comments and reception reports via email at *danveeneman@monitoringtimes.com.* Have a peaceful holiday season and a happy new year, and until next month, keep reading, keep learning, and keep scanning!

ASK BOB
GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *I have a Tecsun PL-360 radio that uses 3 AA batteries for 4.5 volts. Can I replace one of the AA batteries with a "dummy battery" to use 2 AA batteries instead of 3 without damaging the unit internally? Will thus bringing the voltage from 4.5 volts down to 3 volts affect the performance of the radio? (Dean, email)*

A. The flip answer is that if they wanted it to operate at a lower voltage, they would have made it for two batteries. I decided to test a Tecsun PL-660 by taking out one of its four AA batteries; it worked normally for a few seconds, then displayed the low battery alert and went dead. That was for a 25 percent reduction in voltage. Your radio minus one battery is a 33 percent reduction in voltage, much more severe. I suspect it wouldn't work at all.

There's another reason why you wouldn't really be gaining anything. If it's capable of operating at the lower voltage, it won't do so for long; the low battery status will shut off much sooner, meaning that you would be replacing two batteries that had merely dropped a little of their voltage far more frequently than you would three batteries starting at the correct voltage and eventually dropping down to the low voltage.

Q. *Is there any difference between speaker wire and regular zip cord (AC lamp cord) other than the clear insulation and (I think) lower price? Is this simply marketing? (Mark Burns, Terre Haute, IN)*

A. Yup, marketing and some legal considerations. 120 VAC zip cord (lamp cord) has to meet crucial safety standards to avoid fire and electrocution, while speaker wire doesn't since audio voltages are so low. From an audio standpoint, zip cord makes great speaker wire, and you don't need widely-advertised, heavy-duty cable unless you're running thousands of watts into hundreds of feet of wire!

Q. *I have a Grundig G3 to which I just added an 80' long wire antenna coupled with a WiNRADiO long wire. Unfortunately, a 1,000 watt AM tower is located about 1300 feet away, and the radio is severely overloaded throughout the shortwave broadcast bands. Would a PAR 7th order elliptic high-pass filter likely do the job? (Bill, W1WH)*

A. I would suggest two things, the first of which is to shorten the long wire to about half its current length. With today's radio sensitivity levels, wires no more than 30 feet work just fine for shortwave reception.

The second would be to direct the axis of the wire exactly toward the broadcast antenna, minimizing its signal pickup from that direction. Still, such a behemoth signal may well need further attenuation, and the PAR filter (**www.grove-ent.com/FTRHPFDS.html**) should do it.

Q. *How do remote antenna-mounted preamps allow both the signal and the operating voltage to be fed directly through the coax without the operating voltage damaging the receivers and scanners to which they are connected? (Mario Filippi, N2HUN)*

A. Radio frequency energy can't get through an RF choke coil, and DC can't get through a capacitor. The DC is fed from the power supply to the remote amplifier through an RF choke coil, isolating the radio frequency signal on the coax. The radio frequency signal is tapped from the coax with a capacitor, thus preventing the DC from appearing at the receiver's antenna terminal.

Q. *What causes the bluish-white corrosion on a car battery's positive terminal? (M.B., email)*

A. The battery is filled with sulfuric acid which is actually a solution of hydrogen ions (positively charged molecules) and sulfate ions (negatively charged molecules). Seepage of this battery acid coats the surface between the battery posts, conducting a minute electrical current between those terminals.

Since opposite charges attract, the negative sulfate ions migrate to the positive terminal. Here they combine with the lead to form lead sulfate (the white fluff) and with the copper wire to form copper sulfate (the bluish fluff). The hydrogen molecules simply evaporate, that's why we don't see any deposit on the negative terminal.

Q. *I have been experimenting with in-line preamplifiers at the receiver end of a long coax run. The GRE Super Amp gives me a nice increase in signal strength. I have tried three other models that give me no gain, or even a loss. Are the amplifiers desensitizing the receiver? (John, K2AZ)*

A. I suspect one or more of these possibilities:

1. The high gain is providing signal levels driving your receiver down because of its limited dynamic range (desensitization).
2. Some local signals are so strong they are de-sensing the preamps.
3. The noise figure of the preamps is greater than that of the receiver.
4. The cable length drops signals down so far that your preamps are boosting the noise along with the signal.
5. The three preamps are actually defective.

Does the loss occur at all frequencies or just certain ranges? To work best, a preamp should be located remotely at the antenna itself to overcome cable loss. This is especially important with long cable runs, and cables with poor loss characteristics like RG-58/U.

Q. *I'm making a small indoor shortwave antenna for the first time. The radio I have has a 3.5 mm mini external antenna jack. Should the jack I use have 2 lines meaning a "stereo" plug or a jack with 1 line meaning "mono." (Dean, email)*

A. The terms mono and stereo descend from the early days of electronic music amplifiers. Monophonic meant just one speaker and/or microphone, and stereophonic meant two in order to give left and right definition to the reproduced performance as if you were in the concert hall.

A mono plug has two wires attached, the barrel (ground) and the tip. A stereo plug adds the third wire, the ring. All antenna leads (transmission lines) have two wires; with coaxial cable, that would be the shield (ground) connected to the barrel of the plug and the center conductor connected to the tip. Chances are the external antenna jack on your radio is mono rather than stereo.

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

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

Is Short Wave Dead?

A recent series of letters to this column concerns "the end of short wave." This is not the first time. High frequency (HF) radio, below 30 megahertz (MHz), has been given up for dead by someone or other at least once a year ever since the migration of most point-to-point and ship-to-shore circuits to satellites.

The gloom and doom increase every time an HF station closes down, and that's quite often nowadays. The casualty list for 2012 is quite extensive, notably in broadcasting, which continues its post-Cold War decline.

By now, anyone outside the situation who sees all these dire prophecies must think that the HF band has fallen silent. It's quite possible that the public, when they think about it at all, regard it as a spectrum museum. For them, HF is probably 27 MHz of atmospheric noise, with only the occasional stray ham, all ready to be turned over to power-line computer networking.

If this were the case, however, this column would be a lot shorter. Fortunately, no one has told the various private, government, and military customers, legal and illegal, who continue to buy equipment for this "dead" band. They must be doing something with it.

❖ Peeling the Onion

A long time ago, someone explained to this editor how stations come in layers. The top layer is the 20-over-s9 broadcasters and maritime stations, designed by legendary engineers to circle the world with mighty waves easily received on just about anything. These use simple amplitude modulation (AM), or only slightly more complicated single sideband voice.

Most people associate "short wave" with this layer. They tune around, looking for the familiar voices and music from the sky, find only a few, and conclude that yes, HF is dead. However, what is dead is the majority of the huge old stations in this layer.

With somewhat more time and patience, one learns to unearth the lower layers, which remain as plentiful as ever. These go down through the stations which require a little work, to the ones that require a lot of work, to the ones so far down in the noise that human ears will never pick them up.

Fortunately, machines often will. It really is quite remarkable how good today's tools are. Even a decade ago, much of what today's hobbyists take for granted was the cutting edge, known only to highly trained professionals working for major intelligence agencies.

The fact remains that there is insufficient evidence to "kill off" HF radio at this time. It's not dead. It's just evolving.

❖ What's Happening on MARS?

No, not the planet, although that is awfully interesting, I'm referring to the U.S. Military Auxiliary Radio System. Fairly recently, the name was changed from "Affiliate" radio system, and the mission appears to be changing as well. This isn't your father's MARS. It's a widely dispersed operation supporting some pretty heavy-duty Federal activities relating to national security and emergency preparedness (NS/EP).

Right now, an interesting frequency pair is 10150 and 14484 kilohertz (kHz), upper sideband (USB). A large number of MARS stations conduct periodic exercises in which they identify as SHOWDOWN plus three figures.

These stations pass messages to one another, and sometimes they use their regular MARS call signs as well. Often they work a loud base station identifying as DESERT EAGLE. Other call signs continue with the Western-movie images. TOP HAND, HORSE TRADER, and POKER FACE have been heard here.

It's anyone's guess what all this is about. However, certain characteristics do suggest an interoperability training activity with active-duty military, having definite national security implications.

From old Westerns, we go to old World War II movies, with the following message, copied here in September. It was on 10180 kHz, sent in standard, continuous-wave (CW), Morse code: "ALL STATIONS DE AAZ AAZ BT [break sign] GREEN WHITE BLUE RED SIERRA WHISKEY BRAVO ROMEO BT AR [end of message] SW SW SW SW SW SW [unknown]." The meaning of this message, if it even has any, is a complete mystery. It was sent twice, and the rest was silence.

AAZ is almost certainly the U.S. Army MARS station at Fort Huachuca, AZ. This base has a long history in Army communications. Its current activities include the 11th Signal Brigade, the 111th Military Intelligence Brigade, and operations pertaining to the Joint Interoperability Test Command (JITC).

❖ Budget Cuts Silence AFN

Quite a few people listen to the American Forces Network (AFN) on HF. It offers a wide variety of news, music, and sports programming. It is all commercial-free, except for public service announcements, Department of Defense "spots," and special fillers.

This content is distributed by the American Forces Radio/TV Service (AFRTS), a U.S. military unit headquartered at Fort Meade, Maryland. The actual broadcasts, however, originate in Southern California, at the March Air Reserve Base near Riverside.

At one time, the radio programming went out on powerful HF feeders, audible worldwide, for retransmission to the military by local stations. All of this shifted to a satellite net, and an encrypted one at that. U.S. Navy vessels even got their own service, called Direct-To-Sailor (DTS), with selectable channels. Everyone figured that was the end of AFRTS on short wave.

Then came a pleasant surprise, when the Navy decided to supplement the DTS by rebroadcasting one of the audio channels on HF. This came hot off the birds, over four large Navy stations. It was intended both as a backup, and as a primary service for non-DTS vessels or listeners in remote locations on land.

These broadcasts were available for many years, until August of 2012, when the two loudest transmitters in the United States abruptly vanished. Those who are wondering what happened can wonder no more. As usual, it's about funding. The service is yet another victim of the budgetary issues common in this economic condition.

The loudest signal in the continental U.S. had been available around the clock, from a transmitter in Florida. It was one of many at the Naval Radio Transmitter Facility on Saddlebunch Key, near Key West. The AFN web site now lists it as "decommissioned." The second most reported station, at Pearl Harbor in Hawaii, is now shown as "out of service for an indefinite period."

At least at press time, AFN is still available from Diego Garcia, in the Indian Ocean. It's on 12759 kHz upper sideband (USB) in local daytime and 4319 kHz USB at night. It also continues from Guam, on 13362 kHz day and 4319 night. Let's hope that at least these stay on the air.

❖ UVB-76 Resumes Low Buzz

Those missing the old Russian "Buzzer," on 4625.0 kHz, were pleased when it returned, only a few days after last month's column went to press. It had been replaced by a similar type of sawtooth wave about an octave higher, turning the buzzer into a beeper.

As we now know, these odd noises are a channel marker for short, coded, voice messages in Russian. These are likely some kind of command-control broadcasts for unknown military assets, possibly strategic forces.

UVB-76 is a convenient name for this station, but nobody is completely sure what its true call sign is. Quite a few of the messages have a designator "MDZhB," where the Zh is a Cyrillic character in variant, Russian-language, radio phonetics. However, MDZhB shows up on other frequencies. It seems to be tied to the specific messages. It's probably a callup of some sort, or a joint call for a whole type of assets, rather than a station identifier.

There have been a few more voice message flurries on this station. The messages are in a standard format, and always seem to come in bunches. They are often interestingly timed, creating speculation on whether some world event is the cause. One thing everyone has learned, however, is that speculation on this station is a most unrewarding process.

ABBREVIATIONS USED IN THIS COLUMN

AFB................Air Force Base
ALE................Automatic Link Establishment
AM................Amplitude Modulation
ARQ.............Automatic Repeat reQuest
Campspac........Communications Area Master Station, Pacific
CW................On-off keyed "Continuous Wave" Morse telegraphy
DHFCS...........UK Defence High-Frequency Communications System
DSC...............Digital Selective Calling
E07................Russian intelligence English numbers
FAX................Radiofacsimile
FM.................Frequency Modulation
FSK................Frequency Shift Keying
HFDL.............High-Frequency Data Link
HFGCS...........High-Frequency Global Communications System
ID..................Station identification
LSB.................Lower Sideband
M03...............Unknown agency, usually CW 5-figure groups
M18...............Russian CW time strings, possibly Kazakhstan
M89...............Chinese military CW coded/group call signs
MARS............U.S. Military Auxiliary Radio System
Meteo.............Meteorological; weather office
MFA...............Ministry of Foreign Affairs
MX.................Generic for Russian single-letter beacons/markers
NAT...............North Atlantic air route control, families A-F
Navtex...........Navigational Telex
NDB...............Non-Directional Beacon (Aero).
NOAA...........U.S. National Oceanic and Atmospheric Administration
Pactor............Packet Teleprinting Over Radio, modes I-IV
RTTY...............Radio Teletype
S28................Russian strategic "buzzer" and short voice messages
Selcal.............Selective Calling
Sitor...............Simplex Telex Over Radio, modes A & B
UK.................United Kingdom
Unid..............Unidentified
U.S. ....United States
USAF.............U.S. Air Force
USCG............U.S. Coast Guard
V02a.............Cuban "Atencion," Spanish 3x150 format
V13...............Taiwan "New Star," music and numbers in Chinese
VC01.............Chinese voice-chip "female," can last hours
Volmet............Scheduled, formatted, aviation weather broadcasts

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

516.0 YWA-NDB, Canadian Forces Base Petawawa, Ontario, CW ID at 0330 (Mario Filippi-NJ).
518.0 "A"-USCG, FL, Sitor-B Navtex weather forecast for the Gulf area, with warnings for hurricane Isaac, at 0401 (Filippi-NJ).
526.0 ZLS-NDB, Stella Maris Airport, Bahamas, CW ID at 0329 (Filippi-NJ).
3391.0 EDED-Possible Russian military, coded message including "EDED QSX E1" *[listening on frequency E1? -Hugh]*, in hand-sent CW, at 0301 (Filippi-NJ).
3476.0 Gander Radio-NAT-F, working Delta 106, at 0254 (Filippi-NJ).
3883.0 Unid-Russian Intelligence "Pseudo Time Station" (M18), continuous CW local time strings like "0032" and "0033," at 1732 (Ary Boender-Netherlands).
4235.0 NMF-USCG, Boston, MA, FAX schedule at 0301 (Filippi-NJ).
4332.0 4XZ-Israeli Navy, Haifa, fast CW sending of a coded message in 5-letter groups, similar on 11591, at 0312 (Filippi-NJ).
4489.0 ETSO-Russian military, CW checks with S7WF, IRWP, and W51O, using 3981, at 1800 (MPJ-UK).
4553.5 ZLST-German Customs Control Post, Cuxhaven, ALE followed by data modem with ZJAD, Customs Boat *Jade* (DLVL), at 2130 (MPJ-UK).
4594.0 4XZ, with a "VVV" marker, simulkeyed on 6608, at 0344 (Filippi-NJ).
4602.5 E01-Dutch military in exercise Peregrine Sword 2012, calling E06; similar traffic on 3284.5, 4604.5, 5308.5, 5321.5, 5324.5, 5333.5, 5347.5, 5806.5, 5814.5, 5892, and 7684; ALE at 1947 (PPA-Netherlands).
4604.0 RIT-Russian Navy, Severomorsk, CW traffic with RFK77, at 2016 (PPA-Netherlands).
4605.0 OSN-Belgian Navy, Zeebrugge, RTTY channel availability marker, similar on 5741, at 1045 (Filippi-NJ).
4625.0 "The Buzzer"-Russian military (S28), with Russian phonetic voice message "MDZhB 89 653 TVIN 60 42 84 54," at 1241. S28, message "MDZhB 62 347 UVIDYeNNYJ 06 05 96 83," at 1247. S28, message "MDZhB 53 153 KVIVYeT 12 64 44 84," at 1248 (Boender-Netherlands).
5035.0 MX51-Algerian military, working MX40, also on 6847.5, ALE at 2203 (MPJ-UK).
5201.0 Unid-Russian Air Defense, Moscow region, passing usual CW null-message strings with usual erroneous time stamps, at 1926 (MPJ-UK).
5223.0 Unid-Possible Russian military, fast CW coded message at 0352 (Filippi-NJ).
5224.0 RCV-Russian Navy, Sevastopol, Ukraine, 5-letter group CW traffic for RIP90, at 0343 (PPA-Netherlands).
5260.5 GO4ALD-UK amateur experimental station, CW test of near-vertical incidence sky wave, at 1747 (MPJ-UK).
5330.0 "The Chinese Robot"-Chinese Air Defense, fast-talking machine voice with numeric data (VC01), at 1902 (Boender-Hong Kong Remote).
5418.0 SP1OZ2-Algerian Sonatrach oil company, pumping station #1 on pipeline OZ2, sounding in LSB ALE, at 0402 (PPA-Netherlands).
5616.0 N711WM-Canadair CL-600 bizjet, working Gander (NAT-C), at 0608 (Patrice Privat-France).
5680.0 Kinloss Rescue-UK Royal Air Force, working aircraft at 1921 (Michel Lacroix-France).
5725.0 "U-2-B"-North Atlantic Treaty Organization military trigraph ID, tracking net with XSS, probably UK DHFCS, at 1913 (PPA-Netherlands).
5735.5 LN10701-Unknown military or government, ALE and data traffic with LN10704 and LN10707, at 1809 (PPA-Netherlands).
5782.0 "F-8-G"-German Navy vessel *Bad Bevensen* (M1063/ DREV), tracking net with "Z-7-M," Danish Navy vessel *Absalon* (L16/ HDMS), in joint exercise DANEX Northern Coast 2012, also on 6711.5, at 1027 (PPA-Netherlands).
5785.0 BARI-Italian Financial Police, Bari, working PERISSINOTO, Patrol Boat *Finanziere Perissinotto* (G-213), ALE at 1717 (PPA-Netherlands).
5835.0 "W"-Unknown Russian military marker, also on 8162, both gone at 1822 (MPJ-UK).
5898.0 Unid-Cuban intelligence, AM Spanish machine-voice numbers (V02a), signed "final, final, final," at 0844 (Larry Gotts-KY).
6224.0 Taupo Maritime Radio-New Zealand coastal station, maritime weather broadcast at 0535 (Privat-France).
6390.0 AQP4-Karachi Wireless, Pakistan, CW "VVV" marker at 1800 (MPJ-UK).
6535.0 TAM8062-TAM Linhas Aereas A330 reg PT-MVK, working Dakar (Senegal), at 0605 (Privat-France).
6712.0 4K-AZ81-Azerbaijan Airlines B-767 flight J20854, HFDL position for Reykjavik, at 1947 (MPJ-UK).
6773.0 DRV8-Chinese military, coded CW calling marker (M89) to H2FD, at 1004 (Eddy Waters-Australia).
6825.0 FAV22-French CW practice, Favières, drill messages in 5-letter groups, at 1807 (MPJ-UK).
6865.5 EYA31-Possible Russian military in Tajikistan, calling RTH62 in CW, at 1816 (MPJ-UK).
6873.5 XPG-UK DHFCS mobile, ALE link check and data modem traffic with XSS (control, Forest Moor), also on 14485.5, at 0357 (PPA-Netherlands).
6917.5 "L"-Russian military single-letter beacon, also on 8497.8, CW ID at 1543 (Boender-Netherlands).
7431.5 1CDAAT-U.S. Army MARS, voice call AAT1CD, exchanging ALE text messages with 1DGAAR (AAR1DG), and 1AWAAT (AAT1AW), at 1931 (Jack Metcalfe-KY).
7448.5 "O-6-J"-U.S. Army Continuity of Operations Net, radio check with "Q-8-P," at 1859 (Metcalfe-KY).
7467.0 RIT-Russian Navy, Severomorsk, calling RJP30 in CW, at 0622 (PPA-Netherlands).
7477.0 SEMO05-New York State Emergency Management, ALE sounding at 0606 (PPA-Netherlands).
7480.0 ARCKCMO-American Red Cross, Kansas City, MO, ALE sounding, also on 7697, at 1201 (Metcalfe-KY).
7598.0 "IE"-Partial call of Italian police net control, calling long roll of 2-number call signs in LSB, at 0638 (Lacroix-France).
7626.0 I3BP-Unknown military station, voice and data modem with KAXN, at 0925 (PPA-Netherlands).
7630.0 RDP5-Unknown Russian point-to-point station, ARQ with RMC-27, at 0658 (PPA-Netherlands).

7646.0 DDH7-Hamburg/Pinneberg Meteo, Germany, RTTY identifier and weather for Northern Europe, at 0355 (Filippi-NJ).
7697.0 A08-Dutch military, calling A01, ALE at 1811 (PPA-Netherlands).
7710.0 VFF-Canadian Coast Guard, Iqaluit, FAX chart for Hudson Bay, at 0215 (Filippi-NJ).
7795.0 JMH-Japanese Meteo Agency, noisy FAX weather chart at 1826 (MPJ-UK).
8040.0 GYA-UK Royal Navy, Northwood, FAX weather charts, at 0429 (Filippi-NJ).
8058.6 KWT93-U.S. Department of State emergency net, working KWT90, Frankfurt, Germany, ALE and voice at 0822 (Lacroix-France).
8076.0 RDL-Russian Military, long message in 5-letter groups for unknown station, using FSK Morse, ended "24220 22077 K," at 2020 (MPJ-UK).
8417.5 XSV-Tianjin Radio, China, CW ID in Sitor-A marker, at 1911 (MPJ-UK).
8424.0 SVO-Olympia Radio, Greece, CW ID in Sitor-A marker, at 0307 (Filippi-NJ).
8431.0 TAH-Istanbul Radio, Turkey, CW ID in Sitor-A marker, also on 8434 and 12628, at 0229 (Filippi-NJ).
8431.5 UAT-Moscow Radio, Sitor-B navigation warning for live-fire exercise, at 1915 (MPJ-UK).
8473.0 WLO-ShipCom, AL, Sitor-B broadcast of an election news story, then switching to RTTY for similar, at 1217 (Filippi-NJ).
8492.0 "P"-Russian Baltic Fleet, CW single-letter beacon (MX), at 0436 (Filippi-NJ).
8503.9 NMG-USCG, New Orleans, FAX hurricane Leslie and Michael forecasts, at 0300 (Filippi-NJ).
8682.0 NMC-USCG Camspac Point. Reyes, CA, FAX wind/wave forecast, at 0238 (Filippi-NJ).
8734.0 SVO-Olympia Radio, distorted voice loop with female voice announcement in Greek and English; listening on channels 802, 1232, 1640, and 2217; at 0247 (Filippi-NJ).
8764.0 NMC-USCG, CA, northwest U.S. coastal weather in "Iron Mike" voice, at 0442 (Filippi-NJ).
8789.0 GNXG-M89, calling WITN, also on 10779, CW at 1010 (Waters-Australia).
8819.0 Tashkent-Russian volmet, female in Russian with aviation broadcast, left air early at 1930 (MPJ-UK).
8867.0 Bluebird 154-Pacific Blue Airlines B737 reg ZK-PBD, cleared to FL-380 by Auckland (New Zealand), at 0543 (Privat-France).
8879.0 AIC908-Air India A319 reg VT-SCR, answered selcal AE-GM from Mumbai, at 2003 (Privat-France).
8888.0 Luanda-Angola air control, working flight BAW59, a British Airways B747 reg G-BNLR, at 2030 (Privat-France).
8894.0 N647AV-Avianca flight 261, an A319, HFDL status for station 11, Albrook, Panama, at 0455 (PPA-Netherlands).
8903.0 SAA52-South African Airways A330 reg ZS-SXW, calling Accra, Ghana, at 2014 (Privat-France).
8912.0 FTM-COTHEN remote transmitter, Sarasota, FL, COTHEN ALE sounding at 0524 (PPA-Netherlands).
8957.0 13-HFDL ground station, Santa Cruz, Bolivia, uplink and position check with Avianca flight 75, an A320 reg N821AV, at 0506 (PPA-Netherlands).
8971.0 Fiddle-U.S. Navy, FL, clear and secure with Pelican 711 and 712, mention of exercise with Cherry Point, at 1243 (MDMonitor-MD). Fiddle, working P-3C Wafer 712, at 1410 (Allan Stern-FL).
8992.0 Unknown-USAF HFGCS, echoey male voice with 27-character EAM, at 0202 (Filippi-NJ).
9025.0 PLA-USAF, Lajes Field, Azores, ALE sounding at 1503 (Lacroix-France).
9150.0 Unid-"Strich" family CW numbers (M03), sent "VVV" at 1109, then callup "650/00," at 1115 (Boender-Netherlands).
9153.0 Unid-Female reading message in 3-figure groups in an Asian language, at 1014 (Waters-Australia).
9235.5 HQ703N-U.S. National Guard Readiness Center, VA, calling V030AN and D030EB, no joy on either, ALE at 1950 (MDMonitor-MD).
9276.0 New Star Radio Station-Taiwanese intelligence (V13), Program Three, Chinese music and messages at 0700 (Boender-Hong Kong).
10024.0 Aeromexico 028-Aeromexico B767, position for Cenamer (Central American air control), at 0708 (Privat-France).
10100.8 DDK9-Hamburg/Pinneberg Meteo, RTTY marker at 0254 (Filippi-NJ).
10116.0 Unid-Russian intelligence, AM numbers in English (E07), with callup "201 1 647 109," message in 5-figure groups, ended 000 000, same message earlier on 11062 and 12223, at 1740 (Boender-Netherlands).
10321.0 SC43ADMINLO-U.S. National Guard 43rd WMD-CST, SC, working SCTF1, South Carolina Urban Search & Rescue Task Force 1, ALE at 1750 (Metcalfe-KY).
10460.4 Unid-Pirate station imitating "The Buzzer" ("UVB-76"), buzz and occasional programming in Russian, at 0719 (Boender-Netherlands).
10871.7 "D"-Russian Navy cluster beacon (MX), Odessa/Sevastopol, CW ID at 1945 (MPJ-UK).
10871.9 "S"- MX, Severomorsk, CW ID at 1946 (MPJ-UK).
10872.0 "C"-MX, Moscow, CW ID at 1947 (MPJ-UK).
10872.1 "A"- MX, Astrakhan/ Baku, CW ID at 1948 (MPJ-UK).
10872.3 "K"-MX, Petropavlovsk-Kamchatskiy, also on 13528.3 and 16332.3, CW ID at 0923 (Boender-Netherlands).
10872.4 "M"-MX, Magadan, also on 13528.4, CW ID at 0923 (Boender-Netherlands).
11034.8 Unid-Egyptian Embassy, Pyongyang, North Korea, long ARQ plain text messages, at 2004 (MPJ-UK).
11039.0 DDH9-Hamburg/Pinneberg Meteo, Germany, RTTY marker and weather report in German with Isaac warning, also on 147.3 and 14467.3, at 0351 (Filippi-NJ).
11055.0 RMA2-Unknown Russian station, possibly near Orenburg Oblast, idling in RTTY at 0613 (PPA-Netherlands).
11175.0 Reach 459-USAF Air Mobility Command transport, working HFGCS stations Croughton and then Lajes, who sent the aircraft to 11220 for a patch, at 0025. Offutt-USAF HFGCS, NE, patching tanker Ranger 03 to ops in San Diego, at 2235 (Stern-FL).
11198.4 Unid-North Korean MFA, message in ARQ, no decode, at 0631 (PPA-Netherlands).
11220.0 Reach 459-USAF, came from 11175 with Lajes, then switched again to 6712 for a patch to Hilda Global (Scott AFB, IL), at 0028 (Stern-FL).
11232.0 Trenton Military-Canadian Forces, Ontario, working Canforce 2413, at 1715 (Stern-FL).
11253.0 UK Royal Air Force Volmet, English-accent "female" voice with airport weather observations, at 0301 (Filippi-NJ).
11291.0 COTAM 2350-French Air Force, working Dakar South Atlantic air control, Senegal, at 1935 (Lacroix-France).
11396.0 Jakarta-Southeast Asian air control, Indonesia, selcalling Emirates 4866, an Emirates Sky Cargo B777 freighter reg A6-EFG, at 1645 (Privat-France).
11430.0 V13, Program Four, Chinese music and messages at 0600 (Boender-Hong Kong).
12184.0 RQF-Russian point-to-point station, Moscow area, RTTY for RDI, unknown location, who was duplex on 11585, at 0652 (PPA-Netherlands).
12577.0 319060000-Cayman Islands flag luxury yacht *Siren* (ZCTF6), DSC safety test with Istanbul, at 0939 (Privat-France). *[This 242-foot super-yacht can usually be spotted at the Monaco Grand Prix. -Hugh]*
12579.0 NRV-USCG, Guam, Sitor-B typhoon warnings, at 1504 (PPA-Netherlands).
12581.5 WLO-ShipCom, AL, CW ID in Sitor-A marker, at 0329 (Filippi-NJ).
12599.5 UAT-Moscow Radio, Russia, CW ID in Sitor-A marker, at 0330 (Filippi-NJ).
12629.0 TAH-Istanbul Radio, Turkey, CW marker at 0419 (Filippi-NJ).
12681.0 Amazonas-Possible Brazilian Navy, speaking out a numeric message to Natal, in Portuguese, at 1810 (PPA-Netherlands).
12704.5 JFX-Kagoshima Prefectural Fishery Radio, hand-sent CW marker every 15 minutes, at 1715 (PPA-Netherlands).
12788.0 NMG-USCG, New Orleans, clear FAX tropical cyclone chart, at 1342 (Filippi-NJ).
13101.0 GWPWBL-Brazilian Navy training ship *Brasil*, calling GWPWN33, Natal, at 1942 (PPA-Netherlands).
13152.0 WLO-ShipCom, AL, voice-synthesized female with Pacific weather, at 0803 (PPA-Netherlands).
13212.0 Lockheed Ops-Lockheed Aircraft Company, flight test with Lockheed 5706 over central AL, at 1758 (Stern-FL).
13261.0 JST204-JetStar Airways A320 reg VH-VQF, position for Brisbane, Australia, at 0556 (Privat-France).
13270.0 9V-SLJ-SilkAir A320 reg 9V-SLJ, flight MI0477, HFDL log-on with Hat Yai, Thailand, at 1843 (MPJ-UK).
13303.0 CN-ROZ Royal Air Maroc B737, flight AT0285, HFDL log-on with Canarias, Canary Islands, at 1837 (MPJ-UK).
13306.0 New York-NAT-A, clearing Condor 184 to flight level 370, at 1956 (PPA-Netherlands).
13528.2 "F"-MX, Vladivostok, also on 16332.2, CW ID at 0923 (Boender-Netherlands).
13548.0 Unid-Probably ZKLF, New Zealand, weak FAX chart in progress, at 0340 (Filippi-NJ).
13927.0 AFA5QW-USAF MARS, IN, patching B-2A Death 71 to a number in MO, at 1541 (Stern-FL).
14440.0 2UZ7-Russian military, calling IGLM for CW traffic, at 0702 (PPA-Netherlands).
14484.0 AAA9USA-U.S. Army MARS net control, Ft. Huachuca, AZ, working Showdown 810, MARS special use call sign, then sent Showdown 615 (MARS) to "alternate frequency" (probably 10150), at 1545 (Metcalfe-KY). AAN4YQ-U.S. Army MARS, calling Desert Eagle (control station, possibly also Ft. Huachuca), no joy at 1845 (MDMonitor-MD).
16285.0 STAT151-Tunisian police, linking with STAT12, then Pactor-II e-mail traffic, at 0740 (PPA-Netherlands).
17985.0 VP-BGH-Nordwind Airlines A321, HFDL log-on with Reykjavik, Iceland, at 1845 (MPJ-UK).
21997.0 PR-AVP-Avianca Brazil A320, HFDL log-on with Santa Cruz, Bolivia, at 1945 (MPJ-UK).
22613.0 HLF-Seoul Radio, Korea, usual "listening on 22 MHz" CW marker, at 0249 (Filippi-NJ).
33160.0 Unid Possible Arecibo Car Service, Brooklyn, NY, fast-talking dispatcher in Spanish with occasional brief English, in FM at 2219 (Hugh Stegman-CA).
33420.0 WQDC 703-City of Orlando Office of Emergency Management, FL, identifying in FM with a former (expired) call of its travelers' information station on 1650 AM, running continuous NOAA weather from Melbourne, FL, at 2308 (Stegman-CA).

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

Ocean Sensing Radar Update

It's been many years since I covered radar systems used to gauge ocean currents and wave movements in the column and Hugh's mention of the forthcoming regulations covering these useful systems reminded me that an update is probably due.

Swoosh, Swoosh, Swoosh. What's That?

This is one of the most frequently reported "mystery" sounds on HF radio and probably crops up in questions from listeners at least a dozen times each year on the UDXF (Utility DX Forum) mailing list. This is the sound of the most common ocean sensing radar, manufactured by the Californian company CODAR Ocean Sensors.

In fact, these radars are now so popular, the term CODAR is often used synonymously with ocean sensing radar systems. You can hear CODAR systems, usually their SeaSonde product, in many parts of the world, their most frequently used HF ranges being 4.5 to 5 MHz, 12.2 to 12.5 MHz, 13.3 to 13.6 MHz and 24 to 25 MHz. An audio clip of a CODAR system can be heard by checking the link in the resources section below.

Another popular radar is made by the German company Helzel, whose radar is called WERA, short for Wellen Radar, wellen being the German word for waves. Unlike CODAR's SeaSonde that uses a swept FM waveform, WERA uses a pulse waveform and thus sounds more like a tic-tic-tic-tic-tic than the swoosh. Both radars typically occupy a bandwidth of 50 or 100 kHz. Most SeaSonde's sweep their bandwidth in 500 ms and most WERAs in 260 ms. You can hear a clip of a WERA radar in the Resources section too.

How Do Ocean Sensing Radars Work?

Being saline, ocean water is electrically conductive and can therefore be propagated over reasonable distances by HF radio, often well over 100 miles, and so can serve as an "over the horizon" sensor, beyond the range that microwave systems can operate. HF also has the advantage of being unaffected by fog or rain. Radio waves are scattered in many directions after hitting the rough ocean surface which acts as a diffraction grating.

The Bragg Scattering Principle dictates that energy reflected from ocean waves will return to their source when the wave is half the transmitted wavelength and by a wave that is traveling either directly towards or away from the radar. So, for example, a 13 MHz radio signal has a wavelength of around 23 meters and will therefore produce Bragg scattering in an ocean wavelength of roughly 11.5 meters.

