Volume 19, No. 8 August 2000

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Monitoring Times

Vol. 19, No. 8 August 2000

Cover Story

Understanding Handoffs in ATC Communications

By Michael Scofield

All of us who enjoy aeronautical communications have listened as one air traffic controller "hands off" the plane he's been controlling to a controller in the next sector along the plane's flight path. These handoffs provide clues to the size and shape of the sectors, which are by no means uniform. Developing a 3-dimensional concept of the airspace within your listening area adds a whole new dimension to your aero monitoring.

Visualizing how airspace is divided into control areas will also help you understand frequency usage, and show you how to the frequency a plane is using can tell you where the plane came from or where it's going. Story starts on page 10.

On the cover: The newest control tower at Dallas-Ft. Worth International Airport. Photo by Chuck Hudlow, DFW Tracon.

CONTENTS

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Reviews:

Sensitivity, selectivity, dynamic range are terms that mystify a lot of radio hobbyists. Everyone knows that these and other specifications are important, but not everyone knows why. Why do you want a sensitive receiver with good selectivity to work DX? To learn more about the mystery of receiver specifications turn to Bob Grove's column on page **98**.

Newcomers to this hobby have probably never heard of a phone patch, but Bob Parnass will uncover the mystery of that old workhorse and find some new uses for it in the world of scanner listening. He will also share information on scanner crystals and an index to his reviews starting on page **100**. Jock Elliot reviews the GE Sedona Family Radio Service handheld (page **96**), and John Catalano continues his look at more programs to control the TenTec R320 receiver.

Finally, we often hear complaints that there just aren't any good kits around anymore for those who like to "roll their own." Few sources are left, but a happy exception is Hamtronics. We look at their latest offering, the R121 Aviation Receiver Module, starting on page **105**.

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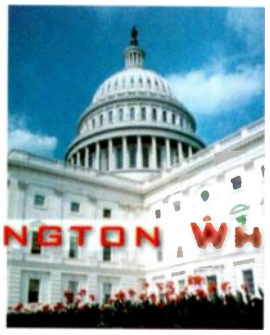

WASHINGTON WHISPERS

Fred Maia, W5YI

FCC Proposes to Unleash New Ultra-Wide Band Technology

The FCC said in a recently released Notice of Proposed Rulemaking that "We believe that UWB technology holds promise for a vast array of new or improved devices that could have enormous benefits for public safety, consumers and businesses. Further, we anticipate the UWB technology could create new business opportunities for manufacturers, distributors and vendors that will enhance competition and the economy. UWB technology may also enable increased use of scarce spectrum resources by sharing frequencies with other services without causing interference. It is important that we find ways to encourage the development and deployment of technologies that may allow more efficient use of the spectrum."

Just what is Ultra-Wide Band Technology?

The next wave in radio transmission technology may be Digital Pulse Radio ...otherwise known by the letters UWB. It stands for "ultra-wide band." It opens up virtually infinite bandwidth in the existing electromagnetic spectrum.

The FCC is seeking to change their Part 15 (unlicensed low power device) rules to pave the way for new types of wireless products incorporating ultra-wide band technology. It all started two years ago when the FCC adopted a proposal to investigate the possibility of permitting the operation of UWB devices on an unlicensed basis under Part 15 of the rules.

The FCC is now beginning the process of identifying potential rule changes and alternatives. The proposals in the NPRM are designed to ensure that existing and planned radio services, particularly safety services, are adequately protected.

Just what is Digital Pulse Radio technology?

UWB was patented in 1987 by engineer Larry Fullerton, chief technology officer of Time Domain Corp., a small, privately held Huntsville, Alabama, company. "Ultra-wide band is today where the Internet was in 1993 and 1994," said Ralph Petroff, Time Domain's president and CEO. "Nobody's even heard of it, but it's going to explode on the scene."

Unlike communications technologies that send information in analog form, ultra-wide band uses a digital transmission format consisting of small on-off bursts of energy at extremely low power but over an extremely wide section of the radio spectrum. By precisely timing the pulses within accuracies up to a trillionth of a second, the system determines if a pulse is a 1 or a 0. Conventional wireless transmissions vary the amplitude (the height of the wave) or the frequency (the number of wave cycles per second). Time Domain's technology is similar to a Morse code system that switches on and off 40 million times a second. But unlike traditional radio signals which are confined to a very narrow frequency, each pulse of ultra-wide band is transmitted across a wide portion of the radio spectrum, so that only a minute amount of energy is radiated at any single frequency.

Ultra-wide band systems actually fall into two categories: systems that use radar techniques for precise measurements of distance and detection or imaging of objects; and communications systems that can be used for voice, data and control signals.

Somewhat similar to Spread Spectrum modulation, the precisely timed, extremely short, coded pulses can carry much more data than conventional communications systems and can support an unlimited number of users.

UWB is virtually impossible to jam or detect, making it ideal for an assortment of applications ranging from networking to through-the-wall radar and secure communications systems.

Time Domain's devices can currently transmit 1.25 million bits a second up to 230 feet using just .5 milliwatts. To transmit information, the pulses are transmitted using a technique called pulse-position modulation. The receiver is programmed with the right detection code to translate the pulses into digital ones and zeros. A receiver without the right code will only hear noise.

UWB technology is relatively new, and further comprehensive testing and analysis is needed before the risks of interference are completely understood. The biggest advantage of UWB is that it holds the promise of dramatically reducing the pressure on wireless spectrum carrying mobile phone voice conversations and data transmissions. Another huge plus is that UWB devices are able to operate on spectrum already occupied by existing radio services without causing interference to their operations. UWB sends signals across a huge slice of spectrum at power levels so low that it can't be distinguished from the existing low level background noise floor (which is filtered out by normal radio circuits) except by the receiver to which it's directed.

At present, UWB can't be used by anyone without a waiver of the rules since the technology does not comply with FCC regulations which never anticipated devices that operate over bandwidth used by many adjacent radio services. UWB spreads its signal across a few gigahertz of spectrum including frequencies reserved for various military, government and civilian users. It may be necessary to program UWB radios with "notches" – gaps in their transmission output to preclude operation on sensitive frequencies such as radio astronomy.

Applications of Ultra-Wide Band technology

Initially, the services were created as radar tools, which can see through walls when traditional radar is blocked. That could allow police, fire and rescue to find people buried under building rubble or to see who or what is in burning buildings, and even to aid in locating land mines. UWB technology doesn't suffer from the problems of conventional radar systems in which multiple reflections off many surfaces can limit imaging and ranging precision.

The technology is initially being aimed at the home networking market, where televisions, computers and stereos can all be lashed to a wireless connection indoors. UWB's highspeed data transmission ability makes it a highly suitable technology for broadband access to the Internet.

Security is good as well. The U.S. military already uses a communications handset created by Time Domain because the transmissions cannot be pinpointed or tapped as easily as traditional mobile services.

Time Domain can also now sell a limited number of their "RadarVision" units to police and emergency units to evaluate their ability to locate criminals behind walls or find survivors in an earthquake. Two other companies, US Radar, Inc., and Zircon Corp., have also received waivers from the FCC to develop the technology. There's still a long way to go before products hit the markets, however.

FCC asks for more UWB testing

The FCC has committed to ensuring that safety services, such as the global positioning system (GPS) are protected against harmful interference. Toward that end, it is asking for more testing before it gives its final approval for the technology to be used. The NTIA, the U.S. Department of Transportation, and other organizations are planning such tests, the results of which are due to regulators by Oct. 30.

The FCC said the process for final approval will likely stretch on at least until early next year. In the meantime, an Ultra-Wide Band Working Group has been formed by 80 companies who will work together to develop and advance the technology. [FCC Notice of Proposed Rulemaking, adopted May 10, 2000.]

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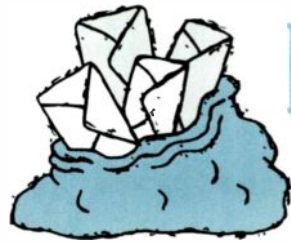


LETTERS TO THE EDITOR

Thank you, *MT*

First an apology: When I received the Jan. 2000 copy of *Monitoring Times*, I got really excited about the new format/arrangement of articles, and just hoped it would continue that way. When I received the Feb. 2000 copy, I was delighted to see that you hadn't changed back.

When I received the March copy, I thought, I really ought to tell the Groves how much I like the format, and why, but, I didn't get around to it. March – same problem, much to my dismay. April, I was busy looking for a new apartment, suitable for senior citizens, and just didn't get around to saying thank you.

May I was busy moving to the new apartment, and unpacking and getting settled. Now, having received the June issue I can't delay any longer. I've been taking *MT* for how-ever-many years just for the SW listening guide – didn't know a dern thing about scanners, and the rest of the stuff you had articles about, and couldn't learn much because most of the articles were written for people who already knew all the stuff I didn't know! Thanks to your new format, I'm starting to learn about some of that stuff. Thank you, I appreciate it! I used to tear out the center section, and throw the rest away. I'm keeping all the magazine, now, in a nice neat notebook, so I can go back and look stuff up when I forget.

Thank you, THANK YOU, THANK YOU, for the article about baseball on radio! Back before WW2 I listened to the Cardinals on radio when Harry Carey was the broadcaster. Baseball is the only team sport I give a rats a** about – every spring I buy 2 or 3 scorebooks, so I can keep score, both at the OU games, (I'm a season ticket holder,) and while watching the pro's on TV. Except for the Rangers and the Orioles (for their Oklahoma connections), I'm a National League fan, and after I send this message off to you, I'm going to the *MT* website to find out about "sister stations" I might be able to tune in to!

As a senior citizen on social security, I've given up a lot of the magazines I used to subscribe to, but believe me, *Monitoring Times* is right up there in the category with *Bird Watchers Digest* and a couple of news magazines that'll be the last to go!

Again, thanks for the present arrangement of the magazine – Please, don't change a thing! I love it, and I'm learning things I wanted to know, before, but didn't know how to learn the basic information so I could understand the somewhat arcane information I was reading in *MT*. I particularly enjoy Gary Webbenhurst's column, the What's New pages, and the Ask Bob section. Thanks again!

– Margaret Snyder, Norman, OK

Thank YOU, Margaret, for making our day! We really didn't make many changes in format – just reorganized the table of contents to show the logic behind it in case it wasn't obvious :-)

– *Rachel*

More on Baseball

We received several other responses to the baseball article, including a couple of small corrections. This is from *John McDermott*:

"I just read your article about the stations that carry the games and I find an error relative to the Mets. Their Flagship Station is WFAN at 660, not 600. 600 is WICC in Bridgeport, CT, which is an affiliate of The Yankees.

"Going through your list on the website I see many of the teams have long lists of affiliates but the Mets seem to have only one or two. Is that correct? The Phillys have a long list, the Cardinals' list is very long, as is the Pirates. I travel through out the NE area and sometimes west and south, and despite 'Fan's bragging, they can't be heard all over. A trip to my wife's home town in western Mass. is a total loss. Likewise Cape Cod. I was hoping to find a nice list of stations to switch to as I motor along."

Author *Ken Reitz* made this reply: "John - I'm sorry to report that you and I are in the same boat. I'm an Orioles fan and their radio network has dwindled through the pennant drought years (and since they were stupid enough to get rid of Jon Miller!). Until last year, when WTOP opened an FM affiliate in Manassas which I can receive very well from my location, I was reduced to trying to pick up WBAL-AM from Baltimore (hopeless on the road).

"The list for the Mets came directly from their PR department and they are about the smallest in the Major Leagues. Their boast about being heard all over, however, is true (at least at night). I have no trouble picking them up on any radio, car, home, crystal set, you name it, from my location in Virginia. Too bad I'm not a Mets fan!"

From *Will Nicodemo*: "Hi Ken – Enjoyed your piece in the June issue of *Monitoring Times* about listening to Major League Baseball. A few years ago I had a job as a security guard which kept me outside, patrolling in a decrepit old van. The one thing that made it enjoyable was the amount of games I could pick up on any given night. It sure helped the summer fly by.

"A real crime is the Montreal Expos situation. With the uncertainty that already surrounds the franchise (lousy attendance and the possibility of the team leaving town), the station that carried their games in English changed formats and didn't want to pay what the team was asking for the rights. As a result, there are no English radio broadcasts. The team is 'casting at their website. The Montreal reporter for **Radiodigest.com** is keeping people informed as to who they're playing that week, and the call letters of the other team's flagship station.

"One other thing: the Toronto Blue Jays flagship, CHUM, broadcasts at 1050 AM, not 1270. Thanks for your time. Cheers."

Forbidden Signals

"I read with interest Ralph Craig's March 2000 article, "Forbidden Signals from an Ancient Transmitter." He may well be the last to hear such a spark signal. I remember, at age 16 (41 years ago), attending an exhibit of old radio equipment at the Henry Ford Museum in Dearborn, Michigan. Ralph Thetreau, "Tate," W8FX was instrumental in setting up the equipment for the exhibit, and demonstrated the operation of a motor-driven spark-gap transmitter.

"Was it illegal? Yes! But the man holding a fluorescent tube in his hand to show RF output was the local FCC Resident Engineer! Thanks for the memories."

– Jerry Begel, W9NPI

Renewing your ham ticket

Ken Brown has a slightly different answer for the June "Ask Bob" question: Q. How do I renew my amateur radio license? He says, "It is simpler to call the 800 number and order this from the phone 1-800-418-3676, order Form 605. If you follow the instructions you will: press 1--press 2--press 1 if you know the FCC form number--enter in time zone (e.g., press 2 CST). The recording will ask for name, address, zip code, phone number. Give all the info and the form requested, the FCC form will arrive in about 4 or 5 days."

– *Ken Brown N4SO, Mobile, AL*

Odds n Ends

"In the Glossary, you mentioned that 'sesqui' (*meaning one and one-half*) was a Hauserism. I first saw this prefix in the early 1940s as a kid.

It was in a book of American war planes. The reference was about the Consolidated P2Y patrol bomber which was called a 'sesquiplane.' No one could tell me what that was nor could I find it in a dictionary. Finally, I saw a good photo of the P2Y. It was a biplane with a large upper wing and a stubby lower wing. I have never seen this word again. Sesquicentennial and such words seem now quite common.

"In your *Ask Bob*, you answered a question on resistor codes. My brother-in-law went to radio school in the Army He told me his sergeant told the students a way to remember the colors – of course, it's not politically correct! (So we didn't print it here so not to offend the ladies.)

–Bob Fraser, Cohasset, MA

The Right to Listen

"I am writing in response to the May guest editorial concerning 'Do citizens have the right to listen to public service?' I agree that this is certainly a touchy issue. However, I sincerely believe that as a U.S. citizen, living in a free Democracy, I have the right to monitor any Federal and local law enforcement radio communications.

"As a scanning hobbyist, I have actually heard law enforcement officers orchestrate situations where they picked up prostitutes and engaged in sex with them in their cars. I have also heard them stop people at quasi Nazi check points, detain and then demand that the citizen show their drivers' license. You may argue that these are very rare events. But I have monitored enough radio traffic to know otherwise. The fact is, I don't wish to live in a white-out society where the local police and law enforcement operations are free to hide behind scrambled or encrypted radio communications. This only encourages or allows those rogue cops to engage in unlawful activities without being held accountable. Moreover, it only serves to perpetuate the 'us against them' mentality. This mentality is growing at a rapid pace.

"Remember, we are the law. We merely delegate it to the police and courts on condition of good stewardship. The purpose for law is to facilitate a reasonable society. The law is only a means, and not an end. It is designed to serve us and we do not serve it or those who enforce it."

– Frederick Turnage, Rocky Mount, NC

MT Appreciation

"As I turned thru the pages of the latest *MT*, 6/200, I was amazed at the amount and quality of content, the breadth of the real-content articles and the great accompanying graphics. Not that this is something unusual for *MT*, it's just that this super issue really brought this home.

"Look, you really have to get *MT* before more eyes. I wonder if you could do some arrangement with vendors or equipment manufacturers to get out samples with anything sold. Yes, I suppose that might be expensive. I'm with you totally in wanting to increase your readership. *MT* is clearly head and shoulders above anything else in the field; one issue like the June one has the content of a year's issues of the nearest U.S. competitor."

– Hue Miller, Albany, Oregon

P.S.: No, I'm not related to the Groves, and I didn't win anything for this letter!

We welcome your Letters to the Editor at P.O. Box 98, Brasstown, NC 28904 or via email at *mteditor@grove-ent.com*

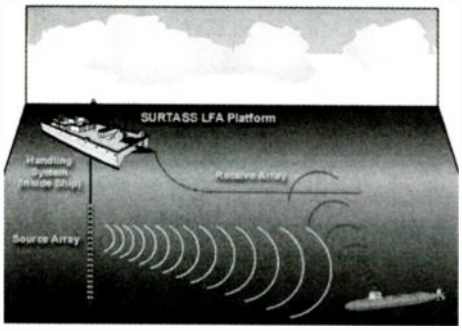
Yellowstone Prohibits Direction-Finding Gear

Yellowstone Park plans to prohibit possession of radio direction-finding gear for anything except official use. The park said such a regulation is needed to protect radiocollared animals – including wolves, grizzlies, bison and elk – from tech-savvy wildlife photographers and overeager tourists.

Chuck Bartlebaugh, director of the Center for Wildlife Information in Missoula, said "There's a growing perception among some of the weekend and amateur photographers that you do whatever you can to get a great photo as quickly as you can, where the really serious nature photographers might spend one or two years working just to get the right shot."

Yellowstone has received telephone calls from people wanting the frequencies to tune in signals from radio collars worn by park wolves. The park does not reveal the frequencies transmitted by the collars, refusing even federal Freedom of Information Act requests when they could disclose the locations of threatened or endangered species.

Anyone using such equipment once the regulation is in place could face a jail sentence of up to six months, and a fine of up to $5,000.



Low Frequency Threat to Marine Life

A report released by the Natural Resources Defense Council cautions that underwater noise pollution from supertankers, oil exploration, and a new low frequency active sonar (LFAS) may be harming marine mammals and causing changes in migration routes and breeding grounds.The coastline around San Francisco, Los Angeles, Monterey, San Diego, and the Channel islands – areas that are home to abundant sea life – show an appalling level of acoustic pollution according to the report.

Most serious, however, is the controversy regarding LFAS technology, which transmits a series of FM pulses below 500 Hz for detection of new and quieter submarines. Testing began in the late 1980s, and some suspect a connection between such testing and unexplained whale and dolphin beachings. The Navy did agree not to perform high-volume sonar tests in recent exercises off the coast of New Jersey. An Associated Press report stated that the sonar noise can be greater than a 747 jetliner at takeoff.

A lawsuit has been filed in Hawaii to obtain an injunction against any further studies there by the Navy until an environmental impact study has been properly completed and complied with.

Voice of Hope Forced to Move

On May 24, High Adventure Ministries, based in Simi Valley, California, dismantled its shortwave station in the buffer zone between Israel and Lebanon. The Voice of Hope has been broadcasting since 1979 to give encouragement to Christians living in the disputed territory. When recent fighting escalated to rockets, mortars, tanks, and helicopter gunships, owner George Otis and others moved most of the equipment, music library, transmitter, and transformer into Israel. They hoped to be broadcasting again within a few days. "We just need the spot to set up."

High Adventure Ministries rebuilt hospitals and brought in food and medicine in the area over the years, but the broadcasting station also brought hope and comfort, said Otis, who noted that about one-quarter of all nations on Earth are in war.

Explorers Affected by Iridium Phone Collapse

When Iridium went bankrupt and made the decision to scuttle its constellation of satellites, globe-trotting businessmen weren't the only users being cut off. Supporters of Norwegian skiers Rune Gjeldnes and Torry Larsen, trying to become the first people to ski from Russia to Canada via the North Pole hauling sledges, lobbied successfully to retain their Iridium connection until they reach Ward Hunt Island in Canada in June. They had an emergency beacon to transmit their position, but would not have been able to receive any data. Organizers had hoped to use the phones, for instance, to tell the pair to change course when satellite photographs showed big gaps in the ice.

Sverdrup Expedition (see feature in this issue) leader Graeme Magor said in a communication with John David Corby in the forepart of June, "Can you believe Irid is still working for us, with limitation that we must place outgoing calls and no more incoming text mssgs. .. I hear the two Norwegians crossing fr Russia to Canada (only 140 km off Ellesmere's N coast at time of writing) & their support crew lobbied strongly to have their Irid service continued on a compassionate basis and have friends in high (Pentagon et al) places. We may have been partly carried on the strength of this association and the ride may end soon but it's all worked out much better than expected."

A French rower trying to cross the Pacific, Jo Le Guen, was also dependent upon Iridium for communications.

Radio Honor Roll

Close call at the North Pole

A huge AN-2 biplane sank beneath thin ice at the North Pole just after landing. Co-pilot of the craft was Dick Rutan, famous for his 1987 around-the-world *Voyager* flight. All six passengers escaped safely and were rescued by Canadian rescue crews who were alerted by ham-radio operator Jerry Curry.

Fake FCC License Scam

Telemarketers can apparently sell just about anything. Six people were charged by the US Attorney in New York with selling more than $1 million worth of fake mobile-radio licenses. Their clients – dispatch businesses such as taxi-cab companies – paid thousands of dollars for licenses which should have cost $45 to $250 through the Federal Communications Commission.

Wireless Medical Devices

The Federal Communications Commission

BULLETIN BOARD

Aug 11-13: Lake Placid, NY
Worldwide TV-FM DX Association (WTFDA) annual meeting at the Whiteface Chalet, hosted by Peter George. http://welcome.to/lakeplacid2000 for details.

Aug 20: Lexington, KY
Bluegrass ARS Central Kentucky Hamfest at the National Guard Armory adjacent to Lexington airport, 8am-4pm, $6 adm; talk-in 147.765/.165. For info contact John Barnes KS4GL KS4GL@juno.com, 606-253-1178 (evenings) or visit http://www.qsl.net/k4kjjq/

August 25-27: Billings, MT
International Radio Club of America (IRCA) convention hosted by John and Nancy Johnson. Log onto the convention web site at http://pages.prodigy.net/john_johnson/irca2000.htm for complete details.

August 27: St. Charles, MO
St Charles ARC Hamfest 2000 at Blanchette Park, 6:30a.m. to 1p.m., talk-in 146.670- No admission charge. Outdoor flea market, indoor vendors. For information and updates see http://www.qth.com/wb0hsi or email kfieser@aol.com or call (314) 428-4383.

Aug 27: Woodstock, IL
Tri-County Radio Group Hamfest at Mchenry Co Fairgrounds (just north of Rte 14 on Rte 47), 6:30 a.m. flea, 8a.m. exhibits; Talk-in 146.52 (simplex). For more info write TCRG, 14 Linden St, Lake in the Hills, IL 60102, call Bob N9KXG (708) 944-0500, or visit http://www.superhamfest.com

has allocated new spectrum and established rules for a Wireless Medical Telemetry Service (WMTS) that allows potentially life-critical equipment to operate on an interference-protected basis.

Medical telemetry equipment is used in hospitals and health care facilities to transmit patient measurement data to a nearby receiver. Examples include heart, blood pressure and respiration monitors. Such devices allow patients to move around early in their recovery, while still being monitored for adverse symptoms.

The Commission allocated 14 MHz of spectrum for primary use by medical telemetry equipment in the 608-614 MHz, 1395-1400 MHz and 1429-1432 MHz bands. The 608-614 MHz band, which corresponds to TV channel 37, had been reserved for radio astronomy uses. The action elevates medical telemetry to a co-primary status with radio astronomy in this band. The 1395-1400 MHz and 1429-1432 MHz bands are former government bands reallocated for nongovernment use. Allocating two separate bands will allow two-way communications greater flexibility.

Medical telemetry equipment has been operating on a secondary basis either on vacant TV channels under Part 15 of the rules or on special channels reserved for low-power operation under Part 90 of the rules.

WMTS will be designated one of the Citizen's Band Services and users will not have to obtain individual operator's licenses. The medical telemetry equipment will be authorized under the certification procedure in Part 2 of the rules. One or more frequency coordinators will be named to maintain a database of all equipment used in conjunction with WMTS.

FCC's New Enforcement Bureau

"Firm, fast, and flexible," is the bureau's motto, says bureau chief David Solomon. Since last November when FCC enforcement was centralized into one department, it has earned a growing respect from industry and telecommunications lawyers alike. In the space of a few months, the bureau has imposed fines, acting quickly on a number of high-profile matters, and reduced the backlog of cases through private or FCC-generated settlement. The bureau even took the first-ever enforcement action against a company for sending unsolicited advertisements to fax machines.

Radio Pest Sentenced

Jack Gerritsen was sentenced to a five-year prison sentence for broadcasting an obscene message more than 1,000 times last fall over police radio frequencies. With Gerritsen's conviction, "a lot of police officers are going to be able to focus on their jobs without being insulted on a daily basis," said Los Angeles County Deputy District Attorney Steven J. Ipsen.

The 64-year old was arrested in December after a lengthy investigation. Gerritsen has interfered in police activities in person and over the radio for the past ten years, said Ipsen.

Gerritsen said his broadcasts did not interfere with police and were protected by his First Amendment rights. Gerritsen also faces 34 misdemeanor counts of violating police frequencies in Orange County.

The Origin of Slinky

"Ever wonder what the *real* story is about how the Slinky toy came to be?" asks reader Ray Dallavecchia. "I contacted the manufacturer this morning, and here's the definitive answer:

"The actual story is back in 1944 Richard James was a naval engineer working at a ship building yard in Philadelphia. He was working with spring torsion experiments that was trying to stabilize instruments on ships. One of the springs fell off his desk and started walking down a pile of books and other things that were stacked up. He took the spring home and his wife Betty named the toy!"

Blooper of the Month

Wes Albright of Huntsville, AL, and Harry Baughn of Hayesville, NC, both caught an amusing typo in a Wal-Mart advertisement. "Check out the FRS radios for $24.97," says Wes. "Not a bad price considering they have 500 megawatts of power. I bet you could keep in touch with those. And I'm not sure about the RF-cancer connection, but I don't think that I would want to be holding one of those up against my head. Anyway, by the time I got to Wal-Mart, all they had left were the 500 milliwatt versions. Now if they would only make a 500 megawatt cordless phone..."

Speaking of high power on FRS radios, the FCC is making it harder to put external antennas on Part 15 devices. MMCX, MCX, and reverse polarity, SMA, BNC and TNC type connectors no longer will be considered sufficient to demonstrate compliance with Section 15.203, because they now have become readily available and no longer deter modification of a Part 15 transmitter by adding an antenna or external power amplifier.

Communications is compiled by Rachel Baughn, Editor, with the help of our readers. This month's reporters include Anonymous, Albany, NY; Harry Baughn, NC; Wes Albright, Huntsville, AL; Chet Copeland, Wash. DC; Ken Hydeman, Xenia, OH; Kevin Klein, Neenah, WI; Maury Midlo, Wimberley, TX; Doug Robertson, Oxnard, CA; Richard Sklar, Seattle, WA. Via email: Roger Cravens, Ray Dallavecchia, Henry LaViers, Eddie Muro, John Young, Larry Van Horn, Bob Wyman

Understanding Handoffs in Air Traffic Control Communications

By Michael Scofield

A great way to accumulate a list of air traffic control frequencies in your area is to simply start with one frequency and listen for the handoffs to other frequencies (to other sectors). The FAA allocates air space into sectors of various shapes, and altitudes. Generally, each sector has one controller, and one VHF frequency and a UHF frequency (which you rarely hear mentioned unless there is a military aircraft in the sector and you can hear the controller's antenna).

The basic organization of controlled air space consists of four kinds of structures.

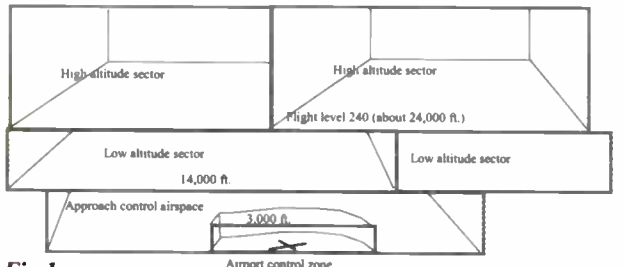


Fig 1

Around the airport is a control zone, now known as a "Class D airspace," generally 3 to 5 miles out from the center of the field and up to 3,000 feet above the ground. Surrounding that control zone, for major urban areas, is the approach control airspace, extending from the ground up to 12,000 to 14,000 feet (sometimes higher), and out perhaps 50 miles from the airport (often further).

Approach control may be called TRACON, traffic control, (though generally not over the air). Some of its airspace may be more restricted (known as Class-B or Class-C) but the approach controller's radar screen extends far beyond that.

An approach control may have one to eight sectors. The sketch above shows only one approach control sector which, of course, excludes the airport control zone which is under the control of the tower on the field.

The air space above the approach control area and between major cities is controlled by an Air Route Traffic Control Center (ARTCC). This expansive air space is generally divided into high and low sectors. The low sectors extend from the ground (or the top of the approach control's airspace) up to about 24,000 ft. The air space above 24,000 ft. is generally high-altitude sectors and usually has no ceiling. I have heard NASA aircraft cruising at flight level 600 (60,000 ft.) over the California desert, talking to the high-altitude sector controller.

There is no reliable pattern as to what range of frequencies are used for each kind of airspace. A tower frequency can be right next to a high-altitude frequency.

Handing Off

A handoff is where a controller passes responsibility for an aircraft to another controller in another airspace (sector). The controller instructs the aircraft to contact the next controller on a certain frequency. When the aircraft acknowledges the instruction, the controller further accomplishes the handoff by either keying the data into his computer terminal or calling the next sector controller on the telephone, or sometimes both – all this, while keeping an eye on the remaining aircraft and other targets in his air space.

A handoff might sound like this:

Controller 1: "American 482, contact Cleveland Center on 133.52."
Pilot: "One-thirty-three fifty-two. American 482."

The controller then makes some entries into his keyboard at his console. If you now switch quickly to 133.52, you will hear the American pilot checking in.

Pilot: "Cleveland Center, American 482, level at flight level 370, smooth"
Controller 2: "American 482, roger."

Now you know the frequencies of two adjacent high altitude sectors. We know they are high-altitude because of the flight level at the time of the handoff, and the fact that the plane is flying level (not climbing or descending). The pilot may say "smooth" to indicate there is no significant air turbulence. Controllers make note of that for aircraft coming through later at that altitude.

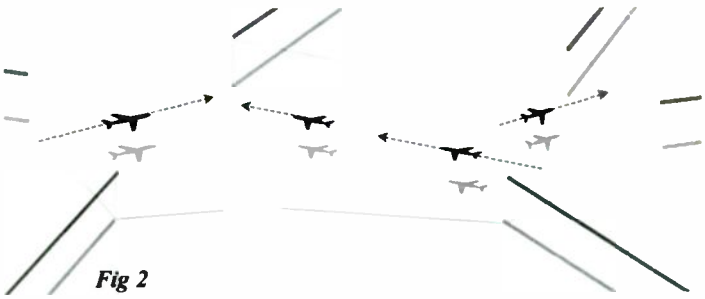


Fig 2

Figure 2 is a typical high-altitude sector somewhere in the Midwest. Right now, the controller only has to deal with four aircraft.

By taking just one sector, and listening to it for a while, you can pick up the frequencies of most of the sectors around it, laterally. This view is from above, like on a map.

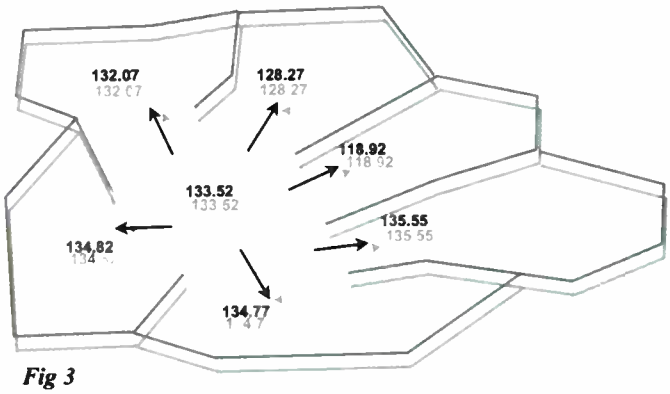


Fig 3

Figure 3 demonstrates how a high-altitude sector may have six other high-altitude sectors around it. Some may be along seldom traveled routes, so you may have to listen for a while to get them all. Additionally, you may hear hand-offs of aircraft descending into various lower sectors.

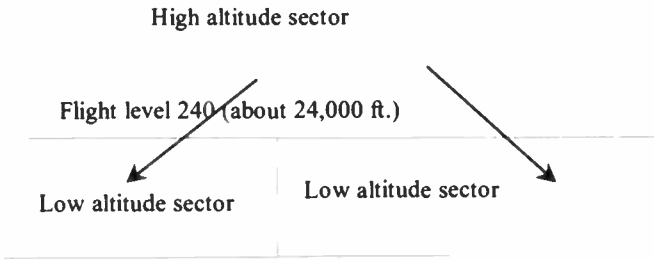


Fig 4

A high altitude sector can be over (and touching) more than one low-altitude sector (Figure 4). These hand-offs sound somewhat similar to level hand-offs. But there are clues. You have to listen to each flight to see if it is cleared for descent or not, prior to the hand-off. The descent clearance can sometimes be issued several minutes before the handoff.

The climb often allows the hand-off at an altitude far lower than the top of the low-altitude sector.

For example, we may hear this hand-off.

Low-alt. sector controller: "United 385, climb and maintain flight level 230."

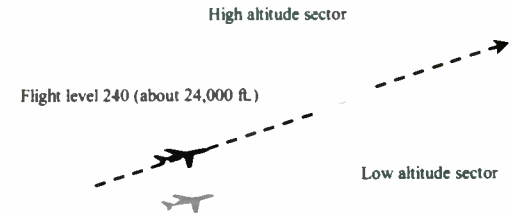


Fig 5

That is a good clue as to the ceiling of the low altitude sector. Should radio contact be lost for some reason, the aircraft will stop at flight level 230, and not intrude into the higher sector until the pilot has made contact on the frequency of the higher sector.

However, once the higher sector can take the hand-off, you may hear this:

Low-alt. sector controller: "United 385, contact Atlanta Center on 134.22."
Pilot: "One thirty-four point two two. United 385."

Then, on 134.22, we would hear. . . .

Pilot: "Atlanta center, United 385 climbing through flight level 193 for 230."
High-alt. controller: "United 385, good morning. Climb and maintain flight level 370."
Pilot: "Climbing to 370. United 385."

The handoff was accomplished well below the floor of the high-altitude sector, but both controllers could see there would be no traffic ahead of the jet. The actual passing of the 24,000 ft. level usually goes unmentioned by either party.

Approach Control

Approach controls have been established above around major commercial airports and military air fields. Nearly every major Air Force base in the United States has an approach control around it, unless it is immediately adjacent to a major commercial airport. Where several major airports are close together (such as the New York City area, or Washington D.C. area) one approach control facility handles the entire metropolitan area.

The tendency lately has been to consolidate approach control activities into larger centers. For example, "SoCal Approach" (meaning southern California) controls over 30 sectors previously handled by Burbank, Los Angeles, Ontario, Coast, and San Diego approach control facilities. Those facilities were subsequently closed down. There is a similar plan for the San Francisco (Bay Approach) and Sacramento areas.

Depending upon the amount of traffic, approach control airspace could be very simple, with one sector for the whole area (see Figure 6).

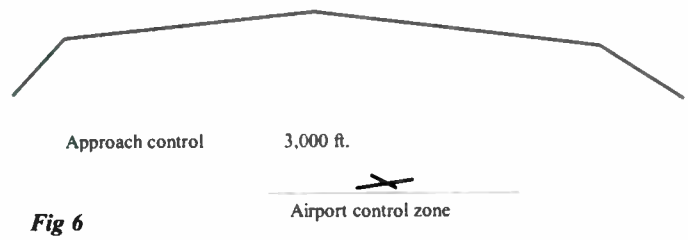


Fig 6

More often, there are two or more chunks of airspace around the airport. Generally around either end of the major runway, there would be an "approach" and a "departure" sector as shown in Figure 7.

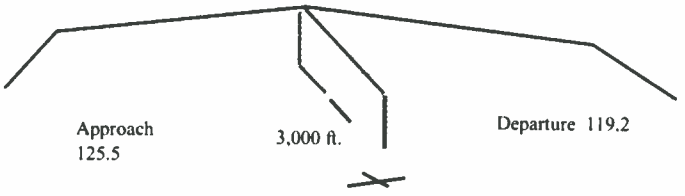


Fig 7

Each sector has its own frequency and controller. So, in the air traffic control facility, there might be at least two radar consoles. Early in the morning and late at night, both sectors may be handled by a single controller. You might hear his/her voice on both frequencies. Pilots may be talking on both frequencies, or may be asked to contact the controller on the preferred or major frequency, "Cessna 57 Bravo, change to my frequency, 125.5."

If there is a lot of air traffic crossing a particular area, the approach air space may be divided into two or more pancakes – with higher level and lower level sectors. Figure 8 shows four sectors, two above the other two.

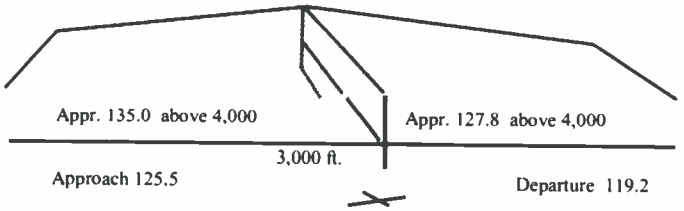


Fig 8

It is common to do this around major metropolitan areas. Transient aircraft passing through the air space will probably stay above 4,000 ft., while the aircraft actually making approaches to the airport will be handled by a controller covering air space below 4,000 feet.

Super-high sectors

In some parts of the country, particularly where the traffic passing over at high altitudes is especially heavy, the high altitude air space may be divided like a stack of pancakes into high and "super-high" sectors (Figure 9).

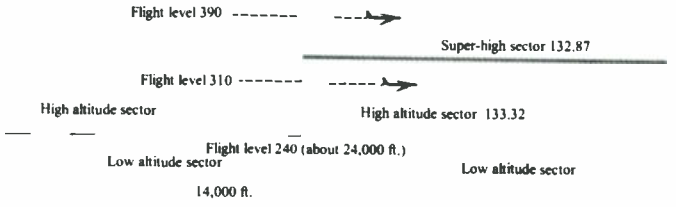


Fig 9

This is done, among other reasons, to minimize the number of handoffs required. When you hear aircraft being handed off to two different frequencies, but they seem to be going in the same direction, think about this. Listen to the "accepting" sector frequency and pay attention to the altitudes they check in at ... "Center, Northwest 582 with you at flight level 390."

In some portions of the United States (for example, over some parts of Montana), there isn't enough traffic to warrant a high altitude and low altitude sector. So they are combined vertically, as in Figure 10.

On the right, we show that the same controller who might be handling a commercial jet at flight level 390 would also be talking to the pilot of a Piper down at 5,000 ft.

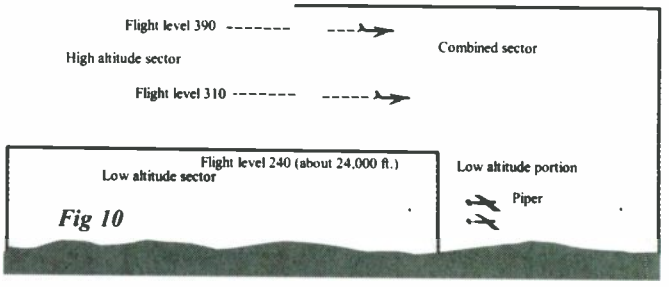


Fig 10

In locations where, by day, there is enough traffic to warrant separate controllers, after midnight the traffic may get so light that one controller may handle many sectors. One controller may handle four adjacent sectors, two high-altitude sectors, and two low-altitude sectors (Figure 11). In these cases you might hear the controller's voice on several different frequencies, but only if you can hear the ground ATC antennae.

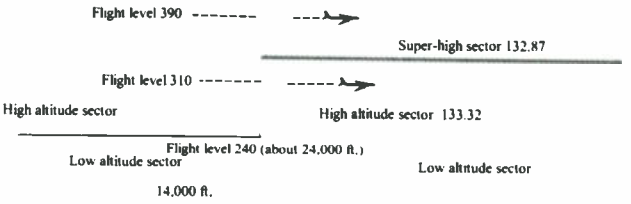


Fig 11

Odd Shaped Sectors

The sketches in this article have shown sectors as flattened cubes, or cylinders, or other simple shapes for ease of illustration. But depending upon common traffic patterns and routes, many sectors of air space (both en-route and approach), have odd shapes.

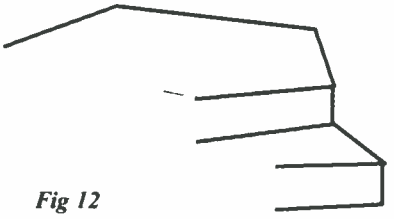


Fig 12

This may be, for instance, because there is a lot of traffic moving through the higher part of the corner nearest us, and to prevent handoffs, this sector "dovetails" with the sector to the right of it, as shown in Figure 13.

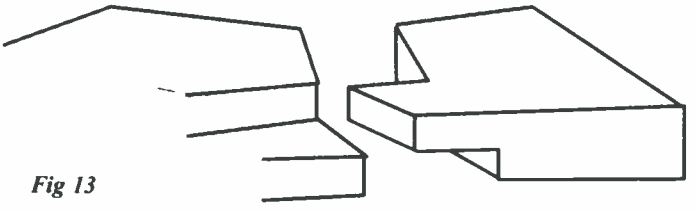


Fig 13

The reader must remember that nearly all of the en-route traffic and much of the traffic in approach control sectors is traveling along standard air routes connecting VORs. So sectors tend to be shaped accordingly.

With all this in mind, listen to the hand-offs. Note the check-ins on the receiving frequency, and learn a little about the general location and shapes of the sectors. Good listening!

About the author:

Michael Scofield is an air traffic control enthusiast, and also does design of large computer databases. When flying commercially, he prefers United Airlines (because of the pilot communication on Channel 6) and he kills for a window seat.

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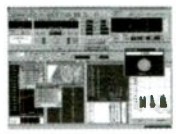

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Over Seas: Monitoring Pacific Ocean Flights

By Laura Quarantiello

Sometimes, when I dream, I see Hawaii: white sandy beaches, palm trees, cool ocean breezes, the easy lap of waves. I take a sip of a Mai-tai . . . and that's usually about the time that I wake up.

We all have our dreams and mine has always been to travel to Hawaii. Unfortunately, my bank account does not share my dream, so I'm forced to seek the islands in another way, by monitoring airline flights crossing the vast Pacific Ocean from the west coast of the U.S. Every day, dozens of flights make this trip, departing for the azure, balmy skies of the Aloha State. For a Southern California listener, catching a ride on the transpacific airwaves is like a little bit of paradise in your headphones.

Tuning In

The only real equipment you need to monitor Pacific ocean flights is an HF-capable ("shortwave" or "world band") radio that can tune upper sideband (USB). Look for a BFO switch on the front panel. Many mid- to high-end World Band radios are capable of tuning shortwave utility broadcasts such as oceanic airline communications.

Though not mandatory, a good outdoor antenna will definitely boost your reception. For years I used a 60-foot long wire antenna strung across the roof of my house with excellent results. Today, I use an active antenna which is virtually maintenance free and more esthetically pleasing to the neighbors.

You'll also want to add a good pair of stereo headphones for those times when you're trying to pull what sounds like whispers from the static hash. Fully enclosed headsets are the best, but Walkman-style earphones work well, too. And don't forget a really comfortable chair, where you can put your feet up, spread your logbook on your lap and settle down for some long distance listening.

Out of Sight, Out of Mind

All commercial airliners in the skies today fly in what is known as positive control airspace. This means they must be on instrument flight plans, which puts them squarely under the watchful eye of air traffic controllers, with whom pilots must maintain contact from takeoff to touchdown. You have undoubtedly monitored these communications between 118-136 MHz on the VHF band.

Unfortunately, VHF is a line-of-sight communications mode, which means that once an aircraft leaves behind the continental United States and heads out over the ocean – Atlantic, Pacific, or Gulf of Mexico – its radio link with ATC will last only about two hundred miles before reception is lost. Radar coverage, too, is distance limited.

So what happens when an airliner leaves the U.S., bound for foreign lands? Far from being out of sight, out of mind, these aircraft are required by the International Civil Aviation Organization (ICAO) Annex Two, to establish and maintain a continuous listening watch and communications capability on HF frequencies assigned to oceanic radio stations in their geographic area (see Table Two for HF frequency ranges).

Control of all oceanic air traffic in the United States is conducted from three oceanic centers located in Oakland, New York, and Anchorage. Because of the limits of shore-based radar coverage, these centers have no real-time radar data to work with; instead they rely on filed flight plans and radio position reporting to track over-ocean flights.

Oceanic air traffic control communications, because of the absence of radar capability and the long distances involved, is a bit different from what we are used to hearing on VHF. Over-water flight routes still fall under the control of the air traffic control Center responsible for that region, but communications are between pilots and international flight service stations or the commercial company Aeronautical Radio, Inc. (ARINC).

These stations relay position reports and any requests for routing and altitude changes from aircraft to the controlling Center facility. They cannot "control" aircraft themselves directly, so instead of hearing "American 1, climb and maintain Flight Level 370," you will hear "ATC clears American 1 to climb and maintain Flight Level 370." The language is nearly the same, but the orders come through an oceanic "go-between."

Hawaii Bound

Though there are many international flight routes connecting all parts of the world, the Pacific routes between the West Coast of the U.S. and points west have somehow failed to capture the interest of many aeronautical listeners. There are several Internet web sites and even an e-mail list devoted to following flights on Atlantic routes, but the Pacific routes seem to have escaped notice despite the fact that thirteen of the top twenty-five busiest routes in the world are

in the Asia/Pacific region. And some of the busiest of these airways run between the U.S. West Coast and Hawaii.

From my monitoring location north of San Diego I am in a good position to listen to most of the communications involved in moving flights out of West Coast airspace and over the ocean and accepting flights back into the airspace from their Pacific routes. The over-ocean portions of these flights are easy for just about anyone in the U.S. to hear on HF and what you'll find is some of the most interesting aeronautical listening around.

Leaving the Mainland

Thanks to the convenience of connecting flights, you can reach Hawaii from just about anywhere in the United States. Almost all flights to the Islands either originate from or make a stop at one of the major hubs at Los Angeles (LAX), San Francisco (SFO) or Seattle (SEA) International Airports. From there, it's roughly a 2200 nautical mile non-stop flight to Honolulu (HNL), Kahului (OGG) or Kona (KOA). What this means for you and I is that there are dozens of flights headed to the Islands every day and by knowing where to tune, you can follow their progress.

If you're close enough to LAX, SFO, or SEA to receive their communications, check out the frequencies listed with this article, particularly the Departure Control frequencies. Flights departing these airports are handed off from Tower to Departure shortly after liftoff. After listening awhile, you'll discover the Departure frequencies most commonly used.

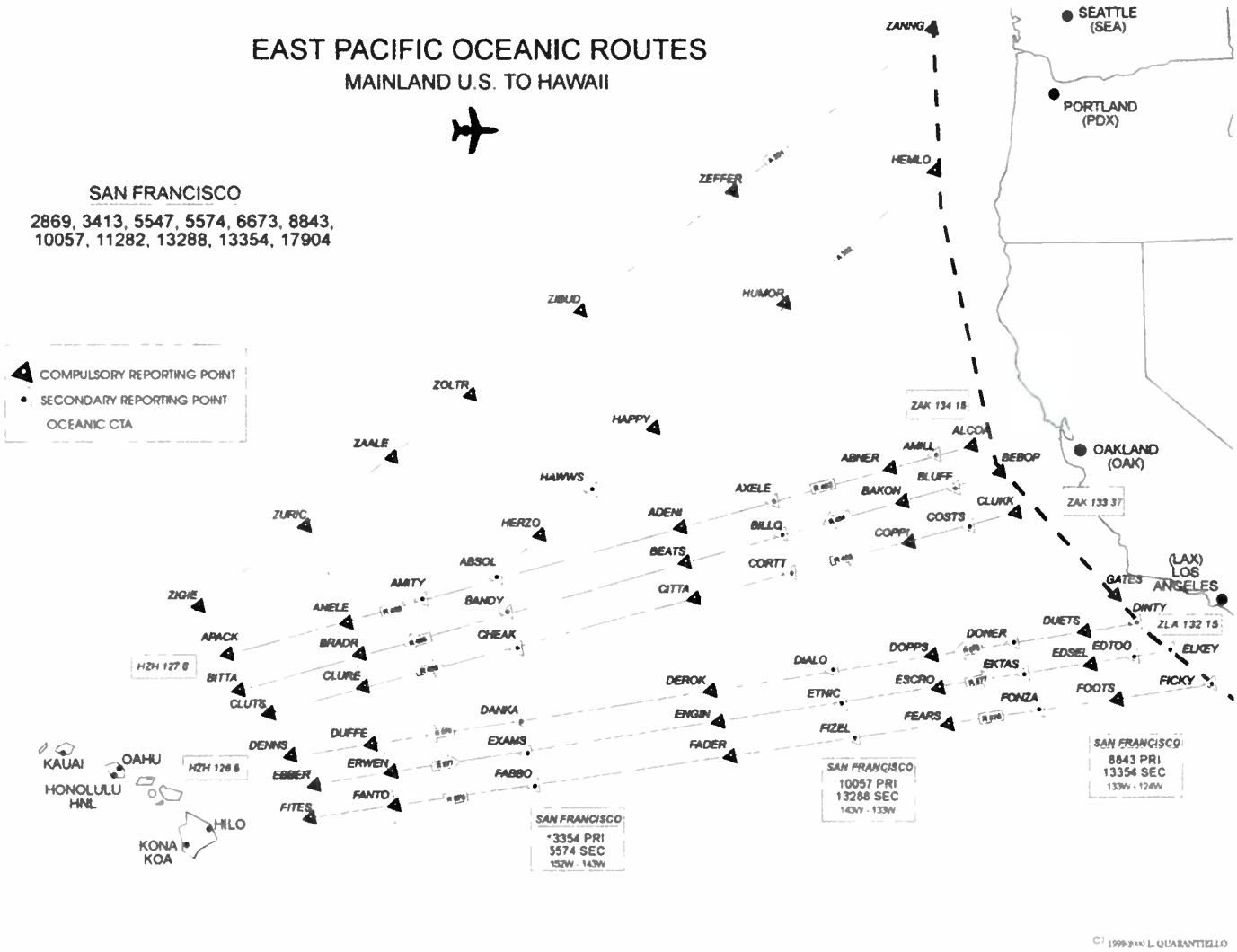
Even if you're too far away from the transmitter to hear the controller, you should still be able to hear the aircraft from some distance. Follow the handoffs from frequency to frequency as they occur. Flights departing for Hawaii eventually reach the FIR or Flight Information Region boundary about two hundred miles offshore. Near this point radar contact is terminated and they are instructed to contact ARINC on HF.

The Deep Blue

Control of air traffic in Pacific airspace is handled by Oakland Oceanic Control, co-located with Oakland Center in Fremont, California. Actual radio communications are handled by ARINC, located in Livermore, California, which relays all clearances, advisories, and other messages. Known formally as the Oakland Oceanic Flight Information Region (FIR), it is the world's largest FIR, covering 18.7 million square miles (9.58% of the world) and comprising eight sectors of oceanic control.

Most of the air traffic in this region travels on the Pacific route system, a series of airways connecting the United States and Hawaii with Japan, the Philippines, New Zealand and Australia, as well as several routes connecting Japan and Korea with Australia and New Zealand. The northern routes are known as the North Pacific Composite Route System or NOPAC.

Traffic traveling between the U.S. West Coast and Hawaii flies on the Central East Pacific Composite Route System (CEPAC). CEPAC consists of six main routes – three westbound, three eastbound – between California and Hawaii (see diagram). These routes are designed with geographic waypoints which are given phonetic names. Though these waypoints exist only on paper and in the memories of onboard com-



puters, many are mandatory reporting points; when aircraft are over the waypoint they are required to call in. Position reports are the only way to track over-ocean flights, since radar coverage does not exist in the FIR.

All communications occur on single-sideband HF radio frequencies. Pilots communicate with operators who have no executive air traffic control authority, but who instead relay messages, reports, and requests to and from Oakland Oceanic Control via teletype, computer, or phone. Aircraft about to enter the FIR contact "San Francisco Radio" on 131.950 MHz to receive primary/secondary HF frequencies and to relay their SELCAL (selective calling) letters. (More on this later.)

Both HF frequencies given are generally guarded throughout the flight, though the secondary frequency serves as a backup in case of loss of contact or degradation of reception on the primary. Should all HF communications fail, the VHF frequency 128.950 MHz can be used to contact another aircraft to relay messages to the ground station.

On March 17, 1999, Oakland Center initiated Controller-Pilot Data Link Communications (CPDLC) in the Oakland FIR. Aircraft that are FANS-1/A (Future Air Navigation System) capable can take advantage of this digital link by contacting ARINC on HF and identifying their flight as CPDLC equipped. ARINC will provide primary and secondary HF frequencies for the entire route of flight and the aircraft must maintain HF communications capability at all times within the FIR; however, all communications normally occur via datalink and cannot be heard by monitors. Less than 5 percent of all aircraft are CPDLC equipped as of this writing.

En Route

Aircraft leaving Los Angeles for Hawaii usually (depending on routing) contact SoCal Departure Control on 135.5 MHz, then are handed off to Los Angeles Center on 126.525 MHz. Once they have reached the limits of L.A. Center's jurisdiction, radar contact is terminated and the flight contacts San Francisco Radio on 131.950 MHz for frequency assignments and then switches to the appropriate HF frequency. The initial contact frequency is usually 8843 kHz (secondary 5574 kHz), but other frequencies in the Pacific Ocean Family can be used depending on ionospheric conditions. Returning from the Hawaiian Islands, the sequence is nearly reversed, with aircraft switching from 8843 kHz to 132.15 MHz, 135.5 and then to Tower.

Once within the jurisdiction of ARINC, flights are required to give position reports at the compulsory reporting points along the route of flight (see chart.) By listening for these reports, you can graphically track a flight as it crosses the Pacific. The sequence of the report is commonly as follows:

- "Position"
- Flight Number
- Present position
- Time over present position in hours and minutes
- Current Flight Level
- Next position and estimated time at that position
- Next subsequent position
- Other information such as fuel remaining, winds aloft and temperature

There are also other in-flight messages that you will hear: Request Clearance and Revised Estimate reports. The Request Clearance messages are used to request a change in route, Flight Level, or speed. This message may be combined with a position report or stand alone as a clearance request if a position report is not needed. The sequence is as follows:

- "Request Clearance"
- Flight number
- Requested route, flight level, or speed.

A Revised Estimate report is used to update the time estimate for the next scheduled position. The sequence is as follows:

- "Revised Estimate"
- Flight number
- Next position on route
- Revised estimate for next position in hours and minutes

You will also often hear reference to SELCAL when monitoring HF frequencies. SELCAL or Selective Calling removes the need for pilots to constantly monitor the radio for calls. Instead, when the ground station wishes to contact a flight it sends an audio signal over the radio which activates a light and bell on the selected airliner's flight deck, alerting the crew to answer the radio. Each aircraft is assigned a unique four letter SELCAL code.

Aloha

As flights progress westbound, they are handed off to other oceanic sectors on HF, until, approaching Hawaiian airspace, flights are handed off to Honolulu Center on VHF (usually on 126.6 MHz at DUFFE, or 127.6 MHz at BRADR). Aircraft are then routed to their destinations on VHF, which is where the stateside listener will "lose" the flight. Fortunately, however, there's always another flight either inbound or outbound from the islands, meaning paradise is just a twirl of the dial away.

TABLE 1: VHF FREQUENCIES

119.800	LAX Tower [Helicopters]
120.950	LAX Tower [South Complex]
133.900	LAX Tower [North Complex]
124.300	SOCAL Approach/Departure [West]
124.500	SOCAL Approach/Departure [225°-044°]
124.900	SOCAL Approach/Departure [090°-224°]
128.500	SOCAL Approach/Departure [045°-089°]
128.200	LA ARTCC [Northeast above 7000]
134.750	LA ARTCC [East above 7000]
132.850	LA ARTCC [Southeast above 7000]
118.100	HNL Tower
118.300	Honolulu Approach/Departure [West]
124.800	Honolulu Approach/Departure [East]
119.100	Honolulu Approach/Departure [Arrive E/NW, Depart NW]
125.500	Kono Tower
126.600	Honolulu ARTCC
127.600	Honolulu ARTCC
118.700	OGG Tower
119.500	OGG Approach/Departure [South]
120.200	OGG Approach/Departure [North]
120.500	SFO Tower
134.500	Bay Area Approach/Departure
120.350	Bay Area Approach/Departure
135.650	Bay Area Approach/Departure
120.900	Bay Area Approach/Departure [NW-E]
135.100	Bay Area Approach/Departure [SE-W]
119.900	SEA Tower
119.200	Seattle Approach/Departure [076°-160° RY 16] [341°-075°]
120.100	Seattle Approach/Departure [199°-300°]
120.400	Seattle Approach/Departure [301°-340° RY 34]
125.900	Seattle Approach/Departure [076°-160° RWY 34] [301°-340° RWY 16] Approach/Departure [161°-198°]

TABLE 2: EN ROUTE FREQUENCIES

HF Frequency Ranges (in kHz)
2850-3155
3400-3500
4650-4750
5450-5730
6525-6765
8815-9040
10005-10100
11175-11400
13200-13350
15010-15100
17900-18030
21850-22000
23200-23350

Pacific Ocean Family
Central East Pacific Areas 1 and 2
2869, 3413, 5547, 8843, 11282, 13261, 17904

Pacific Handoff
131.95 MHz

Honolulu Volmet Weather
2863 6679 8828 10048 13282
at 00 and 30 past the hour

NORTH ATLANTIC CROSSING

by Jean Baker

Following flights across the Atlantic Ocean on High Frequency can make for many hours of fascinating monitoring. Remember, there is NO radar able to track across oceanic areas. Therefore, radio operators (i.e., from Aeronautical Radio Inc., Shanwick, Gander, Santa Maria, etc.) relay instructions, requests, and clearances between pilots and air traffic control. Transmissions can range from ho-hum everyday stuff, such as position reports, weather requests, SELCAL checks, etc., to the downright scary (lost an engine), to the absolutely hilarious. There's never a dull moment!

You never know when you might be the lucky one to catch a transmission like the one from Gander that went like something like this:

Aircraft: "Good afternoon, Gander. This is Crinky Airlines 400 (names changed to avoid embarrassment). What's the weather like at New York JFK?"

Gander: "JFK has slattered crowds, uh, I mean scattered clouds and a temperature of two hundred - uh, I mean 20 degrees Larenfeit - uh Farenheit -oh, let's just start all over again, shall we?"

For those of you who are just starting in the hobby, make sure that any HF receiver that you purchase can receive upper side band (USB) communications. Otherwise all you'll hear are noises that sound very much like Donald Duck at his angriest. Other tips to keep in mind: The higher the sun, the higher the frequency you'll want to use for monitoring. The opposite is true at night.

If you have AirNav or AirNavInternet Lite computer software, you can listen while you track aircraft across the Atlantic! This is extremely interesting and it gives you a feeling of you-are-there with the aircraft and/or radio operators.

ARINC Voice Services — North Atlantic HF SSB Families

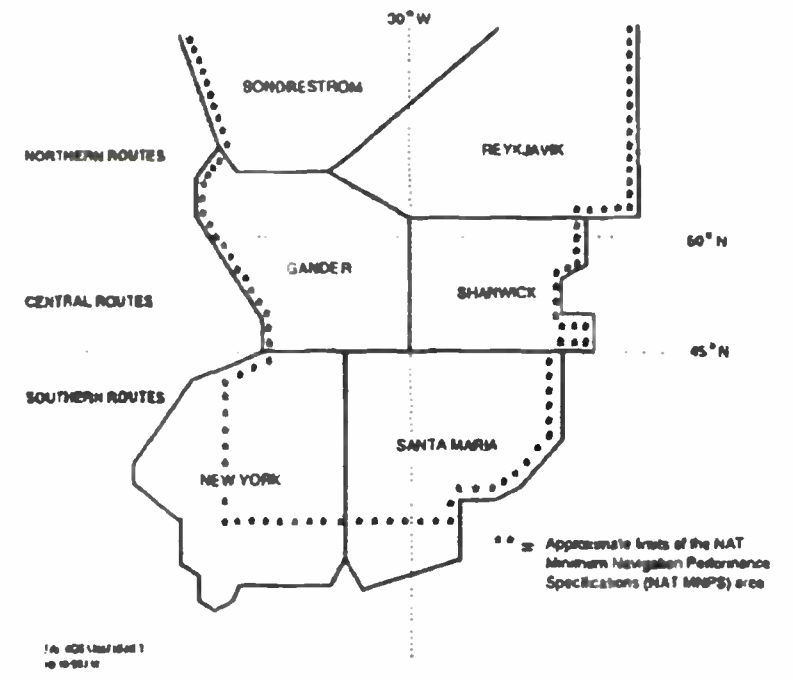


Figure E-1. North Atlantic Flight Information Region Boundaries

Reprinted with permission from the ARINC Voice Services Operating Procedures Handbook

Who's on Where?

The frequencies for transatlantic flights are listed in Table One. The information in Table Two is provided courtesy of Curtice Lewis, Media Specialist, Marketing Department, ARINC (Aeronautical Radio Inc.), and it comes from the *ARINC Voice Services Operating Procedures Handbook.*

As you can see in Figure E-1 from that book, the Atlantic is divided into six flight information regions covering three major air routes:

Northern NAT Routes -

Generally the international air routes extending between North America and Europe, lying North of 60 degrees N latitude.

Central NAT Routes -

Generally, the international air routes extending between North America and Europe, lying between 60 degrees N and 45 degrees N latitude.

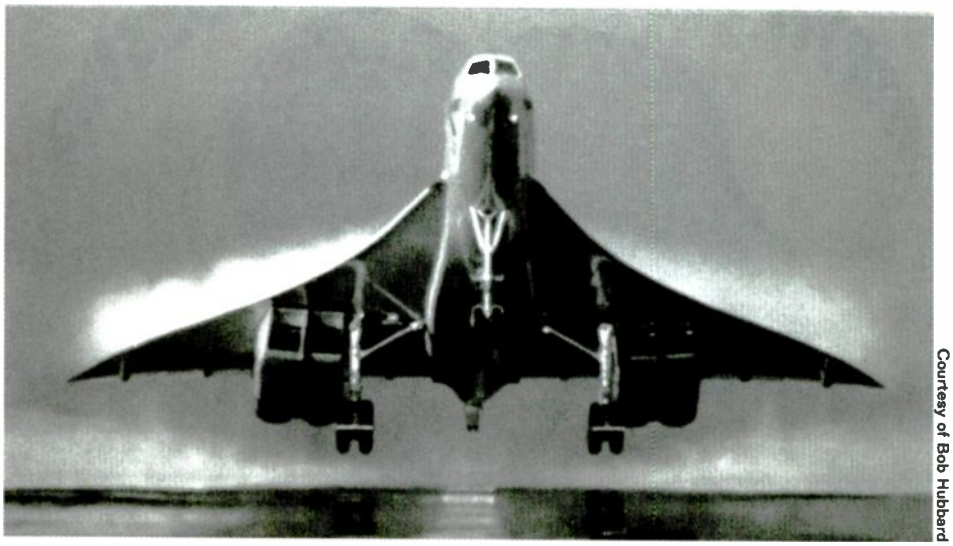
Southern NAT Routes -

Those routes that enter the New York and Santa Maria FIRs (Flight Information Regions).

For most of our readers, the easiest monitoring can probably be found on the HF SSB Long Distance Operational Control (LDOC) frequencies over the Atlantic from New York ARINC on 3494, 6640, 8933, 11342, 13330, or17925.

SELCALs

What does it mean when you hear pilots aloft ask for a SELCAL check and give their aircraft radio's individual code? Selective Calling (SELCAL) equipment is used on both VHF and HF frequencies by ARINC and company stations to communicate with aircraft aloft. SELCAL equipment is used by civilian airlines, some branches of the military, and is also found on some bizjets. Incidentally, SELCAL codes use letters which are defined by the international phonetic alphabet.



Courtesy of Bob Hubbard

For a more thorough description of selective calling, Richard L. Neat, Manager of Frequency Engineering at ARINC, has provided the following information .

Harry Baughn

Due to the background noise level experienced on HF radio frequencies, air crews usually prefer to turn down the audio level of their HF receiver until alerted via SELCAL of a message specifically intended for their aircraft. When the HF ground operator wishes to communicate with an aircraft, he enters into the SELCAL encoder the 4-letter code of that aircraft which is usually included in its flight plan, and transmits that code over the assigned HF radio channel.

All aircraft monitoring that channel receive the SELCAL broadcast, but only those (preferably only one) that have been programmed with that 4-letter code will respond by sounding a chime or otherwise alerting the crew. The crew will then set their volume control higher to listen to the voice traffic and, using recommended radio procedures, assure that the message is intended for them.

There is a critical shortage of possible 4-letter codes, which has required re-use of the same code by more than one aircraft. Duplicate codes are usually assigned to aircraft operated in widely separated areas of the world, and usually do not have the same HF radio frequency assignment. However, there are occasions when two or more aircraft having the same code may be operating in the same general area, and will respond to the same transmission. Therefore, SELCAL should not be used as a substitute for proper voice identification procedures.

SELCAL Operation

Prior to 1 September 1985, there were 12 SELCAL tone codes available from which to obtain 2,970 SELCAL codes. Each code comprises two pairs of tones, the first pair being transmitted for approximately 1 second, with the second pair transmitted for the same duration following a 0.2 second pause. The individual tone frequencies, known by a letter designator "A" through "M," but not including the letter "I," allow 2970 unique SELCAL combinations.

A typical SELCAL code is "AB-CD," which indicates that the frequencies designated by letters "A" and "B" would be sent simultaneously for 1 second followed, after a pause of 0.2 seconds, by the simultaneous 1 second transmission of tones "C" and "D." Duplicate letters (tones) are not permitted in either pair, since simultaneous transmission of two tones of the same frequency would not be distinguishable by the aircraft's SELCAL decoder from any other combination of tones containing that frequency. Also, the same tone pair is not permitted to be used in both the first and second pair. However, this later restriction is not as clearly necessary as will be discussed later!

As of 1 September 1985, an additional four tones, designated as "P," "Q," "R," and "S," were made available for expansion of the number of unique SELCAL codes by 7950, for a total of 10,920. ARINC collaborated with ICAO in preparing an article which was published in the March 1994 issue of the *ICAO Journal* advising readers of the critical shortage of 12-tone codes, which has resulted in multiple and often overlapping assignments. The article stressed the need for proper radio identification procedures, as defined in ICAO Annex 10, to prevent the confusion that could be caused by improperly relying upon SELCAL as a discrete addressing mechanism.

Since August 1994 there have been 2276 new SELCAL assignments made, of which 670 (over 29%) were for 12-tone codes. On average, only about 30 12-tone codes are recovered each year from companies which have ceased operation or which did not respond to four consecutive annual verification letters.

These recovered codes are quickly reassigned to new users who claim not to have the capability to decode the "new" 16-tone codes. ARINC stopped issuing "world-wide" assignments on 12-tone codes in March of 1994. Those operators who do not have the capability to use 16-tone assignments, yet operate world-wide, must use different SELCAL codes for various regions.

Only 375 of the 2970 12-tone codes are assigned to a single user, and these are the prime candidates for any new applicant who cannot use a 16-tone code. Two users are assigned to each of 1658 codes, and three or more users are assigned to the remaining 937 codes.

What is Frequency Management?

Another area that seems to fascinate aero communications monitors are frequencies and how they are used. Here's some information from ARINC about enroute freqs and their allocation which you will find quite interesting!

Frequency Management (FM) is an ICAO program administered by ARINC under a letter of agreement between ICAO and ARINC, and it is free of charge to either ICAO or the regis

trant. Frequency Management is responsible for managing the 128.825 - 132.000 MHz Aeronautical Enroute VHF Spectrum and the Long Distance Operational Control (LDOC) HF spectrum in the United States. Additionally, 20 channels in the 136.500 - 136.975 MHz VHF band have been designated in the USA for Aeronautical Enroute purposes.

Management of these spectrum resources includes coordinating and licensing of over 5000 ground stations and 1000 license renewals per year.

Frequency Management selects frequencies and holds licenses for use by airlines and other aircraft operators in the operational control of aircraft. Frequency Management has developed computer programs which analyze current frequency assignments recorded in a master database to obtain a "first cut" list of candidate frequencies available for assignment to meet a new requirement. The list is then analyzed by displaying each candidate frequency on a map showing the target location, all other co-channel assignments and their coordinated altitudes, the approximate radio range for the requested coordination altitude, and the international coordination zone contours.

Frequency Management participates in International Telecommunications Union (ITU) and International Civil Aviation Organization (ICAO) panels and working groups in matters related to radio spectrum. FM also works closely with the FCC and FAA in formulation of U.S. positions for the World Radio Conference (WRC).

Frequency Management also functions as the International SELCAL Registrar on behalf of ICAO and is responsible for the worldwide assignment of SELCAL codes and management of the SELCAL Database. There are presently 14,440 SELCAL assignments to 1,943 registrants.

Frequency Management provides staff support for the Aeronautical Frequency Committee (AFC). The AFC develops and recommends radio spectrum policy and industry positions regarding regulatory actions to the ARINC Board of Directors. The AFC is composed of the major USA passenger and cargo air carriers, the National Business Aviation Association (NBAA), and the Aircraft Owners and Pilots Association (AOPA) with observers from the Federal Aviation Administration (FAA), the Air Transport Association (ATA), and the International Air Transport Association (IATA).

Harry Baughn

This whole hobby may seem very confusing to newcomers, but remember, it will all clear up with a little experience, so don't give up and keep at it; you'll be glad you did! If you have any questions about monitoring the HF aero bands, let us know and we'll try to answer your questions as clearly and concisely as possible.

The most important thing to remember is that this is a hobby and hobbies are to be enjoyed! Don't get so involved in keeping records of your "catches" and other busy work that you don't enjoy what you're doing.

TABLE 1: Atlantic HF active frequencies

NAT - A (North Atlantic A):
3016, 5598, 8906, 13306, 17946
NAT - B (North Atlantic B):
2899, 5616, 8864, 13291
NAT - C (North Atlantic C):
2862, 5649, 8879, 11306, 17946
NAT - D (North Atlantic D:
2971, 4675, 8891, 11279, 17946
NAT - E (North Atlantic E):
2962, 6628, 8825, 11309, 13354
NAT - F (North Atlantic F):
3476, 6622, 8831, 13291

TABLE 2: North Atlantic HF Radiotelephone Families

Aircraft Registered West of 30 degrees W	Aircraft Registered East of 30 degrees W
NAT-A Southern routes	NAT-A Southern routes
NAT-B Central and Northern routes	NAT-C Central and Northern routes
NAT-D Northern routes while flying	NAT-D Northern routes while flying outside the NAT OTS*
NAT-E Southern routes	NAT-E Southern routes
NAT-F Central routes	NAT-F Central routes

Note: Aircraft registered in Australia will use NAT HF families designated for use by aircraft registered east of 30 degrees W.
*OTS - Organized Track System

North Atlantic HF Radiotelephone Networks

North Atlantic HF Radio Telephone Networks	NAT routes Served by NAT Family Indicated	Availability of NAT HF Families Versus Hemisphere of Aircraft Registration
NAT Family A	Southern NAT routes	Available for use by all aircraft
NAT Family B*	Northern and Central	Available for use by aircraft registered in the hemisphere west of 30 degrees W longitude
NAT Family C*	Northern and Central	Available for use by aircraft registered in the hemisphere east of 30 degrees W longitude
NAT Family D*	Northern NAT routes	Available for use by all aircraft outside the NAT Organized Track System (OTS)
NAT Family E	Southern NAT routes	Available for use by all aircraft
NAT Family F*	Central NAT routes	Available for use by all aircraft

*NAT Family B, C, D, and F not implemented at New York

20th CENTURY NOSTALGIA

The Cautious Clandestine

VOICE OF TOMORROW 1983-1991

By Hans Johnson

Voice of What? The Voice of Tomorrow (VOT) was the most infamous clandestine radio station of our time. Broadcasting on AM and shortwave, VOT was never captured by agents of the Federal Communications Commission (FCC).

VOT was not a mere hobby pirate, content to play a diet of rock-n-roll and off color jokes. Rather, it served up a steady stream of anti-Semitic and racist commentaries and speeches. Along the way, VOT taught the FCC, numerous radio enthusiasts, and the Anti-Defamation League of the B'nah B'rith (ADL) not only about clandestine radio, but that it was virtually impossible to shut down a station that would go to extraordinary lengths to avoid capture.

A neo-Nazi hits the airwaves

The economy was just coming out of a recession and Ronald Reagan was battling the "evil empire" of the Soviet Union in the spring of 1983. Spinning the dials on an April Saturday night, an Ohio listener stumbled across a station identifying as Radio Vanguard International (RVI). They played a few songs and left the air. The listener soon received a letter from the station informing him of their next set of broadcasts, scheduled for June, as well as the station's new name – Voice of To-morrow (VOT).

Not only was the Ohio listener tuned in a few months later, but several other prominent DXers and editors were as well. VOT duped them all into listening on that first weekend by sending each advance notice of their broadcasts. VOT had gotten their addresses from various hobby publications.

All were shocked and bothered by what they heard. The neo-Nazi programming offended many, but all agreed that VOT had a very professional sound and a very strong signal. VOT also got what it wanted, a lot of free media coverage that it would never had gotten without the select mailings.

Listeners in both Nebraska and New York were troubled enough to tip off the Federal Communications Commission (FCC). The FCC office in Grand Island, Nebraska, quickly tuned up Voice of Tomorrow and within seconds had an approximate location through its direction-finding network (DF) – Erwin, Tennessee.

Set up to find Nazi spies during the Second World War, the FCC had 13 direction-finding offices that could quickly find any shortwave station. But pinpointing the station was impossible from a distance. For that, a mobile unit (MADF, in FCC parlance) loaded with direction-finding equipment was needed. The nearest of these was hundreds of miles from Erwin. The FCC could only record the signal for voice analysis and chat away on their internal net. Not realizing his prescience, one of the FCC operators wrote: "*This stn cud cause some irritation.*"

The operator of VOT, who identified himself that first weekend as "Philip Carey," asked listeners to write him at a P.O. Box in Bristol, Virginia, just a bit northeast of Erwin. This probably wasn't Carey's box, as pirate stations typically have someone uninvolved in the station to maintain the P.O. Box and forward the mail to the station's real address. Carey claimed that he was broadcasting from Baltimore, Maryland, and that the station's studios were in Providence, Rhode Island – a deception he maintained for the next nine years.

VOT avoided the critical mistake that virtually every busted pirate station makes – operating too frequently. After that first weekend of test broadcasts, the FCC maintained a "speaker watch" for VOT, but heard nothing. As mentioned above, it's a two-step process for the FCC to pinpoint a station. The FCC couldn't send a mobile unit (MADF) down to Erwin if VOT wasn't on the air.

In the months after the first broadcasts, at least one hobbyist tipped off the Anti-Defamation League (ADL) about VOT and even went to the trouble of photocopying and mailing VOT loggings appearing in the hobby press. The ADL was to take a very keen interest in VOT.

VOT ups the ante

VOT stayed off until Columbus Day weekend of 1983. The FCC located VOT once again in the vicinity of Erwin, but could do nothing more. VOT returned less than a month later on Thanksgiving Day weekend, but from a new location hundreds of miles from Erwin – seemingly Maryland's Eastern Shore. The FCC could only record VOT's signature kettle drum and wolf howl interval signal.

The Commission waits

Although the FCC was stymied in its efforts to catch VOT, the commission didn't just sit around. The FCC obtained a VOT QSL card, probably through subterfuge. With said card, the FCC conducted analysis on the card and verification signer's handwriting against other known pirates that they had also "verified." The FCC also refined its various direction finding results to get better composite fixes on VOT's operating locations. But the next break in the case was to come from a hobbyist.

VOT slips away again

In late 1983, a hobbyist telephoned the FCC and reported that the transmissions of VOT, although infrequent, had a pattern. VOT was always on the air the third Saturday of the month. The FCC started monitoring for VOT in 1984, but the station foiled the FCC by two methods. Firstly, while the pattern of the third Saturday held, VOT was not on every month and sometimes would go for months without a transmission.

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VOT also operated out of a different location nearly every time it was on. The areas of Staunton and Richmond, Virginia, and Washington, DC, were used in addition to Erwin. The combination of infrequent transmissions and different locations from an apparent mobile transmitter frustrated the FCC and its efforts in enlisting the help of amateur radio operators in both Richmond and Bristol, Virginia, for help in pinpointing VOT.

VOT was even bold enough to operate on AM a few times. It would have been much easier to pinpoint their location on AM, but the transmissions were apparently too irregular for the FCC to do this.

Compounding the FCC's difficulties was the fact that another pirate station was operating from around Erwin – Secret Mountain Laboratory (SML). Based on the initial intercept data of SML, the FCC lumped the two together. Although the FCC eventually figured out that the same locations were just a coincidence, it took the commission the better part of 1984 to untangle the two.

The ADL turns up the heat

For its part, the ADL had trouble understanding why the FCC couldn't shut down VOT. After all, the FCC busted illegal stations all the time, why would VOT be any different? The ADL had conversations with the FCC that culminated in a letter to the FCC in the spring of 1985. In it the ADL urged that "the FCC vigorously pursue its investigation of VOT."

Looking back at that time, Gail Gans of the ADL says that their communications with the FCC eventually convinced them that the Commission was doing all it could to catch the station.

How VOT stayed alive

VOT's willingness to stay off the air for months at a time helped it immensely. August 1985 is a case in point. The FCC was convinced that VOT would be on the third weekend that month. The Commission placed MADF units in both Richmond and Washington. A few Commission field offices maintained a watch of VOT that weekend and the chief of the FCC's Signal Analysis Branch was on duty as well. VOT never showed up. The FCC attributed the lack of activity to a big Klu Klux Klan rally that was held in Maryland that same weekend. Down the drain went a lot of effort, not to mention a lot of overtime pay to no avail.

VOT's next trick was to stay off the air for nearly two years. The station was not heard again until August 1987.

