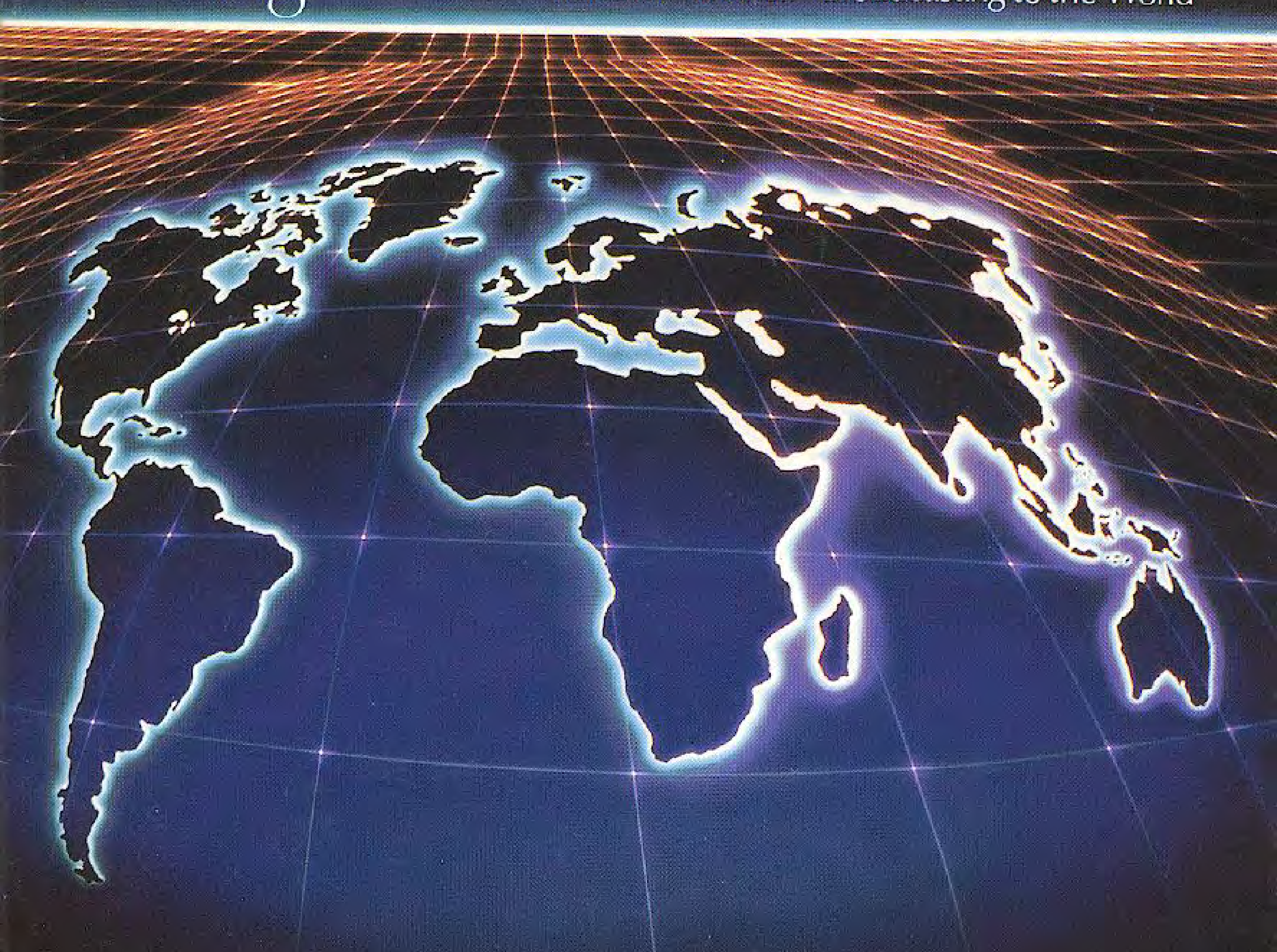
A Guide to Radio Listening

Voice of America "Broadcasting to the World"



Preface

Around 20 years ago, an older cousin of mine came into the possession of an odd-looking piece of equipment with many dials, knobs, and switches. He did not know what it was, nor did he want it, so he gave it to me.

That's how I got my first shortwave radio. Encased in a gray metal cabinet, it was a weighty set with vacuum tubes (valves) and a cumbersome mechanism for tuning. It was a typical shortwave radio of its day.

My favorite time for listening to the bulky gray radio was at night. There was something mysterious about hearing the variety of broadcasts that reached me from places thousands of kilometers away. But, like my cousin, I lacked an understanding of shortwave radio. Eventually, the mystery and novelty of this device wore thin, and I was left with a sense of frustration.

We know that listening to shortwave and long-distance medium wave can be difficult from time to time. This is why we have published this ***VOA Guide to Radio Listening.*** This booklet will help you grasp the basic principles of radio, including shortwave and medium wave broadcasting. You will learn how radio signals travel, why reception conditions change, what to look for when purchasing a radio, and how to build a simple antenna.

The final section of this handbook describes what VOA is doing to improve your reception of our broadcasts. We are now engaged in a major modernization program to improve VOA's technical capabilities. This effort will take several years to complete and will cost hundreds of millions of dollars.

But even after VOA's powerful new transmitters are in operation, there may still be times when our signals will be difficult to hear. Don't give up. Every experienced shortwave listener has encountered difficult and frustrating reception conditions. But they also have the knowledge and inventiveness to cope with these challenges.