Because the ocean wave is moving, it also has a Doppler shift determined by its speed and by the underlying ocean currents. Now we know the frequency and wavelength of the radar, the wavelength of the ocean wave and Doppler shift based on movement of the waters. If we send the radar signals from two different places on shore but direct them to roughly the same place like a river estuary, bay or piece of ocean coastline, with a bit of digital processing magic of course, we have enough information to measure all sorts of dynamics at play on the water. Aside from monitoring ocean currents and other effects, these radars are also able to detect Tsunamis and other storm-related ocean effects anomalies.

Because of their "local" nature of use, the normal maximum useful range for reliable measurement of the ocean's dynamics are a few tens to a hundred kilometers at most. To do this, most radars use little power and usually a series of short monopole vertical antennas a few meters high, strung out in a line and fed by a phasing network so that the signal processing systems are able to sense different arrival signal times to each antenna and are therefore able to improve the resolution of their measurements.

I say "local" because, as you might expect, like any other signal, these systems use HF radio which means that they are at the mercy of prevailing propagation conditions at the frequencies used. We all know that you can work the world with a modest antenna and a few watts of power on 14 MHz with reasonable conditions, so what's to stop an ocean sensing radar operating on 13 MHz from doing the same? Well, you can't of course, and that is one of the major motivations for the new regulations that Hugh covered in last month's *MT*. To reduce interference between systems, some better coordination is required. Not to mention, a number of these radars have crept into protected amateur radio bands and have caused interference problems in that way.

Where Can I Hear These Radars and Where Are They Located?

Certainly in the U.S. the most popular ranges for SeaSonde systems are 4.5 to 5 MHz, 13.4 to 13.6 MHz and 24 to 25 MHz. There are large chains of systems right along the East coast from Maine to Florida and West coast from Oregon to California using these bands, which you will be able to hear easily at night (best for the 4 MHz systems) and daytime for the higher frequency systems. In fact, many of these ranges of spectrum are not so congested that you will often hear two or three overlapping systems. Most are operated by the marine departments of large university systems. A WERA system operating from either Italy or France is easily audible here on the East Coast and scans from 16070 to 16120 kHz daily.

Over the past year, I've collected details on more than 270 ocean sensing radars covering the globe operating from more than 30 countries, from Australia to Japan to the United Kingdom. If you are interested in a copy or might be able to contribute to filling-in missing details, please drop me a line using the email at the top of this column.

Bonobos Back On The Air!

Just a quick reminder that a gap of almost a half a year exactly passed since I heard the stations of the Max Planck Institute's Congo Bonobo project, as documented here in the March 2012 issue of *MT*. I recently copied plenty of PacTOR-III traffic from the home station DRA65 in Leipzig, Germany and the Congolese research station, 9SD56. Most of the traffic is sent using a compressed format, but at least logins and other details will confirm the sender and receiver in that case, though plain text messages have also been copied. Here's an example of the typical compressed exchanges:

```
[SCSmail 1.2.0.3]–[0B5128C9]–

Welcome 9SD56 to SCSmail Server!
Welcome at the MPI-EVA in Leipzig/
Germany.
Contact: noack@eva.mpg.de

##bin##1|2|103|234|login.pac
```

That's all for this month and have fun with ocean sensors!

RESOURCES

WERA Ocean Sensor Clip **https://dl.dropbox.com/u/301213/WERA_16080kHz.wav**

CODAR SeaSonde Clip **https://dl.dropbox.com/u/301213/CODAR_4820kHz.wav**

Kirk A. Kleinschmidt, NT0Z
kirk@monitoringtimes.com

Solar Cycle Defiance: Meteor Scatter!

Certain things in life achieve clarity only in hindsight. The topic of this month's column is the present solar doldrums and at least one way we can offset the loss and increase our enjoyment of amateur radio, even if these conditions persist for months, years or even decades!

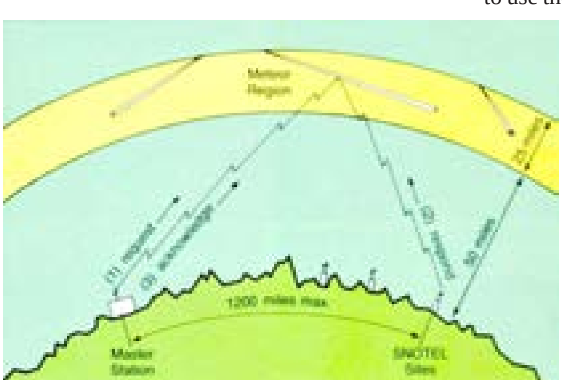
Thankfully, there are many aspects of our hobby that don't depend in any way on the solar cycle. These include foxhunting, local FM and repeaters, home-brewing, etc. The list is long. But for many hams and SWLs, HF DX propagation is what got us into the hobby in the first place, and it's what sustains our interest in it. And HF DX propagation is in pretty bad shape these days!

Simply writing this is sort of bumming me out! And the worst part is, the generally poor HF DX conditions we've been slogging through for the past several years *may last for decades!* More than a few solar scientists are predicting that the sun may be entering a cyclical, yet sustained, period of reduced sunspot activity that may not perk up until 2060 or so! I may have to wait until the summer of my 98th year to experience the day-to-day 10-meter openings I took for granted in my teens and twenties. Dang!

Traditionally, during solar cycle minimums, activity migrates from the high bands to the low bands. We can still do this today. of course, but changes in land use, restrictions, zoning, etc, probably make it more difficult for average hams to put out DX-worthy signals on 160, 80 and, to a lesser extent, 40 meters. Still, if this is where the DX now lives, I want to at least move into the neighborhood!

Digital modes, with their magical signal-to-noise performance, can make up for a lot of poor propagation (on HF and VHF+), and I plan to cover them (PSK31, Olivia, WSPR, etc) in greater detail in future columns.

VHF/UHF weak-signal work is a lot of fun and has never been more popular now that most radios seem to cover at least 6 meters (if not 144 and 432 MHz). I covered 6-meter operating in August and September of 2011, so that's a good place to start if you need a quick refresher. Average ops don't really have a lot of global DX potential on 6 meters, but when the bands are open the action is fun and frenzied, whether stateside, to the Caribbean or even South America. And the Magic Band is mysterious and "different" enough, with wildly varied propagation modes, that it can really hold your attention.



(Courtesy: Natural Resources Conservation Service)

The challenge with 6 meters (2 meters, too) is that when relying on conventional propagation modes such as E-skip, tropospheric ducting and the like the bands are closed more than they're open, and we're still at the mercy of ionospheric and atmospheric conditions beyond our control.

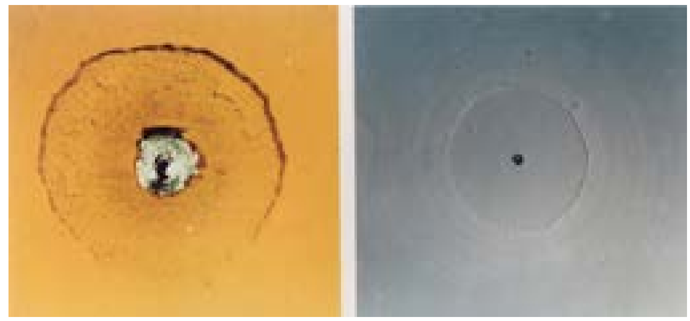
What we need is a reasonable way to use these bands (10, 6 and sometimes 2 meters) without getting too crazy. So, in this probable "first of a series" column about fighting the solar cycle doldrums, let's look at an exotic, yet easily accessible, addition to HF and VHF hamming that's steady, reliable and usable almost every day.

❖ Meteor-Scatter Communications

The concept of bouncing radio signals off of the ionized trails produced by meteors burning through the atmosphere sounds *way out there*, perhaps akin to moon-bounce or old-school satellite operation. But it's not! It takes some study and a bit of patience, but the only tools you actually need you probably have on hand. To get started you need a rig that can cover 10 and/or 6 meters and a typical dipole, loop or small Yagi antenna (and maybe a PC with a sound card for digital modes). No moon-bounce arrays, no legal-limit amplifiers, etc. If you have these on hand feel free to use them, of course (but if you do, chances are good that you have already worked plenty of stations via meteor-scatter). I have made several scatter QSOs over the years, but I'm not an expert. Thankfully, there are plenty of experts out there, and there's lots of good info about getting started.

❖ The Fun is Astronomical!

As the Earth orbits the sun, everything is peaceful on the macro level, but when you get down to the nitty-gritty, the planet is constantly



Long-Duration Exposure Facility (LDEF) in orbit from 1984 to 1990, is pockmarked from tip to tail with impact craters from space junk and micro meteoroids. The impacts shown here (two of thousands) are from a painted aluminum panel . (Courtesy: NASA)

plowing through the orbiting debris streams left by passing comets. Composed of mostly dust and other small particles, this "space junk" burns up as it streaks through the atmosphere. If they're big enough and fast enough, these high-speed particles can punch holes through space station parts and "sandblast" the exteriors of orbiting satellites. Fun!

If you look at photos of the Russian space station Mir as it neared the end of its life you'll see that the station's exterior and all of its solar panels look like they'd been "shotgunned." Junk from Comet Tempel-Tuttle actually killed at least one geosynchronous satellite in the 90s and during many "particle alert days" (meteor showers), project directors at NASA point the delicate front lens of the Hubble Space Telescope at the Earth (and away from the speeding space junk).

The Earth constantly encounters "random debris" as it orbits the sun, but the big-time events, meteor showers, are recurring. The earth plows through specific debris streams at about the same time each year. And, whether produced by random meteors or the more predictable meteors that are part of a recurring shower, nighttime observers see stars streak across the sky.

We see a quick flash, but in the process of burning through the atmosphere (and burning themselves out of existence), the fast-moving particles leave behind long reflective tunnels of ionized particles that—drum roll, please—reflect radio signals! And if two stations on the surface of the Earth can mutually "see" the ionized trails they can communicate with each other by bouncing (scattering) radio signals off of them.

That's the good news. The bad news is that the ionized trails don't last very long. If they did, 10 and 6 meters would be open most of the time, as the earth is constantly being "meteor showered." The meteor-scatter game, then, is figuring out how to take advantage of these ionized trails to make QSOs.

❖ Physics and Geometry

Meteor-scatter QSOs take place mostly on 10, 6 and 2 meters between stations 500 to 2300 km apart. That's a practical maximum of 1400 miles in every direction; much better than an otherwise "dead band." Larger, faster-moving meteors produce more intense, longer-lasting trails and better radio wave propagation. For two stations to communicate via meteor-scatter a meteor (one or more) must pass through the ionosphere in a useful direction and at mutually visible elevations (45 degrees or less is best).

Because they're subtle, fleeting events, typical meteor trails reflect radio waves from a few seconds to a few minutes, depending on the frequency, the size and speed of the meteor (and several other factors). This works best on 10 and 6 meters, where meteor trails can reflect signals for 30 seconds to several minutes (enough for several quick QSOs). At 2 meters, the same meteor burst reflects signals for only a fraction of a second to a minute. Unless you're on the air during a "once in a lifetime" meteor shower, don't plan on rag chewing!

The whole process is eerie. Meteor-scatter signals suddenly appear out of a dead band, persist for a short time, and then disappear! Rarely, when several adjacent ionized trails are scattering radio waves simultaneously (usually only during major events), propagation may persist for several minutes to several hours.

Large meteor showers get meteor-scatter ops *very* excited. The November Leonids shower (meteor showers are named for the constellations in which they appear, Leo, in this case) has produced once-in-a-lifetime radio propagation in years past. Every 33 years or so, when the shower's parent comet Tempel-Tuttle sweeps near the sun, the Leonid meteor shower can become a raging meteor storm.

The last time this happened was in 1966, when observers, hams and otherwise, at various times, saw 150,000 meteors per hour in the night sky! Observers witnessed apocalyptic light shows,

In addition to the operating procedures outlined in *The ARRL Operating Manual for Radio Amateurs*, see the list of web links below for meteor-scatter and WSJT information:

WSJT Home Page: **http://physics.princeton.edu/pulsar/K1JT**
WSJT6 User Manual: **www.physics.princeton.edu/pulsar/K1JT/WSJT_User_600.pdf**
WSJT 9 Supplement **www.physics.princeton.edu/pulsar/K1JT/WSJT_9.0_Supplement.pdf**
ARRL MS Links: **www.arrl.org/weak-signal-vhf-dx-meteor-scatter-eme-moonbounce**
AB7IY MS Links: **www.qsl.net/dk3xt/ms.htm**
NZ3M MS Primer: **www.nz3m.com/wsjt.html**
MS Primer: **www.astrosurf.com/luxorion/qsl-meteor-scatter.htm**
W6AMT MS Links: **www.amt.org/Meteor_Scatter/**
W8WN MS Resources: **www.qsl.net/w8wn/hscw/hscw.html?B1=W8WN**
Shower Calendar: **www.imo.net/calendar**

and in some locations people were awakened in the middle of the night by "bright daylight" streaming in through their curtains! In past centuries, more than one Leonids meteor storm prompted people to assume that apocalyptic events were imminent.

In "The World Above 50 Mc." column of the January 1967 issue of *QST*, titled, "November Leonids—Shower of a Lifetime," columnist Sam Harris W1FZJ, wrote, "By 1100, contacts were being made up to 1400 miles in the whole area from the plains states eastward. Later, the mania was to spread over the entire country, with stations in the central states hearing both coasts. Bursts overlapped and strong pings were superimposed on almost continuous weaker signals."

The same column exactly one year earlier recounted the 1965 Leonids, which was also spectacular. W1FZJ wrote, "Those who arose early November 15-18 were rewarded with meteor-scatter signals the likes of which have never before been recorded in 2-meter history. There were many interstate firsts, with signals staying in for as long as four to seven minutes, readable on voice as well as CW."

❖ Old School Pings and SSB

Two meters sees a lot of meteor-scatter activity, but beginners should start with 10 and 6 meters. Equipment requirements are modest and openings last longer and are more consistent. SSB QSOs, usually made only during meteor showers, can be completed with dipole, vertical and even mobile antennas, but directional antennas often work best. Fifty to 100 watts work well, especially when paired with a small beam antenna.

On 10 meters, perhaps the easiest band to start with, there are no special procedures for meteor-scatter QSOs. Propagation usually last long enough to allow normal, but brief contacts. Limit your transmissions to a few seconds. During meteor showers, try calling "CQ scatter" just above (and or below) 28.5 MHz. If it's rotatable, aim your antenna in the direction you hope to make contacts.

On 6 meters, SSB activity usually starts at 50.130 MHz and moves up. Contacts are quite fast, so be alert! On 2 meters and above, most meteor-scatter work is accomplished via schedules, where each station transmits and receives in coordinated time intervals (more challenging). Most activity centers around 144.2-MHz.

During peak shower periods, try calling CQ on 6 meters for a few seconds, then listen for a few seconds. Contacts are complete when call signs and one other piece of information (grid locator or state) is exchanged and acknowledged by "rogers." Repeats are often required. Keep your transmissions short and stay with the other station until a full exchange of information is made.

Prime time for meteor work is from sunrise to about 9 AM local time, and there are plenty of contacts to be made year-round (especially via FSK441), although June, July and August have the most meteor activity.

It's often impossible to discern meteor-scatter propagation from tropo or E-skip, so there aren't many (any?) specific meteor-scatter awards, but scatter QSOs count for WAS, VUCC and many other awards.

The June VHF QSO Party overlaps the Arteids meteor shower (often a poor performer), and meteor-scatter propagation usually gives a boost to the annual ARRL 10-Meter Contest, which intersects the December Geminids shower. Even when10 meters seems totally dead, morning scatter contacts put at least a few stations in just about everyone's log.

❖ The Digital Day-to-Day

Once the "bread and butter" of all scatter work, SSB is mostly used only during meteor showers, with most day-to-day QSOs coming via a digital mode tailored for meteor-scatter and moon-bounce work called FSK441. FSK441 (and variants JT6M, ISCAM and JT65) is a digital sound card mode that's part of a comprehensive weak-signal data communications suite called WSJT, written by Nobel Prize winner Joe Taylor K1JT. Somewhat like PSK31 "on crack," FSK 441 data is sent back and forth in super-fast bursts that take advantage of the frequent sub-second "pings" produced by the many common, but tiny (weak) meteors entering earth's atmosphere (that can't support SSB QSOs in any way).

Operators using meteor-scatter digital modes need to synchronize their station clocks *precisely*, as the process involves one station transmitting while the other receives, etc. Using FSK441 isn't as easy as using PSK31 on HF, but its superior performance (compared to SSB) has made it a standard for VHF "ping jockeys" everywhere. As with PSK31, meteor-scatter digital modes require much less RF power and offer amazing signal-to-noise performance. It's not as convenient as pressing the Mic key, but it's revolutionized the game.

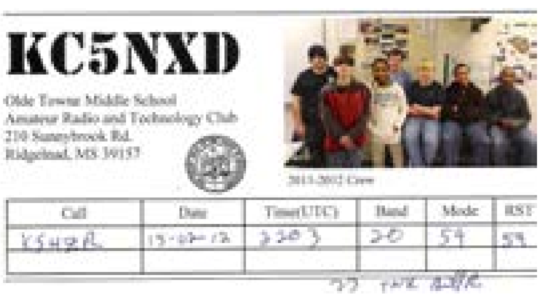
Ken Reitz, KS4ZR
kenreitz@monitoringtimes.com

Why We Need More Beginners and How You Can Help

The FCC data base contains amateur radio licenses totaling more than 700,000. This number was not easy to achieve. It required a tremendous effort over the past 12 years, led mostly by ARRL initiative, which included the scrapping of the Morse code requirement for licensing, re-vamping the license class structure, tweaking FCC rules regarding amateur operating and an all-out recruitment effort by clubs around the country.

I believe these numbers give the amateur radio community a false sense of security. In 2001 the total was just over 683,000, so the new figure is an increase of about 2.5 percent after twelve years of very hard work. But, more troubling is the fact that, according to the latest League numbers available, of the 700,000+ licensees, only 158,000 are ARRL members, a number slightly *lower* than nine years ago.

In a recent League survey, some 20 percent of responding ARRL members admitted that they are inactive. But, more than one-half million licensed hams are not even League members. The act of joining the ARRL shows at least some activity. My guess is that there are far more than 20 percent among the larger group who are inactive. I believe that the true number of inactive licensed hams is closer to 40 percent; more than a quarter million inactive licensees.



I say this because in my own family there were four who were licensed 12 years ago. Since then, one let his license expire and was removed from the database. Two others retain their licenses but have been inactive for at least the past decade. Of the licensed hams in our family, three-quarters are inactive.

Amateur licenses are granted for a period of ten years. But, with a two year grace period it's possible for an inactive amateur license to stay in the active license database for up to 12 years.

The licenses of deceased hams, according to the FCC, are placed from active to cancelled status after notification by the family. Well, I don't know about your family, but if KS4ZR were to go Silent Key, the very last thing that would be said is, "Somebody notify the FCC!" More than likely it wouldn't occur to anyone that my license should be cancelled until 2019 when the current one expires and a letter from the ARRL or W5YI Group reminds someone of that fact. Even then, it's likely that the notification, addressed to a deceased ham and dressed up like junk mail, would get tossed in the trash. I'd be good on QRZ.com for another two years!

According to FCC figures, there are more than 12,000 licensees that don't belong to individuals but are issued to groups and clubs. While they are technically active licenses, they further distort the individual amateur operator population numbers.

Furthermore, there are many individual hams who have more than one license, as foreign-based operators who have earned valid U.S. licenses, for example. The FCC couldn't tell me how many of those were in the database.

My point here is that I would not be surprised to learn that 50 percent of all amateur licenses in the FCC database are trustees, foreign-based operators, deceased or totally inactive.

❖ Well, Who Cares?

The license numbers aren't the only numbers story. When I was first licensed in 1988 I read in QST that the average age of an ARRL member was 55 years old. In the December 2011 issue of QST it was reported that the age of the average ARRL member is now 59. It would appear that even with the colossal efforts of the League and hundreds of successful and active clubs, it's not still enough. Amateur radio grows older each year. Soon it may be ready to retire.

But, this story is also about the education of the next generation of engineers, computer scientists, and inventors; the creative minds behind the next great thing, whatever that may be.

Buddy Sohl, Jr. KC4WQ, trustee for W4KBR, a school club in Kentucky, has a simple motto: "Train your replacement." That's what hundreds of hams like Buddy are doing today. But, they're not doing it by recruiting their peers. They've set up amateur radio programs in classrooms that incorporate science, math, geometry and language skills; the very things all school boards across the U.S. say they want more of.

Twelve years ago the ARRL began a program originally called The Big Project, now known as the Education and Technology Program (ETP), that seeks to introduce wireless technology literacy among American teachers and students. Here's what the program, which is entirely donor funded, does:

It offers resources, including instruction and project kits, to schools at no cost. The program offers professional training to teachers in the ARRL Teacher's Institute on Wireless Technology that also qualifies for continuing education credits for certified teachers.

Each summer the ARRL offers several four-day, expenses-paid, professional development seminars that introduce basic electronics, the science of radio, space technology and satellite communications, as well as weather science, programming microcontrollers and robotics.

In addition, the League makes available amateur radio station equipment through ETP grants. Today, more than 500 schools, from elementary to high school, are part of this program.

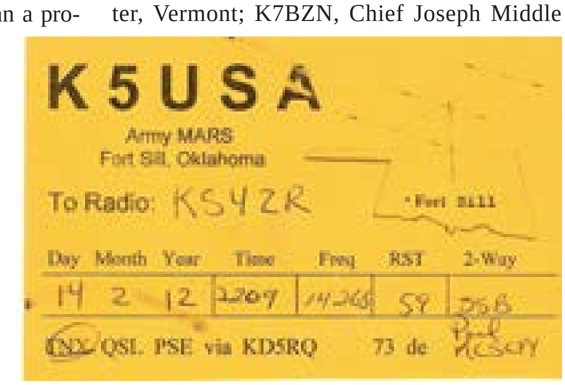
I've talked to dozens of educators from elementary schools to engineering schools over the last five years as I've come to learn about the role of amateur radio in American education. Among them is Carol Perry WB2MGP, who spent 30 years teaching amateur radio to tens of thousands of middle school students in New York's Public School system.

I've talked to Ronny Risinger KC5EES who resurrected a long dormant school station, K5LBJ, at the Liberal Arts and Science Academy in Austin, Texas, whose school station is always among the top schools in the twice yearly School Club Roundup.

I've talked to Paul Crips KI7TS who, over the years, has introduced amateur radio to more than 5,000 students in Cheyenne, Wyoming (population: 60,000). Among his students was Beth Wood KJ7FC, who in 1995 won the Hiram Percy Maxim Award and still comes back to Elmer today's students at the Carey Junior High School Amateur Radio Club in Cheyenne.

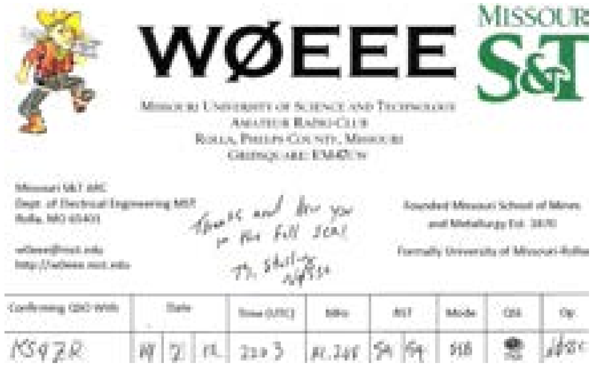
I've talked to Clifton Harper KC5YZB Viking Radio Club at Eisenhower Middle School in Lawton, Oklahoma, whose group boasts a 12 year-old Extra Class YL. They meet every Saturday, rain, snow, heat, or cold at a picnic shelter in a local municipal park to practice their on-air skills.

I've had on-air chats with the students from dozens of schools around the U.S. over the last five years including the kids at K5LMS Lampasas Middle School, Lampasas, Texas; K9SOU Bloomington High School South, Bloomington, Indiana; W0EEE, the Missouri University Science and Technology Amateur Radio Club; K1BBS Burr and Burton Academy in Manchester, Vermont; K7BZN, Chief Joseph Middle



School, Bozeman, Montana; W9GRS Glenn Raymond School Science Club Watseka, Illinois, and W7YH Washington State University, Pullman, Washington among many others.

So, what's behind these amateur-radio-in-the-school success stories? It's not the League, though they've been a tremendous help in providing direction for clubs, individual teacher training and equipment for cash-strapped schools. The one thing they can't do is find the individuals within the local club or school to start such a program.



It's these individuals, whose vision of the difference they could make in their own schools, in their own communities or neighborhoods, and the determination that they've had to see it through, that's made the difference.

But, what is the purpose of such a frenzy of radio activity? It's not only to generate new hams or add numbers to a license database or lower the age of the average ham, though those would all be welcome by-products. Ronny Risinger KC5EES at the Liberal Arts and Science Academy in Austin said, "Instead, it should be to inspire young people with the same spark of interest that first got you into radio; that led to your career in engineering, electronics, communications, teaching or whatever you're in."

Why is that important? Here is one reason: An article from the May 10, 2012 *Washington Post* headlined, "National Science Test Shows Only Slight Improvement." The article notes, "National tests measuring science knowledge among eighth-graders show slight improvement compared with those of two years earlier, but one-third of all students still lack a basic understanding of the physical, life and earth sciences."

Here's more trouble: The article warns that, "The gender gap also has proved stubborn, with boys continuing to outperform girls in the science test, a trend consistent with results from 2009, the previous year the test was given."

But, the worst news is this: "Despite barely significant increases in performance among most every group, scores remained flat for the top-performing students. Just two percent of all students tested were considered advanced."

You can see that the stakes are high. Science dominates in the modern world. From understanding computer-based technology, to an understanding of how to cope with diminishing global resources or how to improve the lives of all individuals; a mastery of science is paramount.

Americans cannot afford to let that mastery fall to other countries. We cannot afford to outsource our own future by falling behind at home. Yet, as the federal school science report shows, we appear to be doing just that.

There are private, federal and state programs intended to add science teachers to our schools and hundreds of millions of dollars may be allocated to such a cause in time through Congress and state legislatures. But, as aging licensed amateur radio operators, attempting to "train our replacements," we can't afford to wait for governments at any level to develop a plan.

Will introducing amateur radio to school children guarantee additional life-long hams and a lowering of the age of the average operator? Maybe. But, I do know this: In my own family's example, of the two children who got their licenses both went on to earn graduate degrees in science. The 12 year-old boy is now a veteran high school science teacher and the 12 year-old girl is now an environmental scientist with 16 years in the field.

Should we give amateur radio the credit for these science success stories? I don't know, but one thing is certain: it didn't hurt!

❖ What You Can Do

What can your club and the individuals in your club do to promote science and amateur radio in our local schools? I have five suggestions and I hope you will have many more.

First, adopt a school. Look at the list of ARRL Education and Technology Schools. If there's not a member school near you, consider starting an ETP school club with the help of your local club. There could be one near you that would like your help. Contact them: **www.arrl.org/etp-schools**

Second, adopt a science teacher. If there is a science teacher in your club perhaps he or she would be interested in attending the Institute on Wireless Technology. If there is not such member, recruit one! While the seminar is free, it costs money to travel and stay at a hotel. Your club should consider setting up a budget to finance such a trip for such a teacher.

Third, give money. Hundreds of thousands of dollars are made available by amateur radio groups all over the U.S. and given away every year to high school graduates in pursuit of a college degree in science. Today, because of the ever-rising cost of higher education, this sort of funding is more meaningful than ever. The Foundation for Amateur Radio administers 48 such scholarships (**www.farweb.org**). The ARRL awards 70 scholarships (**www.arrl.org/scholarship-program**).

Fourth, give equipment. Hams are notorious hoarders. We hoard wire, parts, and radios. Some of us have so many rigs we risk injury just walking across our shack floor. Consider starting an equipment bank at your club where little used but still functional HF rigs or HTs and other station accessories can be inventoried and loaned, temporarily or permanently, to local school clubs as they start up.

Even if your club can't establish such an equipment bank, consider sending your own excess equipment where it will be gratefully accepted and donated to a school amateur radio club somewhere in the country. The ARRL has such a program in place (**www.arrl.org/education-and-technology-fund**) as does the Radio Club of America (**www.radioclubofamerica.org/drupal/node/175**). Be generous.

Fifth, partner with local institutions to promote science. such as science museums, observatories, institutes and the like. Encourage them to start internships for high school students. When partnering with science institutions we must stress the need to include disadvantaged youth which includes minorities, girls and less financially-able kids.

Amateur radio operators are given great latitude by federal law. We are the only FCC licensees allowed to build, modify and put on the air, our own transmitting equipment. We are allowed to move our transmitters and antennas at will without prior approval. Local ordinances and Home Owners Association rules are required by law to exempt amateur radio activities from local rule enforcement.

This freedom is codified in the licenses we are granted and it's what gives us the flexibility to move in and coordinate communications in emergencies, something we do for free. It's just one more reason to stem the shrinking numbers of active amateurs; lower the average age, and do what we can to help American education and our national science curriculum.

Fred Waterer
fredwaterer@monitoringtimes.com
www.doghousecharlie.com/radio

Seasonal Favorites from around the World

This month we shine the Programming Spotlight on one of Canada's remaining shortwave radio stations, and some of the many special programs heard during the festive season.

With the demise of **Radio Canada International** and the **CBC Northern Quebec Shortwave Service**, Canada has really become something of a DX target. **CFRX** on 6070 kHz still broadcasts the programming of Newstalk 1010 **CFRB** in Canada's largest city, Toronto. **CFRX** can often be heard at great distances in spite of a modest 1 kW transmitter. And, of course, they are audible online.

Jim Richards (Courtesy Newstalk 1010 website)

There is some really interesting programming available from this station. Jim Richards has one of the driest, quirkiest senses of humor which I have ever come across. His show can be heard daily from 1-4 pm Eastern or 18-2100 UTC.

Once a week, Mayor Rob Ford of Toronto also hosts a show. Ford is perhaps one of the most polarizing politicians in Canada. In office for just over a year, he has a devoted base of support, and an equally devoted opposition who love to despise him. Ford is a right winger in a left wing city. Whether one thinks of him as a buffoon, a megalomaniac, or a breath of fresh air, it is rare for the chief executive of a city like Toronto to have his own radio talk show, that makes it interesting listening. Try for it on Sunday afternoons from 1-3pm or18-2000 UTC. The Live Drive with John Tory is also worth a listen, daily after the Jim Richards show.

Stuart McLean (Courtesy: CBC website)

While I'm discussing Canada, the popular radio broadcaster and humorist Stuart McLean, longtime host of CBC Radio's Vinyl Cafe (also heard on domestic networks in the U.K., Australia, New Zealand and the U.S.) was awarded the Order of Canada on September 28. This is Canada's highest civilian honor.

❖ Seasonal Programming

As 2012 comes to a close, it is that time of year when many stations present special seasonal and retrospective programs.

As I do every year, I will be posting a page of Festive and Seasonal Programming on my website at **www.doghousecharlie.com.** I invite you to check it out and drop me a line if you have a "heads up" about an upcoming program, or if you hear anything you would like others to know about.

On major holidays such as Christmas, it is a good bet that stations like **Radio New Zealand International** and **Radio Australia** will relay domestic programming from their respective parent networks. **Radio New Zealand**, despite a small population and a tiny budget, turns out lots of quality programming throughout the year, but around Christmas they really outdo themselves.

Check out **RNZI** on December 24, in the early hours of the morning. Starting around 0600 UTC, **RNZI** will be in Christmas Eve mode (that is 7pm local NZ time). I can recall listening in past years to **Radio New Zealand International** and some really fine Christmas music, some of which was sung by a hauntingly beautiful Maori choir. Christmas morning starts around 1700 UTC on the December 24. Music, Church Services and lots of festive programming will be on the schedule for the rest of the evening. If that is too early for **RNZI** to come in clearly you can check them out online.

RNZI (Courtesy WRN)

And don't forget that December in the Southern Hemisphere means summertime. **Radio Australia** and **Radio New Zealand International**, as well as the domestic ABC and RNZ networks switch to their summer schedules inserting many short term replacement programs. **Radio Australia** has been heard well most mornings for many years on 9580 kHz. This will hopefully continue for some time to come. Christmas in the summertime makes for some great radio!

I don't think that **Radio New Zealand International** carries Matinee Idle, but it can be heard every year right after Christmas. The inmates run the asylum for a few weeks. Phil, Simon and Kelle make some of the craziest and funniest radio this listener has ever heard. Check it out at 2312 UTC, Sunday-Thursday.

On Dec 24, 1906 Reginald Fessenden made the first voice broadcast on radio from Brant Rock, Massachusetts. Or at least that is what many believe. There is a debate about whether the broadcast actually took place. Fessenden was a Canadian who was a prolific inventor and experimenter in the early days of radio. There is an excellent web page about the man and the broadcast, with an audio recreation of what that historic broadcast might have sounded like. Check it out at **www.radiocom.net/Fessenden**.

It seems like every year as one tunes around the dials, one can discover some new gem or gems for one's holiday entertainment. For instance in 2011, I listened to the English-language programming of **Radio Exterior de Espana** in the days leading up to Christmas. One program featured an interview with an English woman who lives in Madrid, who released a new CD of Christmas songs, mostly from the 40s and 50s. Another program featured flamenco carols! It was an unusual and wonderful Christmas treat from the Iberian Peninsula! Try for it at Midnight UTC on 6055 kHz.

China Radio International also offered some Chinese interpretations of Christmas music on the big day. **CRI** is well heard on the bands these days, be sure and give them a listen!

The **BBC World Service** is not the easy catch it once was, but one should still be able to hear a couple of traditional Christmas favorites. The Festival of Nine Lessons and Carols is an annual tradition dating back to the end of World War One. As always it opens with the familiar "Once in Royal David's City" sung by one of the choir boys from the Chapel of King's College, Cambridge. This program is so popular it is rebroadcast in other countries including Ireland, New Zealand and Canada. As is the case every year, it can be heard live at 1500 UTC on the 24th. Try 9410 or 15420 kHz around this time.

Another program heard around the world is The Queen's Christmas Message. An annual tradition dating back to 1932, it is the one time of the year that Queen Elizabeth speaks to Britain and the British Commonwealth. It is heard every year on Christmas Day at 1505 UTC. The timing was originally set so the maximum number of people throughout the then-British Empire could all listen at the same time via shortwave.