Back with a vengeance

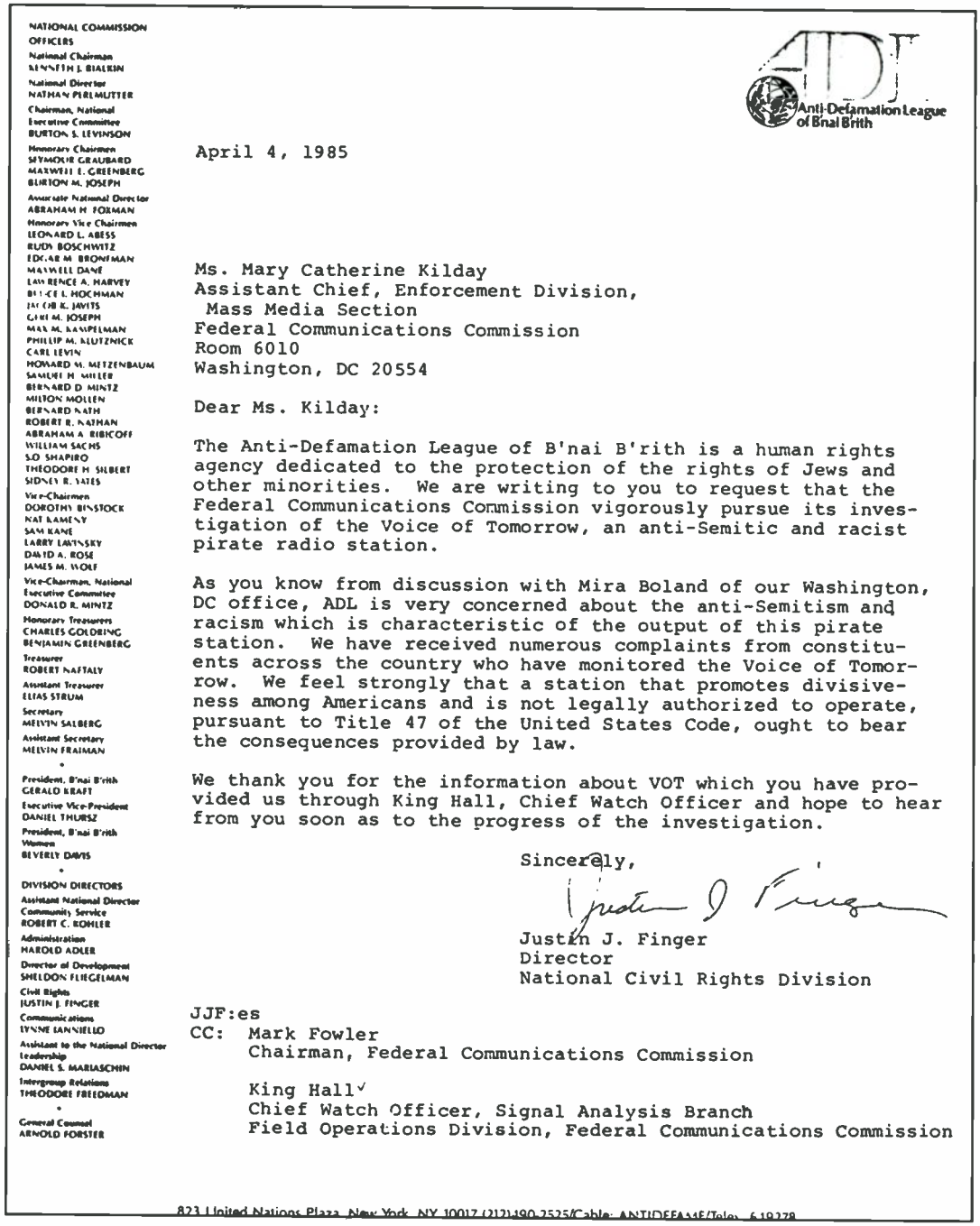
VOT made up for lost time during the latter half of 1987, but with more caution than ever. The station was now announcing an address in Oregon, its third, but rarely answered any letters.

Although VOT continued to operate around some of the fall holidays, it broke its pattern of broadcasting on the third Saturday of the month. VOT was also operating from a different Mid-Atlantic location at each transmission, often in the vicinity of a major roadway.

Whenever the FCC found that the site was anywhere near a field office, they would immediately send out a MADF. VOT's transmission were never over an hour and the MADFs weren't able to close in. If and when VOT returned to the air later that day or weekend, it was from a different and distant location.

A near death experience

What the FCC need was a break and they got one in January 1989. Three MADFs were



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ADL Anti-Defamation League of B'nai B'rith

April 4, 1985

Ms. Mary Catherine Kilday
Assistant Chief, Enforcement Division,
Mass Media Section
Federal Communications Commission
Room 6010
Washington, DC 20554

Dear Ms. Kilday:

The Anti-Defamation League of B'nai B'rith is a human rights agency dedicated to the protection of the rights of Jews and other minorities. We are writing to you to request that the Federal Communications Commission vigorously pursue its investigation of the Voice of Tomorrow, an anti-Semitic and racist pirate radio station.

As you know from discussion with Mira Boland of our Washington, DC office, ADL is very concerned about the anti-Semitism and racism which is characteristic of the output of this pirate station. We have received numerous complaints from constituents across the country who have monitored the Voice of Tomorrow. We feel strongly that a station that promotes divisiveness among Americans and is not legally authorized to operate, pursuant to Title 47 of the United States Code, ought to bear the consequences provided by law.

We thank you for the information about VOT which you have provided us through King Hall, Chief Watch Officer and hope to hear from you soon as to the progress of the investigation.

Sincerely,

Justin J. Finger
Director
National Civil Rights Division

JJF:es
CC: Mark Fowler
Chairman, Federal Communications Commission

King Hall
Chief Watch Officer, Signal Analysis Branch
Field Operations Division, Federal Communications Commission

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providing support on a blustery afternoon to the Presidential inauguration activities in downtown Washington, when VOT came on the air from a location near Richmond. The MADFs went tearing down I-95 towards Richmond. The units got to the outskirts of Richmond when VOT left the air. The FCC summed up the incident, "If he had stayed on another 15-20 mins we probably would have gotten him. Most disappointing, to say the least."

GI V VB HV SHORT INFORMAL FOR U WHEN U QRV 21:55
VB V GIR OK GA K
GI V VB I JUST GOT A CALL FROM AN AVID SWL IN FT. LAUDERDALE. HE HAS BEEN TRACKING THE PIRATES FOR YEARS (EVER SINCE WE WERE IN FT. LAUDERDALE). HE HAS BEEN ESPECIALLY CONCERNED ABOUT THE NEO-NAZI "VOICE OF TOMORROW." HE READ ME A LOGGING (SOURCE UNKNOWN) OF RECEPTION OF VOT ON MAY 4TH, STARTING A 0103 UTC ON 7410 KHZ AND SIGNING OFF AT 0230 UTC. APPARENTLY, THEY JSY'D A FEW TIMES TO SOME OF THEIR OLD FREQS (6240 AND 15040). THEY ALSO REPORTEDLY HAVE 1616 KHZ. THE STATION LOGGING THEM WAS LOCATED IN MARYLAND. SINCE THEY ARE NOT VERY ACTIVE IN RECENT YEARS, I THOUGHT THIS INFO MIGHT BE OF VALUE TO YOU.

This memo found in the FCC's huge file on VOT has special significance to the author.

The End

The cat-and-mouse games continued in 1989. The FCC set traps for VOT during holiday weekends. One MADF set up in Martinsburg, West Virginia, while other waited in the mountain gaps of Midland and Thornton Gap in Virginia. Although the FCC tried this at least twice, VOT never showed up.

For its part, VOT became even more cautious. The station stopped announcing any address and it apparently was able to transmit while on the move, usually from a highway such as Maryland's Route 301. The transmissions became more and more infrequent and finally ended in the late spring of 1991.

Conclusions

Until now, the conventional wisdom has said that the FCC never made a concerted effort to catch VOT, ostensibly for political reasons. Nothing could be further from the truth. The FCC case file (see below) against VOT was known as 83-WA-364. It is hundreds of pages in length. The FCC effort against VOT was immense and ranged from voice and handwriting analysis to spending holiday weekends in a MADF waiting for a station that never came on.

VOT overcame all this through short duration transmissions, great mobility, unpredictability, and an infrequent operating schedule. VOT stayed alive by a willingness to spend holiday weekends and weeknights driving around five different states coupled with a discipline to forego transmitting for years at a time.

Afterword

This article is based in part on the FCC case file on VOT that I obtained through the Freedom of Information Act. Ironically, the most disturbing thing I found in the file was a logging of VOT that had been tipped to the FCC by an unnamed hobbyist. I happen to know the logging was mine.

The SatCom North Arctic Expedition

By John David Corby

It was about two o'clock, the bright sun was hiding behind the steep escarpment to the north, and the local children were playing boisterously in the street below my hotel window. I admired the pleasant summer scene for a few moments, then pulled the drapes closed and returned to bed. Breakfast wasn't served until seven, and I had to make the most of the remaining hours of night to catch up on lost sleep.

I was in Resolute Bay, Canada, visiting the new territory of Nunavut just two months after it received its charter from the Canadian government. The date was mid-June 1999. Resolute is almost six hundred miles north of the Arctic Circle, and just a thousand miles from the North Pole. My solo expedition, christened "SatCom North '99," was intended to test satellite communications for the Otto Sverdrup Centennial Expedition leaving for a year's stay in the Canadian High Arctic just a few weeks later.

North of the Arctic Circle the Sun doesn't set for about three months in the summer. The temperature in mid-June was a balmy minus 1degree Celsius, but the sea was still frozen in this small bay on the northern shore of the Barrow Strait. Resolute Bay has a community of just 170 people, but is served by a twice weekly jet service from Ottawa. The First Air 727s are modified to carry freight at the front of the fuselage, and passengers at the rear. Landings are on the gravelly perma-frost runway a few miles outside the hamlet.

Testing the limits of satcoms

My mission was to test the Inmarsat satellite link that the Sverdrup Expedition would use later in the year. The only Inmarsat bird above the horizon at Resolute's latitude of 74 degrees north is the Atlantic Ocean Region West (AOR-W) satellite orbiting high above equatorial Brazil. AOR-W is a geostationary satellite which is only a little over two degrees above the local horizon at Resolute Bay.

Until I set up the Inmarsat satellite communications set that I had brought with me, I could not be sure that the hills surrounding the bay would not obscure line-of-sight to the satellite.

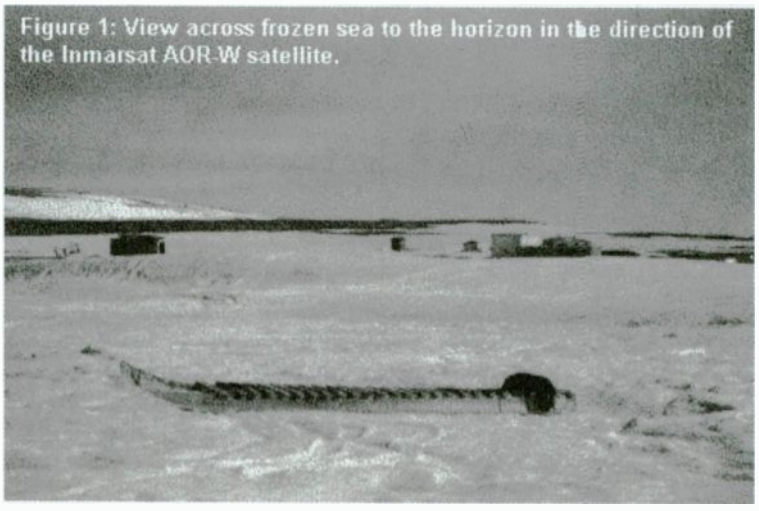

Figure 1: View across frozen sea to the horizon in the direction of the Inmarsat AOR-W satellite.

Figure 1 shows the view across the bay in the direction of AOR-W. The Sverdrup team would be even further north at Hourglass Bay on Ellesmere Island. Even if the rig worked at Resolute there was still no certainty that the local terrain at Hourglass Bay would cooperate.

As it turned out, the terrain at Hourglass Bay would indeed be a problem. The satellite was not visible from the mooring point for the Expedition's boat *Northanger*. However, the problem was resolved by relocating the Expedition's communications tent to a point about a mile away from where the *Northanger* was frozen into the sea ice for the long, dark and very cold winter.

I spent the first day scouting around the settlement, walking along the beach, and taking bold strides out onto the sea ice. The Barrow Strait forms a branch of the famous "Northwest Passage." It is a local tradition for visitors to walk on the Northwest Passage, and I honored that tradition with a strong glow of pride and excitement. I can now claim with some truth that I have walked on water.

The beach, like the entire surface area of Cornwallis Island, is a rough, unspoiled natural gravel area. Just inches below the gravel is perma-frost. Wintertime temperatures reach down to the mid-forties below zero Celsius, and the very brief summer sees temperatures rise to a maximum of only around ten degrees above zero.

At the top of the beach area is the Resolute Bay community TV dish. Figure 2 shows how the dish elevation is set at almost zero degrees. Actually there is a slight elevation for mechanical stability, but the dish has an offset focus which brings the focal plane down almost to the horizon. It is a large dish with a very strongly built mount. Wind loads in the Arctic can place a very high strain on the antenna mount. In winter the weather pattern brings high winds, and there is little to shelter the dish from frequent batterings as months of cold, dark storms lash mercilessly at the tiny Arctic community.

I looked at the dish orientation and made some assumptions about which way to point my Nera Saturn antenna to receive Inmarsat's AOR-W. The Resolute Bay CATV dish has a clear view

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to the south across the Barrow Strait. I pointed my antenna the same way. The Nera Saturn Inmarsat M unit is a device which resembles a plastic briefcase. The "briefcase" lid is a highly-sensitive active antenna which must be pointed with some accuracy at the satellite. The rest of the "briefcase" contains the radio transceiver, a telephone handset, and an RS-232C connector for hooking up the laptop computer that I had brought with me to send and receive e-mail. The Nera unit has a built-in function which sounds an audio beep tone when the antenna is correctly aligned with the satellite. The beeps sound more rapidly as the antenna is oriented closer to the optimum azimuth and elevation. As I powered up the unit my hopes were suddenly dashed – I heard no beeps at all.

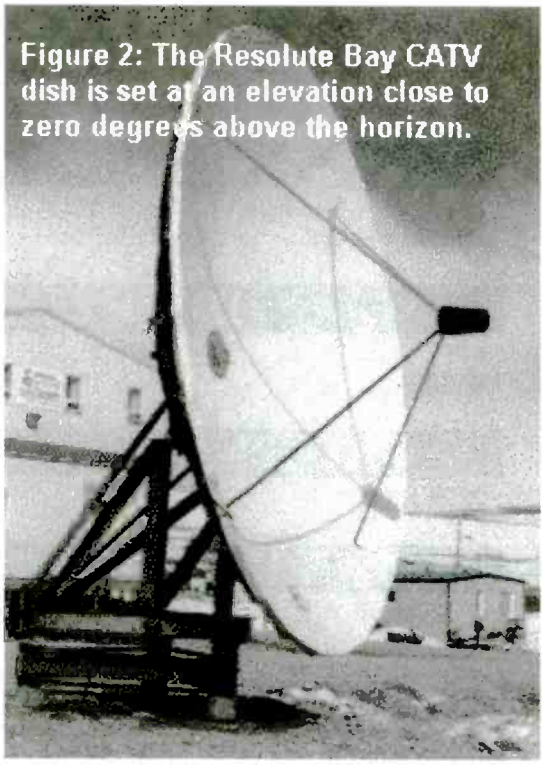


Figure 2: The Resolute Bay CATV dish is set at an elevation close to zero degrees above the horizon.

In my haste to repeat the ease with which I had set up the Nera set many times before on the deck at my home near Toronto, one thousand five hundred miles to the south, I had overlooked the fact that Resolute is further west in longitude than Toronto. The convergence of lines of longitude near the Poles exacerbates human error when trying to guess azimuth settings. My magnetic compass was absolutely useless. The Magnetic North Pole was just beyond the next island, and the compass needle registered an error of something like sixty degrees!

I moved the antenna to the east and started to hear some beeps. The beeps were still weak, but they were there for sure. Excitedly, I pushed the antenna a little further to the east, and the beeps increased rapidly. I checked the signal strength indicator – good signal. After optimizing the elevation I had a signal which was blasting in at a higher signal to noise ratio that I had received in Toronto.

At first I was confused. The line-of-sight distance to the satellite was well over forty-seven thousand kilometers, and the bird was sitting just a hair's breadth above the hills on the eastern shore of Resolute Bay. How could I be receiving a better signal than I got in tests back home with a satellite elevation closer to forty degrees? The answer came later when I posted a question on my own HearSat mailing list (**www.hearsat.org**) and was advised by several people that this is caused by the additive effect of radio waves coming directly from the satellite, with other signals reflecting off the ground. The snow and ice-covered ground stretching for hundreds of miles all around is an excellent conductor and enhances this effect very well.

After the initial tests conducted on the beach (looking over my shoulder from time to time in case a stray Polar Bear wished to re-educate me about my place in the food chain), I moved the rig onto the balcony of my hotel. Figure 3 shows the conveniently placed bird-feeder on which the Nera set's antenna was mounted to get a line-of-sight to the satellite.

The missing link checks in

The members of the Otto Sverdrup Centennial Expedition had assembled in Oslo, Norway, ready for the first part of their adventure. They were going to sail across the North Atlantic in the *Northanger*, past the Shetland Isles, Iceland, Greenland, and finally up into the Canadian Arctic. They were frantically checking e-mail at the University, anxiously awaiting a message from Resolute Bay. On Saturday 19th June, 1999 the message arrived:

"CQ Sverdrup CQ Sverdrup

---

de John Corby; QTH: 74.75N, 95.00W

Graeme is forgiven for his rash statements at the expedition reception in downtown Toronto. This rig actually works!In fact, I made a voice call this morning and got 3 stars for signal strength and a S/N of over 400! Graeme, if you remember the southern trials from my deck, we never got a S/N over about 230."

The reference to "Graeme's rash statements" concerned the Expedition kickoff publicity event in front of Norway's ambassador to Canada, the Press, radio and TV media. Expedition leader Graeme Magor had boasted that communications would not be a problem. I had been sitting in the audience when Graeme introduced me as the Expedition's Communications Consultant. Cameras swooped toward me. My reputation was on the line.

In my second message from Resolute I wrote:

"..... Communications through the Nera continue to be trouble-free. However, I have found that the telephone service and TV experience noise and dropouts. Television requires high bandwidth so I can understand that signal/noise degradations might cause problems. Telephone service probably does not use signal compression (or at least not as much as Inmarsat and Iridium), so it also requires higher bandwidth. BUT, before Graeme goes making any more confident statements about the ease of modern communications in the High Arctic, I should point out that we are rapidly approaching another peak in the 11-year sunspot cycle. Anything could happen in the next couple of years, and the expedition's communications is dependent on a tenuous link through a single satellite. Remember that Anik-E1 lost most of its transponder capacity a few years back. ....."

Later I was told that, while I was in Resolute, all but one of the Expedition members were

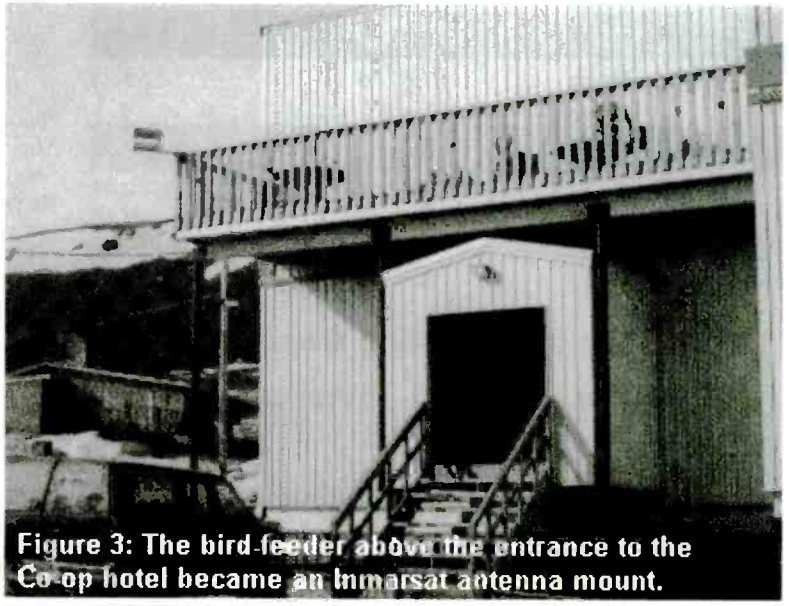
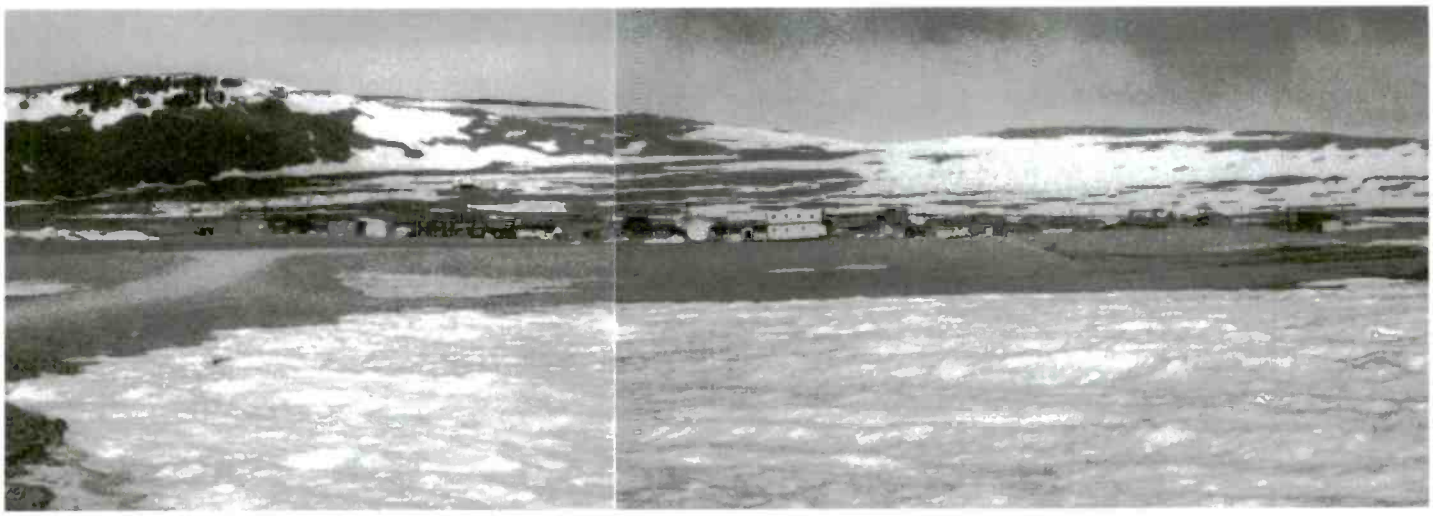


Figure 3: The bird-feeder above the entrance to the Co-op hotel became an Inmarsat antenna mount.



waiting despondently on the platform at an Oslo subway station. They had all but given up hope. Just before the train rolled into the station, the last member of the team arrived. He ran onto the platform excitedly waving a hardcopy of my first Inmarsat message from the Arctic. Apparently, there was a "festive eruption" in the subway station as the good news arrived.

SW – Always good in a pinch

Back in Resolute I had more work to do. The Expedition could not entrust its safety to just a single mode of communication. My remarks about the sunspot cycle, and the loss of Anik E1's transponders might have been prophetic, although in the end the Inmarsat communications worked flawlessly for the Sverdrup team. Nevertheless, at the time I had to check out other alternatives. The team was taking an Iridium phone along for the trip. It worked well during tests in the south, subsequently providing excellent service in the Arctic too, but dark financial clouds were already on Iridium's horizon before the Expedition had even left Oslo. We needed another solution.

Feeling relaxed, I spent another two or three days walking the beach with my Icom R10 handheld communications receiver and a handheld groundplane antenna. I wanted to test the reliability of Orbcomm's satellites above the Arctic Circle. A colleague had met with disappointing results using Orbcomm on an earlier expedition.

In Toronto, Orbcomm signals boom in, but in Resolute things were very different. I received only weak signals and decided that this service would probably not meet the Expedition's needs this time either. In the end, the plain old Spilsbury HF radios, used throughout the Arctic, provided backup.

Enjoying radio silence

In the absence of the thousands of VHF utility stations crowding the spectrum further south, the Arctic is a satellite monitoring enthusiast's dream. I spent hours checking many of the satellites that I monitor from my home base in the south.

The Russian navigation satellites boomed in as usual. I heard the old US Navy satellite Transit 5B5 loud and clear for the first time. In Toronto, its signal is masked by local paging transmitters, but in the Arctic the nearest paging transmitter is more than a thousand miles away. Resolute Bay is 'way too far north to see *Mir* above the horizon, but the many other polar and near-polar satellites came in loud and clear.

On Midsummers Day 1999, I packed up my parka and my hiking boots stained with seal-oil from the Arctic beach, and boarded the plane for home. Southern Ontario was basking in 30 degree Celsius heat, and my Icom dial was saturated with intermodulation distortion.

Footnote:

The Otto Sverdrup Centennial Expedition departed Oslo, Norway, in June 1999 sailing to the Canadian Arctic for a full year's stay. Information about the expedition is available on the Web at **www.sverdrup2000.org**.

About the author:

John David Corby is a Canadian writer and monitoring enthusiast. John is the webmaster of John David Corby's Technofile at **www.johndavidcorby.com**. He is also the owner of the HearSat satellite monitoring enthusiast's website at **www.hearsat.org**.

Hauser's Highlights

China Huayi Broadcasting Co., Fuzhou

rearranged schedule to:
0255-0600 11590 6185
0855-1600 11590 6185
(winter frequencies are 4940, 4830)
Shigenori Aoki, Japan, *Electronic DX Press*

IRAN: IRIB Teheran

No two versions of VIRI's schedule match each other. Here's one, excerpted:
Summer A-00 in English
0030-0130 9022, 9835, 11970
1100-1230 15385, 15430, 15585, 21470, 21730
1530-1630 7115, 9635, 11775
1930-2030 9022, 9575, 11670
2130-2230 11740, 13745
(*Observer*, Bulgaria)
Persian service on 15084.2 0100-0200 accompanied by two very strong spurs on 15017.4 and 15151.0. Modulation totally distorted, but S9
(Hans-Joachim Koch, Niddatal, Germany, *DXLD*)

KOREA NORTH: KCNA

RTTY news in English, F1B, 50 baud
Mon-Sat:
1000-1200 Asia 10580
14568-summer
8512-winter
Eu 15633
13780-summer
11430-winter
1230-1400 Am 13580
11536-summer
11476-winter
Af 8020
11476-summer
11536-winter
((c) BBC Monitoring)

GLOSSARY

A Glossary of radio related terms used in *Monitoring Times*. (See www.grove-ent.com/mtglossary.html for a much more comprehensive list.)

THE RADIO SPECTRUM

ULF - Ultra Low Frequency (3-30 Hz)
ELF - Extremely Low Frequency (30-300 Hz)
VF - Voice Frequencies (300 Hz-3 kHz)
VLF - Very Low Frequency (3-30 kHz)
LF - Low Frequency (30-300 kHz)
MF - Medium Frequency (300 kHz-3 MHz)
HF - High Frequency (3-30 MHz)
VHF - Very High Frequency (30-300 MHz)
UHF - Ultra High Frequency (300 MHz-3 GHz)
SHF - Super High Frequency (3-30 GHz)
EHF - Extremely High Frequency (30 GHz and above)

// - Indicates a Parallel Frequency
µF - Microfarad
µH - MicroHenry
AC/ac - Alternating Current
AGC - Automatic Gain Control
AM - Amplitude Modulation
ARRL - American Radio Relay League
BCB - Broadcast Band (530-1705 kHz AM)
Bd - Baud
BFO - Beat Frequency Oscillator
BNC - Coax connector commonly used with VHF/UHF equipment
CB - Citizen Band
C-band - 3.7-4.2 GHz
Comm - Communications
CQ - General call to all stations
CTCSS - Continuous Tone Controlled Squelch System
CW - Continuous Wave (Morse code)
DAB - Digital Audio Broadcast
dB - Decibel; dBi- decibels over isotropic
DBS - Direct Broadcast Satellite
DC/dc - Direct Current
de - Morse code prosign meaning "from"
DSP - Digital Signal Processing
DTMF - Dual Tone Multi Frequency
DTRS - Digital Trunk Radio System
DX - Distant Station Reception
DXer - A person who engages in the hobby of distant radio/television reception
DXing - The hobby of listening to distant radio or television signals
DXpeditions - DX Expeditions (trips to the boonies by radio listeners)
ECPA - Electronic Communications Privacy Act
ECSS - Exalted Carrier Selectable Sideband
E-skip - Sporadic E-layer ionospheric propagation
FCC - Federal Communications Commission
FD - Fire Department
FM - Frequency Modulation
Freq - Frequency
FRS - Family Radio Service
GHFS - Global High Frequency System
GHz - Gigahertz
GMDSS - Global Maritime Distress and Safety System
GMRS - General Mobile Radio Service
GMT - Greenwich Mean Time (replaced in most applications by UTC)
GPS - Global Positioning Satellites
GSM - Global System for Mobiles (900 MHz)
HT - Handi Talkie/Handheld Transceiver
Hz - Hertz
ID - Identification
IF - Intermediate Frequency
IRC - International Reply Coupon
ISB - Independent Sideband
kHz - Kilohertz
km - Kilometer
Ku-band - 11.7-12.2 GHz (plus 12.2-12.7 GHz in North America)
kW - Kilowatt
LCD - Liquid Crystal Display
LED - Light Emitting Diode
LNA - Low Noise Amplifier
LNB - Low Noise Block Downconverter
LNBF - Low Noise Block Downconverter Feedhorns
LSB - Lower Sideband
LT - Local time
LW - Longwave (150-300 kHz)
mb/MB - meter band/Megabyte
MDT - Mobile Data Terminal
MF - Medium Frequency
MHz - Megahertz
ms - milliseconds
MT - Monitoring Times
MUF - Maximum Usable Frequency
mW - Milliwatt
MW - Medium Wave (typically 530-1710 kHz)
MW - Megawatts
NCS - National Communications System/Net Control Station
NDB - Non-Directional Beacon
NFM - Narrowband Frequency Modulation
NiCd - Nickel Cadmium Battery
NiMH - Nickel Metal Hydride battery
No Joy - Station did not answer call
NWR-SAME - National Weather Radio Specific Area Message Encoding
Ops - Operations
Packet - Amateur radio error correcting mode
PC - Personal Computer/Printed Circuit
PCS - Personal Communication System/Satellite
PD - Police Department/Primary Data
PFC - Prepared Form Card
PL - Private Line
Q - Performance rating regarding selectivity or bandwidth
QRM - Interference from another station
QRN - Interference from natural or man-made sources
QRP - Low power operation
QSL - A card or letter confirming reception of a radio station
QSO - Communications between two or more stations
QTH - Location
RDF - Radio Direction Finding
RF - Radio Frequency
Rptr - Repeater
RTTY - Radioteletype
SASE - Self Addressed Stamped Envelope
S-band - Microwave frequencies above UHF
SCA - Subsidiary Carrier Authorization (now known as SCS)
SCPC - Single Channel Per Carrier
SCS - Subsidiary Carrier Service
SELCAL - Selective Calling
Sesqui - A "Hauserism" meaning one and one-half
SINAD - Signal to noise and distortion ratio
SINPO - A code system used by radio hobbyists to indicate how well a station was received: S=Strength, I=Interference, N=Noise, P=Propagation, O=Overall (sometimes shortened to SIO)
SITOR-A(B) - Simplex teleprinting over radio system, mode A (B)
S-Meter - Signal Strength Meter
SMR - Specialized Mobile Radio
S/N Ratio - Signal-to-Noise Ratio
SSB - Single Sideband
SSN - Sunspot Number
SW - Shortwave (high frequency - HF)
SWBC - Shortwave Broadcast
SWL - Shortwave Listener
SWR - Standing Wave Ratio
Tac - Tactical
Tent - Tentative
TIS - Traveler Information Service
TVRO - TV Receive Only
Tx - Transmit
UHF - Ultra High Frequency
UKoGBaNI - United Kingdom of Great Britain and Northern Ireland
ULS - Universal License System
Unid - Unidentified
USB - Upper Sideband
UT - Universal Time
UTC - Universal Time Coordinated
Vac/VAC - Volts Alternating Current
Vdc/VDC - Volts Direct Current
VFO - Variable Frequency Oscillator
VOLMET - Aviation Weather Broadcasts (on HF)
VOX - Voice Operated Relay
VSWR - Voltage Standing Wave Ratio
WAM - Wideband Amplitude Modulation
WEFAX - Weather Facsimile
WFM - Wideband Frequency Modulation
wpm - Words Per Minute
WWV - National Bureau of Standards Time Station, Ft. Collins, CO
WWVH - National Bureau of Standards Time Station in Hawaii
Wx - Weather
WXSAT - Weather Satellite
X-band - Expanded AM broadcast band (1610-1700 kHz)
Zulu - Military time zone (same as UTC)

Skip Arey, N2EI
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Reasonable Recycled Receivers

Every now and again I get a letter or e-mail from somebody that makes the assumption that my personal monitoring post is populated with the latest, greatest and most expensive radio gear. That I have racks of Watkins-Johnson HF 1000's cross wired for diversity reception. That I have a 360 degree array of Beverage antennas with network computer controlled tuning and switching. That I have a full time staff of technicians on 24/7 call to effect repairs and keep Old Uncle Skip on the air.

Well, I hate to burst any bubbles, but my station is (and always has been) modest. My personal tendencies lean towards proven designs that I then try to get long service life from. I also look for designs that lend themselves to repair at my basement workbench as opposed to shipping off to someone else. If I can come up with a tweak or two to take the radio performance beyond factory specifications, so much the better.

This general philosophy also makes consistent use of the used market when seeking out additions or replacements to my shack. Let me tell you a story about how this works out over time. It may give you a few ideas to apply as you grow I the radio hobby. You will see that the key to success is learning to substitute knowledge for cash in the equation of hobby enjoyment.

A number of years back, I began to realize that my primary shortwave DX receiver (a military surplus Collins R-390A) was getting rather long in the tooth. This old Collins had served its country well and had been resurrected from the surplus stacks to go on to serve me well for many years. As wonderful as this radio was, the number of hours I was spending scrounging parts (mostly tubes) and troubleshooting to keep it up and running was exceeding the time I got to sit and listen to it. It became clear to me that I should start looking around for a lower maintenance receiver for general listening duties.

Now as anyone who follows receiver design history, the R-390A is a hard act to follow. It is probably still head and shoulders above all but the most expensive receivers available to the average listener. This was a project that was going to require some research.

❖ Setting Some Limits

Right off the bat I knew that I couldn't afford a new receiver in the high performance class. Rigs in the performance level I expected ran around $1000 or higher. A married man with two children and a mortgage does not let that kind of money go out the door all that easily. So I needed to take a look at the used market. I started my search with a great overview book, *Shortwave Receivers Past & Present* by Fred Osterman. $24.95, 473 pages, ISBN 1-882123-07-7, Universal Radio Research, Reynoldsburg, OH. Now in its Third Edition , Fred's book series on shortwave receivers has always been a great place to "Window Shop" for receivers.

I began to page through Fred's book with a couple of basic parameters in mind.

1) With plenty of experience as to the care and feeding needs of a vacuum tube design, I wanted to go with a more modern solid state design.

2) I wanted to keep my costs around $300. Yeah, I know that some better new portables go for that much. But remember, many great deals can be had on the used market if you are willing to look for the right situation.

3) While the R-390 has mechanical digital readout (And more gears than a Porsche transmission to make that happen) I figured I'd like electronic digital readout but could live without it if overall performance exceeded that need.

4) The best selectivity and sensitivity my meager monies could buy. It would be hard if not impossible to equal the mechanical filters of the R-390 but good modern ceramic filters, possibly with the option of some modifications and outboard audio filtering might get me close enough for the kind of listening I generally do.

5) Some memory would be nice but not essential to my needs.

6) Last but not least, it had to be a receiver I could "lift the lid" on and do my own alignment and repairs. This last parameter should *only* apply if you have (or have access to someone with) the knowledge and skill to work on electronic equipment. Those warnings about *no user serviceable parts inside* are there for your protection. Poking around inside any electronic device, even one that is unplugged, can result in electrical shock sufficient to *kill*. Never work on electronic devices without proper training and attention to safety.

Fred's book and a few other resources such as back issues of *Passport to Worldband Radio*, *The World Radio TV Handbook* and *Monitoring Times* pointed me to a number of receivers that I could learn to live with. Listed in order of preference, I was interested in the Icom R-70, Yaesu FRG-7700, Kenwood R-2000 and the Panasonic RF-B600. If you are going to seriously search the used equipment market, it is best not to limit your horizon to a single piece of equipment. By doing this, you avoid elevating the process to a quest that might blind you to a particular piece of gear's shortcomings, like the tendency to overlook a couple of scratches that may indicate the radio was dropped down a flight of stairs.

❖ Putting Out the Word

The next step is to start looking around and also getting the word out that you are interested in certain radios. Nowadays, is would be hard to imagine doing this without resorting to the Internet. I would like to place a few words of caution out there if you plan to use the web to find a radio. First, there is no substitute for the hands-on experience. I have passed up radios because of the way they *smelled*! The Net does not yet offer olfactory plug-ins. Further, online buying does not have a lot of sound rules attached to it yet. Even the now famous "Auction" sites can offer little more than disclaimers when a deal goes sour.

Now having said this, I have used the net to make equipment purchases. But what I did was use this environment to transact with folks that I either knew, personally or by reputation, or with people who came recommended to me by folks I know and trust. Not all that different from how most people conduct business in the "real" world. You might want to make liberal use of e-mail to let friends know what you're shopping for. They are often your best resources for seeking out radios at their own clubs, flea markets and swap meets. They might even have the very item you are seeking in their own shack.

So, in my case, I was not in a big rush so I let a few friends know that I was in the market for a moderately priced used desktop receiver and let it go at that. I also made a point of getting to my local ham radio flea markets early to

get first crack at the several rigs I was looking for. Like they often say, "You have to kiss a lot of frogs to find a prince or princess." My flea market search turned up a great number of rigs that all seemed to show signs of ill use. I also saw a number of pristine rigs whose appearance gave their current owners the idea that they could get the original list price (or more) because they took the time to run a dust cloth over them once in awhile. So it goes.

In the end, friendship won the day, Bill Oliver, known to many as the publisher of the North American Shortwave Association's Journal, won a Japan Radio Company NRD-525 as a door prize at the Kulpsville, PA, SWL Winterfest. Now that Bill had this fine rig, I thought he might be interested in making a deal for his Yaesu FRG-7700. This was a great situation; I know Bill well, I had been to his house many many times. I knew he took excellent care of his equipment. I also know that his FRG-7700 was modified by the late, great Perry Gilfer of Gilfer Associates to include much sharper filtering over the generally good Yaesu factory specifications. I knew Perry and I also knew his work to be excellent.

This is a point I can't stress enough to beginners. The friends and associations you make in this hobby will almost always serve you well as you grow in the hobby. Because of these contacts I was able to find a receiver that exceeded my desires within my stated price range. Further, it was a radio with a bonafide pedigree unlike so many of the rigs I had looked over up to that point.

❖ Caring for the new receiver

But this is not the end of the story. Remember that I said that I preferred equipment that I could work on myself should the need arise? As is my practice, soon after bringing the FRG-7700 home, I contacted Yaesu and ordered a copy of the shop manual. This is a practice I recommend to everyone, even if you never intend to do any work yourself. Usually, the shop manual gives additional insight into how the receiver works, well beyond the standard users manual. Further, many shop books include troubleshooting "flow charts" that can help you figure out where to begin your search should trouble arise. If you're counting on professional help in the form of a technician or experienced friend, they'll be very happy to see that shop manual as well. It will prove to be both a time and money saver in the long run.

Paging through the FRG-7700's shop manual showed a couple of suggested modifications that served to improve upon the original design. A quick glace around inside showed that this rig was a later model that included these factory fixes or, as was often the case with Perry Ferrel, he had figured out the solution for himself. I spent a nice evening familiarizing myself with the inner workings of Yaesu's effort to turn radio waves into audio enjoyment.

After about a year of daily use, one evening I turned on the FRG-7700 and the rig was "dark." Okay. first the obvious things, did the cat kick the plug out of the wall, was the fuse blown (either in the house or in the rig). No sign of trouble in these areas meant it was time to take the rig down to the workbench along with the shop manual. Now for someone like me, this is a bittersweet experience. I am saddened by the fact that my radio isn't working but excited about the opportunity to troubleshoot and repair the rig as well. Every cloud has a silver lining if you are a dedicated radio hobbyist.

The diagnosis was fairly simple, thanks to the shop manual's suggestions. A couple of voltage checks at several test points pointed to a failed Rectifier Bridge on the power supply board – a fairly common occurrence, probably brought about by a power surge at some point in the receiver's life. A trip to my local parts house at the cost of two dollars got the FRG-7700 back on the air as it remains today, my old, used but trusted primary desktop shortwave receiver. Proving once again that the used receiver market can be a lot of fun.

Ask Bob

Bob Grove, W8JHD
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GPS Update

In our June, 2000 column, a reader asked whether there was any way to improve the accuracy of GPS receivers due to the purposeful 200-300 foot error built in for military strategic purposes. Well, now there is – President Clinton has authorized civilian access to the more accurate GPS channel, now giving 95% accuracy to within 15 meters (50 feet).

But it gets even better. According to veteran listener David Wilson, there are plans to expand DGPS throughout the U.S. using the low frequency transmitters of former Ground Wave Emergency Network (GWEN) sites. And averaging a position over time can improve accuracy as well; visit David's sites at **http://www.erols.com/dlwilson/nosa.htm** and **http://www.erols.com/dlwilson/gpsavg.htm**. His main page, **http://www.erols.com/dlwilson/gps.htm**, provides updated graphs featuring the improved resolution.

***Q.** Do police radar units drift in frequency, thus becoming unreliable in their readouts? (Gregory Morrow, Portland, ME)*

A. No. They are required by FCC regulation to maintain a certain minimum reliability, and even if they did drift slightly with time, their measurements are made so quickly that minor drift would not be a measurable error.

***Q.** I work in a pulp mill, and there is a large permanent magnet which separates tramp metal from the pulp. It is extremely strong; how are these made? (Mark Burns, Terre Haute, IN)*

A. All permanent magnets are made the same way, by placing them inside the core of an electromagnet and pulsing a substantial DC current through the coil. The strength of the magnetic field is directly related to the number of turns and amps of current through the electromagnet.

But not all permanent magnets will retain the magnetic intensity once the current is removed. During the 1930s, Alnico (aluminum-nickel-cobalt-copper) alloys were found to retain greater field strengths than pure iron or steel magnets. Alnico is still preferred for high temperature applications.

More recently, "rare earths" like samarium cobalt and neodymium iron boron have been introduced for even greater strengths, although such magnets are fragile.

But the bottom line is, yes, they are all magnetized by an external electromagnetic field.

***Q.** A new house is three miles from a radio station, and everything in the house is picking up the signal, even the baby monitors and speakers. The station says that it's not their problem, and the FCC said there was nothing she could do. Have you any suggestions? (Larry Stocking, e-mail)*

A. As long as the broadcaster's emissions are in compliance with FCC rules and regulations, it is the obligation of the homeowner to provide relief from his own problem. Many modern electronic appliances are made with a minimum of electronic components, often failing to take into account interference from other sources. Before proceeding with a cure, several questions should be answered:

Is the broadcaster an AM or FM station? Are other neighbors experiencing the same problem? Is the house wiring properly installed and grounded? Is the signal also heard on wired telephones, AM/FM stereo equipment, TV, radios, cordless phones, baby monitors, etc? Is it heard on battery-operated radios as well as AC powered?

There are several approaches to reducing the interference; these include:

(1) Grounding (chassis may be bonded together and commonly grounded to an actual earth-ground pipe)

(2) Shielding (wrap the affected device in metal foil or screening, being sure it is bonded to the chasses by screws)

(3) Filtering (series chokes and parallel bypass capacitors)

You can check to see if the house wiring is properly grounded by using an inexpensive device available from Wal-Mart and Radio Shack (part no. 22-101, $5.99) that will reveal any wiring errors. If you find any, then contact the electrician. Ask him anyway if he is aware of the problem and has suggestions for relief.

There are books available on solving radio frequency interference (RFI) problems from several sources, including the on-line FCC RFI handbook (**http://www.fcc.gov/cib/Publications/tvibook.html**), and the American Radio Relay League (ARRL) (**http://arrl.org/catalog/** and select the RFI Book, #3864 ($20). For additional interference reduction suggestions, try as well **http://www.funhouse.com/jfw/rfi.html**.

***Q.** I listen to a 1947 Firestone Air Chief radio that only has 31M and 25M. Could you tell me what the actual frequencies are for this radio? (Joe B., e-mail)*

A. To change either megahertz into meters or meters into megahertz, simply divide either one into 300. Thus, 31 meters is 9.7 MHz, and 25 meters is 12 MHz. Since we are talking about entire bands, however, we are referring to the frequencies for the international broadcasters who occupy approximately 9.4-9.9 and 11.6-12.100 MHz.

***Q.** I recently acquired an antique radio. It is in excellent shape, and it has a two-hole configuration for both Aerial and Earth ground. What sort of antenna does it require? (Steven Sager, e-mail)*

A. Internal loop antennas did not become standard on radios until the 1940s (approximately), so they depended upon an external antenna which was as long as possible, typically 25-100 feet or so. The ground can be a cold water pipe, or the metal screw holding the wall plate on an electric outlet (This is the same as connecting it to the third wire ground – the round pin – of the wall socket. Do NOT connect it to either of the two flat pins!). If you have the luxury of a real ground, such as an 8-foot rod driven into moist soil, that's even better.

Questions or tips sent to "Ask Bob," c/o MT are printed in this column as space permits. If you desire a prompt, personal reply, mail your questions along with a self-addressed stamped envelope (no telephone calls, please) in care of MT, or e-mail to bgrove@grove-ent.com. (Please include your name and address.) The current "Ask Bob" is now online at our WWW site: www.grove-ent.com

Bright Ideas

Gary Webbenhurst
ab7ni@arrl.net

This month we concentrate on some ideas and tips for reference books. Here is my list of ideas for how to get the most from each book. After all, they cost enough!

I bet you have a reference book or two on your bookshelf right now. Have you read it? I mean looking at every single page. Page 168 may contain that one tiny piece of information that you have been looking for. Many of us shell out the money and somehow we feel smarter just having the book. Reach for it right now and start reading... Found something new, didn't you?

Before you begin marking up your reference books with highlight pens, etc., I suggest you make a photocopy of the specific pages you need. That way your book remains in a readable condition. Your personal copy pages can then be placed in a binder or other format.

Here is my list of "must have" reference books:

Regional Police Call

The first chapter, *Listeners Guide*, contains great information that enhances your knowledge of radio systems. Even if you have already read it, it may be time to go back and reread these first 30+ pages. Don't overlook the guide to symbols and abbreviations on the inside front cover. It is very informative. I suggest you memorize the important designations. When you understand the material so well you can explain it to others, you have finally mastered the material.

The book is organized into several sections; the first major part is the listings by state (within the region). When you look up an agency, there are two key patterns to look for as you begin to do your research. First find your state, then your city and/or county. The first key information to look for is the callsign. Look for every frequency that has the same callsign. This is a tip-off that the frequencies are related, probably used for the same function and by the same dispatcher. The type of system code (i.e., L or P) might be mixed, but if it has the same callsign, they are probably related to the same function – police services.

The second key: look for the same number of mobiles (mob) licensed. Once you use your bright ink highlight pen on all frequencies with the same callsign and a common number of mobiles, a pattern begins to emerge.

Now look and see which ones are licensed only as mobiles and which are also licensed as MR, CO, TR or BR. This might give a clue as to which channels are simplex or repeater inputs and outputs. Simplex usually means car to car or tactical frequencies, but some agencies use it as car to base.

Part of the fun is figuring out which channels are used for what purpose and what repeater input (or link) is used. Look under the "Name" column and you will often see the channel's use in parenthesis. If this listing is incorrect or you can add new information, be sure to contact the *Police Call* folks as listed in the front of the book.

When you discover a new frequency in use, you can quickly look it up in the second major part, the "Listing by Frequency." If you hear signals from this new agency perhaps you can hear others from the same city.

Police Call also has the "Beyond" section (written by Rich Barnett) with many lists for businesses and presented by class. Thus the local mall security or school district may be listed. The book also includes an excellent **glossary** in the back of the book. When was the last time you read it to update your knowledge of radio terms?

Overall, *Police Call* is crammed with more information than any other source. You should plan on sitting down and spending a few evenings studying every page. Want to know the local TV/radio media logistical frequencies? It's there! Get Reading.

Master Frequency Reference and **Federal Government Frequency Assignments.**

If you are into monitoring the federal government, these are invaluable. Each presents its information in a different format. *Master Frequency Reference* lists agencies and their radio systems, while *Federal Government Frequency Assignments* is more a listing by numbers. While many federal law enforcement operations are going the way of Nextel, there are still many federal agencies that continue to use the VHF and UHF radio frequencies and broadcast in the clear.

Monitor America.

If you travel a great deal, this book, by *MT* columnist Richard Barnett, is your bible. However, it is growing a little out of date (pub.1995), as many large cities and state patrols migrate to 800 MHz trunked systems.

Regional Guides

There are many excellent regional guides. If you live in California, check out *Government Radio Systems, Federal and Military*, written by Robert Kelty. Each book represents many, many hours of research and actual listening to confirm obscure frequencies and PL tones. For further information, contact Robert Kelty of Mobile Radio Resources, 1224 Madrona Avenue, San Jose, CA, 95125-3547, (408) 269-5814 voice or -5811 Fax

Another example is *Scan Colorado*. This book lists everything you ever wanted to know about radio frequencies in the state of Colorado, from AM and FM stations to public safety with repeater inputs, outputs and PL or DPL tones. I can't think of anything they left out. Clearly author Brian Gould has worked very hard on build an incredible database of information as it related to the state of Colorado. You can make contact at them at **www.frii.com/~rmedic**.

There are many other regional or state reference books, even special books for railroad buffs.

Admittedly many reference books are soon out of date on some information. But much of the nonfrequency information is unique and timeless. Hopefully, I have convinced you to purchase a reference book or two. Most are available from Grove Enterprises or Universal Radio (see their ads in *MT*). Then get your money's worth: read the whole darn book. That also applies to *Monitoring Times*, of course!

Our final tip comes from John Maky, KD5EYV. He writes: "I found something that may be useful for people with antenna restrictions. My wife makes jewelry and uses a stranded stainless-steel nylon-coated wire marketed under the name of "Tiger Tail." This wire is similar to fishing line; but is MUCH thinner and cheaper. I don't remember exactly, but is something in excess of 100 lbs. test. It is made for beading and can be found in jewelry supply stores in spools up to 1000 ft. It cannot be soldered; but when stripped, fits into a crimp style banana plug. It is flexible and ties into a knot very easily. I don't know how long the nylon will stand up to UV, but makes a great field-day antenna."

Thanks for the tip, John. I found this product at the "Hobby Lobby" which is a nationwide chain store. I m sure your town has a similar source. From long wire HF to UHF, this can be a cheap and flexible antenna. Probably best as a receiving antenna, but I hope someone will tune one up for HF and report back to us.

Once again, John illustrates how creative we can be at finding new bright ideas. Do you have a bright idea or tip? Send it in and I will work it into the column. See you next month.

Richard Barnett
ScanMaster@aol.com

It was Great'n in Dayton

May 2000 was your scanner editor's first visit to the great Dayton Hamvention and our only regret was that we didn't make this trip before! In view of the fact that there is no consistent national scanner convention, Dayton has served our hobby quite well as the next best thing. (By the way, the headline "It's Great'n in Dayton" is not mine. Fourteen-odd years ago when I first traveled to Dayton for a business meeting with the old Fox Scanner company – remember their whacky skinny scanner? – that horrible tag line, emblazoned on a huge sign, greeted me at the airport.)

Dayton is well known as an enormous flea market of used Ham Radio equipment, as well as computer and miscellaneous electronic gear. Certainly you can find all that and more in the massive parking lots surrounding the Hara Arena. Scanner buffs are likely to be able to find crystals for their old Bearcat IIIs and IVs, as well as long-ago-discontinued scanners that may or may not work.

It's what's inside at Dayton, though, that's really worth the trip. Of course you'll find every Ham Radio equipment manufacturer from Yaesu to ICOM to Kenwood, and all these companies have wide-band receive products that are of interest to our hobby. But, you'll also find booths and representatives from the smaller scanner manufacturers, including AOR, WinRadio and others.

While we didn't have time to study it in detail, the WinRadio product has some valuable features for a computer-controlled receiver. It's well worth checking out this product if you want to do some sophisticated signal analysis. (It's available from Grove Enterprises.) AOR, long known for their excellent high-end scanner lineup, was displaying their new Mark II version of the AR-8200 as well as an elegantly designed ultra-high-end receiver/scope package which we assume is targeted to government users.

AOR's new mobile scanner, which is expected to debut in the U.S. in the late second or third quarter of the year, was also on display. We applaud AOR for entering this competitive market, even though the Uniden-Bearcat 780XLT and the Radio Shack/GRE PRO-2067 are scheduled to be available just ahead or coincident with the AOR model. While the AOR unit will include its famed band-scope feature and dual-VFO, it will not include any trunking capability, a serious limitation in the U.S.

Also displaying their wares were Diamond Antenna, manufacturer of the venerable Discone; Scancat with Jim Springer; Optoelectronics, with a large booth in the main arena where Perry Joseph was demonstrating his remarkable Probe software; the Bearcat Club's booth with Norm Schrein; and Scanner Master (this editor's firm) booth as well.


Bob Grove

On hand at the Scanner Master booth were Greg Knox, inventor of Motorola Trunktracking, with his TrunkTrac ultra-high end trunking software package, as well as Terry Brennan of G/Wiz and EDACS-tracking fame, with his new "SmartLink" device which allows you to Reaction Tune the BC-245XLT scanner with the Optoelectronics Scout.

Many notable dealers including The Ham Station, Lentini, AES, and HRO also came to the show. We were also delighted to see Bob and Judy Grove in attendance. (*See July's Closing Comments - ed.*)

This year many hopeful Dayton visitors were unable to make the show due to weather. While the weather in Dayton was generally fine, Chicago weather was dreadful, with severe thunderstorms closing the airport or the approach lanes into O'Hare. For example, Uniden representatives, scheduled to attend the show to display the new Bearcat 780 at both the Bearcat Scanner Club and the Scanner Master booth, could get no further than Kansas City from their Dallas home. Fortunately, this editor was able to demonstrate the BC-780 for hundreds of interested scanner hobbyists. (It was also a treat to meet so many of the scannists we have been communicating with over the years via mail, e-mail and phone.)

Dave Marshall, Tom Swisher, Mark Meece and others of the All Ohio Scanner Club had a booth at which they provided frequency information for visitors and spread the good word about our hobby. We're very lucky to have such a highly-regarded and long-standing scanner organization represent us all at Dayton. Members of AOSC also host a yearly scanner discussion group in one of the arena's meeting rooms.

Speaking of Mark and the AOSC, we had been meaning to reprint a list of frequencies used at Dayton that was prepared for an on-line list server before the 1999 convention. Save it for use at the 2001 convention. If you know of any frequency changes since '99, please let us know.

Thanks Mark!

Freq	PL	User
154.130	141.3	Northmont Center Fire Dispatch
154.570		Hara Arena Concessions
154.600		Hara Arena Concessions
154.725	103.5	Northmont Center Police Ch. 1
154.785	114.8	Clayton PD
155.010	151.4	Trotwood PD Ch. A 155.850 in
155.220	114.8	Trotwood EMS
155.715	151.4	Trotwood PD Ch. B "Records"
155.850	151.4	Trotwood PD Ch. 3 simplex talkaround
461.050	71.9	Merchants Security F1 repeat and F2 simplex
461.4375		Merchants Security F3 simplex
463.8875		Merchants Security F4
467.725		Hamvention F6, F7, F8 Production Support
469.7375		Hamvention F2
469.850		Hamvention F1 Exhibits and Inside Security
469.8875		Hamvention F3 Traffic (1996)
470.150		Hamvention F4 Flea Market and Outside Security
470.850		Hamvention F3 Traffic (1997)
472.250		Hamvention F5 Communications

It has been reported that Merchants Security may now be using Nextel phones.

If you want to test a counter and reacting tuning, as we were doing with the Scout, BC-245XLT and the SmartLink, you couldn't find a better place than a Hamvention! We brought, but didn't need, a two-way radio to simulate local transmissions for the counter. We were constantly picking up the above frequencies along with wireless microphones and Family Radio Service (FRS) transmissions and, of course, dozens of Ham Radio repeater and simplex frequencies.

Speed Racer Scanning

Add the letter "a" to the end of Dayton and you get Daytona. Two very different places with a like name and a like heritage of being a scanning mecca of one sort or another. One of our favorite contributors, Brian Cathcart, "The Scanner Dude," submitted the following report earlier this year:

Went to Daytona Beach Thursday for the Twin 125 qualifying races, and of course had my scanners with me.The 245xlt performed flawlessly on Daytona's EDACS trunked system, and did an excellent job as a 'racing' scanner too.

Daytona Beach has 22 800-MHz trunked frequencies licensed to it. The trunking websites show 11 of those with their LCN order. However, I found only five of the frequencies in use (LCN 1 through 5); LCN 6 through 11 were not used at all. And, none of the 866.xxxx frequencies were in use either. Police were the only ones using the system, so perhaps they are not using the rest of the frequencies until the rest of the city is put on the system. E-trunk shows the System ID to be 0014.

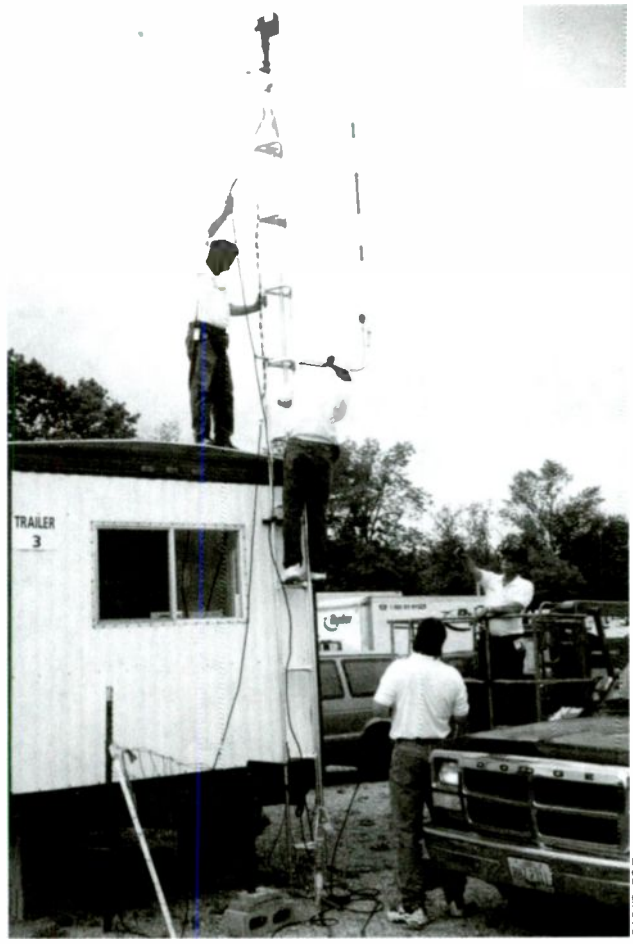
Daytona Beach Police were the traffic coordinators in and around the track; I think FHP handled I-95 traffic but I didn't see them (we used a different exit to avoid the traffic!). They used a few talkgroups that were not listed on the trunking websites:

14-005 = Officers doing Security detail at the track

14-010 = This is the "Event Traffic" channel (on their radios it displays as EVT TRAFFIC). It is used for coordinating the massive traffic coming in and out of the Speedway and local parking.

14-011 = Car-To-Car channel for Traffic units

I saw a couple of Volusia County officers there too, but I did not see what system or channel they were on; my assumption is that they were on the Daytona system, too Volusia Mall across the street from the track (where a LOT of people park) was using 464.575.



Bob Grove

MRN radio was heard on their usual frequency of 454.000; on this you hear the audio feed and director. I also found a direct feed on 455.950 which had no director audio and sounded like it is in WFM mode.

CBS Camera crews were directed on 455.8875.

Race Scan Communications (as well as other dealers) had a trailer in the souvenir vendor area where they sell frequency lists for $5.00 each; it was very accurate and includes PL/DPL codes for Winston Cup, Grand National, and the Craftsman Truck series. They also sell and rent a variety of scanners and headsets. LOTS of people had scanners – everywhere you looked people had them! It's a lot of fun seeing the race, but much more fun when you have your scanner with you, too!

Trunking Updates

Larry J. McMahan was kind enough to recently send in this excellent report on the Dougherty County/City of Albany (GA) trunked radio system:

Frequencies:
855.2125, 855.4875, 856.2125, 856.4875, 856.7625, 857.7625, 858.2625, 858.7625, 859.2625, 859.7625, 859.9875, 860.2625, 860.7375, 860.9875

System Users:
Southwest Georgia Regional Airport (SWGA)
Albany Police Department (APD)
Dougherty County Police Department (DCP)
Dougherty County EMS (EMS)
Albany Fire Department (AFD)
Dougherty County Sheriff's Office (DCSO)
Albany Public Works (APW)
Albany Transit Service (ATS)

Talkgroups:
18560 SWGA maintenance/fire department
18592 SWGA security
18720 APD robot alarm systems
18752 APD
18784 APD detectives, supervisors
18816 APD "Channel 9" car to car
18848 APD "Desk Channel" also "Tac 3"
18880 APD "Channel 4" "information channel"
18912 APD "Channel 5" auxilliary
18944 APD Dispatch
18951 APD all units emergency notices
18976 APD auxilliary dispatch
19008 DCP "Channel 13"
19040 DCP "Channel 6"
19072 APD/DCP emergency ops coordination with Georgia State Patrol
19104 DCP "Channel 8"
19200 DCP "Channel 5"
19264 DCP Dispatch
19328 DCP "Channel 7"
19360 DCP "Channel 3" also "Traffic channel"
19456 APD/DCP/AFD/EMS common
19488 APD/DCP/AFD/EMS common
19552 EMS "Channel 5"
19584 APD/DCP/AFD/EMS common
19591 EMS Dispatch
19648 EMS to Palmyra Medical Center ER
19680 EMS to Phoebe Putney Hospital ER
19904 APD/AFD administration common.
19936 AFD supervisors
20064 AFD fire operations
20103 AFD Dispatch
20256 DCSO County Jail "Central Control"

20352 APD auxiliary car to car. Also "comp 1"
20416 APD special events/details "Event 1"
20448 APD special events/details "Event 2"
20544 APD auxiliary car to car.
20576 APD auxiliary car to car.
20640 APD/AFD Dougherty County Public School Security.
20704 APD/DCP emergency ops coordination with Georgia State Patrol.
20736 APW
20800 APW
20832 APW
20864 ATS
20992 DCSO
21088 DCSO
21184 DCSO "SO channel" APD/DCP common
21296 ATS
22040 DCSO
23040 DCSO
23072 DCSO

Amusement Park Scanning Update

An anonymous reader took me to task for a comment made in a recent column. Thank you for your comments, information and for setting us straight!

"I would like to respond to the following comment you made in your column: 'We've all seen innumerable Disneyworld and Disneyland listings...' I am very interested in Disneyland scanning and have seen very little in the way of accurate comprehensive lists. Many of the lists I've seen are the old 400 MHz frequencies which haven't been used since the 900 MHz trunking system has been installed. Also, you will find very few listings which contain 'non-operational' frequencies.

Here are the two best sources of Disneyland scanning I've seen:

http://members.aol.com/alweho/docs/scan.htm

http://disney_scanning.home.att.net/

These two sites are really outstanding, but if you have some better listings or more up to date information, please send it along. So many people travel to these parks that it makes the adventure all the more enjoyable (at least for you, if not for your spouse and kids) to have detailed and accurate frequency data for your portable. Interestingly, a number of years ago we were told by a travel agent that one tour operator actually included a Disney frequency list in his brochure. We never saw it or could confirm it, but just the idea that tour company might do this made us smile.

July Column Update

In last month's issue we discussed itinerant and low-power frequencies. An adjunct to these channels are wireless microphone frequencies which are low-power and used at such varied venues from a McDonald's Drive-thru to a rock concert where the performers are using wireless mics to transmit their voices to remote amplifiers and speakers. An anonymous reader asked us the following question:

"I'm interested in obtaining information about FM and UHF scanning. I tape many live concerts put on by performers that employ encrypted in-house FM and UHF transmitters. Is there a unit that offers robust scanning capability that would allow access to these signals? Most are in the 900+ MHz range. Are you familiar with the practice or know anyone who may be able to help? X-Wire 905 is the most common wireless device I encounter. Thanks for any help you may offer."


Bob Grove

We were not aware that there were wireless mics that were encrypted (it never occurred to this editor that it would be necessary – why would you want to encrypt such a short-range communication that everyone could already listen to live?). However, now it all makes sense. It is illegal to record, copy and distribute live performances without permission. While many wireless microphones, particularly in the broadcast industry, often use oddball frequencies in the UHF TV-band (as well as, apparently, 900 MHz), there are some high-end scanners that will cover these bands and all scanners will cover the standard VHF wireless mic channels in the 160-174 MHz range.

Thus, it's sensible that popular musicians today would use encrypted wireless microphones and we're glad that they are. If these devices were not available it might just be another straw in legislators' efforts to break our hobby's back.

Some readers might argue with me that we should have the right to try to construct equipment that would decrypt these encrypted wireless microphone channels. I say "hogwash." Probably the only reason to do something like that is to either show that it can be done (maybe acceptable as an intellectual challenge), to pirate the artists' intellectual property (which is what would happen 99 out of 100 times), or to sell the devices to others to do the same. If you disagree, please write so we can air your views in a future article.

Tower Power

A recent article on the death of cellular tower workers was striking not only for its focus on the unfortunate demise of a father and his teenage stepson, but also for the following statistic, "Since 1996, when about 50,000 telecommunication towers existed, increasing demand for towers has resulted in the construction of 20,000 to 50,000 new towers each year."

This is a startling increase, but it's been made quite manifest when one travels down practically any highway in America and sees an unending string of monuments to our nation's collective use of wireless devices. While we like a good tower as much as anyone, enough is enough! Not only can these steel behemoths be eyesores, they also can cause hellacious RF interference problems for scannists and two-way radio users alike.

Scanner Logs

Larry Van Horn
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ASCIET 2000

Long time contributor Roland McComick was reading the Scanner Log's page in the June *MT* and came across Jack NeSmith's submission. He recognized some of the frequencies as ASCIET 2000 frequencies. ASCIET is an acronym for All Services Combined Identification Evaluation Team, and it is an annual exercise conducted in the southeast United States (Savannah, Georgia area). Here is further information regarding some of the frequencies that Jack had in his logs.

265.650	ASCIET frequency. This frequency was used by the ABCCC (Airborne Battlefield Command and Control Center) back-end BOOKSHELF in communications with BAMA F-16 aircraft. It was referred to by BOOKSHELF as the "TOTC Freq"
325.725	TORCH and FIRST aircraft heard, but not during their ASCIET participation. They used it while playing in the warning areas prior to the ASCIETs exercise formal beginning.
302.400	Since it looks like a lot of Jack's intercepts were logged around the time of ASCIET, Roland mentions that the TORCH and FIRST F-15s used this OAKGROVE frequency (in communications with OAKGROVE) as an opposition force (OPFOR) frequency.
384.775	TORCH and FIRST communications; opposition force F-15s; probable 71 Fighter Squadron.

Below is the Roland's ASCIET 2000 exercise frequency list that he compiled with the help of other enthusiasts who were monitoring ASCIET 2000 military exercise.

4.005	Datalink Coordination
6.795	Datalink Coordination
40.400	SUNNY Operations (scrambled)
120.950	Jacksonville Fleet Area Control and Surveillance Facility or FACSFAC (Seolord) unit check-in
123.475	SUNNY aircraft air-to-air
139.975	Unknown
141.600	BANGER 1 working ?
141.800	BAMA aircraft air-to-air
148.125	RACER with air combat maneuvering communications
148.100	Air National Guard fire/crash
148.225	Air National Guard military police
169.575	Hunter Army Airfield crash/fire (used during medical emergency)
225.975	JSTARS (E-8 aircraft) primary
227.850	JSTARS (E-8 aircraft) to DIAMOND CUTTER, BOOKSHELF
234.700	Opposition forces Air – TORCH 63, 64
238.050	BANGER (E-2 aircraft) working fighters for controlled intercepts
238.100	ASCIET CONTROL
245.400	BEACON working MISSION, OLIVE and SALTY DOGs
247.000	MARNE Radio
250.400	BANGER (E-2 aircraft) intercept direction
251.375	VAMPIRE aircraft air-to-air
252.100	Aircraft checking in with CRTC for recovery
253.250	BANDSAW (E-3 aircraft) working IVAN
253.550	ASCIET military satellite downlink frequency
253.900	VAMPIRE aircraft air-to-air
255.100	AUTOCAT (Automatic Communications Airborne Transfer) relay via E-2C aircraft LIGHTNING STRIKE working DUKE and others in clear/scrambled modes
256.200	STRIKESTAR LIMA calling STRIKESTAR, RIFLE 11 working STRIKESTAR
262.950	Scrambled Communications (No clear voice noted)
263.400	VANDY aircraft air-to-air
265.100	BOOKSHELF working BANDSAW
265.600	Close Air Support (CAS) net
267.500	Jacksonville FACSFAC (SEALORD) Warning area check-ins
265.650	Referred to as "TOTC" frequency by BOOKSHELF to BAMA (Ft. Stewart Range)
268.550	SAME working SENTRY, SENTRY working LIGHTNING STRIKE
268.650	Unknown - Possible VANDY aircraft air-to-air
269.700	CARBON Auxiliary/Air-to-air
270.500	New RED CROWN frequency
270.850	RED CROWN Primary check-in
271.100	Moody MOA Ground Controlled Intercept (GCI)/ GREEN CROWN
272.000	UHF Link-11 datalink
274.100	Unknown air-to-air
275.300	Unknown air-to-air
279.725	HUNTER 73 working DOUBLESHOT (ASCIET related?)
282.675	TORCH air-to-air
283.200	GREEN CROWN primary check-in
283.700	ALLEYCAT GCI secondary for OPFOR
284.500	Jacksonville FACSFAC (SEALORD) warning area check-in
284.600	Opposition forces frequency, referenced on 320.4
290.100	ABCCC with helicopters
292.700	NORAD Southeast Air Defense (OAKGROVE) over water GCI for opposition forces (RED-4)
294.225	Scrambled communications, unknown user (Possible satellite uplink)
294.550	ASCIET military satellite uplink frequency
299.500	VANDY aircraft air-to-air; unknown usage
300.500	Tactical Digital Information Link (TADIL- A) datalink frequency
301.175	Unknown type scrambled communications or data
301.200	Not heard, but referenced by BANGERS, suggesting not to use it for communications
302.400	TORCH GCI working Oakgrove (OPFOR)
303.100	SENTRY Operations
304.100	Possible SUNNY air-to-air, SUNNY-type track coordination communications
305.100	AUTOCAT relay of TAD 1, heavy with tactical ground communications
308.050	Unknown modulation
308.250	BANGERs TAC-3 air-to-air
308.400	ALPHA WHISKEY Net, passing scramble info and kills
310.200	NAS Jacksonville Operations/Command Post
311.000	RAYMOND 19 (phone potch RAZOR 61 to PHOENIX 2)
312.200	AUTOCAT relay for 340.4 (TAD 2)
312.800	AUTOCAT relay for ? mostly secure
320.300	Unknown usage
320.400	Opposition forces
322.050	AUTOCAT relay via EC-130 ABCCC air defense net. Scrambled/clear communications (referenced as JUICE frequency)
323.300	SUNNY 12 passing threat info to ABCCC. STRIKESTAR/HOUDINI brief communications. Mostly secure net for signal intelligence (SIGINT) players
323.750	VAMPIRE aircraft, active after no contact with FORTUNE on TAD 2 frequency
324.800	Unknown scrambled communications (unidentified heard. briefly in the clear with LIGHTNING STRIKE)
325.400	CHECKMATE aircraft air-to-air
326.125	ALLEYCAT GCI Primary for opposition forces in Moody MOA
328.400	VPN, 100% scrambled
340.375	Opposition forces (TORCH working SHOWTIME)
340.400	TAD 2 (Army Close Air Support)
345.200	TAD 1 (Marine Close Air Support)
345.000	BAMA aircraft and ADVANCE 10
345.450	RESEARCHER 442 working GROUNDHOG
355.325	Shot Common
356.125	Garbled traffic
356.600	STRIKESTAR calling "any station this net" for radio check
364.200	NORAD Airborne Intercept Command Control (AICC), STARGATE, STRIKESTAR common
376.825	Fighter direction in warning areas
379.200	Jacksonville Center – Moody and Live Oak MOA flight following
384.775	FIRST aircraft air-to-air, also TORCH opposition forces
388.175	STRIKESTAR working unknown regarding MTI data

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Hear the "Hurricane Hunters"

Summer brings hurricane season and the busy time for US Air Force Reserve's famous "Hurricane Hunters."

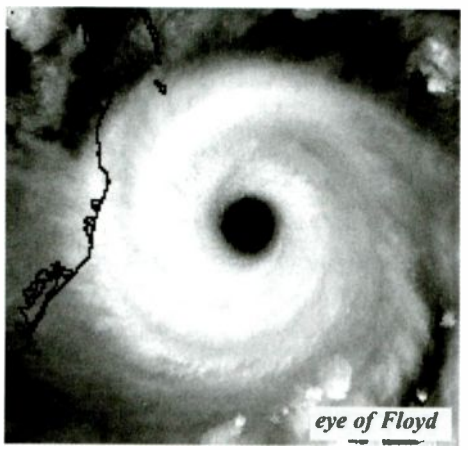
Everyone likes to follow these flights, as propeller planes descend to 10,000 feet and head directly into the same storms that everyone else is fleeing. This looks like a suicide stunt, and it probably would be if some Sunday pilot tried it in a Cessna. For these trained personnel, though, it's a job, and one safe enough to allow news media to fly along.

This mission is flown by the 53rd Weather Reconnaissance Squadron of the 403rd Wing, out of Keesler Air Force Base in Biloxi, Mississippi. However, planes will often deploy to forward airports in Florida, the Caribbean, and occasionally the Pacific.

As the crew members like to say on TV, they are not storm chasers. They are data gatherers. Their mission exists for one reason, and one reason only. This is accuracy, which is absolutely essential when agencies are making agonizing decisions impacting millions of people.

All ten of their planes are of the WC-130H type, a weather-recon version of the venerable, 4-engine Hercules. These are over 30 years old, and they will soon be replaced by the newer WC-130J. Their crew has two pilots, a flight engineer, a navigator, a weather officer, and an operator for the dropsonde – a parachute instrument package.

With its extra fuel tank, the WC-130H can stay airborne for twelve to fourteen hours. Often, it has to. Along with long flights to and from the storm, the actual recon usually makes four passes into the eye from different directions. Once he's broken into the calm, the weather officer watches the data carefully, giving the all-important command to "fix" at the exact point the storm center is reached. At this instant, the official position is recorded, and the sonde is released, recording data throughout the drop.


eye of Floyd

All missions are tasked by CARCAH (Chief, Aerial Reconnaissance Coordination, All Hurricanes), a small liaison office at the NHC. Orders come out daily, in a terse document called the TCPOD, for Tropical Cyclone Plan Of the Day. It's available on Internet and weather "wires," giving definitive information on the next day's flights.

❖ Hurricane Hunter Radio

The radio callword of the 53rd is Teal, like the bird or the color, usually followed by two numbers. Teal was used many years ago by the AF Reserve unit at Keesler. When it was disestablished, the 53rd dropped their Gull callsign and switched to Teal which is now the primary call associated with the hurricane hunter mission.

The long missions and varied landing sites ensure plenty of radio traffic. Of course, this is almost never hurricane data, which goes digitally through satellites whenever possible. On the HF (high-frequency) range that we're concerned with, it's almost always routine position checks and pilot reports. These use the USAF Global High Frequency System (GHFS). GHFS frequencies are 4724, 6712, 6739, 8992, 11175, 13200, 15016, and sometimes 10780 kilohertz (kHz). All are upper-sideband (USB) voice and are busy with all kinds of military traffic any time of the year.

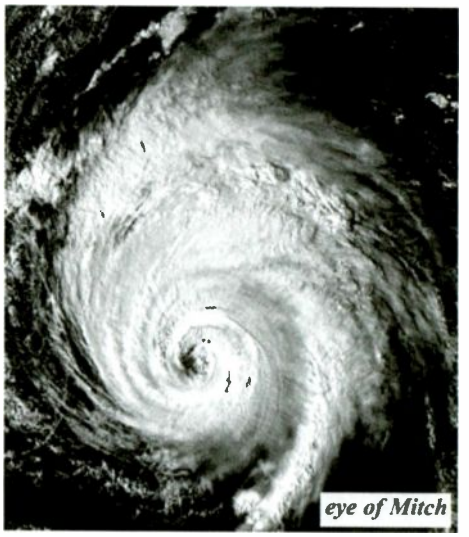
TEAL aircraft often make phone patches. Most are routine arrival data. Sometimes, though, if a threatening hurricane is drawing heavy news coverage, you'll also hear the media. While the 53rd warns that shortwave USB audio is far from broadcast quality, more than one live interview has gone right over 11175 or 13200 kHz.

At one time, NHC "Miami Monitor" had a whole HF net, but it was allowed to die quietly when they moved to newer quarters. The only remaining HF is the amateur W4EHW (Early Hurricane Warning). It activates in storms, usually for the 14325 kHz Hurricane Watch Net.

Once or twice a season, though, an aircraft will actually return hurricane data to Miami Monitor via HF phone patch on the Global System. If you luck into such a catch, it will usually be in a standard brevity code. This bears the header URNT (for "Urgent"), and the code designator Vortex.

Vortex, too, has a standard set of alphabetical items. Explanation of them all would require another column, but look for items A (fix date/time), B (fix coordinates, in degrees and minutes), D (estimated maximum surface wind, in knots), H (minimum sea level pressure, in millibars, marked EXTRAP if not from the dropsonde), and P (the mission description and comments).

The full reports, plus a far more detailed key, appear all over the Internet. They should be regarded as raw data only. Stay dry, and have fun with this stuff.


eye of Mitch

❖ Decoding TCPOD

Each flight request has these seven alphabetical items:

A. Observation dates/times
B. Mission #, aircraft #, storm
C. Departure point, date/time
D. Forecast storm position
E. Destination point
F. Estimated time on-station
G. Type of observation

WSPOD, Winter Storm Plan Of the Day, is a similar document issued for severe storm reconnaissance in winter time.

❖ TCPOD Airport Designators

The recon plans, plus most of the radio traffic, use the standard, 4-letter airport codes issued by the International Civil Aviation Organization (ICAO). Here are some commonly encountered ones:

KBIX	Keesler AFB, MS	TKPK	St. Kitts, US Virgin Islands
KCOF	Patrick AFB, FL	TIST	St. Thomas, USVI
KEYW	Key West, FL	TISX	St. Croix, USVI
KHST	Homestead ARS, FL	TJNR	Roosevelt Roads NAS, PR
KMCF	MacDill AFB, FL	TJSJ	San Juan, PR
KMOB	Mobile, AL	TLPL	St. Lucia
KNQX	Key West NAS, FL	TNCA	Aruba
KVPS	Eglin AFB, FL	TNCB	Bonaire
KWRB	Warner-Robbins AFB, GA	TNCC	Curacao
MWCR	Grand Cayman Island	TNCE	Neth. Antilles
MYNN	Nassau, Bahamas	TNCM	Neth. Antilles
TAPA	Antigua	TVSV	St. Vincent
TFFF	Martinique	TXKF	Hamilton, Bermuda
TFFR	Guadeloupe		

AFB = Air Force Base ARS = Air Reserve Station
NAS = Naval Air Station

Utility Logs

Hugh Stegman

Abbreviations used in this column

ALE	Automatic Link Establishment
AM	Amplitude Modulation
ARQ	Automatic Repeat Request teleprinting system
ASCII	American Standard Code for Information Interchange
ASECNA	Africa/Madagascar Air Safety Agency
CAMSLANT	Communication Area Master Station, Atlantic
CIA	US Central Intelligence Agency
COQ-8	8-tone multi-frequency teleprinting system
CW	Morse code telegraphy ("Continuous Wave")
EAM	Emergency Action Message
FACSFAC	Fleet Area Control and Surveillance Facility
FAX	Radio Facsimile (120/576 mode unless stated)
FEC	Forward Error Correction teleprinting system
FS	French Ship
LDOC	Long Distance Operational Control
LSB	Lower Sideband
MARS	Military Affiliate Radio System
MFA	Ministry of Foreign Affairs
NAVTEX	Navigational Telex
NAWS	Notice to Allied War Ships
PacTOR	Packet Teleprinting Over Radio
R3E	Upper sideband, reduced carrier emission
RSA	Republic of South Africa
RTTY	Radio Teletype
SELCAL	Selective Calling
SITOR	Simplex Teleprinting Over Radio
UK	United Kingdom
Unid	Unidentified
US	United States
USN	US Navy
VOLMET	Aviation weather observations

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 (encrypted, usually unidentified, broadcasts thought to be intelligence-related) are identified in () with their ENIGMA station designators, as issued by the European Numbers Intelligence Gathering and Monitoring Association.

350.0 ROT-Navigational beacon, Rotterdam, Holland, in CW, at 1438. (Ary Boender-Netherlands)

369.0 PS-Navigational beacon, Heenvliet, Holland, in CW, at 1438. (Boender-Netherlands)

518.0 ZSC-Capetown Radio, RSA, with NAVTEX in SITOR-B, at 0825. (Bob Hall-RSA) J-SDJ, Stockholm Radio, Gislovshammar, Sweden, with NAVTEX bulletins in SITOR-B, at 2125. M-OST, Oostende Radio, Belgium, NAVTEX at 2200. P-PBK, Netherlands Coast Guard, Holland, with NAVTEX at 2230. S-GNI, Niton Radio, UK, NAVTEX at 2300. T-OST, NAVTEX at 2310. (Boender-Netherlands)

4012.2 5ST-ASECNA, Antanarivo, Madagascar, with ARQ aircraft data, parallel on 7831.7, at 1550. (Bob Hall-RSA)

4014.5 ZSJ-South African Navy, Silvermine, with FAX weather charts, parallel on 7508.4, at 0830. (Hall-RSA)

4027.0 Cuban CW cut number station with 5-figure groups, using letter substitution "anduwrigmt" for numbers 1 to 0, at 0310. (Tom Sevart-KS)

4216.0 KPH-San Francisco Radio, CA, with weather in SITOR-B, at 0521. (Sevart-KS)

4372.0 Giant Killer-US Navy FACSFAC, VA, in a tracking net with Sierra Echo, 9-Oscar, 0-Echo, and Sierra-2, trying to set up a link-11 data network at 0115. (Ron Perron-MD)

4479.0 Cuban cut number station (M8), with 3 messages in 5-figure CW groups at 0302. Similar transmission at 1100. (Camillo Castillo-Panama)

4635.0 Counting Station-CIA English female "numbers" (E5), message for "007," group count 100, parallel on 5812, at 0200. (John Maky-AR) *See 9222 below for more Bond -Hugh.* Counting Station with 3/2 figure groups in R3E, at 0227. (Sevart-KS)

4640.0 Counting Station-CIA English female "numbers" (E5), ended at 0031. (Jay Steimel-AR)

5135.0 Atencion Station-Cuban "numbers" (V2), Spanish female voice with 5-figure groups in AM, at 0542. (Sevart-KS)

5255.5 "0A"-Irish Navy, Dublin, working "18" in ARQ, at 2048. (Boender-Netherlands)

5277.0 JPTP-Unknown, possibly military, sending CW "VVV" markers at 0600. (Boender-Netherlands)

5419.0 Cut Number Station-Cuban CW "numbers" (M8), five-figure groups, just ending at 0337. (Sevart-KS)

5680.0 Stavanger Rescue, Norway, testing at 0756. Gluecksburg Rescue, Germany, working "Mission 4757," at 0800. DRFB-German vessel *Hamburg*, working Gluecksburg at 0810. Koksijde Rescue, Belgium, working an air force plane, at 0811. Kinloss Rescue, UK, working Rescue 131, Sierra 135, and Rescue 137, at 0818. (Boender-Netherlands)

5696.0 "Coast Guard Z-6-L"-US Coast Guard helicopter on law enforcement operation, attempting to contact CAMSLANT "in the green" (secure voice), at 0022. Skier 93-New York Air National Guard C-130, radio check with CAMSLANT, at 0028. (Perron-MD)

5800.0 Indirect-US military, at 0401. Mince Meat-US military, working Midstream at 0405. (Jeff Haverlah-TX)

5860.0 Unid "numbers," repeating CW call-up 555 555 555 818 818 818 33, then a message of 33 5-figure groups, at 0345. (Sevart-KS)

6227.0 Tropic Night-Private coastal station taking positions and arrival or departure times from several Caribbean shipping vessels with names beginning in "Tropic," daily at 0900. (Todd Helberg-OH)

6407.7 ZSO-South African navy, Durban, testing in plain RTTY (not their new multitone mode), new frequency, parallel on 8629.7, at 0615. (Hall-RSA)

6697.0 Fish Hawk-US military, with EAM, simulcasting on 8992, 11244, and 13245, at 0512. Implicate-US military, with EAM at 0644, then working Fish Hawk, no joy, at 0737. (Haverlah-TX)

6730.0 "9-L-O"-Possible US military, calling "CTP," no joy, at 0512. (Sevart-KS)

6797.0 Cuban cut number station (M8), with 3 CW messages in 5-figure groups, at 1203. (Castillo-Panama)

6824.0 Cuban cut number station (M8), with 3 CW messages in 5-figure groups, two Thursdays at 1200. (Castillo-Panama)

6854.0 Cuban "Atencion" station (V2), with messages in 5-figure code groups by a female AM Spanish voice, two Mondays at 0300. Cuban cut number station (M8), with coded CW messages, bad transmission quality, at 1203. (Castillo-Panama)

6866.0 Cuban cut number station (M8), with 3 CW messages in 5-figure groups, two Fridays at 1200. (Castillo-Panama)

6981.0 Cuban cut number station (M8), with 3 CW messages in 5-figure groups, two Mondays at 1200. (Castillo-Panama)

7554.0 Cuban "Atencion" station (V2), with 3 AM Spanish messages in 5-figure code groups, at 0300. (Castillo-Panama)

7831.7 5ST- ASECNA, Antanarivo, Madagascar, with ARQ aircraft data, at 1605. (Hall-RSA)

7889.0 Cuban cut number station (M8), with CW 5-figure groups, in progress at 1205. (Castillo-Panama)

8135.0 Cuban cut number station (M8), with CW 5-figure groups at 2000. (Castillo-Panama)

8298.0 VTP13/14-Indian Navy, Vishnapatam, with RTTY identifier, then coded message in 4-letter groups to ZD702, at 1603. (Hall-RSA)

8942.0 Manila Radio, taking position from Korean Air flight 367, at 1710. Singapore Radio, position from Korean Air flight 672, at 1724. (Gary Cohen-China)

8971.0 Blue Star-US Navy, Puerto Rico, taking encoded position from aircraft, at 0040. Blue Star calling Wrangler 07 (probably a Navy P-3C), clear and secure, at 0056. Blue Star working Mongoose 05 (probably another P-3) regarding Hunter (British Royal Air Force), clear and secure, at 2335. Trident 745-US Navy, working Fiddle (USN, FL), then Golden Hawk (USN) for "Spare Group" message, at 2345. Red Thunder-Unknown

Utility Logs (continued)

agency, calling Golden Hawk, raised Trident 745 instead, at 2352. (Perron-MD)

9001.0 Kinloss Rescue, UK, working Rescue 137, passed airfield weather at 1112. (Boender-Netherlands)

9031.0 Architect-Royal Air Force flight watch, UK, with European VOLMET at 0040. (Perron-MD)

9105.0 Unid-Busy net of automated stations exchanging ALE link data, with identifiers such as T, T1, H1A, AFM, JVC, and 123, beginning at 1816. Not the US Air Force on 9106, which was also heard. (Hugh Stegman-CA)

9222.0 Counting Station-CIA English female "numbers" (E5), message for "007," group count 100, at 2100. (Steimel-AR)

9283.5 "November"-US Navy, controlling net with various single-letter callsigns at 0326. (Sevart-KS)

10075.0 Northwest 32-Airliner on ground in Detroit, made SELCAL check with controller, at 0055. (Steimel-AR)

10125.0 Cuban cut number station (M8), with CW 5-figure groups, twice at 1115. (Castillo-Panama)

10923.5 Unid-at least 12 US Navy stations with single-letter callsigns in one or more tracking nets, much discussion of link-11 setup, using other frequencies called Horse, Mouse, and Bird, for three days beginning at 0748. (Steimel-AR) *Obviously a major comm exercise, widely heard on and around 9285, 10923, and 11266, all listed USN. -Hugh*

11175.0 Indirect-US military, with a patch to Midstream via Hickam Global, at 0356. (Haverlah-TX)

11181.0 Indirect-US military, telling Mince Meat to pass his traffic via "Whiskey Bravo," then working Midstream, at 0406. (Haverlah-TX)

11244.0 Briquette-US military, working Lone Ace, at 1844. (Haverlah-TX)

11246.0 Continental 1262-Possible contract transport aircraft, calling MacDill, needless to say no joy, at 1605. (Haverlah-TX) *Wrong frequency, closed station – someone needs a new flight handbook. -Hugh*

11342.0 934-Possible TWA flight, advising New York LDOC of sick passenger, decided to give the guy an aspirin and continue on to Newark, went to 8933 at 1155. (Steimel-AR)

11396.0 Hong Kong Radio, in SELCAL check with Japan Air flight 722, at 1715. (Cohen-China)

11494.0 Diplomat-Probable US military, working Originate at 2316. (Sevart-KS)

11554.0 Polytone station-Russian tonal "numbers" (XPH), no message, at 0600. (Boender-Netherlands)

12124.0 Norwegian MFA, Oslo, with FEC news and sports results, in Norwegian, at 0855. (Boender-Netherlands)

12209.0 Polytone station-Russian tonal "numbers" (XPH), no message, at 2040. (Boender-Netherlands)

12604.5 9AR-Rijeka Radio, Croatia, sending FEC list of services at 0748. (Boender-Netherlands)

12666.5 RFFME-French navy La Regine, testing in 150-baud RTTY, at 0850. (Boender-Netherlands)

12877.5 UIW-Kaliningrad Radio, Russia, testing in RTTY at 0746. (Boender-Netherlands)

13155.0 Briquette-US military, with two EAM, took a standby for traffic both times, at 2007 and 2037. (Haverlah-TX)

13245.0 Briquette-US military, working Corrugate at 2255. (Haverlah-TX)

13330.0 Ryan 8180-Aircraft working Houston, TX LDOC, went to 17940 for a patch, at 0030. Houston LDOC with SELCAL, then sent aircraft to 13380, at 2300. (Steimel-AR)

13333.0 Unid-two LSB English-speaking males, one fond of the well-known "F" word, scheduling future bootleg contacts on 8080, 9114, and 9172 kHz, at 0013. (Steimel-AR)

13444.0 RFHINVS-French Navy FS *Nivose*, with a technical message directly to RFLINVS (FS *Ventose*), RFHIVD (FS *Vendemaire*), RFHJPRL (FS *Prairial*), RFVIFLR (French Navy), and RFFLAGE (FS *L'Aigle*), in ARQ at 1503. RRFQP-French Forces, Djibouti, message in ARQ at 1536. (Hall-RSA)

13454.0 Polytone station -Russian tonal "numbers" (XPH), no message, at 0620. (Boender-Netherlands)

13530.0 KAWN-US Air Force Digital Weather Switch/Aviation Weather Network, with continuous RTTY weather broadcasts for northeastern US and Atlantic ocean, from an unknown transmitter, at 0801. (Hall-RSA) *This one is pretty much continuous here, though all the regular KAWN frequencies are still only tone. -Hugh*

13927.0 AFA1QW-US Air Force MARS, calling Reach 251T, probably a transport aircraft, no joy, at 1757. (Sevart-KS)

13938.0 Polytone station-Russian tonal "numbers" (XPH), no message, at 2020. (Boender-Netherlands)

13965.0 AAA9USA-US Army MARS, Fort Huachuca, AZ, working AAT5TWI, in 300-baud packet, at 2017. (Sevart-KS)

14367.4 BAF8-Beijing Meteorological, China, with an unusually clear FAX weather chart, at 0910. (Hall-RSA)

14373.0 SANT-Hospitaller Brothers of St. John of God, transmitter possibly in Spain, with Spanish PACTOR-I messages regarding West African relief, at 1655. (Hall-RSA)

14506.5 Unid-loud, slow PACTOR, connected to NAQD, NMEL, NDWA, and NMAG, never sends any information, first discovered at 2330. (Stegman-CA)

14648.0 4XZ-Israeli navy (M22), with CW "VVV" marker at 2024. (Boender-Netherlands) 4XZ, CW marker at 2040. (Sevart-KS)

15706.0 Polytone station-Russian tonal "numbers" (XPH), no message, at 2000. (Boender-Netherlands)

15920.0 CFH-Canadian Forces, Halifax, NS, with usual NAWS RTTY marker, at 2300. (Sevart-KS)

16278.9 Unid-Algerian Embassy, Cairo, Egypt, with Coq-8 message in Arabic to Algiers, at 1600. (Hall-RSA)

16302.0 DFZG- Yugoslavian MFA, Belgrade, with encrypted RTTY message and some operator chatter, at 0619. (Hall-RSA)

16303.6 Unid-Probably US military intelligence, with drill messages in CW, ASCII, RTTY, and SITOR-B, at 2018. (Sevart-KS)

16328.5 Unid-Financial transactions in French from Zaire Bank, in rare FEC at 1420. (Hall-RSA)

16331.7 DLKGMK-Egyptian Embassy, Luanda, Angola, with ARQ messages in Arabic to MFA, Cairo, at 1550. (Hall-RSA)

16817.5 KPH-San Francisco Radio, CA, with SITOR-B traffic list, at 2307. (Sevart-KS)

16976.0 PWZ33-Brazilian navy, Rio De Janeiro, with Portuguese-language navigation warnings, in a wobbly, continuous version of PACTOR-I *[FEC? –Hugh]*, at 1455. PWX33-Brazilian navy, same continuous Pactor, ended with "CANCEL THIS MESS," at 1530. (Hall-RSA)

17074.0 LGX-Rogaland Radio, Norway, in CW at 2340 w/ traffic list. (Sevart-KS)

18183.4 MAE-Algerian MFA, Algiers, with 23 separate Arabic and French messages about the war in Sierra Leone, all in Coq-8, some of flash priority, in three hours beginning at 1445. Algerian embassy, Kinshasa, with French message to Algiers, New York, and Addis Abbaba, then Algiers with a general bulletin, all in Coq-8, different day at 1508. (Hall-RSA)

18261.7 RFTJD-French Forces, Libreville, Gabon, with an ARQ message at 1555. (Hall-RSA)

18481.0 4XZ- Israeli navy (M22), with three CW messages of 5-letter code groups, at 1805. (Sevart-KS)

19495.0 V5G-Romanian MFA, Bucharest, with FEC radiogram to Lagos, Nigeria embassy, at 0750. (Hall-RSA)

20960.0 SAM-Swedish MFA, Stockholm, with coded ARQ message to an embassy, at 1505. (Hall-RSA)

24370.0 RFGW-French MFA, Paris, with coded embassy circular in FEC at 1555. (Hall-RSA)

24537.0 Unid-Italian MFA, Rome, with encrypted ARQ message to Lagos, Nigeria consulate, at 1300. (Hall-RSA)

26241.6 RFVI-French Forces, Le Port, with ARQ traffic at 0908. (Hall-RSA)

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Russian Intelligence Gathering on HF

This month we focus on a network in operation since the late 1970s. The network is interesting for a number of reasons, not least of which is the use of standard Baudot RTTY for the majority of its transmissions, making it an interesting subject for listeners with even the most modest of equipment.

❖ FAPSI, SOUD or Brotherhood?

Having initially been dismissed by some well-known monitors as "number station gobbledygook," the Americas side of this network only really came to prominence through the investigative work of Don Schimmel. His analysis of traffic carried by the network revealed a similarity in certain operating and message characteristics between transmissions from RCF (shown in many callsign references as Ministry of Foreign Affairs, Moscow) and traffic sent from the Cuban relay station to addressees on the Americas network. It was thus firmly believed that such messages dealt with diplomatic and intelligence matters. Don later documented his years of monitoring the networks in his book *The Underground Frequency Guide* (see the Resources section).

The networks, particularly the European side, gained greater prominence after a series of profiles written by WUN columnist Ary Boender which dubbed the networks the "Brotherhood." Interestingly, these profiles were also posted on the web site of the Federation of American Scientists (**www.fas.org**).

With the formation of the Soviet SOUD organization, the networks then also carried intelligence gathered on "enemies" and dissemination of file information from the SOUD computer located in Moscow. Following the break-up of the Soviet Bloc in the mid-80s, a newly formed organization called FAPSI took over the role of encryption and message handling for all diplomatic, intelligence and some military traffic. And so, the networks are now usually referred to by the acronym FAPSI.

It is very likely that the European network is controlled by Moscow, with the Americas network run by the Russian relay site in Cuba. The Americas network was extremely active until 1999 but since then has taken a downturn in RTTY activity with only three regular schedules remaining in operation. There has been a similar decline in traffic in Europe.

❖ Habits and Frequencies

The operating habits of each region are for the most part similar, with most monitors noting more operator chatter on the European links. Currently, FAPSI utilizes CW for operator chatter and some status messages, the majority of traffic being carried with 75bd/500Hz shift (rarely 50bd or 100bd) Baudot RTTY and CROWD-36.

There are four basic types of traffic – the call-up sequence, off-line encrypted messages, confirmation messages and schedules.

❖ The Call-up

The call-up sequence uses a shifted version of the usual "RYRYRY..." tape and thus appears as "646464..."

4646464646464646464646464646464646464646464646464646464646464646
spk spk spk2/345spk spk spk2/345spk spk spk2/345
4646464646464646464646464646464646464646464646464646464646464646
spk spk spk2/345spk spk spk2/345spk spk spk2/345

The numbers between the "/" represent the number of messages and total number of five letter or figure groups to be sent. In some cases, however, the call-up sequence is sent using a slow multi-tone signalling/selcal system code-named "Mazielka," which seems closely related to the CROWD-36 SELCAL mechanism. The three-letter callsign is the callsign of the station for which the messages are intended, not the callsign of the sending station. It is believed that the Americas network now consists of only three stations: WFO, MIG and KRN. WUN carries frequent updates to the lists of known FAPSI callsigns and link indicators.

❖ Traffic

FAPSI messages contain perhaps the most distinctive signature of this network – a header consisting of five five-digit groups usually beginning with the group "11177". Here is a typical example:
11177 80038 12345 10225 03451

"11177" is probably a message type indicator. Since this is the most common group seen, it's likely that this equates to "routine" traffic. Rarely, this group is "11144", "11166" or "11199".

"80038" is the link identifier. Each link has its own identifier, except in the unusual cases where there is a two-way link between stations in which case both stations use the same indentifier. At present over a hundred different link identifiers have been logged and matched with a callsign.

"12345" is likely a decoding key or other cryptographic indicator.

"10225" gives the date of the message, in this case the 10th day of the month, and the message number, 225.

"03451" is the number of groups in the message plus 1, and the last digit is usually a "1" or a "9".

Then follows off-line encrypted traffic in five-letter or five-figure groups, ten groups per row, often with "11111" as the last group if figures are used. The operators usually close the link with "qru tks gb sk" or "qru qru sk sk".

❖ Confirmation/QSL Messages

Confirmations have the same basic structure as regular traffic, with a five-group header and a series of lines beginning with "55555 77011". They may or may not be sent on the same day as the original messages, and are often sent on unscheduled frequencies.They always begin with the group "11199" and take the following form:
11199 00142 00000 18010 00069
55555 77011 00089 00090 00091

In this case the message numbers QSL'd are 89, 90 and 91.

❖ ETFNJX TKAGAS and QWK Messages

Two further interesting features of this network are the schedule-related messages. Occasionally, one can hear the message ETFNJX TKAGAS sent in CW repeatedly often for up to half an hour at a time and frequency outside of the normal schedule. Generally, within a few minutes, a regular FAPSI station comes on frequency and sends normal traffic. These "ET" messages seem to be the method by which the network allows "out of schedule" messages.

The QWK messages are more overt, and convey the schedule itself with times and frequencies. Here's an actual example from the 4th of November:
QWKQDGFM4/11TONEXTQWK
FM00.00TO13.00QSW 16324/11227/8906
FM13.00TO24.00QSW 16224/13234/20457

❖ FAPSI Frequencies

Here's a list of European and Americas FAPSI activity heard from late 1999 to mid-2000:

UTC	kHz	To	Link#	Mode	Comments
????	14427	???	00918	CROWD36	
1735	17414/14434	KRN	00178	RTTY	Approx Sept 99 went from daily to once per week sked on Thursdays
1100	14532/1804	SPK	00168	RTTY	Last heard 4 Feb 2000
1453	???		20076	CROWD36	
1800	19086/14941	WNY	00139	RTTY	Last heard 4 Feb 2000
????	16151	???	10053	CROWD36	
2000	16218/13544	HZW	00117	RTTY	Last heard Aug 1999
2230	14841/13452	JMS	00127	RTTY	Last heard 4 Feb 2000
2240	22867/19921	PSN	00126	RTTY	Last heard 15 Jan 2000
????	18245	???	60047	RTTY	
????	18247	???	?????	CROWD36	
????	19611	UDZ21	10163	RTTY	

Resources

FAPSI Coverage	www.wunclub.com
Schimmel's Radio Intrigue	www.dxing.com/intrigue.htm
Mazielka Audio Sample	rover.wiesbaden.netsurf.de/~signals/WAV/6TONE.WAV
CROWD-36 Audio Sample	rover.wiesbaden.netsurf.de/~signals/WAV/CROWD36.HTM

The Underground Frequency Guide (3rd Edition), Don Schimmel, HighText Publishing, 1994.

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Radio Verdad, Guatemala, QSLs With Full Station Info

R. Verdad, 4052.5, Chiquimula, is signing on earlier now at *1100 weekdays; half an hour makes a lot of difference in improved propagation for only 800 watts. Local sunrise here in Enid was no earlier than 1111 UT at solstice, actually 0439 Local Mean Time (gh)

Dr. Édgar Amílcar Madrid Morales, director of Radio Verdad, sent a very nice personal letter after 3 weeks. He says that my report was the first one from Germany. Station is operating with only 820 watts only. In the evening voltage drops below the minimum 200V the transmitter can accept, so closes down around 0025 UT. Due to problems with the government the station hasn't got yet a call sign, but expected to be TGAV. The letter contains a nice QSL-card too, which shows the station manager standing on the antenna tower, included a receipt for one US dollar, which I enclosed in my report, the first time I get such a receipt from a radio station. (Michael Schnitzer, Germany, *hard-core-dx*)

Then Michael kindly sent us copies of the original letters and QSL card, which makes clear the names given in the standard ID we have been hearing: "*Desde el Monte Horeb y el Cerro de La Gloria*," two little hills on which the antenna towers are located. Additional info: 20901 is postal code; work phone 502 9-425-689. R. Verdad first went on the air Feb. 25, and was inaugurated March 5. Transmits from San Esteban, Chiquimula. Non-profit station needs more than 40 patrons or 800 members. It is broadcasting directly from the transmitter site, since they do not have the money for a studio-transmitter link, costing 40 kiloquetzales installed. A transformer to correct the low voltage problem has been bought for Q6090 but installation will cost another Q10K. Also urgently needs a signal compressor; unknown how much the transmitter is being underfed causing some noise. Also being built are internal roads and mud walls in the area. The signal will be much better once all this is accomplished.

Later wants the government to authorize higher power and an FM frequency. The transmitter is a 1 kW Omnitrónix, made in Italy, still in need of some adjustments. Antenna is bipolar [dipole], 75m long, 12m high, so as not to miss covering the closest city, Chiquimula. Not all programs have been put on the air yet, and only one third of the music which has been prepared. Have been working intensively for almost a year to prepare the programming. Schedule is 5 am to 6:25 pm [1100-2425 UT]. With the transformer, will stay at 240V and can stay on until 10:30 pm. Sr. Madrid is a 1965 graduate of George Fox University in Newberg, Oregon, Th.D. (*Doctor en Filosofía Teológica*] and has other academic degrees from the State University of Guatemala.

AUSTRALIA A front page report in *The Weekend Australian* shows that a British company 'Christian Vision' has done an amazing deal with the Australian Government. CV has pulled off a 10-year lease-purchase of the former Radio Australia facility at Cox Peninsula NT (near Darwin) to broadcast its Christian shortwave message into Indonesia and China. Australia's third largest political party was expected to seek amendments to the current bill before parliament to guarantee access for Radio Australia at this facility. (Chris Martin, Brisbane, *hard-core-dx*)

This led to cries of outrage by individual Australian SWLs and throughout the Aussie press: Religious war in the airwaves. Australia's most powerful shortwave radio transmitter has been sold to a fundamentalist Christian group that will use the Darwin facility to broadcast across Indonesia, China and India. The sale will heighten tensions between Canberra and other governments in the region offended at the use of an Australian facility to broadcast Christian messages across Asia. The sale is a blow to Radio Australia, which lost access to Cox in 1997, and prompted an extraordinary plea yesterday from ABC chairman Donald McDonald for government support. The Australian Democrats said they would attempt to force changes to a broadcasting bill, yet to be passed by the Senate, that would require Christian Vision to guarantee access for Radio Australia.

Christian Vision's website describes the group as a "charitable company that God has challenged to touch a billion people with the message of Jesus through the use of media." Its listed beliefs include "the everlasting conscious bliss of all who truly believe in our Lord Jesus Christ and that everlasting conscious punishment is the portion of all whose names are not written in the Book of Life." (Michelle Gilchrist and Errol Simper, *The Australian* via John Figliozzi, swprograms)

The Australian Government has totally lost its mind. I would have thought that there was an overload of God-bothering on shortwave directed at Asia already! Words fail me!! (Barry Hartley, Auckland, NZ, *DX Listeners Digest (DXLD)*) Aren't there far too many religious SW broadcasters already (to put it politely)? This should be a stark lesson to other SW broadcasters: *Own and control your own transmitters*. Even the BBC World Service does not any more (gh)

CV Director Mike Edmiston says he has been approached by the ABC about the idea of sharing air space with Radio Australia. He says under the legislation, Christian Voice would be responsible for everything that goes to air, which may be untenable to Radio Australia, as there may have to be some editorial input. "Not necessarily control but on the other hand, we don't want to inherit a responsibility for what is said by Radio Australia, which is the way it's currently framed in draft legislation," he said. (RA news online via Figliozzi, *swprograms*)

This evidences some degree of misunderstanding on the part of CV about listeners, who will not confuse the stations because they are using the same transmitters since transmitters don't identify themselves (e.g., The ID won't be "This is Radio Australia broadcasting from Christian Voice-leased transmitters."). Only a very few listeners (such as enthusiasts and hobbyists) will know or even care. Despite the evidently "soft sell" nature of the CV product, radical religious fundamentalist elements within the target countries will be energized and motivated by CV transmissions far more than CV or the Australian government realize.

There is obviously a great deal of maneuvering going on behind the scenes – perhaps pressure from elements within the Australian Parliament, perhaps of some even within the government, supportive of RA and the ABC, on CV to allow use by RA in exchange for approval of the lease agreement. (John Figliozzi, NY, *swprograms*)

What a waste of resources for the Darwin transmitters to be handed over to yet another religious sender. The Australian govt should be ashamed! Maybe the money they will receive means more than reaching an external audience by radio (Noël R. Green, UK, *BC-DX*)

From R. Australia's Feedback: CV hopes to run tests from the end of August, and commence full programming from early September. They appear to see their initial primary audience in the Indian sub-continent, and will commence programs in English only, as they like to have their stations running in a single language (Phil Hodgson, Whitley Bay, UK, *DXLD*)

Radio Australia may be back broad-

*All times UTC; All frequencies kHz; * before hr = sign on, * after hr = sign off; // = parallel programming; + = continuing but not monitored; 2 x freq = 2nd harmonic; A-00=midyear season, March 26-October 29, 2000; [non] = Broadcast* to *or* for *the listed country, but not necessarily originating there; u.o.s. = unless otherwise stated*

casting from its powerful Darwin transmitter after the Christian group which bought the facilities indicated it may sublease capacity to the national broadcaster. Christian Vision's Mr Tim Boxall said his organisation would be prepared to look at leasing out excess capacity at cost. The subleasing deal for the Cox Peninsula transmitter would be a big boost to Radio Australia, allowing it to restart broadcasts to South-East Asia and China. But the key question for the ABC will again be funding. (Anne Davies, *Sydney Morning Herald* via Barry Hartley)

"We might be Christians, but we're no nut cases." Mr Bob Edmiston has spent millions of dollars spreading the Christian word over the world's airwaves, especially to Third World countries. He dismissed as baseless suggestions that Christian Vision's message could offend Australia's Muslim neighbours. The former bank clerk – whose pay packet of £6.5 million made him Britain's second-best paid company director last year – built his fortune from a £6,000 investment 26 years ago. The 53-year-old Mr Edmiston, who was raised a Roman Catholic but was drawn to the Pentecostals at 17, has poured in more than £30 million of his own money since he founded Christian Vision 12 years ago. He plans to commit up to £100 million.

He defended the group's latest move: "We haven't even put a word out on air and we've been castigated. We're straightforward people who happen to have a sincere and profound faith in God. We're not a bunch of whacky nut-cases." Christian Vision already operates shortwave radio services in Zambia and Chile broadcasting to a potential audience of more than 700 million people. Ultimately, it wants five or so bases around the globe.

The West Bromwich-based entrepreneur, whose [Toyota] car-importing business and property interests are worth more than £300 million, said he was stunned by the political fallout "because the fact of the matter is [Australia] hasn't been using the Cox site since '97." (Simon Mann, *Sydney Morning Herald* via Daniel Say, swprograms)

The Taiwan airtime lease was negotiated last year after the fall of the Suharto government in Indonesia. Radio Australia also tried to negotiate airtime from a transmitter in Singapore but was rejected by the Singapore Government, which did not want to offend Indonesia. Radio Australia general manager Jean-Gabriel Manguy said money to renew the Taiwan lease, which expires on August 31, would have to come from the ABC as Radio Australia had no budget allocation for such leases. (Michelle Gilchrist, The Australian, via Paul Ormandy, NZ)

Excerpt of *Canberra Times* editorial: The Federal Government does not seem to care that it has lost an unparalleled opportunity to have Australian views and Australian news beamed to its neighbours, by a respected practitioner operating according to the principles of a free press, at a time when misinformation about Australia's motives is rife in the region. The wild allegations which were made about Australia's real "agenda" in East Timor, at the time of the independence vote, showed clearly the need for a balanced and unbiased coverage of regional affairs, broadcast to the region.

At the same time, the Government seems incapable of realising that by leasing the Cox transmitter to an organisation which has the stated aim of spreading a narrow and judgmental Christian message into a (largely Muslim) part of the world already racked by considerable religious violence, it might not be acting in the best interests of a ostensibly secular and tolerant country like Australia. (via John Figliozzi, swprograms)

AZERBAIJAN R. Baku is again on traditional 6110, ex-9165, at 0215-0300, 1000-1500 and 1600-1800 (Mikhail Timofeyev, Russia, *DXLD*) Includes English at 1700-1730 (*Observer*, Bulgaria)

BOLIVIA On 4702.23, Radio Eco at 0022, weak but clear, "*Eco San Borja*" canned ID, Spanish pop music (Mark Mohrmann, VT, *DXLD*) On 4702.4, Radio Eco San Borja, 2304-2320, full ID: "*...Para Bolivia, América y el mundo transmite Eco San Borja, 4700 kHz, banda internacional de 60 metros onda corta tropical, desde San Borja, Beni, contigo desde Beni...*"

On 4716.7, Radio Yura, 2324-0030 with messages and notices, then cumbia music, 0125* clearing frequency for a Peruvian [*q.v.*] (Rafael Rodríguez R., Bogotá, Colombia, *DXLD*)

R. Centenario, "La Nueva," 4850, has a program for Mennonites in the area in Plattdeutsch (Low German), Sundays 2330-2400* (Karel Honzík, Czech Republic, *hard-core-dx*)

CANADA RCI announced that effective immediately May 17, the new broadcasts to Africa at 0400 and 0600 are cancelled. Reason: difficulty in getting a good signal into the target area (tho they were using Skelton, Wertachtal and Vienna). (Bill Westenhaver, PQ, *DXLD*)

This is what happened: The two announcer-producers of *African Eyes* know nothing about SWLing and nobody taught them anything. They called 0600 UTC, six a.m. Before the summer season, they did not warn listeners about any new times and frequencies. When the summer season began, their listeners all of a sudden found themselves out of contact. The reasons were not frequency planning, propagation or interference. Nor was there a technical difficulty. Too bad. (David Crystal, Israel, *DXLD*)

And the timing could not have been worse, as this was just before the Challenges VI conference in Montreal, with RCI hosting broadcasters from around the world, including Africa, as Bill Westenhaver pointed out on *International Radio Report* (gh)

The *International Radio Report* with Bill Westenhaver and Sheldon Harvey, from CKUT 90.3 Radio McGill, Montréal, is now archived, thanks to a recent guest on the show, Ricky Leong. No longer do you have to catch it on the live stream Sundays at 1430-1500 UT at **http://www.ckut.ca** or miss it. *IRR* programs since May are at **http://members.fortunecity.com/crazyaboutradio** (IRR via gh) Despite the title, first priority goes to Montréal-market developments, then some national and American media news, and a few shortwave items (gh)

CFVP, 6030 is relaying CKMX (MW 1060 Calgary), both 24 hrs a day, 100 watts. The Chief Engineer told me that occasionally they are off the air in the summer due to lightning strikes. It can take a few days to find the time to get CFVP back on the air. The station's owner is not concerned with this low powered transmitter; it is one of the last 3 private Canadian SW regionals left on the air. The station engineers often donate their own time/money to keep this relay transmitter on the air. Address: CFVP c/o CKMX, PO Box 2750, Station M, Calgary, Alberta, Canada, T2P-4P8 (Joe Talbot, Alberta, DSWCI *DX Mirror*)

CFVP probably made its 100 watts signal through the aurora belt to Denmark with the direct path passing Nuuk on Greenland. 6030 (tentative), June 9 0345-0400, faint signal coming through much noise on this frequency while SWR3, Germany was off. Most of the time fast talks in English with North American accent and one song. No ID heard, but Joe Talbot confirmed it is 24 h. SINPO 22232 until SWR3 signed on exactly at 0400 and covered the frequency (Anker Petersen, Denmark, *DXLD*)

CHIAPAS [non] La Voz del Zapatista clandestine program heard on 13910 USB Sat June 3 at *2214-2220+ (Harold Frodge, MI, MARE *Tipsheet)* This was pirate KIPM, Illuminati Prima Materia, in a marathon session including other programs and Voice of Chiapas (Zapatistas) in Spanish; report via Box 24, Lula GA, 30554 or *kipm_outerlimits@hotmail.com* (Charles Crawford, KY, *Free Radio Weekly*)

CHINA V. of the Strait, *Haixia zhi Sheng*, extended schedule to: 2055-2300 4900 5050 3900, 2300-0100 and 0755-1800 9505 7280 6115. New website **http://www.radiohx.com/** includes live webcast.

China Huayi Broadcasting Co., Fuzhou, rearranged schedule to: 0255-0600, 0855-1600 on 11590 6185 (winter frequencies are 4940, 4830) (Shigenori Aoki, Japan, *Electronic DX Press*)

COLOMBIA Instead of Colombia Estéreo 93.4, previously heard on 4895, Radio 88.9 FM La Súper Estación, desde Santa Fé de Bogotá, was heard May 11 at 0030 with echo ID as *"HJJO la Súper Estación"*; promos for the Armada Nacional, some ads for chocolate, a café and a jingle for Bacardi. Gave this address: Carrera 16-A, No. 87-78, Bogotá, Colombia. Unfortunately, the audio was somewhat distorted. Does this station belong to the national army network CREER or not? (Jorge García Rangel, Venezuela, *Banda Tropical*, Club Diexistas de la Amistad)

CONGO DR Lubumbashi reactivated in early June on 7205, heard from 2000 in French, 2027-2100 blocked by BBC, clear again at 2100-2115 and off before 2130. Frequent mentions of Lubumbashi; likely replaced the ancient 10 kW transmitter (Guido Schotmans, Belgium, *hard-core-dx*)

COSTA RICA RFPI's 25930-USB went off the air in mid-May, after the gardener's tractor cut the overhead transmission line. Considered reviving on new 21 MHz channel instead, then to convert the unit to AM for X-band, and get another SSB SW transmitter later. RFPI is happy that $10K worth of solar and wind power equipment has been delivered, thanks to a grant from Rotary. It comes from Sun Systems in Florida, highly recommended. Includes wind generators, and solar panels. This will be enough to supply office power during blackouts, but not to run the big transmitter.

In June, everything was torn up, totally disrupted at the station with a LAN computer network system being installed. When the LAN is installed, RFPI will then be able to stream direct onto the Internet, rather than via the current SW pickup in the USA, and RFPI will no longer be constrained by a very slow dialup-only Internet connection (RFPI *Mailbags*)

Radio Pampa, Nicoya, 4230.21, a real super surprise, does not seem to be a one time phenomenon as I have logged this on 3-4 occasions, 3 x 1410.07. Listed in *WRTH* on 1420, apparently moved. At 1100-1200 *Música tropical* (Björn Malm, Quito, Ecuador, *SW Bulletin*, translated by Thomas Nilsson for *DXLD*)

CROATIA [non] Have noticed extended English broadcast lasting about 25 minutes irregularly since Feb 19. May 20 on 9925: 0102-0125 "Radio Croatia" ID, English news, 0118-0125 *Topic of the Day* editorial program, 0125 back into Croatian. No English heard 0200-0230. Same English program repeated at 0302-0325; very good (Brian Alexander, PA, *DXLD*) via DTK, Germany

ETHIOPIA [non] V. of Oromo Liberation, in Oromo *Sagalee Bilisumma Oromoo* or SBO, was first heard in 1988-1992 via Sudan, 1993 via USA and Ukraine, now via DTK Germany, Sun, Thu, Fri 1700-1800 on 15715 in Oromo; also has English and Oromo audio 24h via **http://www.oromoliberationfront.org** Addresses in Berlin, and USA: SBO, P O Box 73247, Washington, DC 20056. E-mail SBO13366@aol.com ((c) BBC Monitoring)

V. of the Democratic Path of Ethiopian Unity (Amharic: *Finote Demokrasi Ye-Ethiopia Andinet Dimts*) has been heard since last December, now via European sites all in Amharic: Sun 0700-0900 Af 21550; Wed 1600-1700 15105, Wed 1830-1930 15715. Also archive audio 24h via **http://www.finote.org** Addresses in Amsterdam, and: Finote Democracy, P O Box 88675, Los Angeles, CA 90009; E-mail efdpu@finote.org ((c) BBC Monitoring)

IRAN IRIB Teheran Persian service on 15084.2 0100-0200 accompanied by two very strong spurs on 15017.4 and 15151.0. Modulation totally distorted, but S9 (Hans-Joachim Koch, Niddatal, Germany, *DXLD*)

No two versions of VIRI's schedule match each other. Here's one, excerpted: Summer A-00 in English
0030-0130 9022, 9835, 11970
1100-1230 15385, 15430, 15585, 21470, 21730
1530-1630 7115, 9635, 11775
1930-2030 9022, 9575, 11670
2130-2230 11740, 13745
(*Observer*, Bulgaria)

IRAN [non] R. Voice of Iran (Persian: *Radyo Sedaye Iran*), pro-western and hostile to hardliners in Iran, 1630-1830 daily in Persian via Moldova 12065; website **http://www.krsi.com** includes audio ((c) BBC Monitoring)

Radio Sedaye Iran originates in Los Angeles but I do not think it is on a standard broadcast channel. The calls KRSI belong to a station in Saipan. However, RSI is heard on an FM subcarrier of WAMU 88.5 in Washington DC. The channel is actually passed through a speech inverter to prevent casual piracy from unauthorized receivers. Occasionally one can hear English during a "teen segment". (Tracy Wood, VA, *DXLD*)

ISRAËL Reshet Bet at 0000-2355 50 kW 318 degrees replaced 15615 with 15760 at the end of May. Since it has been officially decided to extend DST until Oct. 29 like all other countries, instead of ending Sept. 22, the present schedule will remain in effect, hoping there will not be any more collisions than before (Moshe Oren, Bezeq, *DXLD*)

KOREA NORTH KCNA RTTY news in English, F1B, 50 baud, Mon-Sat: 1000-1200 Asia 10580, 14568-summer, 8512-winter; Eu 15633, 13780-summer, 11430-winter; 1230-1400 Am 13580, 11536-summer, 11476-winter, Af 8020, 11476-summer, 11536-winter ((c) BBC Monitoring)

LEBANON [non] Due to Israeli withdrawal from southern Lebanon, V. of Hope is no more; went off SW May 20, but continues on FM from Israel; crated and moved SW transmitters there, but unlikely to be used as getting better results with new relay via DTK Germany: 0800-1200 21590, 1200-1600 21460, 1700-2100 11985; all per High Adventure Ministries (Hans Johnson, (c) *Cumbre DX*)

MONGOLIA Voice of Mongolia, Ulaanbaatar now provides its English program on Internet at **http://www.mongol.net/vom/voice.ram** (Volker Willschrey, Germany, *DXLD*) It surely is: I listened to the June 4 program, and so nice to hear loud and clear for a change. But even so, the only announcer, who says her name is similar to the cosmonaut Gagarin, is still hard to understand. Let's hope incoming internet allows her to brush up her English. She began by reading stories from three newspapers, no pretense about it. Seems spring is the worst season for wildfires in Mongölia (gh)

Voice of Mongolia, 12085, English June 7 at 1030-1100 and presumed Mongolian 1100-1130 still coming thru to Northeast Ohio! Very unusual to hear them after mid-May! (Lee Silvi, *DXLD*)

NETHERLANDS ANTILLES [non] RN Bonaire occasionally resumed relays via Antigua, Ascension, WSHB and Jülich upon short notice when temporary generators needed maintenance (Andy Sennitt, Radio Netherlands, *swprograms*) The good news is that Radio Netherlands has acquired four powerful generators which are being shipped out from France. The remains of the old generator room are being demolished, and a new one is to be built in its place. When installed, we will have double the generating capacity we had before the fire. Obviously all this is going to take quite some time, but our staff in Bonaire are working hard to minimise the disruption in the meantime (Andy Sennitt, *Media Network Newsletter* via John Norfolk)

NEW ZEALAND RNZI has extended transmission by one hour and now closes at 1305 on 11720, in effect until Sept. 3 (Adrian Sainsbury, Frequency Manager, Radio New Zealand, International)

NICARAGUA According to a personal letter from Evaristo Mercado P., Director of Radio Miskut dated May 17, 2000, the damaged parts for SW transmitter have been repaired by John Freeman, and the parts will come to the station in June/July. (Tetsuya Hirahara, Japan, *DXLD*)

NIGER La Voix du Sahel reactivated, 2104 music and talk, indirect IDs, exact freq 5020.22 (Zacharias Liangas, Greece, *World Of Radio*) 5020.8, La Voix du Sahel, Niamey, June 8, 2150-2202*, reactivated after 5 months absence, news in French, flute and muslim prayer, closing announcement with ID, flute and National Hymn. Very strong 45444 (Anker Petersen, Denmark, *DXLD*)

PALESTINE [non] Voice of Palestine, Voice of the Palestinian Islamic Revolution (Arabic: *sawt al-filistin, sawt al-thawrah al-islamiyah al-filistiniyah*) operates from Iran. It was first heard in the mid-1980s. Programmes are critical of the Palestinian Authority. It broadcasts on frequencies which at other times carry the the Arabic external service of Voice of the Islamic Republic of Iran (the official Iranian broadcasting organization). Broadcasts may be one hour later in winter. 0330-0430 Daily in Arabic to ME on 7250, 9610 (© BBC Monitoring)

PERÚ Radio Tigre, location? on 5608v at 0030-0105+, program called *Sabor Tropical*, mentioned transmitter problems, "*Radio Tigre, los mejores éxitos del Perú profundo, nuestra música folclórica... Tigre, su radio*". (Yimber Gaviria, Colombia, *DXLD*) R. Tigre can be found between 5580 and 5620 approximately, although it announces 5250. The frequency varies considerably. QTH unknown but perhaps transmitting from Cochapampa, department of Cajamarca. Normally IDs as "*Radio Tigre*" but there are variations: "*Esta es Tigre - la radio*" or "*Radio 2000 es Radio Tigre, la voz del nuevo milenio.*" Also using the slogan (?) *"La Voz del Campesino."*

Radio Paucartambo, 6520.44, at 0030; frequently advertises for "*Radio Universal en la ciudad de Cusco.*" Transmits in Spanish/Quichua. ID/slogan "*Radio Paucartambo - la radio de su preferencia.*" *WRTH* shows it on 5894.7.

Radio Municipal, distrito de Panao, 3172.69 at 0230. It greets people living in "*la ciudad de Panao*," often mentions "Panao" and never "Cangallo" at all. Sometimes Radio Municipal has a program of non-stop music where they ID as "*Panamericana*" between each selection of music. (Björn Malm, Quito, Ecuador, *DXLD*)

On 4663v, where I had been hearing R. Cielo, May 27 the ID at 1030 instead was R. Universo, testing from Cajabamba, saying it broadcasts for northern Perú (Björn Malm, Quito, Ecuador, *SW Bulletin*, translated by Thomas Nilsson) R. Cielo now on 4714.8v, June 4 after the close of R. Yura, Bolivia [*q.v.*] 0135-0208 with Mexican music, IDs, but no live announcers or mentions of location.

Radio San Nicolás, 5470.7, 0135-0150*, full sign-off at 0147 saying they broadcast from the most fertile province in Amazonas department, Rodríguez de Mendoza; anthem.

Radio La Voz del Campesino, 6956.9, 2130-2210 with folk music, mentioning that the Gerente Propietario is Profesor Luís Hernando Huancas Huancas, who was owner of Radiodifusora Paratón de Huarmaca. Now this person is Huarmaca's Mayor (Rafael Rodríguez R., Bogotá, Colombia, *DXLD*)

RUSSIA Perm now on 6150 ex-5290, at 0100 with local programs, lots of ads (Olle Alm, Sweden, *BC-DX*)

SOLOMON ISLANDS Given the situation in early June, I taped Solomon Islands radio on 5020 from about 1030 to 1200, when the signals here have been readily audible. It makes for fascinating listening to see how the national radio station has decided what role to take in the ethnic-based conflict. It seems there has been more religious-based programming lately and many references to a "jubilee celebration" in the north of the main island. There have been numerous appeals by national religious leaders and by government spokespersons for calm, as well as appeals originating with the Red Cross to respect ethnic diversity.

Much more detail about the conflict and the response of various nations in the vicinity (such as the arrival of an Australian naval vessel to evacuate foreign nationals, and the rumours, later denied, that the Australians were charging individual evacuees for their services) has been available than through any other news source I am aware of here. All of which continues to demonstrate the tremendous value and relevance of the shortwave medium as an active agent for change in places where conflict exists or where local authorities want to get the word out (b. cooley, BC, *DXLD*)

SOMALIA R. Mogadishu, V. of the People of the Somali Republic, (pro Husayn Muhammad Aydid) here with fairly strong and clear signal from 1740 tune-in to 1900* on 6690.0 kHz, audible on USB & AM only. Included many IDs plus Koran extract & anthem at sign-off (Alan Pennington, Caversham, England, BDXC-UK)

SWEDEN R. Sweden added 15245 to 9495 for Swedish 0300, English 0330 to North America; comparative reports wanted to *magnus.nilsson@teracom.se* or fax +46 8 55542060 or P-mail: Att: HF Frequency Planning, Uf Teracom AB, P.O. Box 17666, SE-11892 Stockholm Sweden; or direct to R. Sweden (Magnus Nilsson, Teracom AB, June 6, *hard-core-dx*)

THAILAND R. Thailand, English to Europe 0530-0600, changed from 15115 to 21795, much better here (Arto Mujinen, Finland, *Electronic DX Press*)

UKRAINE RUI may have turned off the megawatt formerly used on 13590 including English at 0300-0400, but the transmission is again regularly heard, apparently with ancient 100 kW transmitter instead; some interference from Iran co-channel after 0330 (Kai Ludwig, Bob Thomas, Volodya Salmaniw, Brian Alexander, gh, *DXLD*)

USA Checking *Cumbre* report of WSHB 9430 carrying *New Dimensions* UT Sunday at 0200, instead I found BBC news in English on the frequency. Another feed mixup, if it was coming via Merlin, as New Dims is also being added to Skelton. But *ND* did appear the following weeks (gh)

The feature on shortwave numbers stations I produced aired on *Lost and Found Sound* Friday May 26 on NPR's *All Things Considered*, also available in the archive at **http://www.lostandfoundsound.com** (David Goren, *DXLD*)

Check out this interesting website of the National Association of Shortwave Broadcasters **http://www.shortwave.org** (Sheldon Harvey, Quebec, *DXLD*) Of note is that certain national SW broadcasters are not members of this, but they sure have a nice URL (gh)

URUGUAY R Montecarlo/Oriental: From regular monitoring it seems to be using only 6140 during at 1000-0300. Other ones 11735 and 9595 are not heard. I haven't contacted the station to confirm this, but that's my solid impression (Horacio A. Nigro, Montevideo, *DXLD*)

VIETNAM VOV multilingual external service on 9730 at 1600-2130 has spurs every 10 kHz from 9670 to 9790 (*Observer*, Bulgaria)

WESTERN SAHARA [non] Radio of Arabian Sahara Democratica noted again on SW from May 24. 1800-1900 and 2300-2400 Spanish, 1900-2300 Arabic on new 7497.3/7498.2/7500.0 under R. Bulgaria till 2100. Very good reception from 2100 SINP0 (45554) (Observer, Bulgaria) In late May the Polisario station was using 7500 at 0600-c0700 and at very nice strength too (Noël R. Green, UK, *BC-DX*)

National Radio of the Saharan Arab Democratic Republic also on 7500 at 2300 with news, ID, excellent signal but carrier on 7498 causing a heterodyne. Nothing on 1540 or 1550 medium wave channels where I can usually hear them. Then in early June moved to 7100 until 2357* and next day *0600 (Mike Barraclough, England, *DXLD*) Also 7100 from 1955 in Arabic but QRM by S9 carrier at 7101.6 (Zacharias Liangas, Retziki, Thessaloniki, Greece, *DXLD*) Saharan R at 1900 was again on exact 7100.00: Qur'an prayer in progress, and also two accompanied carriers like on 7498 in previous days, but now on the UPPER side on 7100.96[weak] and much stronger on 7101.83.

RTM Sebaa-Aioun (or a Moroccan Army reserve unit) is on varying 7469.79 again, only 22332 compared to Greece 55555 on nearby 7475 (Wolfgang Büschel, Germany, *DXLD*) June 6 was back on 7460 (ex 7100, 7500) at extended time of 0600-0800. Also noted evening on 7460, in the clear. Meanwhile, Morocco was wasting its time with a jamming relay on 7470 (// 15345) (Chris Greenway, UK, *World Of Radio*)

ZAMBIA Christian Voice, 4965, regularly heard at least on weekends from 2345 to 0257*, US contemporary Christian, gospel music, IDs, English religious talk. Abruptly off at 0257. Weak to poor (Brian Alexander, PA, *DXLD*)

ZANZIBAR Radio Tanzania Zanzibar, 6015, following a tip from Noël Green heard here May 29 at 2312 with continuous local pop music, brief identification in local language 2330. Fair signal on a clear channel. Noël heard 11734 with different programming earlier in the evening, testing new transmitter? (Mike Barraclough, England, *DXLD*)

ZIMBABWE The *Zimbabwe Standard* reported that a new independent station would begin June 14 on 7215 at 1700-1930 in Shona, Ndebele, English, to counter the monopoly of ZBC, likely from outside Zimbabwe, but no further details (Bill Smith, *Cumbre DX*) Likely via South Africa (gh)

Until the Next, Best of DX and 73 de Glenn!

Broadcast Logs

GLOBAL FORUM

Gayle Van Horn

0005 UTC on 4552.3
BOLIVIA: Radio Difusora Tropical. Spanish. Musical ballads to clear station ID and sign-off ine 0019. Bolivian's audible; **Radio San Miguel** 4926.5, 0020-0035 endless text and talk, very weak for ID; **Radio La Cruz del Sur** 4875, 2240-2300 with Spanish news and IDs to political text and ID repeat. (Michael Schnitzer, Germany/ *Hard Core DX*) **Radio Santa Cruz** 6134.79, 1030 station ID in Spanish. (Tom Banks, Dallas, TX)

0026 UTC on 4941
MAURITANIA: ORTM. Tentative logging for Arabic programming and stringed instrumentals to mentions of "Mauritania." (Harold Frodge, Midland, MI) sounds like this station was drifting in their frequency again..*ed.*

0100 UTC on 4825
BRAZIL: Radio Cancao Nova. Portuguese. DJ's rock/pop program format to easy-listening. Excellent full detail identification at 0058. (Frodge, MI)

0100 UTC on 9695
VIETNAM: Voice of. Political and economic news to report on human rights, audible to 0230. (William McGuire, Cheverly, MD)

0100 UTC on 6530.8
PERU: Radio Difusora Huancabamba. Identifications amid local items and 0130*. Peruvian's audible this hour, **Ondas del Rio Mayo** 6797.6; **La Voz de Campesino** 6956.7 drifting permanently 20 Hz up and down, almost non-stop music with very sporadic IDs, noted to 0300*. (Karel Honzik, Czech Rep./*HCDX*); station audible 0207-0307*; *0312-0320+ station broadcasting noticeably later and off abruptly 0312. (Frodge, MI)

0200 UTC on 9685
UNITED STATES: Voice of America. Regional news into ID and editorial on Israel and the Palestinians. World news on Russia, 11820, 0210. (McGuire, MD) Additional US broadcasters audible; **WBCQ** 7415, 0107; **WHRA** 17650, 1710; **WEWN** 11875, 1508. (Robert Carlson, Wapole, MD)

0230 UTC on 11945
GERMANY: Deutsche Welle. Financial news update to station ID. (McGuire, MD) Sports roundup show. (Carlson, MA) Deutsche Welle's Sines, **Portugal relay** audible 0520, 11810. (Tom Banks, Dallas, TX)

0500 UTC on 6110
CANADA: Radio Japan relay. Station ID into national and regional news, to item on Ethiopia. French Guiana relay noted 11895, 0500. (McGuire, MD)

1030 UTC on 12085
MONGOLIA: Voice of. English service to 1100. Presumed Mongolian service 1100-1230.Very good signal for this time of the year at my location. (Lee Silvi, Mentor, OH)

1102 UTC on 4502.52
GUATEMALA: Radio Verdad. Tentative logging with gentle choir singing into station announcements. "Verdad" audible to somber organ music, obviously of religious format. I was beginning to think this station was a figment of South American based DXers imaginations! Pleased with this catch! (David Norrie, Auckland, New Zealand/*HCDX*)

1300 UTC on 9590
SINGAPORE: Radio Singapore International. Fair to poor signal for 1300 station ID into brief national news, and magazine format features, additional ID at 1330, signal fading by 1335. Very pleased, have tried for this station for one year! (Dale Fisher, Cleveland, OH) ...congrats! *.ed*

1642 UTC on 10240
CLANDESTINE: Voice of Mujahed. Audible // 6860 with fair SINPO=34233. Announcer's political editorial amid jammer, switching to 10270 and back to 10240. (Zacharias Liangas, Thessoliniki, Greece, *HCDX*)

1744 UTC on 3200
SWAZILAND: Trans World Radio. English service with interview format of good quality. (Liangas, GRC/*HCDX*) Station noted 1900-2045 on 3200. (R.T. Harimon, Manchester, U.K.)

1750 UTC on 5009.5
MALAYSIA: RTM. Radio play at tune-in continuing past 1800. Noted co-channel interference by 1900 amid western songs, though no problem for reception of S9 quality. (Liangas, GRC/*HCDX*) **Radio 4** on 7295 1137-1217+ best ever heard! Announcer taking calls, birthday announcements, pop music to "R4" ID. News 1200-1203, more of same with annoying amateur radio interference. Poor signal but audible in lower side band. (Frodge, MI)

1755 UTC on 3270
NAMIBIA: NBC. German programs with news and ad on Namibian Internet service. Station ID 1800, news resumed on // 3290. Signal S9 on 3290 and S9+ on 3270, decreasing in quality by 1815. (Liangas, GRC/*HCDX*)

1818 UTC on 4950
ANGOLA: Radio Nacional de Angola. Portuguese sports report and national news of Angola. Excellent signal! (Mark Veldhuis, Borne, Netherlands/*HCDX*)

1838 UTC on 3320
SOUTH AFRICA: Radio Sonder Grense. Afrikaans. English easy-listening tunes to 1846 advertisement, and continued pop music format. Sports report 1851, 1900 time check into national newscast. SINPO=34333. (Veldhuis, NLD/*HCDX*)

1858 UTC on 5003.5
EQUATORIAL GUINEA: Radio Africa. Just caught closing bits of programming with station ID/frequency quote and address in Spanish. Fair signal quality . Station should be on until 2300, no luck here on rechecks. (Harimon, UK)

1910 UTC on 4976
UGANDA: Radio Uganda. English national news and sports report to world news. Very strong at SINPO=54444. Monitored later on 5026, 1911-1918 also with good signal quality. English newscast to flute melody and drum signals. Vernacular text to ID and mentions of Kampala. (Veldhuis, NLD/*HCDX*)

1930 UTC on 5985
CONGO: RTV Congalaise. French. Closing bits of an Afro pop tune to an English identification and brief newscast. Musical bridges to additional ID's audible. Very pleased to have heard this station. (R.T. Harimon, Manchester, UK)

2015 UTC on 13650
CANADA: Radio Canada International. Report on the concern of "super" salmon being a threat to wildlife.(Bob Fraser, Cohasset, MA)

2220 UTC on 13640
TURKEY: Voice of. *Turkey in a Rucksack* segment on hiking a mountain stream // 7190. (Fraser, MA) Check out more English 0300-0400, 6155 // 11655 // 21715; 1230-1330, 17830 // 21540; 1830-1930, 9785 11 11765 USB; 2030-2130, 9525. **www.tsr.gov.tr** - *ed.*

2238 UTC on 4702
BOLIVIA: Radio Eco. Extended Spanish. text into advertisements and promos. Pop music including *Mambo No. # 5* and Britney Spears tunes. DJ's ID at 2306. Bolivia's **Radio Centenario** 4855, 2255-2303*. Slogans and jingles with IDs. Tentative logging on **Radio La Palabra** 2305-2315; **Radio Mallku** 2345-2355 in Quecha service, SINPO=34323. (Michael Schnitzer, Hassfurt, Germany/ *HCDX*; Veldhuis, NLD/*HCDX*)

2300 UTC on 11775
ROMANIA: Radio Romania International. English service to 2359, // 15105 fair to good, presumed // on 11830, // 9690 barely audible. (Silvi, OH)

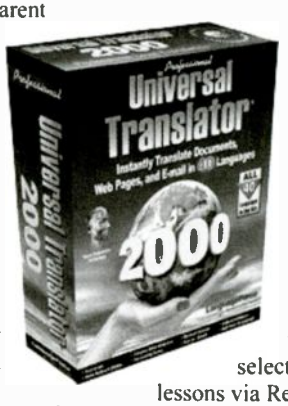
2322 UTC on 6895
ISRAEL: Galei Zahal relay. Hebrew to talks in various languages. Fair signal with what I think to be a jammer having a continuous roar noise through the audio. Identification tentative, programming included French to U.S. pop tunes. Signal peaked by 2345 with jammer following. News at 0000, signal dropping by 0006. Hadn't heard this station for a year, and was surprised to stumble upon it. (Bob Montgomery, Levittown, PA/*HCDX*) good catch Bob ..*ed.*

Thanks to our contributors — Have you sent in YOUR logs? Send to ***Gayle Van Horn****, c/o Monitoring Times (or e-mail gayle@webworkz.com)*
English broadcast unless otherwise noted.

Gayle Van Horn, gayle@webworkz.com

Language Translation Software a Boost for DXers

Language Force, the translation software experts, have released their superb Universal Translator 2000. This exceptional translating package offers document, email and a new transparent Web Page Translation section, expanded dictionaries, translations in 40 languages from one language to another, and an improved input for Chinese and Japanese as well as full Arabic/Farsi glyphing. All formatting, links and graphics remain intact and are compatible for Windows 95/98/2000 applications.



Compose your signal reports in UT2000 Editor for translation and it will post the email to Microsoft Outlook. Or want the ultimate in reception reporting? Dictate your text or have it spoken back to you! UT2000 is available from the Language Force website **www.languageforce.com** or office supply stores for $129. This software is highly recommended and an absolute boost to reception reporting.

The World Wide Web offers additional sites to translate text, and will probably be adequate. However, do not expect a letter-perfect translation, as you would from professional language software. One of the best known translation sites is BabelFish by the Alta Vista web site **www.altavista.com**. Click on the upper top link "translate," where you'll have a choice of languages to translate into English, or from any of those languages into English.

Additional sites offer a broader selection of languages. One is Inter-Tran **www.tranexp.com**. At both sites, you can either type or paste in the text you want to trans ate or list the URL for the web page that needs translating.

The web also offers online dictionaries in other languages that can help you complete those rough areas of reporting. Of course, knowing even a few basic phrases in the programming language can make a tremendous difference in reception reporting. One to check out is **www.logos.it**. You'll find a wide selection of phrases and words to translate. Another excellent site with an extensive selection of languages is **www.travlang.com**. This offers online lessons via Real Audio that teach you the familiar words of dates, times, months, and phrases...all vital to a DXer's listening sessions and reporting accurate information.

Language translation software, on line translations, language lessons...

AUSTRIA

Radio Austria International, 13730 kHz. Full data QSL letter with illegible signature. Received in 12 days for an English email report. Station address: A-1136 Vienna, Austria. Email: **roi.service@orf.at** (Charlie Washburn, Robbinston, ME)

GERMANY

Voice of Orthodoxy via Julich 11900 kHz. Confirmation letter and QSL card signed by Michel Solovieff-General Secretary. Received in seven weeks for one U.S. dollar. Station address: Boite Postal 416-08, 75366 Paris Cedex 08, France. Email: **irinavo@wanadoo.fr** (Richard Jary, Australia/*Cumbre DX*)

LITHUANIA

Radio Vilnius 9855 kHz. Full data blue QSL card unsigned. Received in 29 days for an English report and one IRC. Station address: Lietuvos Radijas, Konarskio 49, LT-2674 Vilnius, Lithuania. (Timothy M. Ford, Houston, TX) **www.lrtv.lt**

MEDIUM WAVE

KLDY-Lacey, WA. 1280 kHz AM. Verification statement signed by Skip Marrow-Owner KLDY/KBRD, noted at bottom of my AM report. Station address: 125 N. Turner, Olympia, WA 98506. (Patrick Martin, Rancho Mirage, CA)

KMPC-Los Angeles, CA. 1540 kHz AM. Full data letter signed by Chuck Haynes-Director of Sports Marketing, plus station stickers. Station address: 2800 28th St. # 133, Santa Monica, CA 90404. QSL # 2,672! (Martin, CA)

KNFT 950 kHz AM. Verification letter signed by Deniene Brown, plus coverage map and station T-shirt. Received in 25 days after AM follow up report. Station address: 5 Race Track Road, Box 1320, Silver City, NM 88062. (Martin, CA)

KQXX 1700 kHz. Prepared verification letter returned and signed by Sandra Conche. Received in 368 days. Station address: 1050 Mac Intosh, Brownsville, TX 78521. This has been the toughest QSL from an X-Bander station, only one left to verify is KBDJ 1650 kHz. (Martin, CA)

PAPUA NEW GUINEA

Radio Eastern Highlands 3395 kHz. Partial data two page letter and postcard signed by Tonko Nanao-Prov. Program Manager. Received in nine weeks for a cassette tape, SASE (used for reply) and one U.S. dollar. Station address: P.O. Box 311, Goroka, EHP, Papua New Guinea. (Greg Myers, VA/*Cumbre DX*)

QATAR

A7D Doha Radio, 12.966.5 MHZ. Full data verification letter. Received in 37 days for an English utility report, souvenir postcard and one U.S. dollar (returned) Station address: Qatar Telecomm, P.O. Box 217, Doha, Qatar. (George Clement, Powder Springs, GA)

RUSSIA

Radio Canada International relay, 7360 kHz. Full data card including notation of relay site via Chita, Siberia, signed by Bill Westenhaver, plus note and schedule. Received in 34 days for an English report of Chinese service broadcast. Station address: P.O. Box 6000, Montreal, Quebec H3C 3A8 Canada. (Washburn, ME) **<www.rcinet.ca>**

SINGAPORE

World Radio Switzerland relay 12010 kHz. Full data (relay site not noted) *Canton of Valais* card unsigned. Received in 23 days for an English report, no return postage. Station address: Giacomettistrasse 1, CH-3000 Bern 15, Switzerland. (Washburn, ME)**www.swissinfo.org**

SWEDEN

Radio Sweden 15960 kHz. Full data *Royal Warship Vasa* card with illegible veri signer. Received in 23 days for an English report. Station address: S-105 10 Stockholm, Sweden. (Washburn, ME)

SYRIA

Radio Damascus 12085 kHz. Full data Syrian scenery card with illegible signature, plus program schedule and personal note card. Received in 126 days for an English report and two U.S. dollars, days. Station address: Ommayad Square, Damascus, Syria. (Sam Wright, Biloxi, MS)

TUNISIA

Radio Tunisienne 12005 kHz. Full data card signed by Abdesselem, plus French full data French letter. Received in one year for a taped report and one IRC. Station address: Cite Ennacim Bourjel, Boite Postal 399 1080 Tunis, Tunisia. Verie says the transmitter is 100kW at 34 deg N49'20"-10 deg E51'18". Several attempts to verify this new county. (Mickey Delmage, Sherwood Oark, Alberta T8E 1H4 Canada/*Hard Core DX*) **www.radiotunis.com**

YEMEN

The Republic of Yemen Radio. Full data QSL card signed by Altashi Ali-Technical Director. Received in 229 days for an English report. Station address: (differs from WRTH 2000) P.O. Box 2371, Sana'a, Republic of Yemen. (Dimitri Mezin, Russia/*hcdx*)

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Icom R2 soft case	CAS 20	$29.95

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How to Use the Shortwave Guide

Convert your time to UTC.

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

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

Find the station you want to hear.

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

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

Day Codes

s	Sunday
m	Monday
t	Tuesday
w	Wednesday
h	Thursday
f	Friday
a	Saturday

In the same column ⑤, irregular broadcasts are indicated "tent" and programming which includes languages besides English are coded "vl" (various languages).

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 publication.

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
au:	Australia
ca:	Central America
do:	domestic broadcast
eu:	Europe
me:	Middle East
na:	North America
om:	omnidirectional
pa:	Pacific
sa:	South America
va:	various

Consult the propagation charts.

To further help you find a strong signal, we've included a chart on page 64 which takes into account conditions affecting the audibility of shortwave broadcasts. Simply pick out the section of the chart for the region in which you live and find the line for the region in which the station you want to hear is located. The chart indicates the optimum frequencies (in megahertz-MHz) for a given time in UTC. (Users outside North America can use the same procedure in reverse to find best reception from North America.)

Choose a program or station you want to hear.

Some selected programs appear on the lower half of the page for prime listening hours – space does not permit 24-hour listings. Our program manager changes the stations and programming featured each month to reflect the variety available on shortwave, though BBC programs are almost always included.

Occasionally program listings will be followed by "See X 0000." This information indicates that the program is a rerun, and refers to a previous summary of the program's content. The capital letter stands for a day of the week, using the same day codes as in the frequency listing (see above), and the four digits represent a time in UTC.

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Program Highlights

Jim Frimmel, Programming Manager

BBC News

The BBC's *On Air* magazine received lots of flak from readers (BBC listeners) about the new magazine format that listed program times mainly in local time rather than GMT. In the July issue, magazine editor Kirsty Cockburn wrote: "By popular request GMT is back on the radio schedules this month, along with some other improvements suggested by readers." No hint was given as to the "other improvements," but they had nothing to do with the very large deficiencies pointed out in this column last month.

Early Radio

In April 2002, the 1930 population census of the U.S. will meet the 72-year restriction on release of information, after which it will become available to the general public. A special high-tech question was asked by the census taker that year for the first time. The question was "Does this family own a radio set?"

A search of the U.S. Census Bureau's web site failed to find an answer to that question. The *World Radio Handbook* had not yet arrived on the scene or we would have looked it up. The question itself, however, confirms that America was jumping on the radio bandwagon. Old Time Radio is still with us, you know. Search for "OTR" on the web.

Programs

The Selected Programs in this month's listings present a completely updated listing of the BBC's total shortwave output. In other pages this month you will also find a column of programs for shortwave listeners in which are listed the most popular programs for DXers.

Adios

After more than 11 years of contributing to *Monitoring Times*, this issue contains my last regular monthly columns. The columns will continue, of course, but under new leadership to be announced next month. I hope to be a contributor in other ways, so this is a "so long" rather than goodbye.

Digital photography, a 1,091 page book on Photoshop, and a new photo and slide scanner are awaiting my attention.

And this is not a goodbye to shortwave radio. How can a guy who took his portable receiver to Hawaii last October so he could DX from his balcony on the 10th floor of the Hale Koa Hotel say goodbye to shortwave?!

Maybe now I can find the time to attend the 14th Annual Winter SWL Festival to be held March 9-10, 2001, in Kulpsville, PA, north of Philadelphia. Check Tom Sundstrom's website for details <**trsc.com**>.

Frequencies

0000	0015		Cambodia, National Radio Of	11940as			
0000	0015		Japan, Radio	6050eu	6145eu	6155af	13650as
				17810as			
0000	0027		Czech Rep, Radio Prague Intl	11615na	13580na		
0000	0030		Egypt, Radio Cairo	9900am			
0000	0030	mtwhfa	Serbia, Radio Yugoslavia	11870na			
0000	0030		Thailand, Radio	9655af	9690af	11905af	
0000	0030		UK, BBC World Service	3915as	5965as	5975na	6175na
				6195as	7110as	9410me	9590am
				9915sa	11945as	11955as	12095sa
				15280as	15310as	15360as	17615as
				17790as			
0000	0030		USA, Voice of America	7215as	9770as	11760as	15185as
				15290as	17735as	17820as	
0000	0030		USA, WRMI Miami FL	9955am			
0000	0045		India, All India Radio	7410as	9705as	9950as	11620as
				13625as			
0000	0056		North Korea, R Pyongyang	4405va	11460na	11710na	13760na
				15180na			
0000	0100		Anguilla, Caribbean Beacon	6090am			
0000	0100	vl	Australia, ABC/Alice Springs	4835do			
0000	0100	vl	Australia, ABC/Katherine	5025do			
0000	0100	vl	Australia, ABC/Tennant Creek	4910do			
0000	0100		Australia, Radio	9660pa	12080va	15240pa	17580pa
				17750as	17795va	21740va	
0000	0100		Canada, CBC Northern Service	9625do			
0000	0100		Canada, CFRX Toronto ON	6070do			
0000	0100		Canada, CFVP Calgary AB	6030do			
0000	0100		Canada, CHNX Halifax NS	6130do			
0000	0100		Canada, CHNX Halifax NS	6160do			
0000	0100		Canada, CKZU Vancouver BC	6160do			
0000	0100		Costa Rica, R for Peace Intl	6970va	15049va		
0000	0100		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
0000	0100		Ecuador, HCJB	9745na	15115na	21455usb	
0000	0100	s	Finland, YLE/R Finland	11985na	13770na		
0000	0100		Guyana, Voice of	3289do	5949do		
0000	0100		Kenya, Kenya BC Corp	4885do	4915do	4935do	
0000	0100		Kiribati, Radio	9809do	9825do		
0000	0100		Malaysia, Radio	7295do			
0000	0100		Malaysia, RTM Kota Kinabalu	5980do			
0000	0100		Malaysia, RTM Sarawak	7160do			
0000	0100	vl	Namibia, Namibian BC Corp	3270af	3289af		
0000	0100		Netherlands, Radio	6165na	9845na		
0000	0100		New Zealand, R New Zealand Int	17675va			
0000	0100		New Zealand, ZLXA	3935do	7290do		
0000	0100	vl	Papua New Guinea, NBC	9675do	11880do		
0000	0100		Singapore R Corp of Singapore	6150da			
0000	0100	vl/as	Solomon Islands, SIBC	5020do			
0000	0100	vl/a	Solomon Islands, SIBC	9545do			
0000	0100		Spain, R Exterior Espana	6055na			
0000	0100	as	UK, Global Kitchen/Merlin	3955eu	6140eu	7325eu	
0000	0100		Ukraine, R Ukraine International	5905eu	6020eu	9640eu	
				13590eu			
0000	0100		USA, Armed Forces Network	4278am	6458am	12689am	
0000	0100		USA, KAIJ Dallas TX	13815va			
0000	0100		USA, KTBN Salt Lake City UT	15590na			
0000	0100		USA, KWHR Naalehu HI	17510as			
0000	0100	twhfa	USA, Voice of America	5995am	6130ca	7405am	
				9455af	9775am	11695ca	
				13740am			
0000	0100		USA, W3CQ Monticello ME	7415na	9330na		
0000	0100		USA, WEWN Birmingham AL	5825va	13615na		
0000	0100		USA, WGTG McGaysville GA	5085va	6890am		
0000	0100		USA, WHRA Greenbush ME	7580na			
0000	0100		USA, WHRI Noblesville IN	5745na	7315sa		
0000	0100		USA, WINB Red Lion PA	12160am			
0000	0100		USA, WJCR Upton KY	7490va	13594as		
0000	0100		USA, WRNO New Orleans LA	7355na			
0000	0100		USA, WSHB Cypress Crk SC	9430na	15285am		
0000	0100		USA, WTJC Newport NC	9370na			
0000	0100	as	USA, WWBS Macon GA	11915eu			
0000	0100		USA, WWCR Nashville TN	5070na	7435na	9475na	
				13845na			
0000	0100		USA, WYFR Okeechobee FL	6085na	9505na		
0000	0100	vl	Vanuatu, Radio	3945do	4960do	7260do	
0015	0100		Japan, Radio	6050eu	6145na	6155eu	
0030	0100		Iran, VOIRI	9022am	9835na	11970na	
0030	0100		Lithuania, Radio Vilnius	9855na			
0030	0100		Sri Lanka, Sri Lanka BC Corp	4940do			
0030	0100		Sri Lanka, Sri Lanka BC Corp	4940do	6005as	6075as	
				9730as	15425as		
0030	0100		Thailand, Radio	9655na	11905as	15395na	
0030	0100		UK, BBC World Service	5965as	5975na	6175na	
				6195as	9410as	9590am	
				9915sa	11955as	12095so	
				15280as	15310as	15360as	
				17790as			
0030	0100		USA, VOA Special English	7215as	9770as	11760as	
				15185as	15290as	17735pa	
				17820as			
0030	0100	twhfa	USA, WRMI Miami FL	7385na			
0030	0100	sm	USA, WRMI Miami FL	3955am			
0050	0100		Italy, RAI International	6010na	9675na	11800na	
0050	0100		UK, International BC Tamil	11570as			

Selected Programs

Sundays

0000 UK, BBC London (am/east as/south as): World Briefing. A news program of varying lengths.
0020 UK, BBC London (am/east as/south as): Sports Roundup. The latest sports news.
0030 UK, BBC London (am): Arts in Action. New program.
0030 UK, BBC London (east as/south as): Agenda. Chris Gunness examines the latest ideas and trends.
0030 VOA (Special English): News (Special English).
0040 VOA (Special English): Words and their Stories (Special English).
0045 VOA (Special English): People in America (Special English).

Mondays

0000 UK, BBC London (am/east as/south as): World Briefing. See S 0000.
0020 UK, BBC London (am/east as/south as): Sports Roundup. See S 0020.
0030 UK, BBC London (am): The World Today. See S 0100.
0030 UK, BBC London (east as/south as): World Business Review. A look back at the previous week's business and a preview of upcoming events.
0045 UK, BBC London (east as): Letter from America. See S 0545.
0030 VOA (Special English): News (Special English).
0040 VOA (Special English): Development Report (Special English).
0045 VOA (Special English): This is America (Special English).

Tuesday-Saturday

0000 UK, BBC London (am): News. See S 1300.
0000 UK, BBC London (east as/south as): World Briefing. See S 0000.
0020 UK, BBC London (east as/south as): Sports Roundup. See S 0020.
0030 UK, BBC London (east as): World Business Report. See M 1350.
0030 VOA (Special English): News (Special English).

Tuesdays

0005 UK, BBC London (am): Meridian Ideas. See M 1405.
0030 UK, BBC London (am): The Music Mix. See M 1430.
0030 UK, BBC London (south as): The World Today. See S 0100.
0040 VOA (Special English): Agriculture Report (Special English).
0045 VOA (Special English): Science in the News (Special English).
0045 UK, BBC London (east as): Analysis. Background to current affairs.

Wednesdays

0005 UK, BBC London (am): Meridian Screen. See T 1405.
0030 UK, BBC London (am): The UK Top Twenty. See T 1430.
0030 UK, BBC London (south as): The World Today. See S 0100.
0040 VOA (Special English): Science Report (Special English).
0045 VOA (Special English): Exploration (Special English).
0045 UK, BBC London (east as): Analysis. See T 0045.

Thursdays

0005 UK, BBC London (am): Meridian Music. See W 1405.
0030 UK, BBC London (am): The UK Album Chart. See W 1430.
0030 UK, BBC London (south as): The World Today. See S 0100.
0040 VOA (Special English): Science Report (Special English).
0045 VOA (Special English): The Making of a Nation (Special English).
0045 UK, BBC London (east as): From Our Own Correspondent. See S 0230.

Fridays

0005 UK, BBC London (am): Meridian Writing. See H 1405.
0030 UK, BBC London (am): World Music. See H 1430.
0030 UK, BBC London (south as): The World Today. See S 0100.
0040 VOA (Special English): Environment Report (Special English).
0045 VOA (Special English): American Mosaic (Special English).
0045 UK, BBC London (east as): Analysis. See T 0345.

Saturdays

0005 UK, BBC London (am): Meridian Masterpiece. See M 0505.
0030 UK, BBC London (am): Music X-Press. See F 1430.
0030 UK, BBC London (south as): Science in Action. See S 0330.
0040 VOA (Special English): In the News (Special English).
0045 VOA (Special English): American Stories (Special English).
0045 UK, BBC London (east as): Analysis. See T 0045.

Hauser's Highlights

CHINA: V. of the Strait, Haixia zhi Sheng extended schedule to:

2055-2300	4900 5050 3900
2300-0100	9505 7280 6115
0755-1800	9505 7280 6115

New website **http://www.radiohx.com/** includes live webcast.