Unless you are a Mayan, there's a new year just around the corner. Traditionally many radio stations pre-record programs for this time of the year so their staff can spend the holidays with their loved ones. Often these programs look back at the year that has just passed, or look forward to the new year as it approaches.

The New Year is celebrated by stations throughout the world. Keith Perron's **PCJ Media** usually has a special New Year edition of the Happy Station which can be heard online and via **WRMI** in Miami. **Voice of Russia** is also a fun listen at the New Year, a holdover from the legacy of the Soviet Union when the New Year was the big day instead of Christmas. However things have changed in Russia so be sure and tune in to The Christian Message from Moscow, shortly after the New Year. Orthodox Christmas is in early January. Listening to this or other programs from Moscow at this time is sure to bring you some of the wonderful Russian hymns and choirs.

On **www.doghousecharlie.com** I will be listing some of the many programs (and frequencies where one can listen) heard at this special time each year. I hope everyone reading this has a Happy Christmas and a terrific New Year!

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

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

Countdown of the Season

The Christmas countdown is upon us. Amid the mad dash of shopping and decorating your abode, take some time to enjoy seasonal programming from shortwave radio. Choral music, dramas, religious services, and old time radio shows dominate the bands. MT's *Programming Spotlight* columnist, Fred Waterer will keep you up to date from his Doghouse Charlie website. Follow the *Christmas and Seasonal Programming* link at **http://doghousecharlie.com.**

There's still time to snare the 16th Anniversary QSL card from Radio Free Asia. The microphone and flag card features a glimpse of what the RFA broadcasters use in the Washington, D.C. studios. The Anniversary card will be used to confirm all valid reception reports through December 31, 2012. Reception report details may be submitted by following the QSL REPORTS link at **www.techweb.rfa.org** or email to *qsl@rfa.org*. Listeners without Internet access, can mail their reports to: Reception Reports, Radio Free Asia, 2025 M. Street NW, Suite 300 Washington, D.C. 20036 U.S.A. Complete multilingual RFA schedules may be found in *MT ExPress*.

Ludo Maes, sends in news of changes from Belgium's TDP, which brokers air time for programs with political or religious background. TDP has been replaced with a new company name called Broadcast Belgium. Please delete the former contact email *info@transmitter.org* with *ludo.maes@broadcast.be* for correspondence and reception details.

Still scrambling to find addresses, for ship communication heard in the utility bands? Try Googling at **www.google.com**, the ship name + vessel owner. Follow the contact link for a *fill-in-the details* page or a postal address.

Armed Forces Radio (AFRTS) closed the Saddlebunch Keys, Florida transmitters, due to budget cuts, however you can still verify Diego Garcia (4319, 12759 USB kHz) and Guam (5765, 13362 USB kHz) relays. Post program details online at the Contact Us link on the AFN website **www.myafn.dodmedia.osd.mil**. Postal mail to: NMC DET AFRTS-DMC, 23755 Z Street, Bldg. 2730, Riverside, CA 92518-2017.

Here's a favorite among DXers. Puzzled on an interval signal? Not sure on an identification announcement? Hobbyists know the value of air checks, jingles, signature tunes, and of course interval signals. Log on to Interval Signals Online **www.intervalsignals.net** to search by-country a plethora of stations from across the globe. Interval Signals Online is an excellent aid to guide you through those puzzling DX moments.

Merry Christmas to one and all from QSL Report. Don't forget to report what you're QSLing in the coming year.

MEDIUM WAVE

Hungary-MR4, Magyar Radio, 1188 kHz AM. Full data verification letter, signed by Edit Julia Kaupert. Received in six months for an AM report. Station address: Stefánia út.7, 6720 Szeged, Hungary (Artur Llorella, Spain/HCDX)

KCEG, 780 kHz AM. Fountain, Colorado. *Colorado's Country Classics*. Full data QSL signed by Timothy C. Cutforth, Owner/General Manager. Received in six days for an AM report. Email *tcut4th@msn.com* or *radioranch@live.com* (John Wilkins, CO/NRC DX News) No station address at press time. Streaming audio **http://780kceg.com/**

KWEI, 1260 kHz AM. Weiser, Idaho. *La Rasa-Spanish Radio*. Full data QSL, signed by David L. Combs. Received in seven days after nine attempts from 2004. Station address: KWEI Spanish Radio, 1156 N. Orchard Street, Boise, Idaho 83706. Streaming audio **www.kweiradio.net** (Wilkins).

WFBL 1390 kHz AM. *CNY Talk Radio*. Full data verification from Don Wagner, General Manager. Received in 65 days for an AM report and mint stamps. Station address: CNY Talk Radio, 8456 Smokey Hollow Road, Baldwinsville, NY 13027. (D. Arrington, PA) Email: *d.wagner@lmgiradio.com* Website: **www.wfbl.com**

WFLF 540 kHz AM. Maitland, Florida. *How Central Florida Stays Informed.* No data confirmation email via Katherine Brown, Program Director *katherinebrown@clearchannel.com*. Received in 141 days for an AM report. Station address: 2500 Maitland Center Parkway, Maitland, FL 32751. (Al Muick, PA/HCDX) Streaming audio via iHeart Radio **www.540wfla.com/**

WVON, 1690 kHz AM. *The Talk of Chicago*. Verification letter signed by LaVetta Hodges-Account Executive, plus audience card. Received in 150 days for an AM report. Station address: 1000 E. 87th Street, Chicago IL 60619-6397. (Patrick Martin, Seaside, OR) Streaming audio **www.wvon.com/**

RUSSIA

Voice of Russia, 11960 kHz. Full data *Manned Flight into Space* card, signed by Mrs. A. Molodkina. Received in 24 days for an E-report to *letters@ruvr.ru* Postal address: Pyatnitskaya 25, 115326 Moscow, Russia (Shukhrat Rakhmatullaev, Uzbekistan/RUS-DX) Streaming/on-demand audio **www.ruvr.ru.**

SPAIN

Radio Exterior España (REE) 7275 kHz. Full data 70th Anniversary card, signed by Secretaría Técnica. Received in ten days for an E-report to *ree@rtve.es* (Llorella) Station address: Casa de la Radio, Avenida de la Radio y Televisíon 4, Pozuelo de Alarcón, 28223 Madrid, Spain. ((Llorella).

UTILITY

France-CROSS Jobourg 2187.5 kHz. No data letter and verification statement, signed by Thierry Pichon, le professeur principal de l'enselgnement maritime, directeur par intérim du CROSS Jobourg. Received in 192 days for a utility report. Station address: CROSS Jouburg, 14 Route d' Auderville, 50440 Jobourg, France. (Patrick Robic, Austria/UDXF) CROSS, sometimes called CROSSMA, is an organization of monitoring activities at sea and rescue coordination, based in Jouburg, France.

Italy-VEN, Non Direction Beacon, Venezia, 379 kHz. Full data prepared QSL card stamped as verified. Received in 16 days for a utility report. Station address: ENAV s.p.A., CAAV Venezia, Aeroporto Internazionale Marco Polo, 30030 Tessera-Venezia, Italy (Robic)

Italy-LIN, Non Directional Beacon, Linate 386 kHz. Full data prepared QSL card stamped and signed by Marco Casiraghi. Received in 21 days for a utility report. Station address: ENAV S.P.A., Milano ACC, C.P. 55, 20090 Linate Airoporto, Italy (Robic).

United States-BL-NAVMARCORMARS Groton, 14391.5 kHz. Full data QSL card in 70 days, for utility report of annual Armed Forces Day broadcast. QSL address: Robert Veth, Director, 4 Lantern Lane, Chelmsford, Massachusetts 01824-1316 (Robic).

Vietnam-XVN-Nha Trang Radio, 8414.5 kHz. Full data prepared QSL card stamped as verified. Received in 68 days for a utility report. Station address: Vishipel Cong Ty Thong Tin Dien Tu Hang Hair, Vietnam, Dai Thong Tin Duyen Hai Nha Trang, 40/1 Tran Pu, Vinh Nguyen, TP Nha Thrang, Vietnam (Robic).

UGANDA

Dunamis Broadcasting, 4750 kHz. Full data QSL card, unsigned. Received in three weeks for E-report to *mail@biblevoise.org* Postal address: Box 425, Station E, Toronto ON Canada M6H 4E3. (Llorella). Website: **www.biblevoice.org/**

SHORTWAVE GUIDE

How to Use the Shortwave Guide

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

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

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

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

FIND THE STATION YOU WANT TO HEAR

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

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

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

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

MT MONITORING TEAM

Gayle Van Horn
Frequency Manager
gaylevanhorn@monitoringtimes.com

Larry Van Horn, MT Asst. Editor
larryvanhorn@monitoringtimes.com

Additional Contributors to This Month's Shortwave Guide:

Thank You to ...

BCL News; BDX Club; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News 743-747; BCDX/WWDX/Top News.

Adrian Petersen/DBS 2012; Alokesh Gupta, New Delhi, India; Ashik Rajshahi, Bangladesh; Brenda Constantino/Florida; Eike Bierwirth, Germany; Georgi Bancov, Bulgaria; Ivo Ivanov, Bulgaria; Nigel Holmes/R Australia; Ron Howard, CA; Sean Gilbert UK/WRTH 2012; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

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

Notes

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

"MISSING" LANGUAGES?

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

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

0000	0030		Egypt, R Cairo	English	9965na
0000	0030		USA, BBG/VOA	English	7555as
0000	0045		India, AIR/External Svc	English	6055as
			9705as 9950as 11670as 13605as		
0000	0045	DRM	India, AIR/External Svc	English	9950eu
0000	0045		USA, WYFR/Family R Worldwide	English	
			11650as		
0000	0056		Romania, R Romania Intl	English	9700na
			11965na		
0000	0100		Anguilla, University Network	English	6090na
0000	0100		Australia, ABC NT Alice Springs	English	4835do
0000	0100		Australia, ABC NT Katherine	English	5025do
0000	0100		Australia, ABC NT Tennant Creek	English	
			4910do		
0000	0100		Australia, ABC/R Australia	English	9660pa
			12080pa 15240pa 15415pa 17795pa		
			19000pa 21740pa		
0000	0100		Bahrain, R Bahrain	English	6010me
0000	0100		Canada, CFRX Toronto ON	English	6070na
0000	0100		Canada, CFVP Calgary AB	English	6030na
0000	0100		Canada, CKZN St Johns NF	English	6160na
0000	0100		Canada, CKZU Vancouver BC	English	6160na
0000	0100		China, China R International	English	6075eu
			6180as 7350eu 7415as 9570na		
			11790as 11885as 15125as		
0000	0100		Malaysia, RTM Kajang/Traxx FM	English	
			7295do		
0000	0100		Micronesia, V6MP/Cross R/Pohnpei	English	
			4755 as		
0000	0100		New Zealand, R New Zealand Intl	English	
			15720pa		
0000	0100	DRM	New Zealand, R New Zealand Intl	English	
			17675pa		
0000	0100		Russia, VO Russia	English	9665va 9800va
0000	0100		Spain, R Exterior de Espana	English	6055na
0000	0100		Thailand, R Thailand World Svc	English	15275na
0000	0100		UK, BBC World Service	English	5970as
			6195as 7395as 9410as 9740as		
			12095as 15335as 15755as 17685as		
0000	0100		USA, Amer Forces Network/AFRTS	English	
			4319usb 5765usb 12759usb 13362usb		
0000	0100	Sat/Sun	USA, WBCQ Monticello ME	English	5110am
0000	0100		USA, WBCQ Monticello ME	English	7490am
			9330am		
0000	0100		USA, WEWN/EWTN Irondale AL	English	
			11520af		
0000	0100		USA, WHRI Cypress Creek SC	English	5920va
			7315ca 9860na		
0000	0100		USA, WINB Red Lion PA	English	9265am
0000	0100		USA, WTWW Lebanon TN	English	5755va
0000	0100		USA, WWCR Nashville TN	English	4840eu
			5935af 6875af		
0000	0100		USA, WWRB Manchester TN	English	3185na
			3215na 9370na		
0000	0100		USA, WYFR/Family R Worldwide	English	
			6145na 17580as		
0000	0100		Zambia, Christian Voice	English	4965af
0030	0100		Australia, ABC/R Australia	English	17750as
0030	0100	mtwhf	USA, WRMI/R Slovakia Intl relay	English	
			9955am		
0035	0045		India, AIR/Aizawl	English	5050do 7295do
0035	0045		India, AIR/Chennai	English	4920do
0035	0045		India, AIR/Guwahati	English	4940do
0035	0045		India, AIR/Hyderbad	English	4800do
0035	0045		India, AIR/Imphal	English	4775do
0035	0045		India, AIR/Port Blair/Andaman & Nicobar	English	
			4760do		
0035	0045		India, AIR/Shimla	English	4965do 6020do
0035	0045		India, AIR/Thiruvananthapuram	English	5010do

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

0100	0115	Sat	Canada, Bible Voice Broadcasting	English	
			9490as		
0100	0130		Vietnam, VO Vietnam/Overseas Svc	English	
			6175na		
0100	0200		Anguilla, University Network	English	6090na
0100	0200		Australia, ABC NT Alice Springs	English	4835do
0100	0200		Australia, ABC NT Katherine	English	5025do
0100	0200		Australia, ABC NT Tennant Creek	English	
			4910do		
0100	0200		Australia, ABC/R Australia	English	9660pa
			12080pa 15160pa 15240pa 15415as		
			17750pa 17795pa 19000pa		
0100	0200		Bahrain, R Bahrain	English	6010me
0100	0200		Canada, CFRX Toronto ON	English	6070na
0100	0200		Canada, CFVP Calgary AB	English	6030na
0100	0200		Canada, CKZN St Johns NF	English	6160na
0100	0200		Canada, CKZU Vancouver BC	English	6160na
0100	0200		China, China R International	English	6175eu
			9410eu 9410eu 9470eu 9535as		
			9570na 9580na 9675eu 11870as		
			15125as 15785as		
0100	0200		Cuba, R Havana Cuba	English	6000na
			6050na		
0100	0200		Malaysia, RTM Kajang/Traxx FM	English	
			7295do		
0100	0200		Micronesia, V6MP/Cross R/Pohnpei	English	
			4755 as		
0100	0200		New Zealand, R New Zealand Intl	English	
			15720pa		
0100	0200	DRM	New Zealand, R New Zealand Intl	English	
			17675pa		
0100	0200		Russia, VO Russia	English	9665va 9800va
0100	0200		Taiwan, R Taiwan Intl	English	11875as
0100	0200		UK, BBC World Service	English	7395as
			9410as 9740as 11750as 12095as		
			15310as 15335as 15755as 17685as		
0100	0200		USA, Amer Forces Network/AFRTS	English	
			4319usb 5765usb 12759usb 13362usb		
0100	0200		USA, BBG/VOA	English	7430va 9780va
			11705va		
0100	0200		USA, KJES Vado NM	English	7555na
0100	0200	Sat/Sun	USA, WBCQ Monticello ME	English	5110am
0100	0200		USA, WBCQ Monticello ME	English	7490am
			9330am		
0100	0200		USA, WEWN/EWTN Irondale AL	English	
			11520af		
0100	0200	m	USA, WHRI Cypress Creek SC	English	9605na
0100	0200		USA, WHRI Cypress Creek SC	English	9840na
			9860na		
0100	0200		USA, WINB Red Lion PA	English	9265am
0100	0200	irreg	USA, WRNO New Orleans LA	English	7505am
0100	0200		USA, WTWW Lebanon TN	English	5745va
0100	0200		USA, WWCR Nashville TN	English	4840eu
			5890na 5935af 6875af		
0100	0200		USA, WWRB Manchester TN	English	3185na
			5050na		
0100	0200		USA, WYFR/Family R Worldwide	English	
			6145na		
0100	0200		Zambia, Christian Voice	English	4965af
0120	0200	mtwhfa	Sri Lanka, SLBC	English	6005as 9770as
			15745as		
0130	0200	twhfas	Albania, R Tirana	English	7425na
0140	0200		Vatican City State, Vatican R	English	9580as
			11730as		

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

0200	0230		Thailand, R Thailand World Svc	English	15275na
0200	0230		USA, KJES Vado NM	English	7555na
0200	0230	Sat	USA, WBCQ Monticello ME	English	5110am
0200	0300		Anguilla, University Network	English	6090na
0200	0300	twhfa	Argentina, RAE	English	11710am
0200	0300		Australia, ABC NT Alice Springs	English	4835do
0200	0300		Australia, ABC NT Katherine	English	5025do
0200	0300		Australia, ABC NT Tennant Creek	English	
			4910do		
0200	0300		Australia, ABC/R Australia	English	9660pa
			12080pa 15160pa 15240pa 15415as		
			17750pa 17795pa 19000pa		
0200	0300		Bahrain, R Bahrain	English	6010me
0200	0300		Canada, CFRX Toronto ON	English	6070na
0200	0300		Canada, CFVP Calgary AB	English	6030na
0200	0300		Canada, CKZN St Johns NF	English	6160na
0200	0300		Canada, CKZU Vancouver BC	English	6160na
0200	0300		China, China R International	English	11770as
			13640as		
0200	0300		Cuba, R Havana Cuba	English	6000na
			6050na		
0200	0300		Egypt, R Cairo	English	9720na
0200	0300		Malaysia, RTM Kajang/Traxx FM	English	
			7295do		
0200	0300		Micronesia, V6MP/Cross R/Pohnpei	English	
			4755 as		
0200	0300		New Zealand, R New Zealand Intl	English	
			15720pa		
0200	0300	DRM	New Zealand, R New Zealand Intl	English	
			17675pa		
0200	0300		Palau, T8WH/World Harvest R	English	17800as
0200	0300		Philippines, R Pilipinas Overseas Svc	English	
			11880me 15285me 17700me		
0200	0300		Russia, VO Russia	English	9665va 15425na
0200	0300		South Korea, KBS World R	English	9580sa

0200 0300 mtwhfa Sri Lanka, SLBC English 6005as 9770as
15745as
0200 0300 Taiwan, R Taiwan Intl English 5950na
9680na
0200 0300 UK, BBC World Service English 6005af
6195me 12095as 15310as 17790as
0200 0300 USA, Amer Forces Network/AFRTS English
4319usb 5765usb 12759usb 13362usb
0200 0300 Sat/Sun USA, WBCQ Monticello ME English 5110am
0200 0300 USA, WBCQ Monticello ME English 7490am
9330am
0200 0300 USA, WEWN/EWTN Irondale AL English
11520af
0200 0300 USA, WHRI Cypress Creek SC English 5920va
0200 0300 USA, WINB Red Lion PA English 9265am
0200 0300 irreg USA, WRNO New Orleans LA English 7505am
0200 0300 USA, WTWW Lebanon TN English 5745va
0200 0300 USA, WWCR Nashville TN English 3215eu
4840na 5890af 5935af
0200 0300 USA, WWRB Manchester TN English 3185na
5050na
0200 0300 USA, WYFR/Family R Worldwide English
5985ca 6145na
0200 0300 Zambia, Christian Voice English 4965as
0215 0227 Nepal, R Nepal English 5005do
0230 0300 Myanmar, Myanma R/Yangon English 9731do
0230 0300 Vietnam, VO Vietnam/Overseas Svc English
6175na
0245 0300 India, AIR/Bhopal English 4810do
0245 0300 India, AIR/Guwahati English 4940do
0245 0300 India, AIR/Hyderbad English 7420do
0245 0300 India, AIR/Imphal English 4775do 7335do
0245 0300 India, AIR/Itanagar English 4990do
0245 0300 India, AIR/Jaipur English 4910do 7325do
0245 0300 India, AIR/Jeypore English 5040do
0245 0300 India, AIR/Kolkata English 4820do 7210do
0245 0300 India, AIR/Kuresong English 4895do
0245 0300 India, AIR/Lucknow English 4880do 7440do
0245 0300 India, AIR/Shillong English 4970do
0245 0300 India, AIR/Shimla English 4965do 6020do
0245 0300 India, AIR/Thiruvananthapuram English 5010do
0250 0300 Vatican City State, Vatican R English 7305am
0255 0300 Sun Swaziland, TWR Africa English 3200af

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

0300 0315 India, AIR/Aizawl English 5050do 7295do
0300 0315 India, AIR/Imphal English 4775do 7335do
0300 0315 India, AIR/Itanagar English 4990do
0300 0315 India, AIR/Shillong English 4970do
0300 0320 Vatican City State, Vatican R English 7305am
0300 0325 Sun Swaziland, TWR Africa English 3200af
0300 0330 Egypt, R Cairo English 9720na
0300 0330 Myanmar, Myanma R/Yangon English 9731do
0300 0330 Philippines, R Pilipinas Overseas Svc English
11880me 15285me 17700me
0300 0330 Vatican City State, Vatican R English 7360af
15460as
0300 0355 South Africa, Channel Africa English 5980af
0300 0355 Turkey, VO Turkey English 6165as 9515va
0300 0356 Romania, R Romania Intl English 9645na
11795na 11895as 15340as
0300 0400 Anguilla, University Network English 6090na
0300 0400 Australia, ABC NT Alice Springs English 4835do
0300 0400 Australia, ABC NT Katherine English 5025do
0300 0400 Australia, ABC NT Tennant Creek English
4910do
0300 0400 Australia, ABC/R Australia English 9660pa
12080pa 15160pa 15240as 15415pa
15515pa 17750pa 21725pa
0300 0400 Bahrain, R Bahrain English 6010me
0300 0400 Canada, CFRX Toronto ON English 6070na
0300 0400 Canada, CFVP Calgary AB English 6030na
0300 0400 Canada, CKZN St Johns NF English 6160na
0300 0400 Canada, CKZU Vancouver BC English 6160na
0300 0400 China, China R International English 9690am
9790na 11770as 13750as 15110as
15120as 15785as
0300 0400 Cuba, R Havana Cuba English 6000na
6050na
0300 0400 Malaysia, RTM Kajang/Traxx FM English
7295do
0300 0400 Micronesia, V6MP/Cross R/Pohnpei English
4755 as
0300 0400 New Zealand, R New Zealand Intl English
15720pa
0300 0400 DRM New Zealand, R New Zealand Intl English
17675pa
0300 0400 Oman, R Sultanate of Oman English 15355af
0300 0400 Palau, T8WH/World Harvest R English 17800as
0300 0400 Russia, VO Russia English 9665va 15425na
0300 0400 South Africa, Channel Africa English 3345af
0300 0400 Sun Sri Lanka, SLBC English 6005as 9770as
15745as
0300 0400 Taiwan, R Taiwan Intl English 5950na
15320as
0300 0400 UK, BBC World Service English 3255af
5875af 6005af 6145af 6190af
6195me 9410me 9750af 12035af
12095as 15310as 15365as 17790as
0300 0400 USA, Amer Forces Network/AFRTS English
4319usb 5765usb 12759usb 13362usb
0300 0400 USA, BBG/VOA English 4930af 6080af
9855af 15580af
0300 0400 USA, WBCQ Monticello ME English 7490am
9330am
0300 0400 USA, WEWN/EWTN Irondale AL English
11520af
0300 0400 USA, WHRI Cypress Creek SC English 5920va
7385na 9825va
0300 0400 irreg USA, WRNO New Orleans LA English 7505am
0300 0400 USA, WTWW Lebanon TN English 5745va
0300 0400 USA, WWCR Nashville TN English 3215eu
4840na 5890af 5935af
0300 0400 USA, WWRB Manchester TN English 3185na
5050na
0300 0400 USA, WYFR/Family R Worldwide English
11740ca
0300 0400 Zambia, Christian Voice English 4965as
0330 0400 Iran, VO Islamic Rep of Iran English 11920eu
13650eu
0330 0400 Vietnam, VO Vietnam/Overseas Svc English
6175na
0335 0345 India, AIR/Kolkata English 4820do 7210do

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

0400 0430 Iran, VO Islamic Rep of Iran English 11920eu
13650eu
0400 0430 USA, BBG/VOA English 4930af 4960af
6080af 9855af 12025af 15580af
0400 0457 Germany, Deutsche Welle English 6180af
7240af 9470af 12045af
0400 0457 North Korea, VO Korea English 3560as
7220as 9345as 9730as 11735as
13760as 15180as
0400 0458 New Zealand, R New Zealand Intl English
15720pa
0400 0458 DRM New Zealand, R New Zealand Intl English
17675pa
0400 0500 Anguilla, University Network English 6090na
0400 0500 Australia, ABC NT Alice Springs English 4835do
0400 0500 Australia, ABC NT Katherine English 5025do
0400 0500 Australia, ABC NT Tennant Creek English
4910do
0400 0500 Australia, ABC/R Australia English 9660pa
12080pa 15160pa 15240pa 15415as
15515pa 21725pa
0400 0500 Bahrain, R Bahrain English 6010me
0400 0500 Canada, CFRX Toronto ON English 6070na
0400 0500 Canada, CKZN St Johns NF English 6160na
0400 0500 Canada, CKZU Vancouver BC English 6160na
0400 0500 China, China R International English 6080na
17730va 17855va
0400 0500 Cuba, R Havana Cuba English 6000na
6050na
0400 0500 Malaysia, RTM Kajang/Traxx FM English
7295do
0400 0500 Micronesia, V6MP/Cross R/Pohnpei English
4755 as
0400 0500 Russia, VO Russia English 13775na 15760me
0400 0500 South Africa, Channel Africa English 3345af
0400 0500 Sun Sri Lanka, SLBC English 6005as 9770as
15745as
0400 0500 DRM UK, BBC World Service English 3955eu
0400 0500 UK, BBC World Service English 3255af
5875af 6005af 6190af 7310af
11945af 12035af 12095me 15310as
15365as 17790as
0400 0500 USA, Amer Forces Network/AFRTS English
4319usb 5765usb 12759usb 13362usb
0400 0500 USA, Overcomer Ministry English 15750af
0400 0500 USA, WBCQ Monticello ME English 9330am
0400 0500 USA, WEWN/EWTN Irondale AL English
11520af
0400 0500 USA, WHRI Cypress Creek SC English 5920va
7385na 9825va

0400	0500		USA, WTWW Lebanon TN	English	5745va
0400	0500		USA, WWCR Nashville TN	English	3215eu
			4840na 5890af	5935af	
0400	0500		USA, WWRB Manchester TN	English	3185na
			5050na		
0400	0500		Zambia, Christian Voice	English	4965as
0430	0500	mtwhf	Swaziland, TWR Africa	English	3200af
0430	0500		USA, BBG/VOA English	4930af	4960af
			6080af 12025af	15580af	
0455	0500		Nigeria, VO Nigeria	English	15120af
0459	0500		New Zealand, R New Zealand Intl		English
			11725pa		
0459	0500	DRM	New Zealand, R New Zealand Intl		English
			13730pa		

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

0500	0527		Germany, Deutsche Welle	English	5925af
0500	0530		Japan, R Japan NHK World	English	5975eu
			6110na 11970va		
0500	0530		Vatican City State, Vatican R	English	11625af
			13765af		
0500	0557		North Korea, VO Korea	English	13650as
			15100as		
0500	0600		Anguilla, University Network	English	6090na
0500	0600		Australia, ABC NT Alice Springs	English	4835do
0500	0600		Australia, ABC NT Katherine	English	5025do
0500	0600		Australia, ABC NT Tennant Creek		English
			4910do		
0500	0600		Australia, ABC/R Australia	English	9660pa
			12080pa 13630pa	15240pa	15415as
			15515pa 21725pa		
0500	0600		Bahrain, R Bahrain English	6010me	
0500	0600		Bhutan, Bhutan BC Svc	English	5030do
			6035do		
0500	0600		Canada, CFRX Toronto ON	English	6070na
0500	0600		Canada, CKZN St Johns NF	English	6160na
0500	0600		Canada, CKZU Vancouver BC	English	6160na
0500	0600		China, China R International	English	11710af
			11895as 15350as	15465as	17505va
			17730va 17855va		
0500	0600		Cuba, R Havana Cuba	English	6010na
			6050na 6060ca	6125am	
0500	0600		Eqt Guinea, Pan American BC/R Africa		English
			15190af		
0500	0600		Germany, Deutsche Welle	English	9470af
			9800af 9850af	11800af	
0500	0600		Malaysia, RTM Kajang/Traxx FM		English
			7295do		
0500	0600		Micronesia, V6MP/Cross R/Pohnpei		English
			4755 as		
0500	0600		New Zealand, R New Zealand Intl		English
			11725pa		
0500	0600	DRM	New Zealand, R New Zealand Intl		English
			13730pa		
0500	0600		Nigeria, VO Nigeria	English	15120af
0500	0600		Russia, VO Russia English	13755na	
0500	0600		South Africa, Channel Africa	English	7230af
0500	0600	Sat/Sun	Swaziland, TWR Africa	English	3200af
0500	0600		Swaziland, TWR Africa	English	9500af
0500	0600		Taiwan, R Taiwan Intl	English	5950na
0500	0600		UK, BBC World Service	English	3255af
			5875af 6005af	6190af	9410af
			11945af 12095me	15310as	15365as
			15420af 17640as	17790as	
0500	0600	DRM	UK, BBC World Service	English	3955eu
0500	0600		USA, Amer Forces Network/AFRTS		English
			4319usb 5765usb	12759usb	13362usb
0500	0600		USA, BBG/VOA English	4930af	6080af
			12025af 15580af		
0500	0600		USA, Overcomer Ministry	English	15750af
0500	0600		USA, WBCQ Monticello ME	English	9330am
0500	0600		USA, WEWN/EWTN Irondale AL		English
			11520af		
0500	0600		USA, WHRI Cypress Creek SC	English	5920am
			7385na 9825va		
0500	0600		USA, WTWW Lebanon TN	English	5745va
0500	0600		USA, WWCR Nashville TN	English	3215eu
			4840na 5890af	5935af	
0500	0600		USA, WWRB Manchester TN	English	3185na
0500	0600		Zambia, Christian Voice	English	6065af
0530	0556	DRM	Romania, R Romania Intl	English	11875eu
0530	0556		Romania, R Romania Intl	English	9700eu
			17760eu 21500eu		
0530	0600		Australia, ABC/R Australia	English	17750as
0530	0600		Thailand, R Thailand World Svc	English	17770eu

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

0600	0627		Germany, Deutsche Welle	English	15275af
0600	0630		China, Xizang PBS English	6025do	6130do
			9580do		
0600	0630		Germany, Deutsche Welle	English	13780af
			17820af		
0600	0630	Sat/Sun	USA, WRMI/R Prague relay	English	9955ca
0600	0645	mtwhfa	Vatican City State, Vatican R	English	15595me
0600	0650	DRM	New Zealand, R New Zealand Intl		English
			13730pa		
0600	0655		South Africa, Channel Africa	English	15255af
0600	0657		North Korea, VO Korea	English	7220as
			9345as 9730as		
0600	0700		Anguilla, University Network	English	6090na
0600	0700		Australia, ABC NT Alice Springs	English	4835do
0600	0700		Australia, ABC NT Katherine	English	5025do
0600	0700		Australia, ABC NT Tennant Creek		English
			4910do		
0600	0700		Australia, ABC/R Australia	English	9660pa
			11945pa 12080pa	13630pa	15240pa
			15415as 17750pa	21725pa	
0600	0700		Bahrain, R Bahrain English	6010me	
0600	0700		Canada, CFRX Toronto ON	English	6070na
0600	0700		Canada, CFVP Calgary AB	English	6030na
0600	0700		Canada, CKZN St Johns NF	English	6160na
0600	0700		Canada, CKZU Vancouver BC	English	6160na
0600	0700		China, China R International	English	11710af
			11870me 11895as	13660as	15140me
			15350as 15465as	17505va	17710as
0600	0700		Cuba, R Havana Cuba	English	6010na
			6050na 6060ca	6125am	
0600	0700		Eqt Guinea, Pan American BC/R Africa		English
			15190af		
0600	0700		Malaysia, RTM Kajang/Traxx FM		English
			7295do		
0600	0700		Micronesia, V6MP/Cross R/Pohnpei		English
			4755 as		
0600	0700		New Zealand, R New Zealand Intl		English
			11725pa		
0600	0700		Nigeria, VO Nigeria	English	15120af
0600	0700		Russia, VO Russia English	21800pa	21810va
0600	0700	DRM	Russia, VO Russia English	11830eu	
0600	0700		South Africa, Channel Africa	English	7230af

Start	End	Days	Station	Language	Frequency
0600	0700		Swaziland, TWR Africa	English	6120af
			9500af		
0600	0700	Sat/Sun	Swaziland, TWR Africa	English	3200af
0600	0700		UK, BBC World Service	English	6005af
			6190af 7365af 9410af 12095va		
			15310af 17640as 17790as		
0600	0700	DRM	UK, BBC World Service	English	5875eu
			7355eu		
0600	0700	mtwhf	UK, BBC World Service	English	15420af
0600	0700		USA, Amer Forces Network/AFRTS	English	
			4319usb 5765usb 12759usb 13362usb		
0600	0700		USA, BBG/VOA	English	6080af 12025af
			15580af		
0600	0700		USA, Overcomer Ministry	English	15750af
0600	0700		USA, WBCQ Monticello ME	English	9330am
0600	0700		USA, WEWN/EWTN Irondale AL	English	
			11520af		
0600	0700		USA, WHRI Cypress Creek SC	English	5920am
			7385na 11910va		
0600	0700		USA, WTWW Lebanon TN	English	5745va
0600	0700		USA, WWCR Nashville TN	English	3215eu
			4840na 5890af 5935af		
0600	0700		USA, WWRB Manchester TN	English	3185na
0600	0700		Zambia, Christian Voice	English	6065af
0600	0700		Zambia, CVC Intl/1 Africa	English	13590af
0617	0630	Sun	Nepal, R Nepal	English	5005do
0630	0645		India, AIR/Guwahati	English	4940do
			7280do		
0630	0645		India, AIR/Hyderbad	English	7420do
0630	0645		India, AIR/Mumbai	English	4840do 7240do
0630	0645		India, AIR/Thiruvananthapuram	English	5010do
0630	0700		Germany, Deutsche Welle	English	13780af
			17820af		
0630	0700		Vatican City State, Vatican R	English	11625af
			13765af 15570af		
0645	0700	mtwhf	Israel, Kol Israel	English	9955na
0651	0700	DRM	New Zealand, R New Zealand Intl	English	
			11675pa		