Frequencies

0100	0110		Italy, RAI International	6010na	9675na	11800na
0100	0115		Finland, YLE/R Finland	11985na	13770na	
0100	0125		Croatia, Croatian Radio	9925na		
0100	0127		Czech Rep, Radio Prague Intl	7345na	11615na	
0100	0127		Vietnam, Voice of	7250na	9695na	
0100	0130		Canada, R Canada International	5960am	9755am	11715am 13670am
				15170am	15305am	
0100	0130	s	Germany, Universal Life	9435as		
0100	0130		Hungary, Radio Budapest	9560na		
0100	0130		Iran, VOIRI	9022am	9835ca	11970na
0100	0130		Kiribati, Radio	9809do	9825do	
0100	0130		Netherlands, Radio	6165na	9845na	
0100	0130		Slovakia, R Slovakia International	5930na	7230ca	9440sa
0100	0130		Switzerland, Swiss R International	9885am	9905am	
0100	0130	twhfa	USA, Voice of America	5995am	6130ca	7405am 9455af
				9775am	13740am	
0100	0130		Uzbekistan, Radio Tashkent	7190as	9375os	9530as 9715as
0100	0145		Germany, Deutsche Welle	6040na	9640am	11810na 13720am
0100	0156		China, China Radio International	9570na		
0100	0156		North Korea, R Pyongyong	3560vo	11735va	15229va 17734va
0100	0200		Anguilla, Caribbean Beacon	6090am		
0100	0200	vl	Australia, ABC/Katherine	5025do		
0100	0200	vl	Australia, ABC/Tennant Creek	4910do		
0100	0200		Australia, Radio	9660pa	12080va	15240pa 15415as
				17580pa	17750as	17795va 21725pa
0100	0200		Canada, CBC Northern Service	9625do		
0100	0200		Canada, CFRX Toronto ON	6070do		
0100	0200		Canada, CFVP Calgary AB	6030do		
0100	0200		Canada, CHNX Halifax NS	6130do		
0100	0200		Canada, CKZN St John's NF	6160do		
0100	0200		Canada, CKZU Vancouver BC	6160do		
0100	0200		Costa Rica, R for Peace Intl	6970va	15049va	
0100	0200		Costa Rica, University Network	5030am	6150va	7375na 9725na
				11870va	13749af	
0100	0200		Cuba, Radio Havana	6000na	9820na	11705na
0100	0200		Ecuador, HCJB	9745na	15115na	21455usb
0100	0200		Guyana, Voice of	3289do	5949do	
0100	0200		Indonesia, Voice of	9525va	11784va	15149va
0100	0200	as	Italy, IRRS	7120va		
0100	0200		Japan, Radio	9515me	11860as	11870me 15325os
				15590os	17685pa	17835sa 17845po
0100	0200		Kenya, Kenya BC Corp	4885do	4915do	4935do
0100	0200		Malaysia, Radio	7295do		
0100	0200		Malaysia, RTM Kota Kinabalu	5980do		
0100	0200		Namibia, Namibian BC Corp	3270af	3289af	
0100	0200		New Zealand, R New Zealand Int	17675va		
0100	0200		New Zealand, ZLXA	3935do	7290do	
0100	0200	vl	Papua New Guinea, NBC	9675do	11880da	
0100	0200		Russia, Voice of Russia WS	9665na	11990na	11990na 12045as
				15595no	17595na	
0100	0200		Singapore R Corp of Singapore	6150do		
0100	0200	vl/os	Solomon Islands, SIBC	5020do		
0100	0200	vl/a	Solomon Islands, SIBC	9545do		
0100	0200		Spain, R Exterior Espana	6055na		
0100	0200		Sri Lanka, Sri Lanka BC Corp	4940do	6005as	6075as 9730as
				15425as		
0100	0200		UK, BBC World Service	5965as	5975na	6175no 6195as
				9410me	9590om	9915sa 11955as
				12095sa	15280as	15310os 15360os
				17790as		
0100	0200		USA, Armed Forces Network	4278am	6458am	12689am
0100	0200		USA, KAIJ Dallas TX	13815va		
0100	0200		USA, KJES Vado NM	7555na		
0100	0200		USA, KTBN Salt Lake City UT	7510na		
0100	0200		USA, KWHR Naalehu HI	17510as		
0100	0200		USA, Voice of America	7115as	9635as	11705as 11725as
				11820as	13650as	15250as 17740as
				17820as		
0100	0200		USA, WBCQ Monticello ME	7415na	9330na	
0100	0200		USA, WEWN Birmingham AL	5825na	13615na	
0100	0200		USA, WGTG McCaysville GA	5085va	6890am	
0100	0200		USA, WHRA Greenbush ME	7580na		
0100	0200		USA, WHRI Noblesville IN	5745na	7315sa	
0100	0200		USA, WINB Red Lion PA	12160am		
0100	0200		USA, WJCR Upton KY	7490va	13594as	
0100	0200	twhfa	USA, WRMI Miami FL	7385na		
0100	0200	sm	USA, WRMI Miami FL	9955am		
0100	0200		USA, WRNO New Orleans LA	7355na		
0100	0200		USA, WSHB Cypress Crk SC	9430na	15285am	
0100	0200		USA, WTJC Newport NC	9370na		
0100	0200		USA, WWCR Nashville TN	3215na	5070na	7435na 13845na
0100	0200		USA, WYFR Okeechobee FL	6065na	15165os	
0100	0200	vl	Vanuatu, Radio	3945do	4960do	7260do
0130	0145	vl	Libya, Voice of Africa	11815af	15415af	15435va
0130	0159		Canada, R Canada International	5960am	9755am	
0130	0159	sm	Canada, R Canada International	11715am	13670am	15305am
0130	0200		Austria, R Austria International	9655na	9870am	13730am
0130	0200		Slovakia, Adventist World Radio	11600as		
0130	0200		Sweden, Radio	13625as		
0130	0200		UK, RTE Radio	6155am		
0130	0200	twhfa	USA, VOA Special English	7405am	9775am	13740am
0130	0200	twhfa	USA, Voice of America	5995am	6130ca	9455af
0140	0200		Vatican City, Vatican Radio	9650au	12055au	
0145	0200		Albania, R Tirana International	6115na	7160na	

Selected Programs

Sundays

0100 UK, BBC London (am/east as/south as): The World Today. The World Service breakfast program.
0130 UK, BBC London (am): Reporting Religion. See S 0030.
0130 UK, BBC London (east as): In Praise of God. Weekly programme of worship and meditation.
0130 UK, BBC London (south as): Assignment. A weekly examination of a topical issue.
0145 UK, BBC London (am): Letter from America. Alistair Cooke shares his inimitable view of contemporary American life.

Monday-Friday

0100 UK, BBC London (am/east as): News. See S 1300.
0100 UK, BBC London (south as): The World Today. See S 0100.
0145 UK, BBC London (east as): Off the Shelf. Daily readings from the best of world literature.

Mondays

0105 UK, BBC London (am): Wright Round the World. Steve Wright's brand new show with listeners' requests and dedications.
0105 UK, BBC London (east as): Talking Point. See S 1405.

Tuesdays

0105 UK, BBC London (am): Health Matters. Keeps track of new developments in the world of medical science, as well as ways of keeping fit.
0105 UK, BBC London (east as): Outlook. See M 1205.
0130 UK, BBC London (am): Everywomon. Features and reports on the activities of women across the globe.
0130 VOA (Special English): News (Special English).
0140 VOA (Special English): Agriculture Report (Special English).
0145 VOA (Special English): Science in the News (Special English).

Wednesdays

0105 UK, BBC London (am): Following Trends (4). A science round table discussion.
0105 UK, BBC London (am): From Lab to Law (2). A discussion program about creating science policy.
0105 UK, BBC London (am): Science Perspective (1/3). Richard Hollingham and Alun Lewis.
0105 UK, BBC London (east as): Outlook. See M 1205.
0115 UK, BBC London (am): Seeing Stars (1). Heather Couper and Nigel Henbest guide listeners through all the best sky sights.
0115 UK, BBC London (am): Soundbyte (3). The computer and information technology magazine.
0130 UK, BBC London (am): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.
0130 VOA (Special English): News (Special English).
0140 VOA (Special English): Science Report (Special English).
0145 VOA (Special English): Exploration (Special English).

Thursdays

0105 UK, BBC London (am): Sports International. Live commentaries and interviews, features and discussions.
0105 UK, BBC London (east as): Outlook. See M 1205.
0130 UK, BBC London (am): From Our Own Correspondent. See S 0230.
0130 VOA (Special English): News (Special English).
0140 VOA (Special English): Science Report (Special English).
0145 VOA (Special English): The Making of a Nation (Special English).

Fridays

0105 UK, BBC London (am): One Planet. See M 1505.
0105 UK, BBC London (east as): Outlook. See M 1205.
0130 UK, BBC London (am): People and Places. See M 1530.
0130 VOA (Special English): News (Special English).
0140 VOA (Special English): Environment Report (Special English).
0145 VOA (Special English): American Mosaic (Special English).

Saturdays

0100 UK, BBC London (am/east as): News. See S 1300.
0100 UK, BBC London (south as): The World Today. See S 0100.
0105 UK, BBC London (am): Discovery. See T 1505.
0105 UK, BBC London (east as): Outlook. See M 1205.
0130 UK, BBC London (am): Variable Feature. See T 1530.
0130 UK, BBC London (south as): People and Politics. Background to the British political scene.
0130 VOA (Special English): News (Special English).
0140 VOA (Special English): In the News (Special English).
0145 VOA (Special English): American Stories (Special English).
0145 UK, BBC London (east as): Waveguide (4). The latest information on international broadcasting with reviews of receivers and news about reception.
0145 UK, BBC London (east as): Write On. Air your views about World Service; write to PO Box 76, Bush House, Strand, London WC2B 4PH.

Frequencies

0200	0210		Bangladesh, Bangla Betar	4882as			
0200	0210	mtwhf	Greece, Voice of	7450va	9420va	12110va	15630va
0200	0229		Canada, R Canada International	9755am	11715am	13670am	15170am
				15305am			
0200	0230	smwfa	Belarus, Radio Minsk	7210va	11670va		
0200	0230		Myanmar, Radio	7185do			
0200	0230	a	UK, Wales Radio Intl/Merlin	9765na			
0200	0230		USA, KJES Vado NM	7555na			
0200	0245		Germany, Deutsche Welle	9615as	11945as	11965as	
0200	0256		North Korea, R Pyongyang	11844va	13649va		
0200	0256		Romania, R Romania International	9510na	9570na	11885na	11940as
				15105pa	15380pa	17790pa	
0200	0300		Anguilla, Caribbean Beacon	6090am			
0200	0300	twhfa	Argentina, RAE	11710am			
0200	0300	vl	Australia, ABC/Alice Springs	4835do			
0200	0300	vl	Australia, ABC/Katherine	5025do			
0200	0300	vl	Australia, ABC/Tennant Creek	4910do			
0200	0300		Australia, Radio	9660pa	12080va	15240pa	15415as
				15515va	17580pa	17750as	21725pa
0200	0300		Bulgaria, Radio	9400na	11700na		
0200	0300		Canada, CBC Northern Service	9625do			
0200	0300		Canada, CFRX Toronto ON	6070do			
0200	0300		Canada, CFVP Calgary AB	6030do			
0200	0300		Canada, CHNX Halifax NS	6130do			
0200	0300		Canada, CKZN St John's NF	6160do			
0200	0300		Canada, CKZU Vancouver BC	6160do			
0200	0300		Costa Rica, R for Peace Intl	6970va	15049va		
0200	0300		Costa Rica, University Network	5030am	6150vo	7375na	9725na
				11870va	13749af		
0200	0300		Cuba, Radio Havana	6000na	9820na	11705na	
0200	0300		Ecuador, HCJB	9745na	15115na	21455usb	
0200	0300		Egypt, Radio Cairo	9475am			
0200	0300		Guyana, Voice of	3289do	5949do		
0200	0300		Kenya, Kenya BC Corp	4885do	4915do	4935do	
0200	0300		Malaysia, Radio	7295do			
0200	0300		Malaysia, RTM Kota Kinabalu	5980do			
0200	0300		Namibia, Namibian BC Corp	3270af	3289af		
0200	0300		New Zealand, R New Zealand Int	17675vo			
0200	0300		New Zealand, ZLXA	3935do	7290do		
0200	0300	vl	Papua New Guinea, N8C	9675do	11880do		
0200	0300		Russia, Voice of Russia WS	9665no	11990no	13690na	15595na
				17595na			
0200	0300		Singapore R Corp of Singapore	6150do			
0200	0300	vl/as	Solomon Islands, SIBC	5020do			
0200	0300	vl/a	Solomon Islands, SIBC	9545do			
0200	0300		South Korea, R Korea Intl	7275as	11725sa	11810sa	15575na
0200	0300		Sri Lanka, Sri Lanka BC Corp	6005as	6075as	6130do	9730as
				15425as			
0200	0300		Taiwan, R Taiwan International	5950na	9680na	11740as	11825pa
				15345as			
0200	0300		UK, BBC World Service	5975na	6135am	6175na	6195eu
				9410eu	9770af	9915sa	11760me
				11955as	12095sa	15280as	15310as
				15360as	17790as		
0200	0300		USA, Armed Forces Network	4278am	6458am	12689am	
0200	0300		USA, KAIJ Dallas TX	5755va			
0200	0300		USA, KTBN Salt Lake City UT	7510na			
0200	0300		USA, KWHR Naalehu HI	17510as			
0200	0300		USA, Voice of America	7115as	9635as	11705as	11725as
				11820as	13650as	15250as	17740as
				17820as			
0200	0300		USA, WBCQ Monticello ME	7415no	9330na		
0200	0300		USA, WEWN Birmingham AL	5825va			
0200	0300		USA, WGTG McCaysville GA	5085va	6890am		
0200	0300		USA, WHRA Greenbush ME	7580na			
0200	0300		USA, WHRI Noblesville IN	5745na	7315sa		
0200	0300		USA, WINB Red Lion PA	12160am			
0200	0300		USA, WJCR Upton KY	7490va	13594as		
0200	0300		USA, WRMI Miami FL	7385na			
0200	0300		USA, WRNO New Orleans LA	7355na			
0200	0300		USA, WSHB Cypress Creek SC	7535na	9430na		
0200	0300		USA, WTJC Newport NC	9370na			
0200	0300		USA, WWCR Nashville TN	3215na	5070na	5935na	7435na
0200	0300		USA, WYFR Okeechobee FL	6065na	9505na		
0200	0300	vl	Vanuatu, Radio	3945do	4960do	7260do	
0200	1215		Cambodia, National Radio Of	11940as			
0215	0220		Nepal, Radio	5005as	7165as		
0230	0257		Vietnam, Voice of	7250na	9695na		
0230	0300		Albania, R Tirana International	6115na	7160na		
0230	0300		Hungary, Radio Budapest	9835na			
0230	0300		Sweden, Radio	9495na			
0250	0300		Vatican City, Vatican Radio	7305am	9605am		
0250	0300	v	Zambia, National BC Corp	6165do	6265do		
0257	0300	vl	Malawi, Malawi BC Corp	3380do			

Selected Programs

Sundays

0200 UK, BBC London (am/east af/east as): The World Today. See S 0100.

0200 UK, BBC London (me/south as): The World Today. The World Service breakfast program.

0230 UK, BBC London (am/east as/me/south as): From Our Own Correspondent. BBC correspondents comment on the background to the news.

Monday-Friday

0200 UK, BBC London (am/east af/me/south as): The World Today. See S 0100.

0200 UK, BBC London (east as): News. See S 1400.

Mondays

0205 UK, BBC London (east as): Meridian Ideas. The edition that explores big cultural ideas.

0230 UK, BBC London (am): Assignment. A weekly examination of a topical issue.

0230 UK, BBC London (east as): The Music Mix. An insight into a current popular music genre.

Tuesdays

0205 UK, BBC London (east as): Meridian Screen. Interviews, documentaries, features and discussions.

0230 UK, BBC London (am): World Business Report. See S 0630.

0230 UK, BBC London (east as): The UK Top Twenty. Tim Smith presents the UK's pop countdown.

0245 UK, BBC London (am): Analysis. See M 0645.

Wednesdays

0205 UK, BBC London (east as): Meridian Music. An in-depth look at the classical music of the world.

0230 UK, BBC London (am): World Business Report. See S 0630.

0230 UK, BBC London (east as): Westway. The World Service's first-ever regular drama (soap opera) serial.

0245 UK, BBC London (am): Analysis. See M 0645.

0245 UK, BBC London (east as): The UK Album Chart. Tim Smith counts down the top ten UK album chart and plays the week's highest entries and climbers.

Thursdays

0205 UK, BBC London (east as): Meridian Writing. The literature edition.

0230 UK, BBC London (am): World Business Report. See S 0630.

0230 UK, BBC London (east as): Andy Kershaw's World of Music. Recordings of diverse music from around the world.

0245 UK, BBC London (am): From Our Own Correspondent. See S 0230.

Fridays

0205 UK, BBC London (east as): Meridian Masterpiece. See M 0605.

0230 UK, BBC London (am): World Business Report. See S 0630.

0230 UK, BBC London (east as): Music X-Press. A chance to hear the most creative new pop music and to hear it discussed by musical experts.

0245 UK, BBC London (am): Analysis. See M 0645.

Saturdays

0200 UK, BBC London (am/east af/east as/me/southas). The World Today. See S 0100.

0230 UK, BBC London (am): World Business Report. See S 0630.

0230 UK, BBC London (east af): From Our Own Correspondent. BBC correspondents comment on the background to the news.

0230 UK, BBC London (east as/me/south as): Global Business. Roger White presents this weekly series of interviews, features and discussions with the movers and shakers of the international business community.

0245 UK BBC London (am): Analysis. See M 0645.

FREQUENCIES

0300	0310	Vatican City, Vatican Radio	7305am	9605am		
0300	0325	Croatia, Croatian Radio	9925na			
0300	0327	Czech Rep, Radio Prague Intl	7345na	7385na	11615na	
0300	0330	Egypt, Radio Cairo	9475am			
0300	0330	S Africa, Adventist World Radio	6015af			
0300	0330	S Africa, Channel Africa	6035af			
0300	0330	Thailand, Radio	9655na	11905am	15395na	
0300	0330 smtwh	USA, Voice of America	4960af			
0300	0345	Germany, Deutsche Welle	9535na	9640na	11810na	
			13780am	15105na		
0300	0356	China China Radio International	9690na			
0300	0400	Anguilla, Caribbean Beacon	6090am			
0300	0400 vl	Australia, ABC/Alice Springs	4835do			
0300	0400 vl	Australia, ABC/Katherine	5025do			
0300	0400 vl	Australia, ABC/Tennant Creek	4910do			
0300	0400	Australia, Radio	9660pa	12080va	15240pa	
			15415as	15515va	17580pa	
			17750as	21725pa		
0300	0400 vl	Botswana, Radio	3356do	4820do	7255do	
0300	0400	Canada, CBC Northern Service	9625do			
0300	0400	Canada, CFRX Toronto ON	6070do			
0300	0400	Canada, CFVP Calgary AB	6030do			
0300	0400	Canada, CHNX Halifax NS	6130do			
0300	0400	Canada, CKZN St John's NF	6160do			
0300	0400	Canada, CKZU Vancouver BC	6160do			
0300	0400	Costa Rica, Faro del Caribe	5054ca	6175ca	9644ca	
0300	0400	Costa Rica, R for Peace Intl	6970va	15049va		
0300	0400	Costa Rica, University Network	5030am	6150va	7375na	9725na
			11870va	13749af		
0300	0400	Cuba, Radio Havana	6000na	9820na	11705na	
0300	0400	Ecuador, HCJB	9745na	15115na	21455usb	
0300	0400 vl	Guatemala, Radio Cultural	3300do	5955do		
0300	0400	Guyana, Voice of	3289do	5949do		
0300	0400 sm	Honduras, Radio Luz y Vida	3250ca			
0300	0400 irreg	Iraq, Radio Iraq International	9684va	11787va		
0300	0400	Japan, Radio	17825ca	21610pa		
0300	0400	Kenya, Kenya BC Corp	4885do	4915do	4935do	
0300	0400 vl	Lesotho, Radio	4800do			
0300	0400	Malaysia, Radio	7295do			
0300	0400	Malaysia, Voice of Islam	6175as	9750as	15295as	
0300	0400 stwhfa	Mexico, R Mexico International	9705am			
0300	0400	Namibia, Namibian BC Corp	3270af	3289af		
0300	0400	New Zealand, R New Zealand Int	17675va			
0300	0400	Oman, Radio Sultanate of	15355va			
0300	0400 vl	Papua New Guineo, NBC	9675do	11880do		
0300	0400	Russia, Voice of Russia WS	7125na	9665na	11990na	
			15595na	17595na	17650na	
			17660na	17690na		
0300	0400 vl	Rwanda, Radio	6055do			
0300	0400	Singapore R Corp of Singapore	6150da			
0300	0400 vl/as	Solomon Islands, SIBC	5020do			
0300	0400 vl/a	Solomon Islands, SIBC	9545do			
0300	0400	Sri Lanka, Sri Lanka BC Corp	6005as	6075as	6130do	9730as
			15425as			
0300	0400	Taiwan, R Taiwan International	5950na	9680na	11745as	11825as
			15345as			
0300	0400	Turkey, Voice of	6155va	11655as	21715as	
0300	0400	Uganda, Radio	4976do	5026do		
0300	0400	UK, BBC World Service	3255af	5975na	6005af	6135om
			6175na	6190af	6195eu	7120af
			7160af	9410eu	11730af	11760me
			11955as	12095af	15280as	15310as
			15360as	17760as	17790as	21660as
0300	0400	Ukraine, R Ukraine International	6020eu	9640eu	12045eu	13590eu
0300	0400	USA, Armed Forces Network	4278am	6458am	12689am	
0300	0400	USA, KAIJ Dallas TX	5755va			
0300	0400	USA, KTBN Salt Lake City UT	7510na			
0300	0400 vl	USA, KVOH Los Angeles CA	9975am			
0300	0400	USA, KWHR Naalehu HI	17510as			
0300	0400	USA, Voice of America	6080af	6115af	7105af	7275af
			7290af	7340af	9575af	9885af
			17725af			
0300	0400	USA, WBCQ Monticello ME	7415na	9330na		
0300	0400	USA, WEWN Birmingham AL	5825va			
0300	0400	USA, WGTG McCaysville GA	5085va	6890am		
0300	0400	USA, WHRA Greenbush ME	7580na			
0300	0400	USA, WHRI Noblesville IN	5745na	7315sa		
0300	0400	USA, WINB Red Lion PA	12160am			
0300	0400	USA, WJCR Upton KY	7490va	13594as		
0300	0400	USA, WRMI Miami FL	7385na			
0300	0400	USA, WRNO New Orleans LA	7395na			
0300	0400	USA, WSHB Cypress Crk SC	11930eu			
0300	0400	USA, WTJC Newport NC	9370na			
0300	0400	USA, WWCR Nashville TN	3215na	5070na	5935na	7435na
0300	0400	USA, WYFR Okeechobee FL	6065na	9505na		
0300	0400 vl	Vanuatu, Radio	3945do	4960do	7260do	
0300	0400 vl	Zambia, National BC Corp	6165do	6265do		
0300	0400 vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045do		
0310	0340	Vatican City, Vatican Radio	9660af			
0330	0345 vl	Libya, Voice of Africa	11815af	15415af	15435va	
0330	0357	Czech Rep, Radio Prague Intl	11600as	15470os		
0330	0357	Vietnam, Voice of	9795na	9830na		
0330	0400	Sweden, Radio	9495no	15245na		
0330	0400	UAE, Radio Dubai	12005na	13675na	15395na	15400na
0345	0400 f	Seychelles, FEBA Radio	11885af			
0357	0400 vl	Malawi, Malawi BC Corp	5995do			
0359	0400	Zambia, Christian Voice	6065do			

SELECTED PROGRAMS

Sundays

0300 UK, BBC London (am/east as/me/south as): World Briefing. Half-hour of news in depth.
0300 UK, BBC London (east af): News Briefing. A news program of varying lengths.
0320 UK, BBC London (am/east af/east as/me/south as): Sports Roundup. See S 0020.
0330 UK, BBC London (am/east as/me/south as): Science in Action. The latest in science and technology.
0330 UK, BBC London (east af): Postmark Africa. Expert answers to any question under the sun.

Monday-Friday

0330 UK, BBC London (east af): Network Africa. Breakfast show of news, sport, personalities, music, and listener's comments.
0330 UK, BBC London (me): World Business Review. A look back at the previous week's business and a preview of upcoming events.
0345 UK, BBC London (am/south as): Off the Shelf. Daily readings from the best of world literature.

Mondays

0300 UK, BBC London (am/east as/me): World Briefing. See S 0300.
0300 UK, BBC London (east as/south as): News. See S 1400.
0305 UK, BBC London (east as): One Planet. Charles Haviland, Richard Black host this program about development and the environment.
0305 UK, BBC London (south as): Talking Point. See S 1405.
0320 UK, BBC London (am/af/me): Sports Roundup. See S 0020.
0330 UK, BBC London (am): Westway Compilation Edition. Catch up on the week's episodes of the World Service's drama serial.
0330 UK, BBC London (east as): People and Places. A forum to exchange views and experience on a global scale.
0345 UK, BBC London (me): Waveguide (4). The latest information on international broadcasting with reviews of receivers and news about reception.
0345 UK, BBC London (me): Write On. Air your views about World Service; write to PO Box 76, Bush House, Strand, London WC2B 4PH.

Tuesday-Saturday

0300 UK, BBC London (am/east as/south as): News. See S 1300.
0300 UK, BBC London (east af/me): World Briefing. See S 030C.
0320 UK, BBC London (east af/me): Sports Roundup. See S 0320.
0345 UK, BBC London (me): Analysis. Background to current affairs. (except thu)

Tuesdays

0305 UK, BBC London (am): Omnibus. Each week a half-hour programme on practically any topic under the sun.
0305 UK, BBC London (east as): Discovery. In-depth look at scientific research.
0305 UK, BBC London (south as): Outlook. See M 1305.
0330 UK, BBC London (am): Body and Mind. A new health strand which deals with how health and medicine relates to you.
0330 UK, BBC London (east as): Variable Feature. Special features and new series.

Wednesdays

0305 UK, BBC London (am): The Alternative. A time spot for a changeable music program such as John Peel or Steve Lamacq.
0305 UK, BBC London (east as): Health Matters. See M 1105.
0305 UK, BBC London (south as): Outlook. See M 1305.
0330 UK, BBC London (am): Patterns of Faith. See M 2345.
0330 UK, BBC London (east as): Everywoman. See M 1130.

Thursdays

0305 UK, BBC London (am): The Greenfield Collection. See S 2330.
0305 UK, BBC London (east as): Following Trends (4). See T 1`05.
0305 UK, BBC London (east as): From Lob to Low (2). See T 1105.
0305 UK, BBC London (east as): Science Perspective (1/3). See T 1105.
0305 UK, BBC London (south as): Outlook. See M 1305.
0315 UK, BBC London (east as): Seeing Stars (1). See T 1115.
0315 UK, BBC London (east as): Soundbyte (3). See T 1115.
0330 UK, BBC London (am): Plain English. See T 2345.
0330 UK, BBC London (east as): Focus on Faith. See T 1130.
0345 UK, BBC London (me): From Our Own Correspondent. See S 0230.

Fridays

0305 UK, BBC London (am): Jazzmatazz. See S 1305.
0305 UK, BBC London (east as): Sports International. See W 1105.
0305 UK, BBC London (south as): Outlook. See M 1305.
0330 UK, BBC London (am): Heart and Soul. See W 2345.
0330 UK, BBC London (east as): Pick of the World. See W 1130.

Saturdays

0305 UK, BBC London (am): Variable Comedy/Quiz Feature. See M 0530.
0305 UK, BBC London (east as): Wright Round the World. Steve Wright's brand new show with listeners' requests and dedications.
0305 UK, BBC London (south as): Outlook. See M 1305.
0330 UK, BBC London (am): Waveguide (4). The latest information on int'l broadcasting with reviews of receivers and news about reception.
0330 UK, BBC London (am): Write On. Air your views about World Service; write to PO Box 76, Bush House, Strand, London WC2B 4PH.
0330 UK, BBC London (east af): African Quiz (1). A monthly test of the listener's knowledge of Africa.
0330 UK, BBC London (east af): This Week and Africa. A roundup of the week's political developments across the continent.
0330 UK, BBC London (me): World Business Report. See M 1420.
0345 UK, BBC London (am): Off the Shelf. See M 1345.
0345 UK, BBC London (south as): Waveguide (4). The latest information on int'l broadcasting with reviews of receivers and news about reception.
0345 UK, BBC London (south as): Write On. Air your views about World Service; write to PO Box 76, Bush House, Strand, London WC2B 4PH.

Frequencies

0400	0405	USA, WWCR Nashville TN	5070na	5935no	7435na	
0400	0405 sm	USA, WWCR Nashville TN	3210na			
0400	0405 twhfa	USA, WWCR Nashville TN	3215na			
0400	0429 as	Canada, R Canada International	11835me	11975me	15215me	
0400	0430	Belgium, Radio Vlaanderen Intl	15565am			
0400	0430	Israel, Kol Israel	9435va	15640va	17535va	
0400	0430 twhfa	Mexico, R Mexico International	9705am			
0400	0430 vl	Nigeria, Radio/Koduna	6090do	7275do		
0400	0430	S Africa, Channel Africa	5955af			
0400	0430	Sri Lanka, Sri Lanka BC Corp	6005as	6075as	6130do	9730os
			15425as			
0400	0430	Switzerland, Swiss R International	9610eu	9885am	9905am	
0400	0445	Germany, Deutsche Welle	7225af	9565af	9765af	13690af
0400	0455	USA, WYFR Okeechobee FL	6065na	9505na	9985eu	
0400	0456	China China Radio International	9730na			
0400	0456	Romania, R Romania International	11940na	15105na	15335as	17745as
0400	0500	Anguilla, Caribbean Beacon	6090am			
0400	0500 vl	Australia, ABC/Alice Springs	4835do			
0400	0500 vl	Australia, ABC/Katherine	5025do			
0400	0500 vl	Australia, ABC/Tennant Creek	4910do			
0400	0500	Australia, Radio	9660pa	12080va	15240pa	15415as
			15515va	17580pa	17750as	21725pa
0400	0500 vl	Botswana, Radio	3356do	4820do	7255do	
0400	0500 vl	Cameroon, RTV/Yaounde	4850do			
0400	0500	Canada, CBC Northern Service	9625do			
0400	0500	Canada, CFRX Toronto ON	6070do			
0400	0500	Canada, CFVP Calgary AB	6030do			
0400	0500	Canada, CHNX Halifax NS	6130do			
0400	0500	Canada, CKZN St John's NF	6160do			
0400	0500	Canada, CKZU Vancouver BC	6160do			
0400	0500	Costa Rica, R for Peace Intl	6970va	15049va		
0400	0500	Costa Rica, University Network	5030am	6150va	7375na	9725na
			11870va	13749af		
0400	0500	Cuba, Radio Havana	6000na	9820na	11705na	
0400	0500	Ecuador, HCJB	9745na	15115na	21455usb	
0400	0500 vl	Guatemala, Radio Cultural	3300do	5955do		
0400	0500	Guyana, Voice of	3289do	5949do		
0400	0500	Kenya, Kenya BC Corp	4885do	4915do	4935do	
0400	0500 vl	Lesotho, Radio	4800do			
0400	0500 vl	Malawi, Malawi BC Corp	3380do	5995do		
0400	0500	Malaysia, Radio	7295do			
0400	0500	Malaysia, Voice of Islam	6175as	9750as	15295as	
0400	0500	Namibia, Namibian BC Corp	3270af	3289af		
0400	0500	New Zealand, R New Zealand Int	17675va			
0400	0500	New Zealand, ZLXA	3935do	7290do		
0400	0500 vl	Nigeria, Radio/Enugu	6025do			
0400	0500 vl	Papua New Guinea, NBC	9675do	11880do		
0400	0500	Russia, Voice of Russia WS	7125na	9665na	11990na	15595na
			17565na	17650na	17660no	17690na
0400	0500 vl	Rwanda, Radio	6055do			
0400	0500	Singapore R Corp of Singapore	6150do			
0400	0500 vl/as	Solomon Islands, SIBC	5020do			
0400	0500 vl/o	Solomon Islands, SIBC	9545do			
0400	0500	Uganda, Radio	4976do	5026do		
0400	0500	UK, BBC World Service	3255af	5975na	6005af	6005af
			6135am	6175na	6190af	6195eu
			7120af	7160af	9410eu	11760me
			12095eu	15280as	15310eu	15420af
			15575me	17640af	17760as	17790os
			21660as	21830as		
0400	0500	USA, Armed Forces Network	4278am	6458am	12689am	
0400	0500	USA, KAIJ Dallas TX	5755va			
0400	0500	USA, KTBN Salt Lake City UT	7510na			
0400	0500 vl	USA, KVOH Los Angeles CA	9975am			
0400	0500	USA, KWHR Naalehu HI	17780os			
0400	0500	USA, Voice of America	6080af	7170va	7265af	7275af
			7290af	9575af	9885af	11965me
			15205va	17725af		
0400	0500	USA, WBCQ Monticello ME	7415na	9330na		
0400	0500	USA, WEWN Birmingham AL	5825va			
0400	0500	USA, WGTG McCaysville GA	5085va	6890am		
0400	0500	USA, WHRA Greenbush ME	7580na			
0400	0500	USA, WHRI Noblesville IN	5745na	7315sa		
0400	0500	USA, WJCR Upton KY	7490va	13594as		
0400	0500 stwhfa	USA, WRMI Miami FL	7385na			
0400	0500 m	USA, WRMI Miami FL	9955am			
0400	0500	USA, WRNO New Orleans LA	7395na			
0400	0500	USA, WSHE Cypress Crk SC	11930eu	15195af		
0400	0500	USA, WTJC Newport NC	9370na			
0400	0500	Zambia, Christian Voice	6065do			
0400	0500 vl	Zambia, National BC Corp	6165do	6265do		
0400	0500 vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045do		
0405	05000	USA, WWCR Nashville TN				3210na
			5070na	5935na	7435na	
0425	0440	Italy, RAI International	5975af	7150af		
0430	0500	Austria, R Austria International	6015na	6155eu	13730eu	
0430	0500	Italy, IRRS	3985va			
0430	0500	Netherlands, Radio	6165na	9590no		
0430	0500 vl	Nigeria, Radio/Ibadan	6050do			
0430	0500 v	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
0430	0500 vl	Nigeria, Radio/Lagos	3326do	4990do		
0430	0500	S Africa, World Beacon	6115af			
0430	0500	Serbia, Radio Yugoslavia	11870na			
0430	0500	Sri Lanka, Sri Lanka BC Corp	6130do			
0430	0500	Swaziland, Trans World Radio	3200af	4775af		
0430	0500	Switzerland, Swiss R International	9885am	9905am		
0445	0500	USA, WYFR Okeechobee FL	9985eu			

Selected Programs

Sundays

0400 UK, BBC London (am/east af/east as/eu/me/south cs): The World Today. See S 0100.

0430 UK, BBC London (am): Global Business. Roger White presents this weekly series of interviews, features and discussions with the movers and shakers of the international business community.

0430 UK, BBC London (east af): African Perspective. A considered view of life and issues facing the African continent.

0430 UK, BBC London (east as): Omnibus. Each week a half-hour programme on practically any topic under the sun.

0430 UK, BBC London (eu): Global Business. Roger White presents this weekly series of interviews, features and discussions with the movers and shakers of the international business community.

0430 UK, BBC London (me/south as): In Praise of God. Weekly programme of worship and meditation.

Mondays

0400 UK, BBC London (am/east af/east as/eu/me): The World Today.

0400 UK, BBC London (south as): News. See S 1300.

0405 UK, BBC London (south as): Meridian Ideas. The edition that explores big cultural ideas.

0430 UK, BBC London (east af/east as): Network Africa. See M 0330.

0430 UK, BBC London (south as): The Music Mix. An insight into a current popular music genre.

0450 UK, BBC London (am/eu/me): Sports Roundup. See S 0020.

Tuesdays

0400 UK, BBC London (am/east af/east as/eu/me): The World Today.

0400 UK, BBC London (south as): News. See S 1300.

0405 UK, BBC London (south as): Meridian Screen. Interviews, documentaries, features and discussions.

0430 UK, BBC London (east af): Network Africa. See M 0330.

0430 UK, BBC London (east as): Sports Roundup. See S 0020.

0430 UK, BBC London (south as): The UK Top Twenty. Tim Smith presents the UK's pop countdown.

0450 UK, BBC London (am/eu/me): Sports Roundup. See S 0020.

Wednesdays

0400 UK, BBC London (am/east af/east as/eu/me): The World Today. See

0400 UK, BBC London (south as): News. See S 1300.

0405 UK, BBC London (south as): Meridian Music. An in-depth look at the classical music of the world.

0430 UK, BBC London (east af): Network Africa. See M 0330.

0430 UK, BBC London (east as): Sports Roundup. See S 0020.

0430 UK, BBC London (south as): The UK Album Chart. Tim Smith counts down the top ten UK album chart and plays the week's highest entries and climbers.

0450 UK, BBC London (am/eu/me): Sports Roundup. See S 0020.

Thursdays

0400 UK, BBC London (am/east af/east as/eu/me): The World Today.

0400 UK, BBC London (south as): News. See S 1300.

0405 UK, BBC London (south as): Meridian Writing. The literature edition.

0430 UK, BBC London (east af): Network Africa. See M 0330.

0430 UK, BBC London (east as): Sports Roundup. See S 0020.

0430 UK, BBC London (south as): Andy Kershaw's World of Music. Recordings of diverse music from around the world.

0450 UK, BBC London (am/eu/me): Sports Roundup. See S 0020.

Fridays

0400 UK, BBC London (am/east af/east as/eu/me): The World Today. See S 0100.

0400 UK, BBC London (south as): News. See S 1300.

0405 UK, BBC London (south as): Meridian Masterpiece. Classical performances.

0430 UK, BBC London (east af): Network Africa. See M 0330.

0430 UK, BBC London (east as): Sports Roundup. See S 0020.

0430 UK, BBC London (south as): Music X-Press. A chance to hear the most creative new pop music and to hear it discussed by musical experts.

0450 UK, BBC London (am): Assignment. See M 0230.

0450 UK, BBC London (eu/me): Sports Roundup. See S 0620.

Saturdays

0400 UK, BBC London (am/east af/east as/eu/me/south as): The World Today. See S 0100.

0430 UK, BBC London (am): Global Business. See S 0430.

0430 UK, BBC London (east af): Talkabout Africa. See W 1630.

0430 UK, BBC London (east as/me/south as): Assignment. A weekly examination of a topical issue.

0430 UK, BBC London (eu): Weekend. European magazine program coproduced by European broadcasters.

Frequencies

0500	0504	Pakistan, Radio	15175me	17834me	21465me	
0500	0515	Canada, CBC Northern Service	9625do			
0500	0520	Vatican City, Vatican Radio	4005eu	5880eu	7250eu	9660af
			11625af	15570af		
0500	0529	Canada, R Canada International	5995am	6145va	7290va	9595va
			9755am	11710va	11830am	13755va
			15330va			
0500	0530	Netherlands, Radio	6165na	9590na		
0500	0530	S Africa, Adventist World Radio	5960af	6015af		
0500	0530	S Africa, Channel Africa	11720af			
0500	0530	Switzerland, Swiss R International	9610eu			
0500	0530	Uganda, Radio	4976do	5026do		
0500	0530	USA, WRMI Miami FL	7385na			
0500	0530 vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045do		
0500	0545	Germany, Deutsche Welle	9670na	9785na	11810na	11985na
0500	0556	China China Radio International	9560na			
0500	0600	Anguilla, Caribbean Beacon	6090am			
0500	0600 vl	Australia, ABC/Alice Springs	4835do			
0500	0600 vl	Australia, ABC/Katherine	5025do			
0500	0600 vl	Australia, ABC/Tennant Creek	4910do			
0500	0600	Australia, Radio	9660pa	12080va	15240pa	15515va
			17580pa	21725po		
0500	0600 as	Australia, Radio	17750as			
0500	0600 vl	Botswana, Radio	3356do	4820do	7255do	
0500	0600 vl	Cameroon, RTV/Yaounde	4850do			
0500	0600	Canada, CFRX Toronto ON	6070do			
0500	0600	Canada, CFVP Calgary AB	6030do			
0500	0600	Canada, CHNX Halifax NS	6130do			
0500	0600	Canada, CKZN St John's NF	6160do			
0500	0600	Canada, CKZU Vancouver BC	6160do			
0500	0600	Costa Rica, R for Peace Intl	6970va	15049va		
0500	0600	Costa Rica, University Network	5030am	6150va	7375na	9725na
			11870va	13749af		
0500	0600	Cuba, Radio Havana	9550na	9820na	9830na	
0500	0600	Ecuador, HCJB	9745na	15115na	21455usb	
0500	0600	Guyana, Voice of	3289do	5949do		
0500	0600	Italy, IRRS	3985va			
0500	0600	Japan, Radio	5975eu	6110na	7230eu	11715as
			11760as	11840as	13630na	15590pa
0500	0600	Kenya, Kenya BC Corp	4885do	4915do	4935do	
0500	0600	Kiribati, Radio	9809do	9825do		
0500	0600	Kuwait, Radio	15110as	15230as		
0500	0600 vl	Lesotho, Radio	4800do			
0500	0600 vl	Liberia, R Liberia International	5100do			
0500	0600 vl	Malawi, Malawi BC Corp	3380do	5995do		
0500	0600	Malaysia, Radio	7295do			
0500	0600	Malaysia, RTM Sarawak	7160do			
0500	0600	Malaysia, Voice of Islam	6175as	9750as	15295as	
0500	0600	Namibia, Namibian BC Corp	3270af	3289af		
0500	0600	New Zealand, R New Zealand Int	17675va			
0500	0600	New Zealand, ZLXA	3935do	7290do		
0500	0600 vl	Nigeria, Radio/Enugu	6025do			
0500	0600 vl	Nigeria, Radio/Ibadan	6050do			
0500	0600 vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
0500	0600 vl	Nigeria, Radio/Lagos	3326do	4990do		
0500	0600 vl	Nigeria, Voice of	7255af	15120af		
0500	0600 vl	Papua New Guinea, NBC	9675do	11880do		
0500	0600	Russia, Voice of Russia WS	17625au	17665au	21790au	
0500	0600 vl	Rwanda, Radio	6055do			
0500	0600	S Africa, World Beacon	6115af			
0500	0600	Singapore R Corp of Singapore	6150do			
0500	0600 vl	Solomon Islands, SIBC	5020do	9545do		
0500	0600	Spain, R Exterior Espona	6055na			
0500	0600	Sri Lanka, Sri Lanka BC Corp	6130do			
0500	0600	Swaziland, Trans World Radio	4775af	6100af	9500af	
0500	0600	UK, BBC World Service	3255af	5975na	6005af	6175am
			6190af	6195eu	7160af	9410eu
			9740as	11760me	11765af	11955pa
			12095eu	15280as	15310as	15360as
			15420af	15575me	17640me	17760as
			17790as	17885af	21660as	
0500	0600	USA, Armed Forces Network	4278am	6458am	12689am	
0500	0600	USA, KAIJ Dallas TX	5755va			
0500	0600	USA, KTBN Salt Lake City UT	7510na			
0500	0600 vl	USA, KVOH Los Angeles CA	9975am			
0500	0600	USA, KWHR Naalehu HI	11565pa	17780as		
0500	0600	USA, Voice of America	5970af	6035af	6080af	7170va
			7195af	11965me	12080af	13670af
			15205va			
0500	0600	USA, WBCQ Monticello ME	7415na	9330na		
0500	0600	USA, WEWN Birmingham AL	5825va			
0500	0600	USA, WGTG McCaysville GA	5085va	6890am		
0500	0600	USA, WHRA Greenbush ME	11565af			
0500	0600	USA, WHRI Noblesville IN	5745na	7315sa		
0500	0600	USA, WJCR Upton KY	7490va	13594as		
0500	0600	USA, WRNO New Orleans LA	7395na			
0500	0600	USA, WSHB Cypress Crk SC	11930eu	9840af		
0500	0600	USA, WTJC Newport NC	9370na			
0500	0600	USA, WWCR Nashville TN	2390na	3210na	5070na	5935no
0500	0600	USA, WYFR Okeechobee FL	5985na	9985eu	11580eu	
0500	0600 vl	Vanuatu, Radio	3945do	4960do	7260do	
0500	0600	Zambia, Christian Voice	6065do			
0500	0600 vl	Zambia, National BC Corp	6165do	6265do		
0505	0510	Croatia, Croatian Radio	9470au	11970al		
0520	0530	Vatican City, Vatican Radio	9660af	11625af	15570af	
0525	0600 vl	Ghana, Ghana BC Corp	3366do	4915do		
0530	0600	Georgia, Georgian Radio	11805eu			
0530	0600	Thailand, Radio	9655eu	11905eu	21795eu	
0530	0600	UAE, Radio Dubai	13675au	15435au	21700au	
0530	0600 mtwhfa	USA, WRMI Miami FL	7385na			
0530	0600 vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do		

Selected Programs

Sundays

0500 UK, BBC London (am/east af/east as/eu/me/south as/west af): The World Today. The World Service breakfast program.
0530 UK, BBC London (am): Play of the Week. A different radio drama program each week.
0530 UK, BBC London (east af/west af): Art Beat. A new arts program for Africa.
0530 UK, BBC London (east as): Reporting Religion. New program.
0530 UK, BBC London (eu): Science in Action. The latest in science and technology.
0530 UK, BBC London (me): Global Business. Roger White presents this weekly series of interviews, features and discussions with the movers and shakers of the international business community.
0530 UK, BBC London (south as): Reporting Religion. New program.
0545 UK, BBC London (east as/south as): Letter from America. Alistair Cooke shares his inimitable view of contemporary American life.

Monday-Friday

0500 UK, BBC London (am/south as): News. See S 1300.
0500 UK, BBC London (east af/east as/eu/me/west af): The World Today. See S 0200.
0530 UK, BBC London (east af/west af): Network Africa. See M 0330.
0545 UK, BBC London (east as): Off the Shelf. See M 0145.

Mondays

0505 UK, BBC London (am): Meridian Masterpiece. Classical performances.
0505 UK, BBC London (south as): One Planet. Charles Haviland and Richard Black host this new program about development and the environment.
0530 UK, BBC London (am): Variable Comedy/Quiz Feature. These programs are panel quizes and other light entertainment in a format heard in America decades ago.
0530 UK, BBC London (east as): Body and Mind. A new health strand which deals with how health and medicine relates to you.
0530 UK, BBC London (south as): People and Places. A forum to exchange views and experience on a global scale.

Tuesdays

0505 UK, BBC London (am): Meridian Ideas. See M 1405.
0505 UK, BBC London (south as): Discovery. In-depth look at scientific research.
0530 UK, BBC London (am): The Music Mix. See M 1430.
0530 UK, BBC London (east as): Patterns of Faith. See M 1245.
0530 UK, BBC London (south as): Variable Feature. Special features.

Wednesdays

0505 UK, BBC London (am): Meridian Screen. See T 1405.
0505 UK, BBC London (south as): Health Matters. See M 1605.
0530 UK, BBC London (am): The UK Top Twenty. See T 1430.
0530 UK, BBC London (east as): Plain English. See T 1245.
0530 UK, BBC London (south as): Everywoman. See M 1630.

Thursdays

0505 UK, BBC London (am): Meridian Music. See W 1405.
0505 UK, BBC London (south as): Following Trends (4). See T 1605.
0505 UK, BBC London (south as): From Lab to Law (2). See T 1605.
0505 UK, BBC London (south as): Science Perspective (1). See T 1605.
0505 UK, BBC London (south as): Science Perspective (3). See T 1605.
0515 UK, BBC London (south as): Seeing Stars (1). See T 1615.
0515 UK, BBC London (south as): Soundbyte (3). See T 1615.
0530 UK, BBC London (am): Omnibus. See T 0305.
0530 UK, BBC London (east as): Heart and Soul. See W 1245.
0530 UK, BBC London (south as): Focus on Faith. See T 1630.

Fridays

0505 UK, BBC London (am): Meridian Writing. See H 1405.
0505 UK, BBC London (south as): Sports International. See W 1605.
0530 UK, BBC London (am): World Music. See H 1430.
0530 UK, BBC London (east as): Best of the Edge. See H 1245.
0530 UK, BBC London (south as): Pick of the World. See W 1630.

Saturdays

0500 UK, BBC London (am/south as): News. See S 1300.
0500 UK, BBC London (east af/east as/eu/me/west af): The World Today. See S 0200.
0505 UK, BBC London (am/south as): Wright Round the World. See M 0105.
0530 UK, BBC London (east af): African Quiz (1). See A 0330.
0530 UK, BBC London (east af): This Week and Africa. See A 0330.
0530 UK, BBC London (east as/eu/me): Arts in Action. See S 0530.
0530 UK, BBC London (west af): Talkabout Africa. See W 1630.

GRUNDIG Best in Technology

Yacht Boy 400 Professional Edition (YB 400PE)

The most powerful compact Radio AM/FM Shortwave Receiver.

"The Best compact shortwave portable we have tested" Lawrence Magne.-Editor in Chief, Passport to World Band Radio.

The Big Breakthrough! Power, performance, and design have reached new heights! The Grundig 400 Professional Edition with its sleek titanium look is packed with features like no other compact radio in the world.

Pinpoint Accuracy! The Grundig 400PE does it all: pulls in AM, FM, FM-Stereo, every shortwave band (even aviation and ship-to-shore)-all with lock-on digital precision.

Ultimate Features. Auto tuning! The Grundig 400PE has auto tuning on shortwave and stops at every signal and lets you listen. With the exceptional sensitivity of the 400PE, you can use the auto tune to catch even the weakest of signals.
Incredible timing features! The Grundig 400PE can send you to sleep listening to your favorite music.
You can set the alarm to wake up to music or the morning traffic report, then switch to BBC shortwave for the world news.
The choice is yours!

Powerful Memory! Described as a smart radio with 40 memory positions, the Grundig 400PE remembers your favorites-even if you don't!

Never Before Value! Includes deluxe travel pouch, stereo earphones, owners manual, external antenna and a 9 volt Grundig AC adapter. Uses 6 AA batteries (not included)

Style • Titanium look

Shortwave, AM and FM • Continuous shortwave from 1.6 - 30 MHz, covering all existing shortwave bands plus FM-stereo, AM and longwave. • Single sideband (SSB) circuitry allows for reception of two-way communication such as amateur radio, military, commercial air-to-ground, and ship-to-shore.

Memory Positions • 40 randomly programmable memory positions allow for quick access to favorite stations.

Multi-function Liquid Crystal Display • The LCD simultaneously displays the time, frequency, band, alarm and sleep timer

Clock, Alarm and Timer • Two alarm modes: Beeper and radio.
• Dual clocks show time in 24 hour format.
• Sleep timer programmable in 15 minute increments.

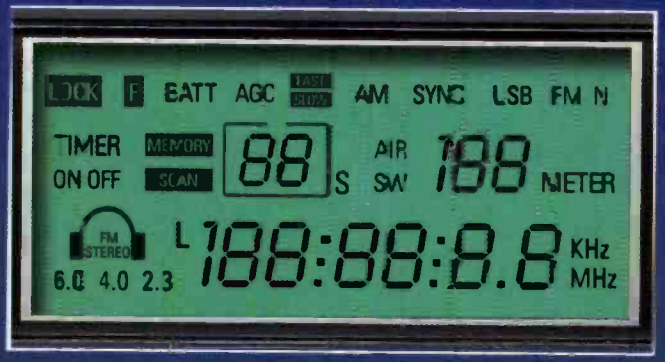
Dimensions: 7.75" L × 4.5" H × 1.5" W

Weight: 1 lb. 5 oz.

by GRUNDIG

Lextronix / Grundig, P.O. Box 2307, Menlo Park, CA 94026 • Tel: 650-361-1611 • Fax: 650-361-1724
Shortwave Hotlines: (US) 1-800-372-2228 (CN) 1-800-637-1648 • Web: www.grundigradio.com • Email: grundig@lx.netcom.com

GRUNDIG The Ultimate in



The LCD
Big! Bold! Brightly Illuminated 5" by 3½". Liquid Crystal Display shows all important data: Frequency, Meter band, Memory position, Time, LSB/USB, Synchronous Detector and more.

Ultra fine-tuning of 50Hz on LSB/USB, 100Hz in SW, AM and Aircraft Band and 2C KHz in FM.
• For Fixed-step Tuning: Big, responsive Up/Down tuning buttons.
• For direct frequency entry: a responsive, intuitive numeric keypad.

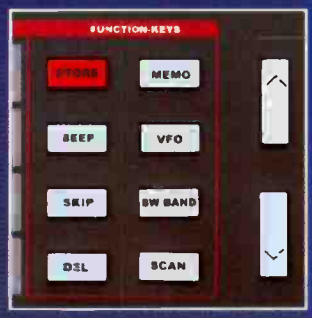
The Signal Strength Meter
Elegant in its traditional Analog design, like the gauges in the world's finest sports cars. Large. Well Lit. Easy to read.

The Frequency Coverage
Longwave, AM and shortwave: continuous 100-30,000 KHz. FM: 87-108 MHz VHF Aircraft Band: 118-137 MHz.

The Tuning Controls
• For the traditionalist: a smooth, precise tuning knob, produces no audio muting during use.

THESE ARE THE SATELLIT 800 MILLENNIUM'S MAJOR FEATURES. FOR A DETAILED SPECIFICATION SHEET, CONTACT GRUNDIG.

Digital Technology

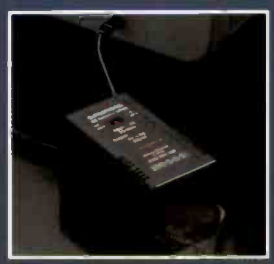


The Operational Controls
Knobs where you want them; Buttons where they make sense. The best combination of traditional and high-tech controls.

The Sound
Legendary Grundig Audio Fidelity with separate bass and treble controls, big sound from its powerful speaker and FM-stereo with the included high quality headphones.

The Technology
Today's latest engineering:
- Dual conversion superheterodyne circuitry.
- PLL synthesized tuner.

The Many Features
- 70 user-programmable memories.
- Two 24 hour format clocks.
- Two ON/OFF sleep timers.
- Massive, built-in telescopic antenna.
- Connectors for external antennas – SW, AM, FM and VHF Aircraft Band.
- Line-out, headphone and external speaker jacks.



The Power Supply
A 110V AC adapter is included for North America (a 220V AC adapter is available upon request). Also operates on 6 size D batteries. (not included)

Dimensions: 20.5" L × 9" H × 8" W

Weight: 14.50 lbs.

by GRUNDIG

Lextronix / Grundig, P.O. Box 2307, Menlo Park, CA 94026 • Tel: 650-361-1611 • Fax: 650-361-1724
nes (US) 1-800-872-2228 (CN) 1-800-637-1648 • Web: *www.grundigradio.com* • Email: *grundig@ix.netcom.com*

GRUNDIG Best in Technology

Yacht Boy 300 Professional Edition (YB 300PE)

Power and Performance with the Affordable Yacht Boy 300 Professional.

Designed for the traveller, the titanium look digital radio provides incredible power and performance for an incredibly low price! Packed with features, this radio is an excellent value, accompanied with 3 AA batteries, AC adapter, earphones, supplementary Antenna and carrying case!

State of-the-art features include:

- Digital tuning with 24 user-programmable memory presets
- 13 SW Bands (2.30-7.30 MHz; 9.10-26.10 MHz)
- Illuminated multifunction LCD display screen
- AM/FM stereo via earphones
- Clock, alarm and 10 to 90 minute sleep timer
- Digital tuning display
- Direct frequency entry
- DX/ local selector
- Titanium look finish
- External antenna jack
- Dynamic micro speaker
- Earphone jack
- Telescopic antenna

Dimensions: 5.75" L x 3.5" H x 1.25" W

Weight: 9.52 oz

by GRUNDIG

Lextronix / Grundig, P.O. Box 2307, Menlo Park, CA 94026 • Tel: 650-361-1611 • Fax: 650-361-1724
Shortwave Hotlines: (US) 1-800-872-2288 (CN) 1-800-637-1648 • Web: www.grundigradio.com • Email: grundig@ix.netcom.com

Frequencies

0600	0605		New Zealand, R New Zealand Int	17675va			
0600	0615		S Africa, Trans World Radio	11640af			
0600	0615		USA, WBCQ Monticello ME	7415na			
0600	0615		USA, WBCQ Monticello ME	7415na			
0600	0630		Kenya, Kenya BC Corp	4885da	4915da	4935do	
0600	0630	mtwhfa	Malta, Voice of Mediterranean	7150eu			
0600	0630		S Africa, Channel Africa	15215af			
0600	0630		USA, Voice of America	5970af	6035af	6080af	7170va
				7195af	9680af	11805af	11965me
				11995af	12080af	13670af	15205va
0600	0641		Romania, R Romania International	11940na	15335na		
0600	0645		Germany, Deutsche Welle	6140eu	13790af	15275af	17860af
0600	0700		Anguilla, Caribbean Beacon	6090am			
0600	0700	vl	Australia, ABC/Alice Springs	4835da			
0600	0700	vl	Australia, ABC/Katherine	5025do			
0600	0700	vl	Australia, ABC/Tennant Creek	4910da			
0600	0700		Australia, Radio	9660as	12080va	15240pa	15415as
				15515va	17580pa	17750as	21725pa
0600	0700	vl	Botswana, Radio	7255da	9600do	7255da	
0600	0700	vl	Cameroon, RTV/Yaounde	4850da			
0600	0700		Canada, CFRX Toronto ON	6070da			
0600	0700		Canada, CFVP Calgary AB	6030da			
0600	0700		Canada, CHNX Halifax NS	6130da			
0600	0700		Canada, CKZU Vancouver BC	6160da			
0600	0700		Costa Rica, R for Peace Intl	6970va			
0600	0700		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
0600	0700		Cuba Radio Havana	9550na	9820no	9830na	
0600	0700		Ecuador, HCJB	9745na	15115na	15160usb	21455va
0600	0700		Germany, Overcomer Ministries	13810au			
0600	0700	vl	Ghana, Ghana BC Corp	3366da	4915da		
0600	0700		Guyana, Voice of	3289da	5949do		
0600	0700	vl/mtwhf	Italy, IRRS	7120va			
0600	0700		Japan, Radio	5975eu	7230eu	11740as	11840as
				13630na	15230pa	21570pa	
0600	0700		Kiribati, Radio	9809da	9825do		
0600	0700		Kuwait, Radio	15110as	15230as		
0600	0700	vl	Lesotho, Radio	4800da			
0600	0700	vl	Liberia, ELWA	4760do			
0600	0700	vl	Liberia, R Liberia International	5100do			
0600	0700	vl	Malawi, Malawi BC Corp	3380do	5995do		
0600	0700		Malaysia, Radio	7295do			
0600	0700		Malaysia, RTM Sarawak	7160do			
0600	0700		Malaysia, Voice of	6175as	9750as	15295as	
0600	0700		Namibia, Namibian BC Corp	3270af	3289af		
0600	0700		New Zealand, ZLXA	3935do	7290do		
0600	0700	vl	Nigeria, Radio/Enugu	6025da			
0600	0700	vl	Nigeria, Radio/Ibadan	6050da			
0600	0700	vl	Nigeria, Radio/Kaduna	4770da	6090do	7275do	9570do
0600	0700	vl	Nigeria, Radio/Lagos	3326da	4990do		
0600	0700	vl	Nigeria, Voice of	7255af	15120af		
0600	0700	vl	Papua New Guinea, NBC	9675do	11880do		
0600	0700		Russia, Voice of Russia WS	15490au	17625au	17655au	17665au
				21790au			
0600	0700		S Africa, World Beacon	6115af			
0600	0700		Sierra Leone, Sierra Leone BS	3316do			
0600	0700		Singapore R Corp of Singapore	6150da			
0600	0700	vl	Solomon Islands, SIBC	5020do	9545da		
0600	0700		Sri Lanka, Sri Lanka BC Corp	6130da			
0600	0700		Swaziland, Trans World Radio	4775af	6100af	9500af	
0600	0700		Uganda, Radio	5026da	7110do	7196do	
0600	0700		UK, BBC World Service	6055af	6175am	6190af	6195eu
				7160af	9410eu	9580va	9740as
				11760me	11765af	11940af	11940af
				11955pa	12095eu	15310as	15360as
				15420af	15485eu	15565as	15575af
				17640af	17760as	17790as	17885af
				21660as			
0600	0700		USA, Armed Forces Network	4278am	6458am	12689am	
0600	0700		USA, KAIJ Dallas TX	5755va			
0600	0700		USA, KTBN Salt Lake City UT	7510na			
0600	0700		USA, KWHR Naalehu HI	11565pa	17780as		
0600	0700		USA, WEWN Birmingham AL	5825va			
0600	0700	twhfa	USA, WGTG McCaysville GA	5085va	6890am		
0600	0700		USA, WHRA Greenbush ME	11565af			
0600	0700		USA, WHRI Noblesville IN	5745na	7315sa		
0600	0700		USA, WJCR Upton KY	7490va	13594as		
0600	0700	twhfa	USA, WRMI Miami FL	7385na			
0600	0700		USA, WRNO New Orleans LA	7395na			
0600	0700		USA, WSHB Cypress Crk SC	13650af			
0600	0700		USA, WTJC Newport NC	9370na			
0600	0700		USA, WWCR Nashville TN	2390na	3210na	5070na	5935na
0600	0700		USA, WYFR Okeechobee FL	5985na	7355eu		
0600	0700	vl	Vanuatu, Radio	3945da	4960do	7260do	
0600	0700		Yemen, Rep of Yemen Radio	9779me			
0600	0700		Zambia, Christian Voice	9865do			
0600	0700	vl	Zambia, National BC Corp	6165do	6265da		
0600	0700	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045da		
0605	0610		Croatia, Croatian Radio	9470au	11970al		
0605	0610	mtwhfa	Croatia, Croatian Radio	6165eu	7365eu	9830eu	
0610	0620	mtwhf	Greece, Voice of	7475va	9375va	9420va	15630va
0615	0630	a	S Africa, Trans World Radio	11640af			
0615	0700	as	USA, WBCQ Monticello ME	7415na			
0630	0645		Finland, YLE-R Finland	15250va	21670va		
0630	0645		Vatican City, Vatican Radio	11625af	13765af	15570af	
0630	0645	mtwhf	Vatican City, Vatican Radio	4005eu	5880eu	7250eu	9645eu
				11740eu	15595eu		
0630	0700	th	Georgia, Georgian Radio	6080eu			
0630	0700		Kenya, Kenya BC Corp	7125do	7150da	7210do	
0630	0700	mtwhfa	UK, BBC World Service	6175am			
0630	0700		USA, Voice of America	7170va	9680af	11805af	11965me
				15205va			
0630	0700	as	USA, Voice of America	5970af	6035af	6080af	7195af
				11995af	12080af	13670af	
0641	0656		Romania, R Romania International	9570eu	11885na	11940na	15250eu
				15335na			
0645	0655	as	Germany, Trans World Radio	6045eu			
0645	0655	as	Monaco, Trans World Radio	9870eu			
0645	0700		Germany, Deutsche Welle	6140eu			
0655	0700		Germany, Trans World Radio	6045eu			
0655	0700		Monaco, Trans World Radio	9870eu			

Selected Programs

Sundays

0600 UK, BBC London (am): Play of the Week (from 0530).

0600 UK, BBC London (east af/east as/eu/me/south as/west af): World Briefing. Half-hour of news in depth.

0620 UK, BBC London (east af/east as/eu/me/south as/west af): Sports Roundup. See S 0320.

0630 UK, BBC London (am): World Business Report. Latest news from the markets in the Far East, Europe and the USA.

0630 UK, BBC London (east af/eu/me): Agendo. Chris Gunness examines the latest ideas and trends.

0630 UK, BBC London (east as/south as): Westway Compilation Edition. The week's episodes of the World Service's drama serial.

0630 UK, BBC London (west af): Agendo. Chris Gunness examines the latest ideas and trends.

Monday-Friday

0600 UK, BBC London (am/eu/south as/west af): World Briefing.

0600 UK, BBC London (east af/east as/me): News. See S 1300.

0620 UK, BBC London (am/eu/south as/west af): Sports Roundup.

0630 UK, BBC London (am/eu): World Business Report. Latest news from the markets in the Far East, Europe and the USA.

0630 UK, BBC London (west af): Network Africa. See M 0530.

0630 UK, BBC London (south as): The Learning Zone. For people who want to learn more about subjects such as science, health, the world and work and literature while practicing English listening skills.

0645 UK, BBC London (east af/me): Off the Shelf. Daily readings from the best of world literature.

Mondays

0605 UK, BBC London (east af/me): Talking Point. See S 1405.

0605 UK, BBC London (east as): Meridian Masterpiece. Classical performances.

0630 UK, BBC London (east as): Variable Comedy/Quiz Feature. These programs are panel quizzes and other light entertainment in a format heard in America decades ago.

0645 UK, BBC London (am): Analysis. Background to current affairs.

0645 UK, BBC London (eu): Letter from America. Alistair Cooke shares his inimitable view of contemporary American life.

Tuesdays

0605 UK, BBC London (east af/me): Outlook. See M 1205.

0605 UK, BBC London (east as): Meridian Ideas. See M 0205.

0630 UK, BBC London (east as): The Music Mix. See M 0230.

0645 UK, BBC London (am/eu): Analysis. See M 0645.

Wednesdays

0605 UK, BBC London (east af/me): Outlook. See M 1205.

0605 UK, BBC London (east as): Meridian Screen. See T 0205.

0630 UK, BBC London (east as): The UK Top Twenty. See T 0230.

0645 UK, BBC London (am): From Our Own Correspondent.

0645 UK, BBC London (eu): Analysis. See M 1545.

Thursdays

0605 UK, BBC London (east af/me): Outlook. See M 1205.

0605 UK, BBC London (east as): Meridian Music. See W 0205.

0630 UK, BBC London (east as): Omnibus. See S 0430.

0645 UK, BBC London (am): Analysis. See M 0645.

0645 UK, BBC London (eu): From Our Own Correspondent.

Fridays

0605 UK, BBC London (east af/me): Outlook. See M 1205.

0605 UK, BBC London (east as): Meridian Writing. See H 0205.

0630 UK, BBC London (east as): Andy Kershaw's World of Music.

0645 UK, BBC London (am): People and Politics. Background to the British political scene.

0645 UK, BBC London (eu): Analysis. See M 1545.

Saturdays

0600 UK, BBC London (am/east as/eu/south as/west af): World Briefing. See S 0300.

0600 UK, BBC London (east af/me): News. See S 1300.

0605 UK, BBC London (east af/me): Outlook. See M 1205.

0620 UK, BBC London (am/east as/eu/south as/west af): Sports Roundup. See S 0020.

0630 UK, BBC London (am): Agenda. Chris Gunness examines the latest ideas and trends.

0630 UK, BBC London (east as/eu/south as): People and Politics. Background to the British political scene.

0630 UK, BBC London (west af): African Quiz (1). A monthly test of the listener's knowledge of Africa.

0630 UK, BBC London (west af): This Week and Africa. A roundup of the week's political developments across the continent.

0645 UK, BBC London (east af/me): Waveguide (4). The latest information on international broadcasting with reviews of receivers and news about reception.

0645 UK, BBC London (east af/me): Write On. Air your views about Word Service; write to PO Box 76, Bush House, Strand, London WC2B 4PH.

FREQUENCIES

0700	0720	Swaziland, Trans World Radio	4775af	6100of	9500af	
0700	0727	Czech Rep, Radio Prague Intl	9880eu	11600eu		
0700	0730	Belgium, Radio Vlaanderen Intl	5985am			
0700	0730 vl	Papua New Guinea, NBC	4890do	9675do		
0700	0730	Slovakia, R Slovakia International	9440au	15460au	17550au	
0700	0730 as	UK, BBC World Service	17885af			
0700	0730 mtwhfa	UK, BBC World Service	6190af			
0700	0730 a	USA, Voice of America	6873va			
0700	0745	USA, WYFR Okeechobee FL	7355eu	13695va	15170eu	
0700	0756	Romania, R Romania International	15580af	17735af		
0700	0800	Anguilla, Caribbean Beacon	6090am			
0700	0800 vl	Australia, ABC/Alice Springs	4835da			
0700	0800 vl	Australia, ABC/Katherine	5025do			
0700	0800 vl	Australia, ABC/Tennant Creek	4910do			
0700	0800	Australia, Radio	9660pa	12080va	15240pa	15415as
			17580pa	17750as	21725pa	
0700	0800 vl	Botswana, Radio	7255do	9600do	7255do	
0700	0800 vl	Cameroon, RTV/Yaounde	4850do			
0700	0800	Canada, CFRX Toronto ON	6070do			
0700	0800	Canada, CFVP Calgary AB	6030do			
0700	0800	Canada, CHNX Halifax NS	6130do			
0700	0800	Canada, CKZU Vancouver BC	6160do			
0700	0800	Costa Rica, R for Peace Intl	6970va			
0700	0800	Costa Rica, University Network	5030am	6150va	7375na	9725na
			11870va	13749af		
0700	0800	Ecuador, HCJB	11755pa	15160eu	21455usb	
0700	0800 mtwhf	Eqt Guinea, Radio Africa	15185af			
0700	0800 as/vl	Eqt. Guinea, Radio East Africa	15185af			
0700	0800	Germany, Deutsche Welle	6140eu			
0700	0800	Germany, Trans World Radio	6045eu			
0700	0800	Germany, Voice of Hope	5975eu			
0700	0800 vl	Ghana, Ghana BC Corp	3366do	4915do		
0700	0800 vl	Ghana, Ghana BC Corp	3366do	4915do		
0700	0800	Guyana, Voice of	3289do	5949do		
0700	0800 vl/as	Italy, IRRS	7120va			
0700	0800	Kenya, Kenya BC Corp	7125do	7150do	7210do	
0700	0800	Kiribati, Radio	9809do	9825do		
0700	0800	Kuwait, Radio	15110as	15230as		
0700	0800 vl	Lesotho, Radio	4800do			
0700	0800 vl	Liberia, ELWA	4760do			
0700	0800 vl	Liberia, R Liberia International	5100do			
0700	0800 vl	Malawi, Malawi BC Corp	3380do	5995do		
0700	0800	Malaysia, Radio	7295do			
0700	0800	Malaysia, RTM Sarawak	7160do			
0700	0800	Malaysia, Voice of	6275as	9750as	15295as	
0700	0800	Monaco, Trans World Radio	9870eu			
0700	0800	Myanmar, Radio	9730do			
0700	0800	Namibia, Namibian BC Corp	3270af	3289af		
0700	0800	New Zealand, ZLXA	3935do	7290do		
0700	0800 vl	Nigeria, Radio/Enugu	6025do			
0700	0800 vl	Nigeria, Radio/Ibadan	6050do			
0700	0800 vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
0700	0800 vl	Nigeria, Radio/Lagos	3326do	4990do		
0700	0800	Palau, KHBN/Voice of Hope	9965as	9985as	15725as	
0700	0800	Russia, Voice of Russia WS	15490au	17495au	17625au	17655au
			21790au			
0700	0800	Sierra Leone, Sierra Leone BS	3316do			
0700	0800	Singapore R Corp of Singapore	6150do			
0700	0800 vl	Solomon Islands, SIBC	5020do	9545do		
0700	0800	Sri Lanka, Sri Lanka BC Corp	6130do			
0700	0800	Taiwan, R Taiwan International	5950no			
0700	0800	Uganda, Radio	5026do	7110do	7196do	
0700	0800	UK, BBC World Service	6190af	9580va	9740as	11760me
			11765af	11940of	11955pa	12095eu
			15310as	15360as	15400af	15485eu
			15565eu	17640eu	17760as	17790as
			17830af	21660as		
0700	0800	USA, Armed Forces Network	4278am	6458am	12689am	
0700	0800	USA, KAIJ Dallas TX	5755va			
0700	0800	USA, KT8N Salt Lake City UT	7510na			
0700	0800	USA, KWHR Naalehu HI	11565pa	17780as		
0700	0800	USA, W8CQ Monticello ME	7415na			
0700	0800	USA, WEWN Birmingham AL	5825va			
0700	0800	USA, WHRA Greenbush ME	11565af			
0700	0800	USA, WHRI Noblesville IN	5745no	7315sa		
0700	0800	USA, WJCR Upton KY	7490va	13594as		
0700	0800	USA, WRNO New Orleans LA	7395no			
0700	0800	USA, WSHB Cypress Crk SC	13650af			
0700	0800	USA, WTJC Newport NC	9370na			
0700	0800	USA, WWCR Nashville TN	2390na	3210na	5070na	5935na
0700	0800 vl	Vanuatu, Radio	3945do	4960do	7260do	
0700	0800	Zambia, Christian Voice	9865do			
0700	0800 vl	Zambia, National BC Corp	6165do	6265do		
0700	0800 vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045da		
0705	0710	Croatia, Croatian Radio	13820au			
0705	0710 s	Croatia, Croatian Radio	6165eu	7185eu	7365eu	9830eu
0705	0800 as	New Zealand, R New Zealand Int	11720va			
0706	0800	New Zealand, R New Zealand Int	11720va			
0730	0740 as	Guam, Trans World Radio	15200as			
0730	0800	Austria, R Austria International	15410me	17870me		
0730	0800	Georgia, Georgian Radio	11910eu			
0730	0800 vl/mtwhfa	Papua New Guinea, NBC	4890do			
0730	0800	Switzerland, Swiss R International	15545af	17685af	21750af	
0730	0800 as	UK, BBC World Service	15575as	17885af		
0740	0800	Guam, Trans World Radio	15200as			
0750	0800 as	Greece, Voice of	9775au			
0800	0810 vl	Malawi, Malawi BC Corp	3380do	5995do		
0800	0820	Germany, Trans World Radio	6045eu			
0800	0820	Monaco, Trans World Radio	9870eu			
0800	0825	Malaysia, Voice of	6275as	9750as	15295as	
0800	0830 vl	Australia, ABC/Alice Springs	4835do			
0800	0830 vl	Australia, ABC/Katherine	5025do			
0800	0830 vl	Australia, ABC/Tennant Creek	4910do			
0800	0830	Myanmar, Radio	9730do			
0800	0900	Anguilla, Caribbean Beacon	6090om			
0800	0900	Australia, Radio	5995pa	9710pa	12080va	13605pa
			15240va	15415as	17750as	21725pa
0800	0900 vl	Botswana, Radio	7255do	9600do	7255do	
0800	0900 vl	Cameroon, RTV/Yaounde	4850do			
0800	0900	Canada, CFRX Toronto ON	6070do			
0800	0900	Canada, CFVP Calgary AB	6030do			
0800	0900	Canada, CHNX Halifax NS	6130do			
0800	0900	Canada, CKZU Vancouver BC	6160do			
0800	0900	Costa Rica, R for Peace Intl	6970va			
0800	0900	Costa Rica, University Network	5030am	6150va	7375na	9725na
			11870va	13749af		
0800	0900	Ecuador, HCJB	11755pa	15150eu	21455usb	
0800	0900 mtwhf	Eqt Guinea, Radio Africa	15185af			
0800	0900 as/vl	Eqt. Guinea, Radio East Africa	15185af			
0800	0900 a	Finland, YLE/R Finland	9560eu			
0800	0900	Germany, Deutsche Welle	6140eu			
0800	0900	Germany, Overcomer Ministries	13810au			
0800	0900	Germany, Voice of Hope	5975eu	21590me		
0800	0900 vl	Ghana, Ghana BC Corp	3366do	4915do		
0800	0900 as	Guam, Trans World Radio	15200as	15330as		
0800	0900	Guyana, Voice of	3289do	5949do		
0800	0900	Indonesia, Voice of	9525va	11784va	15149va	
0800	0900 vl/os	Italy, IRRS	7120va			
0800	0900	Kenya, Kenya BC Corp	7125do	7150do	7210do	
0800	0900	Kiribati, Radio	9809do	9825do		
0800	0900 vl	Lesotho, Radio	4800do			
0800	0900 vl	Liberia, ELWA	4760do			
0800	0900 vl	Liberia, R Liberia International	5100do			
0800	0900	Malaysia, Radio	7295do			
0800	0900 s	Malta, Voice of Mediterraneon	11770eu			
0800	0900	Namibia, Namibian BC Corp	7165af	7215af		
0800	0900	New Zealand, R New Zealand Int	11720va			
0800	0900	New Zealand, ZLXA	3935do	7290do		
0800	0900 vl	Nigeria, Radio/Enugu	6025do			
0800	0900 vl	Nigeria, Radio/Ibadan	6050do			
0800	0900 vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
0800	0900 vl	Nigeria, Radio/Lagos	3326do	4990do		
0800	0900	Palau, KHBN/Voice of Hope	9955as	9965as	9985as	15725as
0800	0900 vl	Papua New Guinea, NBC	4890do			
0800	0900	Russia, Voice of Russia WS	15490au	17495au	17625au	17665au
			21790au			
0800	0900 s	S Africa, Amateur Radio League	9750af	21560af		
0800	0900	Sierra Leone, Sierra Leone BS	3316do			
0800	0900	Singapore R Corp of Singapore	6150do			
0800	0900 vl	Solomon Islands, SIBC	5020do			
0800	0900	South Korea, R Korea Intl	9570ou	13670eu		
0800	0900	Sri Lanka, Sri Lanka BC Corp	6130do			
0800	0900	Uganda, Radio	5026do	7110do	7196do	
0800	0900	UK, BBC World Service	6190af	9740as	11940af	11955pa
			12095eu	15360as	15400af	15485eu
			15565eu	17640eu	17760as	17830af
			21660as			
0800	0900 as	UK, BBC World Service	15310as	17885af	21830va	
0800	0900	USA, Armed Forces Network	4278am	6458am	12689am	
0800	0900	USA, KAIJ Dallas TX	5755va			
0800	0900	USA, KNLS Anchor Point AK	11765as			
0800	0900	USA, KTBN Salt Lake City UT	7510na			
0800	0900	USA, KWHR Naalehu HI	11565po	17780as		
0800	0900	USA, Voice of America	11775as	13610as	15150as	
0800	0900	USA, WEWN Birmingham AL	5825va			
0800	0900	USA, WHRA Greenbush ME	11565af			
0800	0900	USA, WHRI Noblesville IN	5745no	7315sa		
0800	0900	USA, WJCR Upton KY	7490va	13594as		
0800	0900	USA, WRNO New Orleans LA	7395no			
0800	0900	USA, WSHB Cypress Crk SC	9845au	9860eu		
0800	0900	USA, WTJC Newport NC	9370na			
0800	0900	USA, WWCR Nashville TN	2390na	3210na	5070na	5935na
0800	0900 vl	Vanuatu, Radio	3945do	4960do	7260do	
0800	0900	Zambia, Christian Voice	9865do			
0800	0900 vl	Zambia, National BC Corp	6165do	6265do		
0800	0900 vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045da		
0804	0820	Pakistan, Radio	17834eu	21465eu		
0805	0810	Croatia, Croatian Radio	13820au			
0815	0900 f	Seychelles, FEBA Radio	15460as			
0820	0850 s	Germany, Trans World Radio	6045eu			
0820	0850 s	Monaco, Trans World Radio	9870eu			
0830	0900 vl	Australia, ABC/Alice Springs	2310do			
0830	0900 vl	Australia, ABC/Katherine	2485do			
0830	0900 vl	Australia, ABC/Tennant Creek	2325do			
0830	0900 a	Austria, R Austria International	21650as	21765au		
0830	0900	Georgia, Georgian Radio	11910me			
0830	0900	Switzerland, Swiss R International	9885au	13685au		
0840	0900 s	Armenia, Voice of	4810eu	15270eu		

Frequencies

0900	0915	vl	Ghana, Ghana BC Corp	3366do	4915da		
0900	0915		Guam, Trans World Radio	15200as	15330as		
0900	0929		Czech Rep, Radio Prague Intl	21745va			
0900	0930		Kiribati, Radio	9809do	9825do		
0900	0930		UK, BBC World Service	6190af	6195va	9605as	9740as
				11760me	11765as	11940af	11945af
				11955pa	12095eu	15190so	15310as
				15360as	15400af	15485eu	15565eu
				15575as	17640eu	17760as	17790as
				17830af	17885af	21470af	21660as
0900	0930	mtwhfa	UK, BBC World Service	11945as			
0900	0945		Germany, Deutsche Welle	6140eu	6160pa	12035af	15105as
				15410af	15470as	17770as	17800af
				21560as	21680as	21790af	21775af
0900	0956		China China Radio International	11730po	15210pa		
0900	1000		Anguilla, Caribbean Beacon	6090am			
0900	1000	vl	Australia, ABC/Alice Springs	2310do			
0900	1000	vl	Australia, ABC/Katherine	2485do			
0900	1000	vl	Australia, ABC/Tennant Creek	2325do			
0900	1000		Australia, Radio	13605pa	21820os		
0900	1000	as	Australia, Radio	11550vo	11880va	17750va	
0900	1000	vl	Botswana, Radio	7255do	9600do	7255do	
0900	1000	vl	Cameroon, RTV/Yaounde	4850do			
0900	1000		Canada, CFRX Toronto ON	6070do			
0900	1000		Canada, CFVP Calgary AB	6030do			
0900	1000		Canada, CHNX Halifax NS	6130do			
0900	1000		Canada, CKZU Vancouver BC	6160do			
0900	1000	as	Costa Rica, R for Peace Intl	6970va			
0900	1000		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
0900	1000		Ecuador, HCJB	11775pa	21455usb		
0900	1000	mtwhf	Eqt Guinea, Radio Africa	15185af			
0900	1000	as/vl	Eqt. Guinea, Radio East Africa	15185af			
0900	1000	s	Germany, Good News World R	13740au			
0900	1000	a	Germany, Good News World R	5985eu	5995eu		
0900	1000		Germany, Voice of Hope	5975eu	21590me		
0900	1000		Guyana, Voice of	3289do	5949do		
0900	1000	vl/as	Italy, IRRS	7120va			
0900	1000		Kenya, Kenya BC Corp	7125do	7150do	7210do	
0900	1000	vl	Lesotho, Radio	4800do			
0900	1000	vl	Liberia, ELWA	4760do			
0900	1000	vl	Liberia, R Liberia International	6100do			
0900	1000		Malaysia, Radio	7295do			
0900	1000		Namibia, Namibian BC Corp	7165af	7215af		
0900	1000		New Zealand, R New Zealand Int	11720va			
0900	1000		New Zealand, ZLXA	3935do	7290do		
0900	1000	vl	Nigeria, Radio/Enugu	6025do			
0900	1000	vl	Nigeria, Radio/Ibadan	6050do			
0900	1000	vl	Nigeria, Radio/Kaduno	4770do	6090do	7275do	9570do
0900	1000	vl	Nigeria, Radio/Lagos	3326do	4990do		
0900	1000		Palau, KHBN/Voice of Hope	9955os	9965as	9985as	15725as
0900	1000	vl	Papua New Guinea, NBC	4890do			
0900	1000		Sierra Leone, Sierra Leone BS	3316do			
0900	1000		Singapore R Corp of Singapore	6150do			
0900	1000	vl	Solomon Islands, SIBC	5020do			
0900	1000		Sri Lanka, Sri Lanka BC Corp	6130do			
0900	1000		Uganda, Radio	5026do	7110do	7196do	
0900	1000		UK, Merlin Network One	6130eu			
0900	1000		USA, Armed Forces Network	4278am	6458am	12689am	
0900	1000		USA, KAIJ Dallas TX	5755va			
0900	1000		USA, KTBN Salt Lake City UT	7510na			
0900	1000		USA, KWHR Naalehu HI	11565pa	17780as		
0900	1000		USA, Voice of America	11775os	13610as	15150as	
0900	1000		USA, WEWN Birmingham AL	5825va			
0900	1000		USA, WHRA Greenbush ME	11565af			
0900	1000		USA, WHRI Noblesville IN	5745no	7315sa		
0900	1000		USA, WJCR Upton KY	7490va	13594os		
0900	1000		USA, WRNO New Orleans LA	7395na			
0900	1000		USA, WSHB Cypress Crk SC	9455sa	9860eu		
0900	1000		USA, WTJC Newport NC	9370na			
0900	1000		USA, WWCR Nashville TN	2390na	5070no	5935na	7435no
0900	1000	vl	Vanuatu, Radio	3945do	4960do	7260do	
0900	1000		Zambia, Christian Voice	9865do			
0900	1000	vl	Zambia, National BC Corp	6165do	6265do		
0900	1000	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do		
0915	0930		Guam, Trans World Radio	15330as			
0915	1000	vl	Ghana, Ghana BC Corp	6130do	4915do		
0915	1000	vl/as	Ghana, Ghana BC Corp	4915do	4915do		
0915	1000	mtwhf	USA, WRMI Miami FL	9955am			
0930	1000		Guam, Trans World Radio	9865as			
0930	1000		Lithuania, Radio Vilnius	9710eu			
0930	1000		Netherlands, Radio	9795as	12065os	13710as	
0930	1000		UK, BBC World Service	6190af	6195as	9740os	11760me
				11940af	11945as	11955po	12095eu
				15190so	15310os	15400af	15485eu
				15565eu	15575as	17640eu	17760as
				17790as	17830af	17885af	21470af
				21660as			
0945	1000		Germany, Deutsche Welle	6140eu			

1000	1027		Vietnam, Voice of	9839as	12019as		
1000	1030		Netherlands, Radio	9795as	12065os	13710as	
1000	1030		Singapore, RTE Radio	11740va			
1000	1030		Sri Lanka, Sri Lanka BC Corp	4940do			
1000	1030		Switzerland, Swiss R International	15315eu			
1000	1056		China China Radio International	11730pa	15210pa		
1000	1100		Anguilla, Caribbean Beacon	11775am			
1000	1100	vl	Australia, ABC/Alice Springs	2310do			
1000	1100	vl	Australia, ABC/Katherine	2485do			
1000	1100	vl	Australia, ABC/Tennant Creek	2325do			
1000	1100		Australia, Radio	11880va	13605pa	17750as	21820os
1000	1100	os	Bhutan, Bhutan BC Service	6035do			
1000	1100	vl	Botswana, Radio	7255do	9600do	7255do	
1000	1100	vl	Cameroon, RTV/Yaounde	4850do			
1000	1100		Canada, CFRX Toronto ON	6070do			
1000	1100		Canada, CFVP Calgary AB	6030do			
1000	1100		Canada, CHNX Halifax NS	6130do			
1000	1100		Canada, CKZN St John's NF	6160do			
1000	1100		Canada, CKZU Vancouver BC	6160do			
1000	1100	as	Costa Rica, R for Peace Intl	6970va			
1000	1100		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1000	1100		Ecuador, HCJB	11755po	21455usb		
1000	1100	mtwh-	Eqt Guinea, Radio Africa	15185af			
1000	1100	os/vl	Eqt. Guinea, Radio East Africa	15185af			
1000	1100		Germany, Deutsche Welle	6140eu			
1000	1100		Germany, Voice of Hope	5975eu	21590me		
1000	1100	vl	Ghana, Ghana BC Corp	6130do	4915do		
1000	1100	vl/os	Ghana, Ghana BC Corp	4915do	4915do		
1000	1100		Guam, Trans World Radio	9865as			
1000	1100		Guyana, Voice of	5949do			
1000	1100		India, All India Radio	11585as	13700ou	15020os	17485au
				17840as	17895au		
1000	1100	vl/as	Italy, IRRS	7120va			
1000	1100		Japan, Radio	9695as	15590as	21570pa	
1000	1100		Jordan, Radio	17680eu			
1000	1100		Kenya, Kenya BC Corp	7125do	7150do	7210do	
1000	1100	vl	Lesotho, Radio	4800do			
1000	1100	vl	Liberia, ELWA	4760do			
1000	1100	vl	Liberia, R Liberia International	6100do			
1000	1100		Malaysia, Radio	7295do			
1000	1100		N Marianas, KHBI Saipan	11840as			
1000	1100		Namibia, Namibian BC Corp	7165af	7215af		
1000	1100		New Zealand, R New Zealand Int	11720va			
1000	1100		New Zealand, ZLXA	3935do			
1000	1100	vl	Nigeria, Radio/Enugu	6025do			
1000	1100	vl	Nigeria, Radio/ bodan	6050do			
1000	1100	vl	Nigeria, Radio/Kaduno	4770do	6090do	7275do	9570do
1000	1100	vl	Nigeria, Radio/Lagos	4990do	7285do		
1000	1100	vl	Nigeria, Voice of	7255af	1512Caf		
1000	1100		Palau, KHBN/Voice of Hope	9955os	9965as	9985as	15725as
1000	1100	vl	Papua New Guinea, NBC	4890do			
1000	1100		Sierra Leone, Sierra Leone BS	5980do			
1000	1100		Singapore R Corp of Singapore	6150do			
1000	1100	vl	Solomon Islands, SIBC	5020do			
1000	1100		Uganda, Radio	5026do	7110ao	7196do	
1000	1100		UK, BBC World Service	5965no	6190af	6195va	9740as
				11760me	11940af	11955pa	12095eu
				15310as	15360as	15485eu	15565eu
				15575as	17640eu	17760os	17790os
				17885af	21470af	21660os	
1000	1100	os	UK, BBC World Service	15190sa	15400af	17830af	
1000	1100		USA, Armed Forces Network	4278am	6458am	12689am	
1000	1100		USA, KAIJ Dallas TX	5755va			
1000	1100		USA, KTBN Salt Lake City UT	7510no			
1000	1100		USA, KWHR Naalehu HI	9930as	11565pa		
1000	1100		USA, Voice of America	6160as	9645as	9760as	9770pa
				15160as	15240os	15425as	
1000	1100		USA, WEWN Birmingham AL	7425na	15745eu		
1000	1100		USA, WHRI Noblesville IN	6040na	9495so		
1000	1100		USA, WJCR Upton KY	7490va	13594as		
1000	1100	mtwh'a	USA, WRMI Miami FL	9955am			
1000	1100		USA, WRNO New Orleans LA	7395no			
1000	1100		USA, WSHB Cypress Crk SC	6095am	9455sa		
1000	1100		USA, WTJC Newport NC	9370na			
1000	1100		USA, WWCR Nashville TN	2390na	5070na	5935na	9475na
1000	1100		USA, WYFR Okeechobee FL	5950na			
1000	1100	vl	Vanuatu, Radio	3945do	4960do	7260do	
1000	1100		Zambia, Christian Voice	9865do			
1000	1100	vl	Zambia, National BC Corp	6165do	6265do		
1000	1100	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do		
1015	1030	mtwhf	Vatican City, Vatican Radio	5880eu	9645eu	11740eu	15595eu
				21850eu			
1030	1045	mtwhf	Ethiopia, Radio	5990do	7110oo	9705do	
1030	1057		Czech Rep, Radio Prague Intl	9880eu	11615eu		
1030	1100		Guam, Adventist World Radio	11795as			
1030	1100		Israel, Kol Israel	15650va	17535va		
1030	1100		Malaysia, RTM Sarawak	7160do			
1030	1100		Mongolia, Voice of	12085ou			
1030	1100		Netherlands, Radio	6045eu	9795cs	9860eu	12065as
				13710as			
1030	1100		South Korea, R Korea Intl	11715na			
1030	1100		Sri Lanka, Sri Lanka BC Corp	4940do	11835as	15120as	17850as
1030	1100		UAE, Radio Dubai	13675eu	15370eu	15395eu	21605eu

Frequencies

1100	1104		Pakistan, Radio	7110da	17834eu	21465eu	
1100	1120	fa	Kazakhstan, Radio Almaty	11840eu			
1100	1125		Moldova, Radio Moldova Intl	11580am			
1100	1127		Vietnam, Voice of	7285as			
1100	1130		Netherlands, Radio	6045eu	9795as	9860eu	12065as
				13710as			
1100	1130	vl	Solomon Islands, SIBC	5020da			
1100	1130		Sri Lanka, Sri Lanka BC Corp	4940da	11835as	15210as	17850as
1100	1130	mtwhf	UK, BBC Caribbean Report	6195ca	15220ca		
1100	1130	as	UK, BBC World Service	5965na	6195as	9580as	9740as
				11760me	11955as	12095eu	15280as
				15220am	15310as	15400af	15485eu
				15565eu	15575as	17640as	17700as
				17790sa	17830af	17885af	21470af
1100	1130	as	UK, BBC World Service	6195na	15190sa	15220am	
1100	1130	mtwhf	USA, Voice of America	13675af	15550af	17650af	17780af
				21600af			
1100	1130	mtwhf	USA, Voice of America	13675af	15550af	17650af	17780af
				21600af			
1100	1130	mtwhfa	USA, WRMI Miami FL	9955am			
1100	1145		Germany, Deutsche Welle	6140eu	11785af	15410af	17680af
				17860af			
1100	1200		Anguilla, Caribbean Beacon	11775am			
1100	1200	vl	Australia, ABC/Alice Springs	2310da			
1100	1200	vl	Australia, ABC/Katherine	2485da			
1100	1200	vl	Australia, ABC/Tennant Creek	2325da			
1100	1200		Australia, Radio	5995pa	6020pa	9580va	13605pa
				21820as			
1100	1200	vl	Botswana, Radio	7255da	9600da	7255da	
1100	1200		Bulgaria, Radio	15700eu	17500eu		
1100	1200	vl	Cameroon, RTV/Yaounde	4850da			
1100	1200		Canada, CBC Northern Service	9625da			
1100	1200		Canada, CFRX Toronto ON	6070da			
1100	1200		Canada, CFVP Calgary AB	6030da			
1100	1200		Canada, CHNX Halifax NS	6130da			
1100	1200		Canada, CKZN St John's NF	6160da			
1100	1200		Canada, CKZU Vancouver BC	6160da			
1100	1200	mtwhf	Canada, R Canada International	9640na	13650na	17765na	17820na
1100	1200	as	Costa Rica, R for Peace Intl	6970va			
1100	1200		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1100	1200		Ecuador, HCJB	12005am	15115am	21455usb	
1100	1200	mtwhf	Eqt Guinea, Radio Africa	15185af			
1100	1200	as/vl	Eqt Guinea, Radio East Africa	15185af			
1100	1200		Germany, Overcomer Ministries	5850eu			
1100	1200		Germany, Voice of Hope	21590me			
1100	1200	vl	Ghana, Ghana BC Corp	6130da	4915da		
1100	1200	vl/as	Ghana, Ghana BC Corp	4915da	4915da		
1100	1200		Guyana, Voice of	5949da			
1100	1200		Iran, VOIRI	15385as	15430as	15585as	21470as
				21730as			
1100	1200	vl/as	Italy, IRRS	7120va			
1100	1200		Japan, Radio	6120na	9695as	15590as	
1100	1200		Jordan, Radio	17680eu			
1100	1200		Kenya, Kenya BC Corp	7125da	7150da	7210da	
1100	1200	vl	Lesotho, Radio	4800da			
1100	1200	vl	Liberia, ELWA	4760da			
1100	1200	vl	Liberia, R Liberia International	6100da			
1100	1200		Malaysia, Radio	7295da			
1100	1200		Malaysia, TRM Sarawak	7160da			
1100	1200		N Marianas, KHBI Saipan	11840as			
1100	1200		Namibia, Namibian BC Corp	7165af	7215af		
1100	1200		New Zealand, R New Zealand Int	11720va			
1100	1200		New Zealand, ZLXA	3935da			
1100	1200	vl	Nigeria, Radio/Enugu	6025da			
1100	1200	vl	Nigeria, Radio/Ibadan	6050da			
1100	1200	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275da	9570da
1100	1200	vl	Nigeria, Radio/Lagos	4990da	7285da		
1100	1200		Palau, KHBN/Voice of Hope	9955as	9965as	9985as	13840as
1100	1200	vl	Papua New Guinea, NBC	4890da			
1100	1200		Sierra Leone, Sierra Leone BS	5980da			
1100	1200		Singapore, R Singapore Intl	6150as	9590as		
1100	1200		Switzerland, Swiss R International	13735as	21770as		
1100	1200		Taiwan, Voice of Asia	7445as			
1100	1200		Uganda, Radio	5026da	7110da	7196da	
1100	1200	mtwhfa	UK, BBC World Service	6190af	11940af		
1100	1200	a	UK, Virgin Radio/Merlin	21455me	21515af		
1100	1200		Ukraine, R Ukraine International	21520au			
1100	1200		USA, Armee Forces Network	4278am	6458am	12689am	
1100	1200		USA, KAIJ Dallas TX	5755va			
1100	1200		USA, KTBN Salt Lake City UT	7510na			
1100	1200		USA, KWHR Naalehu HI	9930as	11565as		
1100	1200		USA, Voice of America	6160as	9645as	9760as	9770pa
				15160as	15240as	15425as	
1100	1200		USA, WEWN Birmingham AL	7425na	15745eu		
1100	1200		USA, WHRI Noblesville IN	6040na	9495sa		
1100	1200		USA, WJCR Upton KY	7490va	13594as		
1100	1200		USA, WRNO New Orleans LA	7395na			
1100	1200		USA, WSHB Cypress Crk SC	6095am	11660am		
1100	1200		USA, WTJC Newport NC	9370na			
1100	1200		USA, WWCR Nashville TN	5070na	5935na	7435na	15685na
1100	1200		USA, WYFR Okeechobee FL	5850na	5950na		
1100	1200	vl/s	Vanuatu, Radio	3945da	4960da	7260da	
1100	1200		Zambia, Christian Voice	9865da			
1100	1200	vl	Zambia, National BC Corp	6165da	6265da		
1100	1200	vl	Zimbabwe, Zimbabwe BC Corp	5975da	6045da		
1110	1120		Greece, Voice of	9420va	15630va		
1115	1145		Nepal, Radio	5005as	7165as		
1120	1140	w	Kzaakhstan, Radio Almaty	9620eu	11840eu		
1130	1145	vl	Libya, Voice of Africa	11815af	15415af	15435va	
1130	1157		Czech Rep, Radio Prague Intl	6055eu	21745as		
1130	1200		Belgium, Radio Vlaanderen Intl	9865as	9925eu		
1130	1200		Netherlands, Radio	6045eu	9860eu		
1130	1200		Sri Lanka, Sri Lanka BC Corp	4940da			
1130	1200		Sweden, Radio	18960na			
1130	1200		USA, WRMI Miami FL	9955am			
1130	1200	f	Vatican City, Vatican Radio	15595va	17515va		
1140	1200	t	Kzaakhstan, Radio Almaty	9620eu	11840eu		
1145	1200		Germany, Deutsche Welle	6140eu			

Selected Programs

Sundays

1100 UK, BBC London (am/east af/east as/eu/me/west af): World Briefing. Half-hour of news in depth.
1120 UK, BBC London (am/east af/east as/eu/me/west af): British News. Ten minutes of news about Britain.
1130 UK, BBC London (am/east afeu/me): Arts in Action. See S 0030.

Monday-Friday

1100 UK, BBC London (am/eu/south as/west af): World Briefing.
1100 UK, BBC London (carib): World News. Broadcast on the hour of 5, 10, or 15 minutes in length.
1105 UK, BBC London (carib): BBC Caribbean Report Morning Edition. Weekday coverage of current affairs in the Caribbean region with emphasis on political and economic analysis.
1110 UK, BBC London (carib): Sports Caribbean. A round-up of the latest scores and sports news.
1115 UK, BBC London (carib): Caribbean Magazine. General news and features from around the islands.
1120 UK, BBC London (me/am/eu/south as/west af): British News. Ten minutes of news about Britain.
1145 UK, BBC London (am/eu/south as/west af): Sports Roundup.

Mondays

1130 UK, BBC London (am/eu/south as): Letter from America.
1130 UK, BBC London (me): Variable Comedy/Quiz Feature.
1130 UK, BBC London (west af): Inside Track. New program.

Tuesdays

1105 UK, BBC London (east af): Health Matters. Keeps track of new developments in the world of medical science, as well as ways of keeping fit.
1105 UK, BBC London (east as): Following Trends (4). A science round table discussion.
1105 UK, BBC London (east as): From Lab to Law (2). A discussion program about creating science policy.
1105 UK, BBC London (east as): Science Perspective (1/2). Richard Hollingham and Alun Lewis.
1115 UK, BBC London (east as): Seeing Stars (1). Heather Couper and Nigel Henbest guide listeners through all the best sky sights.
1115 UK, BBC London (east as): Soundbyte (3). The computer and information technology magazine.
1130 UK, BBC London (east af): Everywoman. Features and reports on the activities of women across the globe.
1130 UK, BBC London (east as): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.
1130 UK, BBC London (am/eu/south as/west af): Analysis. Background to current affairs.

Wednesdays

1105 UK, BBC London (east af): Following Trends (4). A science round table discussion.
1105 UK, BBC London (east af): From Lab to Law (2). A discussion program about creating science policy.
1105 UK, BBC London (east af): Science Perspective (1/2). Richard Hollingham and Alun Lewis.
1105 UK, BBC London (east as): Sports International. Live commentaries and interviews, features and discussions.
1115 UK, BBC London (east af): Seeing Stars (1). Heather Couper and Nigel Henbest guide listeners through all the best sky sights.
1115 UK, BBC London (east af): Soundbyte (3). The computer and information technology magazine.
1130 UK, BBC London (east af): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.
1130 UK, BBC London (east as): Pick of the World. Daire Brehar celebrates the diversity and range of the whole of BBC World Service output.
1130 UK, BBC London (am/eu/south as/west af): Analysis.

Thursdays

1105 UK, BBC London (east af): Sports International. Live commentaries and interviews, features and discussions.
1105 UK, BBC London (east as): One Planet. See M 0305.
1130 UK, BBC London (east af): Pick of the World. Daire Brehan celebrates the diversity and range of the whole of BBC World Service output.
1130 UK, BBC London (east as): People and Places. See M 0330.
1130 UK, BBC London (am/eu/south as/west af): From Our Own Correspondent. See S 0230.

Fridays

1105 UK, BBC London (east af): One Planet. Charles Haviland and Richard Black host this new program about development and the environment.
1130 UK, BBC London (am/eu/south as/west af): Analysis.
1130 UK, BBC London (east af): People and Places. A forum to exchange views and experience an a global scale.
1130 UK, BBC London (east as): Variable Feature. See T 0330.

Saturdays

1100 UK, BBC London (am/east as/eu/west af): World Briefing.
1100 UK, BBC London (me/south as): News. See S 1300.
1105 UK, BBC London (east af): Westway Compilation Edition. Catch up on the week's episodes of the World Service's drama serial.
1105 UK, BBC London (south as): The Edge (hour 2). The second hour of a two-hour show of music, chat and humor, aimed at younger listeners.
1120 UK, BBC London (am/east as/eu/west af): British News.
1130 UK, BBC London (am/eu/west af): Analysis. See M 0645.
1135 UK, BBC London (east af): The Greenfield Collection. This classical music program replaces Ray on Record.
1145 UK, BBC London (eu/west af): Sports Roundup. See S 0620.

Frequencies

1200	1220	as	UK, BBC World Service	6195na	15220am	
1200	1230		Canada, R Canada International	9640na	9660as	13650na 15195as
				17765na	17820na	
1200	1230		Iran, VOIRI	15385as	15430as	15585as 21470as
				21730as		
1200	1230		Netherlands, Radio	6045eu	9860eu	
1200	1230		Sri Lanka, Sri Lanka BC Corp	4940da		
1200	1230		Switzerland, Swiss R International	15315eu		
1200	1230		Uzbekistan, Radio Tashkent	7285as	9715as	15295as 17775as
1200	1245		USA, WYFR Okeechobee FL	5850na	5950na	17750na
1200	1255		Poland, Radio Polonia	6095eu	7270eu	9525eu 11820eu
1200	1256		China China Radio International	9715as	9760pa	11675pa 11980as
				15415as		
1200	1256		North Korea, R Pyongyang	3560va	9640va	9850va 9975va
				11335va	13650va	
1200	1300		Anguilla, Caribbean Beacon	11775am		
1200	1300	vl	Australia, ABC/Alice Springs	2310da		
1200	1300	vl	Australia, ABC/Katherine	2485da		
1200	1300	vl	Australia, ABC/Tennant Creek	2325da		
1200	1300		Australia, Radio	5995pa	6020pa	9580va 11650pa
				21820as		
1200	1300	mtwhf	Bhutan, Bhutan BC Service	5030da		
1200	1300	vl	Botswana, Radio	7255da	9600da	7255da
1200	1300		Brazil, Radio Nacional Bras	15445am		
1200	1300	vl	Cameroon, RTV/Yaounde	4850da		
1200	1300	vl	Canada, CBC Northern Service	9625da		
1200	1300		Canada, CFRX Toronto ON	6070da		
1200	1300		Canada, CFVP Calgary AB	6030da		
1200	1300		Canada, CHNX Halifax NS	6130da		
1200	1300		Canada, CKZN St John's NF	6160da		
1200	1300		Canada, CKZU Vancouver BC	6160da		
1200	1300		Costa Rica, R for Peace Intl	6970va		
1200	1300		Costa Rica, University Network	5030am	6150va	7375na 9725na
				11870va	13749af	
1200	1300		Ecuador, HCJB	12005am	15115am	21455usb
1200	1300	as/vl	Eqt. Guinea, Radio East Africa	15185af		
1200	1300		France, R France International	11670eu	15155eu	15195af 15540af
1200	1300		Germany, Deutsche Welle	6140eu		
1200	1300		Germany, Overcomer Ministries	5850eu		
1200	1300		Germany, Voice of Hope	21460me		
1200	1300	vl	Ghana, Ghana BC Corp	4915do	6130do	
1200	1300		Guyana, Voice of	5949do		
1200	1300	vl/as	Italy, IRRS	7120va		
1200	1300		Jordan, Radio	11690eu		
1200	1300		Kenya, Kenya BC Corp	7125do	7150do	7210do
1200	1300	vl	Lesotho, Radio	4800do		
1200	1300	vl	Liberia, ELWA	4760do		
1200	1300	vl	Liberia, R Liberia International	6100do		
1200	1300		Malaysia, Radio	7295do		
1200	1300		N Marianas, KHBI Saipan	11550as		
1200	1300		Namibia, Namibian BC Corp	7165af	7215af	
1200	1300		New Zealand, R New Zealand Int	11720va		
1200	1300		New Zealand, ZLXA	3935do		
1200	1300	vl	Nigeria, Radio/Enugu	6025do		
1200	1300	vl	Nigeria, Radio/Ibadan	6050da		
1200	1300	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275da 9570da
1200	1300	vl	Nigeria, Radio/Lagos	4990da	7285da	
1200	1300		Palau, KHBN/Voice of Hope	9955as	9965as	9985as 13840as
1200	1300	vl/mtwhfa	Papua New Guinea, NBC	4890da	9675da	
1200	1300		Sierra Leone, Sierra Leone BS	5980da		
1200	1300		Singapore, R Singapore Intl	6150as	9590as	
1200	1300	vl	Solomon Islands, SIBC	5020da		
1200	1300		Taiwan, R Taiwan International	7130as	9610au	
1200	1300		Uganda, Radio	5026da	7110da	7196da
1200	1300		UK, BBC World Service	5965na	6190af	6195as 9515na
				9580as	9740as	11760me 11940af
				11955as	12095eu	15280as 15310as
				15485eu	15565eu	15575me 17640eu
				17700as	17830af	17885af 21470af
1200	1300	a	UK, Virgin Radio/Merlin	21455me	21515af	
1200	1300		USA, Armed Forces Network	4278am	6458am	12689am
1200	1300		USA, KAIJ Dallas TX	13815va		
1200	1300		USA, KTBN Salt Lake City UT	7510na		
1200	1300		USA, KWHR Naalehu H	9930as	11565pa	
1200	1300		USA, Voice of America	6160as	9645as	9760as 15160as
				15240as	15425as	
1200	1300		USA, WEWN Birmingham AL	7425na	15745eu	
1200	1300	mtwhf	USA, WGTG McCaysville GA	9400va	12172am	
1200	1300		USA, WHRI Noblesville N	6040na	9495sa	
1200	1300		USA, WJCR Upton KY	7490va	13594as	
1200	1300		USA, WRMI Miami FL	9955am		
1200	1300		USA, WRNO New Orleans LA	7395na		
1200	1300		USA, WSHB Cypress Crk SC	6095am	11660am	
1200	1300		USA, WTJC Newport NC	9370na		
1200	1300		USA, WWCR Nashville TN	5070na	7435na	13845na 15685na
1200	1300	vl/s	Vanuatu, Radio	3945do	4960do	7260do
1200	1300		Zambia, Christian Voice	9865do		
1200	1300	vl	Zambia, National BC Corp	6165do	6265do	
1200	1300	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do	
1204	1220	mtwhf	UK, BBC Caribbean Report	6195ca	15220ca	
1205	1210		Croatia, Croatian Radio	6165eu	7185eu	7365eu 9830eu
				13830eu		
1215	1300		Egypt, Radio Cairo	17595as		
1220	1300	mtwhf	UK, BBC World Service	15220am		
1230	1257		Vietnam, Voice of	9839as	12019as	
1230	1259		Canada, R Canada International	9640na	13650na	17765na 17820na
1230	1300		Austria, R Austria International	6155eu	13730va	
1230	1300		Bangladesh, Bangla Betar	7184as	9558as	
1230	1300		Guam, Adventist World Radio	15330va		
1230	1300		Italy, Adventist World Radio	9610eu		
1230	1300		Sri Lanka, Sri Lanka BC Corp	4940do	6005as	6075as 9735as
				15425as		
1230	1300		Sweden, Radio	17505as	18960na	21810as
1230	1300		Thailand, Radio	9655as	9885as	11905as
1230	1300		Turkey, Voice of	17830as	21540eu	
1230	1300	a	UK, Wales Radio Intl/Merlin	17650au		
1245	1300	a	Seychelles, FEBA Radio	15535me		

Selected Programs

Sundays

1200 UK, BBC London (am/east af/me/south as/west af): Newshour A comprehensive look at the major topics of the day, plus up-to-the-minute international and British news.

1200 UK, BBC London (east as): Play of the Week (from 1130). See S 1130.

1200 UK, BBC London (eu): News. A five-minute news summary.

1205 UK, BBC London (eu): John Peel. Tracks from newly released albums and singles from the contemporary music scene.

1230 UK, BBC London (eu): Global Business. See S 0430.

Monday-Friday

1200 UK, BBC London (am/me/south as/west af): Newshour. See S 1200.

1200 UK, BBC London (east af/east as/eu): News. See S 1300.

1205 UK, BBC London (east af/east as/eu): Outlook. An up-to-the-minute mix of conversation, controversy and color from around the world.

1210 UK, BBC London (carib): BBC Caribbean Report Morning Edition. See M 1105.

Mondays

1230 UK, BBC London (east af): Plain English. The workings of the English language.

1245 UK, BBC London (east as): Patterns of Faith. Though-provoking and illuminating reflections on a wide range of issues.

1245 UK, BBC London (eu): Plain English. The workings of the English language.

Tuesdays

1230 UK, BBC London (east af): Heart and Soul. The complementary strand to patterns of faith.

1245 UK, BBC London (east as): Plain English. The workings of the English language.

1245 UK, BBC London (eu): Heart and Soul. The complementary strand to patterns of faith.

Wednesdays

1230 UK, BBC London (east af): Best of the Edge. A 15-minute replay of pop music.

1245 UK, BBC London (east as): Heart and Soul. The complementary strand to patterns of faith.

1245 UK, BBC London (eu): Best of the Edge. A 15-minute replay of pop music.

Thursdays

1230 UK, BBC London (east af): Body and Mind. A new health strand which deals with how health and medicine relates to you.

1245 UK, BBC London (east as): Best of the Edge. A 15-minute replay of pop music.

1245 UK, BBC London (eu): Body and Mind. A new health strand which deals with how health and medicine relates to you.

Fridays

1230 UK, BBC London (east af): Patterns of Faith. Though-provoking and illuminating reflections on a wide range of issues.

1245 UK, BBC London (east as): Body and Mind. See M 0530.

1245 UK, BBC London (eu): Patterns of Faith. Though-provoking and illuminating reflections on a wide range of issues.

Saturdays

1200 UK, BBC London (am/east af/me/south as/west af): Newshour. See S 1200.

1200 UK, BBC London (east as/eu): News. See S 1400.

1205 UK, BBC London (east as): Variable Comedy/Quiz Feature. See M 0630.

1205 UK, BBC London (eu): Wright Round the World. Steve Wright's brand new show with listeners' requests and dedications.

Frequencies

1300	1305		New Zealand, R New Zealand Int	11720va		
1300	1315	smtwhf	USA, WRMI Miami FL	9955am		
1300	1320		Brazil, Radio Nacional Bras	15445am		
1300	1329		Czech Rep, Radio Prague Intl	13580eu	17485as	
1300	1330		Egypt, Radio Cairo	17595as		
1300	1330	s	Germany, Universal Life	9710eu	9955na	
1300	1330		Germnay, Voice of Hope	21460me		
1300	1330		Kenya, Kenya BC Corp	7125da	7150da	7210da
1300	1330		Turkey, Voice of	17830as	21540eu	
1300	1356		China China Radio International	7405na	9570na	11675pa 11900pa
				11980as	15180as	
1300	1356		Ramania, R Ramania International	15250na	15390na	17770eu 17790na
1300	1400		Anguilla, Caribbean Beacon	11775am		
1300	1400	vl	Australia, ABC/Alice Springs	2310da		
1300	1400	vl	Australia, ABC/Katherine	2485da		
1300	1400	vl	Australia, ABC/Tennant Creek	2325da		
1300	1400		Australia, Radio	5995pa	6020pa	9580va 11650pa
				21820as		
1300	1400	vl	Botswana, Radio	7255da	9600da	7255da
1300	1400	vl	Cameroan, RTV/Yaounde	4850da		
1300	1400	vl	Canada, CBC Northern Service	9625da		
1300	1400		Canada, CFRX Toronto ON	6070da		
1300	1400		Canada, CFVP Calgary AB	6030da		
1300	1400		Canada, CHNX Halifax NS	6130da		
1300	1400		Canada, CKZN St John's NF	6160da		
1300	1400		Canada, CKZU Vancouver BC	6160da		
1300	1400	smtwhf	Canada, R Canada International	13650na		
1300	1400	s	Canada, R Canada International	17800na		
1300	1400	mtwhf	Canada, R Canada International	9640na	11795na	17820na
1300	1400		Casta Rica, R for Peace Intl	15049va		
1300	1400		Casta Rica, University Network	5030am	6150va	7375na 9725na
				11870va	13749af	
1300	1400		Ecuador, HCJB	12005am	15115am	21455usb
1300	1400	as vl	Eqt Guinea, Radio East Africa	15185af		
1300	1400		Germany, Deutsche Welle	6140eu		
1300	1400	s	Germany, Good News World R	15330as		
1300	1400		Germany, Overcomer Ministries	5850eu	13810eu	
1300	1400	vl	Ghana, Ghana BC Corp	4915da	6130da	
1300	1400		Guyana, Voice of	5949da		
1300	1400	vl/as	Italy, IRRS	7120va		
1300	1400		Jordan, Radio	11690eu		
1300	1400	vl	Lesotho, Radio	4800da		
1300	1400	vl	Liberia, ELWA	4760da		
1300	1400	vl	Liberia, R Liberia International	6100da		
1300	1400		Malaysia, Radio	7295da		
1300	1400		N Marianas, KHBI Saipan	9940as		
1300	1400		Namibia, Namibian BC Corp	7165af	7215af	
1300	1400		New Zealand, ZLXA	3935da		
1300	1400	vl	Nigeria, Radio/Enugu	6025da		
1300	1400	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275da 9570da
1300	1400	vl	Nigeria, Radio/Lagos	4990da	7285da	
1300	1400		Palau, KHBN/Voice of Hope	9955as	9965as	9985as 13840as
1300	1400	vl/mtwhfa	Papua New Guinea, NBC	4890da	9675da	
1300	1400	as	S Africa, Channel Africa	11720af	17780af	21725af
1300	1400		Sierra Leone, Sierra Leone BS	5980da		
1300	1400		Singapore, R Singapore Intl	6150as	9590as	
1300	1400	vl	Solomon Islands, SIBC	5020da		
1300	1400		South Korea, R Korea Intl	9570as	9640am	13670as
1300	1400		Sri Lanka, Sri Lanka BC Corp	4940da	6005as	6075as 9735as
				15425as		
1300	1400		Uganda, Radio	4976da	5026da	
1300	1400		UK, BBC World Service	5965na	5990as	6190af 6195va
				9515na	9740as	11760me 11865na
				11940af	12095eu	15220am 15310as
				15420af	15485eu	15565eu 15575me
				17640eu	17700as	17830af 17885af
				21470af		
1300	1400	a	UK, Global Kitchen/Merlin	9750eu	12005eu	15235eu
1300	1400	a	UK, Virgin Radio/Merlin	21455me	21515af	
1300	1400		USA, Armed Forces Network	4278am	645Bam	12689am
1300	1400		USA, KAIJ Dallas TX	13815va		
1300	1400		USA, KJES Vado NM	11715na		
1300	1400		USA, KNLS Anchor Point AK	9615as		
1300	1400		USA, KTBN Salt Lake City UT	7510na		
1300	1400		USA, KWHR Naalehu HI	9930as	11565pa	
1300	1400		USA, Voice of America	6160as	9645as	9760as 15160as
				15425as		
1300	1400		USA, WEWN Birmingham AL	11875na	15745eu	
1300	1400	mtwhf	USA, WGTG McCaysville GA	9400va	12172am	
1300	1400		USA, WHRI Noblesville IN	6040na	15105sa	
1300	1400		USA, WJCR Upton KY	7490va	13594as	
1300	1400		USA, WRNO New Orleans LA	7395na		
1300	1400		USA, WSHB Cypress Crk SC	9430am	9455na	
1300	1400		USA, WTJC Newport NC	9370na		
1300	1400		USA, WWCR Nashville TN	9475na	12160na	13845na 15685na
1300	1400		USA, WYFR Okeechobee FL	11550as	11830na	11970na 17750na
1300	1400		Zambia, Christian Voice	9865da		
1300	1400	vl	Zambia, National BC Corp	6165da	6265da	
1300	1400	vl	Zimbabwe, Zimbabwe BC Corp	5975da	6045da	
1306	1400	accsnal	New Zealand, R New Zealand Int	6100va		
1315	1400	s	USA, WRMI Miami FL	9955am		
1330	1357		Vietnam, Voice of	9730eu	13740eu	
1330	1400		Australia, Radio	5995pa	6020pa	9475as 9580va
				11650pa	11660va	21820as
1330	1400		Canada, R Canada International	9535as	17795as	
1330	1400		Germany, Voice of Hope	15715as	17550af	21460me
1330	1400		Guam, Adventist World Radio	11705as	11750as	
1330	1400		India, All India Radio	9710as	11620as	13710as
1330	1400		Kenya, Kenya BC Corp	4885da	4915da	4935da
1330	1400		Sweden, Radio	17505va	18960na	21810as
1330	1400		UAE, Radio Dubai	13675eu	15395eu	21605eu
1330	1400		Uzbekistan, Radio Tashkent	7285as	9715as	15295as 17775as
1345	1400		Vatican City, Vatican Radio	17515au	21620au	

Selected Programs

Sundays

1300 UK, BBC London (am/east af/me/south as): News. A five-minute news summary.

1300 UK, BBC London (east as): Newshour. A comprehensive look at the major topics of the day, plus international and British news.

1300 UK, BBC London (eu): Newshour. A look at the major topics of the day, plus up-to-the-minute international and British news.

1300 UK, BBC London (west af): News Summary. One minute news.

1301 UK, BBC London (east af): Concert Hall. Classical music concerts.

1305 UK, BBC London (am): Jazzmatazz.

1305 UK, BBC London (me): Variable Comedy/Quiz Feature. These programs are panel quizes and other light entertainment in a format heard in America decades ago.

1305 UK, BBC London (south as): Wright Round the World. Steve Wright's new show with listeners' requests and dedications.

1305 UK, BBC London (west af): Concert Hall. Classical music.

1330 UK, BBC London (am): In Praise of God. Weekly programme of worship and meditation.

1330 UK, BBC London (me): Global Business. See S 0530.

Monday-Friday

1300 UK, BBC London (am/east af/eu/me/south as/west af): News.

1300 UK, BBC London (east as): Newshour. See S 1300.

1305 UK, BBC London (am/south as): Outlook. An up-to-the-minute mix of conversation, controversy and color from around the world.

1345 UK, BBC London (am): Off the Shelf. Daily readings from the best of world literature.

1350 UK, BBC London (east as): World Business Report. Latest news from the markets in the Far East, Europe and the USA.

Mondays

1305 UK, BBC London (east af/eu/west af): Meridian Masterpiece.

1305 UK, BBC London (me): Discovery. A look at scientific research.

1330 UK, BBC London (east af/eu/west af): Variable Comedy/Quiz Feature. These programs are panel quizes and other light entertainment in a format heard in America decades ago.

1330 UK, BBC London (me): Variable Feature. Special features.

1330 UK, BBC London (south as): Patterns of Faith. Though-provoking and illuminating refections on a wide range of issues.

Tuesdays

1305 UK, BBC London (east af/eu/west af): Meridian Ideas. See M 1605.

1305 UK, BBC London (me): Health Matters. Keeps track of new developments in the world of medical science, as well as ways of keeping fit.

1330 UK, BBC London (east af/eu)/west af: The Music Mix. An insight into a current popular music genre.

1330 UK, BBC London (me): Everywoman. Features and reports on the activities of women across the globe.

1330 UK, BBC London (south as): Plain English. The workings of the English language.

Wednesdays

1305 UK, BBC London (east af/east af/west af): Meridian Screen.

1305 UK, BBC London (me): Following Trends (4).

1305 UK, BBC London (me): Science Perspective (1/2).

1315 UK, BBC London (me): From Lab to Law (2). A discussion program about creating science policy.

1315 UK, BBC London (me): Seeing Stars (1). Heather Couper and Nigel Henbest guide listeners through all the best sky sights.

1315 UK, BBC London (me): Soundbyte (3). The computer and information technology magazine.

1330 UK, BBC London (east af/eu/west af): The UK Top Twenty. Tim Smith presents the UK's pop countdown.

1330 UK, BBC London (me): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.

1330 UK, BBC London (south as): Heart and Soul. The complementary strand to patterns of faith.

Thursdays

1305 UK, BBC London (east af/eu/west af): Meridian Music.

1305 UK, BBC London (me): Sports International. Live commentaries and interviews, features and discussions.

1330 UK, BBC London (east af/eu/west af): Omnibus. Each week a half-hour programme on practically any topic under the sun.

1330 UK, BBC London (me): Pick of the World. Daire Brehan celebrates the diversity and range of the BBC World Service output.

1330 UK, BBC London (south as): Best of the Edge. A 15-minute replay of pop music.

Fridays

1305 UK, BBC London (east af/eu/west af): Meridian Writing.

1305 UK, BBC London (me): One Planet. Charles Haviland and Richard Black host this program about development and the environment.

1330 UK, BBC London (east af/eu): World Music. The best of folk, non-western classical and non-western popular music.

1330 UK, BBC London (me): People and Places. A forum to exchange views and experience on a global scale.

1330 UK, BBC London (south as): Body and Mind. A new health strand which deals with how health and medicine relates to you.

1330 UK, BBC London (west af): Andy Kershaw's World of Music. Recordings of diverse music from around the world.

Saturdays

1300 UK, BBC London (am/east af/me/south as/west af): News.

1300 UK, BBC London (east as/eu): Newshour. See S 1300.

1305 UK, BBC London (am): Global Business. See S 0430.

1305 UK, BBC London (east af): Jazzmatazz. The request program that lives up to its title.

1305 UK, BBC London (me): Variable Feature. See M 1330.

1305 UK, BBC London (south as): Variable Comedy/Quiz Feature. These programs are panel quizes and other light entertainment in a format heard in America decades ago.

1330 UK, BBC London (ameast af/me): People and Politics.

1330 UK, BBC London (south as): The Greenfield Collection. This classical music program replaces Ray on Record.

Frequencies

1400	1405		Vatican City, Vatican Radio	17515au	21620au		
1400	1430		Israel, Kol Israel	15650va	17535va		
1400	1430		Mexico, R Mexico International	5985am	9705am		
1400	1430	vl	Solomon Islands, SIBC	5020da			
1400	1430		Thailand, Radio	9655as	9830as	11905as	
1400	1430	s	USA, Voice of America	18275va			
1400	1455	as	S Africa, Channel Africa	11720af	17780af	21725af	
1400	1456		China China Radio International	7405na	9700as	11675as	11825as
				13685af	15110as	15125af	
1400	1500		Anguilla, Caribbean Beacon	11775am			
1400	1500	vl	Australia, ABC/Alice Springs	2310da			
1400	1500	vl	Australia, ABC/Katherine	2485da			
1400	1500	vl	Australia, ABC/Tennant Creek	2325da			
1400	1500		Australia, Radio	5995as	6080va	9475as	9580va
				11650pa	11660as		
1400	1500	vl	Botswana, Radio	7255da	9600do	7255da	
1400	1500	vl	Cameroon, RTV/Yaounde	4850do			
1400	1500	vl	Canada, CBC Northern Service	9625da			
1400	1500		Canada, CFRX Toronto ON	6070da			
1400	1500		Canada, CFVP Calgary AB	6030da			
1400	1500		Canada, CHNX Halifax NS	6130da			
1400	1500		Canada, CKZN St John s NF	6160da			
1400	1500		Canada, CKZU Vancouver BC	6160da			
1400	1500	s	Canada, R Canada International	13650na	17800na		
1400	1500		Costa Rica, R for Peace Intl	15049va			
1400	1500		Costa Rica, University Network	5030am	6150va	7375na	9725ra
				11870va	13749af		
1400	1500		Ecuador, HCJB	12005am	15115am	21455usb	
1400	1500	as/vl	Eqt Guinea, Radio East Africa	15185af			
1400	1500		France, R France International	11610as	17620va	17680as	
1400	1500		Germany, Deutsche Welle	6140eu			
1400	1500		Germany, Overcomer Ministries	5850eu	13810eu		
1400	1500		Germany, Voice of Hope	15715as	17550af	21460me	
1400	1500	vl	Ghana, Ghana BC Corp	4915do	6130do		
1400	1500		Guyana, Voice of	5949do			
1400	1500		India, All India Radio	9710as	11620as	13710as	
1400	1500	vl/as	Italy, IRRS	7120va			
1400	1500		Japan, Radio	9505na	9860as	11730as	11880me
1400	1500		Jordan, Radio	11690eu			
1400	1500		Kenya, Kenya BC Corp	4885da	4915da	4935da	
1400	1500	vl	Lesotho, Radio	4800da			
1400	1500	vl	Liberia, ELWA	4760da			
1400	1500	vl	Liberia, R Liberia International	6100da			
1400	1500		Malaysia, Radio	7295da			
1400	1500		Malaysia, RTM Sarawak	7160da			
1400	1500		Namibia, Namibian BC Corp	7165af	7215af		
1400	1500	accsnal	New Zealand, R New Zealand Int	6100va			
1400	1500		New Zealand, ZLXA	3935do			
1400	1500	vl	Nigeria, Radio/Enugu	6025do			
1400	1500	vl	Nigeria, Radio/Ibadan	6050do			
1400	1500	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275do	9570do
1400	1500	vl	Nigeria, Radio/Lagos	4990da	7285da		
1400	1500		Oman, Radio Sultanate of	15140va			
1400	1500		Palau, KHBN/Voice of Hope	9955as	9965as	9985as	13840as
1400	1500	vl/mtwhfa	Papua New Guinea, NBC	4890da	9675da		
1400	1500		Russia, Voice of Russia WS	11695as	12025as	12055me	
1400	1500		Sierra Leone, Sierra Leone BS	5980do			
1400	1500		Singapore R Corp of Singapore	6150do			
1400	1500		Sri Lanka, Sri Lanka BC Corp	4940do	6005as	6075as	9735as
				15425as			
1400	1500		Switzerland, Swiss R International	9575as	17670as		
1400	1500		Taiwan, R Taiwan International	15125as			
1400	1500		Uganda, Radio	4976da	5026do		
1400	1500		UK, BBC World Service	5990as	6190af	6195as	9515na
				9740as	11865na	11940af	12095eu
				15220na	15310as	15485eu	15565eu
				15575me	17640eu	17700as	17830af
				17840am	21470af	21660af	
1400	1500	a	UK, Global Kitchen/Merlin	9750eu	12005eu	15235eu	
1400	1500	a	UK, Virgin Radio/Merlin	21455me	21515af		
1400	1500		USA, Armed Forces Network	4278am	6458am	12689am	
1400	1500		USA, KAIJ Dallas TX	13815va			
1400	1500		USA, KJES Vado NM	11715na			
1400	1500		USA, KTBN Salt Lake City LT	7510na			
1400	1500		USA, KWHR Naalehu HI	9930as	11565as		
1400	1500		USA, Voice of America	6160as	7125as	9645as	9760as
				15160as	15255va	15425as	
1400	1500		USA, WEWN Birmingham AL	11875na	15745eu		
1400	1500		USA, WGTG McCaysville GA	12172am			
1400	1500	mtwht	USA, WGTG McCaysville GA	9400va			
1400	1500		USA, WHRI Noblesville IN	6040na	15105sa		
1400	1500		USA, WJCR Upton KY	7490va	13594as		
1400	1500	s	USA, WRMI Miami FL	9955am			
1400	1500		USA, WRNO New Orleans LA	7395na			
1400	1500		USA, WTJC Newport NC	9370na			
1400	1500		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
1400	1500		USA, WYFR Okeechobee FL	11550as	11830na	11970na	17750na
1400	1500		Zambia, Christian Voice	9865da			
1400	1500	vl	Zambia, National BC Corp	6165da	6265do		
1400	1500	vl	Zimbabwe, Zimbabwe BC Corp	5975da	6045do		
1415	1420		Nepal, Radio	5005as	7165as		
1430	1500		Guam, Adventist World Radio	9355as			
1430	1500		Guam, Trans World Radio	15330as			
1430	1500		Malaysia, RTM Kota Kinabalu	5980da			
1430	1500		Myanmar, Radio	5985do			
1430	1500		Netherlands, Radio	9890as	12065as	15590as	
1430	1500		Slovakia, Adventist World Radio	17525as			
1445	1500		USA, WINB Red Lion PA	13570am			

Selected Programs

Sundays

1400 UK, BBC London (am/east af/eu/east as/me/south as/west af): News. A five-minute news summary.

1405 UK, BBC London (am/east af/east as/eu/me/south as/west af): Talking Point. Robin Lustig and Diana Madill host this regular phone-in program which encourages strong opinions about key issues.

Monday-Friday

1400 UK, BBC London (am/eu/south as/west af): News. See S 1300.

1400 UK, BBC London (east af/me): World Briefing. See S 1100.

1400 UK, BBC London (east as): East Asia Today. Current affairs, politics and finance.

1420 UK, BBC London (east af/me): World Business Report. Latest news from the markets in the Far East, Europe and the USA.

1430 UK, BBC London (east af/east as/me): British News. See S 1120.

1445 UK, BBC London (east af/east as/me): Sports Roundup. See S 0320.

Mondays

1405 UK, BBC London (am/south as): Meridian Ideas. The edition that explores big cultural ideas.

1405 UK, BBC London (eu/west af): Discovery. In-depth look at scientific research.

1430 UK, BBC London (am): The Music Mix. An insight into a current popular music genre.

1430 UK, BBC London (eu/west af): Variable Feature. Special features and new series.

1430 UK, BBC London (south as): The Music Mix. See M 0430.

Tuesdays

1405 UK, BBC London (am/south as): Meridian Screen. Interviews, documentaries, features and discussions.

1405 UK, BBC London (eu/west af): Health Matters. Keeps track of new developments in the world of medical science, as well as ways of keeping fit.

1430 UK, BBC London (am/south as): The UK Top Twenty. Tim Smith presents the UK's pop countdown.

1430 UK, BBC London (eu/west af): Everywoman. Features and reports on the activities of women across the globe.

Wednesdays

1405 UK, BBC London (am/south as): Meridian Music. An in-depth look at the classical music of the world.

1405 UK, BBC London (eu): Science View. A look at complex issues and the implications of the latest research findings.

1405 UK, BBC London (west af): Following Trends (4). A science round table discussion.

1405 UK, BBC London (west af): From Lab to Law (2). A discussion program about creating science policy.

1405 UK, BBC London (west af): Science Perspective (7/3). Richard Hollingham and Alun Lewis.

1415 UK, BBC London (west af): Seeing Stars (1). Heather Couper and Nigel Henbest guide listeners through all the best sky sights.

1415 UK, BBC London (west af): Soundbyte (3). The computer and information technology magazine.

1430 UK, BBC London (am/south as): The UK Album Chart. Tim Smith counts down the top ten UK album chart and plays the week's highest entries and climbers.

1430 UK, BBC London (eu): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.

1430 UK, BBC London (west af): Variable Feature. See M 1430.

Thursdays

1405 UK, BBC London (am/south as): Meridian Writing. The literature edition.

1405 UK, BBC London (eu/west af): Sports International. Live commentaries and interviews, features and discussions.

1430 UK, BBC London (am): World Music. The best of folk, non-western classical and non-western popular music.

1430 UK, BBC London (eu/south as/west af): Pick of the World. Daire Brehan celebrates the diversity and range of the whole of BBC World Service output.

Fridays

1405 UK, BBC London (am/south as): Meridian Masterpiece. See M 0505

1405 UK, BBC London (eu)/west af: One Planet. Charles Haviland and Richard Black host this new program about development and the environment.

1430 UK, BBC London (am/south as): Music X-Press. A chance to hear the most creative new pop music and to hear it discussed by musical experts.

1430 UK, BBC London (eu): People and Places. A forum to exchange views and experience on a global scale.

1445 UK, BBC London (east af): Football Extra. A review of the week's action and the upcoming weekend matches.

Saturdays

1400 UK, BBC London (am/east af/east as/eu/me/south as/west af): News. See S 1300.

1405 UK, BBC London (am/east af/east as/eu/me/south as): Sportsworld. The weekly sports magazine.

1405 UK, BBC London (west af): Jazzmatazz. The request program that lives up to its title.

1430 UK, BBC London (west af): Arts in Action. See M 1130.

1500 UTC SHORTWAVE GUIDE

11:00 AM EDT
10:00 AM CDT
8:00 AM PDT

Frequencies

1500	1505	occsnol	New Zealand, R New Zealand Int	6100va			
1500	1530		Austria, R Austria International	17865na			
1500	1530		Ecuador, HCJB	12005am	15115am	21455usb	
1500	1530	twhla	Mexico, R Mexico International	5985am	9705am		
1500	1530		Mongolia, Voice of	12015as	12085as		
1500	1530		S Africa, Channel Africa	17770af			
1500	1556		China China Radio International	7160as	7405na	9785as	13685af
				15125af			
1500	1556		North Korea, R Pyongyang	4405va	6574na	9335na	11710na
				13760na			
1500	1559	s	Canada, R Canada International	13650na	17800na		
1500	1600		Anguilla, Caribbean Beacon	11775am			
1500	1600	vl	Australia, ABC/Alice Springs	2310da			
1500	1600	vl	Australia, ABC/Katherine	2485da			
1500	1600	vl	Australia, ABC/Tennant Creek	2325da			
1500	1600		Australia, Radio	5995as	6080va	9475as	9580va
				11650pa	11660as		
1500	1600	vl	Botswana, Radio	7255do	9600do	7255do	
1500	1600	vl	Cameroon, RTV/Yaounde	4850do			
1500	1600	vl	Canada, CBC Northern Service	9625do			
1500	1600		Canada, CFRX Toronto ON	6070do			
1500	1600		Canada, CFVP Calgary AB	6030do			
1500	1600		Canada, CHNX Halifax NS	6130do			
1500	1600		Canada, CKZN St John's NF	6160do			
1500	1600		Canada, CKZU Vancouver BC	6160do			
1500	1600		Costa Rica, R for Peace Intl	15049va			
1500	1600		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1500	1600	as/vl	Eqt Guinea, Radio East Africa	15185af			
1500	1600		Germany, Deutsche Welle	6140eu			
1500	1600		Germany, Overcomer Ministries	5850eu			
1500	1600		Germany, Voice of Hope	15715as	17550af	21460me	
1500	1600	vl	Ghana, Ghana BC Corp	4915do	6130do		
1500	1600		Guam, Trans World Radio	15330as			
1500	1600		Guyana, Voice of	5949do			
1500	1600		Japan, Radio	9750as	9860as	11730as	
1500	1600		Jordan, Radio	11690eu			
1500	1600		Kenya, Kenya BC Corp	4885do	4915do	4935do	
1500	1600	vl	Lesotho, Radio	4800do			
1500	1600	vl	Liberia, ELWA	4760do			
1500	1600	vl	Liberia, R Liberia International	6100do			
1500	1600		Malaysia, Radio	7295do			
1500	1600		Malaysia, RTM Kota Kinabalu	5980do			
1500	1600		Malaysia, RTM Sarawak	7160do			
1500	1600		Myanmar, Radio	5985do			
1500	1600		Namibia, Namibian BC Corp	7165af	7215af		
1500	1600		Netherlands, Radio	9890as	12065as	15590as	
1500	1600		New Zealand, ZLXA	3935do			
1500	1600	vl	Nigeria, Radio/Enugu	6025do			
1500	1600	vl	Nigeria, Radio/Ibadan	6050do			
1500	1600	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
1500	1600	vl	Nigeria, Radio/Lagos	4990do	7285do		
1500	1600	vl	Nigeria, Voice of	7255af	15120af		
1500	1600		Palau, KHBN/Voice of Hope	9955as	9965as	9985as	13840as
1500	1600	vl/mtwhla	Papua New Guinea, NBC	4890da	9675da		
1500	1600		Russia, Voice of Russia WS	4940me	4965me	4975me	7325me
				9730eu	11500as	12015me	
1500	1600		Seychelles, FEBA Radio	11600as			
1500	1600		Sierra Leone, Sierra Leone BS	5980do			
1500	1600		Singapore R Corp of Singapore	6150da			
1500	1600		Sri Lanka, Sri Lanka BC Corp	4940da	6005as	6075as	9735as
				15425as			
1500	1600		Uganda, Radio	4976da	5026da		
1500	1600		UK, BBC World Service	5975as	5990as	6190af	6195as
				9515na	9740as	11860af	11865na
				11940af	12095eu	15220na	15310as
				15400af	15420af	15485eu	15575eu
				17700as	17830af	17840am	21470af
				21490af	21660af		
1500	1600	a	UK, Global Kitchen/Merlin	9750eu	11785eu	15235eu	
1500	1600	a	UK, Virgin Radio/Merlin	21455me	21515af		
1500	1600		USA, Armed Forces Network	4278am	6458am	12689am	
1500	1600		USA, KAIJ Dallas TX	13815va			
1500	1600		USA, KJES Vada NM	11715na			
1500	1600		USA, KTBN Salt Lake City UT	15590na			
1500	1600		USA, KWHR Naalehu HI	9930as	11565pa		
1500	1600		USA, VOA Special English	6160as	9760as	9845as	12040as
				15235as			
1500	1600		USA, Voice of America	7125as	9645as	9700me	9780as
				15205va	15255va		
1500	1600		USA, WEWN Birmingham AL	11875na	15745eu		
1500	1600		USA, WGTG McCaysville GA	12172am			
1500	1600	mtwhf	USA, WGTG McCaysville GA	9400va			
1500	1600		USA, WHRA Greenbush ME	17650af			
1500	1600		USA, WHRI Noblesville IN	13760na	15105sa		
1500	1600		USA, WINB Red Lion PA	13570am			
1500	1600		USA, WJCR Upton KY	7490va	13594as		
1500	1600	s	USA, WRMI Miami FL	9955am			
1500	1600		USA, WRNO New Orleans LA	7395na	15420al		
1500	1600		USA, WTJC Newport NC	9370na			
1500	1600		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
1500	1600		USA, WYFR Okeechobee FL	11830na	17750na		
1500	1600		Zambia, Christian Voice	9865do			
1500	1600	vl	Zambia, National BC Corp	6165do	6265do		
1500	1600	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do		
1506	1600	occsnal	New Zealand, R New Zealand Int	6145va			
1515	1600	vl	Malawi, Malawi BC Corp	3380do			
1530	1545		Afghanistan, Voice of Shari'ah	7002do	7073do	7085as	
1530	1545		Bangladesh, Bangla Betar	4882as	15520as		
1530	1600	vl	Botswana, Radio	3356do	4820do	7255do	
1530	1600		Ecuador, HCJB	12005am	15115am		
1530	1600		Georgia, Georgian Radio	6180me			
1530	1600		Iran, VOIRI	7115as	9635as	11775na	
1545	1600	sh	Bangladesh, Bangla Betar	4882as	15520as		
1550	1600		Vatican City, Vatican Radio	12065au	13765au	17730au	

Selected Programs

Sundays

1500 UK, BBC London (am/east af/east as): News. See S 1300.
1500 UK, BBC London (eu/me/south as/west af): News Summary. One minute news update.
1501 UK, BBC London (me): Concert Hall. Classical music concerts.
1501 UK, BBC London (south as): Play of the Week. A different radio drama program each week.
1505 UK, BBC London (am/eu): Concert Hall. Classical music concerts.
1505 UK, BBC London (east af): Play of the Week. A different radio drama program each week.
1505 UK, BBC London (east as/west af): The Alternative. A time spot for a changeable music program such as John Peel or Steve Lamacq.
1530 UK, BBC London (east as): Omnibus. See S 0430.

Monday-Friday

1500 UK, BBC London (am/east af/east as/me/west af): News. See S 1300.
1500 UK, BBC London (eu/south as): World Briefing. See S 0600.
1505 UK, BBC London (east af/west af): Focus on Africa. Up-to-the-minute reports on the day's events from all over the continent.
1505 UK, BBC London (me): Outlook. An up-to-the-minute mix of conversation, controversy and color from around the world.
1530 UK, BBC London (east af/west af): The Learning Zone. For people who want to learn more about subjects such as science, health, the world and work and literature while practicing English listening skills.
1530 UK, BBC London (eu/south as): British News. See S 1120.
1545 UK, BBC London (south as): World Business Report. Latest news from the markets in the Far East, Europe and the USA.

Mondays

1505 UK, BBC London (am): One Planet. Charles Haviland and Richard Block host this new program about development and the environment.
1505 UK, BBC London (east as): Meridian Ideas. See M 0205.
1530 UK, BBC London (am): People and Places. A forum to exchange views and experience on a global scale.
1530 UK, BBC London (east as): The Music Mix. See M 0230.
1545 UK, BBC London (am): People and Places. See M 1530.
1545 UK, BBC London (eu): Analysis. Background to current affairs.

Tuesdays

1505 UK, BBC London (am): Discovery. In-depth look at scientific research.
1505 UK, BBC London (east as): Meridian Screen. See T 0205.
1530 UK, BBC London (am): Voriable Feature. Special features and new series.
1530 UK, BBC London (east as): The UK Top Twenty. See T 0230.
1545 UK, BBC London (eu): Analysis. See M 1545.

Wednesdays

1505 UK, BBC London (am): Health Matters. See T 0105.
1505 UK, BBC London (east as): Meridian Music. See W 0205.
1530 UK, BBC London (am): Everywoman. See T 0130.
1530 UK, BBC London (east as): The UK Album Chart. See W 0245.
1545 UK, BBC London (eu): From Our Own Correspondent. BBC correspondents comment on the background to the news.

Thursdays

1505 UK, BBC London (am): Following Trends (4). See W 0105.
1505 UK, BBC London (am): From Lab to Law (2). See W 0105.
1505 UK, BBC London (am): Science Perspective (1/3). See W 0105.
1505 UK, BBC London (east as): Meridian Writing. See H 0205.
1515 UK, BBC London (am): Seeing Stars (1). See W 0115.
1515 UK, BBC London (am): Soundbyte (3). See W 0115.
1530 UK, BBC London (am): Focus on Faith. See W 0130.
1530 UK, BBC London (east as): World Music. The best of folk, non-western classical and non-western popular music.
1545 UK, BBC London (eu): Analysis. See M 1545.

Fridays

1505 UK, BBC London (am): Sports International. See H 0105.
1505 UK, BBC London (east as): Meridian Masterpiece. See M 0605.
1530 UK, BBC London (am): Pick of the World. Daire Brehon celebrates the diversity and ronge of the whole of BBC World Service output.
1530 UK, BBC London (east as): Westway. See W 0230.
1545 UK, BBC London (east as): Variable Feature. See T 0330.
1545 UK, BBC London (eu): Analysis. See M 1545.

Saturdays

1500 UK, BBC London (am/east af/east as/eu/me/south as/west af): News. See S 1300.
1505 UK, BBC London (am/east af/east as/eu/me/south as/west af/): Sportsworld. See A 1405.

Frequencies

1600	1610		Vatican City, Vatican Radio	12065au	13765au	17540au		
1600	1615		Pakistan, Radio	11570me	15100af	15334af	7510me	
				17720af	17720af			
1600	1615		Switzerland, Swiss r International	9575va	17670as			
1600	1627		Czech Rep, Radio Prague Intl	5930eu	21745af			
1600	1630		Ecuador, HCJB	12005am	15115am			
1600	1630	s	Germany, Universal Life	15105af				
1600	1630		Germany, Voice of Hope	15715as	17550af			
1600	1630	as	Guam, Trans World Radio	15330as				
1600	1630		Iran, VOIRI	9635as	11775as			
1600	1630		Jordan, Radio	11690eu				
1600	1630		Netherlands, Radio	9890as	12065as	15590as		
1600	1630		S Africa, Channel Africa	9525af				
1600	1630	vl	Zimbabwe, Zimbabwe BC Corp	5975do	6045do			
1600	1640		UAE, Radio Dubai	13675eu	15395eu	21605eu		
1600	1645		Germany, Deutsche Welle	6140eu	6170as	7225as	9735af	
				11810af	17595as	21775af		
1600	1650	occsnal	New Zealand, R New Zealand Int	6145va				
1600	1650	occsnal	New Zealand, R New Zealand Int	6145va				
1600	1656		China China Radio International	7190af	9565af	9870af		
1600	1656		North Korea, R Pyongyang	3560va	6520va	9600va	9975va	
1600	1700		Algeria, R Algiers International	11715va	15160va			
1600	1700		Anguilla, Caribbean Beacon	11775am				
1600	1700	vl	Australia, ABC/Alice Springs	2310do				
1600	1700	vl	Australia, ABC/Katherine	2485do				
1600	1700	vl	Australia, ABC/Tennant Creek	2325do				
1600	1700		Australia, Radio	5995as	6080va	9475as	9580va	
				11650pa	11660as			
1600	1700	vl	Botswana, Radio	3356do	4820do	7255do		
1600	1700	vl	Cameroon, RTV/Yoounde	4850do				
1600	1700	vl	Canada, CBC Northern Service	9625do				
1600	1700		Canada, CFRX Toronto ON	6070do				
1600	1700		Canada, CFVP Calgary AB	6030do				
1600	1700		Canada, CHNX Halifax NS	6130do				
1600	1700		Canada, CKZN St John's NF	6160do				
1600	1700		Canada, CKZU Vancouver BC	6160do				
1600	1700		Costa Rica, R for Peace Intl	15049va				
1600	1700		Costa Rica, University Network	5030am	6150va	7375na	9725na	
				11870va	13749af			
1600	1700		Ethiopia, Radio	7165af	9560af			
1600	1700		France, R France International	11615af	11995af	12015af	15270af	
				17605af	17850af			
1600	1700	a	Germany, Good News World R	15105af				
1600	1700		Germany, Overcomer Ministries	5850eu	13810af			
1600	1700	vl	Ghana, Ghana BC Corp	4915do	6130do			
1600	1700	a	Greece, Voice of	9420va	15455va	15630va		
1600	1700		Guam, Adventist World Radio	9355as				
1600	1700		Guyana, Voice of	5949do				
1600	1700	irreg	Iraq, Radio Iraq International	7070va				
1600	1700		Kenya, Kenya BC Corp	4885do	4915do	4935do		
1600	1700	vl	Lesotho, Radio	4800do				
1600	1700	vl	Liberia, ELWA	4760do				
1600	1700	vl	Liberia, R Liberia International	6100do				
1600	1700	vl	Malawi, Malawi BC Corp	3380do				
1600	1700		Malaysia, Radio	7295do				
1600	1700		Namibia, Namibian BC Corp	7165af	7215af			
1600	1700		New Zealand, ZLXA	3935do				
1600	1700	vl	Nigeria, Radio/Enugu	6025do				
1600	1700	vl	Nigeria Radio/Ibadan	6050do				
1600	1700	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	7570do	
1600	1700	v	Nigeria, Radio Lagos	3326do	4990do			
1600	1700	v	Nigeria, Voice of	7255af	15120af			
1600	1700		Palau, KHBN/Voice of Hope	9955as	9965as			
1600	1700	v/mtwhfa	Papua New Guinea, NBC	4890do	9675do			
1600	1700		Russia, Voice of Russia WS	9730eu	9875as	12015me	12025as	
				12055me				
1600	1700	v	Rwanda, Radio	6055do				
1600	1700		S Africa, World Beacon	6145af				
1600	1700		Sierra Leone Sierra Leone 85	5980da				
1600	1700		South Korea R Koreo Intl	5975am	9515af	9870af		
1600	1700		Sri Lanka, Sri Lanka BC Corp	4940da				
1600	1700		Swaziland, Trans World Radio	9500af				
1600	1700		Uganda, Radio	4976do	5026do			
1600	1700		UK, BBC World Service	3195as	5975as	6190af	6195af	
				7160as	9515na	9740as	11940af	
				12095eu	15310as	15400af	15485eu	
				15575eu	17700as	17830am	17840am	
				21470af	21660af			
1600	1700	a	UK, Global Kitchen/Merlin	9750eu	11785eu	15235eu		
1600	1700		USA, Armed Forces Network	4278am	6458am	12689am		
1600	1700		USA, KAIJ Dallas TX	13815va				
1600	1700		USA, KTBN Salt Lake City UT	15590na				
1600	1700		USA, KWHR Naalehu HI	9930as				
1600	1700		USA, VOA Special English	13600af	15445af	17895af		
1600	1700		USA, Voice of America	6035af	6160as	7125as	9645as	
				9700me	9760as	13710af	15205va	
				15225af	15255va	15410af		
1600	1700		USA, WEWN Birmingham AL	11875na	13615na	15745eu		
1600	1700		USA, WGTG McCaysville GA	12172am				
1600	1700	mtwhf	USA, WGTG McCaysville GA	9400va				
1600	1700		USA, WHRA Greenbush ME	17650af				
1600	1700		USA, WHRI Noblesville IN	13760na	15105sa			
1600	1700		USA, WINB Red Lion PA	13570eu				
1600	1700		USA, WJCR Upton KY	7490va	13594as			
1600	1700	mtwhf	USA, WMLK Bethel PA	9465eu				
1600	1700	s	USA, WRMI Miami FL	9955am				
1600	1700		USA, WRNO New Orleans LA	7395na	15420al			
1600	1700		USA, WSHB Cypress Crk SC	18910af				
1600	1700		USA, WTJC Newport NC	9370na				
1600	1700		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na	
1600	1700		USA, WYFR Okeechobee FL	11830na	15600na	17750na	18980na	
				21455eu	21525af			
1600	1700		Zambia, Christian Voice	4965do				
1600	1700	vl	Zambia, National BC Corp	6165do	6265do			
1615	1630	as	UK, BBC World Service	11860af	15420af	21490af		
1615	1630		Vatican City Vatican Radio	4005eu	5880eu	7250eu	9645eu	
				15595eu				
1625	1640		Armenia, Trans World Radio	5895me				
1625	1640		Monaco, Trans World Radio	6145me				
1630	1657		Canada, R Canada International	6140as	7150as			
1630	1657		Vietnam, Voice of	9730eu	13740eu			
1630	1700		Austria, R Austria International	6155eu	13730va	15240me	17765as	
1630	1700		Egypt, Radio Cairo	15255af				
1630	1700	s	Seychelles, FEBA Radio	11605as				
1630	1700		Slovakia, R Slovakia International	5920eu	6055eu	7345eu		
1630	1700	as	UK, BBC World Service	11860af	21490af			
1630	1700	mtwhf	UK, Merlin Network One	12065as				
1630	1700	v	Zimbabwe, Zimbabwe BC Corp	4828do	6045do			
1645	1700		Germany, Deutsche Welle	6140eu				
1650	1700	mtwhf	New Zealand, R New Zealand Int	6145va				

Selected Programs

Sundays

1600 UK, BBC London (am/east as/me): News. See S 1300.
1600 UK, BBC London (east af/south as): Play of the Week from 1500).
1600 UK, BBC London (eu/west af): News Summary. See S 1500.
1605 UK, BBC London (am/east as/eu/me/east af/south as/west af): Sunday Sportsworld. The Sunday sports magazine.
1605 UK, BBC London (west af): Play of the Week. See S 1505.

Monday-Friday

1600 UK, BBC London (am/east as/eu): Europe Today. All the latest news, analysis and comment.
1600 UK, BBC London (east af/south as/west af): News. See S 1300.
1600 UK, BBC London (me): News Briefing. See S 0600.
1630 UK, BBC London (am/east as/eu): World Business Report.
1645 UK, BBC London (am/east as/eu): Sports Roundup. See S 0020.

Mondays

1605 UK, BBC London (east af/me/west af): Meridian Ideas. The edition that explores big cultural ideas.
1605 UK, BBC London (south as): Health Matters. Keeps track of new developments in the world of medical science, as well as ways of keeping fit.
1630 UK, BBC London (east af/west af): Fast Track. The latest African sports news and action.
1630 UK, BBC London (me): The Music Mix. An insight into a current popular music genre.
1630 UK, BBC London (south as): Everywoman. Features and reports on the activities of women across the globe.

Tuesdays

1605 UK, BBC London (east af/me/west af): Meridian Screen. Interviews, documentaries features and discussions.
1605 UK, BBC London (south as): Following Trends (4). A science round table discussion.
1605 UK, BBC London (south as): From Lab to Law (2). A discussion program about creating science policy.
1605 UK, BBC London (south as): Science Perspective (1/3). Richard Hollingham and Aun Lewis.
1615 UK, BBC London (south as): Seeing Stars (1). Heather Couper and Nigel Henbestguide listeners through all the best sky sights.
1615 UK, BBC London (south as): Soundbyte (3). The computer and information technology magazine.
1630 UK, BBC London (east af/west af): African Perspective. See S 0430.
1630 UK, BBC London (me): The UK Top Twenty. Tim Smith presents the UK's pop countdown.
1630 UK, BBC London (south as): Focus on Faith. Alison Hilliard talks to church leaders about their hopes for the future.

Wednesdays

1605 UK, BBC London (east af/me/west af): Meridian Music. An in-depth look at the classical music of the world.
1605 UK, BBC London (south as): Sports International. Live commentaries and interviews features and discussions.
1630 UK, BBC London (east af/west af): Talkabout Africa. Telephone conversations with BBC correspondents on late-breaking African events.
1630 UK, BBC London (me): The UK Album Chart. Tim Smith counts down the top ten UK album chart and plays the week's highest entries and climbers.
1630 UK, BBC London (south as): Pick of the World. Daire Brehan celebrates the diversity and range of the whole of BBC World Service output.

Thursdays

1605 UK, BBC London (east af/me/west af): Meridian Writing. The literature edition.
1605 UK, BBC London (south as): One Planet. See M 0505.
1630 UK, BBC London (east af/west af): Art Beat. See S 0530.
1630 UK, BBC London (me): World Music. The best of folk, non-western classical and non-western popular music.
1630 UK, BBC London (south as): People and Places. See M 0530.

Fridays

1605 UK, BBC London (east af/me/west af): Meridian Masterpiece. See M 1305.
1605 UK, BBC London (south as): Discovery. See T 0505.
1630 UK, BBC London (east af/west af): Fast Track. See M 1630.
1630 UK, BBC London (me): Music X-Press. A chance to hear the most creative new pop music and to hear it discussed by musical experts.
1630 UK, BBC London (south as): Variable Feature. See T 0530.

Saturdays

1600 UK, BBC London (am/east af/east as/eu/me/south as/west af): News. See S 1300.
1605 UK, BBC London (am/east af/east as/eu/me/south as): Sportsworld. See A 1405.