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

Start	End	Days	Station	Language	Frequency
0700	0730		Myanmar, Myanma R/Yangon	English	9731do
0700	0750		Austria, TWR Europe	English	6105eu
0700	0750		Germany, TWR Europe	English	6105eu
0700	0758		New Zealand, R New Zealand Intl	English	
			11725pa		
0700	0758	DRM	New Zealand, R New Zealand Intl	English	
			11675pa		
0700	0800		Anguilla, University Network	English	6090na
0700	0800		Australia, ABC NT Alice Springs	English	4835do
0700	0800		Australia, ABC NT Katherine	English	5025do
0700	0800		Australia, ABC NT Tennant Creek	English	
			4910do		
0700	0800		Australia, ABC/R Australia	English	7410pa
			9475pa 9660pa 9710pa 11945pa		
			12080pa 13630pa 15240pa		
0700	0800		Bahrain, R Bahrain	English	6010me
0700	0800	m/DRM	Belgium, TDP Radio	English	6015eu
0700	0800		Canada, CFRX Toronto ON	English	6070na
0700	0800		Canada, CFVP Calgary AB	English	6030na
0700	0800		Canada, CKZN St Johns NF	English	6160na
0700	0800		Canada, CKZU Vancouver BC	English	6160na
0700	0800		China, China R International	English	11895as
			13660as 13710eu 15125va 15350as		
			15465as 17490eu 17540as 17710as		
0700	0800	mtwhfa	Ecuador, HCJB/LV de los Andes	English	3995eu
0700	0800		Eqt Guinea, Pan American BC/R Africa	English	
			15190af		
0700	0800		Malaysia, RTM Kajang/Traxx FM	English	
			7295do		
0700	0800		Micronesia, V6MP/Cross R/Pohnpei	English	
			4755 as		
0700	0800		Papua New Guinea, R Fly	English	3915do
0700	0800		Russia, VO Russia	English	21800pa 21810va
0700	0800	DRM	Russia, VO Russia	English	11830eu
0700	0800		South Africa, Channel Africa	English	9625af
0700	0800		Swaziland, TWR Africa	English	6120af
			9500af		
0700	0800	Sat/Sun	Swaziland, TWR Africa	English	3200af
0700	0800		UK, BBC World Service	English	6190af
			11760me 11770af 12095af 15310af		
			15400af 15575me 17640af 17790as		
			17830af		
0700	0800	DRM	UK, BBC World Service	English	5875eu
			7355eu		
0700	0800		USA, Amer Forces Network/AFRTS	English	
			4319usb 5765usb 12759usb 13362usb		
0700	0800		USA, WBCQ Monticello ME	English	9330am
0700	0800		USA, WEWN/EWTN Irondale AL	English	
			11520af		
0700	0800		USA, WHRI Cypress Creek SC	English	5920am
			7385na		
0700	0800		USA, WTWW Lebanon TN	English	5745va
0700	0800		USA, WWCR Nashville TN	English	3215eu
			4840na 5890af 5935af		
0700	0800		USA, WWRB Manchester TN	English	3185na
0700	0800		Zambia, Christian Voice	English	6065af
0700	0800		Zambia, CVC Intl/1 Africa	English	13590af
0730	0745		India, AIR/Aizawl	English	5050do 7295do
0730	0745		India, AIR/Chennai	English	4920do 7380do
0730	0745		India, AIR/Guwahati	English	4940do
			7280do		
0730	0745		India, AIR/Imphal	English	4775do 7335do
0730	0745		India, AIR/Jaipur	English	4910do 7325do
0730	0745		India, AIR/Kolkata	English	4820do 7210do
0730	0745		India, AIR/Shimla	English	4965do 6020do
0730	0800		Australia, HCJB Global Australia	English	
			11750pa		
0759	0800		New Zealand, R New Zealand Intl	English	
			9765pa		
0759	0800	DRM	New Zealand, R New Zealand Intl	English	
			9870pa		

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

Start	End	Days	Station	Language	Frequency
0800	0830		Australia, ABC NT Alice Springs	English	4835do
0800	0830		Australia, ABC NT Katherine	English	5025do
0800	0830		Australia, ABC NT Tennant Creek	English	
			4910do		
0800	0830		Australia, HCJB Global Australia	English	
			11750pa		
0800	0830	Sun	Canada, Bible Voice Broadcasting	English	
			5945eu		
0800	0830		France, R France International	English	9955na
0800	0845	Sat	Canada, Bible Voice Broadcasting	English	
			5945eu		
0800	0900		Anguilla, University Network	English	6090na
0800	0900		Australia, ABC/R Australia	English	5995pa
			7410pa 9475pa 9580pa 9660pa		
			9710pa 11945pa 12080pa 15240pa		
0800	0900		Bahrain, R Bahrain	English	6010me
0800	0900	t/DRM	Belgium, TDP Radio	English	6015eu
0800	0900		Canada, CFRX Toronto ON	English	6070na
0800	0900		Canada, CFVP Calgary AB	English	6030na
0800	0900		Canada, CKZN St Johns NF	English	6160na
0800	0900		Canada, CKZU Vancouver BC	English	6160na
0800	0900		China, China R International	English	11620as
			11895as 13710eu 15350as 15465as		
			15625va 17490eu 17540as		
0800	0900		Eqt Guinea, Pan American BC/R Africa	English	
			15190af		
0800	0900	Sat	Italy, IRRS SW	English	9510va
0800	0900		Malaysia, RTM Kajang/Traxx FM	English	
			7295do		
0800	0900		Micronesia, V6MP/Cross R/Pohnpei	English	
			4755 as		
0800	0900		New Zealand, R New Zealand Intl	English	
			9765pa		
0800	0900	DRM	New Zealand, R New Zealand Intl	English	
			9870pa		
0800	0900		Nigeria, VO Nigeria	English	15120af
0800	0900	mtwhfs	Palau, T8WH/World Harvest R	English	9930as
0800	0900		Palau, T8WH/World Harvest R	English	17650as
0800	0900		Papua New Guinea, R Fly	English	3915do
0800	0900		Russia, VO Russia	English	21800pa 21810va
0800	0900	DRM	Russia, VO Russia	English	9850eu 11830eu
0800	0900		South Africa, Channel Africa	English	9625af
0800	0900	Sun	South Africa, R Mirror Intl	English	7205af
			17570af		
0800	0900		South Korea, KBS World R	English	9570as
0800	0900		UK, BBC World Service	English	6190af
			11760me 12095af 15310as 15400af		
			15575me 17640af 17790as 17830af		
			21470af		
0800	0900		USA, Amer Forces Network/AFRTS	English	
			4319usb 5765usb 12759usb 13362usb		
0800	0900		USA, WBCQ Monticello ME	English	9330am
0800	0900		USA, WEWN/EWTN Irondale AL	English	
			11520af		
0800	0900		USA, WHRI Cypress Creek SC	English	5920am
			7385na		
0800	0900		USA, WTWW Lebanon TN	English	5745va
0800	0900		USA, WWCR Nashville TN	English	3215eu
			4840na 5890af 5935af		
0800	0900		USA, WWRB Manchester TN	English	3185na
0800	0900		Zambia, Christian Voice	English	6065af
0800	0900		Zambia, CVC Intl/1 Africa	English	13590af

0815	0827		Nepal, R Nepal	English	5005do	
0820	0900	mtwhfa	Guam, KTWR/TWR Asia	English	15170as	
0830	0845		India, AIR/Aizawl	English	5050do	7295do
0830	0845		India, AIR/Chennai	English	4920do	7380do
0830	0845		India, AIR/Hyderbad	English	7420do	
0830	0845		India, AIR/Imphal	English	4775do	7335do
0830	0845		India, AIR/Kolkata	English	4820do	7210do
0830	0845		India, AIR/Shillong	English	4970do	7315do
0830	0845		India, AIR/Thiruvananthapuram	English	5010do	
0830	0900		Australia, ABC NT Alice Springs	English	2310do	
0830	0900		Australia, ABC NT Katherine	English	2485do	
0830	0900		Australia, ABC NT Tennant Creek	English		
			2325do			
0830	0900	mtwhfa	Guam, KTWR/TWR Asia	English	11840pa	
0830	0900		India, AIR/Itanagar	English	4990do	

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

0900	0910	mtwhfa	Guam, KTWR/TWR Asia	English	11840as	
0900	0930	mtwhfa	USA, WRMI/R Prague relay	English	9955ca	
0900	1000		Anguilla, University Network	English	6090na	
0900	1000		Australia, ABC NT Alice Springs	English	2310do	
0900	1000		Australia, ABC NT Katherine	English	2485do	
0900	1000		Australia, ABC NT Tennant Creek	English		
			2325do			
0900	1000		Australia, ABC/R Australia	English	6080pa	
			9580pa	11945pa		
0900	1000		Bahrain, R Bahrain	English	6010me	
0900	1000	w/DRM	Belgium, TDP Radio	English	6015eu	
0900	1000		Canada, CFRX Toronto ON	English	6070na	
0900	1000		Canada, CFVP Calgary AB	English	6030na	
0900	1000		Canada, CKZN St Johns NF	English	6160na	
0900	1000		Canada, CKZU Vancouver BC	English	6160na	
0900	1000		China, China R International	English	11620as	
			13790pa	15210as	15270eu	15350as
			17490eu	17570eu	17750as	
0900	1000	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu	
0900	1000		Malaysia, RTM Kajang/Traxx FM	English		
			7295do			
0900	1000		Micronesia, V6MP/Cross R/Pohnpei	English		
			4755 as			
0900	1000	3rd Sun	Netherlands, XVRB Radio	English	6045eu	
0900	1000	DRM	New Zealand, R New Zealand Intl	English		
			9870pa			
0900	1000		New Zealand, R New Zealand Intl	English		
			9765pa			
0900	1000		Nigeria, VO Nigeria	English	9690af	
0900	1000		Palau, T8WH/World Harvest R	English	9930as	
0900	1000		Papua New Guinea, R Fly	English	3915do	
0900	1000		Russia, VO Russia	English	9560as	15170as
			21800pa	21810va		
0900	1000	DRM	Russia, VO Russia	English	9850eu	11830eu
0900	1000		South Africa, Channel Africa	English	9625af	
0900	1000		UK, BBC World Service	English	6190af	
			6195as	9740as	11760me	12095af
			15285as	15310as	15575me	17640af
			17760as	17790as	17830af	21470af
			21660as			
0900	1000		USA, Amer Forces Network/AFRTS	English		
			4319usb	5765usb	12759usb	13362usb
0900	1000		USA, WBCQ Monticello ME	English	9330am	
0900	1000		USA, WEWN/EWTN Irondale AL	English		
			11520as			
0900	1000		USA, WHRI Cypress Creek SC	English	11565pa	
0900	1000		USA, WHRI Cypress Creek SC	English	7315am	
			7385na			
0900	1000		USA, WTWW Lebanon TN	English	5745va	
0900	1000		USA, WWCR Nashville TN	English	4840eu	
			5890af	5935af	6875af	
0900	1000		USA, WWRB Manchester TN	English	3185na	
0900	1000		USA, WYFR/Family R Worldwide	English		
			9465as			
0900	1000		Zambia, Christian Voice	English	6065af	
0900	1000		Zambia, CVC Intl/1 Africa	English	13590af	
0905	0910		Pakistan, PBC/R Pakistan	English	15725as	
			17720as			
0930	1000	fs	China, VO the Strait	English	6115do	
0930	1000	Sun	Italy, IRRS SW	English	9510va	

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

1000	1030		Japan, R Japan NHK World	English	9605as	
			9625pa	9695as		
1000	1030		Vietnam, VO Vietnam/Overseas Svc	English		
			9840as	12020as		
1000	1057		North Korea, VO Korea	English	3560ca	
			11710sa	15180as	11735as	13650as
1000	1058		New Zealand, R New Zealand Intl	English		
			9765pa			
1000	1100		Anguilla, University Network	English	11775na	
1000	1100		Australia, ABC NT Alice Springs	English	2310do	
1000	1100		Australia, ABC NT Katherine	English	2485do	
1000	1100		Australia, ABC NT Tennant Creek	English		
			2325do			
1000	1100		Australia, ABC/R Australia	English	6080pa	
			9580pa			
1000	1100		Bahrain, R Bahrain	English	6010me	
1000	1100	h/DRM	Belgium, TDP Radio	English	6015eu	
1000	1100		Canada, CFRX Toronto ON	English	6070na	
1000	1100		Canada, CFVP Calgary AB	English	6030na	
1000	1100		Canada, CKZN St Johns NF	English	6160na	
1000	1100		Canada, CKZU Vancouver BC	English	6160na	
1000	1100		China, China R International	English	6040na	
			11610as	11635as	13620as	13690as
			13720as	13790pa	15190as	15210as
			15350as	17490eu		
1000	1100	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu	
1000	1100		India, AIR/External Svc	English	7270as	
			13695pa	15020as	15410as	17510pa
			17800as	17895pa		
1000	1100		Indonesia, VO Indonesia	English	9526va	
1000	1100		Malaysia, RTM Kajang/Traxx FM	English		
			7295do			
1000	1100		Micronesia, V6MP/Cross R/Pohnpei	English		
			4755as			
1000	1100	DRM	New Zealand, R New Zealand Intl	English		
			9870pa			
1000	1100		Nigeria, VO Nigeria	English	9690af	
1000	1100		Palau, T8WH/World Harvest R	English	17650as	
1000	1100		Russia, VO Russia	English	9560as	11500as
			15170as			
1000	1100		Saudi Arabia, BSKSA/External Svc	English		
			15250as			
1000	1100		South Africa, Channel Africa	English	9625af	
1000	1100		UK, BBC World Service	English	6190af	
			6195as	9740as	11760me	12095af
			15285as	15310as	15575me	17640af
			17760as	17790as	21470af	21660as
1000	1100	Sat/Sun	UK, BBC World Service	English	15400af	
			17830af			
1000	1100		USA, Amer Forces Network/AFRTS	English		
			4319usb	5765usb	12759usb	13362usb
1000	1100		USA, KNLS Anchor Point AK	English	9655as	
1000	1100		USA, WBCQ Monticello ME	English	9330am	
1000	1100		USA, WEWN/EWTN Irondale AL	English		
			11520as			
1000	1100		USA, WHRI Cypress Creek SC	English	7315am	
			7385na			
1000	1100		USA, WTWW Lebanon TN	English	5745va	
1000	1100		USA, WWCR Nashville TN	English	4840na	
			5890af	5935af	6875af	
1000	1100		USA, WWRB Manchester TN	English	3185na	
1000	1100		USA, WYFR/Family R Worldwide	English		
			9465as			
1000	1100		Zambia, Christian Voice	English	6065af	
1000	1100		Zambia, CVC Intl/1 Africa	English	13590af	
1030	1100		Iran, VO Islamic Rep of Iran	English	21590va	
			21640va			
1030	1100		Mongolia, Voice of Mongolia	English	12085as	
1030	1100		USA, WINB Red Lion PA	English	9265am	
1059	1100		New Zealand, R New Zealand Intl	English		
			17675pa			

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

1100	1104		Pakistan, PBC/R Pakistan	English	15725as	
			17720as			
1100	1127		Iran, VO Islamic Rep of Iran	English	21590va	
			21640va			
1100	1130	Sat/DRM	South Korea, KBS World R	English	9760eu	
1100	1130		UK, BBC World Service	English	15400af	
1100	1130		Vietnam, VO Vietnam/Overseas Svc	English		
			7285as			
1100	1156		Romania, R Romania Intl	English	15210eu	
			15430eu	17510af	17670af	
1100	1158	DRM	New Zealand, R New Zealand Intl	English		
			9870pa			
1100	1200		Anguilla, University Network	English	11775na	
1100	1200		Australia, ABC NT Alice Springs	English	2310do	
1100	1200		Australia, ABC NT Katherine	English	2485do	
1100	1200		Australia, ABC NT Tennant Creek	English		
			2325do			
1100	1200		Australia, ABC/R Australia	English	5995pa	
			6020pa	6080as	6140as	9475as
			9580as	11945pa	12080pa	

1100	1200		Bahrain, R Bahrain	English	6010me
1100	1200	f/DRM	Belgium, TDP Radio	English	6015eu
1100	1200		Canada, CFRX Toronto ON	English	6070na
1100	1200		Canada, CFVP Calgary AB	English	6030na
1100	1200		Canada, CKZN St Johns NF	English	6160na
1100	1200		Canada, CKZU Vancouver BC	English	6160na
1100	1200		China, China R International	English	5955as 11650as 11660as 11750na 11795as 13590as 13645as 13650eu 13720as 16490eu
1100	1200	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu
1100	1200		Malaysia, RTM Kajang/Traxx FM	English	7295do
1100	1200		New Zealand, R New Zealand Intl	English	17675pa
1100	1200		Nigeria, VO Nigeria	English	9690af
1100	1200	DRM	Russia, VO Russia	English	12030as
1100	1200		Russia, VO Russia	English	9560as 11500as 12065as
1100	1200		Saudi Arabia, BSKSA/External Svc	English	15250as
1100	1200		South Africa, Channel Africa	English	9625af
1100	1200		Taiwan, R Taiwan Intl	English	7445as 9465as
1100	1200		UK, BBC World Service	English	6190af 6195as 9740as 11760me 12095af 15285as 15310as 15575me 17640af 17790as 17830af 21470af
1100	1200		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1100	1200		USA, WBCQ Monticello ME	English	9330am
1100	1200		USA, WEWN/EWTN Irondale AL	English	11520as
1100	1200		USA, WHRI Cypress Creek SC	English	7315am 9795am
1100	1200		USA, WINB Red Lion PA	English	9265am
1100	1200		USA, WTWW Lebanon TN	English	5745va
1100	1200		USA, WWCR Nashville TN	English	4840na 5890af 5935af 15825eu
1100	1200		USA, WWRB Manchester TN	English	3185na
1100	1200		Zambia, Christian Voice	English	6065af
1100	1200		Zambia, CVC Intl/1 Africa	English	13590af
1130	1145	f	Palau, T8WH/World Harvest R	English	15525as
1130	1200	f	Vatican City State, Vatican R	English (Mass)	15595me 17590me
1130	1200		Vietnam, VO Vietnam/Overseas Svc	English	9840as 12020as
1135	1145		India, AIR/Aizawl	English	5050do 7295do
1135	1145		India, AIR/Shillong	English	4970do

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

1200	1225		Saudi Arabia, BSKSA/External Svc	English	15250as
1200	1230		Japan, R Japan NHK World	English	6120na 9695as
1200	1258		New Zealand, R New Zealand Intl	English	17675pa
1200	1300		Anguilla, University Network	English	11775na
1200	1300		Australia, ABC NT Alice Springs	English	2310do
1200	1300		Australia, ABC NT Katherine	English	2485do
1200	1300		Australia, ABC NT Tennant Creek	English	2325do
1200	1300		Australia, ABC/R Australia	English	5995pa 6080as 6140as 9475as 9580as 11945pa
1200	1300		Bahrain, R Bahrain	English	6010me
1200	1300	Sat/DRM	Belgium, TDP Radio	English	6015eu
1200	1300		Canada, CFRX Toronto ON	English	6070na
1200	1300		Canada, CFVP Calgary AB	English	6030na
1200	1300		Canada, CKZN St Johns NF	English	6160na
1200	1300		Canada, CKZU Vancouver BC	English	6160na
1200	1300		China, China R International	English	5955as 9460as 9645as 9660as 9730as 9760pa 11650as 11660as 11690va 11760pa 11980as 13645as 13650eu 13790eu 17490eu
1200	1300		Ethiopia, R Ethiopia/Natl Pgm	English	9705do
1200	1300	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu
1200	1300		Malaysia, RTM Kajang/Traxx FM	English	7295do
1200	1300		Nigeria, VO Nigeria	English	9690af
1200	1300		Palau, T8WH/World Harvest R	English	9930as
1200	1300	DRM	Russia, VO Russia	English	9445eu 9850as 12030as
1200	1300		Russia, VO Russia	English	9560as 11500as
1200	1300		South Korea, KBS World R	English	9650na
1200	1300		UK, BBC World Service	English	5875as 6190af 6195as 9740as 11750as 11760me 15310as 15575me 17790as 17830af 21470af
1200	1300		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1200	1300		USA, BBG/VOA	English	7575va 9510va 12075va 12150va
1200	1300		USA, KNLS Anchor Point AK	English	7355as
1200	1300		USA, WBCQ Monticello ME	English	9330am
1200	1300		USA, WEWN/EWTN Irondale AL	English	11520as
1200	1300		USA, WHRI Cypress Creek SC	English	9795am 9840na
1200	1300		USA, WINB Red Lion PA	English	9265am
1200	1300		USA, WTWW Lebanon TN	English	9479va
1200	1300		USA, WWCR Nashville TN	English	7490na 9980af 13845af 15825eu
1200	1300		USA, WWRB Manchester TN	English	3185na 9370na
1200	1300		Zambia, Christian Voice	English	6065af
1200	1300		Zambia, CVC Intl/1 Africa	English	13590af
1215	1300		Egypt, R Cairo	English	17870as
1225	1245		India, AIR/Imphal	English	4775do
1230	1245		India, AIR/Aizawl	English	5050do 7295do
1230	1245		India, AIR/Chennai	English	4920do
1230	1245		India, AIR/Hyderbad	English	4800do
1230	1245		India, AIR/Imphal	English	4800do
1230	1245		India, AIR/Jeypore	English	5040do
1230	1245		India, AIR/Kuresong	English	4895do
1230	1245		India, AIR/Port Blair/Andaman & Nicobar	English	4760do
1230	1245		India, AIR/R Kashmir	English	4950do
1230	1245		India, AIR/Shillong	English	4970do
1230	1245		India, AIR/Thiruvananthapuram	English	5010do
1230	1300		Thailand, R Thailand World Svc	English	9890va
1230	1300		Turkey, VO Turkey	English	15450va
1230	1300		Vietnam, VO Vietnam/Overseas Svc	English	9840as 12020as

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

1300	1325		Turkey, VO Turkey	English	15450va
1300	1330		Egypt, R Cairo	English	17870as
1300	1330		Japan, R Japan NHK World	English	15735as
1300	1357		North Korea, VO Korea	English	9335na 11710na 13760eu 15245eu
1300	1400		Anguilla, University Network	English	11775na
1300	1400		Australia, ABC NT Alice Springs	English	2310do
1300	1400		Australia, ABC NT Katherine	English	2485do
1300	1400		Australia, ABC/R Australia	English	5940as 5995pa 6020pa 9580pa 11945pa
1300	1400		Bahrain, R Bahrain	English	6010me
1300	1400	Sun/DRM	Belgium, TDP Radio	English	6015na
1300	1400		Canada, CFRX Toronto ON	English	6070na
1300	1400		Canada, CFVP Calgary AB	English	6030na
1300	1400		Canada, CKZN St Johns NF	English	6160na
1300	1400		Canada, CKZU Vancouver BC	English	6160na
1300	1400		China, China R International	English	5995as 9570na 9730as 9760pa 9765va 9870as 11660as 11760pa 13610eu 13755as 13790eu
1300	1400	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu
1300	1400		Indonesia, VO Indonesia	English	9526va
1300	1400		Italy, IRRS SW	English	15190va
1300	1400		Malaysia, RTM Kajang/Traxx FM	English	7295do
1300	1400		New Zealand, R New Zealand Intl	English	5950pa
1300	1400		Nigeria, VO Nigeria	English	9690af
1300	1400		Palau, T8WH/World Harvest R	English	9930as
1300	1400	DRM	Russia, VO Russia	English	9560as 12065as
1300	1400		Russia, VO Russia	English	12065as
1300	1400		South Korea, KBS World R	English	9570as
1300	1400		Tajikistan, VO Tajik	English	7245va
1300	1400		UK, BBC World Service	English	5875as 6190af 6195as 9740as 11760me 15310as 15420af 15575me 17640af 17790as 17830af
1300	1400		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1300	1400	Sat/Sun	USA, BBG/VOA	English	7575va 9510va 9610va 9760va 12150va
1300	1400		USA, KJES Vado NM	English	11715na
1300	1400		USA, WBCQ Monticello ME	English	9330am
1300	1400		USA, WEWN/EWTN Irondale AL	English	15615as
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC	English	9795na 9840am

Start	End	Days	Station	Language	Frequency	
1300	1400		USA, WINB Red Lion PA	English	13570am	
1300	1400		USA, WTWW Lebanon TN	English	9479va	
1300	1400		USA, WWCR Nashville TN	English	7490af	
			9980af 13845eu 15825eu			
1300	1400		USA, WWRB Manchester TN	English	9370na	
1300	1400		USA, WYFR/Family R Worldwide	English		
			11540as			
1300	1400		Zambia, Christian Voice	English	6065af	
1300	1400		Zambia, CVC Intl/1 Africa	English	13590af	
1330	1400		India, AIR/External Svc	English	9690as	
			11620as 13710as			
1330	1400		Vietnam, VO Vietnam/Overseas Svc	English		
			9840as 12020as			

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

Start	End	Days	Station	Language	Frequency	
1400	1430		Japan, R Japan NHK World	English	11705as	
			15735as			
1400	1430		Thailand, R Thailand World Svc	English	9395va	
1400	1430	Sun	USA, Pan Amer Broadcasting	English	15205as	
1400	1500		Anguilla, University Network	English	11775na	
1400	1500		Australia, ABC NT Alice Springs	English	2310do	
1400	1500		Australia, ABC NT Katherine	English	2485do	
1400	1500		Australia, ABC NT Tennant Creek	English		
			2325do			
1400	1500		Australia, ABC/R Australia	English	5940as	
			5995pa 9580pa 11945pa			
1400	1500		Bahrain, R Bahrain	English	6010me	
1400	1500	Sun	Canada, Bible Voice Broadcasting	English		
			17495as			
1400	1500		Canada, CFRX Toronto ON	English	6070na	
1400	1500		Canada, CFVP Calgary AB	English	6030na	
1400	1500		Canada, CKZN St Johns NF	English	6160na	
1400	1500		Canada, CKZU Vancouver BC	English	6160na	
1400	1500		China, China R International	English	5955as	
			9765va 9870as 11665me 11675as			
			11765as 13710eu 13740na 13790eu			
			17630af			
1400	1500		Eqt Guinea, Pan American BC/R Africa	English		
			15190af			
1400	1500	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu	
1400	1500		India, AIR/External Svc	English	9690as	
			11620as 13710as			
1400	1500		Italy, IRRS SW	English	15190va	
1400	1500		Malaysia, RTM Kajang/Traxx FM	English		
			7295do			
1400	1500		New Zealand, R New Zealand Intl	English		
			5950pa			
1400	1500		Nigeria, VO Nigeria	English	9690af	
1400	1500		Oman, R Sultanate of Oman	English	15140va	
1400	1500	DRM	Russia, VO Russia	English	12095eu	
1400	1500		Russia, VO Russia	English	4975va	9560as
			11500as 11840as			
1400	1500		South Korea, KBS World R	English	9570as	
1400	1500		UK, BBC World Service	English	5845as	
			5875as 6190af 6195as 9740as			
			11890as 12095af 13820me 15310as			
			17640af 17830af 21470af			
1400	1500		USA, Amer Forces Network/AFRTS	English		
			4319usb 5765usb 12759usb 13362usb			
1400	1500		USA, BBG/VOA	English	4930af	6080af
			15265af 15580af 17530af			
1400	1500	mtwhf	USA, BBG/VOA	English	7540va	7575va
			12150va			
1400	1500		USA, Overcomer Ministry	English	9655eu	
1400	1500		USA, WBCQ Monticello ME	English	9330am	
1400	1500	Sat/Sun	USA, WBCQ Monticello ME	English	15420am	
1400	1500		USA, WEWN/EWTN Irondale AL	English		
			15615as			
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC	English	9795am	
			9840am 21670va			
1400	1500		USA, WJHR Intl Milton FL	English	15550usb	
1400	1500		USA, WTWW Lebanon TN	English	9479va	
1400	1500		USA, WWCR Nashville TN	English	7490af	
			9980af 13845eu 15825eu			
1400	1500		USA, WWRB Manchester TN	English	9370na	
1400	1500		USA, WYFR/Family R Worldwide	English		
			11540as			
1400	1500		Zambia, Christian Voice	English	6065af	
1400	1500		Zambia, CVC Intl/1 Africa	English	13590af	
1405	1435	Sat/Sun	Canada, Bible Voice Broadcasting	English		
			15270as			
1415	1427		Nepal, R Nepal	English	5005do	
1415	1430	mtwhfa	USA, Pan Amer Broadcasting	English	15205as	
1420	1440		India, AIR/Itanagar	English	4990do	
1420	1455		Swaziland, TWR Africa	English	4760af	
1430	1445		India, AIR/Aizawl	English	5050do	7295do
1430	1445		India, AIR/Gangkok	English	4835do	
1430	1445		India, AIR/Jeypore	English	5040do	
1430	1445		India, AIR/Mumbai	English	4840do	7240do
1430	1445	Sun	USA, Pan Amer Broadcasting	English	15205as	
1430	1500		Australia, ABC/R Australia	English	9475as	
			11660as			
1430	1500	Sat	Canada, Bible Voice Broadcasting	English		
			17495as			
1430	1500		China, China Business R	English	6190do	
			7220do			
1430	1500		China, China Natl R/CNR11	English	4905do	
			4920do 6130do			
1430	1500		Myanmar, Thazin BC Sta	English	7110do	
1430	1500		USA, WRMI/R Prague relay	English	9955ca	
1445	1500		Australia, HCJB Global Australia	English		
			15340as			
1450	1500		India, AIR/Itanagar	English	4990do	
1450	1500		India, AIR/Kuresong	English	4895do	

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

Start	End	Days	Station	Language	Frequency	
1500	1515	Sun	Canada, Bible Voice Broadcasting	English		
			13740as			
1500	1525	mhf	Guam, KTWR/TWR Asia	English	15200as	
1500	1530		Australia, ABC/R Australia	English	11945pa	
1500	1530		Australia, HCJB Global Australia	English		
			15340as			
1500	1530		Vietnam, VO Vietnam/Overseas Svc	English		
			7285as 9840as 12020as			
1500	1535	twas	Guam, KTWR/TWR Asia	English	15200as	
1500	1550		New Zealand, R New Zealand Intl	English		
			5950pa			
1500	1557		North Korea, VO Korea	English	9335na	
			11710na 13760eu 15245eu			
1500	1600		Anguilla, University Network	English	11775na	
1500	1600		Australia, ABC NT Alice Springs	English	2310do	
1500	1600		Australia, ABC NT Katherine	English	2485do	
1500	1600		Australia, ABC/R Australia	English	5940as	
			5995pa 7240pa 9475as 11660as			
1500	1600		Bahrain, R Bahrain	English	6010me	
1500	1600		Canada, CFRX Toronto ON	English	6070na	
1500	1600		Canada, CFVP Calgary AB	English	6030na	
1500	1600		Canada, CKZN St Johns NF	English	6160na	
1500	1600		Canada, CKZU Vancouver BC	English	6160na	
1500	1600		China, China R International	English	5955as	
			6095me 7325as 7395as 9720me			
			9800as 9870as 11965eu 13640eu			
			13740na 17630af			
1500	1600		Eqt Guinea, Pan American BC/R Africa	English		
			15190af			
1500	1600	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu	
1500	1600	Sat	Italy, IRRS SW	English	15700va	
1500	1600		Malaysia, RTM Kajang/Traxx FM	English		
			7295do			
1500	1600		Nigeria, VO Nigeria	English	15120af	
1500	1600		Russia, VO Russia	English	4975va	9560as
			11840as 15640me			
1500	1600		South Africa, Channel Africa	English	9625af	
1500	1600		Uganda, Dunamis Shortwave	English	4750do	
1500	1600		UK, BBC World Service	English	5845as	
			5875as 6190af 6195as 7435af			
			9410as 9740as 11890as 12095af			
			13820me 15310as 15400af 17640af			
			17830af 21470af			
1500	1600		USA, Amer Forces Network/AFRTS	English		
			4319usb 5765usb 12759usb 13362usb			
1500	1600		USA, BBG/VOA	English	4930af	6080af
			7540va 7575va 12150va 13570va			
			15265as 15530va 15580as 17895as			
1500	1600	mtwhf	USA, BBG/VOA	English	7450va	7575va
			12150va			
1500	1600		USA, KNLS Anchor Point AK	English	9655as	
1500	1600		USA, Overcomer Ministry	English	13810me	
1500	1600		USA, WBCQ Monticello ME	English	9330am	
1500	1600	Sat/Sun	USA, WBCQ Monticello ME	English	15420am	
1500	1600		USA, WEWN/EWTN Irondale AL	English		
			15610eu			
1500	1600	Sat/Sun	USA, WHRI Cypress Creek SC	English	9795am	
			9840am			
1500	1600	Sun	USA, WHRI Cypress Creek SC	English	21630af	
1500	1600		USA, WINB Red Lion PA	English	13570am	
1500	1600		USA, WJHR Intl Milton FL	English	15550usb	
1500	1600		USA, WTWW Lebanon TN	English	9479va	
1500	1600		USA, WWCR Nashville TN	English	9980af	
			12160af 13845eu 15825eu			
1500	1600		USA, WWRB Manchester TN	English	9370na	
1500	1600		USA, WYFR/Family R Worldwide	English		
			6280as 13690as 15520as			
1500	1600		Zambia, Christian Voice	English	6065af	

1500	1600		Zambia, CVC Intl/1 Africa	English	13590af
1515	1530	f	Canada, Bible Voice Broadcasting	English	15275as
1525	1555	Sat/Sun	Swaziland, TWR Africa	English	4760af
1530	1545		India, AIR/Aizawl	English	5050do 7295do
1530	1545		India, AIR/Bhopal	English	4810do 7430do
1530	1545		India, AIR/Chennai	English	4920do
1530	1545		India, AIR/Guwahati	English	4940do
1530	1545		India, AIR/Hyderbad	English	4800do
1530	1545		India, AIR/Imphal	English	4775do
1530	1545		India, AIR/Itanagar	English	4990do
1530	1545		India, AIR/Jaipur	English	4910do 7325do
1530	1545		India, AIR/Jeypore	English	5040do
1530	1545		India, AIR/Kuresong	English	4895do
1530	1545		India, AIR/Lucknow	English	4880do 7440do
1530	1545		India, AIR/Port Blair/Andaman & Nicobar	English	4760do
1530	1545		India, AIR/R Kashmir	English	4950do
1530	1545		India, AIR/Shillong	English	4970do
1530	1545		India, AIR/Shimla	English	4965do 6020do
1530	1545		India, AIR/Thiruvananthapuram	English	5010do
1530	1550	smtwhf	Vatican City State, Vatican R	English	17510as
1530	1600		Afghanistan, RTV Afghanistan	English	7200as
1530	1600		Australia, ABC/R Australia	English	11880pa
1530	1600	DRM	Belgium, The Disco Palace	English	15775as
1530	1600	h	Canada, Bible Voice Broadcasting	English	15275as
1530	1600		Iran, VO Islamic Rep of Iran	English	11945va 13780va 13720al
1530	1600		Mongolia, Voice of Mongolia	English	12015as
1530	1600	smtwa	Sri Lanka, AWR Asia	English	15255as
1530	1600		Vatican City State, Vatican R	English	11850as 13765as
1530	1600	DRM	Vatican City State, Vatican R	English	17815as
1550	1600	Sat	Vatican City State, Vatican R	English	17510as
1551	1600		New Zealand, R New Zealand Intl	English	9765pa
1551	1600	DRM	New Zealand, R New Zealand Intl	English	7440pa