FREQUENCIES

1700	1727		Czech Rep, Radio Prague Intl	5930eu	21745af		
1700	1727		Vietnam, Voice of	12070eu			
1700	1730		Azerbaijan, Voice of	6110eu			
1700	1730		France, R France International	15210af	17605af		
1700	1730		Georgia, Georgian Radio	11910eu			
1700	1730		S Africa, Channel Africa	17860af			
1700	1730		Swaziland, Trans World Radio	9500af			
1700	1730	mtwhf	UK, Merlin Network One	12065as			
1700	1755		Poland, Radio Polonia	6000eu	7285eu		
1700	1756		China China Radio International	5220af	9570af	9670af	9695af
				11910af	13700af		
1700	1756		Romania, R Romania International	15250eu	15390eu	17735eu	17805eu
1700	1800		Anguilla, Caribbean Beacon	11775am			
1700	1800	vl	Australia, ABC/Alice Springs	2310da			
1700	1800	vl	Australia, ABC/Katherine	2485da			
1700	1800	vl	Australia, ABC/Tennant Creek	2325da			
1700	1800		Australia, Radio	5995as	6080va	9475as	9580va
				9815pa	11880va		
1700	1800	vl	Botswana, Radio	3356da	4820da	7255da	
1700	1800	vl	Cameroon, RTV/Yaounde	4850da			
1700	1800	vl	Canada, CBC Northern Service	9625da			
1700	1800		Canada, CFRX Toronto ON	6070da			
1700	1800		Canada, CFVP Calgary AB	6030da			
1700	1800		Canada, CHNX Halifax NS	6130da			
1700	1800		Canada, CKZN St John's NF	6160da			
1700	1800		Canada, CKZU Vancouver BC	6160da			
1700	1800		Costa Rica, R for Peace Intl	15049va			
1700	1800		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1700	1800		Egypt, Radio Cairo	15255af			
1700	1800	mtwhf	Eqt Guinea, Radio Africa	15185af			
1700	1800		Germany, Deutsche Welle	6140eu			
1700	1800	a	Germany, Good News World R	11795me			
1700	1800		Germany, Voice of Hope	11985va			
1700	1800	vl	Ghana, Ghana BC Corp	3366da	4915da		
1700	1800		Guyana, Voice of	5949da			
1700	1800	vl	Italy, IRRS	3980va	3985		
1700	1800		Japan, Radio	9505na	12000eu	15355af	
1700	1800		Kenya, Kenya BC Corp	4885da	4915da	4935da	
1700	1800	vl	Lesotho, Radio	4800da			
1700	1800	vl	Liberia, ELWA	4760da			
1700	1800	vl	Liberia, R Liberia International	6100da			
1700	1800	vl	Malawi, Malawi BC Corp	3380da			
1700	1800		Malaysia, Radio	7295da			
1700	1800		Namibia, Namibian BC Corp	3270af	3289af		
1700	1800	mtwh	New Zealand, R New Zealand Int	6145va			
1700	1800		New Zealand, ZLXA	3935da			
1700	1800	vl	Nigeria, Radio/Enugu	6025da			
1700	1800	vl	Nigeria, Radio/Ibadan	6050da			
1700	1800	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275da	9570da
1700	1800	vl	Nigeria, Radio/Lagos	3326da	4990da		
1700	1800		Palau, KHBN/Voice of Hope	9955as	9965as		
1700	1800	vl/mtwhfa	Papua New Guinea, NBC	4890da	9675da		
1700	1800	sm wh a	Russia, Voice of Russia WS	9820eu			
1700	1800		Russia, Voice of Russia WS	9710eu	9775eu	9890eu	11510af
				11675eu	12015af	12055me	
1700	1800	vl	Rwanda, Radio	6055da			
1700	1800		S Africa, World Beacon	6145af			
1700	1800		Sierra Leone, Sierra Leone BS	5980da			
1700	1800	irreg	Sri Lanka, Sri Lanka BC Corp	4940da			
1700	1800	vl	Sudan, Radio Omdurman	7199da	9200da	9505da	
1700	1800		Uganda, Radio	4976da	5026da		
1700	1800		UK, BBC World Service	3255af	3915af	5975as	6005af
				6190af	7160as	9510as	9630af
				9740as	12095eu	15400af	15420af
				15485eu	15575me	17830af	17840na
1700	1800		USA, Armed Forces Network	4278am	6458am	12689am	
1700	1800		USA, KAIJ Dallas TX	13815va			
1700	1800		USA, KTBN Salt Lake City UT	15590na			
1700	1800		USA, KWHR Naalehu HI	9930as			
1700	1800		USA, Voice of America	6160as	7125as	7170as	9645as
				9700me	9760af	15255va	15410af
				15445af	17895af		
1700	1800	mtwhf	USA, Voice of America	5990as	6045as	7150as	9550as
				9770as			
1700	1800		USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1700	1800		USA, WGTG McCaysville GA	12172am			
1700	1800	mtwhf	USA, WGTG McCaysville GA	9400va			
1700	1800		USA, WHRA Greenbush ME	17650af			
1700	1800		USA, WHRI Noblesville IN	9495sa	13760na		
1700	1800		USA, WINB Red Lion PA	13570eu			
1700	1800		USA, WJCR Upton KY	7490va	13594as		
1700	1800	mtwhf	USA, WMLK Bethel PA	9465eu			
1700	1800		USA, WRNO New Orleans LA	7395na	15420al		
1700	1800		USA, WSH8 Cypress Crk SC	18910af			
1700	1800		USA, WTJC Newport NC	9370na			
1700	1800		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
1700	1800		USA, WYFR Okeechobee FL	18980eu	21455eu		
1700	1800		Zambia, Christian Voice	4965da			
1700	1800	vl	Zambia, National BC Corp	6165da	6265da		
1700	1800	vl	Zimbabwe, Zimbabwe BC Corp	4828da	6045da		
1730	1745	vl	Libya, Voice of Africa	11815af	15415af	15435va	
1730	1745	mtwhf	Swaziland, Trans World Radio	3200af			
1730	1800		Belgium, Radio Vlaanderen Intl	5910eu	9925eu	13710eu	17590af
1730	1800	as	Georgia, Georgian Radio	6080eu			
1730	1800		Guam, Adventist World Radio	11560va	11965va	11965as	
1730	1800		Netherlands, Radio	6020af	7120af	11655af	
1730	1800		Philippines, Radio Filipinas	11720me	15190me	17720me	
1730	1800		S Africa, Adventist World Radio	12130va			
1730	1800	mtwhfa	Sweden, Radio	6065eu			
1730	1800	s	Sweden, Radio	13800eu			
1730	1800	s	UK, BBC World Service	9750as	12045as	15310as	
1730	1800	mtwhf	UK, Merlin Network One	12065as	15560as		
1730	1800		Vatican City, Vatican Radio	13765af	15570af	17515af	
1735	1745	vl/th	Paraguay, Radio Nacional	9739sa			
1745	1800		Bangladesh, Bangla Betar	7184eu	7462eu	9558eu	15520eu
1745	1800		India, All India Radio	7410eu	9950eu	11620eu	11935af
				13750af	15075af	15200af	
1745	1800	as	Swaziland, Trans World Radio	3200af			
1800	1827		Vietnam, Voice of	7440eu	9730eu	13740eu	
1800	1830		Egypt, Radio Cairo	15255af			
1800	1830		Netherlands, Radio	6020af	7120af	11655af	
1800	1830	vl/mtwhfa	Papua New Guinea, NBC	4890da	9675da		
1800	1830		S Africa, Adventist World Radio	5960af	6100af		
1800	1830		S Africa, Channel Africa	17870af			
1800	1830		UK, BBC World Service	3255af	5975as	6190af	9410eu
				9510as	9740pa	12095eu	15400af
				15420af	15575as	17830af	
1800	1830		UK, RTE Radio	15315me			
1800	1850	mtwhf	New Zealand, R New Zealand Int	6145va			
1800	1900		Anguilla, Caribbean Beacon	11775am			
1800	1900	mtwhf	Argentina, RAE	15345eu			
1800	1900	vl	Australia, ABC/Alice Springs	2310da			
1800	1900	vl	Australia, ABC/Katherine	2485da			
1800	1900	vl	Australia, ABC/Tennant Creek	2325da			
1800	1900		Australia, Radio	6080pa	7240pa	9475as	9580va
				9815pa	11880va		
1800	1900		Bangladesh, Bangla Betar	7184eu	7462eu	9558eu	15520eu
1800	1900	vl	Botswana, Radio	3356da	4820da		
1800	1900	vl	Cameroon, RTV/Yaounde	4850da			
1800	1900		Canada, CFRX Toronto ON	6070da			
1800	1900		Canada, CFVP Calgary AB	6030da			
1800	1900		Canada, CHNX Halifax NS	6130da			
1800	1900		Canada, CKZN St John's NF	6160da			
1800	1900		Canada, CKZU Vancouver BC	6160da			
1800	1900		Costa Rica, R for Peace Intl	15049va			
1800	1900		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1800	1900	mtwhf	Eqt Guinea, Radio Africa	15185af			
1800	1900		Germany, Deutsche Welle	6140eu			
1800	1900		Germnay, Voice of Hope	11985va			
1800	1900	vl	Ghana, Ghana BC Corp	3366da	4915da		
1800	1900		Guyana, Voice of	5949da			
1800	1900		India, All India Radio	7410eu	9950eu	11620eu	11935af
				13750af	15075af	15200af	
1800	1900	vl	Italy, IRRS	3980va	3985		
1800	1900		Kenya, Kenya BC Corp	4885da	4915da	4935da	
1800	1900		Kuwait, Radio	11990va	15230as		
1800	1900	vl	Lesotho, Radio	4800da			
1800	1900	vl	Liberia, ELWA	4760da			
1800	1900	vl	Liberia, R Liberia International	5100da			
1800	1900	vl	Malawi, Malawi BC Corp	3380da			
1800	1900		Malaysia, Radio	7295da			
1800	1900		Namibia, Namibian BC Corp	3270af	3289af		
1800	1900		New Zealand, ZLXA	3935da			
1800	1900	vl	Nigeria, Radio/Enugu	6025da			
1800	1900	vl	Nigeria, Radio/Ibadan	6050da			
1800	1900	vl	Nigeria, Radio/Kaduna	4770da	6090da	7275da	9570da
1800	1900	vl	Nigeria, Radio/Lagos	3326da	4990da		
1800	1900		Palau, KHBN/Voice of Hope	9965as			
1800	1900		Philippines, Radio Filipinas	11720me	15190me	17720me	
1800	1900		Russia, Voice of Russia WS	7330eu	9710eu	9720eu	9775eu
				9820eu	9890eu	11510af	11675eu
				11695af	12015af		
1800	1900	vl	Rwanda, Radio	6055da			
1800	1900	m	S Africa, Amateur Radio League	3215af			
1800	1900		S Africa, World Beacon	3230af	9675af		
1800	1900		Sierra Leone, Sierra Leone BS	5980da			
1800	1900	irreg	Sri Lanka, Sri Lanka BC Corp	4940da			
1800	1900		Swaziland, Trans World Radio	3200af			
1800	1900		Taiwan, R Taiwan International	3955eu			
1800	1900		Uganda, Radio	4976da	5026do		
1800	1900	a	UK, BBC World Service	17840na			
1800	1900	mtwhf	UK, Merlin Network One	12065as			
1800	1900	hf	UK, Merlin Network One	6130af			
1800	1900		UK, World Beacon	9675af			
1800	1900		USA, Armed Forces Network	4278am	6458am	12689am	
1800	1900		USA, KAIJ Dallas TX	13815va			
1800	1900		USA, KTBN Salt Lake City UT	15590na			
1800	1900		USA, KWHR Naalehu HI	17510as			
1800	1900		USA, Voice of America	6035af	7415af	9760af	9770me
				11975af	15410af	15580af	17895af
1800	1900		USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1800	1900		USA, WGTG McCaysville GA	12172am			
1800	1900	mtwhf	USA, WGTG McCaysville GA	9400va			
1800	1900		USA, WHRA Greenbush ME	17650af			
1800	1900		USA, WHRI Noblesville IN	9495sa	13760na		
1800	1900		USA, WINB Red Lion PA	13570eu			
1800	1900		USA, WJCR Upton KY	7490va	13594as		
1800	1900	mtwhf	USA, WMLK Bethel PA	9465eu			
1800	1900		USA, WRNO New Orleans LA	7395na	15420al		
1800	1900		USA, WSH8 Cypress Crk SC	15665eu	18910af		
1800	1900		USA, WTJC Newport NC	9370na			
1800	1900		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
1800	1900		USA, WYFR Okeechobee FL	17555eu			
1800	1900		Yemen, Rep of Yemen Radio	9779me			
1800	1900		Zambia, Christian Voice	4965da			
1800	1900	vl	Zambia, National BC Corp	6165da	6265da		
1800	1900	vl	Zimbabwe, Zimbabwe BC Corp	4828da	6045da		
1805	1830		Croatia, Croatian Radio	13830eu			
1810	1900	s	Greece, Voice of	9420eu	15630af	17705na	
1830	1840	s	Greece, Voice of	7475eu	9420eu	15630af	17705na
1830	1845		Albania, R Tirana International	7180eu	9510eu		
1830	1900		Ascension Is, RTE Radio	21630af			
1830	1900		Austria, R Austria International	13730af			
1830	1900		Canada, RTE Radio	13725va			
1830	1900		Georgia, Georgian Radio	11760eu			
1830	1900		Kiribati, Radio	9809da	9825do		
1830	1900		Netherlands, Radio	6020af	7120af	9895af	11655af
				13700af	17605af	21590af	
1830	1900		Serbia, Radio Yugoslavia	6100eu			
1830	1900		Slovakia, R Slovakia International	5920eu	6055eu	7345eu	
1830	1900		Turkey, Voice of	9785as	11765as		
1830	1900		UK, BBC World Service	3255af	6005af	6190af	9410eu
				9630af	9740pa	12095eu	15400af
				15420af	15575as	17830af	
1830	1900	as	USA, Voice of America	7170af	11940af	15525af	
1845	1900		Congo, RTV Congolaise	5985do			
1850	1900		New Zealand, R New Zealand Int	11725va			
1855	1900		New Zealand, R New Zealand Int	11725va			

Frequencies

1900	1915		Congo, RTV Congolaise	5985do			
1900	1927		Vietnam, Voice of	9730eu	13740eu		
1900	1930		Hungary, Radio Budapest	6025eu	7130eu		
1900	1930		Israel, Kol Israel	11605af	15640va	15650af	17535va
1900	1930	vl/mtwhfa	Papua New Guinea, NBC	4890do	9675do		
1900	1930		Philippines, Radio Filipinas	11720me	15190me	17720pa	
1900	1930		Switzerland, Swiss R International	6110eu			
1900	1930		Turkey, Voice of	9785as	11765as		
1900	1930		USA, Voice of America	7260me	9525po	9760af	9770af
				11870pa	15180pa		
1900	1930	as	USA, Voice of America	6035af	7375af	7415af	11975af
				15410af	15445af	15580af	
1900	1930	a	USA, Voice of America	4950af			
1900	1945		Germany, Deutsche Welle	11765af	11810af	13720af	15390af
				17810af			
1900	1945		India, All India Radio	7410eu	9950eu	11620eu	11935af
				13750af	15075af	15200af	
1900	1950		New Zealand, R New Zealand Int	11725va			
1900	1956		China China Radio International	9440af	9595af	11750af	
1900	2000		Anguilla, Caribbean Beacon	11775am			
1900	2000	vl	Australia, ABC/Katherine	2485do			
1900	2000	vl	Australia, ABC/Tennant Creek	2325do			
1900	2000		Australia, Radio	6080pa	7240pa	9500as	9580va
				9815pa	11880va		
1900	2000	vl	Botswana, Radio	3356do	4820do		
1900	2000		Bulgaria, Radio	9400na	11700eu		
1900	2000	vl	Cameroon, RTV/Yaounde	4850do			
1900	2000		Canada, CFRX Toronto ON	6070do			
1900	2000		Canada, CFVP Calgary AB	6030do			
1900	2000		Canada, CHNX Halifax NS	6130do			
1900	2000		Canada, CKZN St John's NF	6160do			
1900	2000		Canada, CKZU Vancouver BC	6160do			
1900	2000		Costa Rica, R for Peace Intl	15049va			
1900	2000		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
1900	2000		Ecuador, HCJB	17660eu			
1900	2000	mtwhf	Eqt Guinea, Radio Africa	15185af			
1900	2000		Germany, Voice of Hope	11985va			
1900	2000	vl	Ghana, Ghana BC Corp	3366do	4915do		
1900	2000	vl	Italy, IRRS	3980va	3985		
1900	2000		Kenya, Kenya BC Corp	4885do	4915do	4935do	
1900	2000		Kiribati, Radio	9809do	9825do		
1900	2000		Kuwait, Radio	11990va	15230as		
1900	2000	vl	Lesotho, Radio	4800do			
1900	2000	vl	Liberia, ELWA	4760do			
1900	2000	vl	Liberia, R Liberia International	5100do			
1900	2000	vl	Malawi, Malawi BC Corp	3380do			
1900	2000		Malaysia, Radio	7295do			
1900	2000	mtwhfa	Malta, Voice of Mediterranean	12060eu			
1900	2000		Namibia, Namibian BC Corp	3270af	3289af		
1900	2000		Netherlands, Radio	6020af	7120af	11655af	13700af
				17605af	21590af		
1900	2000		New Zealand, ZLXA	3935do			
1900	2000	vl	Nigeria, Radio/Enugu	6025do			
1900	2000	vl	Nigeria, Radio/Ibadan	6050do			
1900	2000	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
1900	2000	vl	Nigeria, Radio/Lagos	3326do	4990do		
1900	2000	vl	Nigeria, Voice of	7255af	15120af		
1900	2000		North Korea, R Pyongyang	4405va	6574na	9335na	11710na
				13760no			
1900	2000		Russia, Voice of Russia WS	9710eu	9775eu	9820eu	9890eu
				11675eu	12070eu		
1900	2000	vl	Rwanda, Radio	6055do			
1900	2000		S Africa, World Beacon	3230af	5925af	9675af	
1900	2000		Sierra Leone, Sierra Leone BS	3316do			
1900	2000	vl	Solomon Islands, SIBC	5020do			
1900	2000		South Korea, R Korea Intl	5975om	7275eu		
1900	2000	irreg	Sri Lanka, Sri Lanka BC Corp	4940do			
1900	2000	a	Sri Lanka, Sri Lanka BC Corp	6010eu			
1900	2000		Swaziland, Trans World Radio	3200af			
1900	2000		Thailand, Radio	7195eu	9655eu	11905eu	
1900	2000		Uganda, Radio	4976do	5026da		
1900	2000		UK, BBC World Service	3255af	6005af	6190af	6190eu
				9410eu	9630af	9740pa	12095eu
				15400af	15575me	17830af	
1900	2000	a	UK, BBC World Service	17840na			
1900	2000	hf	UK, Merlin Network One	6130af			
1900	2000		UK, World Beacon	9675af			
1900	2000		USA, Armed Forces Network	4278am	6458am	12689am	
1900	2000		USA, KAIJ Dallas TX	13815va			
1900	2000		USA, KJES Vado NM	15385na			
1900	2000		USA, KTBN Salt Lake City UT	15590na			
1900	2000		USA, KWHR Naalehu HI	17510as			
1900	2000		USA, VOA Special English	6160me	9680me	13690me	
1900	2000	mtwhf	USA, Voice of America	9565eu	9840as	11780me	11970as
				12015as	13725me	15235as	
1900	2000		USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1900	2000		USA, WGTG McCaysville GA	12172am			
1900	2000	mtwhf	USA, WGTG McCaysville GA	9400va			
1900	2000		USA, WHRA Greenbush ME	17650af			
1900	2000		USA, WHRI Noblesville IN	9495sa	13760na		
1900	2000		USA, WINB Red Lion PA	13570eu			
1900	2000		USA, WJCR Upton KY	7490va	13594as		
1900	2000	mtwhf	USA, WMLK Bethel PA	9465eu			
1900	2000	as	USA, WRMI Miami FL	9955am			
1900	2000		USA, WRNO New Orleans LA	7395na	15420al		
1900	2000		USA, WSHB Cypress Crk SC	15665eu	18910af		
1900	2000		USA, WTJC Newport NC	9370na			
1900	2000		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
1900	2000		USA, WYFR Okeechobee FL	17555eu			
1900	2000		Zambia, Christian Voice	4965da			
1900	2000	vl	Zambia, National BC Corp	6165do	6265do		
1900	2000	vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045do		
1930	1945		Finland, YLE/R Finland	6110eu			
1930	1956		Belgium, Radio Vlaanderen Intl	5960eu			
1930	2000	t h	Belarus, Radio Minsk	7210va	11960va		
1930	2000		Iran, VOIRI	9022eu	9575eu	11670eu	
1930	2000	vl	Papua New Guinea, NBC	4890do	9675do		
1930	2000		Poland, Radio Polonia	6035eu	7185eu	7265eu	9525eu
1930	2000		Sweden, Radio	6065eu			
1930	2000		USA, Voice of America	4950af	6035af	7260me	7375af
				7415af	9525pa	9760af	9770af
				11870pa	15180pa	15410af	15445af
				15580af			
1935	1955		Italy, RAI International	5970eu	7290eu	9750eu	
1940	1950	m	Vatican City, Vatican Radio	9660eu			
1950	2000		Vatican City, Vatican Radio	4005eu	5880eu	7250eu	9645eu
1950	2000	m	Vatican City, Vatican Radio	9660eu			
1951	2000		New Zealand, R New Zealand Int	17675va			
1955	2000	mtwhfa	Armenia, Voice of	4810eu	9965eu		
1955	2000		New Zealand, r New Zealand Int	17675va			

2000	2010		Vatican City, Vatican Radio	4005eu	5880eu	7250eu	9645eu
				9660af	11625af	13765af	
2000	2015	mtwhfa	Armenia, Voice of	4810eu	9965eu		
2000	2015		Swaziland, Trans World Radio	3200af			
2000	2025		Poland, Radio Polonia	6035eu	7185eu	7265eu	9525eu
2000	2027		Czech Rep, Radio Prague Intl	5930eu	11600as		
2000	2030		Iran, VOIRI	9022eu	9575eu	11670eu	
2000	2030		Mongolia, Voice of	12015eu	12085eu		
2000	2030		Netherlands, Radio	6020af	7120af	11655af	13700af
				17605af	21590af		
2000	2030		Switzerland, Swiss R International	13710af	13770af	15220af	17580af
2000	2030		USA, Voice of America	4950af	6035af	6095me	7375af
				7415af	9760af	9770af	11855af
				11975af	15410af	15445af	15580af
				17725af	17745af		
2000	2045		Germany, Deutsche Welle	7130eu			
2000	2056		China China Radio International	7390eu	9440af	11735af	11790eu
				13640af	15110eu	17790eu	
2000	2100		Algeria, R Algiers International	11715eu	15160eu		
2000	2100		Angola, R Nacional de Angola	3374va	7245va		
2000	2100		Anguilla, Caribbean Beacon	11775am			
2000	2100	vl	Australia, ABC/Alice Springs	2310do			
2000	2100	vl	Australia, ABC/Katherine	2485do			
2000	2100	vl	Australia, ABC/Tennant Creek	2325do			
2000	2100		Australia, Radio	9500as	9580va	9815po	11880va
				12080va			
2000	2100	vl	Botswana, Radio	3356do	4820do		
2000	2100	vl	Cameroon, RTV/Yaounde	4850do			
2000	2100		Canada, CFRX Toronto ON	6070do			
2000	2100		Canada, CFVP Calgary AB	6030do			
2000	2100		Canada, CHNX Halifax NS	6130do			
2000	2100		Canada, CKZN St John's NF	6160do			
2000	2100		Canada, CKZU Vancouver BC	6160do			
2000	2100		Canada, R Canada International	5995va	11690va	13650va	13670va
				15325va	15470va	17820va	17870va
2000	2100		Costa Rica, R for Peace Int	15049va			
2000	2100		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
2000	2100		Ecuador, HCJB	17660eu			
2000	2100	mtwhf	Eqt Guinea, Radio Africa	15185af			
2000	2100		Germany, Voice of Hope	11985va			
2000	2100	vl	Ghana, Ghana BC Corp	3366do	4915do		
2000	2100		Indonesia, Voice of	9525va	11784va	15149va	
2000	2100	irreg	Iraq, Radio Iraq International	9684va	11787va		
2000	2100	vl	Italy, IRRS	3980va	3985		
2000	2100		Kenya, Kenya BC Corp	4885do	4915do	4935do	
2000	2100		Kiribati, Radio	9809do	9825do		
2000	2100		Kuwait, Radio	11990va	15230as		
2000	2100	vl	Lesotho, Radio	4800do			
2000	2100	vl	Liberia, ELWA	4760do			
2000	2100	vl	Liberia, R Liberia International	5100do			
2000	2100	vl	Malawi, Malawi BC Corp	3380do			
2000	2100		Malaysia, Radio	7295do			
2000	2100		Namibia, Namibian BC Corp	3270af	3289af		
2000	2100		New Zealand, R New Zealand Int	17675va			
2000	2100		New Zealand, ZLXA	3935do	7290do		
2000	2100	vl	Nigeria, Radio/Enugu	6025do			
2000	2100	vl	Nigeria, Radio/Ibadan	6050do			
2000	2100	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
2000	2100	vl	Nigeria, Radio/Lagos	3326do	4990do		
2000	2100	vl	Nigeria, Voice of	7255af	15120af		
2000	2100	vl	Papua New Guinea, NBC	4890do	9675do		
2000	2100		Russia, Voice of Russia WS	9775eu	9775eu	9820eu	9890eu
				11675eu	15485eu		
2000	2100	vl	Rwanda, Radio	6055do			
2000	2100		S Africa, World Beacon	3230af	5925af	9675af	
2000	2100		Sierra Leone, Sierra Leone BS	3316do			
2000	2100	vl	Solomon Islands, SIBC	5020do			
2000	2100	mtwhf	Spain, R Exterior Espana	9595af	15285af		
2000	2100	irreg	Sri Lanka, Sri Lanka BC Corp	4940do			
2000	2100	vl	Syria, Radio Damascus	12085eu	13610eu		
2000	2100		Uganda, Radio	4976do	5026da		
2000	2100		UK, BBC World Service	3255af	5975pa	6005af	6190af
				6195eu	9410eu	9630af	9740pa
				11835eu	12095eu	15400af	17830af
2000	2100		UK, World Beacon	9675af			
2000	2100		USA, Armed Forces Network	4278am	6458am	12689am	
2000	2100		USA, KAIJ Dallas TX	13815va			
2000	2100		USA, KJES Vado NM	15385au			
2000	2100		USA, KTBN Salt Lake City UT	15590na			
2000	2100		USA, KWHR Naalehu HI	17510as			
2000	2100		USA, WBCQ Monticello ME	7415na			
2000	2100		USA, WEWN Birmingham AL	11875na	13615na	15745eu	
2000	2100		USA, WGTG McCaysville GA	12172am			
2000	2100	mtwhf	USA, WGTG McCaysville GA	9400va			
2000	2100		USA, WHRA Greenbush ME	17650af			
2000	2100		USA, WHRI Noblesville IN	5745sa	9495sa		
2000	2100		USA, WINB Red Lion PA	13570eu			
2000	2100		USA, WJCR Upton KY	7490va	13594as		
2000	2100	mtwhf	USA, WMLK Bethel PA	9465eu			
2000	2100	s	USA, WRMI Miami FL	9955am			
2000	2100	a	USA, WRMI Miami FL	7385na			
2000	2100		USA, WRNO New Orleans LA	7395na	15420al		
2000	2100		USA, WTJC Newport NC	9370na			
2000	2100		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
2000	2100		USA, WYFR Okeechobee FL	17555eu	17845af		
2000	2100	vl	Vanuatu, Radio	3945do	4960do	7260da	
2000	2100		Zambia, Christian Voice	4965da			
2000	2100	vl	Zambia, National BC Corp	6165do	6265do		
2000	2100	vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045da		
2000	2100		USA, WSHB Cypress Crk SC	15665eu	18910af		
2010	2030		Vatican City, Vatican Radio	9660af	11625af	13765af	
2025	2045		Italy, RAI International	7125af	9710af	11880af	
2030	2045	vl	Libya, Voice of Africa	11815af	15415af	15435va	
2030	2045		Thailand, Radio	9655eu	9680eu	11905eu	
2030	2055		Moldova, Radio Moldova Intl	7520eu			
2030	2057		Vietnam, Voice of	9730eu	13740eu		
2030	2100	th	Belarus, Radio Minsk	7210va	11960va		
2030	2100		Croatia, Croatian Radio	9430al	11805af		
2030	2100		Cuba, Radio Havana	13660eu	13750eu		
2030	2100		Egypt, Radio Cairo	15375af			
2030	2100		Germany, Adventist World Radio	15560af			
2030	2100		S Africa, Adventist World Radio	9745af			
2030	2100		Turkey, Voice of	9525eu			
2030	2100	f	UK, Wales Radio Intl/Merlin	7325eu			
2030	2100	as	USA, Voice of America	4950af			
2030	2100		Uzbekistan, Radio Tashkent	9540eu	9545eu		
2045	2100		India, All India Radio	7150au	7410eu	9650eu	9910au
				9950eu	11715au		

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2100	2115	mtwhf	UK, BBC World Service	11675ca			
2100	2130	vl	Australia, ABC/Alice Springs	2310da			
2100	2130	vl	Australia, ABC/Katherine	2485da			
2100	2130	vl	Australia, ABC/Tennant Creek	2325da			
2100	2130		Australia, Radio	7240pa	9500as	9580va	9660pa
				11880va	12080va	17715pa	21740va
2100	2130		China China Radio International	5965va	7150va	7590va	9535va
				11735af	11790eu	13640af	15110eu
				15125eu	17790eu		
2100	2130		Cuba, Radio Havana	13660eu	13750eu		
2100	2130		Hungary, Radio Budapest	6025eu			
2100	2130		Kenya, Kenya BC Corp	4885da	4915da	4935da	
2100	2130		Serbia, Radio Yugoslavia	6100eu			
2100	2130		South Korea, R Korea Intl	3970eu	6480eu	15575eu	
2100	2130		Turkey, Voice of	9525as			
2100	2130		USA, Voice of America	6035af	6040me	6095me	7375af
				7415af	9535af	9705pa	9760eu
				11870pa	11975af	15185as	15410af
				15445af	15580af	17725af	17735as
				17820as			
2100	2145		Germany, Deutsche Welle	9670as	9765as	9875af	11865af
				11915as	15135va		
2100	2145		USA, WYFR Okeechobee FL	15120af	17555eu	17845af	
2100	2156		North Korea, R Pyongyang	6574va	9335va		
2100	2156		Romania, R Romania International	11740eu	11940eu	15105eu	15180eu
2100	2200		Anguilla, Caribbean Beacon	11775am			
2100	2200	vl	Botswana, Radio	3356do	4820do		
2100	2200		Bulgaria, Radio	9400eu	11700eu		
2100	2200	vl	Cameroon, RTV/Yaounde	4850do			
2100	2200	vl	Canada, CBC Northern Service	9625da			
2100	2200		Canada, CFRX Toronto ON	6070da			
2100	2200		Canada, CFVP Calgary AB	6030da			
2100	2200		Canada, CHNX Halifax NS	6130da			
2100	2200		Canada, CKZN St John's NF	6160do			
2100	2200		Canada, CKZU Vancouver BC	6160do			
2100	2200		Canada, R Canada International	7235va	11690va	13650va	13670va
				15325va	17820va	17870va	
2100	2200		Costa Rica, R for Peace Intl	15049va			
2100	2200		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
2100	2200		Ecuador, HCJB	17660eu			
2100	2200		Egypt, Radio Cairo	15375af			
2100	2200	mtwhf	Eqt Guinea, Radio Africa	15185af			
2100	2200	vl	Ghana, Ghana BC Corp	3366do	4915do		
2100	2200		India, All India Radio	7150va	7410eu	9650eu	9910au
				9950eu	11715au		
2100	2200	vl	Italy, IRRS	3980va	3985		
2100	2200		Japan, Radio	6035pa	9725eu	11850pa	11855af
				17825na	21670pa		
2100	2200		Kiribati, Radio	9809do	9825do		
2100	2200	vl	Lesotho, Radio	4800do			
2100	2200	vl	Liberia, ELWA	4760do			
2100	2200	vl	Liberia, R Liberia International	5100do			
2100	2200	vl	Malawi, Malawi BC Corp	3380do			
2100	2200		Malaysia, Radio	7295do			
2100	2200		Namibia, Namibian BC Corp	3270af	3289af		
2100	2200		New Zealand, R New Zealand Int	17675va			
2100	2200		New Zealand, ZLXA	3935do			
2100	2200	vl	Nigeria, Radio/Enugu	6025do			
2100	2200	vl	Nigeria, Radio/Ibadan	6050do			
2100	2200	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
2100	2200	vl	Nigeria, Radio/Lagos	3326do	4990do		
2100	2200		Palau, KHBN/Voice of Hope	9985as			
2100	2200	vl	Papua New Guinea, NBC	4890do	9675do		
2100	2200		S Africa, World Beacon	3230af	5925af	9675af	
2100	2200		Sierra Leone, Sierra Leone BS	3316do			
2100	2200	vl	Solomon Islands, SIBC	5020do	9545do		
2100	2200	irreg	Sri Lanka, Sri Lanka BC Corp	4940do			
2100	2200	vl	Syria, Radio Damascus	12085eu	13610eu		
2100	2200		UK, BBC World Service	3255af	3915as	5965as	5975va
				6005af	6190af	6195va	9410eu
				9740pa	11835af	11945as	12095sa
				15400af			
2100	2200	as	UK, Global Kitchen/Merlin	3955eu	6140eu	7325eu	
2100	2200		UK, World Beacon	9675af			
2100	2200		Ukraine, R Ukraine International	5905eu	6020eu	9640eu	11950eu
				15530eu			
2100	2200		USA, Armed Forces Network	4278am	6458am	12689am	
2100	2200		USA, KAIJ Dallas TX	13815va			
2100	2200		USA, KTBN Salt Lake City UT	15590na			
2100	2200		USA, KWHR Naalehu HI	17510as			
2100	2200		USA, WBCQ Manticello ME	7415na			
2100	2200	mtwhf	USA, WBCQ Manticello ME	9330na			
2100	2200		USA, WEWN Birmingham AL	11875na	13615na	15745eu	
2100	2200		USA, WGTG McCaysville GA	12172am			
2100	2200	mtwhf	USA, WGTG McCaysville GA	9400va			
2100	2200		USA, WHRA Greenbush ME	17650af			
2100	2200		USA, WHRI Noblesville IN	5745na	9495sa		
2100	2200		USA, WINB Red Lion PA	13570eu			
2100	2200		USA, WJCR Upton KY	7490va	13594as		
2100	2200	s	USA, WRMI Miami FL	9955am			
2100	2200	a	USA, WRMI Miami FL	7385na			
2100	2200		USA, WRNO New Orleans LA	7395na	15420al		
2100	2200		USA, WSHB Cypress Crk SC	15665eu	18910af		
2100	2200		USA, WTJC Newport NC	9370na			
2100	2200		USA, WWCR Nashville TN	9475na	12160na	13845na	15685na
2100	2200	vl	Vanuatu, Radio	3945do	4960do	7260do	
2100	2200		Zambia, Christian Voice	4965da			
2100	2200	vl	Zambia, National BC Corp	6165da	6265da		
2100	2200	vl	Zimbabwe, Zimbabwe BC Corp	4828do	6045da		
2105	2200	a	Spain, R Exterior Espana	9595af	9840eu		
2115	2130	mtwhf	UK, BBC Caribbean Report	5975ca	11675ca	15390ca	
2115	2130	as	UK, BBC World Service	5975ca			
2115	2200		Egypt, Radio Cairo	9990eu			
2120	2200	s	Greece, Voice of	9425au	15650au		
2130	2145	tf	UK, BBC Calling Falklands	11680sa			
2130	2156		China China Radio International	15110eu	17790eu		
2130	2157		Czech Rep, Radio Prague Intl	11600as	15545af		
2130	2200		Albania, R Tirana International	7130eu	9540eu		
2130	2200	vl	Australia, ABC/Alice Springs	4835do			
2130	2200	vl	Australia, ABC/Katherine	5025do			
2130	2200	vl	Australia, ABC/Tennant Creek	4910do			
2130	2200		Australia, Radio	7240pa	9660pa	11880va	12080va
				17715pa	21740va		
2130	2200		Australia, Radio	7240pa	9660pa	11880va	12080va
				17715pa	21740va		
2130	2200		Austria, R Austria International	5945eu	6155eu	13730af	
2130	2200		Guam, Adventist World Radio	11980as	15550as		
2130	2200		Hungary, Radio Budapest	3975eu			
2130	2200		Iran, VOIRI	11740as	13745as		
2130	2200		South Korea, R Korea Intl	15575eu			
2130	2200		Sweden, Radio	6065eu	9435eu	15255as	
2130	2200		USA, Voice of America	6040me	6095me	9535af	9705as
				9760eu	11870pa	15185as	17735as
				17820as			
2130	2200	smtwhf	USA, Voice of America	6035af	7375af	7415af	11975af
				15410af	15445af	15580af	17725af
2130	2200		Uzbekistan, Radio Tashkent	9540eu	9545eu		
2145	2200		USA, WYFR Okeechobee FL	15120af	17845af		

2200

2200	2210	vl	Malawi, Malawi BC Corp	3380do			
2200	2210	vl	Zambia, National BC Corp	6165da	6265da		
2200	2220	s	Greece, Voice of	9425au	15650au		
2200	2225		Iran, VOIRI	11740as	13745as		
2200	2225		Italy, RAI International	9675as	11900as	15240as	
2200	2230		Canada, R Canada International	5960am	9755am	13670am	15305am
				17695am	17835as		
2200	2230		India, All India Radio	7150va	7410eu	9650eu	9910au
				9950eu	11715au		
2200	2230		Mexico, R Mexico International	5985am	9705am		
2200	2230	smtwhf	Serbia, Radio Yugoslavia	7230au			
2200	2230		USA, Voice of America	7215as	9705as	9770as	11760as
				15185as	15290as	15305as	17735as
				17820as			
2200	2230	mtwhf	USA, Voice of America	6035af	7340af	7375af	7415af
				11975af			
2200	2245		Egypt, Radio Cairo	9990eu			
2200	2245	a	USA, WRMI Miami FL	7385na			
2200	2245		USA, WYFR Okeechobee FL	11740na	15120af	17845af	
2200	2256		China China Radio International	7170eu	9880eu		
2200	2300		Anguilla, Caribbean Beacon	6090am			
2200	2300	vl	Australia, ABC/Alice Springs	4835do			
2200	2300	vl	Australia, ABC/Katherine	5025do			
2200	2300	vl	Australia, ABC/Tennant Creek	4910do			
2200	2300		Australia, Radio	11715pa	17795va	21740va	
2200	2300	vl	Cameroon, RTV/Yaounde	4850do			
2200	2300		Canada, CBC Northern Service	9625do			
2200	2300		Canada, CFRX Toronto ON	6070do			
2200	2300		Canada, CFVP Calgary AB	6030do			
2200	2300		Canada, CHNX Halifax NS	6130do			
2200	2300		Canada, CKZN St John's NF	6160do			
2200	2300		Canada, CKZU Vancouver BC	6160do			
2200	2300		Costa Rica, R for Peace Intl	15049va			
2200	2300		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
2200	2300	mtwhf	Eqt Guinea, Radio Africa	15185af			
2200	2300		Germany, Overcomer Ministries	7295eu			
2200	2300	vl	Ghana, Ghana BC Corp	3366do	4915do		
2200	2300		Kenya, Kenya BC Corp	4885do	4915do	4935do	
2200	2300		Kiribati, Radio	9809do	9825do		
2200	2300	vl	Liberia, R Liberia International	5100do			
2200	2300		Malaysia, Radio	7295do			
2200	2300		Namibia, Namibian BC Corp	3270af	3289af		
2200	2300		New Zealand, R New Zealand Int	17675va			
2200	2300		New Zealand, ZLXA	3935do			
2200	2300	vl	Nigeria, Radio/Enugu	6025do			
2200	2300	vl	Nigeria, Radio/Ibadan	6050do			
2200	2300	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275do	9570do
2200	2300	vl	Nigeria, Radio/Lagos	3326do	4990do		
2200	2300		Palau, KHBN/Voice of Hope	9955as	9965as	9985as	
2200	2300		Sierra Leone, Sierra Leone BS	3316do			
2200	2300	vl	Solomon Islands, SIBC	5020do	9545do		
2200	2300	irreg	Sri Lanka, Sri Lanka BC Corp	4940do			
2200	2300		Taiwan, R Taiwan International	11565eu	15600eu		
2200	2300		Turkey, Voice of	7190as	13640as		
2200	2300		UK, BBC World Service	5965as	5975na	6175na	6195va
				7110as	9590na	9660as	11835af
				11955as	12080pa	12095sa	15400af
2200	2300	as	UK, Global Kitchen/Merlin	3955eu	6140eu	7325eu	
2200	2300		USA, Armed Forces Network	4278am	6458am	12689am	
2200	2300		USA, KAIJ Dallas TX	13815va			
2200	2300		USA, KTBN Salt Lake City UT	15590na			
2200	2300		USA, KWHR Naalehu HI	17510as			
2200	2300		USA, WBCQ Manticello ME	7415na			
2200	2300	mtwhf	USA, WBCQ Manticello ME	9330na			
2200	2300		USA, WEWN Birmingham AL	9385na	9975eu	13615na	
2200	2300		USA, WGTG McCaysville GA	5085va	6890am		
2200	2300		USA, WHRA Greenbush ME	7580af			
2200	2300		USA, WHRI Noblesville IN	5745na	9495sa		
2200	2300		USA, WINB Red Lion PA	13570eu			
2200	2300		USA, WJCR Upton KY	7490va	13594as		
2200	2300	s	USA, WRMI Miami FL	9955am			
2200	2300		USA, WRNO New Orleans LA	7395na	15420al		
2200	2300		USA, WSHB Cypress Crk SC	13770eu	15285sa		
2200	2300		USA, WTJC Newport NC	9370na			
2200	2300		USA, WWCR Nashville TN	7435na	9475na	12160na	13845na
2200	2300	vl	Vanuatu, Radio	3945do	4960do	7260do	
2230	2257		Czech Rep, Radio Prague Intl	11600na	15545na		
2230	2300		Canada, R Canada International	5960na	9755na	13670na	
2230	2300		Cuba, Radio Havana	9550am			
2230	2300	vl	Papua New Guinea, NBC	9675do	11880do		
2230	2300	vl/as	Solomon Islands, SIBC	5020do			
2230	2300	vl/a	Solomon Islands, SIBC	9545do			
2230	2300		UK, BBC World Service	5965as	5975na	6175na	6195va
				7110as	9590na	9660as	11835af
				11955as	12080pa	12095sa	15400af
2245	2300		India, All India Radio	7410as	9705as	9950as	11620as
				13625as			
2245	2300	smtwhf	USA, WRMI Miami FL	9955am			
2245	2300	a	USA, WRMI Miami FL	7385na			
2245	2300		USA, WYFR Okeechobee FL	11740na			
2245	2300		Vatican City, Vatican Radio	9600as	11830as		

Frequencies

2300	0000		Anguilla, Caribbean Beacon	6090am			
2300	0000	vl	Australia, A8C/Alice Springs	4835da			
2300	0000	vl	Australia, A8C/Katherine	5025da			
2300	0000	vl	Australia, A8C/Tennant Creek	4910da			
2300	0000		Australia, Radio	9660pa	12080va	17715pa	17795va
				21740va			
2300	0000		Bulgaria, Radio	9400na	11700na		
2300	0000	vl	Cameroon, RTV/Yaounde	4850da			
2300	0000		Canada, CBC Northern Service	9625da			
2300	0000		Canada, CFRX Toronto ON	6070da			
2300	0000		Canada, CFVP Calgary AB	6030da			
2300	0000		Canada, CHNX Halifax NS	6130da			
2300	0000		Canada, CKZN St John's NF	6160da			
2300	0000		Canada, CKZU Vancouver BC	6160da			
2300	0000		Costa Rica, R for Peace Intl	15049va			
2300	0000		Costa Rica, University Network	5030am	6150va	7375na	9725na
				11870va	13749af		
2300	0000		Egypt, Radio Cairo	9900am			
2300	0000	a	Finland, YLE/R Finland	11985as	13785as		
2300	0000	vl	Ghana, Ghana BC Corp	3366do	4915da		
2300	0000		India, All India Radio	7410as	9705as	9950as	11620as
				13625as			
2300	0000		Kenya, Kenya BC Corp	4885do	4915da	4935da	
2300	0000		Kiribati, Radio	9809da	9825da		
2300	0000	vl	Liberia, R Liberia International	5100da			
2300	0000		Malaysia, Radio	7295da			
2300	0000		Malaysia, RTM Kota Kinabalu	5980da			
2300	0000		Namibia, Namibian BC Corp	3270af	3289af		
2300	0000		New Zealand, ZLXA	3935do			
2300	0000		Palau, KHBN/Voice of Hope	9965as	9955as	9985as	
2300	0000	vl	Papua New Guinea, N8C	9675do	11880da		
2300	0000		Sierra Leone, Sierra Leone BS	3316do			
2300	0000	vl/as	Solomon Islands, SI8C	5020da			
2300	0000	vl/a	Solomon Islands, SI8C	9545do			
2300	0000		Sri Lanka, Sri Lanka BC Corp	4940da			
2300	0000		UK, BBC World Service	3915as	5965as	5975na	6035as
				6175na	6195as	7110as	9590na
				11945as	11955as	12095sa	15280as
2300	0000	as	UK, Global Kitchen/Merlin	3955eu	6140eu	7325eu	
2300	0000		USA, Armed Forces Network	4278am	6458am	12689am	
2300	0000		USA, KAIJ Dallas TX	13815va			
2300	0000		USA, KTBN Salt Lake City UT	15590na			
2300	0000		USA, KWHR Naalehu HI	17510as			
2300	0000		USA, Voice of America	7215as	9770as	11760as	15185as
				15290as	15305as	17735as	17820as
2300	0000		USA, WBCQ Monticello ME	7415na			
2300	0000	mtwhf	USA, WBCQ Monticello ME	9330na			
2300	0000		USA, WEWN Birmingham AL	9385na	9975eu	13615na	
2300	0000		USA, WGTG McCaysville GA	5085va	6890am		
2300	0000		USA, WHRA Greenbush ME	7580na			
2300	0000		USA, WHRI Noblesville IN	5745na	9495sa		
2300	0000		USA, WINB Red Lion PA	13570am			
2300	0000		USA, WJCR Upton KY	7490va	13594as		
2300	0000	a	USA, WRMI Miami FL	9955am			
2300	0000		USA, WRNO New Orleans LA	7355na			
2300	0000		USA, W5H8 Cypress Crk SC	13770eu	15285sa		
2300	0000		USA, WTJC Newport NC	9370na			
2300	0000	as	USA, WW8S Macon GA	11915eu			
2300	0000		USA, WWCR Nashville TN	7435na	9475na	12160na	13845na
2300	0000	vl	Vanuatu, Radio	3945da	4960do	7260da	
2300	2305	vl	Nigeria, Radio/Enugu	6025da			
2300	2305	vl	Nigeria, Radio/Ibadan	6050do			
2300	2305	vl	Nigeria, Radio/Kaduna	4770do	6090do	7275da	9570do
2300	2305	vl	Nigeria, Radio/Lagos	3326da	4990do		
2300	2315		Vatican City, Vatican Radio	9600as	11830as		
2300	2330		Canada, R Canada International	5960am	9755am	11895an	13670am
				15305am	17695am		
2300	2330		Cuba, Radio Havana	9550am			
2300	2330		Mexico, R Mexico International	5985am	9705am		
2300	2330		USA, VOA Special English	7190as	7200as	9545as	9795as
				11925as			
2300	2345		Germany, Deutsche Welle	9815as	12055as	13610as	21790as
2300	2345		USA, WYFR Okeechabee FL	11740na			
2300	2356		China, China Radio International	5990na			
2300	2359		New Zealand, R New Zealand Int	17675va			
2300	2359		Romania, R Romania International	9690eu	11775na	11830eu	15105na
				15195na			
2330	0000	as	Canada, R Canada International	11895am	15305am	17695am	
2330	0000		Kyrgyzstan, Kyrgyz Radio	4010eu			
2330	0000		Malaysia, RTM Sarawak	7160do			
2330	0000		Netherlands, Radio	6165na	9845na		
2330	0000		USA, VOA Special English	6060as	7190as	7200as	7225as
				7260as	9545as	9795as	11805as
				11925as	13735as	15205as	
2330	2345	vl	Libya, Voice of Africa	11815af	15415af	15435va	
2330	2356		Belgium, Radio Vlaanderen Intl	15565na			
2330	2357		Vietnam, Voice of	9840as	12019as		
2330	2359		Canada, R Canada International	5960am	9755am	13670am	

Selected Programs

Sundays

2300 UK, BBC London (am/east as): The World Today. See S 0100.
2300 VOA (Special English): News.
2306 VOA (Special English): New Dynamic English.
2330 UK, BBC London (am): The Greenfield Collection. This classical music program replaces Ray on Record.
2330 UK, BBC London (east as): Arts in Action. See S 0530.
2330 VOA (Special English): News (Special English).
2340 VOA (Special English): Words and their Stories (Special English).
2345 VOA (Special English): People in America (Special English).

Monday-Friday

2300 UK, BBC London (am): News. See S 1300.
2300 UK, BBC London (east as): The World Today. See S 0100.
2300 VOA (Special English): News.
2305 UK, BBC London (am): Outlook. See M 1305.
2306 VOA (Special English): New Dynamic English.
2330 VOA (Special English): News (Special English).

Monday

2340 VOA (Special English): Development Report (Special English).
2345 VOA (Special English): This is America (Special English).
2345 UK, BBC London (am): Patterns of Faith. Though-provoking and illuminating reflections on a wide range of issues.

Tuesdays

2340 VOA (Special English): Agriculture Report (Special English).
2345 VOA (Special English): Science in the News (Special English).
2345 UK, BBC London (am): Plain English. The workings of the English language.

Wednesdays

2340 VOA (Special English): Science Report (Special English).
2345 VOA (Special English): Exploration (Special English).
2345 UK, BBC London (am): Heart and Soul. The complementary strand to patterns of faith.

Thursdays

2340 VOA (Special English): Science Report (Special English).
2345 VOA (Special English): The Making of a Nation (Special English).
2345 UK, BBC London (am): Best of the Edge. A 15-minute replay of pop music.

Fridays

2330 UK, BBC London (east as): Global Business. Roger White presents this weekly series of interviews, features and discussions with the movers and shakers of the international business community.
2340 VOA (Special English): Environment Report (Special English).
2345 VOA (Special English): American Mosaic (Special English).
2345 UK, BBC London (am): Body and Mind. See T 0330.

Saturdays

2300 UK, BBC London (am): News Summary. One minute news update.
2300 UK, BBC London (east as): The World Today. See S 0100.
2300 VOA (Special English): News.
2301 UK, BBC London (am): Play of the Week. See S 0530.
2306 VOA (Special English): New Dynamic English.
2330 UK, BBC London (east as): Global Business. See F 2330.
2330 VOA (Special English): News (Special English).
2340 VOA (Special English): In the News (Special English).
2345 VOA (Special English): American Stories (Special English).

Thank You ...

Additional Contributors to This Month's Shortwave Guide:

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PROPAGATION CONDITIONS, U.S.

OPTIMIZE YOUR MONITORING

Jacques d'Avignon
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How To Use This Table

The *Monitoring Times* propagation table is set up to cover three main areas of the continental US and similar circuits are calculated for each area. If you live in Canada or along the 49th parallel, and have access to the Internet, you can check the following sites for similar tables for the Canadian and northern US users at **http://www.odxa.on.ca/rac2txt99.htm**.

In the *MT* tables and on the Canadian web site, the OWF (Optimum Working Frequency) frequency for a particular circuit is displayed. This frequency should give you the best chance, 90% of the time, to hear a station located at the other end of the circuit. If you feel adventurous, look up higher than the OWF for possible signals.

The tabulated OWF is approximately equivalent to 80% of the MUF (Maximum Usable Frequency) so you could still go up in frequency in your search for a signal. For example, if the tabulated OWF is 8.0 MHz, the MUF would be 10 MHz, so you could go lurking in the upper reaches up to 10 MHz. When you reach the MUF, your chances of hearing a good signal have now decreased to about 10%. When the solar activity is high you might find some of the MUF in the 35 to 45 MHz area; you never know what you can find "up there."

The OWF can, at times, have a calculated value of "0". This value is replaced by an asterisk (*) and the cells are shaded in the *Monitoring Times* chart and on the Web pages. When you see this, do not despair; keep on looking in the vicinity of the last frequency listed for that circuit. The reason why the OWF can have a calculated value of "0" is simply that the ALF (Absorption Frequency) on this circuit, at that particular time of day, is higher than the OWF and, in theory, communication at the OWF should be impossible. But I have been in the radio field long enough to know that theory and practice do not always agree!

As it is relatively safe to assume reciprocity in the forecasts most of the time, the *MT* circuits are labeled "TO/FROM." There are some technical arguments against this assumption, but we know that the *MT* forecasts have been used with success by overseas listeners to listen to North American broadcasts.

A "P" after the name of a circuit indicates that the signal on that particular circuit can be influenced by auroral zone disturbances while traveling over the pole.

Enjoy DXing and use the propagation charts to help you locate unusual signals.

OPTIMUM WORKING FREQUENCIES (MHz)

For the Period 15 August 2000 to 14 September 2000 Flux=195 SSN=152

Predictions prepared using ASAPS for Windows®

UTC	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TO/FROM US WEST COAST																								
CARIBBEAN	17	18	17	16	15	13	12	12	12	11	11	10	10	12	14	15	17	18	18	19	18	18	17	17
SOUTH AMERICA	18	19	20	20	18	16	14	14	14	13	12	12	11	15	18	20	21	20	21	21	21	21	21	20
WESTERN EUROPE	12	12	11	10	10	11	12	11							14	16	17	16	17	17	17	16	15	14
EASTERN EUROPE (P)	12	12	11	12	14	14	13								14	15	16	16	17	16	16	15	14	13
NORTH AFRICA	18	17	15	15	15	16	14	13							16	17	18	18	19	19	19	19	19	18
CENTRAL AFRICA	18	18	18	17	17	15	13								16	18	20	21	21	21	21	21	20	18
SOUTH AFRICA	19	14	12	11	10	13	14	13	*					15	17	19	20	21	21	22	21	21	20	19
MIDDLE EAST (P)	14	14	15	18	18	16	15								14	17	18	20	20	19	17	16	16	15
CENTRAL ASIA (P)	17	18	19	19	19	18	16	14					11	11	13	15	16	16	16	16	15			14
INDIA (P)	19	18	18	19	19	18	16						*	11	12	15	17	19	20	19	18	16	16	16
THAILAND	19	18	19	20	20	19	18	16			12	11	11	11	12	14	17	18	20	20	18	17	17	20
AUSTRALIA	22	22	22	23	24	22	20	17	16	16	15	14	13	13	13	15	17	15				15	22	21
CHINA	19	18	19	19	19	19	17	15		12	11	11	10	11	12	14	16	15	15	14		14	17	18
JAPAN	18	18	18	18	19	18	16	14	12	11	11	10	10	10	11	13	14	14	13	14	16	18	19	18
SOUTH PACIFIC	20	20	21	21	20	19	17	15	15	14	14	13	11	11	12	13	11	14	19	20	20	21	21	20
TO/FROM US MIDWEST																								
CARIBBEAN	19	19	17	16	14	13	13	13	12	11	10	11	14	16	18	19	19	19	20	20	20	19	19	19
SOUTH AMERICA	21	23	22	20	18	17	17	17	16	14	13	14	18	21	23	23	23	24	25	24	24	24	24	22
WESTERN EUROPE	15	13	13	12	12	12	13	12	11				15	16	17	18	18	17	17	18	18	18	17	16
EASTERN EUROPE (P)	12	11	10	11	13	12	11							15	17	17	18	18	18	17	16	15	13	12
NORTH AFRICA	18	17	15	15	14	13	12							16	17	18	18	19	18	19	19	18	18	18
CENTRAL AFRICA	20	20	19	17	16	15	13	13					16	17	18	19	19	20	20	20	20	20	19	20
SOUTH AFRICA	19	14	12	11	10	13	15	14					17	18	19	21	21	22	22	21	21	19	20	21
MIDDLE EAST	15	15	15	17	16	15	14						15	16	17	18	19	19	19	19	18	17	16	15
CENTRAL ASIA (P)	16	18	19	18	16	15						12	14	15	17	17	18	18	17	16	15	14	13	14
INDIA	17	19	19	18	16	15							12	15	17	19	20	20	20	19	19	17	16	16
THAILAND	18	18	20	19	17	15						10	11	13	16	18	19	20	21	20	17	17	16	18
AUSTRALIA	21	21	22	22	20	19	16	14	13	13	13	13	12	13	16	17	17	15				15	21	21
CHINA (P)	18	19	19	19	17	15					11	11	12	14	16	17	16	16	16	14	14	14	16	18
JAPAN	18	18	19	19	18	16	14	12	11	11	10	10	10	12	14	15	15	14	14	15	16	17	18	18
SOUTH PACIFIC	21	22	22	21	19	17	15	15	15	14	13	12	12	13	17	14		17	21	22	22	22	21	21
TO/FROM US EAST COAST																								
CARIBBEAN	14	12	12	11	11	10	10	9	8	8	7	10	13	13	13	14	14	14	15	15	14	14	14	14
SOUTH AMERICA	20	20	20	19	18	18	17	16	15	12	12	18	21	22	22	22	22	22	22	22	21	22	21	20
WESTERN EUROPE	15	13	13	12	11	11	13	12			13	15	16	17	18	18	17	17	17	18	18	18	18	17
EASTERN EUROPE	12	11	10	10	12	13	12					14	15	17	17	17	17	18	18	18	17	15	14	13
NORTH AFRICA	17	16	15	15	14	14	13	12			13	16	17	18	19	20	20	20	20	19	18	18	18	17
CENTRAL AFRICA	18	17	17	16	16	16	15	14			16	18	18	20	20	20	20	21	21	21	20	20	20	18
SOUTH AFRICA	18	13	11	11	11	13	16	14	*		17	21	22	23	22	22	23	23	23	23	22	22	23	23
MIDDLE EAST	15	15	15	16	15	14	*					16	17	18	19	19	19	20	20	19	19	17	17	16
CENTRAL ASIA (P)	15	17	19	17	15	14					13	15	17	18	19	19	19	18	17	16	16	15	14	14
INDIA (P)	16	19	18	16	14							14	17	19	20	21	21	21	20	19	19	17	16	16
THAILAND (P)	20	20	19	17	*							13	16	18	19	20	21	21	21	20	18	16	16	17
AUSTRALIA	21	22	22	19	17	15	15	14	14	13	13	13	14	17	18	18	17	15				15	20	20
CHINA (P)	19	19	19	17	15							13	15	18	19	18	17	16	15	14		13	15	18
JAPAN	20	20	20	19	16	14	13	12	11	11	11	12	14	16	16	16	15	14	15	15	17	18	19	19
SOUTH PACIFIC	23	24	22	20	17	16	16	16	15	14	13	12	14	19	18	15	14	20	23	24	24	24	23	23

Unfavorable conditions: Search around the last listed frequency for activity.

(P) denotes circuit across polar auroral zone; reception may be poor during ionospheric disturbances.

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The SWL's "National" Sports

There isn't much in the way of play-by-play national professional sports on international radio these days, but what's there seems to come full circle in August. August marks the start of the football (soccer) seasons for the premier leagues in England and Scotland, which culminate with their respective Cup Finals each May. On the other hand, by August the long regular seasons of the Australian Football League (AFL) and the National Rugby League (NRL), having begun in March, are reaching their climax. These three have to be considered the shortwave listener's "national sports" as they are the only ones whose seasons' are given full week-by-week coverage on the medium!

❖ Australian Football and Rugby

There is a "great divide" in Australian sport that reflects the traditional (and not always completely friendly) rivalry between the country's two largest cities – Sydney and Melbourne – that attempts at clever marketing still have had only limited success in overcoming.

❖ The AFL

We'll spend the most time on this one, because it's apt to be the most unfamiliar to North Americans. Melbourne and the State of Victoria is the home of "Aussie Rules," otherwise known to its denizens as "footy." The game is played on a large oval with goal posts on opposite ends of the field flanked, in turn, by smaller posts to either side of the main posts. The game begins and restarts after goals with a neutral "ball up" in the center of the field. The ball, which is similar to a rugby football but smaller, is advanced by each team of eleven players through kicks, hand passes and runs punctuated by dribbling every several steps.

A team scores six points when one of its players kicks the ball through the center goal posts; one point if the ball carries inside the smaller posts to either side. If a player is about to be tackled, he must relinquish the ball. Blocking of players is prohibited, but while the ball is in the air players may use just about any means to place themselves in position to receive it (i.e., no pass or kick interference).

Scoring is frequent and often comes in spurts and alternate charges by each team. The game is divided into quarters of 20 minutes playing time each with time added for play stoppages. It is not unusual for team scores to run in excess of 100 points. The action is fast, furious and aggressive – sometimes even somewhat violent.

It is a very popular game in Victoria – the Melbourne Cricket Ground (the MCG) is hallowed ground – and there has been some success for the AFL in its attempts to export the game to other regions of Australia and internationally. There are even a handful of amateur leagues in the US and Canada.

In August, the eight top teams in the AFL vie to reach the Grand Final through an intricate series of playoffs held over a three week period. (I still don't understand exactly how it works, which is the reason for the reference section elsewhere in the column this month.) This year's Grand Final will be held on September 2nd.

❖ The NRL

The National Rugby League consists of teams in major cities and regions of both Australia and New Zealand. Sydney and the state of New South Wales are acknowledged as the hotbed of Australian rugby. As with the AFL, the NRL's wildly enthusiastic fan base diminishes the further it wanders from its spiritual center, but there is evidence of growing interest in the hinterlands – including Brisbane and even Melbourne. It, too, begins an intricate series of playoffs in August that culminate in the Grand Final, held this year on August 27.

These two dates (AFL and NRL Grand Finals) are among the most anticipated and celebrated by sports fans in the land down under and, accordingly, it is a time of numerous parties and celebrations at least on a par with the Super Bowl parties held here.

Tuning In:
Radio Australia
Grandstand
Sat. 0205-0800. Sun. 0305-0800 on 9660, 12080, 17580, 17715, 17750, 21725 kHz.

Grandstand reserves Saturdays for play-by-play coverage of key AFL matches, and Sundays for the NRL. Matches generally start between 0400 and 0430. Shortwave reception at these times remains generally favorable in North America through September. The ABC's (Radio Australia's parent corporation) rights to broadcast AFL and NRL matches do not extend to Internet webcasts; therefore, Grandstand broadcasts are receivable internationally only via shortwave.

Here's a reminder that we are but a few weeks from the start of the 2000 Sydney Olympics which begin September 15. More on this in next month's column, but Radio Australia and *Grandstand* have full coverage of the run-up to the big day of the Opening Ceremonies. You also can follow the preliminaries by accessing the official Sydney 2000 Internet site at <**www.olympics.com/eng/**>.

❖ English Premier League Soccer

Soccer (called "football" everywhere in the world except North America) by far is the most popular sport on the planet. The proliferation of youth leagues appear to bode well for the professional future of this sport in North America, which up to now has had a difficult time gaining the committed attention of fans here.

The brand of football played in the British Isles is acknowledged to be among the best in the world. The BBC has managed to hold onto its rights to broadcast English League matches and the World Service religiously broadcasts the second half of a key match every week during the Premier League season, which extends from August to May.

Although the League Championship is a fine objective, the most coveted prize is the F.A. (for Football Association) Cup, a season-long tournament contested by every team at every competitive level in England. It is not uncommon for teams from lesser divisions to advance deeply into the competition, creating several classic underdog versus favorite contests that always stimulates interest in sport. The World Service also carries many of these matches, as well. A great sight for full explanations of the F.A. is <**www.the-fa.org/index.htm**>.

Australian Sports Resources:
Official AFL site—<http://www.afl.com.au/>
Official NRL site—<http://www.nrl.com.au/>
ABC Grandstand site—<http://abc.net.au/grandstand/>
Sydney Morning Herald—<http://www.smh.com.au>
Melbourne Age—<http://www.theage.com.au>

Tuning In:
BBC World Service
Sportsworld
Sat. 1405-1700; Sun. 1605-1700

Sportsworld is an omnibus program covering all sorts of sports all over the world, as well as key events in the British Isles. Second-half football commentary from the English Premier League usually commences at 1505 on Saturdays, but special coverage can occur at any time.

Until September, good listening!

SWL PROGRAM GUIDE

PUBLISHED QUARTERLY

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Sundays

0000 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
0021 Radio Exterior de Espana: "Radio Waves"
0100 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
0110 HCJB (am): "DX Partyline"
0115 Hungary, Radio Budapest: "Radio Budapest DX Blockbuster"
0121 Radio Exterior de Espana: "Radio Waves"
0130 Radio For Peace Intl: "Continent of Media"
0130 Glenn Hauser via WRN1: "World of Radio"
0136 Radio Havana Cuba: "DXers Unlimited"
0145 WWCR #3 (Tennessee): "Ask WWCR"
0200 Kim Elliott via WWCR #3: "Communications World"
0200 Glenn Hauser via RFPI: "World of Radio"
0230 Glenn Hauser via WWCR #3: "World of Radio"
0245 Radio Bulgaria: "Radio Bulgaria Calling"
0300 Radio Mexico Intl: "DXperience"
0300 WWCR #3 (Tennessee): "Spectrum (live)"
0323 Voice of Turkey: "The DX Corner" (biweekly)
0330 Australia, Radio: "Feedback"
0336 Radio Havana Cuba: "DXers Unlimited"
0410 HCJB (am): "DX Partyline"
0430 Marie Lamb via WHRI (Angel 2): "DXing with Cumbre"
0508 Vatican Radio: "On-the-Air"
0521 Radio Exterior de Espana: "Radio Waves"
0536 Radio Havana Cuba: "DXers Unlimited"
0600 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
0630 Glenn Hauser via WRN1: "World of Radio"
0630 Glenn Hauser via WWCR #3: "World of Radio"
0704 Belgium, R Vlaanderen Intl: "Radio World"
0830 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
0838 Radio Korea: "Multiwave Feedback"
0930 Radio For Peace Intl: "Continent of Media"
0930 Italy (AWR): "Wavescan"
1000 Kim Elliott via WRN1 to NAm (Internet): "Communications World"
1000 KSDA (Guam): "Wavescan"
1000 Glenn Hauser via RFPI: "World of Radio"
1015 WWCR #1 (Tennessee): "Ask WWCR"
1030 KSDA (Guam): "Wavescan"
1030 Glenn Hauser via WRN1: "World of Radio"
1038 Radio Korea: "Multiwave Feedback"
1134 Belgium, R Vlaanderen Intl: "Radio World"
1230 Italy (AWR): "Wavescan"
1230 KSDA (Guam): "Wavescan"
1300 Marie Lamb via KWHR (Angel 4): "DXing with Cumbre"
1330 KSDA (Guam): "Wavescan"
1335 Radio Canada Intl: "The Maple Leaf Mailbag"
1338 Radio Korea: "Multiwave Feedback"
1400 Kim Elliott via VOA (News Now): "Communications World"
1430 Kim Elliott via Astra 1B to Eu (Satellite): "Communications World"
1430 Marie Lamb via WHRI (Angel 2): "DXing with Cumbre"
1430 KSDA (Guam): "Wavescan"
1431 World Radio Network (WRN1): "Radio World"
1500 Marie Lamb via WHRI (Angel 1): "DXing with Cumbre"
1600 KSDA (Guam): "Wavescan"
1605 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
1637 Radio Canada Intl: "The Maple Leaf Mailbag"
1638 Radio Korea: "Multiwave Feedback"
1700 WWCR #1 (Tennessee): "Ask WWCR"
1730 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
1730 KSDA (Guam): "Wavescan"
1737 Belgium, R Vlaanderen Intl: "Radio World"
1830 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
1937 Belgium, R Vlaanderen Intl: "Radio World"
1938 Radio Korea: "Multiwave Feedback"
1945 BBC (west af): "Waveguide" (4)
1945 BBC (west af): "Write On"
2000 Kim Elliott via WBCQ: "Communications World"
2037 Canada, Radio Canada Intl: "The Maple Leaf Mailbag"
2105 Radio Korea: "Multiwave Feedback"
2130 KSDA (Guam): "Wavescan"
2200 WRMI (Florida): "Wavescan"
2208 Radio Korea: "Multiwave Feedback"
2231 Belgium, R Vlaanderen Intl: "Radio World"
2300 Radio Mexico Intl: "DXperience"
2300 Glenn Hauser via RFPI: "World of Radio"

Mondays

0030 Glenn Hauser via WWCR #1: "World of Radio"
0131 Canada, Radio Canada Intl: "The Maple Leaf Mailbag"
0238 Radio Korea: "Multiwave Feedback"
0300 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
0345 BBC (me): "Waveguide" (4)
0345 BBC (me): "Write On"
0401 Belgium, R Vlaanderen Intl: "Radio World"
0407 Canada, Radio Canada Intl: "The Maple Leaf Mailbag"
0500 Glenn Hauser via WWCR #1: "World of Radio"
0530 Kim Elliott via WWCR #1: "Communications World"
0700 WWCR #1 (Tennessee): "Spectrum (live)"
0700 Glenn Hauser via RFPI: "World of Radio"
0945 BBC (east af): "Waveguide" (4)
0945 BBC (east af): "Write On"
1040 All India Radio: "DX-ers Corner" (2/4)
1115 WWCR #1 (Tennessee): "Ask WWCR"
1500 Glenn Hauser via RFPI: "World of Radio"
1545 KTWR (Guam): "Pacific DX Report"
1840 All India Radio: "DX-ers Corner" (2/4)
2130 All India Radio: "DX-ers Corner" (2/4)
2135 Radio New Zealand Intl: "Mailbox" (biweekly)

Tuesdays

0033 Radio Exterior de Espana: "Radio Waves"
0133 Radio Exterior de Espana: "Radio Waves"
0533 Radio Exterior de Espana: "Radio Waves"
0600 WWCR #3 (Tennessee): "Ask WWCR"
0900 KTWR (Guam): "Pacific DX Report"
0945 WWCR #1 (Tennessee): "Ask WWCR"
1100 Glenn Hauser via WWCR #1: "World of Radio"
1355 FEBC (Philippines): "DX Dial"
1900 Glenn Hauser via RFPI: "World of Radio"
2000 Radio For Peace Intl: "Continent of Media"
2000 Poland, Polish R Warsaw: "Polish Radio DX Club"
2111 Radio Havana Cuba: "DXers Unlimited"
2300 Radio Mexico Intl: "DXperience"
2311 Radio Havana Cuba: "DXers Unlimited"
2340 All India Radio: "DX-ers Corner" (2/4)

Wednesdays

0140 Radio Havana Cuba: "DXers Unlimited"
0246 Radio Bulgaria: "Radio Bulgaria Calling"
0300 Glenn Hauser via RFPI: "World of Radio"
0340 Radio Havana Cuba: "DXers Unlimited"
0400 Radio For Peace Intl: "Continent of Media"
0540 Radio Havana Cuba: "DXers Unlimited"

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0630 HCJB (eu): "Ham Radio Today"
0930 Kim Elliott via WWCR #1: "Communications World"
0930 HCJB (pac): "Ham Radio Today"
1100 Kim Elliott via WWCR #1: "Communications World"
1200 Radio For Peace Intl: "Continent of Media"
1315 FEBC (Philippines): "DX Dial"
1720 Poland, Polish R Warsaw: "Polish Radio DX Club"
1730 Radio For Peace Intl: "Continent of Media"
1735 Radio New Zealand Intl: "Mailbox" (biweekly)
1820 Argentina, RAE: "DX'ers Special"
1930 HCJB (eu): "Ham Radio Today"
2105 Hungary, Radio Budapest: "Radio Budapest DX Blockbuster"
2330 Glenn Hauser via WBCQ: "World of Radio"

Thursdays

0030 Australia, Radio: "Media Report"
0130 HCJB (am): "Ham Radio Today"
0235 Hungary, Radio Budapest: "Radio Budapest DX Blockbuster"
0239 Argentina, RAE: "DX'ers Special"
0430 HCJB (am): "Ham Radio Today"
0800 KTWR (Guam): "Pacific DX Report"
0930 Radio For Peace Intl: "Continent of Media"
1008 Netherlands, Radio: "Media Network"
1030 Australia, Radio: "Media Report"
1130 World Radio Network (WRN1): "Media Report"
1138 Netherlands, Radio: "Media Network"
1220 Poland, Polish R Warsaw: "Polish Radio DX Club"
1500 Radio Mexico Intl: "DXperience"
1508 Netherlands, Radio: "Media Network"
1530 Australia, Radio: "Media Report"
1808 Netherlands, Radio: "Media Network"
1938 Netherlands, Radio: "Media Network"
2030 Glenn Hauser via WWCR #1: "World of Radio"
2300 Glenn Hauser via RFPI: "World of Radio"

Fridays

0008 Netherlands, Radio: "Media Network"
0508 Netherlands, Radio: "Media Network"
0700 Glenn Hauser via RFPI: "World of Radio"
0930 Glenn Hauser via WWCR #1: "World of Radio"
1030 KTWR (Guam): "Pacific DX Report"
1500 Glenn Hauser via RFPI: "World of Radio"
1900 Radio For Peace Intl: "Continent of Media"
1930 Radio New Zealand Intl: "Mailbox" (biweekly)
1930 Glenn Hauser via RFPI: "World of Radio"
1947 Radio Bulgaria: "Radio Bulgaria Calling"
2000 WWCR #1 (Tennessee): "Ask WWCR"
2030 Glenn Hauser via WBCQ: "World of Radio"
2130 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
2238 Voice of Turkey: "The DX Corner" (biweekly)
2330 Australia, Radio: "Media Report"
2345 Radio Bulgaria: "Radio Bulgaria Calling"

Saturdays

0030 Australia, Radio: "Feedback"
0100 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
0133 Kim Elliott via VOA (News Now): "Communications World"
0145 BBC (east as/pac): "Waveguide" (4)
0145 BBC (east as/pac): "Write On"
0300 Radio For Peace Intl: "Continent of Media"
0300 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
0300 Glenn Hauser via WWCR #1: "World of Radio"
0315 Voice of Turkey: "The DX Corner" (biweekly)
0330 BBC (am): "Waveguide" (4)
0330 Glenn Hauser via RFPI: "World of Radio"
0330 BBC (am): "Write On"
0345 BBC (south as): "Waveguide" (4)
0345 BBC (south as): "Write On"
0500 Marie Lamb via WHRI (Angel 1&2): "DXing with Cumbre"
0533 Kim Elliott via VOA (News Now): "Communications World"
0600 Marie Lamb via KWHR (Angel 3): "DXing with Cumbre"
0605 Australia, Radio: "Feedback"
0610 HCJB (eu): "DX Partyline"
0645 BBC (east af): "Waveguide" (4)
0645 BBC (me): "Waveguide" (4)
0645 BBC (east af): "Write On"
0645 BBC (me): "Write On"
0700 Kim Elliott via VOA (News Now): "Communications World"
0730 Marie Lamb via WHRI (Angel 1&2): "DXing with Cumbre"
0745 BBC (eu): "Waveguide" (4)
0745 BBC (eu): "Write On"
0800 Kim Elliott via Astra 1B to Eu (Satellite): "Communications World"
0845 WWCR #3 (Tennessee): "Ask WWCR"
0845 BBC (west af): "Waveguide" (4)
0845 BBC (west af): "Write On"
0910 HCJB (pac): "DX Partyline"
0930 Marie Lamb via KWHR (Angel 4): "DXing with Cumbre"
0933 Kim Elliott via VOA (News Now): "Communications World"
1100 Radio For Peace Intl: "Continent of Media"
1130 Glenn Hauser via RFPI: "World of Radio"
1130 Glenn Hauser via WWCR #1: "World of Radio"
1145 Radio Bulgaria: "Radio Bulgaria Calling"
1200 Glenn Hauser via WRN1: "World of Radio"
1230 Marie Lamb via WHRI (Angel 1): "DXing with Cumbre"
1245 Voice of Turkey: "The DX Corner" (biweekly)
1315 WWCR #1 (Tennessee): "Ask WWCR"
1333 Kim Elliott via VOA (News Now): "Communications World"
1342 Radio Tashkent: "Radio Tashkent DX Program"
1430 Marie Lamb via WHRI (Angel 2): "DXing with Cumbre"
1430 Marie Lamb via KWHR (Angel 4): "DXing with Cumbre"
1455 FEBC (Philippines): "DX Dial"
1730 Radio For Peace Intl: "Continent of Media"
1733 Kim Elliott via VOA (News Now): "Communications World"
1800 Marie Lamb via WHRI (Angel 2): "DXing with Cumbre"
1800 Glenn Hauser via RFPI: "World of Radio"
1845 Voice of Turkey: "The DX Corner" (biweekly)
1910 HCJB (eu): "DX Partyline"
1958 Vatican Radio: "On-the-Air"
2045 WWCR #3 (Tennessee): "Ask WWCR"
2045 Voice of Turkey: "The DX Corner" (biweekly)
2106 Radio Havana Cuba: "DXers Unlimited"
2110 Australia, Radio: "Feedback"
2130 Marie Lamb via WHRA (Angel 5): "DXing with Cumbre"
2130 WRMI (Florida): "Wavescan"
2131 Radio Exterior de Espana: "Radio Waves"
2133 Kim Elliott via VOA (News Now): "Communications World"
2147 Radio Bulgaria: "Radio Bulgaria Calling"
2215 Voice of Turkey: "The DX Corner" (biweekly)
2230 Marie Lamb via WHRI (Angel 1): "DXing with Cumbre"

Single Channel Per Carrier (SCPC) Services

By Robert Smathers, roberts@nmia.com

An SCPC transmitted signal is transmitted with its own carrier, thus eliminating the need for a video carrier to be present. Dozens of SCPC signals can be transmitted on a single transponder. In addition to a standard TVRO satellite system, an additional receiver is required to receive SCPC signals.

The frequency in the first column is the 1st IF (typical LNB frequency) and the second column frequency (in parentheses) is the 2nd IF (commercial receiver readout) for the SCPC listing. Both frequencies are in MHz.

GE-2 Transponder-Vertical 13 (C-band)

1178.70 (81.3)	NASA space shuttle audio (missions only)

Galaxy 4R Transponder 1-Horizontal (C-band)

1443.80 (56.2)	Voice of Free China (International Shortwave Broadcaster) Taipei, Taiwan
1443.60 (56.4)	KBLA-AM (1580) Santa Monica, CA–*Radio Korea*
1438.30 (61.7)	WWRV-AM (1330) New York, NY–Spanish religious programming and music, ID–*Radio Vision Christiana de Internacional*

Galaxy 4R Transponder 3-Horizontal (C-band)

1404.60 (55.4)	WGN-AM (720) Chicago, IL–news and talk radio/Cubs MLB radio network
1404.40 (55.6)	WMVP-AM (1000) Chicago, IL–"ESPN Radio 1000"/White Sox MLB radio network
1404.20 (55.8)	Tribune Radio Networks/Wisconsin Radio Network
1402.90 (57.1)	USA Radio Network
1402.70 (57.3)	Occasional Audio
1402.00 (58.0)	Occasional Audio
1401.80 (58.2)	People's Radio Network
1399.00 (61.0)	Sports Byline USA/Sports Byline Weekend
1398.80 (61.2)	Talk Radio Network (TRN)
1398.50 (61.5)	Occasional audio
1397.80 (62.2)	Occasional audio
1397.50 (62.5)	Minnesota Talking Book Radio Network–reading service for the blind
1397.10 (62.9)	Wisconsin Radio Network
1396.70 (63.3)	Radio Americo Network
1395.80 (64.2)	WTMJ-AM (620) Milwaukee, WI–talk radio/Brewers MLB radio network
1395.50 (64.5)	Michigan News Network–network news feeds
1395.00 (65.0)	Occasional audio
1394.70 (65.3)	WJR-AM (760) Detroit, MI–news and talk radio/Michigan News Network/Tigers MLB radio network
1394.30 (65.7)	Michigan News Network – network news feeds
1383.10 (76.9)	KIRO-AM (710) Seattle, WA–news and talk radio/Mariners MLB radio network
1382.60 (77.4)	Soldiers Radio Satellite (SRS) network–U.S. Army information and entertainment radio
1382.30 (77.7)	Motor Racing Network (occasional audio) NASCAR racing
1382.00 (78.0)	Occasional audio
1381.60 (78.4)	KEX-AM (1190) Portland, OR–news and talk radio/Portland Fire WNBA radio network
1381.40 (78.6)	Occasional audio
1381.20 (78.8)	KJR-AM (950) Seattle, WA– sports talk radio
1380.90 (79.1)	Occasional audio
1377.10 (82.9)	In-Touch–reading service
1376.00 (84.0)	Kansas Audio Reader Network–reading service

Anik E2 Transponder 1-Horizontal (C-band)

1446.00 (54.0)	Canadian Broadcasting Corporation (CBC) Radio–North (Quebec) service

Anik E2 Transponder 5-Horizontal (C-band)

1366.00 (54.0)	Canadian Broadcasting Corporation (CBC) Radio–North (Eastern Arctic) service

Anik E2 Transponder 7-Horizontal (C-band)

1326.00 (66.0)	Canadian Broadcasting Corporation (CBC) Radio–North (MacKenzie) service
1325.50 (65.5)	Canadian Broadcasting Corporation (CBS) Radio–Occasional feeds/events

Anik E2 Transponder 17-Horizontal (C-band)

1126.00 (54.0)	Canadian Broadcasting Corporation (CBC) Radio–North (Western Arctic) service
1125.50 (54.5)	Canadian Broadcasting Corporation (CBC) Radio–North (Newfoundland and Labrador) service

Anik E2 Transponder 23-Horizontal (C-band)

1006.00 (54.0)	Societe Radio-Canada (SRC) Radio–AM Network
1005.50 (54.5)	Canadian Broadcasting Corporation (CBC) Radio-North (Yukon) service

Solidaridad 1 Transponder 1-Vertical (C-band)

1447.90 (52.1)	Antenna Radio/Antenna Radio Noticias
1447.60 (52.4)	Antenna Radio/Antenna Radio Noticias
1447.20 (52.8)	La Grande Cadena Raza

Anik E1 Transponder 21-Horizontal (C-band)

1036.70 (63.3)	Wal-Mart In-store music
1037.00 (63.0)	Wal-Mart In-store music
1037.50 (62.5)	Wal-Mart In-store music

Galaxy 10R Transponder 4 (Ku-band)

1012.75 (87.25)	Wal-Mart In-store network
1013.15 (86.85)	Sam's Club In-stare network
1013.50 (86.50)	Wal-Mart In-store network
1013.95 (86.05)	Wal-Mart In-store network
1014.25 (85.75)	Sam's Club In-store network
1014.75 (85.25)	Wal-Mart In-store network
1015.05 (84.95)	Wal-Mart In-store network

RCA C5 Transponder 3-Vertical (C-band)

1404.60 (55.4)	Wyoming News Network/Northern Ag Network
1400.60 (59.4)	Learfield Communications
1400.40 (59.6)	Learfield Communications/MissouriNet
1400.20 (59.8)	Learfield Communications
1400.00 (60.0)	Learfield Communications
1396.60 (63.4)	Kansas Information Network/Kansas Agnet–network news feeds
1396.40 (63.6)	Liberty Works Radio Network

1396.20 (63.8)	MissouriNet/Cardinals MLB radio network
1395.90 (64.1)	Western Montana Radio Network/Red River Farm Network
1395.70 (64.3)	MissouriNet/Royals MLB radio network
1386.40 (73.6)	Learfield Communications
1386.20 (73.8)	Radio Iowa
1384.00 (76.0)	Capitol Radio Network
1383.80 (76.2)	Learfield Communications
1383.40 (76.6)	Capitol Radio Network
1382.90 (77.1)	MissouriNet
1382.10 (77.9)	Learfield Communications/MissouriNet

SATELLITE LOADING REPORT OF THE MONTH:

Galaxy 11 at 99 degrees West longitude

(soon to be Galaxy 4R at 99 degrees West)

C-band

1	Data Transmissions
2	Galaxy 3D
3	SCPC Services
4	Data Transmissions
5	Occasional video
6	Occasional video
7	Occasional video
8	Occasional video
9	Televisa (Digital)
10	Galaxy 3D
11	Mexico feeds (digital)
12	Occasional video
13	Data Transmissions
14	Eternal Word Television Network (digital)
15	World Harvest Television Network
16	Shepherd's Chapel Network
17	STARZ! (East) [VC2+]
18	STARZ! (West) [VC2+]
19	STARZ! Theatre (East) [VC2+]
20	STARZ! Westerns (East) [VC2+]
21	Occasional video
22	Occasional video
23	Occasional video
24	Occasional video

Ku-band

The only currently active Ku-band transmission is the TCI Headend in the Sky service – 12 transponders using Digicipher 2 video compression.