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

1600	1627		Iran, VO Islamic Rep of Iran	English	11945va 13780va 13720al
1600	1630		Australia, ABC/R Australia	English	9540as
1600	1630	DRM	Belgium, The Disco Palace	English	15775as
1600	1630		Guam, AWR Asia/Pacific	English	15215as 15660as
1600	1630		Vietnam, VO Vietnam/Overseas Svc	English	7220me 7280eu 9550me 9730eu
1600	1650	DRM	New Zealand, R New Zealand Intl	English	7440pa
1600	1657		North Korea, VO Korea	English	3560eu 9990va 11545va
1600	1700		Anguilla, University Network	English	11775na
1600	1700		Australia, ABC NT Alice Springs	English	2310do
1600	1700		Australia, ABC NT Katherine	English	2485do
1600	1700		Australia, ABC/R Australia	English	5940as 5995pa 7240pa 11660as 11880pa 19475as
1600	1700		Bahrain, R Bahrain	English	6010me
1600	1700		Canada, CFRX Toronto ON	English	6070na
1600	1700		Canada, CFVP Calgary AB	English	6030na
1600	1700		Canada, CKZN St Johns NF	English	6160na
1600	1700		Canada, CKZU Vancouver BC	English	6160na
1600	1700		China, China R International	English	6060as 7235as 7420af 9570af 11900af 11940eu 11965eu 13760eu
1600	1700		Egypt, R Cairo	English	15345af
1600	1700		Eqt Guinea, Pan American BC/R Africa	English	15190af
1600	1700		Ethiopia, R Ethiopia	English	7235va 9560va
1600	1700	Sat/Sun	Germany, Mighty KBC Radio	English	6095eu
1600	1700		Malaysia, RTM Kajang/Traxx FM	English	7295do
1600	1700		New Zealand, R New Zealand Intl	English	9765pa
1600	1700		Palau, T8WH/World Harvest R	English	15530as
1600	1700	DRM	Russia, VO Russia	English	6070as 7370eu
1600	1700		Russia, VO Russia	English	4975as 7285me 11985me
1600	1700		South Korea, KBS World R	English	9515eu 9640as
1600	1700		Taiwan, R Taiwan Intl	English	9435as 15485as
1600	1700		Uganda, Dunamis Shortwave	English	4750do
1600	1700		UK, BBC World Service	English	3255af 5845as 5975as 6190af 9410as 11890as 12095af 13820me 15400af 17795af 17830af 21470af
1600	1700		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1600	1700		USA, BBG/VOA	English	4930af 6080af 6080as 15580as
1600	1700		USA, Overcomer Ministry	English	15425as
1600	1700		USA, WBCQ Monticello ME	English	9330am
1600	1700	Sat/Sun	USA, WBCQ Monticello ME	English	15420am
1600	1700		USA, WEWN/EWTN Irondale AL	English	15610eu
1600	1700	Sat/Sun	USA, WHRI Cypress Creek SC	English	9795am
1600	1700		USA, WHRI Cypress Creek SC	English	9840na 11630af
1600	1700		USA, WINB Red Lion PA	English	13570am
1600	1700		USA, WJHR Intl Milton FL	English	15550usb
1600	1700		USA, WTWW Lebanon TN	English	9479va
1600	1700		USA, WWCR Nashville TN	English	9980af 12160af 13845eu 15825eu
1600	1700		USA, WWRB Manchester TN	English	9370na
1600	1700		USA, WYFR/Family R Worldwide	English	11850as
1600	1700		Zambia, Christian Voice	English	6065af
1600	1700		Zambia, CVC Intl/1 Africa	English	13590af
1615	1630		Vatican City State, Vatican R	English	15595va
1630	1700		Guam, AWR Asia/Pacific	English	15660as
1630	1700		Turkey, VO Turkey	English	15520as
1630	1700		USA, BBG/VOA/Sudan in Focus	English	9490af 11655af 13800af
1645	1700		Canada, Bible Voice Broadcasting	English	15215me
1651	1700		New Zealand, R New Zealand Intl	English	9890pa

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

1700	1710		Pakistan, PBC/R Pakistan	English	11575eu
1700	1715	mf	Canada, Bible Voice Broadcasting	English	15215me
1700	1720	h	Canada, Bible Voice Broadcasting	English	15215me
1700	1725		Turkey, VO Turkey	English	15520as
1700	1730		Australia, ABC/R Australia	English	11660as
1700	1730		Vietnam, VO Vietnam/Overseas Svc	English	9625eu
1700	1750	DRM	New Zealand, R New Zealand Intl	English	9890pa
1700	1750		New Zealand, R New Zealand Intl	English	9765pa
1700	1755		South Africa, Channel Africa	English	15235af
1700	1756	DRM	Romania, R Romania Intl	English	9535eu
1700	1756		Romania, R Romania Intl	English	11740eu 11740eu
1700	1800		Anguilla, University Network	English	11775na
1700	1800		Australia, ABC NT Alice Springs	English	2310do
1700	1800		Australia, ABC NT Katherine	English	2485do
1700	1800		Australia, ABC/R Australia	English	5995pa 9475as 9500pa 9580pa 9710pa 11880pa
1700	1800		Bahrain, R Bahrain	English	6010me
1700	1800	asm	Canada, Bible Voice Broadcasting	English	15215me
1700	1800		Canada, CFRX Toronto ON	English	6070na
1700	1800		Canada, CFVP Calgary AB	English	6030na
1700	1800		Canada, CKZN St Johns NF	English	6160na
1700	1800		Canada, CKZU Vancouver BC	English	6160na
1700	1800		China, China R International	English	6090as 6140as 6145eu 6165me 7235as 7265af 7410as 7420as 9570af 9695eu 11900af 13760eu
1700	1800		Egypt, R Cairo	English	15345af
1700	1800		Eqt Guinea, Pan American BC/R Africa	English	15190af
1700	1800		Malaysia, RTM Kajang/Traxx FM	English	7295do
1700	1800		Poland, Polish R/External Svc	English	9955na
1700	1800	DRM	Russia, VO Russia	English	7370eu
1700	1800		Russia, VO Russia	English	4975va 7285va 11985af 12040eu
1700	1800		Swaziland, TWR Africa	English	3200af
1700	1800		Taiwan, R Taiwan Intl	English	15690af
1700	1800		UK, BBC World Service	English	3255af 5845as 5975as 6190af 7565as 9410as 12095af 15400af 15420af 17640af 17795af 17830af
1700	1800		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1700	1800		USA, BBG/VOA	English	6080af 11795af 15580af 17895af

Start	End	Days	Station	Language	Frequencies
1700	1800		USA, Overcomer Ministry	English	15425as
1700	1800		USA, WBCQ Monticello ME	English	9330am 15420am
1700	1800		USA, WEWN/EWTN Irondale AL	English	15610eu
1700	1800		USA, WHRI Cypress Creek SC	English	9840na 21630af
1700	1800		USA, WINB Red Lion PA	English	13570am
1700	1800		USA, WJHR Intl Milton FL	English	15550usb
1700	1800		USA, WTWW Lebanon TN	English	9479va
1700	1800		USA, WWCR Nashville TN	English	9980af 12160af 13845eu 15825eu
1700	1800		USA, WWRB Manchester TN	English	9370na
1700	1800		USA, WYFR/Family R Worldwide	English	7395af 17545af
1700	1800		Zambia, Christian Voice	English	4965as
1700	1800		Zambia, CVC Intl/1 Africa	English	13590af
1730	1745	h	Canada, Bible Voice Broadcasting	English	15215me
1730	1745		India, AIR/Bhopal	English	4810do 7430do
1730	1745		India, AIR/Chennai	English	4920do
1730	1745		India, AIR/Guwahati	English	4940do
1730	1745		India, AIR/Hyderbad	English	4800do
1730	1745		India, AIR/Imphal	English	4775do
1730	1745		India, AIR/Jaipur	English	4910do 7325do
1730	1745		India, AIR/Kuresong	English	4895do
1730	1745		India, AIR/Lucknow	English	4880do 7440do
1730	1745		India, AIR/R Kashmir	English	4950do
1730	1745		India, AIR/Shimla	English	4965do 6020do
1730	1745		India, AIR/Thiruvananthapuram	English	5010do
1730	1800		Australia, ABC/R Australia	English	6080pa
1730	1800	Sun	Italy, IRRS SW	English	7290va
1730	1800	m	South Africa, R Mirror Intl	English	3230af
1730	1800		Vatican City State, Vatican R	English	11625af 13765af 15570af
1745	1800	Sat	Canada, Bible Voice Broadcasting	English	17515af
1745	1800	DRM	India, AIR/External Svc	English	9950eu
1745	1800		India, AIR/External Svc	English	7400af 7550eu 9415af 11580af 11670as 11935af 13695af
1751	1800		New Zealand, R New Zealand Intl	English	11725pa
1751	1800	DRM	New Zealand, R New Zealand Intl	English	11675pa

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

Start	End	Days	Station	Language	Frequencies
1800	1830		Japan, R Japan NHK World	English	15720af
1800	1830	m	South Africa, R Mirror Intl	English	3230af
1800	1830		Tanzania, Zanzibar BC/VO Tanzania	English	11735do
1800	1830		UK, BBC World Service	English	5850as 5975as
1800	1830	mtwhf	USA, BBG/VOA	English	6080af 9850af 12015af 15580af
1800	1830	Sat/Sun	USA, BBG/VOA	English	4930af 6080af 9850af 12015af 15580af
1800	1850	DRM	New Zealand, R New Zealand Intl	English	11675pa
1800	1857		North Korea, VO Korea	English	13760eu 15245eu
1800	1900		Anguilla, University Network	English	11775na
1800	1900	mtwhf	Argentina, RAE	English	15345eu
1800	1900		Australia, ABC NT Alice Springs	English	2310do
1800	1900		Australia, ABC NT Katherine	English	2485do
1800	1900		Australia, ABC/R Australia	English	6080pa 7240as 9475as 9500pa 9580as 9710pa 11880pa
1800	1900		Bahrain, R Bahrain	English	6010me
1800	1900	Sat	Canada, Bible Voice Broadcasting	English	9430me
1800	1900	Sun	Canada, Bible Voice Broadcasting	English	6130eu 15215me
1800	1900		Canada, CFRX Toronto ON	English	6070na
1800	1900		Canada, CFVP Calgary AB	English	6030na
1800	1900		Canada, CKZN St Johns NF	English	6160na
1800	1900		Canada, CKZU Vancouver BC	English	6160na
1800	1900		China, China R International	English	6175eu 9600eu 13760eu
1800	1900	mtwhfa	Ecuador, HCJB/LV de los Andes	English	3995eu
1800	1900		Eqt Guinea, Pan American BC/R Africa	English	15190af
1800	1900	DRM	India, AIR/External Svc	English	9950eu
1800	1900		India, AIR/External Svc	English	7400af 7550as 9415af 9445af 11580af 11670eu 11935af 13695af
1800	1900	fa	Italy, IRRS SW	English	7290va
1800	1900		Kuwait, R Kuwait	English	15540eu
1800	1900		Malaysia, RTM Kajang/Traxx FM	English	7295do
1800	1900		New Zealand, R New Zealand Intl	English	11725pa
1800	1900	DRM	Russia, VO Russia	English	7370eu 9880eu
1800	1900		Russia, VO Russia	English	4975me 9900va 12040eu
1800	1900		South Korea, KBS World R	English	7275eu
1800	1900		Swaziland, TWR Africa	English	3200af 9500af
1800	1900		Taiwan, R Taiwan Intl	English	6155eu
1800	1900		UK, BBC World Service	English	3255af 5875me 5950as 6190af 11810af 12095af 15400af 15420af 17795af
1800	1900		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
1800	1900		USA, KJES Vado NM	English	15385na
1800	1900		USA, WBCQ Monticello ME	English	9330am 15420am
1800	1900		USA, WEWN/EWTN Irondale AL	English	15610af
1800	1900		USA, WHRI Cypress Creek SC	English	9840na 21630af
1800	1900		USA, WINB Red Lion PA	English	13570am
1800	1900		USA, WJHR Intl Milton FL	English	15550usb
1800	1900		USA, WTWW Lebanon TN	English	9479va
1800	1900		USA, WWCR Nashville TN	English	9980af 12160af 13845eu 15825eu
1800	1900		USA, WWRB Manchester TN	English	9370na
1800	1900		USA, WYFR/Family R Worldwide	English	5905af 9610af 9925af 13750af
1800	1900		Zambia, Christian Voice	English	4965af
1800	1900		Zambia, CVC Intl/1 Africa	English	13590af
1815	1845	Sun	Canada, Bible Voice Broadcasting	English	6130eu 9430me
1830	1900	f	Canada, Bible Voice Broadcasting	English	17515af
1830	1900	Sun	Canada, Bible Voice Broadcasting	English	9635me
1830	1900	Sun	Italy, IRRS SW	English	7290va
1830	1900	mtwhf	Moldova, R PMR/Pridnestrovye	English	9665eu
1830	1900	DRM/mtwhf	Nigeria, VO Nigeria	English	15120af
1830	1900		Serbia, International R Serbia	English	6100eu
1830	1900		South Africa, AWR Africa	English	11830af
1830	1900		Turkey, VO Turkey	English	9785va
1830	1900		UK, BBC World Service	English	9410af
1830	1900		USA, BBG/VOA	English	4930af 6080af 9850af 15580af
1851	1900	DRM	New Zealand, R New Zealand Intl	English	15720pa
1851	1900		New Zealand, R New Zealand Intl	English	11725pa

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

Start	End	Days	Station	Language	Frequencies
1900	1915	Sun	Canada, Bible Voice Broadcasting	english	9635me
1900	1925		Turkey, VO Turkey	English	9785va
1900	1927		Germany, Deutsche Welle	English	9735af
1900	1930	f	Canada, Bible Voice Broadcasting	English	17515af
1900	1930		Germany, Deutsche Welle	English	7365af 11800af
1900	1930		USA, BBG/VOA	English	4930af 4940af 6080af 9850af 15580af 17895af
1900	1930		Vietnam, VO Vietnam/Overseas Svc	English	7280eu 9730eu
1900	1945	DRM	India, AIR/External Svc	English	9950eu
1900	1945		India, AIR/External Svc	English	7400af 7550eu 9415af 9445af 11580af 11670eu 11935af 13695af
1900	1950		New Zealand, R New Zealand Intl	English	11725pa
1900	1957		North Korea, VO Korea	English	3560eu 7210af 9975va 11535va 11910af
1900	2000		Anguilla, University Network	English	11775na
1900	2000		Australia, ABC NT Alice Springs	English	2310do
1900	2000		Australia, ABC NT Katherine	English	2485do
1900	2000		Australia, ABC/R Australia	English	6080pa 7240as 9500pa 9710pa 11660as 11880pa
1900	2000		Bahrain, R Bahrain	English	6010me
1900	2000		Canada, CFRX Toronto ON	English	6070na
1900	2000		Canada, CFVP Calgary AB	English	6030na
1900	2000		Canada, CKZN St Johns NF	English	6160na
1900	2000		Canada, CKZU Vancouver BC	English	6160na
1900	2000		China, China R International	English	7295va 9435af 9440af

SHORTWAVE GUIDE

1900 2000 Cuba, R Havana Cuba English 11760am
1900 2000 Egypt, R Cairo English 15290af
1900 2000 Eqt Guinea, Pan American BC/R Africa English
15190af
1900 2000 Indonesia, VO Indonesia English 9526va
1900 2000 Kuwait, R Kuwait English 15540eu
1900 2000 Malaysia, RTM Kajang/Traxx FM English
7295do
1900 2000 Micronesia, V6MP/Cross R/Pohnpei English
4755as
1900 2000 DRM New Zealand, R New Zealand Intl English
15720pa
1900 2000 DRM/mtwhf Nigeria, VO Nigeria English 15120af
1900 2000 DRM Russia, VO Russia English 6155eu
1900 2000 Russia, VO Russia English 12040eu
1900 2000 mtwhf Spain, R Exterior de Espana English 9665af
11620af
1900 2000 Swaziland, TWR Africa English 3200af
1900 2000 Thailand, R Thailand World Svc English 7205eu
1900 2000 UK, BBC World Service English 3255af
5875me 5950as 6005af 6190af
9410af 11810af 12095af 15400af
17795as
1900 2000 USA, Amer Forces Network/AFRTS English
4319usb 5765usb 12759usb 13362usb
1900 2000 USA, Overcomer Ministry English 9400eu
1900 2000 USA, WBCQ Monticello ME English 9330am
15420am
1900 2000 USA, WEWN/EWTN Irondale AL English
15610af
1900 2000 USA, WHRI Cypress Creek SC English 9840na
21630af
1900 2000 USA, WINB Red Lion PA English 13570am
1900 2000 USA, WJHR Intl Milton FL English 15550usb
1900 2000 USA, WTWW Lebanon TN English 9479va
1900 2000 USA, WWCR Nashville TN English 9980af
12160af 13845eu 15825eu
1900 2000 USA, WWRB Manchester TN English 9370na
1900 2000 USA, WYFR/Family R Worldwide English
9775af 9925af
1900 2000 Zambia, Christian Voice English 4965af
1900 2000 Zambia, CVC Intl/1 Africa English 13590af
1905 1920 Sat Mali, ORTM/R Mali English 9635do
1930 1957 Germany, Deutsche Welle English 7365af
1930 2000 Eqt Guinea, Pan American BC/R Africa English
9515af
1930 2000 Germany, Deutsche Welle English 11800af
1930 2000 Iran, VO Islamic Rep of Iran English 9540eu
9800eu 11750af 11885af
1930 2000 USA, BBG/VOA English 4930af 4940af
6080af 15580af
1930 2000 Sat USA, Pan Amer Broadcasting English 9515af
1951 2000 New Zealand, R New Zealand Intl English
17675pa

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

2000 2027 Iran, VO Islamic Rep of Iran English 9540eu
9800eu 11750af 11885af
2000 2030 mtwhfa Albania, R Tirana English 7465eu
2000 2030 Australia, ABC/R Australia English 6080pa
9500pa 11660pa
2000 2030 Egypt, R Cairo English 15290af
2000 2030 Eqt Guinea, Pan American BC/R Africa English
9515af
2000 2030 Sat Swaziland, TWR Africa English 3200af
2000 2030 USA, BBG/VOA English 4930af 6080af
15580af
2000 2030 Vatican City State, Vatican R English 9755af
11625af
2000 2057 Germany, Deutsche Welle English 9490af
2000 2100 Anguilla, University Network English 11775na
2000 2100 Australia, ABC NT Alice Springs English 2310do
2000 2100 Australia, ABC NT Katherine English 2485do
2000 2100 Australia, ABC NT Tennant Creek English
2325do
2000 2100 Australia, ABC/R Australia English 9580pa
11650pa 11660pa 12080pa 15515pa
2000 2100 Bahrain, R Bahrain English 6010me
2000 2100 Belarus, R Belarus English 7255eu 11730eu
2000 2100 DRM Belgium, The Disco Palace English 17875na
2000 2100 Canada, CFRX Toronto ON English 6070na
2000 2100 Canada, CFVP Calgary AB English 6030na
2000 2100 Canada, CKZN St Johns NF English 6160na
2000 2100 Canada, CKZU Vancouver BC English 6160na
2000 2100 China, China R International English 5960eu
5985af 7285eu 7295va 7415eu
9440af 9600eu
2000 2100 Eqt Guinea, Pan American BC/R Africa English
15190af

2000 2100 Germany, Deutsche Welle English 6150af
11800af
2000 2100 Kuwait, R Kuwait English 15540eu
2000 2100 Malaysia, RTM Kajang/Traxx FM English
7295do
2000 2100 Micronesia, V6MP/Cross R/Pohnpei English
4755as
2000 2100 DRM New Zealand, R New Zealand Intl English
15720pa
2000 2100 New Zealand, R New Zealand Intl English
17675pa
2000 2100 DRM Russia, VO Russia English 6155eu
2000 2100 Russia, VO Russia English 12040eu
2000 2100 South Africa, CVC 1 Africa R English 9505af
13590af
2000 2100 UK, BBC World Service English 3255af
6005af 6190af 9410af 9855af
11810af 12095af 15400af
2000 2100 USA, Amer Forces Network/AFRTS English
4319usb 5765usb 12759usb 13362usb
2000 2100 mtwhf USA, BBG/VOA English 7485af 9480va
2000 2100 USA, Overcomer Ministry English 9400eu
2000 2100 USA, WBCQ Monticello ME English 7490am
9330am 15420am
2000 2100 USA, WEWN/EWTN Irondale AL English
15610af
2000 2100 mtwhfa USA, WHRI Cypress Creek SC English 21630af
2000 2100 USA, WHRI Cypress Creek SC English 17510va
2000 2100 USA, WINB Red Lion PA English 13570am
2000 2100 USA, WJHR Intl Milton FL English 15550usb
2000 2100 USA, WTWW Lebanon TN English 9479va
2000 2100 USA, WWCR Nashville TN English 9980af
12160af 13845eu 15825eu
2000 2100 USA, WWRB Manchester TN English 9370na
2000 2100 USA, WYFR/Family R Worldwide English
15195af
2000 2100 Zambia, Christian Voice English 4965af
2000 2100 Zambia, CVC Intl/1 Africa English 9505as
2030 2045 Thailand, R Thailand World Svc English 9680eu
2030 2056 DRM Romania, R Romania Intl English 9700eu
2030 2056 Romania, R Romania Intl English 11880na
13800na 15220na
2030 2100 Australia, ABC/R Australia English 9500pa
11695as
2030 2100 mtwhf Moldova, R PMR/Pridnestrovye English 9665eu
2030 2100 Turkey, VO Turkey English 7205va
2030 2100 mtwhf USA, BBG/VOA English 4930af 6080af
15580af
2030 2100 Sat/Sun USA, BBG/VOA English 4930af 4940af
6080af 15580af
2030 2100 USA, BBG/VOA English 7555as
2030 2100 Vietnam, VO Vietnam/Overseas Svc English
7220me 7280eu 9730me 9730eu
2045 2100 India, AIR/External Svc English 7550eu
9445eu 9910pa 11620pa 11670eu
11715pa
2045 2100 DRM India, AIR/External Svc English 9950eu

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

2100 2125 Turkey, VO Turkey English 7205va
2100 2130 Australia, ABC NT Alice Springs English 2310do
2100 2130 Australia, ABC NT Katherine English 2485do
2100 2130 Australia, ABC NT Tennant Creek English
2325do
2100 2130 Austria, AWR Europe English 9830af
2100 2130 Serbia, International R Serbia English 6100eu
2100 2130 South Korea, KBS World R English 3955eu
2100 2150 New Zealand, R New Zealand Intl English
17675pa
2100 2150 DRM New Zealand, R New Zealand Intl English
15720pa
2100 2157 North Korea, VO Korea English 13760eu
15245eu
2100 2200 Angola, Angolan National R English 7217af
2100 2200 Anguilla, University Network English 11775na
2100 2200 Australia, ABC/R Australia English 9500pa
9660as 11650pa 11695pa 12080pa
13630pa 15515pa 21740pa
2100 2200 Bahrain, R Bahrain English 6010me
2100 2200 Belarus, R Belarus English 7255eu 11730eu
2100 2200 Canada, CFRX Toronto ON English 6070na
2100 2200 Canada, CFVP Calgary AB English 6030na
2100 2200 Canada, CKZN St Johns NF English 6160na
2100 2200 Canada, CKZU Vancouver BC English 6160na
2100 2200 China, China R International English 5960eu
7205af 7285eu 7325af 7415eu
9600eu

Start	End	Days	Station	Language	Frequencies
2100	2200		Eqt Guinea, Pan American BC/R Africa	English	15190af
2100	2200		Germany, Deutsche Welle	English	11800af 11830af 11865af
2100	2200		India, AIR/External Svc	English	7550eu 9445eu 9910pa 11620pa 11670eu 11715pa
2100	2200	DRM	India, AIR/External Svc	English	9950eu
2100	2200		Malaysia, RTM Kajang/Traxx FM	English	7295do
2100	2200		Micronesia, V6MP/Cross R/Pohnpei	English	4755 as
2100	2200	DRM	Russia, VO Russia	English	6155eu
2100	2200		South Africa, CVC 1 Africa R	English	9505af 13590af
2100	2200	Sat/Sun	Spain, R Exterior de Espana	English	9650eu
2100	2200		Syria, R Damascus	English	9330va
2100	2200		UK, BBC World Service	English	3255af 3915as 5875as 5905af 6005af 6190af 6195va 9410af 12095af
2100	2200		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
2100	2200		USA, BBG/VOA	English	6080af 7555as 15580af
2100	2200		USA, Overcomer Ministry	English	9400eu
2100	2200		USA, WBCQ Monticello ME	English	7490am 9330am
2100	2200		USA, WEWN/EWTN Irondale AL	English	15610af
2100	2200		USA, WHRI Cypress Creek SC	English	17510va
2100	2200		USA, WINB Red Lion PA	English	9265am
2100	2200		USA, WJHR Intl Milton FL	English	15550usb
2100	2200		USA, WTWW Lebanon TN	English	9479va
2100	2200		USA, WWCR Nashville TN	English	6875eu 9350af 9980af 13845eu
2100	2200		USA, WWRB Manchester TN	English	3185na 3215na 9370na
2100	2200		USA, WYFR/Family R Worldwide	English	12070af
2100	2200		Zambia, Christian Voice	English	4965af
2100	2200		Zambia, CVC Intl/1 Africa	English	9505as
2115	2200		Egypt, R Cairo	English	11890eu
2130	2200		Australia, ABC NT Alice Springs	English	4835do
2130	2200		Australia, ABC NT Katherine	English	5025do
2145	2200		India, AIR/R Kashmir	English	4950do
2151	2200		New Zealand, R New Zealand Intl	English	15720pa
2151	2200	DRM	New Zealand, R New Zealand Intl	English	17675pa

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

Start	End	Days	Station	Language	Frequencies
2200	2230		India, AIR/External Svc	English	7550eu 9445eu 9910pa 11620pa 11670eu 11715pa
2200	2230	DRM	India, AIR/External Svc	English	9950as
2200	2230	smtwh	USA, BBG/VOA	English	5895va 5915va 7480va 7575va 12150va
2200	2245		Egypt, R Cairo	English	11890eu
2200	2255		Turkey, VO Turkey	English	9830va
2200	2256		Romania, R Romania Intl	English	7435eu 9540eu 9790eu 11940eu
2200	2300		Anguilla, University Network	English	6090na
2200	2300		Australia, ABC NT Alice Springs	English	4835do
2200	2300		Australia, ABC NT Katherine	English	5025do
2200	2300		Australia, ABC/R Australia	English	9660as 9855as 12080pa 13630pa 15230pa 15415pa 15515pa 21740pa
2200	2300		Bahrain, R Bahrain	English	6010me
2200	2300		Canada, CFRX Toronto ON	English	6070na
2200	2300		Canada, CFVP Calgary AB	English	6030na
2200	2300		Canada, CKZN St Johns NF	English	6160na
2200	2300		Canada, CKZU Vancouver BC	English	6160na
2200	2300		China, China R International	English	9590as
2200	2300		Eqt Guinea, Pan American BC/R Africa	English	15190af
2200	2300		Malaysia, RTM Kajang/Traxx FM	English	7295do
2200	2300		Micronesia, V6MP/Cross R/Pohnpei	English	4755 as
2200	2300		New Zealand, R New Zealand Intl	English	15720pa
2200	2300	DRM	New Zealand, R New Zealand Intl	English	17675pa
2200	2300	Sat	Palau, T8WH/World Harvest R	English	9930as
2200	2300		Russia, VO Russia	English	9800va
2200	2300		UK, BBC World Service	English	3915as 5875as 5905as 6195as 7490as 9580as 9730af 9740as 12095af
2200	2300		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
2200	2300		USA, BBG/VOA	English	7555as
2200	2300		USA, Overcomre Ministry	English	9400as
2200	2300		USA, WBCQ Monticello ME	English	7490am 9330am
2200	2300		USA, WEWN/EWTN Irondale AL	English	15610me
2200	2300		USA, WHRI Cypress Creek SC	English	11775va 13620na 17510va
2200	2300	twhfas	USA, WINB Red Lion PA	English	9265am
2200	2300		USA, WTWW Lebanon TN	English	9479va
2200	2300		USA, WWCR Nashville TN	English	6875eu 9350af 9980af 13845eu
2200	2300		USA, WWRB Manchester TN	English	3185na 3215na 9370na
2200	2300		Zambia, Christian Voice	English	4965af
2215	2300		USA, WYFR/Family R Worldwide	English	6145va
2230	2300		China, Xizang PBS	English	4905do
2230	2300		Guam, AWR Asia/Pacific	English	15320as
2230	2300	mtwhf	Moldova, R PMR/Pridnestrovye	English	9665eu
2230	2300		USA, WYFR/Family R Worldwide	English	6145na 11580af 15255af
2245	2300		India, AIR/External Svc	English	6055as 9705as 9950as 11670as 13605as
2245	2300	DRM	India, AIR/External Svc	English	11645as
2245	2300		India, AIR/R Kashmir	English	4950do

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

Start	End	Days	Station	Language	Frequencies
2300	0000		Anguilla, University Network	English	6090na
2300	0000		Australia, ABC NT Alice Springs	English	4835do
2300	0000		Australia, ABC NT Katherine	English	5025do
2300	0000		Australia, ABC/R Australia	English	9660as 9855as 12080pa 15230pa 15415pa 15230pa 15415pa 17795pa 19000pa 21740pa
2300	0000		Bahrain, R Bahrain	English	6010me
2300	0000		Canada, CFRX Toronto ON	English	6070na
2300	0000		Canada, CFVP Calgary AB	English	6030na
2300	0000		Canada, CKZN St Johns NF	English	6160na
2300	0000		Canada, CKZU Vancouver BC	English	6160na
2300	0000		China, China R International	English	5915as 5990ca 6145na 7350eu 7410as 9610as 11690as 11790as
2300	0000		Cuba, R Havana Cuba	English	5040va
2300	0000		Egypt, R Cairo	English	9965na
2300	0000		India, AIR/External Svc	English	6055as 9705as 9950as 11670as 13605as
2300	0000	DRM	India, AIR/External Svc	English	11645as
2300	0000		Malaysia, RTM Kajang/Traxx FM	English	7295do
2300	0000		Micronesia, V6MP/Cross R/Pohnpei	English	4755 as
2300	0000		New Zealand, R New Zealand Intl	English	15720pa
2300	0000	DRM	New Zealand, R New Zealand Intl	English	17675pa
2300	0000		Russia, VO Russia	English	9665va 9800va
2300	0000		Spain, R Exterior de Espana	English	6055na
2300	0000		UK, BBC World Service	English	3915as 6195as 7490as 9580as 9740as 9890as 11850as 12010as
2300	0000		USA, Amer Forces Network/AFRTS	English	4319usb 5765usb 12759usb 13362usb
2300	0000		USA, WBCQ Monticello ME	English	7490am 9330am
2300	0000	Sat/Sun	USA, WBCQ Monticello ME	English	5110am
2300	0000		USA, WEWN/EWTN Irondale AL	English	15610me
2300	0000		USA, WHRI Cypress Creek SC	English	13620na 17510va
2300	0000	Sun	USA, WHRI Cypress Creek SC	English	11775va
2300	0000	mtwhfs	USA, WHRI Cypress Creek SC	English	7315ca
2300	0000		USA, WINB Red Lion PA	English	9265am
2300	0000		USA, WTWW Lebanon TN	English	9479va
2300	0000		USA, WWCR Nashville TN	English	6875eu 9350af 9980af 13845eu
2300	0000		USA, WWRB Manchester TN	English	3185na 3215na 9370na
2300	0000		USA, WYFR/Family R Worldwide	English	6145na 15255sa 11580sa
2300	0000		Zambia, Christian Voice	English	4965af
2330	0000		Australia, ABC/R Australia	English	17750pa
2330	0000		Australia, ABC/R Australia	English	17750as
2330	0000	tw	Guam, AWR Asia/Pacific	English	17700as
2330	0000		Vietnam, VO Vietnam/Overseas Svc	English	9840as 12020as

Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com
Blog: http://mt-milcom.blogspot.com
Twitter: MilcomMP

Aerial Refueling Frequencies in North America

Aerial refueling is one aspect of monitoring the military that anyone with a military air-capable scanner can do no matter where they live in the United States. On any given day, military aircraft fly overhead and, during some of their missions, take on fuel from flying Department of Defense (DoD) gas stations or aerial refueling tankers. The mission is known as aerial refueling or in-flight refueling, and these DoD missions are used by the military to transfer fuel from one aircraft to another during flight.

The conduct of aerial refueling (AR) is based on the strict requirement that participating aircraft remain within specifically designated airspace. Aerial refueling operations are normally conducted on tracks or in anchor areas that are published in various DoD Flight Information Publications (FLIP). Aircraft participating in these missions must operate under instrument flight rules and positive radar control from either an air route traffic control center or military radar unit.

In December 2010, in this column I presented a list of frequencies used for random refueling activity. In November 2009, I presented the latest list of aerial refueling (AR) frequencies used by DoD in North America. Since those lists were published, more major frequency changes have been observed in the 225-400 MHz spectrum.

This month we present our latest exclusive frequency list of 225-400 MHz DoD aerial refueling frequencies. All the aerial refueling tracks/anchors listed in our frequency list are operated by the U.S. Air Force unless otherwise indicated.

Aerial Refueling By Frequencies (MHz)

225.500 AR-042V (E/W) VFR helicopter track
226.325 Bristol MOA California track – MCAGCC Twenty Nine Palms (primary)
227.425 AR-643 anchor (primary)
228.000 Mid-Atlantic AAR common/AR-777 track (primary)
228.250 AR-400 (N/S) track (primary)
229.350 U.S. Navy (USN) Omega AAR boom
229.375 Bristol MOA, California track – MCAGCC Twenty Nine Palms (secondary)
229.500 AR-121 (N/S) track (primary)
229.525 Florida Air/Refueling operations
229.675 USN AAR boom
230.050 AR-041V (N/S) VFR helicopter track (primary)
233.325 USN AAR boom
233.725 AR-135V (N/S) VFR helicopter track (secondary)/AR-136V/AR-137V (N/S) (primary)
235.025 AR-117V VFR helicopter track
235.100 Tracks/Anchors primary: AR-332 (NE/SW), AR-003L, AR-004B, 167 (N/S), AR-011, 112H (E/W), AR-200, AR-206L, AR-328, AR-605, AR-607, AR-626, AR-627, AR-634
235.575 Florida Air/Refueling operations
236.250 U.S. Marine Corps (USMC) Air/Refueling operations
236.650 Tracks/anchors primary: AR-007B, AR-019, 024 (N/S), AR-315 (E/W), AR-602, AR-610A/B, AR-615
238.050 USN AAR boom
238.500 AR-135V (N/S) VFR helicopter track (primary), AR-136V, 137 (N/S) VFR helicopter tracks (secondary)
238.900 Tracks/Anchors primary: AR-009A,013, 105, 209 (E/W), AR-203, 212 (NE/SW), AR-603, AR-619, AR-620 (Avon Park "Crystal Track"), AR-630, AR-632, AR-636, AR-646, AR-648A/B, Tracks secondary: AR-307A (E)/B (W)/C, AR-331, AR-355, AR-356
239.725 AR-042V (E/W) VFR helicopter track (primary)
240.350 Tracks/Anchors primary: AR-008A, AR-106H, 314, 318 (E/W), AR-625H, AR-631, AR-633A/B, AR-650
241.925 USN AAR boom
243.450 AR-062 Canada track secondary
249.500 AR-123 Track/AR-672 Anchor (primary)
249.525 AR-652 (N/S)/A/B Anchor (primary)
249.875 USMC VMGR-352 AR Tactical (secondary)
250.750 USMC VMGR-352 AR Tactical (primary)
251.475 USMC VMGR-352 AR Tactical (tertiary)
252.100 Air/Refueling operations (New Mexico)
252.175 R-2508 Coaldale area/Saline MOA refueling route (California)
252.800 AR-015V (N/S) and AR-068V VFR helicopter tracks (secondary)
252.975 AR-125V VFR helicopter track
254.600 Air/Refueling operations Roswell, New Mexico, AR anchor
255.775 AR-652 (N/S)/A/B Anchor (primary)
256.650 Tracks primary: AR-005L (E/W), AR-006 (N/S), Tracks/Anchors secondary: AR-001 (E), AR-002 (W), AR-003L, AR-005H, AR-007A/B, AR-008A/B, AR-020 (NE/SW), AR-201, 209, 314, 642 (E/W), AR-310, AR-331, AR-603, AR-619, AR-620 (Avon Park Crystal Track), AR-630, AR-632, AR-636, AR-646, AR-648A/B, AR-602, AR-603, AR-621, AR-624, AR-625H/L, AR-634, AR-635, AR-639, AR-639A, AR-641A/B, AR-644 (N/S), AR-647A, AR-648A/B, AR-649, AR-651, AR-659
258.050 Tracks/Anchors secondary: AR-011, 012H, 105, 106L/H, 109L/H (E/W), AR-017, 019, 024 (N/S), AR-453, AR-606, AR-607, AR-619, AR-622, AR-640A/B
258.200 AR-121 (N/S) Track (secondary)
260.050 Anchors primary: AR-644 (N/S), AR-645, AR-653, AR-657
260.200 AR-041V (N/S) VFR helicopter track (secondary), Tracks/Anchors secondary: AR-013, 104, 108, 112L/H, 116, 302, 309, 318, 330 (E/W), AR-101, 167, 313/A (N/S), AR-102A (E), AR-102B, AR-103, AR-104M, AR-114, AR-312L, AR-614, AR-615, AR-643, AR-646, AR-650, AR-653, AR-654, AR-674
260.300 AR-113 (E/W) Track (secondary)
263.900 Alaska tracks/anchors secondary: AR-505, 507, 508 (E/W), AR-506 (N/S), AR-719 (Yukon Range), AR-720, 721, 722, 725, 727 (NE/SW), AR-723, AR-724
264.600 AFSOC Air/Refueling operations (New Mexico)
264.900 AR-307A (E)/B (W)/C Track (primary) and AR-667 Anchor (secondary)
265.050 AR-003H (E/W)/233 Tracks (primary) and AR-611A/B Anchor
266.225 USN AAR boom
266.350 Paradise (MOA Jarbridge), Idaho track
268.550 Anchors: AR-654/674
269.050 Paradise east MOA, Idaho track
270.200 Alaska track/anchors primary (Yukon Range): AR-507 (E/W), AR-719, AR-721, 727 (NE/SW)
271.500 USN NAS Fallon, Nevada, AAR boom
271.650 Tracks/Anchors primary: AR-004A (N/S), AR-012L, 104 (E/W), AR-621 Track secondary: AR-003H (E/W), AR-233
272.175 Edwards AFB, California R-2508 Panamint/Shoshone area refueling
272.375 Southeast U.S. AFSOC refueling
273.350 USN AAR boom
273.750 AR-040V (E/W) VFR helicopter track (primary)

274.450 Tracks/anchors primary: AR-006, 313/A (N/S), AR-012H (E/W), AR-218, AR-220 , AR-310, AR-614, AR-627, AR-635
275.925 Tupelo, Mississippi Tanker/T-1 Student/ Instructor training anchor
276.025 Berry, Tennessee instrument/student training anchor
276.350 USN AAR boom
276.500 Tracks/Anchors primary: AR-007A, AR-017 (N/S), AR-102A/B, AR-216 (NE/SW), AR-321, AR-604, AR-609, AR-651, AR-655, AR-658
276.700 Alaska anchor primary: AR-720/722 (NE/SW)
276.750 Track/anchor secondary: AR-014 (E/W)/AR-623
278.400 Alaska anchor primary: AR-723/724
278.750 Tracks/anchors primary: AR-005L, 116, 302 (E/W), AR-010 (SE/NW), AR-114, AR-218H, AR-606, AR-624
278.775 USN AAR boom
279.800 AR-643 Anchor primary
280.400 AR-678 Anchor primary
282.000 Tracks/anchor primary: AR-337, AR-338, AR-685
282.550 AR-613 Anchor primary
282.700 Tracks/Anchors secondary: AR-010, AR-204, 212 (NE/SW), AR-205, AR-206L/H, AR-217, AR-218, AR-219, AR-220, AR-321, AR-608, AR-609, AR-612, AR-616A/B, AR-631, AR-632
283.800 Alaska AR-725 (NW/SE) Anchor primary
283.900 Tracks/Anchors primary: AR-002 (W), AR-005H, 113, 255H, 309 (E/W), AR-217, AR-601, AR-616A/B, AR-647L/H, AR-647A, AR-716, AR-717A/B
284.075 AR-312H Track primary
286.200 AR-658 High Block Anchor primary
286.300 AR-649 Anchor primary
288.100 AR-305/306AV/BV VFR helicopter track secondary
288.800 Alaska track primary: AR-506 (N/S), AR-508E, AR-508W
289.375 USN AAR boom
289.550 Tracks/Anchors: AR-108, 112L (E/W), AR-615
289.650 Anchors: AR-642 (E/W), AR-659
291.650 AR-659 Anchor primary
291.700 AR-304AV/BV VFR helicopter track secondary
291.900 Tracks/Anchors primary: AR-312L, AR-453, AR-455 (E/W), AR-625L, AR-637, AR-639, AR-639A, AR-640B
292.000 UK RAF east coast refueling frequency
292.600 Alaska statewide refueling, Tracks/ Anchors secondary: AR-004A/B (N/S), AR-009/A, 012L (E/W), AR-010 (SE/NW), AR-604, AR-605, AR-610A/B, AR-626, AR-628, AR-630, AR-645, AR-717A/B
295.400 Tracks/Anchors primary: AR-019, 024 (N/S), AR-602, AR-610A/B, AR-615, AR-641A, AR-647
295.800 NORAD Western / Eastern Air Defense Sector refueling, Tracks/Anchors primary: AR-106H, 112L. 314 (E/W), AR-625H, AR-631, AR-650
296.000 AR-629 Anchor primary
297.300 AR-406H (E/W) track secondary, AR-406L (E/W) track primary
299.000 Anchors: AR-611A/B, AR-658L
302.250 Tracks primary: AR-197L/H (N/S)
303.000 USN AAR boom
303.075 AR-042 Eridu track
303.125 AR-018V (N/S) VFR helicopter track (secondary)
305.350 Tracks/Anchor secondary: AR-337, AR-338, AR-685
305.500 Tracks/Anchors primary: AR-008B, AR-020 (NE/SW), AR-106L, 330 (E/W), AR-219, AR-613, AR-640A, AR-659
305.750 AMC Nationwide refueling network

309.950 AR-042V (E/W) VFR helicopter track secondary
310.425 Track/Anchor: AR-123, AR-672
311.500 AR-133V (N) VFR helicopter track secondary
311.550 USN AAR boom
311.575 AR-018V (N/S) VFR helicopter track primary
312.000 AMC Nationwide tanker intra-cell frequency primary
312.225 AR-312H track secondary
315.900 AR-505 (E/W) track primary
318.000 Air/Refueling operations (New Mexico), AR-131V (N) and AR-132V (S) VFR helicopter track secondary, Tracks/Anchors primary: AR-462, AR-622, AR-658 Low Block, AR-667
319.050 AR-041V (N/S) VFR helicopter track
319.500 Tracks/Anchors secondary: AR-201, 310, 314, 642 (E/W), AR-602, AR-603, AR-613, AR-621, AR-623, AR-624, AR-625L/H, AR-634, AR-635, AR-639/A, AR-641A, AR-644 (N/S), AR-647/A, AR-649, AR-651, AR-659
319.700 Tracks/Anchors secondary: AR-016, 110, 111 (E/W), AR-200, AR-203 (NE/SW), AR-600, AR-601, AR-627, AR-636, AR-637
320.525 AR-197L/H (N/S) track secondary
320.900 Tracks/Anchors secondary: AR-011, 110, 106L/H, 109L/H (E/W), AR-017, 019, 024 (N/S), AR-453, AR-606, AR-607, AR-619, AR-640A/B, Tracks primary: AR-355, AR-356
324.250 AR-452 (NE/SW) track
324.400 Anchors primary: AR-644 (N/S), AR-645
324.600 Tracks/Anchors primary: AR-101 (N/S), AR-107, AR-204, 207 (NE/SW), AR-617, AR-638, AR-644 (N/S), AR-645, AR-653, AR-657
327.400 R-3008 Moody AFB, Georgia Air/Refueling operations
327.425 Tracks: AR-013 (E/W), AR-103, AR-116 (E/W)
327.600 Tracks primary: AR-324 (Puerto Rico), AR-103, AR-109L, 110, 255L (E/W), AR-202 (S/N/Alt N), AR-205
328.450 AR-134V (S) VFR helicopter track secondary
336.100 Track primary: AR-014, 201, 455 (E/W)
340.125 Southeast U.S. tanker track operations
341.400 Anchors primary: AR-654, AR-674
341.750 AR-020 (NE/SW) track primary
341.800 Randolph AFB, Texas, air/refueling operations T-1A aircraft in formation
342.000 AMC Nationwide tanker intra-cell frequency secondary
342.550 Track/Anchor secondary: AR-005H (E/W), AR-716, Anchors primary: AR-601, AR-616A/B, AR-647H, AR-648A/B, AR-717A/B
342.250 Tracks/Anchors secondary: AR-324 (Puerto Rico), AR-332 (Puerto Rico), 203, 207, 216 (NE/SW), AR-016, 110, 111, 315 (E/W), AR-200, AR-202 (S/N/Alt N), AR-328, AR-600, AR-601, AR-617, AR-618, AR-62 (Avon Park Crystal Track), AR-627, AR-633A/B, AR-636, AR-637, AR-638, AR-655, AR-716
343.275 USN AAR boom
343.500 Tracks/Anchors primary: AR-001 (E), AR-016, 109H (E/W), AR-608, AR-628, Tracks secondary: AR-080 (NE/SW) Canada, AR-081 Canada, AR-157 (Atlantic)
344.700 Track/Anchor primary: AR-004A (N/S), AR-104 (E/W), AR-104M, AR-621
347.200 AR-658 High block anchor secondary
348.900 Tracks/Anchors primary: AR-108, 111 (E/W), AR-206H, AR-600, AR-618
348.950 USN AAR boom
349.700 AR-020 (NE/SW) track secondary
352.600 Tracks/Anchors: AR-310 (E/W), AR-313/A (N/S), AR-614, AR-627, AR-635
354.400 Edwards AFB, California, Flight test support tanker primary
359.100 Track/Anchor: AR-014 (E/W) secondary, AR-623 primary
360.500 USN AAR boom
360.900 AR-015V (N/S) VFR helicopter track primary, Anchors secondary: AR-629, AR-678
361.700 AR-452 (NE/SW) track primary
363.400 Eglin AFB, Florida, AR Common
363.650 USN AAR boom
363.900 AR-015V (N/S) VFR helicopter track primary
364.325 AR-400 (N/S) track secondary
365.775 AR-255L/H (E/W) track secondary
366.300 Tracks/Anchors primary: AR-114, AR-116 (E/W), AR-606, AR-624
373.600 Tracks primary: AR-080 (NE/SW) Canada, AR-081 Canada, AR-157 (Atlantic)
374.000 USN AAR boom
374.225 AR-040V (E/W) VFR helicopter track secondary
375.025 Edwards AFB, California air refueling
377.025 AMC Canada interplane
377.700 AR-678 Anchor secondary
379.400 AR-135V/136V (N/S) VFR helicopter track
384.600 Tracks/Anchors secondary: AR-358H, AR-452 (NE/SW), AR-462, AR-658 High Block, AR-669
391.800 AR-658 Low block anchor primary
394.900 AR-669 Anchor Primary
396.200 AR-406L/H (E/W) track primary/secondary

And that does it for this month. Until next time, 73 and good hunting.

Doug Smith, W9WI
dougsmith@monitoringtimes.com
http://americanbandscan.blogspot.com

AM Salvation

It's no secret that AM broadcasting, as a business, is in trouble. FCC records show 16 AM stations have been permanently silenced between June 2011 and June 2012. This column will list eight Canadian AM stations silenced in the last two months alone. The "big guns" still make a good profit, and you can still make a (small) living in AM if you super-serve a smaller community. However, sometimes it seems an AM broadcasting license is more a license to toss your money in the trash.

Radio World online published an article in September titled, "How to Help AM Radio in Six Steps." Some of the same ideas appeared when FCC Commissioner Ajit Pai spoke at the NAB Radio Show in Dallas in September. And, most of these ideas are not new.

One point that appears in both Pai's speech and David Webster's Radio World article is a proposal for an across-the-board power increase for all AM stations. One plan suggested a 10dB increase; ten times each station's current power. This would do nothing to eliminate interference between stations. WXNT and KZQZ both currently operate at 5,000 watts at night on 1430. Both stations are of the same strength at my location, a signal difference of zero dB, and both severely interfere with each other. Allowing both stations to increase power to 50,000 watts would result in exactly the same zero dB difference in signal. There would be no improvement in inter-station interference whatsoever.

Where the increase would help would be in cases where the interference is coming from something other than another station. Noisy computers, power lines, battery chargers, automotive electronics, and a variety of other sources that make AM reception difficult even when there is no interference from other stations. A 10dB power increase at WXNT and KZQZ wouldn't help either station override the other, but it would help both get past noisy computers in their local cities.

Pai and Webster both also suggested more research into "anti-skywave" antennas. Of course, AM stations' coverage areas increase greatly at sunset; this is because their signals "bounce" off ionized layers of the upper atmosphere. If a transmitting antenna could be designed that would prevent the AM broadcasts from reaching these ionized layers, the coverage of the station would not increase at sunset – and the station could operate with the same power day and night without interfering with distant operations.

This development would be very bad for the DXer, who relies on this ionized "bounce." But it would be a boon for the AM station that can't reach the suburbs at night.

The third suggestion made by both men was to investigate "synchronized" transmission. This is the process of using multiple smaller transmitters on the same frequency, instead of a single, more powerful, transmitter. Synchronized transmission is very common in the U.K.. There are a few smaller synchronized operations in the U.S.; probably the best-known belongs to KKOB-770 Albuquerque. See the KKOB history link in the sidebar; see Page 27 for information on the synchronized system.

KARS-860 Belen, New Mexico proposes to move to 840. (Courtesy: KARS)

Signal strength drops off drastically with distance. If you could replace a single 5,000 watt transmitter with a collection of 250 watt transmitters on the same frequency, spread around the city, you might find most of your audience living far closer to a transmitter and receiving a stronger signal. A 5,000-watt transmitter 25 miles away is actually weaker than a 250-watt transmitter 5 miles distant.

One of the more controversial recent technical moves in AM broadcasting involved two stations on 1190: WLIB New York and WOWO Fort Wayne. WLIB-1190 was required to sign off the air at sunset in Fort Wayne, Indiana to protect WOWO from interference. WLIB bought WOWO, modified the WOWO license so the interference protection would no longer be required, modified the WLIB license so the interference protection would no longer be given, and then sold WOWO. WLIB can now operate all night. In a similar move some time ago, WINS-1010 New York purchased an Arkansas station on the same frequency, canceled the Arkansas license, and then modified the WINS license to remove interference protection towards Arkansas.

Webster proposes to make this type of move easier. He'd allow stations to sell their interference-protection rights, or to be paid to leave the air entirely.

Finally, Webster echoed an earlier proposal to expand the FM broadcasting band into TV channels 5 and 6 (or alternatively, to allow domestic DRM broadcasts in the 26 MHz shortwave band). Sixty analog FM channels could be placed in these two TV channels. That spectrum (76-88 MHz) is already in use for FM broadcasting in Japan, Russia, and parts of eastern Europe.

TV channels 5 and 6 are off-limits for an "FM expanded band" in heavily-populated parts of the country. (Courtesy: Doug Smith & Google Maps)

❖ Salvation isn't Easy

As you might imagine, these proposals are not magic. There are issues with most of them. And there are opportunities with most of them. An across-the-board power increase seems easy: The FCC issues every station a new license specifying ten times the power, everybody cranks up their transmitter, and all is good in the AM world.

Increasing power is truly easy, as long as you have plenty of money! A more-powerful transmitter is just the start. Most stations will also be looking at replacing their antenna-coupling equipment; installing higher-current electrical service; more air conditioning; and quite possibly a larger building to house the larger transmitter. A larger transmitter also draws more electricity from the power utility.

Chances are that many smaller AM stations simply cannot afford to increase power. When their larger companions on the channel do increase, the small stations will suffer a significant increase in interference. Does the small station go ahead with the increase, taking out a loan they won't be able to pay back? Do they forego the increase and lose their audience to interference from stations that did upgrade? Or do they select option #3: surrender their license and go out of business?

A truly effective anti-skywave antenna really would be the "holy grail" for AM broadcasters. If the coverage area of an AM station was the same day and night, there would be no need to reduce power and/or go directional at sunset. Nighttime coverage would be greatly improved. Most stations that require multiple towers for directional nighttime operation could use only one tower. Yes, it would mean the end of DX, but unfortunately the FCC doesn't operate on our behalf.

Anti-skywave designs do exist. I'm not sure these designs are able to provide enough skywave reduction to allow full-time operation with daytime power. The nulls necessary are often very deep. For example, Rochester's WXXI-1370 has a 27dB null in the direction of Toledo's WSPD.

The larger problem, however, may be the very large size of these designs. A typical "regular" AM broadcast tower is on the order of one-quarter wavelength in height. For a station in the middle of the band at 1000 kHz, one-quarter wavelength is 75 meters or about 250 feet. A typical anti-skywave antenna is more than twice the height. Imagine the NIMBY (Not In My Back Yard) problems.

Synchronized transmission makes a lot of sense from a technical standpoint. Here, the issue is almost entirely economic and regulatory. I mentioned the NIMBY effect. Imagine fighting this battle at each of a half-dozen or more transmitter sites! Telecommunications costs may be the larger issue. You have to have some way to deliver your programming to the transmitter(s). This can be expensive enough when you only have one transmitter. Reliable links to ten or more sites will probably be prohibitive for smaller stations.

The problem with expanding the FM band into TV channels 5 and 6 is that there are still TV stations there (see maps). AM stations wishing to move to an "FM expanded band" would need to be far enough from the circles on the map that their interfering signals wouldn't extend into those areas.

Note in particular that Baltimore and Philadelphia are within the circles on both maps; AM stations in these areas would be unable to take advantage of an expanded FM band. In very large areas of the Northeast (including New York) and in an extensive area between Chicago and Cleveland, only half the band would be available.

❖ Montreal 690

The long-silent 690 frequency in Montreal is back on the air. As originally planned, it's in English, with the sports format moved from 990 kHz. 990 is to broadcast in French to Montreal's LGBT community. The new 990 station is not yet on (it's still simulcasting 690) but I suspect it will have flipped by the time you read this. Last time, you read that the operators of 690 wish to flip languages, operating in French instead of English. Rumor is that this request is still pending.

The nine-tower antenna of WISN-1130, Milwaukee. Yes, those are Wisconsin cows in the foreground. (Courtesy: Doug Smith)

❖ New AM Log

Just in time for Christmas giving! The 33rd Edition of the National Radio Club's AM Radio Log is out. As always, this is the most comprehensive source for information about the stations you're chasing. It includes the technical information available from government sources like the FCC website as well as non-technical information not available anywhere else (programming formats, slogans, mailing addresses, phone numbers, etc.). See **http://www.nrcdxas.org** for more information.

❖ Until next time…

What do you think would help save the AM band? Please write, at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to dougsmith@monitoringtimes.com. Good DX!

STATION REPORT

NEW STATIONS:
New stations on the air:

Evansville, Wyoming	1580	KLNQ 1,000/220 ND

Permits granted for new stations:

Juneau, Alaska	1400	25,000/1,000 ND
Red Bluff, California	1580	3,000/1,000 DA-N

Applications for new stations denied:

Brampton, Ontario	1190	500 ND-D
Markham, Ontario	1480/ 1490	1,000/ 500 ND

The Markham, Ontario station would have operated on 1480 during the day & 1490 at night.

TECHNICAL CHANGES

Frequency changes on the air:

Soda Springs, Idaho	800	KBRV	from 790

Frequency changes proposed:

Belen, New Mexico	840	KARS	from 860

DELETIONS

Stations deleted:

Coleman, Alberta	1450	CBXC (going to 102.3 FM)
Edson, Alberta	1540	CBXD (going to 95.3 FM)
Fort Vermilion, Alberta	1460	CBKC (going to 105.1 FM)
Grande Cache, Alberta	1450	CBWI (going to 92.3 FM)
High Level, Alberta	1560	CBKD (going to 99.5 FM)
Rainbow Lake, Alberta	1240	CBXX (going to 101.5 FM)
Beverly Hills, Florida	1560	WINV
Johnston City, Illinois	810	WDDD
St. Boniface, Manitoba	1050	CKSB (going to 88.1 FM)
Jackson, Mississippi	1590	WZRX
La Tuque, Quebec	1240	CFLM (going to 97.1 FM)

Five licenses in Kentucky and Tennessee were canceled, but they appear to be clerical mix-ups; at least one of these stations is still on the air.

New-station permits cancelled:

Chanhassen, Minnesota	1200	(no calls yet)

ND: non-directional
ND-D: non-directional, only operates daytime
DA-N: directional at night only
DA-D: directional during daytime only
DA-2: directional all hours, two different patterns
DA-3: directional day, night and critical hours, three different patterns

URLS IN THIS MONTH'S COLUMN

http://americanbandscan.blogspot.com - My AM DX blog
http://www.nrcdxas.org/catalog/books/index1.html - NRC AM Radio Log
http://www.tsn.ca/montreal/ - CKGM "TSN 690" Montreal
http://www.770kkob.com/page/770_KKOB_History/104 - A history of KKOB-770.
http://www.fcc.gov/document/commissioner-pai-remarks-radio-show - Commissioner Pai's comments at the NAB Radio Show
http://www.radio-broadcast-engineer.com/AM-interference-power.htm - Richard Arsenault's proposal for an across-the-board AM power increase
http://radioworld.com/article/how-to-help-am-radio-in-six-steps/214779 - David Webster's proposals for AM improvement
http://radiomagonline.com/transmission/antennas/radio_tall_am_towers/ - An article on anti-skywave antennas for AM

Ernest Robl
ernestrobl@monitoringtimes.com

Operators, Interchange and Priority Channels

During the early part of the 20th century, American railroads had many agent/operators who, among other duties, sometimes controlled local interlockings, under the general supervision of a dispatcher.

Interlockings are locations where tracks meet or cross and where having trains on conflicting routes would be a problem. In the beginning, these interlockings were manual; mechanical devices preventing signals from being cleared on conflicting routes or switches being set to route trains into one another. Over time, these safety measures became electrical and electronic and, for the most part, interlockings were operated remotely by dispatchers, even on lines where other train movements are handled by track warrant.

One exception to the disappearance of local operators is where railroads have movable bridges. These bridges fall into three general categories: lift, where the bridge remains parallel to the ground but is raised between two towers; swing, where the bridge pivots either at one end or at the center; and bascule, where the bridge is tilted up at one end.

In almost all cases, these movable bridges still have local operators. The reason, of course, is that the local operator can see and talk (by radio) to local river traffic to see when the bridge needs to be opened. That same operator can also talk to nearby trains to advise them of the status of the bridge. And, most importantly, the operator can verify that the bridge is correctly positioned for rail movement.

What the "normal" status of the bridge is depends on how busy the rail line is. On a line with little rail traffic, the bridge is normally left in the open position (for water traffic) and the bridge tender or operator may not arrive at the bridge until just before a train is due. The operator's cabin is otherwise left unstaffed.

On a busy rail line, the bridge is normally left closed (lined for rail traffic) and staffed around the clock. The bridge is only opened when requested by towboats or other watercraft.

❖ Decatur, Alabama

I was reminded of this at the beginning of August during a visit to Huntsville, Alabama. I spent a few days in nearby Decatur, which is at the intersection of two important rail routes and which therefore sees a variety of interesting rail traffic.

A north-south CSX main line "crosses" an east-west Norfolk Southern (NS) main line. The reason that I put crosses in quotation marks is that the two lines don't actually cross at all, but rather merge together to share a major single-track bridge over the Tennessee River and then split apart again on the other side.

The bridge, which includes a large lift section, is owned by NS, but also used by CSX. In addition, both NS and CSX have industrial customers in the area, particularly along the banks of the river, which sees considerable commercial barge traffic.

Though I had visited Decatur on a previous trip to Alabama, this time I did a little more advance research, which included finding an on-line schematic map of the rails in the Decatur area, which gave me a much better understanding of rail traffic at that location. (See: **www.alabamarailfan.com/images/decatur_map_v092007.gif**. This site, **www.alabamarailfan.com**, also contains a large volume of information about the Decatur area as well as a complete list of radio frequencies in use there.)

An eastbound Norfolk Southern (NS) merchandise train approaches the merger of the NS and CSX lines in Decatur, Alabama. Though the 25 mph speed board visible at the far left of the photo applies to the CSX line, both lines have sharp curves in the area, which limit train speeds.

In addition to the two major railroads having to coordinate operations because they share a common bridge, the two lines also interchange traffic in Decatur.

❖ Interchange

Major railroads are different from other types of industries in that they both compete and have to cooperate. Nowhere is this more true than at interchanges. Unlike trucking companies, which can reach almost any point on land via public roads and highways, no railroad can directly serve every point in North America.

Though there are major industrial facilities, such as automobile and power plants that are directly connected to more than one major railroad, most industries are only served by a single railroad. So, for a product or commodity to get from one part of the country to another, it usually travels over the tracks of more than one railroad.

Interchange is the act where railcars and their contents go from the custody of one railroad to another, governed by a detailed set of rules from the Association of American Railroads (AAR) the major rail trade association.

Interchange can take place several ways. Unit trains consisting entirely of one product or commodity (or sometimes of one type, such as intermodal containers) typically run from one point to another, with the motive power staying on the train. For example, a coal train may be loaded at a mine on one railroad and then run intact to a power plant on another railroad. Only the crews change at the transition point between the two railroads.

Even for merchandise trains (consisting of a variety of railcars carrying a variety of goods, going between many different points) two railroads may have an agreement to run a train from a major terminal (yard) on one railroad to a major yard on the other. Again, only crews change at the transition. The originating railroad may even "pre-block" the train; cars going to different destinations grouped together. The receiving railroad breaks apart the train at its yard and sorts the cars into trains for a variety of destinations.

The third form of interchange is used for "loose-car" exchange between railroads. At a point where two railroads cross or connect, there are one or more tracks set aside specifically for interchange. A local or through freight operating through that point sets out cars for the other railroad on the interchange track or tracks; these are then picked up by the other railroad's train or trains.

Though the interchange tracks are jointly used by the two railroads, they always belong to one railroad or the other. When the non-owning railroad needs to go onto the interchange tracks owned by the other railroad, either to set out or pick up cars, the crew needs to call the dispatcher of the owning railroad for permission to enter those tracks.

Where there is a substantial amount of interchange at a given location, there may even be a small yard devoted solely to interchange. Once a train has permission to be within that yard, yard limit rules normally apply. That means that all movements must be made at slow speeds within the range of sight—but crews do not need further permission to make those moves, until they are ready to leave the yard.

A CSX yard job with interchange traffic for Norfolk Southern approaches the junction of the two lines.

❖ Back to Decatur

In Decatur, thanks to advance information from a local fan, I found a good parking and train-watching spot clear of the tracks near the town's old depot (the town has not had passenger service in many years). Put the following address into mapping or navigation software: "650 Railroad St. NW, Decatur, Alabama." Or, simply drive a few blocks southwest from the intersection of US 72A and Railroad St.

Because Norfolk Southern and CSX are the predominant railroads in my home state of North Carolina, and because I already had the major frequencies from both railroads programmed in both my car-mounted and hand-held scanners, I didn't need to make any adjustments to either of those scanners.

One of the reasons that Decatur is such a good train-watching spot is that, not only are there through-trains on both major railroads, but the two railroads also do loose-car interchange in a small yard near the depot. In addition, on NS tracks, you will see run-through trains with both Union Pacific (UP) and BNSF power. These include both loaded and empty coal trains and intermodal trains with double-stacked containers.

One of the days I was at Decatur, shortly after watching a couple of long-distance NS trains pass, a CSX local (Y103) came up the line from a nearby CSX Oakworth Yard, stopping at one of the signals guarding the point where the two lines merge.

The CSX crew called the NS dispatcher on the NS road channel (160.95) for permission (and a signal) to go out onto the NS tracks heading out toward the lift bridge, which then allowed it to back into the small NS interchange yard along the NS main line.

The CSX crew set out two blocks of cars on two different tracks, one block to be picked up by eastbound NS trains, the other to be picked up by westbound NS trains. Then, the CSX crew picked up two blocks of cars for CSX destinations on two other interchange tracks.

Because the interchange yard has no switching lead, most of the switching moves tied up the NS main line between the yard and the river. This yard is within a couple of city blocks of the riverbank in a densely populated area, so there's no room for additional tracks.

While within the interchange yard, the CSX crew stayed on the NS channel for their switching moves. That meant that, if necessary, the NS dispatcher could call the crew through a nearby remote base station. And, of course, nearby NS personnel and trains would also be aware of the switching activity. All moves outside the area were governed by the interlocking signals.

Setting out and picking up cars is a time-consuming activity. Any cars left anywhere for more than a few minutes have to have hand brakes applied (usually to at least the first three or four cars in a cut of cars), because over time, the air in the airbrake system will bleed off.

Cars being picked up have to have hand brakes released and the crew has to verify that both coupling and air brake connections are good.

When Y103 completed its work, it again pulled out onto the approach to the river bridge and then the NS dispatcher lined a route that allowed the train to back down south to the nearby CSX yard.

As soon as the CSX crew left NS tracks, it switched back to its own channel, alerting Oakworth yard that it was approaching.

By the way, if you're more interested in watching trains going over the bridge spanning the Tennessee River (and watching the lift span go up and down), there's a public park on the southwest shore of the river in Decatur that offers a good view. The park includes covered picnic tables and public toilets.

❖ Priority channels

Almost all modern scanners allow you to designate one or more priority channels. This feature is often ignored by railfans. The scanner samples the priority channel at short intervals, and, if there is radio traffic on that channel, it switches to that channel, even if previously stopped on another channel.

As Norfolk Southern is the predominant railroad in my home town in North Carolina (CSX only sends one local a day up a branch to set out and pick up a few cars), I have the NS road channel set up as my priority channel. (Amtrak trains between Raleigh and Charlotte, which I sometimes travel on, also use this channel on this route.)

This priority setup worked well for me in Alabama, too. I did pick up some radio traffic from CSX through trains and switching crews. But, as all through-trains on both NS and CSX (and CSX crews working the interchange) needed to talk to the NS dispatcher and the NS bridge tender on the NS road channel, I heard all of those calls.

❖ Railroad news source

One very useful source of railroad and rail transit news is **trainnews.org**. This site, maintained by volunteers, sees an updated news summary posted most weekdays (Monday-Friday) evenings. Each posting consists of brief headlines and links to rail-related news articles on sites of newspapers, TV stations, and trade magazines, among other sources. The site operates as multiple bulletin boards, so you can post questions or responses to news items on the site.

While the CSX yard job waits patiently short of the signals guarding the junction, a westbound Norfolk Southern intermodal stack train with Union Pacific run-through power rolls by on the NS tracks.

Kevin Carey, WB2QMY
kevincarey@monitoringtimes.com

Gone but Not Forgotten

Some of the earliest work in radio took place on the longwave band. In fact, at one time it was believed the longer the wavelength the longer the communication range that could be achieved. Many people considered the shortwaves to be essentially worthless, and U.S. hams were relegated to the range of 200 meters and down by the federal government. Thanks to the enterprising work of hams, the shortwaves were soon proved to be anything but worthless, and took on new importance for radio's long haul work. The exodus from longwave was not complete, however.