GE-4 at 101 degrees West longitude

C-band

1	Data Transmissions
2	(none)
3	Data Transmissions
4	(none)
5	Occasional video
6	(none)
7	Occasional video
8	(none)
9	Data Transmissions
10	Daystar Television Network
11	(none)
12	Hollywood Treasures Home Shopping Network (occasional)
13	Data Transmissions
14	FOX Sports Networks (digital)
15	Data Transmissions
16	FOX Sports Networks (digital)
17	WSVN-TV, Miami, FL – Primetime 24 FOX affiliate [VC2+]
18	WNBC-TV, New York, NY – Primetime 24 NBC affiliate [VC2+]
19	Cornerstone Television
20	(none)
21	Data Transmissions
22	WKRN-TV, Nashville, TN – Primetime 24 ABC affiliate [VC2+]
23	Data Transmissions
24	WSEE-TV, Erie, PA – Primetime 24 CBS affiliate [VC2+]

Ku-band

Tr Freq	Pol	Service	Tr Freq	Pol	Service
11720	V	GE-4 ID Slate	11960	V	Data Transmissions
11740	H	Fordstar (digital)	11980	H	Data Transmissions
11760	V	Data Transmissions	12000	V	Occasional video
11780	H	Data Transmissions	12020	H	Data Transmissions
11800	V	Data Transmissions	12040	V	Occasional video
11820	H	Data Transmissions	12060	H	Data Transmissions
11840	V	Occasional video	12080	V	Data Transmissions
11860	H	Occasional video	12100	H	Data Transmissions
11880	V	Data Transmissions	12120	V	Occasional video
11900	H	Occasional video	12140	H	Occasional video
11920	V	Data Transmissions	12160	V	Occasional video
11940	H	Data Transmissions	12180	H	Data Transmissions

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Easy Satellite Service Tips Save Big Bucks

Cable TV is so simple: when you get bad service, you just call them up and register your complaint with the answering machine, within weeks your service doesn't improve but your bill reflects the increase in costs they've incurred by upgrading the service. If only satellite TV services were so easy.

No, with satellite service you're on your own. Oh, they'll do the installation for free (sometimes) and be happy to authorize the system and do whatever else is necessary to make sure the bill comes to you on time, but once that service truck has left your driveway you're on your own. With C-band satellite installations the trepidation is even greater. With all the moving parts, the potential for something to go wrong just minutes after the warranty expires is great. No matter which system you have you'll find that service calls are expensive. By the time the parts, labor and travel time have been calculated you'll wonder why you bothered.

❖ Lightning Damage Prevention

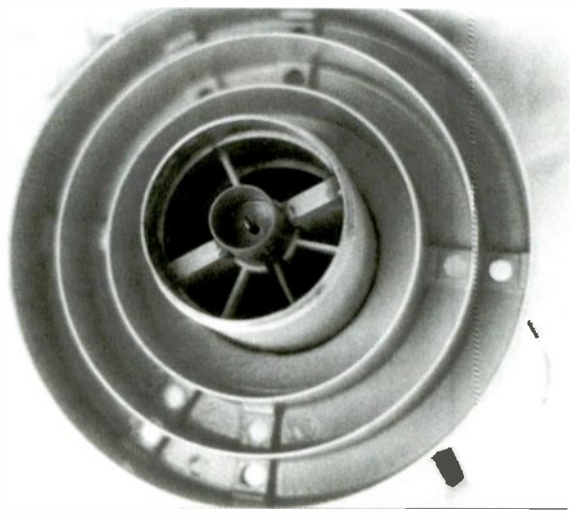
If you are contemplating getting into the satellite TV hobby or just switching from cable to DBS for the programming you need to consider the future. You need to keep in mind that the original purchase price, whatever it was, was only the beginning. Over the years you may be replacing or upgrading feed horns, LNBs, servo-motors, actuator motors, or the entire dish. Inside the house you may be swapping receivers, adding MPEGII, or SCPC receivers or installing extra receivers in different parts of the house. Whatever you do, the more you can do for yourself the cheaper the entire endeavor will be.

With DBS systems there are no moving parts, everything is solid state and the expectation is that the system will last a long time before requiring any replacement parts or service. That is, until the first thunderstorm hits. You can prevent costly service calls or the inconvenience of doing without your system by taking some routine precautions. Forget the $3.95 power strips with built-in circuit breakers. Chances are they won't have a fast enough reaction time to prevent lightning damage.

Go directly to heavy duty surge protectors such as the Panamax series. They make different protectors for DBS and C-band systems which include AC receptacles, "F" connectors and phone line jacks. Panamax products are sold by Skyvision whose ad appears elsewhere in this magazine.

With Big Dish C/Ku-band systems you need the same protection but have the added worry of the extra electrical devices at the dish. Servo motors which change polarity seem to be more sensitive to stray lightning voltage than the heavier actuator motors which move the dish. LNBs seem to be less susceptible but can be blown by voltage coming from the receiver in the house due to a surge on the AC lines and carried to the dish by the coax.

Satellite system surge protection devices are not cheap, but they could pay for themselves the first time you get a thunderstorm after installation. Expect to pay from $50-150 for the Panamax devices. While you're at it you should consider installing Ground Fault Interrupter (GFI) AC outlets in place of the standard outlets where you plug in your satellite receiver, VCR and TV set. If you don't feel competent to swap out the receptacles hire an electrician to do the job. Since most lightning damage to receivers, VCRs and TV sets comes from surges via the AC wiring in your house, this is where you should concentrate your lightning protection.



Inside the feed horn cover of a C/Ku-band feed horn. Plenty of places for wasps to build their nests which could affect reception. (Courtesy Ken Reitz)

❖ Aging Components

Even if you never experience a problem with lightning, various parts on Big Dish systems eventually wear out and need to be replaced. Some components appear to be more reliable than others. My experience is that actuator motors are extremely well built and work forever even under the most demanding circumstances. I've been using the same 36" actuator motor to drive a 10' dish across the entire arc dozens of times a day for well over ten years without a failure.

The small servo motors which rotate the probe in the feed horn to change polarity seem to be the weakest link in the mechanics of a Big Dish system. Over the last 16 years I've probably had to replace three or four. But then again, I give them a real workout. If you consider that the motor has to move each time you switch channels, my servo turns hundreds of times a day as I scour the birds for audio and video action.

Feed horns are nearly impervious to aging, but I've found that the nylon bearing in which the probe is mounted which turns with each new channel selection can wear out. I've had two such incidents in the last 16 years. The main problem with feed horns is keeping the throat cover in place to prevent wasps from building their homes on the probe. If you ever experience a gradual decline in reception on all channels on all satellites, check first to see if critters have set up shop in the feed horn. Take care removing them.

Direct burial cable is designed to last a long time. I still use the original cable

bundle I put in the ground 16 years ago. However, I've found that some RG-6 cable, which I've run to additional dishes in the "dish farm" doesn't fare so well underground. I recently had to replace a run of RG-6 which has been in the ground only 5 years. I also had to replace the servo motor wires which went up to the feed horn on the big dish as they mysteriously broke.

LNBs are extremely well built. While some dealers install plastic feed horn protectors over the LNBs, I've found that they simply add to the ambient temperature of the devices and are a pain in the neck to take off when swapping out LNBs, feed horns, servo motors, etc. You'll notice that virtually all commercial Big Dish installations don't have the LNB covers. Instead, it's helpful if you use CoaxSeal or other similar product at the "F" connector on the LNBs to prevent rain from leaking into the connection. Nothing degrades reception like moisture in the connector.

Inclinometer in action. Helps check angles of your dish at the mount, on the pole and on the feed horn. Peaking the dish for optimum performance is easy and can save a service call. (Courtesy Ken Reitz)

❖ Out of Whack

Weather, wind, snow and ice load are all combining throughout the year to knock your DBS or Big Dish out of alignment. The heat of summer and cold of winter along with the winds of all seasons can loosen the bolts and nuts which keep your dish at the proper angles to pick up the satellites. You may be surprised to discover that the signal from whatever satellite your dish is looking at is not as strong as it was when you first installed your dish. What you may believe is a failing component may actually be poor dish alignment.

There are many tools you can buy to peak your dish, a task which you should do at least once a year. But, before you do anything else, make a few measurements to see if there is a problem. If you have a level, first determine that the mounting pole is plumb. It's possible that the first winter thaw of the ground around your system may have tilted the pole slightly off plumb. If the mounting pole isn't plumb any other adjustments you make will be a waste of time. Now check that the dish is lined up properly on the east/west axis. While watching the screen, gently nudge the dish from side to side. If the picture improves in either direction loosen the mounting bolts and peak the signal. Now gently nudge the dish up and down. Again, if there's improvement you'll need to change the elevation angle. Each dish has a different scheme for making this adjustment so check out your owner's manual for details.

On Big Dish systems stretch two strings across the lip of the dish from side to side and top to bottom. Where the strings cross should be directly below the feed horn. If not, the feed horn is not illuminating the entire dish and not getting all the signal being picked up by the reflector. Next determine that the feed horn is the proper distance from the center of the dish; this is called the *focal point*. Your owner's manual will say exactly what the focal distance should be in inches or millimeters.

❖ Making Changes

Any time you want to make changes in your Big Dish installation, turn off the receiver and disconnect it from the power source. This prevents accidently shorting out the components. If you want to replace a worn out servo motor, it's easy. First mark the three connecting wires with labels "+5 Volts," "GND," and "Pulse." Now disconnect the wires, undo the screws holding the servo to the feed horn. Lift the motor off the nylon probe holder (don't forget to use the rubber gasket). Replace with the new servo in the reverse order.

If you want to replace an old LNB with a new lower temperature LNB, you can do it yourself. First undo the coax cable from the LNB "F" connector. Now loosen all the bolts which hold it to the feed horn. Lift the old LNB off and replace it with the new one. Once again, don't forget the rubber gasket. These gaskets prevent rain from getting into the fittings or components and rain is the enemy of microwave reception. Now re-attach the coax. It's that simple.

To add a Ku-band LNB to your current installation you'll need a whole new C/Ku-band feed horn and a Ku-band LNB. First disconnect all things connected. Now loosen the three bolts which hold the feed horn to the feed horn supports on the dish. If you have a center "button hook" support it's the easiest. With a tri- or quad-support the supports may tend to flop around after being disconnected. Now mount the new C/Ku-band feed horn on the support Next, take the old C-band LNB off the old feed horn and mount it on the appropriate hole. Now add the new Ku-band LNB. Next hook up the wires for the servo and attach the two coax feed lines. That's it!

❖ Final Say

Of all the tools you could buy, I recommend an inclinometer or "protractor aiming tool" as some call it. With it you can check that your mount pole is plumb and the dish at the proper angles. It's also nice to have a peaking meter, but it's not entirely necessary. Other than that, simple wrenches, pliers, and screw drivers are all you'll need. A socket set with extension really speeds things up when you're swapping out LNBs. With a TV, an extension cord and a 20-ft. length of coax you can set up right by the dish and make the necessary adjustments while watching the screen yourself. Try to do it on an overcast day which makes looking at the screen much easier and your task a whole lot cooler.

The main thing is that you can save hundreds of dollars throughout the course of your satellite TV hobby. But, the other thing is that you'll find it interesting and educational to do these simple maintenance things on your own. It makes your hobby that much more satisfactory.

VIEW FROM ABOVE

WATCHING THE WEATHER SATELLITES

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http://www.itchycoo-park.freeserve.co.uk/wxsats.html

Surface Events Captured on Satellite

Seems like only a short time ago we were suffering from winter blues, yet I write this just days before the summer solstice. Within a period of a few weeks, we have seen dangerous fires, volcanic eruptions and the season's first hurricane! The surely amazing point here is that all these significant events can be monitored by the amateur, using equipment that can, in some cases, be home-built, or at least bought at a price within most budgets.

When the price of satellite dishes was exorbitant (about 15 years ago here in Britain) I constructed my own Meteosat (the equivalent of GOES) dish and had instant success receiving WEFAX signals (in the 1694MHz band) – for the cost of a few dollars of "chicken wire." Such dishes are now at "takeaway" prices, if not free to collect.

For those not yet into weather satellite image monitoring can I suggest spending a pleasant weekend or couple of evenings looking at the amount of data available and the costs involved? With thousands of enthusiasts across the world, you are not alone.

❖ Operational WXSATS

The return of NOAA-12 to active automatic picture transmission (APT) status on 137.50 MHz means that all three NOAA WXSATs are once more operational. With the sun at its seasonal highest around June 21, visible-light channels on all three NOAAs are now near their best for the year.

The content of recent "night-time" passes of NOAA-14 (137.62 MHz) surprised me. I don't usually leave my monitoring equipment on overnight, except for special occasions, but I decided to check out some late spring, night passes, not having done so for some time. The satellite passes southbound during the early hours of the morning – at about 0500UTC in Britain – and at corresponding times (6am local summer time) elsewhere. This is about one hour after local sunrise at these latitudes in early summer, so the "overnight" image is actually in sunlight – and shows considerable detail! The curve of the morning twilight zone can be seen.

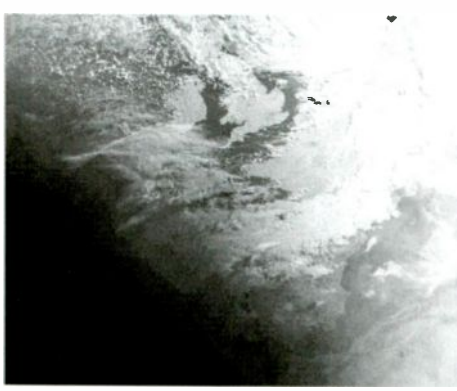

Fig 1: NOAA-14 early morning pass 0505 UTC May 29, 2000 over UK.

The three NOAA satellites are sun-synchronous, having their orbital planes separated with respect to each other. From local midnight, NOAA-14 is the first of the satellites to pass by, doing a series of three passes – the highest one as described above. NOAA-12 passes southbound an hour or two later, and NOAA-15 an hour or two after that. Although NOAA-14 manages to pass just before sunrise during the weeks near the solstice, it passes in darkness for the rest of the year. NOAA-15 has its orbital plane positioned so that it always passes overhead after sunrise, even in mid-winter.

After NOAA-15's last southbound pass, there is a break of some hours before NOAA-14 passes northbound, and then the sequence continues; later passes of NOAA-14 cover the timeframe of NOAA-12's afternoon passes.

❖ Meteor 3-5 early and late

Meteor 3-5 was reactivated on 137.30 MHz some weeks ago, after its orbital plane had crossed the twilight zone and moved once more into "stronger" sunlight. This period of non-transmission happens at intervals because the orbit is not sun-synchronous. During June, Meteor 3-5 was passing north-bound during the day; passes slowly move earlier (towards the morning), due to precession of the orbit.

Correspondingly, Meteor 3-5's evening, southbound passes (that were in darkness), caught the June evening sun. These evening passes allowed transmission to continue while the satellite rose high above the horizon – only switching off when it entered darkness. Projecting into July, transmissions should cease during morning passes because the satellite moves into the sunrise terminator, but by then, the evening passes will lengthen as the orbital plane moves towards afternoon.

I have found image quality from Meteor 3-5 to have degraded during recent weeks, to the extent that I could not select a picture for inclusion. Similarly, image quality from Resurs 01-N4 seems to have degraded. Meteor 3-5 is an old satellite – launched back in 1991. It is to be replaced by the Meteor-3M series of satellites – an advanced series of polar orbiters with a 1.4 km resolution visible channel, and a ten-channel radiometer with 3 km resolution. The APT transmission will have one reduced-resolution (2 km) visible channel data.

Meteor 3M-1 remains scheduled for launch mid-2000, though this now seems unlikely. As at April, launch of Meteor-3M is officially scheduled for 31 July, together with Badr-2, Maroc-Tubsat, TiungSat-1.

Russia launched Resurs 01-N4 in July 1998, and this carries a meteorological package similar to that planned for the 3M series.

❖ GOES-11 working fine

GOES 11 is at 104° west for its check-out period. It will eventually replace one of the other operational GOES (8 at 75° west or 10 at 135° west); most likely it will become GOES East, and will eventually move to the eastern position.

No visible imagery was received following its first operational day, though monitoring continued from various science establishments.

One of the systems on GOES is the SEM (Space Environment Monitor) System, consisting of a three-axis magnetometer, an Energetic Particle Sensor (EPS) and associated High-Energy Proton and Alpha Detector (HEPAD), and X-Ray Sensor (XRS). This set of instruments is designed to provide real-time measurement of solar activity, the charged particle environment, and the Earth's magnetic field at synchronous orbit. Major solar flares – such as those detected in April and June – enable actual measurements to be made of the energy emitted by the sun, and sometimes intercepted by the earth. This complements the measurements made by SOHO, the

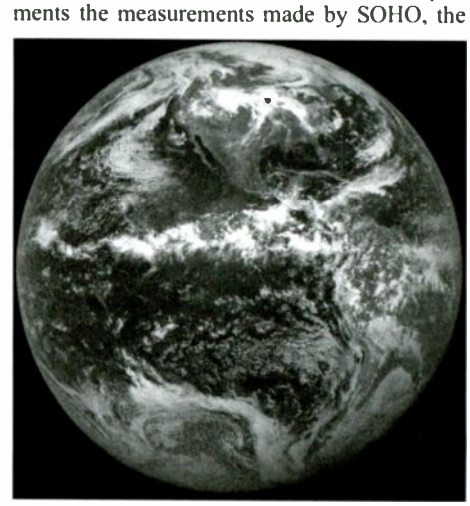

Fig 2: First GOES-11 visible-light image – May 17, 2000 at 1900 UTC

solar observatory that is positioned nearer the sun to detect solar flares as early as possible.

❖ May Shuttle (STS-101) Launch Captured

During the early hours of May 19, Shuttle flight STS-101 was launched from Kennedy Space Center. Nothing unusual about that – but coincidentally NOAA-12 was making its early morning south-bound pass, and captured the event. Hector Cintron had recently installed a new high resolution picture telemetry (h.r.p.t.) system from Timestep Weather Systems (co-incidentally, so have I!) and evidently had the system operating under automatic control. This was a high elevation pass at 1015 UTC, tracking down the east coast. Hector made a set of images from the various spectral components of the original image.

Hector lives in San Juan, Puerto Rico, and has been involved in wxsat reception for several years, moving into h.r.p.t. just one week before launch. He is also a ham radio operator (N1TKK) and the SKYWARN Coordinator for Puerto Rico, as well as webmaster of HuracanNet (www.huracan.net) – "The first and biggest website in Spanish of the Caribbean, related to hurricanes in the area." He built a 5-feet diameter aluminum dish, then fitted the preamp and remainder of the system. On close examination, the images reveal a plume from the Shuttle.

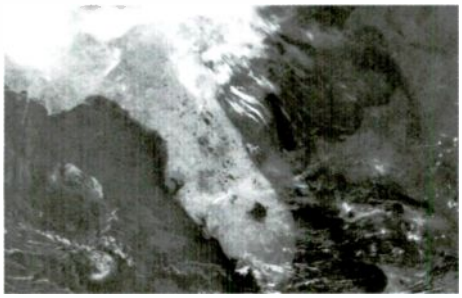

Fig 3: shuttle launch seen by NOAA-12 on May 19 – from Hector Cintron

❖ Drama of Los Alamos Fire Imaged by NASA's Terra Satellite

The view from above the fire that raged out of control during mid-May near Los Alamos, New Mexico, was captured in a series of images by the Multi-angle Imaging Spectro-Radiometer (MISR) on NASA's Terra satellite – see figure 4.

These true-color images covering north-central New Mexico capture the bluish-white smoke plume of the Los Alamos fire, just west of the Rio Grande river. The middle image is a downward-looking view taken by MISR. As the satellite flew from north to south, the instrument viewed the scene from nine different angles. The top image was taken by the MISR camera looking 60 degrees forward along its orbit, whereas the bottom image looks 60 degrees aft.

The fire plume stands out more dramatically in the steep-angle views. Its color and brightness also change with angle. By comparison, a thin, white water cloud appears in the upper right portion of the scene, and is most easily detected in the top image. MISR scientists use these angle-to-angle differences to monitor particulate pollution to identify different types of haze.

MISR is managed by the Jet Propulsion Laboratory, a division of the California Institute of Technology, for NASA' s Office of Earth Science, Washington, D.C. The Terra satellite is managed by NASA's Goddard Space Flight Center, Greenbelt, Md. My thanks to NASA/GSFC/JPL, MISR Science Team for the picture.

First tropical storm of season

On May 23, tropical storm Aletta – see figure 5 – formed off the coast of Mexico. Aletta was moving in a west-northwesterly direction at 8 miles per hour with maximum sustained winds of 40 knots, and gusts to 50 knots.

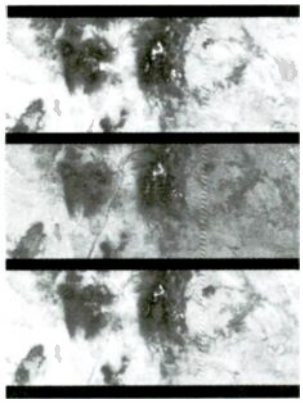

Fig 4: Los Alamos fire captured by Terra satellite

Frequencies

NOAA-14 transmits APT on 137.62 MHz
NOAA-12 and 15 transmit APT on 137.50 MHz
NOAAs transmit beacon data on 137.77 or 136.77 MHz
Meteor 3-5 may transmit APT on 137.30 MHz when in sunlight
Resurs 1-4 transmits APT on 137.85 MHz
Okean-O, Okean-4 and Sich-1 sometimes transmit APT briefly on 137.40 MHz
GOES-8 and GOES-10 use 1691 MHz for WEFAX

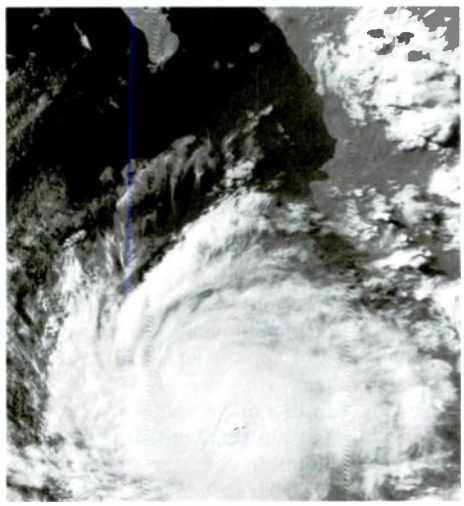

Fig 5: Aletta – tropical storm image from Chuck Vaughan

Larry Van Horn, N5FPW
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Feds in the Civilian Aircraft Band

There are more than just private aircraft and commercial airliners using the civilian aircraft band (118-137 MHz). Federal monitor enthusiasts, especially in metropolitan areas and near military bases will find quite a bit of activity squeezed into civilian air frequencies. Most of the activity will be heard federal/military aircraft on air traffic control en route frequencies. But other areas of this spectrum will have activity, all in the AM mode. Table One is *Fed Files'* exclusive list of possible frequencies to hear federal/military activity in the civilian aircraft band.

Keep in mind you may go days, weeks, even months without hearing *anything* on some of these frequencies; there are no schedules when you should listen to these frequencies like broadcasters have. But when something major goes down, these are frequencies that could come alive with a lot of federal/military activity. These assignments are not nationwide unless indicated so some of these frequencies may never be used in your local area.

Frequencies in table one marked as a "spectrum hole" have no known allocation in the United States or any previous activity reported on them. Be sure to plug these frequencies into your scanner and let us know what you hear. They could be some of the more interesting civilian aircraft frequencies in the spectrum. Be sure to let us know of any government aircraft activity you might hear on these frequencies.

Hurricane Season is Here

As usual, this time of year we think about the hurricane season and where we can hear the famed Hurricane Hunters on our radios. Over the last several years quite a few things have changed the way these brave men and women communicate their information while in flight. Most of the observation information is now sent via satellite link back the National Hurricane Center (NHC) in Miami, unlike the old days when the center depended heavily on shortwave frequencies. After Hurricane Andrew destroyed the old NHC in Coral Gables and the new one was built in its place, HF antennas for the old HF air-to-ground network were not replaced.

You can still occasionally catch the C-130 aircraft from the Air Force Reserve unit out of Biloxi AFB on various Global HF frequencies establishing communications with stations in the network for phone patch traffic. Look for this activity on one of the following frequencies: 4724, 6712, 6739, 8992, 11175, 13200, or 15016. Usually the higher frequencies work best during daylight hours and lower frequencies are used at night. However, current propagation conditions will dictate the frequency selection used by the aircrew that provides the best path between them and ground (not necessarily your listening post).

After initial communications are established, they are usually moved off of the primary frequencies on to secondary or discrete allocations. The biggest problem in catching communications from these aircraft (callsign Teal), is to know when they are going to be flying a mission. Enter the World Wide Web for a little help with this problem. You will find the current Tropical Cyclone Plan of the Day for both the Atlantic and Pacific at: **http://asp1.sbs.ohio-state.edu/text/severe/tropical/NOUS42.KNHC**

If you hear any reports being passed and you would like to decode them, the Hurricane Hunter website has a great page to teach you how to interpret the message and the current messages themselves at **http://www.hurricanehunters.com/wxdata.htm**.

To learn more about the Hurricane Hunters, be sure to visit their website at: **http://www.hurricanehunters.com/**

Keep in mind also that National Oceanic and Atmospheric Administration (NOAA) has two aircraft (NOAA 42 and 43) that also fly missions into hurricanes, especially some of the big ones. You will also hear them using the same frequencies as their military counterparts above.

Canadian Federal Frequencies

I get occasional requests asking about Canadian federal frequencies and where those might be found. One website I can recommend for Canadian government information is **www.globalserve.com/~ebowlby/**, Duckman's Ottawa Carleton Monitoring Resources; you will find quite a bit of information on Canadian radio systems there.

Finally, this month we will pick up where we left off last month with our tour of the VHF low band spectrum. In this issue we will cover the 34, 36 and 38 MHz federal government subbands in table two. Those of us in North America can expect the long distance skip conditions to pick up as we move into the fall and winter months on the VHF low band frequencies.

Until next month, 73 and good hunting all.

Table One: Fed/Military Civilian Aircraft Frequencies

118.650	USN Fleet Support
120.325	Customs Service Air-to-Air
120.350	Justice Department Air-to-Air
120.375	Justice Department Air-to-Air
120.450	Customs Service Air-to-Air
120.650	Justice Department Air-to-Air
120.775	Justice Department Air-to-Air
120.825	Customs Service Air-to-Air
121.500	Civilian VHF Emergency Frequency
121.600	Civil Air Patrol/FAA – Practice Distress Beacons
121.775	Civil Air Patrol – Practice Distress Beacons
122.750	Energy Department Aircraft Advisory Services
122.800	Unicom (variety of government agencies hove services here)
122.850	Unicom (variety of government agencies have services here), Forest Service Helicopter Operations, Corps of Engineers Scene of Disaster comms, Environmental Research Labs Severe Storms Studies (backup frequency), NASA Aircraft Air-to-Air
122.900	Unicom (variety of government agencies have services here), Agriculture Department (various bureau air operations), Air Force (airlift mission support), Bureau of Indian Affairs (multicom service), Civil Air Patrol (practice SAR missions), Coast Guard (SAR support), Environmental Research Labs Severe Storms Studies, EPA Aircraft, Forest Service (Air-to-Air/Air-to-Ground), Interior Department (multicom support), National Park Service (multicom support), NASA aircraft air-to-air, NOAA Aircraft (Air-to-Air)
122.925	Variety of government agencies have services here, Environmental Research Labs Severe Storms Studies/NOAA Aircraft Air-to-Air
122.950	U.S. Military Unicom services, USAF F-16 Flight Demonstration Team
122.975	Forest Service (Air-to-Air/Air-to-Ground)
123.025	Forest Service (Helicopters)
123.050	Forest Service (Helicopters), NASA aircraft air-to-air, NOAA aircraft air-to-air
123.075	Forest Service (Helicopters)
123.100	Various government agencies – Search and Rescue missions
123.125	USAF flight check operations, NASA T-38 air-to-air
123.150	Flight Test Support
123.175	Flight Test Support
123.200	Flight Test Support
123.225	Flight Test Support
123.250	Flight Test Support
123.275	Flight Test Support
123.350	Flight Test Support
123.375	Flight Test Support
123.400	Flight Test Support
123.425	Flight Test Support
123.475	Flight Test Support, Army Golden Knights Parachute Team
123.500	Army Golden Knights Parachute Team
123.525	Flight Test Support
123.550	Flight Test Support
123.575	Flight Test Support
126.200	Military Control Towers
128.625	NASA Air-to-Ground
130.650	AMC Command Post
135.850	FAA Flight Inspection
135.950	FAA Flight Inspection
135.975	Forest Service Air-to-Air/Air-to-Ground

Spectrum Holes: 118.275, 121.925, 121.975, 122.025, 122.125, 122.175, 122.225, 122.275, 122.325, 122.375, 122.425, 122.475, 122.525, 122.575, 122.625, 122.675,

Table Two: Federal Frequency Allocations: 34-35, 36-37, 38-39 MHz

34.000 Government Contractors
34.010 Coast Guard (Nationwide)
34.020 National Weather Service
34.025 Air Force, Army
34.030 Energy Department (Nationwide), Federal Reserve System (Nationwide)
34.050 Air Force, Coast Guard (Nationwide), Department of Education (Nationwide), Health and Human Services (Nationwide), Indion Health Service, Navy, Transportation Department, Treasury Department (Nationwide)
34.070 Coast Guard (Nationwide), Treasury Department (Deportment)
34.075 Army
34.090 Air Force, Army (Nationwide)
34.100 Air Force, Army (Nationwide), Government Contractors, Navy
34.110 Air Force, Army (Nationwide)
34.125 Air Force (SE United States Air-to-Air), Army
34.140 Army, Energy Department
34.150 Air Force, Army, Navy
34.170 Air Force (Nationwide)
34.175 Air Force (SE United States Air-to-Air), Army
34.190 Air Force (Nationwide)
34.200 Air Force, Navy
34.210 Air Force (Nationwide)
34.225 Army
34.230 Agriculture Department (Natianwide), Forest Service (Region 6), U.S. Fish and Wildlife Service (Region 3)
34.250 Agriculture Department (Nationwide), Air Force, Army, Navy, U.S. Fish and Wildlife Service
34.270 Agriculture Department (Nationwide), Forest Service (Region 6)
34.275 Army
34.290 Army (Nationwide)
34.300 Army (Nationwide, Navy
34.310 Army (Nationwide)
34.325 Army
34.330 Army
34.350 Air Force, Army, Navy
34.370 Agriculture Department (Nationwide)
34.375 Army
34.390 Agriculture Department (Nationwide)
34.400 Air Force, Navy
34.410 Agriculture Department (Nationwide), Forest Service (Region 5), U.S. Fish and Wildlife Service (Region 6)
34.425 Army
34.430 Agriculture Department (Nationwide), U.S. Fish and Wildlife Service
34.450 Agriculture Department (Nationwide), Army, Navy
34.470 Agriculture Deportment (Natianwide), Army
34.475 Army
34.490 Army (Nationwide)
34.500 Air Force, Army, Navy
34.525 Army
34.530 Navy
34.550 Air Force, Army, Navy
34.570 Air Force (Nationwide)
34.575 Air Force, Army
34.580 Air Force
34.590 Air Force (Nationwide)
34.600 Air Force (Nationwide), Navy
34.610 Air Force (Nationwide)
34.625 Air Force
34.630 Agriculture Department (Nationwide), Animal and Plant Health Inspection Service (Nationwide)
34.650 Agriculture Department (Nationwide), Army, Navy
34.670 Agriculture Department (Natianwide), Animal and Plant Health Inspection Service (Nationwide), Veterans Administration
34.675 Army
34.690 Army (Nationwide)
34.700 Air Force, Army (Nationwide), Navy
34.710 Army (Nationwide)
34.725 Army
34.730 Navy
34.750 Air Force, Army, Navy
34.770 Interior Department (Nationwide)
34.775 Army
34.780 Bureau of Indian Affairs, Bureau of Reclamation
34.790 Air Force, Interior Department (Nationwide)
34.810 Interior Department (Nationwide), U.S. Fish and Wildlife Service (Natianwide)
34.825 Army
34.830 Energy Department (Nationwide), Interior Department (Natianwide), U.S. Fish and Wildlife Service (Nationwide)
34.850 Army, Interior Department (Nationwide), Navy, U.S. Fish and Wildlife (Region 4)
34.860 Mine Safety and Health Administration
34.870 Interior Department (Notionwide)
34.875 Army
34.890 Army (Nationwide)
34.900 Army (Nationwide-Civil Emergency), Navy
34.910 Army (Nationwide)
34.925 Army
34.930 Navy
34.950 Air Force, Navy
34.980 Energy Department (Nationwide), National Ocean Service (Coastal Areas)
36.000 Air Force
36.010 Interior Department (Notionwide)
36.020 Energy Department (Nationwide), Interior Department (Nationwide)
36.050 Air Force, Army, DEA (Nationwide), Energy Department, Navy
36.070 FBI (Nationwide), Immigration and Naturalization Service (Nationwide)
36.090 Army (Nationwide)
36.100 Army (Nationwide), Navy
36.110 Army (Nationwide)
36.130 Navy (Nationwide)
36.150 Air Force, Navy
36.160 Veteran's Administration
36.170 Bureau of Mines, Interior Department (Natianwide)
36.180 Bureau of Indian Affairs, Indian Health Service, U.S. Fish and Wildlife Service
36.190 Interior Department (Nationwide), National Ocean Service (Coastal Areas)
36.200 Air Force, Navy
36.210 WHCA (Natianwide), Secret Service (Nationwide)
36.220 National Institutes of Health, National Ocean Services (Coastal Areas)
36.230 Interior Department (Natianwide)
36.250 Air Force, Army, Coast Guard (Nationwide), Education Department (Nationwide), Health and Human Services (Nationwide), Interior Department (Nationwide), Navy, Oil Spill and Containment (Nationwide-paired with 41.710), Transportation Department
36.270 Coast Guard (Nationwide), Education Department (Nationwide), Health and Human Services (Nationwide), Interior Department (Nationwide)
36.280 Air Force
36.290 Army (Nationwide)
36.300 Army (Nationwide), Navy
36.310 Army (Nationwide)
36.330 Energy Department (Nationwide)
36.350 Air Force, Army, Coast Guard (Nationwide), National Institutes of Health, Navy
36.370 Agriculture Department (Nationwide), Forest Service
36.390 Energy Department (Nationwide)
36.400 Navy
36.410 Agriculture Department (Nationwide), Forest Service
36.430 Agriculture Department (Nationwide), Forest Service
36.450 Agriculture Department (Nationwide), Air Force, Army, Forest Service, Navy
36.470 Agriculture Department (Natianwide), Forest Service
36.490 Air Force, Army
36.500 Air Force, Army (Nationwide), Navy
36.510 Air Force, Army (Nationwide)
36.530 Army, Navy
36.550 Air Force, Army, Navy
36.570 Navy
36.580 Navy
36.590 Navy (Nationwide)
36.600 Air Force, Navy
36.610 Agriculture Department (Nationwide), Forest Service
36.630 Agriculture Department (Nationwide), Army, Forest Service, Navy
36.650 Agriculture Department (Nationwide), Army, Forest Service, Navy
36.670 Agriculture Department (Nationwide), Forest Service
36.690 Army (Nationwide)
36.700 Air Force, Army (Nationwide), Navy, Veterans Administration
36.710 Army (Nationwide)
36.730 Agriculture Department (Nationwide), Forest Service
36.750 Agriculture Department (Nationwide), Agricultural Research Service, Air Force, Army, Forest Service, National Institutes of Health, Navy
36.770 Agriculture Department (Nationwide), Forest Service
36.775 Air Force
36.790 Air Force (Notionwide), Army
36.800 Air Force, Army, Navy
36.810 Air Force (Nationwide)
36.825 Air Force (Nationwide)
36.830 Air Force (Nationwide)
36.850 Air Force, Army, Navy
36.870 Navy
36.890 Army (Notionwide)
36.900 Army (Notionwide)
36.910 Army (Nationwide)
36.930 Agriculture Department (Nationwide), Army, Forest Service
36.950 Agriculture Department (Nationwide), Air Force, Army, Forest Service, Navy
36.970 Agriculture Department (Nationwide), Forest Service
36.990 Agriculture Department (Nationwide), Energy Department (Nationwide), Forest Service
38.000 Air Force
38.025 Air Force
38.100 Army, Navy
38.220 National Ocean Service (Nationwide)
38.250 Navy
38.270 Coast Guard (Nationwide)
38.300 Air Force, Army, Navy
38.310 Navy
38.330 Energy Department (Nationwide), Forest Service, Postal Service
38.350 Agriculture Department (Nationwide), Agriculture Research Service, Forest Service, Navy, Soil Conservation Service
38.370 Agriculture Department (Nationwide), Forest Service
38.390 Agriculture Department (Nationwide), Forest Service
38.400 Army, Navy
38.410 Agriculture Department (Nationwide), Forest Service
38.430 Agriculture Department (Nationwide), Forest Service
38.450 Army (Nationwide), Navy
38.460 Navy
38.470 Army
38.490 Army (Nationwide)
38.500 Air Force, Army (Nationwide), Navy
38.510 Army (Nationwide)
38.530 Army (Nationwide)
38.540 Forest Service
38.550 Agriculture Department (Nationwide), Animal and Plant Heath Service, Army, Forest Service, Navy
38.570 Agriculture Department (Nationwide), Forest Service
38.590 Agriculture Department (Nationwide), Forest Service, Soil Conservation Service
38.600 Navy
38.610 Immigration and Naturalization Service (Nationwide)
38.630 Immigration and Naturalization Service (Nationwide)
38.650 Air Force, Army, Navy
38.670 Air Force
38.675 Air Force (Nationwide)
38.690 Army (Nationwide), Corps of Engineers
38.700 Air Force, Army (Nationwide), Navy
38.710 Army (Nationwide)
38.730 Agriculture Department (Nationwide), Forest Service (Nationwide)
38.750 Agriculture Department (Nationwide), Army, Forest Service, Navy
38.770 Agriculture Department (Nationwide), Forest Service
38.790 Agriculture Department (Nationwide), Forest Service
38.800 Air Force, Army, Navy
38.810 Agriculture Department (Nationwide), Forest Service
38.830 National Institutes of Health
38.850 Agriculture Department (Nationwide), Air Force, Army, Forest Service, Navy, Soil Conservation Service
38.870 Agriculture Department (Nationwide), Forest Service
38.890 Army (Nationwide), Corps of Engineers
38.900 Army (Nationwide), Navy
38.910 Army (Nationwide), Corps of Engineers
38.950 Air Force, Army, Navy
38.970 Bureau of Indian Affairs, Interior Department (Nationwide), TVA
38.980 Bureau of Indian Affairs, TVA
38.990 Interior Department (Nationwide), TVA, Veterans Administration

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Figuring out a Fleet Map

One of the most common areas of confusion in trunked radio scanning is the fleet map. This month we'll take a detailed look at why a fleet map is needed, how they are put together, and a step-by-step plan to figure them out.

There are currently three primary vendors of trunked radio systems of interest to scanner listeners. Motorola is the most popular, followed by GE/Ericsson and E.F. Johnson. GE/Ericsson markets EDACS (Enhanced Digital Access Communications System) and E.F. Johnson sells LTR (Logical Trunked Radio). Each of these systems has been discussed in previous *Tracking the Trunks* columns.

There are two generations of Motorola trunking systems in operation, Type I and Type II. The more recent Type II systems use a relatively simple method for identifying radios that does not require a fleet map. Fleet maps are only necessary for Motorola Type I systems.

❖ Transmitting information bits

Mobile radios communicate with fixed repeaters by transmitting to the repeater and listening for signals from the repeater. The inbound direction is transmissions from the mobile to the repeater. The outbound direction is transmissions from the repeater to the mobile.

Mobile radios and repeaters exchange information by modulating a radio frequency carrier. The transmitter varies the carrier according to the data to be sent, and the receiver attempts to identify those variations. Because receivers in a typical system are only capable of identifying two different carrier states, the transmitter must deliver information that has been broken down into the smallest size possible.

The smallest unit of information is a *binary digit*, or *bit*. A bit has only two possible values – either 0 or 1. Put simply, when the transmitter wants to send a 0 it modulates the carrier one way and modulates it the other way to deliver a 1. The receiver identifies the way the carrier is modulated and reproduces the 0 or the 1, as appropriate.

A bit all by itself doesn't carry much information, so bits are usually strung together to form *words*. The number of possible values a word can have depends on how many bits are in it. A word that has one bit only has two possible values, 0 or 1. A word with two bits has four different possible values, namely 00, 01, 10, or 11. A word with three bits has eight possible values, and so on. See the pattern? Each additional bit doubles the number of possible values. This will become important when we start talking about the capacities of various fleet maps, so bear with me.

Number of Bits	Possible Values
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256

❖ Outbound Status Word

Because radio signals from mobile units are relatively weak and signals from repeaters are relatively strong, scanner users listen to outbound messages from the repeater to the mobile.

Motorola repeaters continuously transmit data on the *control channel*. These data are made up of blocks of information called *outbound status words*.

The simplest outbound status word (OSW) is made up of 27 information bits divided into three groups. The first 16 bits are used to carry an identification code. The 17th bit is used to signal whether the first sixteen bits refer to a single radio or a group of radios. The remaining 10 bits are the instruction or message the repeater is trying to deliver.

Motorola Type I systems divide up their mobile radios into fleets, subfleets, and individual identities. Since there are a total of 16 identification bits available for use, they must somehow be shared between a fleet identifier, a subfleet identifier, and an individual identifier.

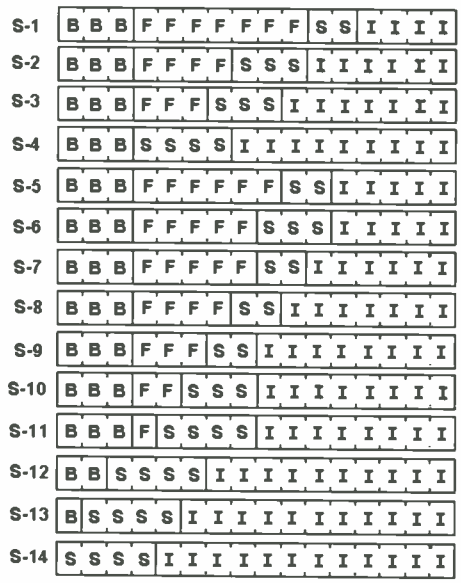
A fleet map is used to figure out how to divide the 16 bits of identification into fleets, subfleets, and individual IDs.

❖ Blocks

Most fleet maps are represented as eight blocks, numbered 0 through 7. Each block is assigned a size code that determines how the identification bits are used within that block. For instance, size code S-5 has 64 fleets, 4 subfleets, and 32 individual IDs. 6 bits are required to represent 64 possible fleets, 2 bits are required to represent 4 possible subfleets, and 5 bits are needed to represent 32 possible individual IDs. This size code uses a total of 13 bits for fleet, subfleet, and individual. The remaining three bits identify the particular block in which this size code resides.

Size codes S-12, S-13, and S-14 are unusual in that they consume more than one block. One or more of the bits usually used to specify the particular block are instead used to increase the number of possible individual IDs.

MOTOROLA TYPE I SIZE CODES



B = BLOCK
F = FLEET
S = SUBFLEET
I = ID

Size codes and their corresponding capacities.

Size Code	Fleets	Bits for Fleet	Subfleets	Bits for Subfleets	IDs	Bits for IDs
S-0	Reserved for Type II IDs					
S-1	128	7	4	2	16	4
S-2	16	4	8	3	64	6
S-3	8	3	8	3	128	7
S-4	1	0	16	4	512	9
S-5	64	6	4	2	32	5
S-6	32	5	8	3	32	5
S-7	32	5	4	2	64	6
S-8	16	4	4	2	128	7
S-9	8	3	4	2	256	8
S-10	4	2	8	3	256	8
S-11	2	1	16	4	256	8
S-12	1	0	16	4	1024	10 (2 blocks)
S-13	1	0	16	4	2048	11 (4 blocks)
S-14	1	0	16	4	4096	12 (8 blocks)

❖ Hybrid Systems

Each block in a fleet map is assigned a size code. S-0 is a special code to designate the block will use Type II talkgroups. It is possible have some blocks designated as Type I and others as Type II. These mixed systems are called *hybrids*, and are usually found in cities that are slowly migrating to new equipment and have a mixture of old and new radios.

Note that Type I and Type II talkgroups will not appear together in the same block.

❖ Determining Fleet Maps

To scan Type I or Hybrid systems, you must program each of the eight blocks with the correct size code. If you pick the right size codes for all eight blocks you will have the complete fleet map and be able to listen to all of the fleet and subfleet combinations used by the system.

Here are some steps you can take to work out fleet maps. I've included some specific instructions for two popular scanners, the Uniden Bearcat BC245XLT Trunk Tracker II and the Radio Shack PRO-92 500-channel Portable Trunking Scanner.

1. *Be sure all of the radio frequencies for the trunked system are programmed into the scanner.*

Some scanners require that all the frequencies for a particular system be in the same bank of memory. The order of the frequencies is not important for Motorola systems.

2. *Be sure all talkgroups are unlocked.*

On the Bearcat 245XLT this is done by pressing and holding the L/O button until you hear two short beeps, then pressing E. (Page 45 in the *Operating Guide*).

On the PRO-92 this is done by pressing PGM, then TRUNK, selecting a bank with FUNC or the up/down arrows, then pressing FUNC and 3, then pressing 1. (Page 63 in the *Owner's Manual*).

3. *Start by using size code S-0 for each of the eight blocks.*

This will allow you to see the full talkgroup ID on the scanner display. Trunk tracking scanners are usually set to scan Type II talkgroups by default. Type II user IDs appear as an even number without a dash (for example, 1440). Type I IDs appear as a 3 or 4 digit number followed by a dash and a 1 or 2 digit number (for example, 160-12).

The BC245XLT defaults to S-0 (Type II), and PRO-92 users should follow the instructions beginning on page 58 of the *Owner's Manual*.

4. *Begin scanning the trunk frequencies and write down each of the different IDs that appear during a conversation.*

For the PRO-92 be sure to run in Open Mode (page 64 in the *Owner's Manual*) so that the scanner will stop on any talkgroup.

5. *Identify the block in which the talkgroup resides. You can determine which block an ID belongs to according to the following table:*

Block	Lowest ID	Highest ID
0	0	8191
1	8192	16383
2	16384	24575
3	24576	32767
4	32768	40959
5	40960	49151
6	49152	57343
7	57344	65535

For instance, a talkgroup of 32950 is part of block 4.

6. *For each of the eight blocks, determine whether it is a Type I or Type II.*

If the entire conversation from all parties occurs on the same talkgroup ID, then it's probably a Type II. If the talkgroup changes, or is occasionally an odd number, it's probably a Type I.

If the block is a Type II, leave it as size code S-0 and move on to another talkgroup in a different block.

If the block is a Type I, the next step is to figure out the correct size code.

7. *Keep track of a conversation and write down all the talkgroup IDs that appear.*

A conversation should only occur between members of the same fleet and subfleet, so the only thing changing is the individual ID. When you've gathered a number of IDs, subtract the lowest numbered ID from the highest numbered ID to get the *minimum* number of IDs that are part of a talkgroup. Use that number in the following table to figure out the possible size codes. Size codes ordered according to maximum number of IDs.

Size Code	IDs	Bits for IDs
S-1	16	4
S-5	32	5
S-6	32	5
S-2	64	6
S-7	64	6
S-3	128	7
S-8	128	7
S-9	256	8
S-10	256	8
S-11	256	8
S-4	512	9
S-12	1024	10 (2 blocks)
S-13	2048	11 (4 blocks)
S-14	4096	12 (8 blocks)

For example, if the highest ID is 42151 and the lowest is 42052, the block must support at least 99 individual IDs. Checking the table, size codes S-1, S-5, S-6, S-2, and S-7 are ruled out since they each support fewer than 99 individual IDs.

As a shortcut, the most common number of individual IDs in a fleet/subfleet is either 128, 256, or 512. These correspond to size codes S-3, S-8, S-9, S-10, S-11, and S-4. Note that S-3 and S-8 both allow up to 128 IDs, and S-8, S-9, and S-10 all allow up to 256 IDs.

8. *Set the proper block to the size code that supports at least the number of individual IDs determined in step 7.*

In our example with IDs between 42151 and 42052, we'd set block 5 to size code S-3. For the BC245XLT, set the size code by following the instructions on pages 58 and 59 of the *Operating Guide*. For the PRO-92, press PGM, then TRUNK, select a bank with FUNC or the up/down arrows, then press FUNC and 8, then follow the directions on the display (pages 58 and following in the *Owner's Manual*).

9. *Continue to monitor the talkgroup over time.*

If you receive complete conversations, the size code is probably correct. If you occasionally miss part of a conversation, you will probably need to try another size code with the same number of individual IDs (use S-8 instead of S-3, for example) or move to the next higher size code.

❖ Check the Internet

Of course, the easiest way to determine the proper fleet map is to find someone who has already done this work, or who has received the information from a helpful contact at the agency using the system. A number of Internet web sites have such listings of Type I fleet maps, including Uniden's compilation at **www.trunktracker.com**.

More trunking information is available on my website at **www.signalharbor.com**, as well as other radio-related information at **www.decodesystems.com**. E-mail from readers is always welcome at *dan@signalharbor.com* or *dan@decodesystems.com*. Until next month, happy monitoring!

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National Civilian Aeronautical Band Assignments

108.000-117.950	VHF omni-range
108.100-111.950	ILS localizers
118.000-121.400	Air traffic control (towers/centers)
121.500	Civilian aircraft emergency
121.600-121.925	Ground control (25 kHz spacing)
121.600	Civil Air Patrol Nationwide (Practice Distress Beacons)
121.775	Civil Air Patrol Nationwide (Practice Distress Beacons)
121.950	Flight schools
121.975	Flight service stations (private aircraft)
122.000	Flight service stations (national flight watch-private aircraft)
122.025	Flight service stations (private aircraft)
122.050	Flight service stations (aircraft transmit)
122.075	Flight service stations (private aircraft)
122.100-122.675	Flight service stations (private aircraft transmit)
122.700	Unicom (uncontrolled airports)
122.725	Unicom (uncontrolled airports-private aircraft only)
122.750	Unicom (private air-to-air fixed wing)
122.775	Various air show flying acts nationwide/Flight International air-to-air/Nicorette-Nicoderm CQ Skytypers Skytyping Act/Patty Wagstoff aerial demonstrations
122.800	Unicom (uncontrolled airports)
122.825	ARINC/Airline company frequency (aero enroute)
122.850	Multicom/NOAA severe storms study aircraft/U.S. Forest Service helicopter operations
122.875	ARINC/Airline company frequency (aero enroute)
122.900	Multicom/U.S. Coast Guard search and rescue/U.S. Forestry Service fire cache air operations/Numerous government agencies and military services/Canadian Skyhawk JumpTeam
122.925	Multicom (plane-to-plane)/NOAA severe storms study aircraft/NASA research aircraft/National Park Service aircraft/Numerous government agencies and military services/California Department of Forestry statewide/Various air show flying acts nationwide/Diamonds T-6s flight demonstration team/BudLite Microjet/US Navy F-14 air show demonstration
122.950	Unicom (controlled airports)/USAF Viper F-16 West Demo Teams
122.975	Unicom (high altitude)/U.S. Forest Service air operations
123.000	Unicom (uncontrolled airports)
123.025	Unicom (helicopters/air-to-air)/U.S. Forestry Service helicopter (helispot) operations/California Department of Forestry statewide/Media traffic helicopters
123.050	Unicom (heliports)/NOAA severe storms study aircraft/U.S. Forestry Service helicopter (helispot) operations/Media traffic helicopters
123.075	Unicom (heliports)/U.S. Forestry Service helicopter (helispot) operations/Media traffic helicopters
123.100	U.S. Coast Guard/Civil Air Patrol search and rescue
123.125	U.S. Air Force NAVAID flight check/NASA T-38 Interplane Nationwide
123.125-123.475	Flight Test (Itinerant: 123.125/.150/.175/.400)
123.150	Air show common frequency/Lima Lima flight demonstration squadron
123.200	Flight schools/Flight Manufacturers
123.300	Flight schools/balloons
123.325	Northern Lights air show performers nationwide
123.350	NASA ER-2 aircraft nationwide
123.400	Flight schools/Mohr-Simonson helicopter flight demo team
123.425	Don Johnson-Star Aerobatics-Toyota Airsports flight demonstration teams
123.450	Multicom (air-to-air informal)/USAF Viper F-16 West demonstration teom
123.475	US Army Golden Knights air-to-ground nationwide primary
123.500	Flight schools/balloons/US Army Golden Knights air-to-ground nationwide secondary
123.525-123.575	Flight Test (Itinerant: 123.575)
123.550	Canadian Military Dewline ATC frequency nationwide
123.600-128.800	Air traffic control (towers/centers)
126.200	U.S. military control towers/ground controls
128.525	Florida Forestry statewide tanker/spotting aircraft
128.625	NASA/NOAA research frequency
128.825-132.000	ARINC/Airlines company frequencies
129.525	USAF 89 AW (Andrews AFB) SAM VIP mission aircraft interplane
130.500	Aguila Flight Demonstration Team (Europe only)
130.650	USAF Air Mobility Command (AMC) command post/contract airlines nationwide
132.025-135.975	Air traffic control (towers/centers)
134.100	Military airports (ground controlled approach radar)
135.850	Federal Aviation Administration/U.S. Air Force/U.S. Army NAVAID flight inspection
135.950	Federal Aviation Administration/U.S. Army NAVAID flight inspection
135.975	U.S. Forestry Service air-to-ground (wildfires)
136.000-136.075	Air traffic control operations
136.100	Reserved for future unicom or automotic weather observation stations
136.125-136.175	Air traffic control operations
136.175	Halcones (Chile) Flight Demonstration Team
136.200	Reserved for future unicom or automatic weather observation stations
136.225-136.250	Air traffic control operations
136.275	Reserved for future unicom or automatic weather observation stations
136.300-136.350	Air traffic control operations
136.375	Reserved for future unicom or automatic weather observation stations
136.400-136.450	Air traffic control operations
136.475	Reserved for future unicom or automatic weather observation stations
136.500-136.875	Aeronautical enroute (domestic VHF)
136.725	USAF 89 AW (Andrews AFB) SAM VIP mission aircraft interplane
136.900-136.975	Aeronautical enroute (domestic/international VHF)
136.975	Blue Eagles Flight Demonstration Team/Northern Lights AirShow Demo Team

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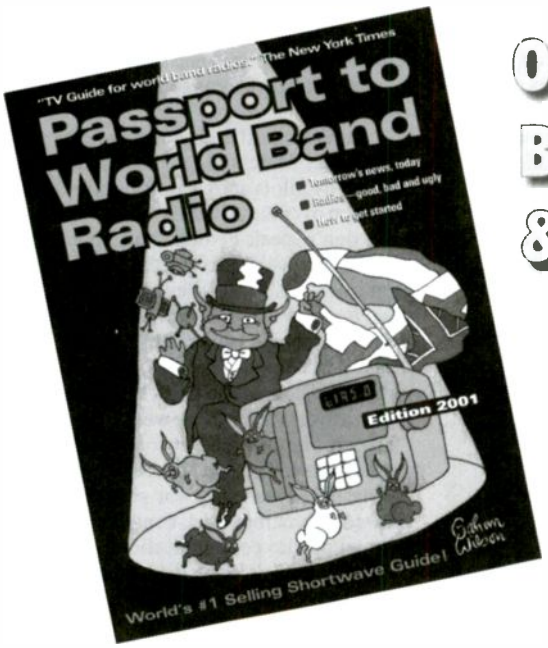

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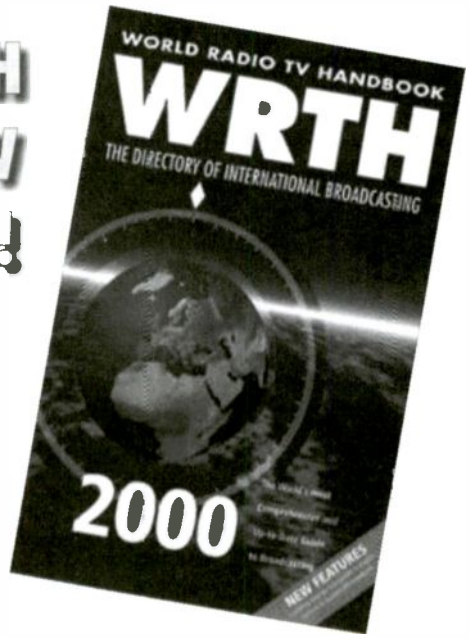

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Dallas Ft. Worth Traffic Control

Welcome aboard and fasten your seatbelts! Today we're off to visit the tower and traffic control (TRACON) at the magnificent DFW (Dallas-Fort Worth) airport. Thanks to Chuck Hudlow, Operations Manager at the DFW TRACON and DFW website Webmaster, for contributing the frequencies and this month's cover photo, and for giving us permission to utilize this material. Visit their website at **http://members.home.com/chuckhud** for a map.

❖ The Facilities:

Air traffic control operations for the Dallas-Fort Worth terminal area take place within the facilities located on the Dallas-Fort Worth International Airport. These facilities include the Terminal Radar Approach Control (TRACON), or D-10 as it is designated by the FAA, and the three (!) control towers, designated DFW by the FAA. Administrative offices are co-located in these buildings. In support of these control facilities are several Airway Facilities' equipment buildings, offices, and work areas.

On July 27, 1996, DFW TRACON moved into a new three story building that was constructed immediately south of its old location. The room available in the new operations area is more than double that of the old TRACON room. In addition to approach control operations (*of course, this includes departure ops as well, jb*), training facilities, some administrative offices, equipment rooms, and technical support offices are located in this new building. Renovation of the old TRACON building has been completed and Air Traffic Administrative offices moved into this building on May 10, 1999. The Airway Facilities support group moved into the building several weeks earlier. Besides this offices, larger locker rooms and eating areas are available in this building as well as meeting rooms.

Chuck Hudlow

Harry Baughn

Three air traffic control towers enable controllers to see all areas of the airport. The Center Tower, The "East" Tower, and the "West" tower are located on the airport as their names imply. The **Center Tower** is used only during late night (midnight shift) operations at this time.

The East Tower: Controllers in this tower work all operations, landings, and departures, which occur on the east side of the airport. The dividing line is the International Parkway, a multi-lane roadway that transects the airport north and south. At the base of this tower, the tower controllers' NATCA (National Air Traffic Controllers Association) office and other support offices and workshops are located.

The West Tower: Controllers in this tower work all operations, landings, and departures, which occur on the west side of the airport. Tower management and radar technician offices, along with training rooms, are located at the base of this building, along with other support workshops.

As mentioned above, the new TRACON facility consists of a three-story structure which houses all of the electronics (communications), ARTS computers, and technical workshops), the radar room, and all administrative offices. Connected to this building is the Environmental Support Unit (ESU) building. This structure houses three diesel generators of which any one could support the electrical requirements of the entire facility. The heating and cooling requirements for the facilities are controlled from this building. Finally, south of the ESU building is a multi-floor parking garage.

Thanks, Chuck, for this tour of DFW.

❖ France's Friendly Skies ?

Bob Bell, our Australian Correspondent, contributed the following news clipping: Air France pilots on final approach to Paris' Charles de Gaulle airport will have to speak English from now on. France's national airline said the decision to order its pilots to speak English in all radio communication with air traffic control is designed to improve safety (*English is the international language of aviation, allegedly, jb*). But French enthusiasts are outraged and say it's another example of the English language's creeping worldwide dominance.

Air France officials, defending the policy that took effect March 23, contend that the language spoken by pilots and air traffic controllers is not a question of culture. "Often, other pilots in the area who don't speak French can't understand when the (Air France) pilots and the control tower communicate," said Jean-Claude Couturier, a spokesman for Air France. "We wanted to do this before something tragic happened."

But Marceau Dechamps, vice president of the group Defense of the French Language, said the prohibition of French was "inconceivable." "French pilots should absolutely be allowed to speak French," he said. The argument that the new ruling improves safety for surrounding pilots is flawed, Dechamps said, contending that the new ruling impedes communication.

"If you don't know the language of the country, it's good to speak in English, but to tell French people not to speak French is foolish," Dechamps said.

Last week, Quebec's minister responsible for the French language Charter, Louise Beaudoin, lambasted the decision as "scandalous," "the imperialism of English must have some limits," said Beaudoin on a visit to Paris.

The French government is reserving judgment on Air France's decision until it can study the decision's impact on safety. French Foreign Ministry deputy spokesman Francois Rivasseau said, "Until now it hasn't been an issue ... There are certain advantages to speaking one's mother tongue in exchanges with air control."

Thanks, Bob! Well, folks, what do YOU think, based on your monitoring of international flights? Do you think that English should be used by *all* pilots at de Gaulle? Let's hear from you!

❖ The State of Aviation in Australia

Another contribution via Bob Bob comes from the *Sydney Morning Herald*: QANTAS has confirmed yet another safety scare, this time on a flight between Cairns and Sydney. Pilots cut power from one of two engines on flight QF 567 on Monday (April 24) after losing oil pressure about 10,000 metres above Brisbane, QANTAS said.

Earlier, the same flight made *two* unsuccessful attempts to take off from Cairns airport. This was caused by "a broken wire" a QANTAS spokeswoman said.

Dallas-Ft.Worth Tower/TRACON Frequencies

Position	Frequency	Type Position
Meacham North	118.100	West-Side Low Altitude (North)
Arrival 3	118.425	Final Controller
Departure 1	118.550	Departure Control
FDEP2	118.850	Flight Data (TRACON)
Feeder East	119.050	East Side Feeder
Arrival 1	119.400	Arrival Controller
CDE	119.450	Clearance Delivery (East Tower)
Feeder West 1	119.875	West Side Feeder
Flight Data Center	120.650	Center Tower Flight Data
FDEP2	121.350	Flight Data (TRACON) McKinney (Airport Remote Freq)
GE1	121.650	Ground Control One (East Tower)
GE2	121.800	Ground Control Two (East Tower)
GW1	121.850	Ground Control One (West Tower)
ATIS	123.775	Arrival ATIS (Towers)
FEL	123.900	Feeder East Low
FDEP2	123.950	Flight Data (TRACON) Denton (Airport Remote Freq)
LCW	124.150	Local Control West (West Tower)
Departure 3	124.250	Departure Control
Dallas North	124.300	East-Side Low altitude (North)
Arrival 3	124.500	Arrival Controller
Departure 4	124.825	Departure Control
Feeder East 1	125.025	East Side Feeder
Departure 2	125.125	Departure Control
Dallas South	125.200	East-Side Low Altitude (South)
Dallas East	125.275	East-Side Feeder (Low Altitude)
Feeder West	125.800	West Side Feeder
FDEP2	125.900	Flight Data (TRACON) Hicks Airport (Remote Freq)
Dallas South High	125.950	East-Side Feeder (Low Altitude)
Departure 3	126.475	Departure Control (Spare)
LC	126.550	Local Control East (East Tower)
Arrival 2	127.075	Final Controller
LE13/31	127.500	Local Control Runway 13/31 (East Tower)
Arrival 4	127.750	Arrival Controller DFW Runway 13R (Spare)
LCW2	128.150	Local Control West (West Tower) (Spare)
Clearance Delivery C	128.250	Clearance Delivery (Center Tower)
GW2	132.500	Ground Control Two (West Tower)
Arrival 4	133.150	Arrival Control DFW Runway 13R
Feeder East 2	133.525	East Side Feeder
Feeder West 2	133.625	West Side Feeder
Clearance Delivery W	134.600	Clearance Delivery (West Tower)
LCW	134.900	Local Control West DFW Runway 13R/31L
Arrival 6	135.000	Arrival Controller
GCE2	135.700	Ground Control East 2
ATIS	135.925	Departure ATIS (DFW)
Meacham South High	135.975	West -Side Feeder (Low Altitude)

About 200 people heading to Sydney were on board the flight and QANTAS said it was treating the incidents seriously (*I certainly hope so! jb*). The news came as the airline admitted that cabin crew may have acted too aggressively during the Seekend emergency in Rome – when landing gear collapsed – and owed passengers an apology.

The executive general manager of operations, Mr. David Forsythe, defended the actions of the crew aboard QF16 from Rome, but confirmed the company was investigating two incidents in which a male and female member of the crew became "assertive" with passengers. Some passengers complained that one crew member "lost it" while another allegedly told passengers: "For Christ's sake, would everybody get moving." (*I'd WANT the cabin crew to be assertive, if MY life was at stake in a situation like that! jb*).

The Cairns and Rome incidents follow an accident in Bangkok last year when an airliner overshot the runway, resulting in a $100 million repair bill, and the recall on April 9 of a flight from Sydney to Manila when the plane developed fuel valve problems.

The incident has been reported to the Australian Transport Safety Bureau, which will make further inquiries. QANTAS technicians yesterday replaced the 767-200 engine while investigators examined the oil pressure problem.

The *Herald* was told about the Cairns-Sydney flight by a QANTAS staffer who detailed other incidents that have occurred during the past 12 months. The staffer, who refused to be named, said QANTAS was making its employees work too hard, which risked safety standards. "It's the pressure. Everyone's being pushed to the limit all the time. Since Bangkok, we've been asked to do things we just haven't got time to do. It's just to cover their backs," he said.

The company spokeswoman rejected attacks on the company's safety standards and said its program was sound and well within acceptable limits. Referring to the Cairns incident, she said: "We treat anything like this very seriously." While not seeking to play down the incident she said similar problems happened regularly among all international airlines and were an unavoidable part of a managed safety and repair program.

A spokesman for the Australian Transport Safety Bureau said the case would have to be examined on its merits, but added that 767-200s were certified to fly on one engine and were even able to glide with auxiliary power. "These are extremely well engineered aircraft," he said.

Mark Hanrahan

The Victorian secretary of the Australian Manufacturing Workers Union, Mr.Julius Roe, said the latest incident highlighted the need for a moratorium on the contracting out of QANTAS maintenance services and on the increasing intensity of airline work. Mr. Roe called on the Government to intervene and investigate standards at the national carrier: "This is not just a matter for QANTAS. Where's the government? Where's the regulator? Why aren't they supporting our calls to halt the contracting out of vital maintenance services?"

Until next month, 73 and out!

Doug Smith, W9WI
w9wi@bellsouth.net

That Spotted Ole Sun

Shortwave listeners and hams have been waiting for years for the return of the sunspots. Every 11 years, the blemishes return to the sun's face, and shortwave conditions improve markedly. The return of the sunspots has a different effect on the AM broadcast DXer. Knowing what the sun's doing can improve your results considerably.

Sunspot activity has been correlated with ultraviolet and X-ray radiation. This radiation, in turn, affects the ionization of the Earth's upper atmosphere, which in turn reflects and absorbs radio signals. Also correlated with sunspot activity are emissions of radio noise. A more intensely ionized atmosphere helps the shortwave DXer; it makes the reflecting F layer more effective and allows long-distance reception at higher frequencies.

This more intense ionization isn't quite so valuable for the AM DXer. The F layer is virtually always effective at the low frequencies used for AM broadcasts; extra solar radiation is not necessary to allow long-distance AM reception. Unfortunately, this radiation also enhances the D layer. This layer absorbs radio signals passing through it, especially low-frequency signals. It's the reason why DX is worse during the day, and the sunspots only enhance its DX-killing abilities. In general, AM DX is better during sunspot minima, which means AM conditions should improve over the next five years as the cycle passes its peak and begins declining.

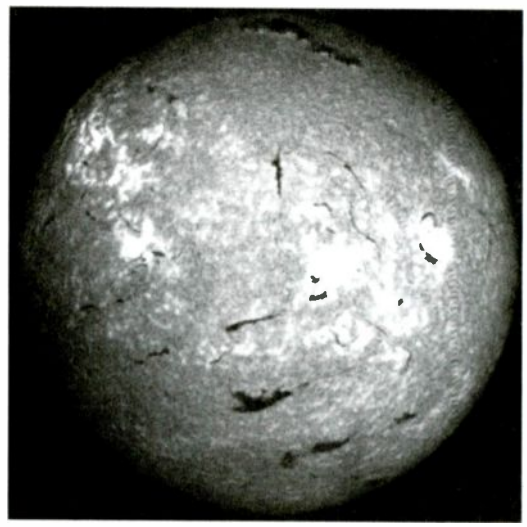
Variations in solar radiation aren't smooth. The sunspot numbers don't just gradually increase and then drop again. There are changes from day to day, and even from hour to hour. There are also occasional "storms," where bursts of intense radiation cause large changes in the atmosphere with little warning. (These bursts can even damage satellites and put astronauts at risk.)

⁘ Checking the weather

It's not enough to say that AM propagation conditions are relatively poor but will improve over the next five years. There will be major changes from day to day. By keeping track of these changes, you can know when AM reception is likely to be best.

One of the first radio stations most shortwave listeners find is the U.S. Government's WWV in Colorado. WWV is best known as a time-signal station. But, it broadcasts other information of value to the radio listener. At 18 minutes after the hour, a solar activity broadcast is made. The announcement includes the solar flux, the A and K indices, the solar-terrestrial conditions for the last 24 hours, and the predicted conditions for the next 24 hours. If you've got a shortwave receiver, tune to 2.5, 5, 10, 15, or 20 MHz for these broadcasts.

You don't have to wait for 18 after the hour to hear the information, though. You can call WWV at (303) 497-3235 to get a recorded forecast. This is a long-distance call to Fort Collins, Colorado. You can also find the information on the Internet at **http://oh2aq.kolumbus.com/dxs** (Yes, that's Kolumbus with a K. The site is in Finland.) The WWV information appears in the bottom window.



The white splotches on this picture are sunspots. They're good news for SWLs, not so good for AM DXers.

Shortwave listeners pay most attention to the solar flux. As an AM DXer, you're more interested in the A and K indices. These indices predict the amount of absorption. When the numbers increase, long-distance AM signals are weaker and more likely to disappear under noise and interference from closer stations. The K index is measured every three hours, while the A index is averaged over 24 hours. When both these indices are low – say, below 3 – conditions are best. If you see both indices at 1, be sure to schedule some time for DXing! (It was on just such a night I got my only two European AM loggings...)

The condition forecasts are also valuable for the AM DXer. Solar activity levels can range from "Very Low" to "Very High," and geomagnetic activity from "Quiet" to "Severe Storm." Low and quiet activity are best for long-distance propagation.

Higher solar fluxes allow shortwave signals at higher frequencies to be propagated over long distances. On the very best days, the maximum usable frequency can exceed 50 MHz, and international TV DX becomes possible. If you've got a scanner, you might try listening to 48.25 MHz for Western European TV carriers. 49.25 MHz is used in Eastern Europe. Unfortunately, these are the picture carriers, so all you'll hear is a buzz. (If you have a channel 2 TV station in your area, tune to 55.25 MHz to hear what a picture carrier sounds like.) Under *extremely* intense conditions, European TV sound might be received at several frequencies. Try 53.75, 54.25, and 54.75 MHz. If you have access to a multi-system TV set, you might even be able to see a picture from a foreign station. Unfortunately, multipath ("ghosting") is severe in international reception. Add in interference from other stations on the same channel, and it's unlikely you'll recognize much. Still, it's a blast just knowing you've been able to receive TV signals from overseas!

⁘ Bits and Pieces

At this time, there has not been any additional action on the law that would severely restrict the new LPFM service. If you're interested in starting one of these stations, the FCC now has a "channel finder" on their web site. Visit **www.fcc.gov/mmb/asd/lpfm/lpfm_channel_finder.html** and provide the geographical coordinates of your location. Act quickly, though; LPFM filing windows have already opened (and closed) for some states.

It's summer – traditional slack time for AM DX. But it's also traditional time for traveling. Why not take your radio along and see what you can hear in an unfamiliar part of the country? Please let the rest of us know what's going on at your favorite vacation spot. Write: Box 98, Brasstown NC 28902-0098, or by email to *w9wi@bellsouth.net*. Good DX!

OUTER LIMITS

THE CLANDESTINE, THE UNUSUAL, THE UNLICENSED

George Zeller
georgez@nacs.net

Mobilization Radio Targets Washington

During this spring's protests of the International Monetary Fund meeting in Washington, DC, a temporary pirate took to the airwaves. The low powered **Mobilization Radio** signal blanketed the immediate area of central Washington on April 16 and 17. It broadcast news about demonstrations, including some coordination of protester movements. Like the pirate that operating during the World Trade Organization meetings in Seattle, this station reminds us that pirate DXing is a viable activity around large demonstrations.

It didn't take long for the FCC and the police to arrive. At first, the station was rescued from a closedown by hundreds of demonstrators who surrounded the pirate busters. The station later closed down voluntarily. Thanks go to Alan Henney for forwarding Joe Tuba's account of this interesting confrontation.

❖ Spectrum

The "Spectrum" radio program has targeted a talk show to DXers and amateur radio operators for several years. Sure, there are plenty of talk shows on the radio today. But, Spectrum is uniquely targeted to readers of this magazine. They by no means focus only on unlicensed broadcasting, although your columnist George Zeller was the guest for this purpose recently. They cover diverse radio topics of interest to radio hobbyists. If you haven't checked out Spectrum lately, you can hear them UTC Sundays at 0300 UTC on 5070 kHz via **WWCR.**

❖ Addresses Change

Two staple pirate information sources are using new contact addresses. *Free Radio Weekly*, the excellent internet pirate newsletter is using **yukon@ mdn.net** for inquiries. You can't beat the price: this timely resource is free to contributors! Meanwhile, the new ACE address that we announced in June has also been altered. The Association of Clandestine radio Enthusiasts can be reached via PO Box 1, Belfast, NY 14711. Samples are $2.00; tell them that *MT* sent you.

Still at their old address of PO Box 642, Mont Alta, PA 17237 is Andrew Yoder's *Hobby Broadcasting*, which will interest those who focus on the FM microcasting scene. This one costs money; check out **http://www.hobbybroadcasting.com** for their current rates.

If you're looking for Europirate addresses, Hans-Joachim Koch's web site is a good place to check. One link at the **http://members.aol.com/mwo210370/freeradio.html** URL is particularly useful.

What's on the Air

Why not tune your radio to 6955 kHz just before it gets dark? The pirates have been operating on or near this frequency as usual. Station programming formats and contact maildrops are shown for stations that were heard by *MT* readers this month:

Blind Faith Radio- Dr. Napalm remains the most prominent example of a classic rock format on shortwave. Compared to shortwave broadcasters, he may be the *only* example. (Merlin)

Cell Phone Radio- The cellular telephone lobby still preaches to Representative Tauzin, but they have been ineffective at silencing this pirate rebroadcast of actual telephone calls. (None)

Indira Calling- If you like a mix of East Indian standards and Beach Boys oldies, then this is the station for you. (Providence)

KIPM- Their rock is supplemented by eclectic drama, mystery music, and an occasional clandestine relay. (Lula)

KRMI- An example of their novelty music fare is Willie Nelson's "On the Road Again" tune with "Pick My Nose Again" lyrics. (None)

La Voz del Zapatistas- This quasi-Mexican clandestine is in Spanish, but if you speak the language, this political program is extremely well produced. (None)

Radio Free Speech- Bill O. Rights is back with yet another "last program" of comedy and freedom advocacy. (Used Belfast in the past)

Radio Garbanzo- When they construct the Pirate Radio Hall of Fame, Fearless Fred will be an automatic inductee for his raw comedy. (Belfast)

Radio USA- Mr. Blue Sky remains by far the longest running active pirate station, with two decades under his belt. He defines the pirate format, with punk rock and comedy. (Belfast)

Radio Toronto- As the name implies, this one supposedly transmits from a college in Toronto. Punk rock is creeping into their playlist. (Merlin)

Sycko Radio- What was thought to be Psycho Radio is actually this. They are now producing elaborate comedy, and they say that they may have an address soon. (None yet)

Tuna Radio- They have been testing so far, so it's hard to tell what programming direction they have planned. (None)

WHYP- If you hear somebody giving the weather report for eastern Lake Erie cities, it's certainly this James Brownyard memorial station in action. (Uses whyp1530@yahoo.com e-mail)

WMFQ- Nobody in shortwave radio promotes QSLs for listeners quite like this station does. (Providence)

WKND- Radio Animal's pirate advocacy is unusual, since he always broadcasts in AM, always using the "We're K-9 Dogs" slogan. (Blue Ridge Summit)

WRX- Jimmy the Weasel mixes caustic remarks about your mother with sarcasm about his listeners. This may sound like a format designed to chase away his audience, but his unusual shows are ear-catching. (Manomet)

❖ Reports and QSLs

Reception reports to pirate stations require three first class stamps for USA maildrops or $2 US to foreign addresses. Send your letters to PO Box 1, Belfast, NY 14711; PO Box 28413, Providence, RI 02908; PO Box 24, Lula, GA 30554; PO Box 109, Blue Ridge Summit, PA 17214; PO Box 1454, Manomet, ME 02345; and PO Box 293, Merlin, Ontario N0P 1W0.

❖ Thanks

Your input is always welcome via PO Box 98, Brasstown, NC 28902, or via my new e-mail address. This month's contributors include Alfred, Hoogeveen, Netherlands; John T. Arthur, Belfast, NY; Kirk Baxter, North Canton, OH; Jerry Coatsworth, Merlin, Ontario; Ross Comeau, Andover, MA; Charles Crawford, Henderson, KY; Mike Fanderys, Parma, OH; Harold Frodge, Midland, MI; Raul Gonzalez, Santiago, Chile; Paul Griffin, Berkeley, CA; Sheldon Harvey, Montreal, Quebec; Alan Henney, Washington, DC; Hans-Joachim Koch, Niddatal, Germany; Chris Lobdell, Stoneham, MA; Greg Majewski, Oakdale, CT; Bill McClintock, Minneapolis, MN; Mke Prindle, New Suffolk, NY; Chuck Rippel, Cornland, VA; Lee Silvi, Mentor, OH; and Niel Wolfish, Toronto, Ontario.

Kevin Carey, WB2QMY
lowband@gateway.net

Tuning in to NAVTEX

With the boating season in full swing, now is an excellent time to tune in to NAVTEX teleprinter transmissions at 518 kHz. NAVTEX is an internationally standardized method of sending bulletins to ships equipped with low cost digital receiving equipment. Although many small boaters use NAVTEX, it is *required equipment* for large vessels as part of the Safety of Life at Sea (SOLAS) convention, amended in 1988.