The unique behavior of longwave for navigation, military, and other specialized uses meant that some services continued to operate on the band for many years. Some remain there today, or at least their successors do. Longwave is also being "rediscovered" in recent years as a fertile ground for low power experimentation and homebrew construction. As such, we expect to see ham usage return to longwave from 472 to 479 kHz in the near future. This is an outgrowth of the ITU's World Radio Conference held earlier this year in Geneva, Switzerland.

Longwave's rich history means that it has been home to many stations over the years which have made a strong impact on radio communication. This month, we'll take a look at some of these stations and services with a retrospective eye. We can't cover all of them in one column, but we will describe some of the best known and tell you how they were used. While it is no longer possible to hear these stations live, recordings do exist for some of them. For many newer listeners, recordings are the only way to experience what these "extinct" signals sounded like. Elsewhere in this issue, you will find information on a CD recording that I prepared several years ago for this purpose.

❖ Longwave at Sea

Perhaps the most significant lifesaving event ever played out on longwave was the 1912 distress call from the *RMS Titanic* and the response of the brave crew from the *RMS Carpathia* some 58 miles away. This communication is believed to have taken place at or near 600 meters (500 kHz) and employed spark transmitters, state of the art at the time.

You can see an excellent modern-day movie about the Titanic, with a heavy focus on the role of wireless, at **www.youtube.com/watch?v=7-AWbrdNo58**. The 42-minute film, called *The Last Signals* is an independent production said to have been made with a budget of just $2300. It's the only film I'm aware of that focuses squarely on the experience of the Titanic's wireless operators. I highly recommend it. The event on that frigid April night might well have been longwave's finest hour, with over 700 lives saved due to the actions of wireless operators. All large passenger ships were soon required to carry wireless communications as a result of the tragedy.

Maritime use of 600 meters and nearby frequencies had a run of nearly 100 years before being phased out by the satellite-based GMDSS service and other systems. As recently as the late 1990s you could still hear CW, some of it hand sent, on these frequencies.

Going a bit lower in the band (285-325 kHz) were the sequenced marine beacons used around the Great Lakes of the U.S. and Canada for navigation and direction finding. These stations, active into the 1990s, would take turns sending their IDs for predetermined lengths of time, at which point another station would begin sending its ID. In this way, a mariner could tune to one frequency and obtain fixes from several stations to plot a map position, even before GPS. It could also help guide a vessel to a safe harbor in the event of stormy seas. Small RDF receivers were common on many boats, even recreational ones. In recent years, with the advent of GPS, these receivers have been showing up at hamfests and swap meets. They make good DXing receivers for beacon hunters.

LORAN (LOng RAnge Navigation) at 100 kHz was another prominent player on longwave. Until its recent shutdown in the U.S. by the Coast Guard, LORAN provided wide coverage for air, ground, and maritime users. Its clickety-clack signals could not be missed over a wide swath of spectrum slightly above and below 100 kHz at all hours of the day. Considered a nuisance by some, especially DXers living near one of the transmitting sites, the advantages of LORAN could not be denied by anyone needing high accuracy and repeatability in a wide-coverage navigation system.

❖ Longwave & Aviation

The link between aviation and longwave is a strong one, dating back to at least the 1920s, when radiobeacons and the four-course A/N Radio Range took to the air. Several decades before GPS and radar, longwave was helping to guide pilots safely home from all corners of the map with this system. Essentially, it sent out the letter "A" and the letter "N" from different antennas at one transmitting site. Depending on whether the pilot heard and A or an N in the headphones, one's position with respect to the station could be determined. A solid tone with no Morse characters meant you were flying "on the beam." It wasn't long before Automatic Direction Finding (ADF) equipment became standard gear aboard most aircraft, making the use of radio-navigation essentially a "hands-off" affair. Want to know more about how the A/N Range worked? Don't miss the excellent video recreation at **http://tinyurl.com/3anbh5j**.

The granddaddy of all navigation systems was the global OMEGA system operating in the range of 10-14 kHz, which was chiefly used by long range pilots. The system used a network of eight transmitters around the globe to cover any point on Earth. Its signals could sometimes be heard by natural radio listeners because receivers for this work often cover up to 20 kHz or so. A similar Russian system also operated at the same time as OMEGA in the 11-15 kHz range. OMEGA was finally decommissioned on September 30, 1997.

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

Today, the only remaining TWEBs that I'm aware of are located in Alaska, but there are many Automated Weather Observing System (AWOS) stations operating on both longwave and the VHF Airband. These stations, as their name implies, broadcast automated weather readings taken at airports. They are used to help pilots understand the conditions around them and to receive Notice to Airmen (NOTAM) broadcasts. An excellent list of beacons with notations for those with TWEB or AWOS service is maintained by William Hepburn at **www.dxinfocentre.com/ndb.htm**. Also, the main **www.dxinfocentre.com** site includes a number of aviation, time, and weather services, covering the spectrum from VLF to VHF.

❖ The "Last Radio Station"

WGU-20, also known by many as "the last radio station," was operated by the U.S. Defense Civil Preparedness Agency (a pre-cursor to FEMA) in the mid-to-late 1970s on a frequency of 179 kHz. It was intended to provide communications during a widespread disaster and to act as a medium for the government to get important messages out.

Rare signals archivist Myke Weiskopf has recently re-mastered a recording of WGU-20 originally provided by Joe Flaska, which was made in 1973. Myke is looking for additional audio of WGU-20, if any exists. If you have information, please contact him at the link provided in the sound sample below, or visit his web site at **www.myke.me**. *Link to WGU-20 audio:* **http://soundcloud.com/shortwavemusic/wgu-20-1973-final-mp3**

In 1963, time station **WWVL** began operation on 20 kHz. As a sister station of WWV (HF) and WWVB (60 kHz), this station remained active until 1972 when it was permanently shut down. Parts of the antenna system and other components were used to support a later upgrade to WWVB, which remains on the air today. WWVB is used by everything from laboratory test equipment to wrist watches to maintain precise timing control.

The U.S. Government's **Ground Wave Emergency Network** (GWEN) was active from 150-175 kHz well into the late 1990s. Operation ended entirely in 2000. The bursty data signals could be heard all over the US, and had a unique, even eerie-sounding "breathy" quality. GWEN was designed to be a survivable communications system that could prevail even in the event of a widespread electromagnetic pulse event (EMP) that might take out other equipment. More on GWEN, including transmitter locations can be found online at:
http://en.wikipedia.org/wiki/AN/URC-117_Ground_Wave_Emergency_Network.

Project ELF was a U.S. Navy program that operated on the extremely low frequency of 76 Hz. It was comprised of two transmitters; one in Clam Lake, Wisconsin, and another in Republic, Michigan. Enormous antennas were used for these transmissions, which were intended to signal submerged submarines around the globe. Data bandwidth at such a low frequency was limited, so it is believed that the system served mainly as a "bell ringer" to alert a sub to come up on an HF frequency if two-way communication was required. Project ELF transmitters were active from 1989 until its shutdown in September of 2004.

❖ Mailbag

We were pleased to hear from Mario Filippi N2HUN (New Jersey), who writes: "Kevin, thanks very much for publishing my logs and comments in the *Below 500 kHz* column. I have been hunting beacons since the early 1980s when I had a Kenwood R-2000, a great receiver. I logged many beacons from '82 -'87, but unfortunately I tossed all my logs several years ago, a big mistake! It would have been nice to look back and see what beacons were around then, especially those marine beacons in the 285-325 kHz region.

"Back at that time there was a small magazine called the *Lowdown* (if memory serves me correctly) which accepted loggings from listeners and I remember sending in some, and also reading what others were hearing at their locations. Fortunately I do have my loggings since 2003 and recently looked them over to see what beacons were around then. Many are still on the air. One station I have not heard anymore is Lowfer TH at 187 kHz which at that time was located in Colts Neck, New Jersey. It used to send "VVV de TH TH" and give an address for QSLing.

"Noticeably absent from my logs in 2003 and later are the maritime beacons, which were in the process of being phased out. I still listen in for them from time to time, but the new DGPS systems pretty much blanket that part of the band, making it all but impossible to hear beacons."

Hello Mario, and thanks for your latest loggings. I well remember the days of the sequenced marine beacons around the Great Lakes. They are discussed in more detail above. Around here (south of Rochester, NY) I recall hearing Lowfers "VP" from Suffern, New York, "KRY" from Chardon, Ohio, and "TH" in Colts Neck, New Jersey. Luckily, I saved most of my old logs, but they are just on paper for the most part. The longwave band certainly has changed over the years, but some of the old timers remain. By the way, the *Lowdown* journal is alive and well today. I volunteer as its *DX Downstairs* loggings editor! More information is available at **www.lwca.org.**

Marc Ellis, N9EWJ
marcellis@monitoringtimes.com

How Many Volts to Light a Tube?

This month I'm taking a short vacation from the Howard restoration. The main reason: some extra work I've had to do on another project this month and, more importantly, having to deal with a computer crash. Would you believe that a new HP computer, only about six months old, would lose its hard drive? Luckily all of the data on my previous computer had been backed up on a flash drive so all I lost was the data accumulated since May. And, since my e-mail is stored by the provider and not on my computer and most of the material I deal with is attached to e-mails, I should be able to reacquire most of my May through October files a little at a time. Kudos to the HP techs, though. They were sympathetic, thorough and patient.

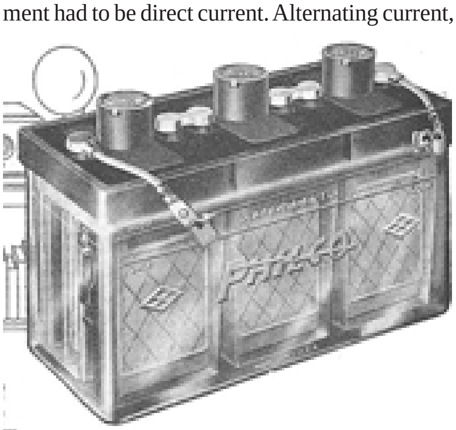
So what's on the menu for this month, you ask? Well, we'll be answering the question posed in the title of this article. A trivial question, you might reply. Not really, as we'll see!

❖ Storage Battery Tubes

Let's go back to the year 1920, just prior to the dawn of broadcast radio. At that time, the first tubes likely to be widely used by the public were the type '01 amplifier and the type '00 detector. (The apostrophes in front of the tube designations, which will be dropped for the rest of this article, represented letters and a number that indicated the tube's manufacturer and certain details of the base. These were eventually eliminated from the tube identification system and are not needed for this discussion.)

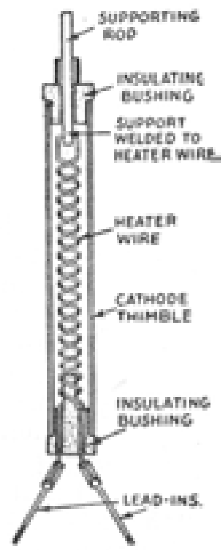
The type 00 never saw wide usage; the 01 was typically used in both the detector and amplifier sockets of most receivers. But as far as the filament design is concerned, both types are identical. The purpose of the filament is to emit the steady stream of electrons necessary for the operation of the tube. In these tubes it was, essentially, a tungsten wire.

The power source needed to light up the filament had to be direct current. Alternating current, such as conveniently available in most homes of the time, was not suitable because it would introduce severe hum into the signal. The current had to be D.C., and the only common source of D.C. for lighting tubes was the automobile type storage battery. At the time there was no economical way to convert A.C. into D.C.



Philco radio battery, similar to automotive types, has glass case for ease in monitoring electrolyte level.

Though the nominal voltage available from an automotive storage battery was six, it would slowly drop to five as the battery was discharged through use. Accordingly, the 00 and 01 filaments were designed to operate on five volts. Radios using these tubes were equipped with rheostats in the filament circuits so that the voltage from a freshly charged battery could be reduced to the proper value. As the battery discharged, resistance could be cut out of the circuit to maintain the voltage at five until the battery could no longer supply even that. Then it was time to haul it down to the local garage for a recharge.



Drawing illustrates a typical cathode construction

In order to provide an electron flow sufficient for proper operation, the tungsten filaments of these tubes had to be designed to draw one ampere at five volts. I don't really know the capacity of a 1920s era automotive style six-volt storage battery; I'll guess it might be 60 ampere-hours. A five-tube 3-dialer of the era would draw five amperes of filament current if equipped with five 01s or a 00 and four 01s. Thus, the battery would need recharging after only about 12 hours of operation.

A few years later, relief was at hand. It had been discovered that a small amount of the element thorium added to the tungsten prior to formation of the filament resulted in a dramatic increase in electron production. In fact, the new "thoriated" tungsten filaments required only a quarter of the current (0.25A) for proper operation at five volts. This would mean that the 3-dialer of the preceding example would now run for 48 hours before a recharge would be required. The type 01-A, released by General Electric in 1923, was the thoriated tungsten filament version of the 01. A few years later the companion 00-A was released, but never saw wide usage. The 01-A was probably one of the most manufactured tubes of all time; it was sold under at least 500 brand names.

❖ Dry Cell Tubes

At the same time the 01-A was introduced, G.E. released another tube that could free the radio listener from storage batteries entirely. This was the 199, whose 3.3-volt thoriated tungsten filament drew only .06 amperes. It ran from three 1.5-volt dry cells connected in series to supply 4.5 volts. A rheostat was included in the circuit to keep the voltage at 3.3 as the cells discharged.

Our younger readers may not be familiar with these cells, which were known as No. 6 dry cells. They were cylindrical in shape, about 1 ¾" in diameter and 6 inches tall. Besides lighting radio tubes, they were used for such things as powering doorbells and supplying ignition for small engines. Of course the dry cells were not nearly as bulky, heavy and messy as a storage battery. But they still took up a lot of space and they were not rechargeable. When exhausted, they had to be thrown away.

A couple of years later a companion tube to the 199 was released. This was the 120, which was intended for use in the last audio stage of a receiver, where it could supply more punch to the speaker than the 199. Its thoriated tungsten filament operated from the same voltage as the 199, but drew about .13 amperes.

For the final dry cell tube, we go back to the year 1921 to discuss the 11 and 12. I'm reporting them out of the timeline because their filaments are not thoriated. Instead, optimum electron flow is achieved by an oxide coating. The 11 and 12 are identical except for their basing. Their filaments, which draw 0.25 A at 1.1 volts, operate from a single dry cell!

This completes our discussion of the common battery tubes of the 1920s, but it's important to note that we've been discussing only filament batteries (known at the time as "A" batteries). A battery set of the era also required batteries to provide plate voltage ("B" batteries) and sometimes even a battery ("C" battery) to provide grid bias. These contributed to the unwieldy mess under the radio table and, like the No. 6 dry cell, had to be thrown away and replaced when exhausted.

❖ The First A.C. Tubes

It's easy to understand the quick acceptance by the radio listening public of the first tubes that could be lit by household alternating current. As fast as they could afford it, families relegated their battery sets to the attic, or trash can, replacing them with sets that would run on the inexpensive and inexhaustible power available at their wall outlets. Because of this rush to supply the large and hungry market, manufacturers of the first A.C. sets resorted to using a patchwork of tube types all of which required different filament voltages.

The first two tubes released to facilitate A.C. operation were the types 26 and 27, both released in 1927. Each used a different approach to make this possible. The type 26 was almost identical to the 01-A it was designed to replace. The major difference was in the filament voltage and current. Where the 01-A filament ran at 5 volts and 0.25 amperes, the type 26 operated at 1.5 volts at 1.5 Amperes. Engineers had discovered that one way to reduce hum was to balance it out by operating the filament at reduced voltage and increased current.

However, while the type 26 was a good amplifier, it was not suitable for use as a detector because it introduced too much him in that position. Nor could it supply enough power to drive the larger speakers that were coming into use. As it turned out, a useful power amplifier tube was already at hand. The 71-A was designed to be used as the final amplifier in sets otherwise using 01-As. However, the tube was little used in that application, most set owners being satisfied with the sound available from a 01-A final amplifier.

Like the 01-A, the 71-A had a 5-volt, 0.25 mA filament. However, it didn't introduce unacceptable hum when lit by alternating current. One reason was because as a final amplifier, its output was not further amplified before driving the speaker. This tube was immediately pressed into service for the first A.C. sets and was used as a final amplifier in many A.C. set models for several years thereafter.

❖ Development of the Cathode

The need for a suitable detector tube was not filled quite so easily, however. The solution to that problem came about through what amounted to a quantum change in the technology for electron production in vacuum tubes. Instead of directly supplying the tube's electron stream, the filament was used only to heat a surrounding structure called the cathode.

The original cathode was a ceramic cylinder, coated with a metallic oxide that surrounded the filament but was electrically insulated from it. When heated by the filament, it emitted the required electron stream. The cathode structure had enough "heat inertia" to smooth out the A.C. pulsations so that the tube operated without unacceptable hum. In this application the filament is more properly called the "heater," with the term "filament" being reserved for use with tubes not having a cathode.

For reasons I have not been able to discover, the voltage selected for the heater of the first A.C. detector tube, the type 27, was set at 2.5. When used as a heater, the filament had to supply much more power than when supplying the electron stream directly. Reflecting that need, the heater current of the type 27 was 1.75 amperes, far greater than that of any of the tubes mentioned previously.

The development of the cathode had a profound influence on tube design. Virtually all tubes with A.C. operated filaments from then to now were indirectly heated via a cathode. The selection of 2.5 volts for the type 27 heater was a similar watershed event. It became the standard heater or filament voltage for virtually all receiving type tubes until 1931 when the advent of the auto radio created a need for tubes that could be lit directly from the car battery.

This resulted in the introduction of the familiar 6.3 volt heater that quickly became the standard for all tubes whether for auto radios or not; 6.3 happened to be the voltage of a fully-charged auto battery. Incidentally, while cathodes were not required for tubes operating on D.C. from the auto battery, there were no special "cathode-less" types made for mobile use. The auto radio tubes were generally the same types used in home radios and other fixed applications. By the same token, 6.3-volt heaters became the standard for all home radios even though their tubes were not operated from a battery.

Power transformer removed from junked 1929 era radio. Note the three different heater voltages.

The Atwater Kent Model 42 is an excellent example of a "plug-in" radio using the first A.C. tubes. The tube complement included three type 26 R.F. amplifiers, a type 27 detector, a type 26 first audio amplifier and a type 71-A power amplifier. An additional tube, not yet mentioned, is the type 80 rectifier used in the AK 42 and virtually all early A.C. sets. This is part of the power pack that converts the alternating current from the wall outlet into the higher voltage direct current voltage ("B" supply) needed for the plate circuits of the receiver.

And so the power transformer of the AK 42, as in most receivers of the era, had to have four different filament windings: 1.5 volts for the type 26s, 2.5 volts for the type 27, 5 volts for the 71-A and an additional 5 volts for the 80 rectifier (which requires a separate filament winding because the rectified high voltage is also present on it).

This discussion takes us to the late 1920s by which most of the important innovations in filament design had been made. Another column on radio history will appear next time I'm in a bind because I hadn't been able to complete my restoration homework!

Stan Nelson KB5VL
stannelson@monitoringtimes.com

Radio Noise from Hale-Bopp Comet?

The Roswell Astronomy Club in Roswell, New Mexico, recently hosted Dr. Alan Hale, one of the co-discoverers of the Hale-Bopp comet in 1997. I had the opportunity to guide him around two Roswell elementary schools where he spoke to enthusiastic students about astronomy. I had done some preliminary searches on the web about the Hale-Bopp comet before he arrived.

Radio astronomers were using microwave wavelengths to scan the comet in the GHz range (1 GHz =1000 MHz), looking for various kinds of molecules. This process is called radio spectroscopy. Radio astronomers detected molecules that shows two formamide molecules, 'cousins' to formaldehyde, NH_2CHO,in C/1995 O1 (Hale-Bopp) at the spectral lines at 254.877 and 227.606 GHz!

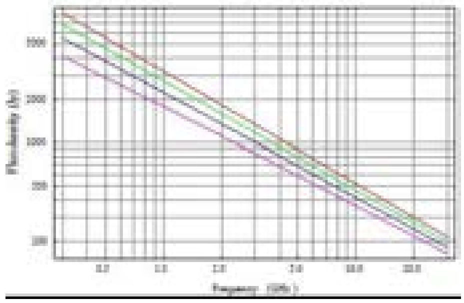
Here's an interesting web link, *AstroChymi*st, that lists manyof the molecules measured with radio astronomy: **www.astrochymist.org.** It's unlikely the average amateur can achieve this kind of detection without a large dish. However, keep in mind the frequency 1420.40575MHz has been used by amateur radio astronomers successfully with modest dishes.A good discussion of this process can be found at: **www.setileague.org/general/waterhol.htm**.

Dr. Hale mentioned his involvement in the new Spaceport being built north of Las Cruces, New Mexico. He also highlighted private ventures looking to mine asteroids in the future. No doubt there will be further analysis of these materials when they're brought back to Earth.

❖ The Cassiopeia A Radio Source

A strong source, often used for calibration of radio telescopes, was discovered by Ryle and Smith (1948) in England in the constellation Cassiopeia. It was assigned the letter A for being the strongest signal in that constellation. At the time, the source could not be optically identified. That was common in early radio astronomy. To get an idea what the expected levels of Cassiopeia A are, the book, *The Parabolic Reflector Antenna in Radio Astronomy and Communications* by Jacob W.M. Baars, includes a CD. It has a variety of *Mathematica* formulas related to the dish. One of the formulas and its related graphic shows Cassiopeia's Flux Density in flux density versus its spectrum. I ran the 'Radio Spectrum of Cassiopeia A' segment and reproduced the graph in my Mathematica program. See next column.

The vertical axis shows the 'Flux Density' in Janskys (Jy) vs. the Frequency (GHz), along the horizontal axis. The Flux Density of one Jansky (Jy) = $10^{-26} Wm^{-2}Hz^{-1}$. In English, One Jansky is equal to one times ten to the minus 26th power watts per meter squared per Hz.



In the graph, you can see four colored lines sloping downward. The red one is for measurements taken during 1965 over a range of frequencies from 300 MHz to 30 GHz. The next one, green, is for 1980; the blue line, in 1995, and finally the purple line, in 2010. Note the power in Jy decreases over time at any given frequency. In case the color is hard to see, red is on top and then green, blue, and purple. Is Cassiopeia A's 'candle' burning out?

❖ What to do with a Surplus Dish

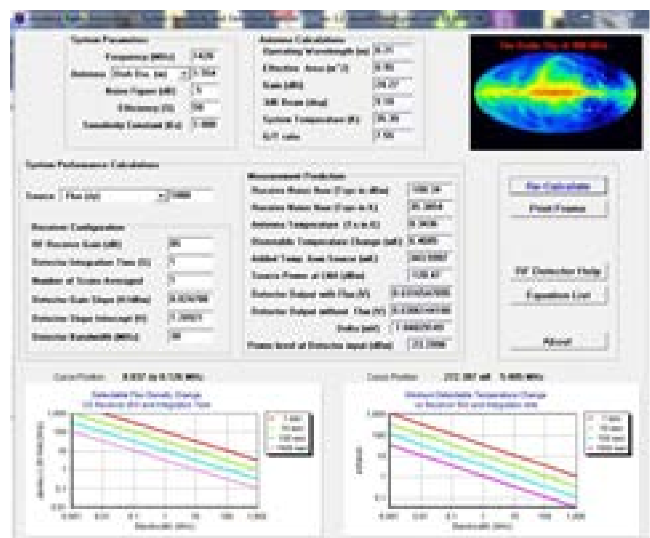
I recently acquired a 5 foot (1.554 meter) dish that was used in a Hughes satellite data network. The dish and the mounting hardware for a flat roof version was for the taking since the landowner was told the network didn't want it. He had a leaky roof, too. With some help, we broke the antenna down and hauled it off along with the LNB (Low Noise Block Converter). Here are some pictures of the haul.

The LNB is probably not suitable for radio astronomy and will require another type of feed horn/converter.

The dish mounting hardware is tough and was designed for a fixed elevation and azimuth. Some 'engineering' will be required.

Now that the dish is parked in my backyard, the next step is to see if it can be turned into a useful radio astronomy project. After measuring the dish's diameter of 5.1 feet (1.554 meters) I make the assumption that I will operate on 1420 MHz. Radio astronomy is definitely wrapped up in mathematics. For us amateurs, anything that can help understand the concepts easily are appreciated. Here's a free application,*RAsensitivity*,you can download from **http://radiosky.com/tminishere.html**. It is written by Dave Halley.

Below is a screen capture of the *RAsensitivity*program using the parameters for 1420 MHz. The 'G/T Ratio' is the figure of merit of the receiving system. An excellent reference to how to use this calculation can be found at **http:setileuague.org/articles/g-t.htm.** It is written by Richard Flag AH6NM.



The 1420 MHz in the 'Systems Parameters' box is converted to its wavelength of 21 cm (centimeters). The numbers in the 'Receiver Configuration' box will affect the 'Measurements Predictions' and shows the factors that determines the usefulness of the dish. Try changing the integration time and see the effect on the 'Discernible Temperature Change', in mK (milli-Kelvins.) In the chart below, I used the parameters from my inputs to the *RAsensitivity* program, just changing the integration time.

Notice the efficiency factor in the 'System Parameters' block. The efficiency factor defaults to 50%. Be aware that most radio astronomy noise is non-polarized and the detector probes normally use either horizontal or vertical polarization. Some can do both. Therefore, the probe captures about half of the power delivered to it.You can change this to suit your setup.

Have fun exploring the program. Hopefully you be inspired to look for a surplus dish and explore its parameters. As for mine, with the temperatures now approaching 105 Degrees F, work on the dish mount will wait for a cooler day.

❖ Video of the VLA Using Time Lapse

I found a video on the web created by artist Douglas Koke. It shows the VLA in motion. Check it out at: **www.geek.com/articles/geek-cetera/time-lapse-of-the-vla-in-new-mexico-20120212/.** It's a clever way to show the action of this huge array.

❖ More Cheap Used Astronomy Books

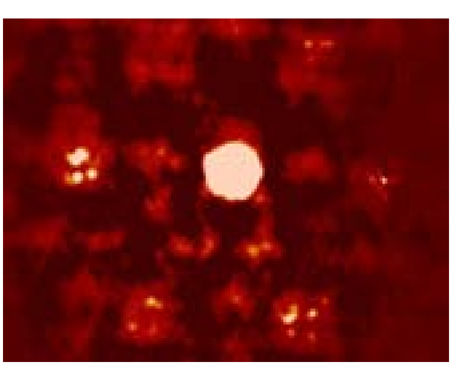
Just in case you want to add a few interesting books to your collection for next to nothing, look for these titles at **ABEbooks.com**. Most cost from $1 to $5 and are a bit dated. But they all offer great insight into the growth of radio astronomy written by the pioneers of the science. And they tend to give clear explanations of the science of radio astronomy.

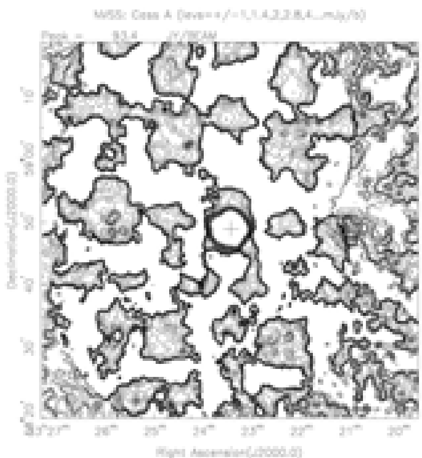
Radio Astronomy by J. H. Paddington, 1961
Radio Studies of the Universe by R.D. Davies and H.P. Palmer, 1959
The Evolution of Radio Astronomy by J. S. Hey, 1973
Solar System Radio Astronomy, edited by Jules Aarons, 1965
Radio Astrophysics: Non-thermal Processes in Galactic and Extragalactic Sources, by A. G. Pacholczyk, 1970.

❖ NRAO VLA Sky Survey

If you are curious what radio astronomy surveys are available on line, check out this site at **www.cv.nrao.edu/nvss.** This site has details for a 1420 MHz survey and how to obtain the images. First, download and install a free *FITS viewer* from **www.nrao.edu/software/fitsview**. This program allows you to view, manipulate, and obtain values and position of objects in the images. Then go to **www.cv.nrao.edu/nvss/postage.shtml** to obtain the images. Here, you can enter the coordinates of objects you may be interested in. I entered the coordinates for Cassiopeia A, Right Ascension (RA) 23 23 25.54, Declination (DEC) +58 48 56.60, in degrees, minutes, and seconds. The image size used is 0.5 x 0.5 degree. Save the file as 'FITS save to disk.' Then open it in *FITSviewer*.

Below is a screen shot of the image enhanced using the program's color controls. You can also download contour maps of selected areas. Below is a contour map for the same Cassiopeia A in a 1 degree square of sky. Note the similar features around the 'hot spot' in the middle of both images. Each image is on a different scale.





In 2006, a 74 MHz (4 meter) VLA Low-Frequency Sky Survey produced FITS files can be downloaded at **www.cv.nrao.edu/4mass/MAPS/**and viewed with *FITSviewer*. Complete details on this survey can be found at **lwa.nrl.navy.mil/VLSS.**

❖ Radio Astronomy in the Movies

OK, this is not a Hollywood movie but well worth the look. Low Frequency Array (LOFAR) has a short on-line movie available at **www.lofar.org** that describes the system using VHF frequencies from 10 to 230 MHz. The system is a project of ASTRON, Netherlands Institute for Radio Astronomy. The video shows several other aspects of the operation such as geophysical sensing as well.

The movie shows the Dwingeloo array which consists of 14 each 25 meter dishes. And the development of a square kilometer flat plate array which uses beam forming to enable wide area studies. At the beginning of the movie, you'll see a brief shot of their original 25 meter dish, erected in the 1950s. For a short time, it was the world's largest dish.

❖ Links Used in Column

There is so much astronomy out there on the Web. It is tempting to share links in my column, and I do. If you don't have an MTXtra e-subscription, you have to type the links in. So I have decided to put the links in a list for the month the column is published. You can reach my web site by going to: **www.RoswellMeteor.com** and select the link option. Hope this helps. Also, if you have a link you think would be helpful to radio astronomy amateurs, send it me. I'll be happy to add it to the list.

❖ Meteor Burst with Argo

I recently was made aware of the new version of I2PHD's ARGO V1 build 142 weak signal software update. I downloaded it and now use it on the PC that broadcasts my 216.979 MHz meteor burst monitor activity to **SpaceWeatherRadio.com**. ARGO's spectrograph shows the meteors 'pings' nicely. The newest version now has an option for FTP (File Transport Protocol). Using the capture option, ARGO dumps a copy to the hard drive. I set up the FTP to send the latest capture to **www.roswellmeteor.com**. On the home page, you'll find a link which allows you to view the pix. The graphic displays the capture time over a minute of activity. The FTP up-loads occur automatically every minute or so. Comments appreciated.

❖ FUN Cube Dongle SDR radio

Recently, Dennis K0LGI, sent me some details about his monitoring NAVSPASUR (now Air Force Space Surveillance) from his QTH in Indiana. He mentioned he rigged up a *FUNcube Dongle*. The FUNcube is a Software Define Radio, all squeezed into a USB dongle. He rigged the receiver up with a tuned RF LNA (Low Noise Amplifier), connected to his Yagi antenna with RG9913 coaxial cable. He uses *Spectra-Vue* software to monitor the radio tuned to NAVSPASUR which operates on 216.979 MHz. Dennis's original setup was described in my June 2012 column. The FUNcubeDongle replaced his ICOM PCR1500 for the meteor burst monitoring. While checking out the FUNcube Dongle on-line, I ran across this reference to the use of the FUNcube for amateur radio astronomy use: **www.britastro.org/radio/projects/An_SDR_Radio_Telescope.pdf**

You guessed it. I bought one, too. But that's another column.

❖ Radio Astronomy in the Movies

In the movie, *Transformers: The Dark of the Moon*, the VLA antennas near Socorro, New Mexico appear briefly, to set the stage for some facility detecting a lunar crash. The camera pans away from the VLA to a building on a nearby hill. The room shows radar and equipment reminiscent of the 60s. Soon, Apollo 11 is on the way to the moon and 'discovers' the crash site.

Does the movie imply the VLA was used in the detection of the Transformer's crash? If you check out commentary on movies such as Contact and the VLA, experts note nobody sits around listening to signals. Keep Listening Up.

Dan Farber AC0LW
donfarber@monitoringtimes.com

Antennas of the Past: WWII-Era Skyhooks

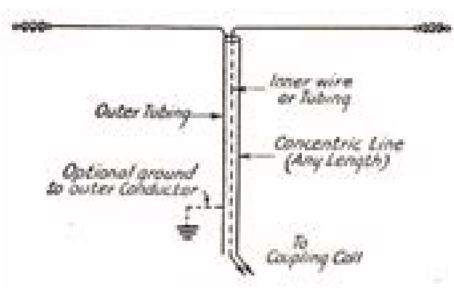
Welcome back, my friends. I fear that I may have jumped the gun a bit last month, talking about showing details this month for a sweet 'n' stealthy antenna you can scale for ten or six meters. We'll get to that in the future, I promise you. This month, though, is our annual vintage radio issue and that means it's time for your trusty antenna columnist to trot out another fabled textbook of bygone days showing how they conceived, designed and built antennas back in the olden times. Last year, we perused *Practical Radio*, a delightful gem from 1924, depicting radios and antennas in their first flush of youth. This year, I give you the 1944 edition of the American Radio Relay League's *Radio Amateur's Handbook.*

Many of us are of course very familiar with one or more editions of this perennial gold mine. I still have the one from 1967 I was given in 1970, when I was twelve. And, it's quite instructive to compare it to, say, the 1997 or the 2006 editions which I also own. For many years, this book has been a veritable Rosetta stone to many of us, unlocking the technical and procedural know-how of our wonderful hobby. The 1944 edition, though, is really something else.

The biggest difference is the environment in which the '44 edition came to be. There was a little spat called World War Two going on. In case you didn't know, amateur radio activity was completely suspended by the federal government for the duration of the war. So there's a "holding your breath" aspect to the whole book, as it limits itself to what the state of the art was when the war started, and to a hopeful looking forward to privileges being restored someday. The section on antennas is delightful, way ahead of the primitive work in the 1924 *Practical Radio*, and beginning to be recognizable even to us modern operators.