NAVTEX bulletins are primarily intended for waters 0–200 miles from shore and contain information about radionavigation status, search and rescue operations, weather forecasts, mine sweeping exercises, and other pertinent data. It can provide a nice change of pace from conventional beacon hunting.

❖ Equipment Required

NAVTEX bulletins can be read with rather simple equipment. The first consideration is the receiver itself. It's best if it has an RTTY mode to optimize the bandwidth for NAVTEX tones. However, any stable receiver with an SSB/CW setting or a BFO (Beat Frequency Oscillator) should provide satisfactory results.

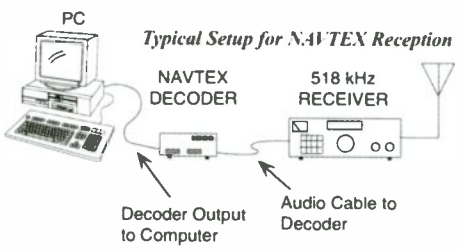
A personal computer and decoder are also required. An audio sample from the receiver is connected to the decoder input. The decoder in turn outputs a digital signal to the computer, where the message can be viewed on-screen. Figure 1 shows a typical NAVTEX setup.

As an alternative to a computer, self-contained "Readers" for NAVTEX are also available. These units have a built-in display screen and often include a printer port for saving a hard copy of bulletins. NAVTEX Readers can be connected directly to a receiver's audio output.

A number of manufacturers make equipment capable of NAVTEX reception. Universal Radio, Inc., 6830 Americana Pkwy,. Reynoldsburg, OH 43068-4113 (**http://www.universal-radio.com/catalog/decoders.html**) has a longstanding reputation as a supplier of digital receiving gear. Their technical Information line is available during normal business hours at (614) 866-4267.

❖ Tuning In

NAVTEX is transmitted in SITOR Mode B (FEC Mode). This is similar to the AMTOR protocol used by ham radio operators, but it is intended for one-way broadcast as opposed to the "chirp-chirp" two-way exchanges commonly heard on the amateur bands. Nevertheless, most ham-grade RTTY terminal units do have the capability to receive NAVTEX by simply selecting "AMTOR Mode B."



Typical Setup for NAVTEX Reception

❖ Timetable for NAVTEX

Table 1 shows some selected NAVTEX stations. If you are close to one of these sites, you should be able to copy transmissions even during daylight hours. At night, It's likely that you will receive signals from several stations. Happy listening and printing.

Table 1. Selected U.S. NAVTEX Stations (518 kHz)

Location	Transmission Times (UTC)
Boston, MA	0445, 1045, 1645, 2245
Portsmouth, VA	0130, 0730, 1330, 1930
Miami, FL	0000, 0600, 1200, 1800
San Juan, PR	0415, 1015, 1615, 2215
New Orleans, LA	0300, 0900, 1500, 2200
Long Beach, CA	0445, 1045, 1645, 2245
San Francisco, CA	0400, 1000, 1600, 2200
Astoria, OR	0130, 0730, 1330, 1930
Kodiak, AK	0300, 0900, 1500, 2115
Adak, AK	0000, 0500, 1200, 1745
Honolulu, HI	0040, 0640, 1240, 1840
Guam	0100, 0700, 1300, 1900

❖ DGPS News

On May 1, the US Government announced it was shutting off the intentional "dithering" of signals from the Global Positioning System (GPS) satellites. The intentional error signals were meant to discourage use of GPS by foes for hostile purposes, such as missile guidance. With the dithering shut off, civilians now have the same basic accuracy as military users.

What about the growing network of Differential GPS (DGPS) beacons on longwave? These stations will continue to provide a small improvement in GPS accuracy, but how many users require this level of precision? This may result in a scaling back of the DGPS network. For an online status listing of all US DGPS stations, point your browser to **http://www.navcen.uscg.mil/ADO/DgpsLatestStatusComplete.asp**.

❖ Web Updates

LF Engineering Co. (17 Jeffry Road, East Haven, CT 06513) is now on the web at **http://www.lfengineering.com/**.

Want to identify that strange digital signal you're hearing? Check out this neat site: **http://people.mainz.netsurf.de/~signals/DIG_intro.htm**

If Natural Radio is your thing, you may want to check out this new site by LF experimenter Larry Kramer: **http://home.pon.net/785/**.

❖ Loggings

Veteran DXer Al Hemmalin (RI) provides our loggings for this month. Al used a Drake R8A and an LF Engineering L-400 Active Antenna to make these intercepts. The list shows a nice assortment of DX stations as well as two unidentified beacons.

FREQ.	ID	LOCATION
206	GLS	Galveston, TX
232	GT	Grand Turk Island, BWI
251	ZQA	Nassau, BAH
258	ZSJ	Sandy Lake, ON
305	YQ	Churchill, MB
323	BSD	Davids Head, BERM
326	BHF	Freeport, Grand BAH
339	UCU	Santiago, Cuba
343	ZBM	East Farnum, QC
344	ZIY	Georgetown, Cayman Is.
353	HOT	Higuerote, VENZ
360	G	*Unidentified**
363	1F	Manta-Bathurst, NB
364	G	*Unidentified (dash after ID)**
369	ZDX	St. Johns, Antigua
370	UCM	Camaguey, Cuba
387	PV	Turks & Caicos Is.
398	HFY	Indianapolis, IN
402	C	Camaguey, Cuba
412	UNG	Nueva Gerona, Cuba
520	F9	Chatham, NB

* Information on unidentified stations may be sent to Below 500 kHz, P.O. Box 98, Brasstown, NC 28902.

❖ Out of Range

For many years Howard "Mort" Mortimer (WB2ZWI) has operated a longwave beacon from his location in Baldwinsville, NY. Recently, Mort sent word that he's doing some new experiments on a somewhat higher frequency – 40 meters to be exact. Readers may wish to try for his new 1 watt CW beacon operating at 7,080.5 kHz. Reception reports are encouraged and will be acknowledged with a QSL card from Mort. His longwave beacon on 178.6 kHz (ZWI) is off the air for now.

❖ End Notes

I'd like to hear from readers who built the **Natural Radio Receiver** presented earlier this year. Did you enjoy this project? Would you like to see more coverage of Natural Radio topics in this column? Your ideas are always appreciated. *See you next month!*

Larry Van Horn, N5FPW/NNN0JVP
larry@grove-ent.com

Have you tried the new mode in town?

I have been a ham now for well over a quarter century and have enjoyed working quite a few of the various communications opportunities that ham radio has to offer. During this time I have experience the thrill of chasing DX, VHF/UHF weak signal communications, all sorts of contests, satellite operations, net operations, certificate chasing, and rag chewing in a variety of amateur modes of operation.

But now there is a new player in the ham radio world that has changed my normal mode of operation here at N5FPW and put a little zip into ham radio again. It is called the PSK31 (Phase Shift Keying) digital mode. No doubt if you hang out around some digital enthusiasts you will hear them talking about some of these new PSK modes (PSK31: BPSK-Binary Phase-Shift Keying)/QPSK-Quaternary Phase-Shift Keying).

So what makes PSK31 so special? Why should you get interested in a non-voice mode?

PSK31 is a new digital mode recently designed by Peter, G3PLX. It was a significant improvement over the slow BPSK mode, an idea and implementation of Pawel, SP9VRC. PSK31 is based on the radio teletype (RTTY) mode of operation (uses a varicode character coding) and it is very useful for live keyboard-to-keyboard rag chewing at 31.25 baud. But instead of using frequency shift keying (FSK) or on/off keying, PSK31 uses BPSK or QPSK with a Viterbi decoder.

The best part is that it is available for free for many platforms, including Windows ©, and no extra terminal node controllers or decoders are needed. These free programs interface with Sound Blaster type computer sound cards, and use advanced digital signal processing (DSP) and narrow band 31-Hz techniques. I have seen upwards of 15 to 20 simultaneous PSK31 QSOs being conducted in the same bandwidth that a single sideband transmission would occupy. Now that is efficient spectrum utilization!

PSK31 is very easy to use and to monitor and it gives very good copy under even the most difficult of band conditions. This mode is very suitable to the low power (QRP) enthusiast. I recently worked CN8 station in Rabat, Morocco, on 20 meters during a solar storm with both of us using no more than 25 watts power. His signal was below the noise floor (I could not hear any audio from my transceiver speaker), but I had 100 percent copy on the computer screen. What makes this even more remarkable was my antenna system. I was using a 64-foot offset L dipole sealed in my roof and fed through my MFJ-986C tuner.

So it doesn't take much to work a station in this mode. Hams in antenna restrictive areas or those who have TVI problems, etc., will find this mode much more compatible to their surrounding environment. No other amateur mode I know of lets you copy stations with signals below your local noise floor with 100 percent copy. In fact, on PSK31 you will see most stations running with power levels frequently at less than 5 watts, simple attic antennas and perfect copy on the computer screen.

❖ Where to get started

Basically, all you need is one of the PSK31 computer programs, sound card, computer, and HF or VHF/UHF rig (yes, even the line of sight crowd is jumping on the PSK31 bandwagon). The best starting point to learn about this exciting new mode is the PSK31 homepage at: **http://aintel.bi.ehu.es/psk31.html**. Here you will find a detailed technical description of the mode, articles about PSK31, the PSK31 mailing list, other PSK31 links, frequencies being used (see table one), and more information and links to free software for this mode's operation.

Speaking of software, point your browser towards **http://aintel.bi.ehu.es/psk31.html** for a big list of currently available PSK31 software for a variety of operating systems and languages. My personal favorite program, which is incredibly easy to operate, is *Digipan* by Howard, KH6TY, and Nick, UT2UZ. There is a new version of the amazing program called Digipan 1.2 with some great operating features. It offers a panoramic view of the entire audio band, where you can instantly tune a new QSO with a click of the mouse and many other things as macros, etc.. You can get a copy of this super software package from **http://members.home.com/hteller/digipan**, and did I mention it is absolutely free?

There is also a new 3-watt 14 MHz transceiver made by Small Wonder Labs that will allow taking a snapshot of the actual IF passband using the *Digipan* software. Go to **http://smallwonderlabs.com/swl_psk31.html** for more details. Finally, if you need a good transmit interface for your HF rig, the best available is called the RigBlaster from West Mountain Radio (**http://www.westmountainradio.com/**).

So get your software, tune up your rig to 14.070 MHz and look for a waterfall trace from N5FPW (I QSL 100 percent). 73 all and I hope to work you soon using the PSK31 mode.

Table One: Suggested PSK31 Frequencies

Listen for the warble of PSK31 signals around the following frequencies:

1838.15
3580.15
7035.15 for region 1 and region 3, and 7080.15 for region 2 *
10140.15
14070.15
18100.15
21080.15 (although most activity can be found 10 kHz lower)
24920.15
28120.15
50.290 and 50.350–50.375
144.144–144.150**
222.07–222.15**
432.2 and up**
909.0 and up**
1296.2 and up**

* This is due to the fact that the 7 MHz band is much wider in region 2 (the Americas), and the IARU band plan reflects this.
** Recently proposed PSK allocations by the 6-Plus Activity Club that have not been coordinated by any other organizations

In 1986, Ike Kerschner started writing for *Monitoring Times* as the Getting Started columnist. Now that he's retired from the ham column, Beginner's Corner columnist Skip Arey (who came on board in 1988) is moving to take Ike's place "On the Ham Bands." We'll welcome Skip to the column starting next month.

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A Legendary Multiband Antenna

Last month we discussed building your own halfwave dipole antenna and mentioned that there are a number of other dipole designs available. This month we continue with a discussion of an HF dipole antenna-system which uses only a single dipole yet supports multiband operation.

In honor of the many operators who have enjoyed this antenna system in years past we'll call it "The Old-Timers Antenna System," or "TOTAS." Old-time radio operators, and not a few experienced contemporary operators, have considerable respect for the performance of the TOTAS when used on HF, and fed with balanced feedline and a tuner.

❖ Both More and Less Gain Than a Halfwave Dipole!

A linear wire antenna will have twice as many nulls and lobes in its horizontal radiation and reception (R&R) pattern as it has half wavelengths in its length. So a halfwave wire has two nulls and two lobes, a full wavelength wire has four nulls and lobes, and so on. If the wire's overall length is 135 feet it is a halfwave on 80 meters, a full wavelength on 40 meters, two wavelengths on 20 meters, and so on. Thus the TOTAS antenna's R&R pattern changes from band to band.

An example of the effect of changing the TOTAS's frequency of operation is shown in fig. 1A and 1B which contrasts a horizontal R&R pattern of a halfwave dipole, and a pattern comparably measured from a dipole two wavelengths long. Note that although the two wavelength dipole has more gain (the pattern extends out farther from the antenna in some places), it also has less gain (the pattern extends out less far in some places than does that of the dipole). Thus the longer dipole is both a higher-gain and a lower-gain antenna than the shorter dipole!

Although there are many nulls in the TOTAS R&R pattern we find that for practical installations the nulls tend to be a bit filled in, and so the antenna gives some performance in all directions with the antenna being more responsive in the direction of its larger lobes. Overall, the TOTAS has long had a reputation as a good multiband antenna.

❖ So Let's Build an Old-Timer's Antenna

To build a TOTAS you need to collect a few feet more wire than you plan to use for the overall length, three antenna insulators, some rope or wire for attaching the antenna to its masts, trees or buildings, some high-impedance, balanced lead-in (open-wire, ladder-line, or twinlead). If you're going to use this antenna for transmitting as well as receiving, the twinlead is only good up to something like 500 watts of transmitter power.

You must also have an antenna tuner (transmatch). Note that not all tuners have connections for balanced feedline. Often it is possible to remedy this by using a 4:1 (or higher ratio) balun with the low impedance winding to the transmatch's coax antenna-input connector, and the high-impedance winding to the feedline.

General consensus is that the longer the dipole element of this system, the better results you have. Usually 135 feet is the suggested antenna length, but the antenna will give a decent account of itself with dipoles as short as a quarterwave at the lowest frequency of operation. Using the formulas below you can determine just what that length is.

Length (in feet) = 234/frequency in MHz
or
Length (in meters) = 71.3/frequency in MHz

For example, at 10 MHz (30 meters) a quarter wavelength would be 234/10, or 23.4 feet long. In meters that's 71.3/10, or 7.13 meters. So, if your lowest anticipated operating frequency is 10 MHz, an overall antenna length of 23 feet or so should give you a decent antenna. Of course, twice that length, a halfwave, would be better.

Realize that the overall antenna length is composed of two equal lengths, each equal to one half the overall length. When cutting your two element segments to length, remember to leave enough extra length to bend around and attach to the insulators. Clean and solder any wire well where it must be attached to another wire.

As shown in fig. 1C, the lead-in should fall away from the antenna as close to 90 degrees as is practical for best performance. The lead-in should then be kept away from all conductive objects as much as possible on the run to the transmatch.

If you can't deal with the balanced lead-in coming into your building try putting a 4:1 balun (or higher ratio) between the lead-in and a *short* length of coax running to your rig. The high-impedance winding of the balun should go to the lead-in, and the low impedance to the coax. The coax should be low-loss and short, or you defeat the advantage of the low-loss lead-in as explained in the Radio Riddle answer given below. If you can, it's best to use balanced feedline all the way to the tuner rather than using the coax and balun.

If the antenna is used where lightning is at all likely, some form of lightning protection should be used. The minimum here is never use the antenna

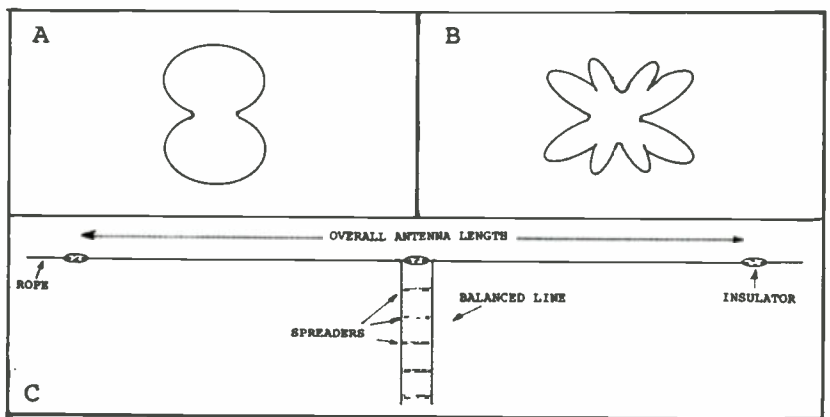

Fig. 1. A horizontal radiation and reception pattern for a halfwave dipole (A), and a two wavelength dipole (B). Configuration of a multiband dipole system (C).

This Month's Interesting Antenna-Related Web site:

What single item can cool an auto, defrost its windshield, and receive AM-FM signals? Check out this month's web site to find out: **www.eng.ohio-state.edu/archives/9901/antennas.html**

during weather likely to produce lightning, and disconnect the antenna and ground it when it is not in use.

Mount the antenna as in-the-clear as possible. To emphasize HF DX performance, mount the antenna a half wavelength or more above the ground; for shorter-haul HF communications, about a quarter wavelength above the ground is preferable. Happy operating, and good luck!

RADIO RIDDLES

Last Month:

I asked: "Why does a dipole become a multiband antenna when used with low-loss feedline and a transmatch...?"

Here's one way of looking at it: A transmitting antenna's function is to accept energy from the feedline and radiate it. As the band of operation is changed, the feedpoint impedance of the antenna also changes and some very high SWR values for the feedpoint-feedline junction can result. This means that on some bands a good bit of the energy sent to the antenna is reflected back down the feedline rather than being accepted and radiated. With low-loss feedline this reflected energy will not be attenuated much, and when it encounters the tuner it will be returned back up the feedline to the antenna. Thus most of the energy sent to the antenna eventually does get radiated despite the severe mismatches that do occur.

During reception, due to the mismatches just mentioned, the feedpoint-feedline junction reflects some energy received by the antenna back into the antenna rather than passing it on to the feedline and the receiver. This reflected energy circulates in the antenna, part of it being re-radiated back into space and part of it eventually re-entering the feedline and being routed to the receiver. On HF the loss of a portion of the received-signal's strength is not as important for good reception as is the signal-to-noise ratio, and so multiband reception is pretty decent with such a multiband antenna.

This Month:

We sometimes see the term "conjugate" mentioned in antenna and feedline articles. What does this term mean, and who cares anyhow?

You'll find an answer for this month's riddle, another interesting, antenna-related web site, and much more in next month's issue of *Monitoring Times*. 'Til then Peace, DX, and 73.

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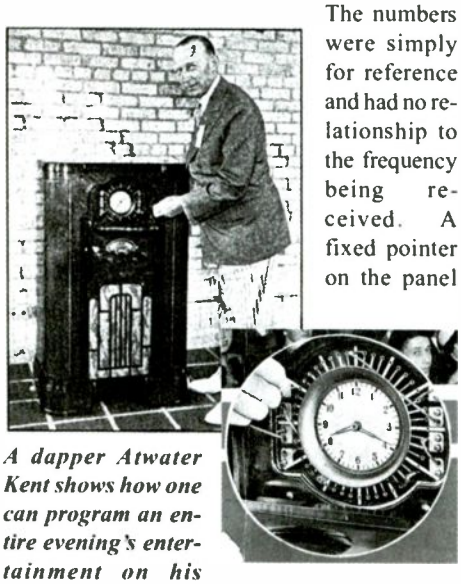
New Twists on Tuning

With this column, I'll conclude our coverage on the physical and electronic evolution of the home radio receiver. Beginning last January with the simple one-tube receivers of the early 1920s, we touched on the major radio industry landmarks, including the development of the regenerative, TRF (tuned radio frequency) and superheterodyne circuits; the appearance of the first "plug in" radios; the streamlining of component design and layout to suit the demands of mass production; the resulting changes in cabinetry; and the emergence of the ubiquitous "a.c.-d.c." set.

As mentioned last time, most of the basic circuitry for the home radio had been developed by the time the a.c.-d.c. set design was maturing in the early 1940s. Radio marketing now began to stress special features rather than competitive performance. Most of these features centered around the most visible and obvious function of the radio set – its tuning range and tuning system.

❖ Dial Evolution

The first tuning dials were simply knobs having a numbered scale around their circumference (typically zero through one hundred). The numbers were simply for reference and had no relationship to the frequency being received. A fixed pointer on the panel allowed the dial to be positioned at the desired setting. Simple regenerative sets had one tuning dial; the average TRF receiver usually sported three – all of which had to be tuned for maximum to select the desired station.



A dapper Atwater Kent shows how one can program an entire evening's entertainment on his newly-introduced (1934) console radio.

1934 International Kadette broadcast/shortwave set has "airplane" dial, cathedral cabinet.

By the time multi-section single-shaft tuning capacitors had been developed (see May column), most dials were marked with actual frequency in kHz or wavelength in meters. The typical tuning dial was viewed through a small window having a fixed pointer at the top. The dial markings were imprinted on a circular wheel, or sometimes a drum, that rotated behind the window as the tuning capacitor was adjusted. Usually only a few divisions on either side of the received frequency could be seen.

As time passed, manufacturers discovered that radio panels would look more inviting and interesting if more of the dial scale were visible. It became common for the dial window to be broadened out to form a semicircular arc, showing much more of the set's tuning range. Next, the "airplane" style dial appeared. This had a fixed scale showing the complete tuning range and laid out in a circular, square or oval pattern. A movable pointer, similar to a clock hand, traveled around the dial to indicate the frequency.

❖ Short Wave Coverage

By the early 1930s, many cities were installing radio communications for their police cars. Some set manufacturers were quick to see this as an opportunity to add a competitive new feature, and soon shoppers had the option of buying a radio with "police" or "police calls" prominently lettered on the dial just above the broadcast band. Persistent listeners in big cities might eventually be rewarded by hearing the crackling voice of the police dispatcher "calling all cars," or even the sounds of a chase in progress radioed from a speeding cruiser.

But soon there would be even stronger fare for the adventurous listener. As war clouds gathered in Europe, interest heightened in the shortwave bands. International broadcasts from stations all over the world were airing propaganda and news from country after country. Later, as hostilities erupted, there was the opportunity of hearing tactical communications from the warring armies. As always, these frequencies also hosted the point to point messages of maritime, aircraft and other commercial services as well as the friendly world-wide conversations of ham radio operators.

Radios with one shortwave band generally used an "airplane" style dial divided into upper and lower segments. The upper end of a double pointer swept the top segment, which showed standard broadcast frequencies; the lower end traveled over the lower segment, which showed the shortwave frequencies. Of course, the actual frequencies picked up by the radio depended on the setting of its two-position bandswitch.

RCA-Victor 1940s offering has both slide-rule dial and push-button tuning

Multiband sets (those with more than one shortwave band) often used a single pointer traveling over an "airplane" dial scale on which the broadcast frequencies and the frequencies of the shortwave band were laid out concentrically. But

by the late 1930s, the "slide rule" dial began to appear. In this style, the frequencies covered were marked on a horizontal straight-line scale (or on two or more parallel scales in the case of sets with short-wave coverage). A vertical cursor traveled across the scales to indicate frequency – with the active scale, of course, depending on the position of the bandswitch.

As any collector of 1930s radios knows, it was not unusual for certain shortwave frequencies to be marked with the names of the countries typically using them for international broadcasting. Other frequencies might be labeled with the types of services found there, such as "Police," "Aircraft," "Amateur," or "Maritime." All in all, this kind of labeling added quite a lot of excitement to the appearance of the radio dial – giving the listener the feeling of having the world at his or her fingertips.

⁘ Tuning Devices

Devices to make tuning automatic were among the most favored by radio designers looking for features to make their sets stand out from those of the competition. The most obvious of these – and you're all familiar with it – was pushbutton tuning. Instead of moving a pointer over a dial (or a dial under a pointer) to find the desired station, the listener merely pressed a preset button to bring in the station of choice. It's interesting that, widespread as this feature was when first introduced, few radio receivers have pushbuttons today.

1940s vintage Airline is equipped with both telephone-dial tuning and a tuning eye. This model is a vibrator-powered farm radio.

Even auto radios, which – for obvious reasons – were among the last surviving sets to have pushbuttons for tuning, are rarely equipped with them now. The only tuning button typically found on an auto set is a "seek" button that jumps reception to the next available station. Of course, today's TV remote certainly represents the ultimate elaboration of the push-button tuning principle!

The radio pushbuttons of old worked on either electrical or mechanical principles. The electrical method involved shunting individual trimmer capacitors across the main tuning capacitor. Once adjusted by screwdriver, these capacitors remained fixed at the value necessary to tune the station of interest. The mechanical buttons actuated a system of levers and cams that physically moved the dial to the required station. Once again, stations were set by screwdriver adjustment which, in this case, limited dial travel to the exact amount required. With some sets (certain Zenith and Midwest models come to mind) a button-operated motor did the tuning, and the listener could watch the dial turn automatically until it reached the desired setting.

The idea of controlling appliances "at the touch of a button" was definitely well established in our culture near the end of the 1930s. Pushbutton tuning was the obvious application to radio receivers, but many designers went wild with the concept – creating radio panels that bristled with inviting things to press. Bandswitches, tone controls, and even the "on-off" switch could be "buttonized."

No discussion of tuning devices would be complete without touching on the "tuning eye." First appearing on sets about the middle of the 1930s, the device was actually an electron ray tube – related to an oscilloscope tube but much simpler. It was housed in a cylindrical glass envelope and had a standard tube base.

The tube was mounted so that it was viewed end-on through the radio panel. The listener saw a small circular screen having a round electrode at the center that resembled the pupil of an eye. When the radio was turned on, much of the screen lit up with a phosphorescent green glow. As a station was tuned in, the glowing segment of the screen grew at the expense of the shadow segment in a manner reminiscent of the closing of an eye. When the eye was at the point of maximum closure, the station was tuned in as accurately as possible.

Never mind that countless listeners before and after the heyday of the tuning eye managed to tune in their stations just fine by ear! The cute little glowing tubes did their part in attracting buyers for the models equipped with them.

⁘ More Tuning Gimmicks

Moving further out to the left of conservative, we could cite some tuning gimmicks that fall into the "wild and wonderful" class. For example, during the 1930s, radio mogul Atwater Kent announced a set that could be pre-programmed for an entire evening's entertainment, switching from station to station under the control of an electric clock. In the same era, Philco offered its "mystery control" radio, a console set that could be remotely operated from a chairside box containing a low-powered, battery-powered radio transmitter.

Montgomery Ward's "Airline" sets often had interesting and innovative front panel treatments. Many had shortwave dials elegantly lettered with names of countries and types of radio services. One model had an automatic station selector that operated like a telephone dial. You stuck your finger in the opening corresponding to the station you wanted and turned the dial until it stopped. Ward also came up with the well-known "movie dial," which was a screen on which station settings were projected by means of an internal optical system.

One advertising slogan I remember really typifies radio marketing's shifting emphasis – beginning in the 1930s – on features and gimmicks rather than true design innovations. I can't remember with certainty the manufacturer that used it – but if I had to guess I'd say that Philco probably used it to tout its early-1940s sloping-panel console models. The ad copywriter's's memorable, if slightly inelegant, phrase was "No stoop–No squat–No Squint!"

See you next month, when we'll begin a discussion of the tools, facilities and equipment you'll need to set up a basic radio restoration workshop.

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More Programs to Control the TenTec R320

Last time we dusted off the Ten-Tec R320, digital signal processor (DSP) based, computer-controlled receiver, which was introduced a few years ago. Many people have been busy writing software for this radio which still can boast high levels of operational performance. We have already covered four programs, Ten-Tec, Dxtra, GNR and Turner. Anyone looking for a control program for an R320 should "test-drive" each one. In my opinion, they all had something to offer, some more than others.

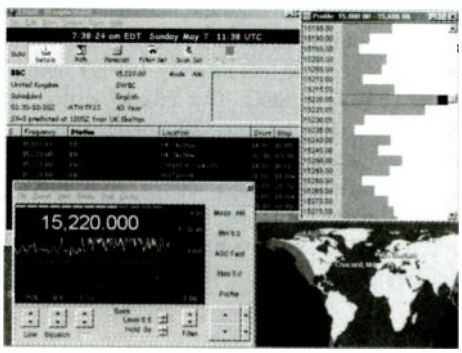

Figure 1 - ERGO's Compressive Display - A Lot Going On Here!

This month we will complete the R320 odyssey and look at three more R320 programs. Again, each with a uniqueness that makes them possible candidates for your choice to control your R320. All of the following three programs require Windows 95/98.

❖ Simple but Colorful

Sometimes we forget to consider the first time/novice listener. Their confusion and frustration were once ours! Attempting to remember new monitoring terminology, assimilating some radio technology, while learning how to use a computer-controlled radio can take the fun out SWLing. The RX-320 AT/SWL99 program suite can help with the last chore. This program is one of the easiest to install and use. It provides a user interface with an uncluttered, clean screen layout.

The excellent use of color makes for easy operation, as well as being aesthetically appealing (really cool when visitors are in the shack!). AT/SWL99 comes close to the Ten-Tec software in features and performance.

❖ A Bit of Conflict

While trying all the different R320 programs I ran across a "conflict" between AT/SWL99 and Turner's (KF5OJ). It seems that these programs have elements with common names. This is not usually a problem, except in this case these program elements are loaded into the Windows operating system. One of the offenders seems to be Knob.ocx. Both SWL99 and Turner load a program with this name into the Windows System directory. Although the names are the same, the programs are not! The effect is that once Turner is loaded AT/SWL99 does not work.

I tried to run AT/SWL99 on another Windows 98 machine and was greeted with the banner "Will not work OLEAUT32.DLL is out of date." Funny, everything else works on this machine.

One thing that is certain, AT/SWL99's price is right. It's free and worth a try from **http://www.mole3d.com/radio/rx.htm.**

❖ "See" What You're Monitoring

The ERGO program is a tour-de-force in the visual presentation of data. Installation is simple. However, a bit of confusion can occur since it does not tell the user what installation operation it's performing or that it is even in the loading process. My suggestion is to just be patient and make sure it has finished completely. Once loaded, a powerful suite of monitoring programs is now at the user's disposal.

ERGO has many useful features, each presented in a screen box of its own. To avoid confusion I suggest you keep the number of open screens to a minimum. Figure 1 shows four different functions displayed simultaneously: Receiver control and database, map of propagation path, frequency spectrum and signal strength versus time. It's a lot of simultaneous information, but all nicely presented.

ERGO's spectrum profile is a nice variation on all the others. The top area in Figure 1 shows the spectrum as a horizontal bar graph centered about the BBC Skelton station at 15.220 MHz. Another unique and useful feature is the signal strength recording versus time screen; see Figure 1 lower left. Reminiscent of the old ink pen recorders, this clearly shows propagation variations.

❖ No One Home?

How many times have you wanted to monitor a station broadcasting at times when you were either at work or asleep. (Or during the Honey Dew hours – "Honey do this. Honey do that."). ERGO makes available a large number of timer options including on/off timers for unattended monitoring.

I could go on and on ... ERGO includes online updating of propagation details and station database; nice handling of importing of databases files from various formats; World Map with home QTH and target. Once you are "schooled" in ERGO's integral operation of database, receiver control, mapping and propagation, the results can be powerfully impressive. But this does come at a price – $99. Check their website at **http://swldx.com/index.htm** for more information.

❖ Free Is Good ... Very Good

N4PY has produced a R-320 program simple called N4PY. The current version, 1.04, is well thought out, easy for anyone to use, regardless of their computer or monitoring experience level. It provides most of the important functions of the R320 in a simple, intuitive manner. Add to these impressive facts its price – Free.

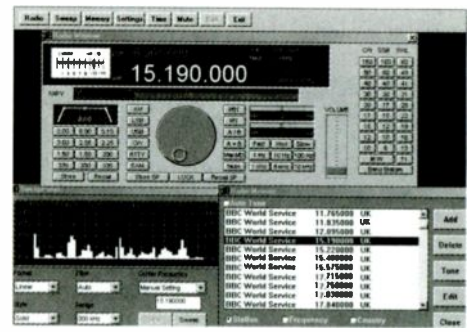

Figure 2 - A Free Lunch ? - N4PY version 1.04r

Quick and simple pretty well defines N4PY's user interface, from installation through use. Quite a bit of thought has gone into its design and the result is a program that is "the way it should be." The program will appeal to both the novice or advanced user.

Figure 2 shows N4PY with three screens open: Main receiver control (top), Sweep frequency panel (bottom left) and Radio Memory database (bottom right). The buttons along the top of the screen are the command keys which open various feature screens. Everything is in plain sight, easy to understand and totally functional.

Turning our attention to the main receiver control N4PY, frequency tuning can be performed in a number of ways. The use of both

the computer keyboard's arrow keys and mouse, for tuning, was neatly implemented.

Looking at the right side of the receiver we see three columns of buttons. These also provide quick and simple selection of specific bands. The SWL buttons tune the R320 to the beginning international shortwave bands. While the CW and SSB tune to sections of ham radio bands. I found this feature very useful.

The database at the lower right of Figure 2 is once again quick and simple to use. Adding, recalling and editing is straightforward. If the user tunes to a frequency in the database, the program automatically displays the station name above the frequency on the receiver screen. Very nice touch!

❖ SAM Who?

If you look to the lower left of the tuning knob you'll see the SAM button. Sam is explained in the program's Readme file, " ..."SAM" is for synchronous AM. It is not really sync AM, but the next best thing. This mode simply turns on the BFO and sets the step size to 1 Hz. You must carefully zero beat the AM carrier ..." I was surprised at how well this worked.

I use Time stations, such as WWV, to get a view of propagation conditions and thereby indicating the best frequencies to monitor. N4PY provides a pulldown menu which gives direct access to Time stations with the click of the mouse.

❖ Picky, Picky, Picky

Could I extol the virtues of any program without a few "but, it would be nice" items? Uh...no! N4PY's Tuning knob has one irritating aspect. When using the mouse buttons for tuning, the left button tunes the frequency up. But right does not tune down! This breaks the quick, simple and intuitive rule.

Another observation is that the gain of vertical axis of the frequency is sometimes unpredictable, resulting in either huge, or tiny signal peaks.

N4PY's R320 program has much more to offer that we didn't cover. Since it's free I 'd suggest you check it out at **http://www.qsl.net/tentec/pegasus/n4py104r.zip**

❖ That's It

There are other programs which control the R320, but in my opinion, these are some of the best. As for the R320? I'm more impressed with TenTec's blackbox each time I use it, and these programs enhance its impressive operation.

Finally, we'll end with a riddle, "When is a PC-controlled receiver not a PC-controlled receiver?" Confused? All will be made clear next time. If you own an ICOM PCR1000, or a TenTec R320, you will not want to miss this. 'Til next time, here's hoping your monitoring shack has air conditioning.

Jock Elliott, KB2GOM
lightkeeper@sprintmail.com

GE's Sedona FRS

At the risk of sound self-serving, I've got to admit that it's a pretty cool thing to be a writer who reviews radio equipment. For one thing, you get to play with some seriously neat gear, put it through its paces and see where it shines and where it falls down.

Another benefit is interacting with a lot of nice people. Some of them are manufacturers who are knowledgeable about their industry. Talking with them is almost always educational.

The most important constituent of the great folks I have contact with are the readers of this column. When an email arrives asking a question, offering a suggestion or delivering some bit of information, it's always welcome. It lets me know that you are reading the column and that something piqued your interest. I answer all the emails that I get, and I usually try to answer in a day or two. If you don't get an answer in, say, a week, please "ping" me again, and I'll try to respond immediately.

Yet another benefit of doing a column like this is that you get to see trends emerging. Lately, I've been meditating on what's going on with the Family Radio Service. So here it is: Uncle Jock's Crackpot Theory of What's Going on with FRS.

Now, just in case you are unfamiliar with the Family Radio Service (FRS), it is an unlicensed radio service in the 460 MHz range established in 1996 that is intended for short-range communications. There are 14 channels currently assigned to FRS:

Channel	MHz		
1	462.5625	8	467.5625
2	462.5875	9	467.5875
3	462.6125	10	467.6125
4	462.6375	11	467.6375
5	462.6625	12	467.6625
6	462.6875	13	467.6875
7	462.7125	14	467.7125

The radios are limited by FCC rules to 1/2-watt maximum power in FM mode, and external antennas are not allowed. Most FRS handitalkies are small (often pocket-sized) and most offer excellent audio quality over distances up to two miles. FRS radios work well in buildings, outdoors, and inside vehicles.

I once talked with a couple that was moving cross country, and they were using a pair of FRS radios to keep in touch between vehicles. It was the ideal solution for them: no antennas to install, no lingo to learn, just push the button and talk. And everywhere, it seems, people are discovering that FRS units are incredibly handy for staying in touch over short distances. One of my brothers-in-law uses a pair to stay in touch between his workshop and his house. Another brother-in-law, who runs a landscaping business, finds FRS radios outperform Nextel telephones for staying in touch with his crew when they are maintaining and installing in-ground sprinkler systems.

A number of readers have written to tell me how they are putting FRS to use in their lives. Their applications include staying in touch while skiing and biking, maintaining communications among staff members in a hotel, and even coordinating operations at a rifle range.

Okay, back to the trend: when FRS first came on the scene, it seemed that every single unit cost at least $120. And then, for a while, manufacturers appear to have gotten the idea that if they added more features, bells, and whistles, FRS would become more popular. Unfortunately, adding more goodies to the radios also added to the cost. Some radio were hitting the market with suggested retail prices just pennies under two hundred dollars. A typical comment from my friends and relatives was: "Two hundred dollars?! Heck, I can buy a whole cell phone and some months of service for that."

Priced to Sell

So now we're entering the era of low-cost FRS radios. A case in point is the GE Sedona FRS radio, which typically costs less than $50 apiece. It measures about 2.5 inches wide by 4 inches tall (excluding antenna) by about 1.25 inches deep (excluding belt clip). On the front panel is an On/Volume knob, a pair of buttons for changing channels, and a paging button. There is also a small panel with a red light-emitting diode to indicate channel number and additional LEDs that light when transmitting or when battery power is low.

On the top of the Sedona is a rubber-covered hatch for plugging in an earphone and the antenna. On the left side, there's a push-to-talk button and a button for defeating the autosquelch. On the back, you'll find a detachable belt clip and a slide-off panel that allows you to drop three AA batteries into place.

That's it! There are no other goodies; no so-called "privacy" codes, no vibrating alert, no tricks, just a very basic FRS handitalkie at a no-nonsense kind of price.

So how does it work?

The answer, it turns out, depends on what you need it for. The audio on transmit and receive is exceptional, sounding very much like the highest quality telephone. Operation, of course, is dirt simple, which is a plus for many FRS users.

The range, however, is extremely limited. At about 1/3 of a mile, the gorgeous audio starts to get noisy. At roughly 1/2 half mile, two-way communication disappears entirely. And there was an additional anomaly: on one of our test radios, the paging tone would go off suddenly for no particular reason. We had no way of determining if someone else in the area was perhaps transmitting an alert tone, so this remains a mystery.

The bottom line: the GE Sedona is a fine radio if all you need is very short range communication. If you anticipate needing longer range communication, you'll be better satisfied with another choice.

GOVERNMENT SPECIAL

ICOM R8500

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- **Signals Surveillance**
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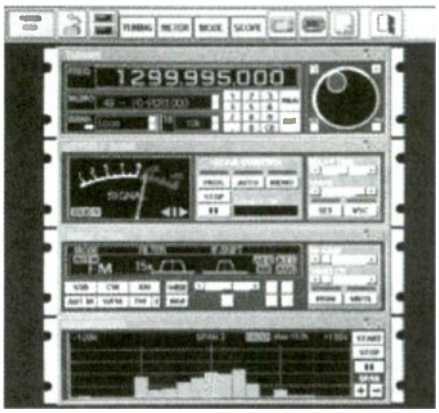

Portable/Mobile wideband receiving system!

Adapt your desktop or laptop computer for superb, all-mode reception, 500 kHz-1300 MHz (usable with reduced performance as low as 10 kHz)! Display up to 400 kHz of spectrum in real time; manual selection or factory default for mode, tuning step, filter setting for any frequency; IF shift enhances single-signal reception; noise blanker resists pulse noise interference; three separate screens may be called up to show full communications receiver emulation, list of functions for quick access, or simplified graphics screen for casual listening. Tracking filters improve image and intermod rejection at VHF and UHF.

Other features include drift-cancelling AFC, voice scanning control to skip unmodulated channels, S-meter-settable squelch, CTCSS (subaudible tone "PL") squelch decoder, user-selectable scanning methods and tuning steps, 20 dB RF attenuator for overload protection, triple up-conversion design, high sensitivity (0.4 uV typical on NFM), 5 selectivity choices, and 1 Hz tuning resolution.

Requires Windows 3.1 or 95, 486 or better, 10 MB hard disk, 16 MB RAM, serial interface, 640 x 480 pixel resolution or better. Accessories provided include program disk, telescopic antenna, RS232 interface cable, AC adaptor, and full instructions.

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Review by Bob Grove
bgrove@grove-ent.com

What do Those Specs Really Mean?

Everyone knows that specifications are important, but not everyone knows why. Oh, sure, we can generalize: "A sensitive shortwave receiver is better for DX." Maybe.

Let's take a look at some of the more important specifications for shortwave receivers and try to make sense out of what they are telling us.

Frequency Range

While the shortwave spectrum is officially 1.8-30 MHz, we have to keep in mind that all receivers currently manufactured include the medium wave broadcast band as well (540-1700 kHz, the same as 0.54-1.7 MHz). But there's more.

Since virtually all portables are made and marketed overseas, the foreign domestic broadcast band (150-300 kHz) is included as well. There are no voice transmissions below this, only some Navy digital communications; most tabletop receivers go down to 100 kHz.

Keypad Frequency Entry

Often called "Direct Entry," keypads are far more convenient for selecting discrete frequencies than rocking a dial back and forth, fine-tuning the desired frequency. Until digital synthesis of receiver oscillators, such exact control was impossible.

Tuning Steps

In the days of analog tuning, precise tuning of a signal to within a few hertz was easily obtainable, but with digital synthesis, such accuracy is expensive. Realistically, it becomes more of an issue with the reception of digital modes and single sideband than AM, where being off by hundreds of hertz is no problem.

Voice single-sideband stations, to sound natural, must be tuned within better than 25 Hz or so, while music, because of its absolute pitch intervals, must be even tighter.

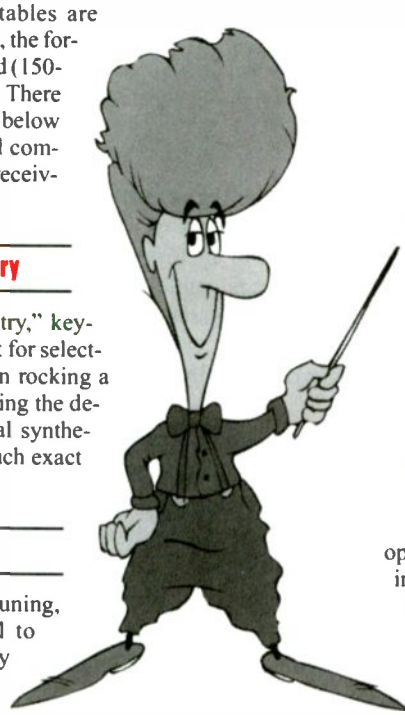
Some receivers employ "direct digital synthesis," enabling increments as small as 1 Hz; in fact, 10 Hz is probably plenty good for virtually any hobby application.

Modes

Amplitude modulation (AM) is still the preferred mode for domestic and international broadcasting even though it does waste spectrum. It is sometimes called "full carrier double sideband," and the same audio information is duplicated in both sidebands (upper and lower).

Synchronous detection (AM-Synch) is a receiving mode which locks onto the station's signal frequency without drifting. By choosing the stronger of the two sidebands, the reception remains stable during fades, and eliminates distortion produced by unequal sidebands.

Single sideband (SSB) actually transmits one sideband, eliminating both the carrier and the opposite sideband, making it inherently more spectrum-efficient, and immune from selective fading distortion. Virtually all two-way voice communications heard in the shortwave spectrum are in upper sideband (USB). Exceptions include amateur radio voice comms in the 160, 75, and 40 meter bands which are lower sideband (LSB).



Sensitivity

The measurement of a receiver's ability to respond to weak signals is its sensitivity. Since shortwave radio signals are detected as minute voltages, the measurement is made in microvolts (millionths of a volt).

Years ago, less sensitive vacuum-tube receivers required significantly larger antennas to capture enough signal energy to overcome their own noisy circuitry, the result of the hot filaments and cathodes producing electrical noise ("thermionic emission"). Modern solid-state electronics makes high sensitivity practical, with half-microvolt (0.5 uV) ratings, and smaller antennas commonplace.

Dynamic Range

But high sensitivity is only half the story. The ability of a receiver to respond faithfully and equally to weak and strong signals is a measure of its dynamic range, expressed in decibels (dB). Overly-sensitive receivers often become overloaded by strong signals, producing spurious, phantom signals which interfere with reception. Most common is intermodulation ("intermod"), but desensitization ("desense") which lowers the weak-signal capability of a receiver in the presence of strong signals.

Preamplifiers and Attenuators

During weak signal conditions, it is often an advantage to boost signal levels before they come into the receiver. Preamps are wide-bandwidth devices that amplify all signals over the entire frequency range at one time (with the possible exception of the medium-wave broadcast band to avoid strong local signal overload).

And if signal levels are generally excessive, an attenuator may be invoked to reduce all signal strengths to make them more manageable for the receiver's tuning and detecting circuitry.

Selectivity

Single-signal reception is the goal; we want it audible and without interference. There is little we can do to separate two signals on the same frequency, but there is plenty we can do to separate two adjacent-frequency signals.

Filters are frequency-selective components used in receivers to decrease the amount of spectrum being detected at any one time. While it may seem prudent to make filters as narrow ("sharp")

as possible, in fact different modes require different bandwidths, as we noted before.

Since the human voice occupies approximately 3 kHz of audio spectrum, and AM signals double the amount of bandwidth, a conventional AM signal is about 6 kHz wide. If we narrow it down much below 4 kHz, we reduce its high frequency components considerably and it sounds muffled.

SSB is already narrower, so selectivity on the order of 2.1-2.4 kHz is common. Even narrower are digital modes; Morse code (continuous wave or "CW") is the narrowest of all, with bandwidths of less than 0.5 kHz adequate in most cases.

Passband Tuning and IF Shift

These two techniques allow the operator to manipulate a receiver's filtering circuitry to favor one of two close-spaced signals without simply narrowing the passband, which would produce muffling of the audio. Instead, the unwanted signal is rejected and the desired signal's bandwidth is preserved.

Notch Filter

A filter which can be invoked and adjusted to remove single tones ("heterodynes") from the desired signal is quite useful. Some advanced receivers use digital signal processing (DSP) to do this automatically and instantly without the listener having to turn a knob until the irritating pitch disappears.

Noise Blankers

Years ago, crackly electrical noise interference was reduced by an audio noise limiter (ANL). This was basically a voltage "clipper" which allowed an adjustable amount of normal audio to pass to the amplifier, but would clip off any sharp bursts of noise. These characteristically caused some distortion to the sound.

More modern receivers employ noise blankers which sense the arrival of the noise spike and momentarily shut off the circuitry for the duration of the interference spike. While they do result in less distortion, they are effective over a narrower range of interference than the old ANL.

Scannable Memory

The ability to store a favorite frequency and mode into a memory channel is certainly a benefit; switch the radio on, push a button, and there it is! Most shortwave sets now have memory, and often offer the ability to scan as well, allowing an automated hunt for active stations among the memorized channels.

Audio Output Power

In a home stereo system reserve audio powers in the 100-200 watt range are common. But we seldom crank the volume up that loud! In actual practice, as little as 3 watts into a decent-size speaker can provide room filling sound.

Engineers often provide this specification along with another parameter: 10% total harmonic distortion (THD). This is the maximum audio power the receiver can deliver to a matched speaker without audibly distorting the sound.

These definitions are admittedly simplified. We've scheduled some additional columns elaborating on some of the often ignored or misunderstood specifications. However, the above summary should provide a guide to understanding the various circuit design characteristics which make up a receiver's specifications. After reading them over, you'll have a better idea of which specs are more important for your listening requirements!

Bob Parnass, AJ9S
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www.megsinet.com/parnass

Patches, Crystals, and Past Reviews

Part of any hobby is sharing the fun with friends. I often call one of my scanner buddies when monitoring an odd signal to find out if he can identify it, especially when hunting down sources of intermod.

Holding the telephone handset up to a scanner's speaker doesn't provide a good acoustical connection. That's why I use a gadget called a telephone patch so my buddy can hear through the telephone what I'm hearing on my radio.

A telephone patch is a device which connects a telephone line to a radio receiver and/or transmitter. The most basic patch consists of a transformer to match the phone line to the radio, a DC blocking capacitor between the phone line and transformer, and a switch with routes the audio to either the telephone line or speaker. Commercially made patches for ham use provide transmitter controls and a low pass filter to prevent RF energy from the station transmitter from getting into the phone line.

Phone patches were a popular ham radio accessory from the 1960s through the 1980s. Hams used patches to provide public service, letting two people communicate via the radiotelephone connection. As satellite and cellular telephone usage spread in the 1990s, the demand for ham radio phone patches shrank.

You can find used phone patches sold at hamfests for as little as $15 for an older, no frills model. I use two higher end models, a Waters Universal Hybrid Coupler, model 3001 (fig. 1) and a Drake P75 (fig. 2). Both were inexpensive hamfest purchases.

The patch connects to the telephone line. It also connects between a receiver and an external speaker. Phone patches for ham use provide transmitter connections, too, but you can ignore them for scanner applications.

Almost all patches have a volume control which permits you to adjust the audio level fed from your scanner into the phone line. Most phone patches are passive devices and do not require power to operate. The typical patch has a switch to activate the connection and the patch should be turned off when not in use.

Identifying Scanner Crystals

If you collect older scanners, you probably collect crystals they use, too. My crystal inventory started with one pill box full. Over the years, I bought a couple of scanners at each hamfest, removed their crystals, and added them to the crystal pile. I bought loose crystals if the price was right, too. At one point, I bought the entire crystal inventory of a defunct scanner repair business. Now, my crystal collection has mushroomed into the hundreds.

Crystals are the most delicate component in a scanner. If you are buying a used crystal, avoid one with visible dents in the case. It could have been dropped or crushed by careless use of pliers to remove it. Crystals are like people, in that some age more gracefully than others. I've had crystals change their operating frequency by several kHz or fail completely after a few years. Be prepared to "get stuck" with a few bad ones.

There is no such thing as a universal scanner crystal. Dozens of types were produced because scanner manufacturers failed to standardize on crystal specifications. Many scanner companies made Citizens Band transceivers and they couldn't agree on a standard microphone connector, either.

Most Radio Shack scanners will work with crystals for Regency models and vice versa, though some of the earliest Radio Shack models (e.g., PRO-88) use oddball crystals on UHF. Most Sonar scanners employ a 10.7 MHz first IF, but require special crystals. If you install a Radio Shack or Regency crystal in a Sonar scanner, it will usually oscillate a few kHz off frequency. This affords poor reception of weak signals, but may suffice for monitoring local stations.

My crystal collection is organized into three categories: crystals for Regency and Radio Shack scanners, crystals for Bearcat scanners, and crystals for other radios. The crystals are further sorted within each category by band. Crystal sorting requires a knowledge of how to decode the case markings.

A few crystals bear the model number of the target scanner, e.g., "FR105." Virtually all scanner crystals are marked with the scanner's operating frequency. That's the frequency on you want to receive. Some crystals bear a second frequency marking which is the frequency at which they are designed to oscillate. Most crystals will bear another marking which is the manufacturer's part number designation. I've compiled crystal marking information from several sources, including my own inventory and catalogs from CTS Knights and other manufacturers (table 1).

Scanner Review Index

We're constantly being asked when a particular scanner was reviewed, so here's an index of reviews performed in this column since 1996. This list posted at **www.grove-ent.com/mtscanrevu.html** will be forward and backward updated as staff time permits.

Table 1: Crystal Designations

DESIG.	COMMENT	IF	SCANNER
7-RG	Bomar	10.7	Regency
A135	CTS Knights	10.8	Bearcat
A-7	Bomar	10.7	Regency
ACT	Shepherd	10.7	Regency
BC3/4	USCC	10.8	Bearcat
BCM		10.8	Bearcat
BCT		10.8	Bearcat
BMRU	UHF	10.7	Regency
BRM		10.7	Regency
D-4	Bomar	10.8	Bearcat VHF-low
FR105		10.7	Sonar
FR2517		10.7	Sonar
H-5	Bomar	10.7	Regency
JK 1	CTS Knights	10.7	Regency
JK 2	CTS Knights	10.5	Regency TMR8A air
JK 3	CTS Knights	44	Radio Shack PRO88 UHF
JK 4	CTS Knights	13	Regency TMH1 TML1 TML2
JK 5	CTS Knights	10.8	Bearcat, Penney Pinto 6183
JK 6	CTS Knights	0.56	Courier COP20H COP30L, Sonar FR103 FR105 FR107
JK A1	CTS Knights	10.7	Ameco, Browning XM888, Kris 3302018, Lafayette HA39 HA42 HA45 HA46 Telstat50, Peterson HL44 UHF800 RM200, Sonar FR104 FR2515, Unimetrics HA39
JK A5	CTS Knights	10.8	Bearcat BCL 40-50 MHz
JK A6	CTS Knights	10.7	Sonar FR102
JK B1	CTS Knights	10.7	B&K Cobra PF1
JK B5	CTS Knights	10.8	Bearcat BCA air
JK B6	CTS Knights	10.7	Regency MC40 MCA100L DR200
JK C1	CTS Knights	10.7	B & J Cobra PF1, Lafayette HE51, Hammarlund FM50A, Midland 13-920, Realistic PRO1 PRO2, RPA30/50, Regency MR33D MR35B, Sonders Alert 152, Sonar 101
JK C5	CTS Knights	0.6	Electra Lil Tiger
JK D1	CTS Knights	10.7	Heath GR88
JK E1	CTS Knights	10.7	Heath GR98 air
JK F1	CTS Knights	10.7	Kris air
JK G1	CTS Knights	10.7	Plectron SM311 UHF
JK J1	CTS Knights	10.7	Plectron SM311 UHF, Teaberry RA800 UHF
MCS-1	MCS	10.7	Regency
MCS10	MCS	10.7	Regency
MCS-2	MCS	10.8	Bearcat
MRH-2	VHF-high	10.8	Bearcat
MRH-3	VHF-high	10.7	Sonar
MRL-1		10.7	Regency
MRL-2	VHF-low	10.8	Bearcat
MRU-1	UHF	10.7	Regency
P5	UHF	10.7	Regency
P-5SD		10.7	Regency
P77A		10.7	Regency
P77-AH	KDS	10.7	Regency
P-77UD	UHF	10.7	Regency
RCD-1		10.7	Regency
REG-TMR	Bomar	10.7	Regency
TMR		10.7	Regency
Z-13	PR	10.8	Bearcat

Table 2: Index to Scanner Reviews

Scanner Reviews 1/1996 - 7/2000

Alinco DJ-X10T -- NOV 1998
AOR AR16 -- AUG 1999
AOR AR7000 -- JAN 1999
AOR AR8200 -- OCT 1998
AOR's AR5000 -- DEC 1996
BC220XLT/BC230XLT -- APR 1996
BC235XLT -- JUL 1997
BC895XLT -- DEC 1997
Electra Tiger Scan TSA -- JUL 00
Harris RF-590 -- AUG 1999
Icom IC-R10 -- MAR 1997
Icom IC-R2 -- APR 1999
Icom R8500 -- JAN 1997
Opto DC442 Decoder -- JUN 1998
Racing Electronics RE2000 -- JUL 1999
Radio Shack PRO-2004 - MAR 1987
Radio Shack PRO-2006 - OCT 1990
Radio Shack PRO-2042 -- FEB 1996
Radio Shack PRO-2045 -- FEB 1997
Radio Shack PRO-2046 -- OCT 1996
Radio Shack PRO-2050 -- MAY 1998
Radio Shack PRO-2052 -- JUN 2000
Radio Shack PRO-2066 -- FEB 1999
Radio Shack PRO-64 -- AUG 1997
Radio Shack PRO-67 -- OCT 1997
Radio Shack PRO-91 -- DEC 1998
Radio Shack PRO-92 -- JAN 2000
Radio Shack PRO-94 -- MAY 2000
RCA RP-6150 --APR 1998
RELM HS200 -- APR 1997
RELM MS-200 -- MAR 1998
Sony ICF-SC1PC --AUG 1998
Sporty's JD-100 -- NOV 1997
Uniden BCT-10 -- JUL 1996
Uniden BC245XLT -- SEP 1999
Uniden BC248CLT -- DEC 1999
Uniden BC278CLT -- NOV 1999
Uniden BC800XLT - MAR 1986
Uniden SC-200 -- MAR 2000
Yaesu VF-500 -- FEB 2000

NOTICE: It is unlawful to buy cellular-capable scanners in the United States made after 1993, or modified for cellular coverage, unless you are an authorized government agency, cellular service provider, or engineering/service company engaged in cellular technology.

Smart Link Reaction Tuner

A slick timesaver for owners of a frequency counter, reaction tuning can automatically tune a receiver in to the frequencies detected by the counter by means of a cable interface. The Optoelectronics Scout can reaction tune devices which use a CI-5 or R8000 interface, but it could not be used with Uniden products. Smart Link now enables reaction tuning the Uniden BC245XLT from the Scout.

This allows a number of nifty scanning alternatives: The BC245 can be set to scan selected banks while the Scout captures and stores frequencies to be scanned later, or the BC245 can scan and store frequencies as they are captured by the Scout, or you can use the Scout alone to capture frequencies to be reaction-tuned later.

Powerful paging signals which impair reaction tuning can be locked out, whether real-time scanning or scanning stored frequencies. When listening to a mobile communication, the Repeater Finder feature will automatically search for and tune to the repeater using standard offsets. "You won't miss anything, you don't have to write frequencies down, and you don't even have to figure out the repeater frequencies," says the manual.

For a further time-saver, Smart Link can instantly download to your scanner commonly-used medical, FRS, GMRS, and itinerant channels. Smart Link is produced by Scanner Master (800-722-6701) and is available from Grove Enterprises (800-438-8155) for $69.95 plus shipping.

This Counter's Got it All

Optoelectronics has come out with the new Multicounter CD100 Counter/Decoder. The Multicounter combines a frequency counter and tone decoder in one handheld package. A great tool for the two-way radio technician, who can quickly check a whole fleet of portables for frequency and tone, the Multicounter is so easy to operate that even non-technical staff will find operation intuitive.

Internal memories can store all data for use or review on the Multicounter or for download to a PC through the optional Optolinx interface. The Multicounter can also reaction tune the ICOM R10, R7000, R7100, R8500, R9000, AOR AR8000, AR8200, and Optoelectronics Optocom, R11, OS456, OS456Lite, and OS535. (And the Uniden BC245, too, using the Smart Link interface.) Decodes CTCSS, DCS, LTR, and DTMF.

The CD100 features two line LCD display, simple single button controls, EL backlight, 4-hour NiCad operation, 100 Hz resolution, 10 MHz - 1 GHz frequency range. Cost is $399 from Optoelectronics, 800-327-5912 or visit **www.optoelectronics.com**

Receivers and Rumors of Receivers

AOR announced the AR8200IIB at the Dayton Hamvention in May – This unit has 1) better sensitivity, 2) higher dynamic range, and 3) brighter display. The AR8200IIB is expected to sell at $599.95 and will be available from Grove Enterprises (800-438-8155 or check out **www.grove-ent.com**). Expect to find the AR8200 at close-out prices.

AOR also announced the SR1050 surveillance receiver, expected to cost in the $4000 range. This is basically the AOR SDU5500, plus AR5000+3, plus power supply, plus speaker, all mounted in a 19" rack. The AOR JT2000 DSP radio receiver, due late this year, will compete with the WiNRADiO WR3100DSP. The new AR8600 desktop/mobile is essentially the same electronically as the AR8200 in a larger case.

Yaesu introduced the VR-5000 wideband receiver to compete with the AOR AR5000 and Icom R8500.

The Uniden 780XLT is expected to be available by September as is the Icom R3.

Alinco announced the DJX2T – a credit-card-sized scanning receiver.

It has been rumored for some time that a digital decoder is in the works. A reliable source has confirmed that Greg Knox is working on an APCO 25 (IMBE) digital board. But it will be expensive – in the $900 range.

The new Radio Shack PRO2067 is a base/mobile version of the PRO92, but with upgraded software. In spite of the widely-published complaints about the software on the original PRO92, Radio Shack says officially that of 90% of the sales tracked, only 3% were ever returned. That's a very low return rate.

The PRO92, now discontinued, will be followed by a PRO92A with upgraded software (the same as in the new PRO2067). Radio Shack is planning to offer an upgrade service for the old PRO92s.

IC-718 Makes HF Easy

ICOM America announced a new compact HF amateur radio – the IC-718. The IC-718 is designated an entry-level radio, but it offers advanced features rarely offered under $900, including direct frequency input, Voice Activated Transmission (VOX), Frequency Shift Keying (FSK), Digital Signal Processing (DSP), and 1 Hz tuning.

The front panel was designed with minimal knobs and buttons but is well organized in spite of its compact size. A front facing speaker and large LCD readout provide big, clear visual and audio information.

As a general coverage radio (.03-30 MHz), the IC-718 is meant for more than just communications. Enjoy listening to AM broadcast, maritime, and other HF services as well as Amateurs. 101 memory channels can be used for programming your favorite stations for scanning or quick recall. Band Stack Registers makes hopping around the bands a simple one button control, or the user may go directly to a desired frequency using the numeric keypad.

For those who have problems with RF noisy environments, the optional UT-106 DSP filter offers Auto Notch, Noise Reduction, and Noise Reduction Level controls.

To learn more about the IC-718 visit the ICOM America web site at **http://www.icomamerica.com/amateur/hf**

Let your computer do the Morse

A free software program called WinMorse v1.01 is available from **www.markbellamy.com/winmorse/** to turn text into Morse code. Like the online language translators, all you have to do is enter the chosen text into a field. Intead of producing written text or dots and dashes, however, this will create a standard windows Waveform audio file (.wav) in Morse code, for you to use virtually anywhere! You can choose the Words Per Minute (WPM) rate, the Audio Frequency, and the sample rate of the Wave file.

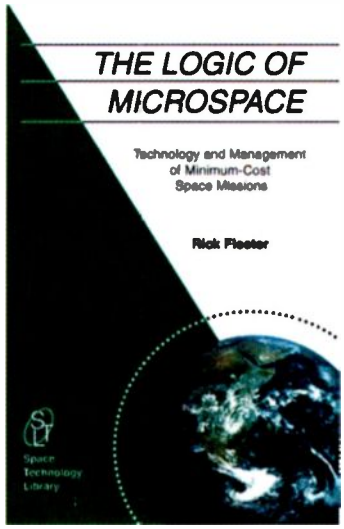
You can't use WinMorse to pass your code test, but it can be used as an aid to learning Morse code by letting you hear what Morse code letters and words sound like at different speeds and frequencies. You can also use the wave files to upload to your ham web pages or to send to your friends. The interface is very simple – all of the settings are on a single window, so you do not have to wade through a bunch of dialogs and menus to generate Morse code tones.

Beacon hunters and DXers will ask, "Can the process can be reversed to turn Morse code back into text?" Not yet, says the author, but because of popular demand he plans to include that feature in the next major revision.

Thanks to Axel Camp for this tip.

The Logic of Microspace

The Logic of Microspace, Technology and Management of Minimum-Cost Space Missions sounds intimidating, but author Rick Fleeter's style is anything but condescending. In fact, the text reads a little like Uncle Skip on three quarts



of coffee. Early on, the author puts you at ease with the assurance that "A junior high school class can build a satellite. That satellite can be observed and tracked in the night sky or heard on a radio for a few days as it orbits overhead. A single college class could build a satellite with a radio repeater, and a group of students working over several years can build a stabilized platform with a pretty capable computer, digital radios, and some scientific instrumentation."

This author goes back to basic theory with every subject he tackles. Flipping past the chapters on propulsion and "How to Get There," Chapter 7 brings us to familiar ground – "Everything You Wanted To Know About Radio." He points out the relevance of good old-fashioned analog radio: "Satellites have a few pesky qualities about them that make their dependence on radio rather significant. For one thing, they are far away. ... they are pretty useless if we can't exchange information with them." And he proceeds to describe the radio spectrum, propagation, Doppler effect, etc.

In the same inimitable style, Fleeter goes on to describe thermal dynamics, spin stabilization, and attitude control. Then he begins to talk about construction of the satellite itself – different kinds of memory systems, semiconductors,

power sources and consumption, part suppliers, software, the trade-offs between what one requires and what one can afford. He even gets into personal relations – how to market or explain your project to sources of funding, the dynamics of small workgroups, why NASA has its problems, etc.

Finally, as if you hadn't had enough fun, the 447-page book concludes with a novella – an imaginary view of what the world could be like if space were used for utiliarian purposes to make life better for people on earth, rather than for "its potential for religious inspiration and the pursuit of some hypothetical human destiny among the stars..."

Still, inspiration is what this book is about – a push to get people excited about the potential of low-cost, practical missions. Fleeter is founder of the small spacecraft company, AeroAstro, and has built more than 20 successful small satellites. For anyone trying to reach young people and get them excited about technical topics, this book will help get them thinking "outside the box" and relating to obscure theories in a way that makes them as everyday as ... well, radio.

The *Logic of Microspace* is published and distributed jointly by Microcosm Press (401 Coral Circle, El Segundo, CA 90245-4622) and Kluwer Academic Publishers (101 Philip Drive, Norwell, MA 02061). Paperback version around $30.

Recent Books from IRCA

When DXing mediumwave AM stations, the bottom line is getting a positive ID. The station may or may not cooperate by using its call letters, but almost all AM stations repeat the station slogan ad nauseum. The latest *AM Slogans List* from the International Radio Club has been completely revised by Rich Toebe and includes X-Band stations as well. This 24-page "DX Aid" can be yours for only $5.00 through the IRCA Bookstore. Non-IRCA/NRC members, add $1.00; Overseas, add $0.50.

IRCA Foreign Log #10 is $10.00 US from the IRCA Bookstore. Overseas, add $2.00 US for airmail delivery. This edition contains ALL the SDXM DXWW-E and DXWW-W tips from 9/96 to 7/99... almost three years of material! All collated and in frequency order by TA, PA and TP for each DXWW column.

A DXers Technical Guide. Now in its 3rd edition (published early 1998), this 155 page book answers questions on receiver and antenna theory (how to improve their performance), how audio filters and loop antennas can improve DX (and hints on their construction), how to build a Beverage and phasing unit, and much more. Only $10.00 for IRCA/NRC members, $12.00 for non-members (overseas airmail add $2.50).

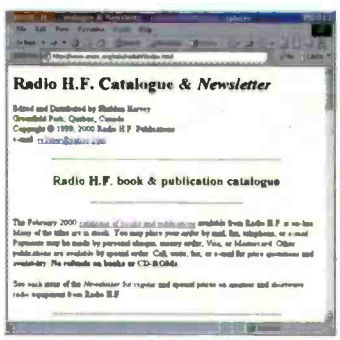
Send check or money order payable to Phil Bytheway, IRCA Bookstore, 9705 Mary NW, Seattle WA 98117-2334

Palstar 30 Filter Specs

Shortwave listeners ordering the Palstar R30 receiver (see review in June *MT*) have the option of having a Collins mechanical filter installed. Here are the specifications for the Collins high-selectivity SSB mechanical filter: (-6 -60 dB): 2.5/5.2 kHz (2.1:1 shape factor)

Radio HF Closes Storefront

Sheldon Harvey reports that although his storefront in Greenfield Park, Quebec, has been closed due to rising costs and a drop in amateur radio sales. Radio H.F. continues with all the same products but will be operating out of his home. Radio H.F. carries publications of Radio Amateurs of Canada, Radio Amateur du Quebec, the American Radio Relay League (ARRL), and Radio Society of Great Britain (RSGB), as well as a large selection of books on vintage receivers .



A full product catalog and new website should be available soon, but meanwhile you can view the book catalog on line at **www.anarc.org/cidx/radiohf/index.html**. RADIO H.F., P.O. Box 67063-Lemoyne, St. Lambert, Quebec J4R 2T8 Telephone & FAX: (450) 671-3773. CANADA only: 1-800-463-3773: ve2shw@yahoo.com

Books and equipment for announcement or review should be sent to " What's New?" c/o Monitoring Times, P.O. Box 98, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to mteditor@grove-ent.com.

While it would be tempting to say this is an all-weather test rig for kettledrums, in fact it's a microwave hub for a telephone network. The purpose is to combine thousands of telephone calls by multiplexing them on a microwave radio link rather than to have to provide hardwire lines for them. (Photo submitted by Al Shack, Simi Valley, CA)

MT REVIEW

Hamtronics R121 Aviation Receiver Module

By Bob Grove, W8JHD

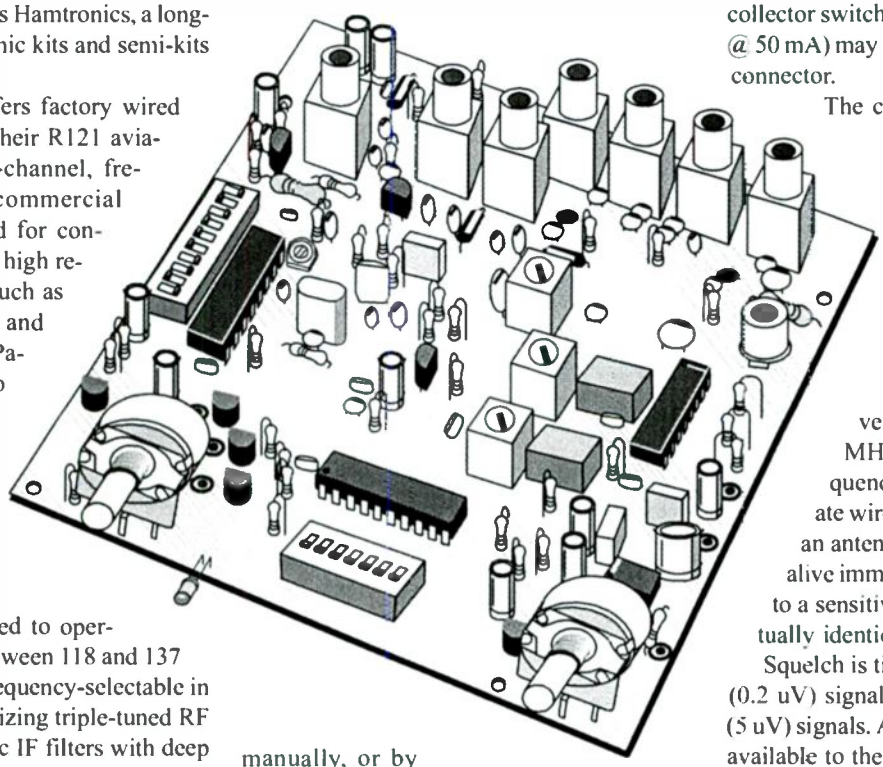
We often hear complaints that there just aren't any good kits around anymore for those inveterate experimenters who like to have the pride of "rolling their own." With the demise of Heathkit, Lafayette, EICO, and many other companies that catered to this elite and inquisitive group, few sources of good kits are left. A happy exception is Hamtronics, a long-time provider of electronic kits and semi-kits for the radio enthusiast.

Hamtronics also offers factory wired instruments, including their R121 aviation receiver, a single-channel, frequency-synthesized, commercial grade receiver intended for continuous operation under high reliability requirements, such as small airports, search and rescue teams, Civil Air Patrol, and amateur radio communications support groups. The receiver is available as an unenclosed circuit board or in a factory-formed box.

The R121 is designed to operate on any frequency between 118 and 137 MHz, AM mode, and frequency-selectable in 25 kHz increments. Utilizing triple-tuned RF circuits and dual ceramic IF filters with deep skirts, this radio provides excellent immunity to adjacent channel interference (80 dB down) and intermodulation.

The receiver is contained in an optional anodized aluminum cabinet with mounting flanges. The only controls are volume and squelch; a red LED indicates power applied since there is no on/off switch. It also signals operation of its alarm, test mode, and slave circuits (discussed below). An SO239 connector accepts a PL-259 equipped coax from the antenna (not supplied), and a DB9 computer-type connector provides a variety of interface options.

A low-noise FET front end results in an overall sensitivity on the order of 0.2 microvolts, but this radio is intended for more than just listening to pilot chatter. Frequency selection is made by binary-coded DIP switches; the code is calculated manually, or by visiting the Hamtronics web site look-up tables.



For pilot-controlled runway light operation, the R121 can be programmed to respond to a microphone being keyed three, five, or seven times in any five second period. Those lights can also be programmed to remain on for up to 15 minutes, and even varied in intensity.

Perhaps most important, this is an ideal emergency locator transmitter (ELT) monitor. Set on 121.5 MHz, an alarm can be triggered after a predetermined time once a carrier is detected; it can automatically reset itself after the signal drops out.

Power (13.6 VDC @ 200 mA nom.), 8-ohm audio to an external speaker (there is no internal speaker), S-meter voltage (for driving a 1 mA meter, or more sensitive with a shunt resistance), and three separate open-collector switching transistors (up to 15 VDC @ 50 mA) may be interfaced through the DB9 connector.

The circuit is designed to operate properly even under adverse temperature conditions, allowing +/-20 ppm frequency stability from –30 to +50 degrees C.

Our Test

We ordered an enclosed version, factory set for 119.675 MHz, a local air-to-ground frequency. Connecting the appropriate wires to a speaker and power, and an antenna to the jack, the radio came alive immediately. Comparing reception to a sensitive scanner, reception was virtually identical.

Squelch is tight, responding to very weak (0.2 uV) signals, yet adjustable for stronger (5 uV) signals. Audio is plentiful, with 2 watts available to the external speaker.

The quality of workmanship is indisputable. Jerry Vogt, owner of Hamtronics, has earned the respect of his colleagues for the quality of his products. And it shows in the R121.

(R121 wired and tested, $209; installed with connectors in metal cabinet, $299. Hamtronics, 65MT Moul Road, Hilton, NY 14468-9535. Web site **www.hamtronics.com**, e-mail *jv@hamtronics.com*.)

Ads for **Stock Exchange** must be received 45 days prior to publication date. All ads must be paid in advance to *Monitoring Times*.
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1-3/4" SQUARE DISPLAY AD: $50 per issue if camera-ready copy or, $85 if copy to be typeset. Photo-reduction $5 additional charge. For more information on commercial ads, contact Beth Leinbach, 828-389-4007.

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Monitoring Times assumes no responsibility for misrepresented merchandise.

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Closing Comments

By Bob Grove, Publisher

Will There be a Digital Scanner? APCO 25, the Wild Card

Digital Encryption Standard (DES), Digital Voice Protection (DVP), and similar encryption modes intentionally obscure communications for privacy purposes and it is unlawful for interceptors to decode them. On the other hand, AMTOR, PACTOR, RTTY, FECTOR, ARQ, CW, SITOR, and dozens of other digital modes use public algorithms (codes) for spectral efficiency and communications reliability. Privacy is not an issue, and it is lawful to decode them.

Enter APCO 25, a nationwide digital standard proposed by the Association of Public-Safety Communications Officials International, Inc. It has four levels of analog and digital processing, with the higher levels intended to restrict access. But what about the lower levels? A recent issue of their magazine, *Public Safety Communications* (May 2000) provides some insight.

In a prominently-displayed article entitled, "An Old Nemesis Resurrected —Trunked Radio Systems' Vulnerability to Scanners Then and Now," Kirk Miller, communications specialist for a telecommunications consulting firm, draws the battle lines by likening criminals who use scanners to Japanese attempts to break the Navajo code during World War II. A somewhat over-dramatic comparison, to be sure. However, he occasionally speaks respectfully of scanner listeners: "Volunteers often use scanners to stay abreast of breaking events and monitor dispatch channels."

It would have been nice if Miller had reflected on the myriad cases where scanner listeners have assisted law enforcement by providing license numbers, locations, descriptions, and other valuable information which have assisted in the apprehension of suspects. And how scanners are consistently used by civilian auxiliaries who assist in public safety missions during disasters and other emergencies. But Miller has a product to sell, and his bias is understandable.

Instead, Miller compares these beneficial uses to illegitimate interceptors: "...scanners can be used for criminal purposes as well as lawful ones. Throughout the law enforcement community, stories abound of criminals using scanners to evade police." Of course there's no data presented as to whether the blaring sirens of the arriving vehicles may have provided some advance notice as well!

The author also wisely points out that scanner laws only discriminate against recreational listeners; criminals will break the law anyway. He therefore suggests that police return to "good, old-fashioned radio protocol." But for a more complete solution he recommends "the implementation of scanner-resistant technologies..." Miller says more and more jurisdictions are moving to the digital APCO Project 25 standard. "This move is for numerous reasons other than just disabling the potential danger of scanners, but that is one beneficial side effect."

He points out that "a more forceful, nationwide approach would be for the FCC to prohibit... the manufacture of scanners with the ability to scan public safety frequencies." However, since the FCC says it is legal to intercept most radio transmissions, including public safety, he states he doesn't think that will happen.

Or will it? Contrary to his statement, none of these issues is up to the FCC; their role is to interpret and enforce telecommunications law enacted by Congress. House Telecommunications Subcommittee Billy Tauzin (D-LA) told me that top-ranking law enforcement officials would like to see such a sweeping prohibition. Though the author is not a law-enforcement official, if his attitude is shared by the founders of the APCO 25 standard, their influence could be significant. Only through vigilance on our part and political activism through our representatives can we assure the survival of our hobby, guarantee public safety volunteers the ability to monitor relevant communications using affordable scanners, and allow the public to keep an ear as well as an eye on their public servants.

Stay tuned.

Markey Gets His Due

Many Americans expressed their revulsion over the way the scanner hearings in Washington were conducted by the House Telecommunications Subcommittee in January 1997. None of the political puppets was as vocal or obnoxious as Edwin Markey (D-MA).

As the author of much of the repressive wording of the anti-scanner portions of the FCC Rules and Regulations, Markey strutted back and forth, mistaking his own pomposity for oratorical eloquence.

Markey was particularly miffed when I pointed out deficiencies in his regulations. Misusing his position of trust as a personal platform (or, as Washington wags call it, a "photo op"), Markey pointed his long, boney finger at me, and in his best sepulchral tone, threatened from his lofty perch, "You will see scanner sales drop precipitously!"

He was playing, of course, to one of his principal sponsors, the Cellular Telecommunications Industry Association (CTIA).

But Markey's self-serving antics haven't gone unnoticed. Recently, some of his more refined Congressional colleagues have gone public with their disapproval of his personal agenda. The *Boston Herald* (June 7, 2000) quotes Massachusetts GOP Chairman Brian Cresta calling Markey a "poster boy for campaign reform" because of his enormous consumption of income from special interests.

"He's the master at raising special interest money," Cresta continued. "Markey is a prime example of why voters are sick of the process." Cresta specifically referred to Markey's influential position on the House Telecommunications Subcommittee, and noted that he had hit the million dollar mark this spring.

The *Herald*'s article refers to a study by the nonpartisan watchdog group Center for Responsive Politics which points out that nearly half of Markey's campaign wealth is derived from contributions from the telecommunications industry. But Markey rebutted the implication, insisting that the positions he takes on the subcommittee are not swayed by the money he receives from industry. Right.

Interestingly, his own district doesn't support him much; almost three-fourths of Markey's political donations are from outside his own state. Apparently he collected $35,500 in Colorado from a single fund-raising dinner hosted by EchoStar's CEO Charles Ergen only five weeks after his successful passage of a law benefiting the satellite industry. Just a coincidence, I'm sure.

But it's hard to single out Edward Markey in the Washington money market. There are so many politicians, and so much tainted cash to be had. The temptation is irresistible to those who are willing to sell out to the highest bidder.

It's an election year, and the seat for Massachusetts District 7 is at stake. Are there any statesmen available?

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