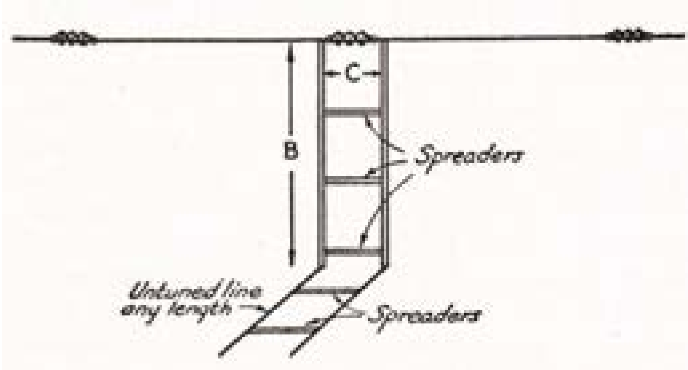
❖ The Granddaddy of Coax

The first item to really catch my attention, in the chapter called "Antenna Systems," was a feedline described as a *concentric transmission line of 70 ohms surge impedance.* Glancing briefly at the illustration, I thought from my modern perspective that they were talking about good old coaxial cable. Not at all! What they are describing is a homemade, air-insulated line made from 5/16" diameter copper tubing, with a #14 wire running down its center. And, "ceramic insulating spacers are available commercially for this combination." Wow. I guess hard-line coax goes back farther than we thought.



Recall that the war was still on and all that "military surplus" coax that so popularized the flexible cable is still some years in their future. The description goes on to say that the feeder system is "slightly unbalanced, because the inner and outer conductors do not have the same capacity to ground." Hmmm……seems like nowadays we think of any coaxial line as definitely "unbalanced." However, their employment of this 70 ohm line to match a half-wave dipole is certainly a concept we can all still relate to. Homebrew hardline, anyone? I'll say one thing; if I ever decide to hang that much copper tubing in the air above my house here in Kansas, the bottom will definitely be very, very grounded.

❖ Quarter-Wave Matching, Old School



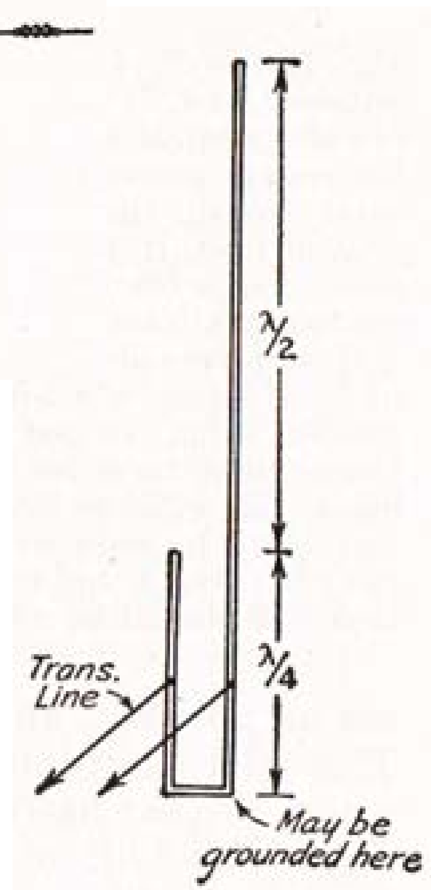
Almost-déjà vu happened again when my eye fell on the 1944 method of arranging a *quarter-wave matching section.* Of course, in the modern world we've seen quarter-wavelength stubs of coax used in a variety of matching situations, but probably never envisioned using a stub of *open-wire line* as a matching transformer. That, though, is exactly what they've rigged up here. Referred to in the text as a "'Q-section transformer," the setup takes advantage of the fact that a wide range of impedances can be created in open-wire line by varying spacing and wire size; in fact, a chart is even provided to allow you to create your own custom-impedance line from your choice of wire sizes and spacings!

Given this flexibility, and assuming the feedline from the rig to be "standard" 400 to 600 ohm open-wire line, and the antenna to be a nominal 72 ohm dipole, it's fairly straightforward to apply the eternal formula: the square root of antenna impedance times line impedance, and in this case, they wind up with 208 ohms for the matching section impedance, and proceed to detail how this custom line can be built of "lengths of one-half inch tubing, spaced 1.5 inches." Now that's a stout quarter-wave matching section, folks!

❖ Doctor "J," Back in the Day

Seems the good old J-pole has been around longer than you might think, too. Here they present a very recognizable version, which they quaintly call the "J" antenna, and already the construction from tubing was viewed as a standard approach. Also its use on VHF is mentioned as a commonplace; I guess I didn't realize there was that much activity above 30 MHz seventy years ago. Oops, I mean 30 Mc.

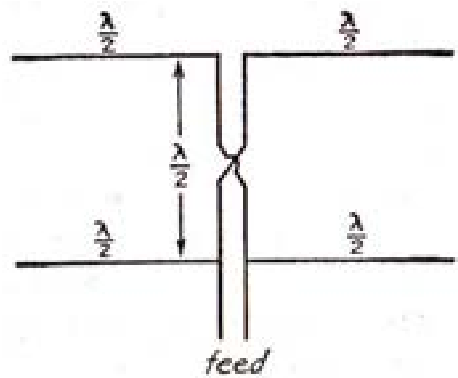
Looking at the illustration, and noting the quiet hints in the text, one gets the feeling that the J-pole may have caught on so early and so well due to the relative ease with which it is matched to open-wire line, which no doubt would be the *de rigueur* feedline at VHF back then. Nowadays, of course, we use coax and match a bit differently



to the J-pole, but it's amazing to see how much Grampa resembles Sonny on this one. Oh, and the text politely mentions that you may ground the bottom of the assembly if you wish, since it is at "practically zero r.f. potential," and thus attain "grounding through a metal conductor for lightning protection." Is it just me, or is there a sort of H.G. Wells vibe to some of these phrasings?

❖ Directive Antennas: Ghost Town, Not Boom Town

One class of antennas conspicuous in their absence from this old tome is the Yagis 'n' quads family of "driven element and parasitic element(s) on a rotatable boom" warriors so prevalent in the hobby today. Antennas with directivity and gain were common, and fairly well understood, but they largely consisted of lengths of wire arranged according to several different formulae. For example, the full-sized rhombic, which most of us totally lack the real estate (and trees!) to put up, is touted here as one of the very finest weapons in the DXer's arsenal. The text goes on at some length about various terminations, angles, and heights for the rhombic, which will maximize power gain and low-angle radiation. Gee, if I only owned my own stadium parking lot with four tall poles at the right spots….naturally, the perennial longwire comes in for discussion and is also held up as an example of an antenna that is readily multi-banded with a good tuner.



I think my favorite of the gain/directivity antennas showcased in this old volume, though, is this classic presentation of the venerable lazy H antenna. And, what do you know, they called it a "lazy H antenna." It is quite recognizable, having survived in basically this format for lo, these many years. Of course, they feed it with 600 ohm open-wire line; and they claim a gain over a half-wave dipole of five to six decibels.

❖ Conclusion

You know, the antenna chapter of this nearly 70-year old handbook may be the most technically advanced, when you look at the other chapters and see the endless banks of vacuum tubes laboring to do the job that transistors and chips came later to do so much faster, cooler, and cheaper. Some of their terminology is a bit stilted, granted; but the examination and exposition of antenna information is solid, quite familiar to modern eyes, and most of all, is giant strides beyond the material presented in *Practical Radio* a mere twenty years earlier.

Working without coax, remote tuners, transceivers, or even, apparently, much in the way of SWR measurement, these hardy souls of a bygone age nevertheless hung some impressive wire and proceeded to work the original DX the hard way, with a straight key, headphones that weighed a ton, manual transmit/receive switching, and no DXpeditions.

Quantum QX v3.0 AM Loop Antenna

By Loyd Van Horn, W4LVH

Dare I say it, but a good medium wave loop antenna is hard to find.

Sure, you can build one, or find a vintage loop antenna on eBay. Still, these days it seems that to find a truly remarkable piece of medium wave engineering is just much more difficult now than it was 20 years ago.

There are a long list of quality AM loops that have passed into and out of the market. Today, most of the other loops on the market are either insanely expensive or cheap and flimsy attempts at a loop that fail miserably compared to their more expensive counterparts.

In the words of Lee Corso: not so fast, my friends. There is a loop antenna on the market today that is reasonably affordable and packs quite a bit of punch in the results department too.

I bring you the Quantum QX v3.0 AM loop antenna. Produced by Gerry Thomas through his company Radio Plus Electronics in Pensacola, Florida.

Judging by the name, it should be obvious that this is the third installment in the Quantum series. I remember back in the 90s when the Quantum first hit the industry, reading favorable reviews on the quality and workmanship of the build as well as the results it produced once plugged in. Some DXers with pretty well-known names and reputations were singing the praises of the Quantum.

Does the latest incarnation live up to the tradition of earlier Quantum Loops? Does it earn a spot among modern loop antenna's hallowed names like Space Magnet, Kiwa and Palomar? Let's take a look.

❖ Out of the Box

The Quantum Loop came extremely well-packaged from the folks at Radio Plus. There were two main components in the box, the amplifier/controller and the loop head. You can also order optional accessories like an AC adapter and a coupler for use with portable radios or those with their own built-in antennas. It also came with a three-page instruction manual to walk you through setup and use of the loop.

The antenna comes in a black finish, with the loop head having a nice piano-black finish. The controller-base is made of a metal housing; the loop head encases the ferrite coil inside with plastic. The knobs and switches are all sturdy, easy to grip and manipulate and well placed for their function. The tuning knob, for instance, is the one you will use the most, which makes it nice that it is the largest knob on the box.

Assembly is very easy. You plug the loop head into the controller-base. That's it.

The loop head utilizes a ¼ inch phono plug in connecting to the controller-base. Power is supplied by either the AC adapter accessory or a 9-volt battery.

Looking at the controls, it is fairly straightforward to those with any experience using a powered loop antenna. There is an on/off switch that allows you to choose between AC and DC power, depending on which source you are using. You have your tuning control, to match the loop to the receiving frequency of the radio (this is further controlled with a Low/Mid/High-range switch to quickly jump through the band). There is a gain control to modify how much gain the amplifier is adding to the incoming signal and a QX control that will narrow the tuned passband, improve the signal-to-noise ratio and overall increase signal strength.

In addition, there is a 'Q-spoil' control which can broaden the tuning of the loop for a less touchy QX control (not a very commonly used control, but helpful when needed). Finally, there is a variable coupling control that can be used when you connect an external antenna directly to the loop head.

On the back of the controller, you will find an SO-239 jack for connecting the loop directly to your communications receiver. If your radio has a built-in antenna, the optional coupler is needed to use the loop. You will also find the jack for plugging in the AC adapter and the battery compartment for the 9-volt battery.

My first impression was that this is a well-built device. Each control is clearly labeled and the simple layout permits an ease of use over long periods of time.

Turning the loop head for nulling stations is a pretty effortless maneuver. There is a plastic cover on the metal shaft holding the loop that makes rotating comfortable and easy. Tilting the loop head for deeper nulls is fairly painless. My loop head needed to be tightened slightly, as it was falling when tilted past a certain point. A quick touchup with a screwdriver fixed that.

The footprint of the antenna is certainly much smaller than that of something along the lines of the Kiwa. It fits comfortably on a shelving unit that sits on top of my radio desk. Even at an elevated position, the controls are easy to manipulate and the loop head is easy to rotate and tilt.

The size is especially nice when you take this thing out of the shack. This was probably my favorite aspect of the Quantum once I really started getting into my tests. With the addition of the coupler, I was able to take the Quantum to the bedroom, out in the yard, or in the car while parked in an open field and it was not cumbersome at all to use. Up to this point, the only portable option I had was a Select-A-Tenna. Comparing these two is not a fair fight at all.

It is extremely lightweight, even with the loop head connected. This adds to the portability of the loop, and increases the applications for its use.

❖ Performance

For my testing, I used an ICOM R-72 for direct-connection use and a Grundig G4000A for testing portable use with the coupler accessory.

A quick note about your DX environment: no antenna is perfect and no antenna can make up for a less than ideal DX environment. My own DX shack is plagued with noise from my incoming cable wiring, CFI bulbs and a neighbor that loves to leave his TV on all hours of the day and night. My longwire antennas pick up every bit of this noise, especially in the daytime. While a loop antenna can help you null out certain sources of noise, amplified-loops especially can magnify the noise that you are experiencing in most cases. Don't think that a loop is going to magically erase your noise problems. Noise issues can only be corrected by eliminating the issue at the source of the noise.

When testing a new antenna, especially a loop, it is important to be able to have a basis for comparison. While running my in-shack testing, I compared the ICOM/Quantum combination side-by-side to my Kenwood R-2000 which I had bouncing between two longwire antennas oriented perpendicular to each other. For my portable test, I used the Quantum coupled to the radio, as well as purely the built-in ferrite loop inside the Grundig.

Tuning the loop to a frequency is fairly straightforward. First, you select the appropriate 'range' with the Low/High/Medium selector switch. (Note: It is not oriented Low/Medium/High, but Low/High/Medium. That took some getting used to). The included instructions outline the frequency ranges covered by each. Then, you turn the 'tune' knob until you see a peak in signal strength on your signal meter, or once you hear one with your ears. It is important to do this with the gain turned fully 'on' (clockwise) and the QX control fully counter-clockwise. Once you have tuned in the frequency, you can manipulate these controls.

Starting with the in-shack testing, I wanted to see how the Quantum handled nighttime DX. I tuned to 560 kHz where WXBT in Columbia, SC is normally dominant. The only other station heard here in South Carolina on this frequency has been WFRB in Frostburg, Maryland. The Kenwood had WXBT coming in weak, but audible. Firing up the Quantum and tuning for 560 kHz, I heard WXBT a bit louder than normal here. With a quick turn of the loop head, though, I suddenly had WQAM-Miami, Florida coming in louder than any other station on the frequency.

I then wanted to check a bit higher up the band. I tuned to 1130 kHz, a frequency that since I moved to South Carolina has been a mash of multiple stations, none wanting to overtake the others for dominance. The long-wires on the Kenwood demonstrated this, with 3-4 stations duking it out just above the noise floor. Over on the Quantum, I was able to back off the gain and pull in KWKH in Shreveport, Louisiana.

Higher up the band still, I went to 1440 kHz, which is home of local WGVL, a sports-talk station here in the Upstate. They are usually a bit weaker at night, but still the dominant station on the frequency and this night was no different. With the Quantum though, I was able to null them out and tune in WGMI-Bremen, Georgia with their staggering 62-watts of nighttime signal.

The instructions recommend backing off the gain on the controller to about a 9dB on your radio's signal meter. I agree that this seemed to produce the best results, especially when combined with at least some attenuation on the radio itself. This allowed stations that pulled to the top to really stick out and dominate the frequency.

The QX control took some getting used to. There are detailed instructions included in the documentation that comes with the antenna on how to use it. Now that I am used to it, I haven't found there to be a lot of situations that call for it, but when it is needed, it does make a pretty big difference in helping to further null out pesky stations.

On the portable side of things, I was even more impressed. I was able to leave the noisy conditions surrounding my shack, and head out in my vehicle to a large field. There, I did some daytime portable DX with the Quantum's

coupler accessory to match it with my Grundig G4000A. Once again, the Quantum was able to shine.

Once you get this antenna into a noise-free environment, look out. I was able to tune in my former radio station on 540 kHz, WRGC-Sylva, North Carolina. I couldn't duplicate this either with the Grundig's built-in antenna or at home on any combination of radios or antennas. Next up came WZAP-Bristol, Virginia on 690 kHz, a frequency that is normally silent at my DX shack during the daytime. To really see if I could push the Quantum, I tried to get around a pesky local, by completely nulling out the slop of local WYRD on 1330 kHz and was able to pick up WJRI-Lenoir, North Carolina on 1340 kHz.

In my testing, the controls were easy to manipulate, the rotating and tilting of the loop head to null stations was effortless. It will take some getting used to, even for those with experience using amplified loops. This is especially true of the QX control as well as placement and use of the coupler with portable radios.

The nulls were pretty deep for a ferrite-coil loop. They weren't as deep as our old Kiwa, and it did seem to be a bit noisier than the air-coil loops I have used over the years, even in the noise-free environment. But really, this is just splitting hairs at this point. The Quantum performed admirably in every situation I threw at it.

MT RATING: 4 1/2 STARS

★★★★½

Quality: 4.5 out of 5 stars – The screw that controls the tilt of the loop head may need regular tightening.

Performance: 4.5 out of 5 stars – As an amplified, ferrite-coil loop antenna, it performs outstandingly well.

Features: 5 out of 5 stars – Having the AC adapter included instead of an optional accessory might not be a bad idea, but come on, it's $6.

Design/Appearance: 4.75 out of 5 stars – The finish can make dust and fingerprints pretty annoying. The layout is perfect.

Overall: 4.75 out of 5 stars – I know what I hope is under my tree this holiday season. Why didn't I get one 20 years ago?

❖ Bottom Line

There are better loop antennas that have hit the market that provided deeper nulls and quieter operation. If you want to fork out the money for one of those, or go to the trouble of building one, you probably already have done so. But for the casual DXer, who just wants a reliable and effective loop antenna for their shack that will produce some pretty fantastic DX, I can't think of a better option for your money. Throw in the ease of portability for DXpeditions, ocean-side Trans-Atlantic/Trans-Pacific DX, or just some backcountry, low-noise DX from a tent and this is an absolute winner.

The Quantum QX v3.0 is now shipping from Radio Plus Electronics. You can find them online at their Web site **www.dxtools.com** where you can find information on the Quantum and other Radio Plus products. The setup I tested, with the loop antenna ($249) coupler ($15) and AC adapter ($6) totaled $270. Gerry offers a 10 percent discount for radio club members. You can reach him by emailing him at radioplus@bellsouth.net. Tell him that *MT* sent you!

Loyd Van Horn, W4LVH
globalnetmt@gmail.com
Twitter: @GlobalnetMT

Need a Boost? How to Get the Most out of Your WiFi Signal

I knew it would eventually happen; I just tried to avoid it as long as I could. I finally have run into a need for a WiFi signal booster.

I guess I was spoiled living all of those years in an apartment, when I could cover the entire expanse of my living area with a full WiFi signal with nothing more than my Linksys router. In my new home, though, it appears I might need a little extra help in covering the entire house.

Normally this wouldn't be a big deal, as most of my WiFi usage is coming from the Apple TV device in the living room or the WiFi radio in my home office; all within eyesight of the router. It finally came though as I tried to access Netflix on my Kindle Fire on my back patio, or WiFi radio through my Logitech Squeezebox in my bedroom only to find my WiFi signal a bit thin.

So, I started to research what my options were to get a beefier WiFi signal at all corners of my home and even the outdoor space. Thinking that some of you may be suffering as well from a weenie WiFi signal, I present some of my own findings to help you get your options organized.

First, before shelling out your hard earned dollars on any new equipment, analyze your current WiFi configuration. Could you move the router higher or to a more centralized location that could provide better coverage? The Linksys WRT54G that is sitting in my living room uses a 2.4 GHz signal, which is heavily influenced by height. If I can raise my router's altitude, it may give its signal more altitude.

Alright, so let's assume that didn't help. What other options are on the table?

You can always try bridging multiple wireless routers. This is the option I am going to try, as I have a spare router lying around in storage that I can configure to act as a wireless 'bridge.' The setup can be complicated for those unfamiliar, so do your research. Effectively, you turn the extra router into a WiFi access point, wirelessly.

If you don't already have an extra router, you can buy one or buy a wireless access point (often called a range extender). These are a little easier to configure, but can run about the same price as a router. Of course, by using a second router, you will have access to multiple Ethernet ports, in case you would like to run devices directly into the second router.

There are also a multitude of options for external antennas, hi-gain boosters and amplifiers and parabolic dishes. Remember, WiFi is nothing more than a radio signal. The same rules apply here that would apply to running D-STAR or any other VHF/UHF transmitter/receiver. Many of you can likely put your technical expertise to good use here to come up with a homebrew solution to a better WiFi signal. That spirit of innovation and homespun ingenuity is one of the truly fascinating and satisfying elements of our hobby.

Some great places to search for methods for boosting your WiFi signal include YouTube where there are a number of videos on the subject. You can find anything from homemade beer can antennas to reviews of the various routers and boosters on the market. I have found that in any research for a project, I spend a good bit of my time watching YouTube videos of what others have done.

You may also want to try Web sites like PC World or CNet. They have tutorials and reviews of products that can get you started. A simple Google search for "extending your wireless network signal" will produce a number of pages for you to pour through.

The good thing about WiFi, is that it is relatively cheap and easy to enhance the signal of your wireless network. Even if you have to go the route of purchasing new equipment, we are usually talking under $100.

Have a similar problem with your WiFi you were able to overcome? How did you do it? Send me an email at globalnetmt@gmail.com with the details!

❖ GlobalNet Mailbag

Reaching into the mailbag this month, we find that there can in fact be a harmonious marriage between DX and WiFi radio. If you want to add your thoughts on the matter, drop me a message at globalnetmt@gmail.com!

"Hi Loyd, I love reading GlobalNet in *MT*, you always have a lot of great information. You were talking about WiFi radio in the October issue and I wanted to say that radio over the airwaves and radio over the Internet are both alive and well in my home. I do enjoy listening to radio stations both ways, just depends on what I want to hear at the time. I purchased a V-Tech WiFi radio a couple years ago and when I first started using it, it just blew me away. There was so much to find and tune in that it seemed unlimited. It was like a new hobby in itself. Just like when I got my first SW radio when I was a kid. […] Another fun use I get out of my WiFi radio is the added capability to listen to scanner audio streams from many locations all over the US and the entire globe. It doubles as a world wide scanner, just pick the location. So while I will never give up listening to radio over the airwaves, this is a great addition to the hobby. Keep up the great work and thanks for all of the great information you provide." 73, Larry Shaunce, WDØAKX, Albert Lea, Minnesota

Thanks, Larry! Isn't it great having the best of both worlds? For so long, I thought I would never be able to hear the sounds of car commercials in Sydney, Australia or a wacky morning show in Manchester, England. WiFi radio finally made that a possibility without having to pay for an expensive plane ticket.

At the same time, I am still able to get my DX fix, while using the Internet as a powerful DX-aid. I have said it multiple times, but I feel like we are in the midst of a DX renaissance of sorts. Glad to know I'm not the only one out there that is able to see both sides of the fence!

GLOBALNET LINKS

Extend Your Wireless Network – PC World - **www.pcworld.com/article/254644/extend_your_wireless_network.html**

Extend Your Wireless Network with Tomato Powered Routers - **www.howtogeek.com/104007/how-to-extend-your-wireless-network-with-tomato-powered-routers/**

How to Extend Your Wireless Network For More Range - **www.ehow.com/how_5061388_extend-wireless-network-range.html**

Wireless Network Bridging – DD-WRT Wiki - **www.dd-wrt.com/wiki/index.php/Bridging**

What's NEW

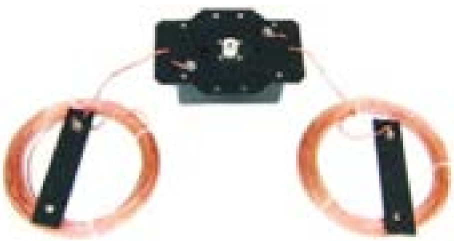
Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

New MFJ Off-Center Fed HF Wire Antennas

MFJ recently released two more antennas in their series of off-center fed dipole (OCFD) antennas. The MFJ-2016 covers the low end of 160 meters and the 75 meter SSB DX window. This antenna is 240 feet long and is rated at 1500 Watts CW/SSB. The MFJ-2013 is a one-half wave dipole ERP on 60 meters plus up to 9-dBi of gain on 30 meters. This antenna is 86 feet long and handles up to 300 Watts PEP SSB.

The Power-Lite™ for 160 and 75 Meters



and the Ultra-Lite™ for 60 and 30 Meters, engineered by K1BQT, breaks traditional OCFD design barriers to deliver wider bandwidth, lower SWR, solid gain, and full-frequency agility without a tuner.

These are high-efficiency antennas with full-sized radiators and Matchmaker™ feed blocks that have been tested with over 98 percent efficiency. The NEC-modeled elements deliver the same feed-point impedance on every band thanks to a new transformer design. Element feed points are compensated for typical mounting height, so you always get lowest possible SWR on all bands.

OCFDs need good baluns to block feed-line radiation. The new OCFDs have built-in bifilar-wound Guanella current-chokes that have over 30 dB of common-mode rejection on all bands. These new baluns kill pattern irregularities, radio frequency interference (RFI), and noise.

The MFJ-2016 delivers a 6-dBi ground-reinforced dipole pattern on the fundamental and a 9-dBi full-wave cloverleaf on the second harmonic. You get up to 11.5 dBi peak gain on higher bands.

These antennas are built to last with UV-resistant marine-ABS feed blocks, stainless hardware, and Teflon® SO-238 connectors to ensure maximum protection from the environment. They can be installed as a flat-top or inverted-Vsetup, and the feed block for each antenna has attachment points for tower or tree support. MFJ suggested an installation height of 35-70 feet.

The MFJ-2016 sells for $130 and the MFJ-2016 for $80 plus shipping from MFJ (**www.mfjenterprises.com**) and selected *MT* advertisers.

MFJ-9211 QRP Balun

If you are a QRP enthusiast and need an inexpensive balanced antenna balun, MFJ has a new product that should certainly interest you. The MFJ-9211 QRP Balun is a 4:1 current balun and the price is definitely right: $20 plus shipping.

It has five way binding posts for balanced line connections and BNC output to your rig. The balun comes in a tiny cabinet two inches by three inches by one inch. It is available from the MFJ website at **www.mfjenterprises.com**.

70 cm ATV Transmitter from PC Electronics

The PC Electronics TX70-5s is a four channel ATV transmitter on the 70 cm and is designed primarily for emergency communications applications. This unit can also be used in home stations.

The Videolynx TX70-5s accepts line level audio and video from video cameras and camcorders. Power requirement for this unit is 11 to 14 VDC at 1.5 A and has a power output of more than four watts PEP on 426.250, 427.250, 434.000 or 439.250 MHz (channel one is not used to transmit, but all channels correspond to the PC Electronics companion TVC-4S down converter).

PC Electronics also has 50-100 mW versions of the unit above in the same enclosure for the 902-928 MHz and 1240-1300 MHz amateur bands. These transmitters can drive the Downeast Microwave 3340PA and 2330PATV amplifiers respectively.

A built-in TR relay switches the antenna jack between the transmitter output and a jack for the receiver. The TX70-5s sells for $499, the TX33-1 (33 cm band at 50-100 mW) or the TX23-1 (23 cm at 50-100 mW) sells for $449. For more information on these products or to order, visit **www.hamtv.com**.

Inflatable Antenna Tower from LTA

Need a portable mast to put an antenna up in a hurry? LTA Projects may have a solution with their new portable towers. These portable inflatable towers are everything you need to quickly put up your antennas/repeaters, video, or sensor payloads after emergencies or at large public gatherings. They're portable enough to mount on any vehicle so you can enhance your radio or mobile phone range on any remote operation. The COMET version will even put a high quality video camera 37 feet in the air.

These new inflatable towers easily handle 35+ mph winds; are easy to setup and are safe to operate; are constructed with super rugged materials, self inflating, auto-pressure control; and can ground mount or on any vehicle.

Made in Cookeville, Tennessee, these new towers use a powerful continuous 110V 9.5A blower that inflates the tower in less than 40 seconds with a setup time of about seven minutes.

These towers come in three standard and five optional colors. You can even have your amateur call sign printed on the tower for an extra $60. LTA new 33 foot HAM tower weighs just 52.5 lbs complete with blower, stakes, and ropes. The HAM33 will lift 10 lbs of antenna, with additional payload options along the sides. For more information and pricing call LTA Projects at 877-897-5158 or visit their website at **http://ltaprojects.com/ham.html**.

HamCall Announces HamCall on DVD, HamCall Archives

The venerable HamCall amateur radio call sign database has been published on CD-ROM since 1990. HamCall has now outgrown the 700 Megabyte CDs can hold so newer versions will be published on DVD, which can hold up to 4.7 GB (4,800 Megabytes.).

The HamCall database includes 2,175,000 current call signs and now with the extra DVD space includes 590,000 archival call signs from 1960 and 1983, all integrated into one call sign lookup program. You will now be able to search by name, city, county, state, country, and more. HamCall is supported by over 53 logging programs and ham-related programs. It is the world's largest call sign database and the only one to include downloadable updates.

HamCall is available for $50 including

six months of updates and six months of HamCall.net gold member website access, or $80 for 12 months of updates and HamCall.net access. You can get more information by contacting Buckmaster Publishing at 800-282-5628 or on their website at **http://hamcall.net**.

P25 Phase II TDMA Decoding Available?

The word on the scanner street is that GRE has released some beta firmware that allows P25 Phase II TDMA decoding for the GRE PSR-800 scanner only. It also includes (and is used with) version EZ Scan DG 1.07 computer software. According to GRE this P25 Phase II upgrade will not work with the PSR-500/600 or Radio Shack Pro-196/197 scanner as they lack the required hardware to decode the Phase II data stream.

So one can now say (even being just a beta) that the PSR-800 is now the only scanner sold today that has the option for P25 Phase II reception. See Communications column on page 7 for an update on GRE-Japan.

Thanks to David Zantow N9EWO for the heads up.

DX Engineering Maxi-Core® High-Power Multi-Band UNUN

The DXE-UN-43 DX Engineering Multi-Band Vertical UNUN is a matching device specifically designed for use with any non-resonant 43 foot tall vertical multi-band antennas, such as DXE's MBVE-1 and MBVE-5. This UNUN assures the best efficiency from your vertical multi-band antenna and transmission line/tuner installation.

DX Engineering's UN-43 minimizes the additional transmission lines losses caused by SWR and lets your antenna to perform to its full potential. By allowing your wide-range tuner to easily match the antenna's complex impedance, low frequency performance is improved over other devices currently available.

Features include full band tunable coverage on 160-10 meters when used with customer supplied wide-band tuner, SWR under 1.5:1, and 2 KW CW/ 5 KW SSB power handling capability. Components are enclosed in a high impact weather sealed NEMA-spec case. Rugged hardware is used throughout, including a silver-Teflon SO-239 input, stainless steel washers and wing nuts at the feed point connection.

The UNUN is priced at $105. A complete kit with mounting hardware and tinned braid connections, the DXE-UN-43-R is priced at $130. Customer supplied wide band tuner required. For more information or to order, visit **www.dxengineering.com**.

bhi, Ltd. Mini Switch for GAP DSP Speaker

One of the better speakers in the radio hobby marketplace is the GAP "Hear It" DSP Speaker. This speaker is an active filter; that is, it isn't just capacitors and resistors, it has electronic components like ICs and transistors. It is used to cut off high and low frequencies much more accurately than simple tone controls.

This compact speaker system utilizes powerful digital signal processing (DSP) to suppress annoying background hiss and static, revealing crisp, clean audio for shortwave reception, scanner monitoring, ham radio transceivers, CB installations, maritime mobile, noisy recordings, and other sources of crackly, hiss-ridden audio. Unlike competitive models which produce harsh, distorted audio with distracting DSP artifacts, the "Hear It" reveals up to 2-1/2 watts of clean, undistorted sound. Controls are provided for volume and DSP level.

Measuring a mere 4-1/3 wide by 2-1/2 high by 2-1/2 inches deep and weighing only seven ounces, The "Hear It" is designed to be used in compact mobile installations and includes a mounting bracket, eight inch input cord with 1/8" (3.5 mm.) mini plug, a fused DC power cord, and an instruction booklet. The unit's standard 2.1 mm. power jack will accept 12-28 VDC at approximately 500 mA, making it universally applicable to fixed, mobile, and even aeronautical configurations. The small internal speaker is ideally suited to voice frequencies; for more demanding sound requirements, an external speaker or headphones may be plugged into the 1/8" jack provided. This speaker sells for $169 from Grove Enterprises.

A new mini switch from bhi Ltd now enables you to connect two radios to the GAP Hear It Speaker. The switch measures 2.1 by 1.75 by 0.75 inches and is supplied with 3.5 mm mono connectors, hook and loop pads for mounting and instruction for use. For more information and pricing, see the **www.gapantenna.com**, **www.w4rt.com** or **www.bhi-ltd.com** websites.

The N0AXS PicoKeyer-Plus Kit

After the success of the original PicoKeyer kit, the company wanted to offer a PicoKeyer with everything mounted on-board, and do it in a nice enclosure. Now you can order your PicoKeyer-Plus kit with the enclosure already drilled and ready to install your completed kit. The end panels are drilled for the controls and connectors, counter-bored for the nuts on the RIG and KEY jacks, and a set of speaker "grille" holes are drilled in the top cover.

This kit has all of the features of the original PicoKeyer kit in the exact same size package. The only differences are the addition of a horizontally mounted speed pot and pushbutton switch on one end of the board. The header and solder pads for external power are still there, if you choose to build it without the on-board battery or need to build it into some other project. Parts are included for a Zener voltage regulator if you choose to go that route, though the on-board coin cell battery will last at least a couple of years of normal use.

The PicoKeyer Plus complete kit contains everything you need to build a stand-alone Morse code memory keyer and code practice oscillator with speed control. You can put it in a nice looking plastic box (not included, available as an option), build it into your next homebrew rig, or even retrofit it into your favorite commercial rig. At less than 1.3 inches by 2 inches, you can stuff this tiny board into some pretty tight spots. The latest PicoKeyer chip and all the parts you need are included, along with a high quality double-sided printed circuit board with plated-through holes and silk screened component outlines. The setup/memory button and speed control are mounted on one end of the board, and the RIG and KEY jacks are on the other.

The PicoKeyer is an advanced, super low power iambic keyer with a long list of standard features. The PicoKeyer-Plus kit includes the PicoKeyer chip, a high quality solder masked and silkscreened PCB, and all parts needed to build a complete keyer. All parts carry a 90 day warranty. Of course, complete documentation is included on a mini CD-ROM, and a PDF copy of the documentation is available in English and in French.

You can get information on this product on the **www.hamgadgets.com** website, via email at **sales@hamgadgets.com,** or you can call toll free within the U.S. at 1-888-777-1393, or from anywhere in the world at +1-402-527-1000.

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*.

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