This handbook will give you a basic knowledge of radio. It also helps to have patience. So, please, keep trying. Experiment with your radio. Soon you will discover the best times and frequencies for reception, and you will learn what kind of antenna provides the best reception.

As your efforts continue, so will ours: to bring you accurate, objective, and comprehensive news, lively informational programs, entertainment ... and soon a stronger and clearer signal.

Gene Reich
Producer and Host of VOA's
Worldwide Shortwave Spectrum

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by Kim Andrew Elliott
Director, Audience Research, VOA

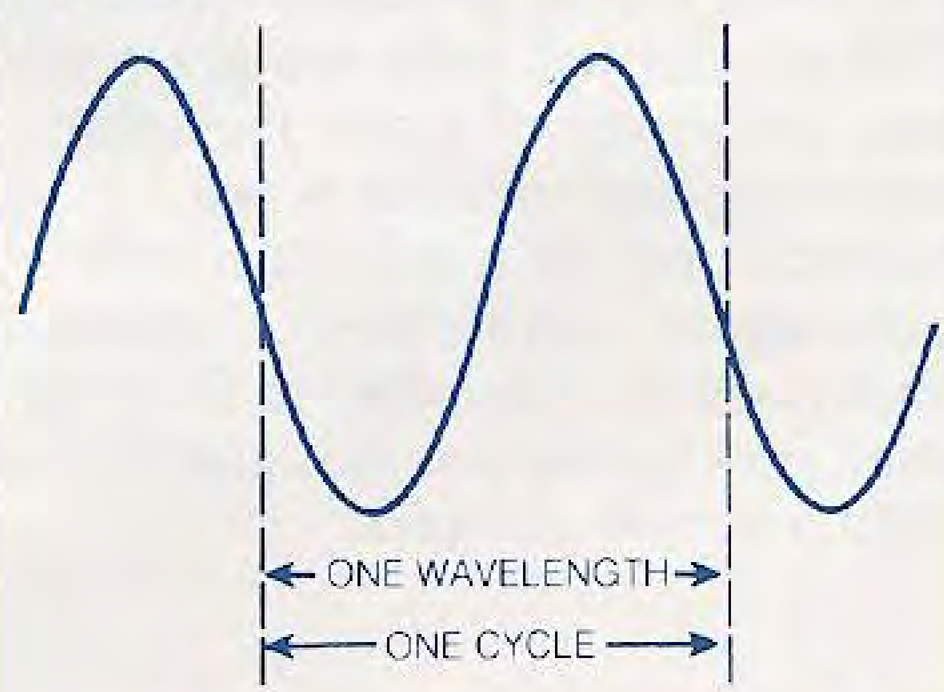
I. Radio Energy and the Radio Spectrum

Radio is a form of electromagnetic energy-waves that travel at 3 million meters per second (the speed of light). If you drop a pebble on a smooth surface of water, the ripples that result provide a good picture of what radio waves might look like (although radio 'ripples' travel much faster!).

Radio energy can be used to transmit voices, music, and all sorts of information through the air or even through the void of outer space. Your radio receiver converts electromagnetic energy back into sounds you can hear.

Wavelength. All radio waves travel at the speed of light but they vary in length from thousands of meters to fractions of a centimeter. This is important, because the length of a radio wave largely determines how far and in what manner it will travel. The **wavelength** of a radio signal is usually measured in **meters.** (See Figure 1.)

Figure 1



A sine wave, which is an abstract representation of a radio wave.

Frequency. A radio wave can also be thought of as a **cycle** of radio energy. (Again, see Figure 1.) This brings us to **frequency,** a more modern way of measuring radio energy. Frequency is the number of ***cycles*** (or waves) ***per second*** emitted from the source of the radio energy. By international agreement, **hertz** is the unit meaning 'cycles per second.' (Heinrich Hertz was an important early radio experimenter.) A thousand cycles per second is a **kilohertz** (kHz.), and a million cycles per second is a **megahertz** (MHz.). (One megahertz equals 1,000 kilohertz; thus, for example, 9.58 MHz. would equal 9580 kHz.)

Comparing frequency and wavelength. Wavelength and frequency are two ways of measuring the same thing—radio waves. As frequency gets higher, wavelength gets smaller. This makes sense when you think about it: Since all radio waves travel at the same speed, twice as many radio waves 10 meters in length can be emitted per second than radio waves 20 meters in length. (A wavelength of 10 meters equals a frequency of 30 MHz.; a wavelength of 20 meters equals a frequency of 15 MHz.)

The tuning dial on your radio may indicate frequency in MHz. or kHz., or wavelength in meters (M). Although many radio dials show both frequency and wavelength, the trend in modern radios is to indicate only the frequency.

Table 1 The Radio Spectrum

Frequency	Wavelength	Designation	Remarks
Below 30 kilohertz	Above 10,000 meters	Very Low Frequency (VLF)	
30 to 300 kHz.	10,000 to 1,000 M.	Low Frequency (LF)	Includes the longwave broadcast band (155 - 281 kHz.)
300 to 3,000 kHz.	1,000 to 100 M.	Medium Frequency (MF)	Includes the medium wave broadcast band (531 - 1603 kHz.)
3,000 to 30,000 kHz. (3 to 30 MHz.)	100 to 10 M.	High Frequency (HF)	Includes the shortwave broadcast bands
30 to 300 megahertz	10 to 1 M.	Very High Frequency (VHF)	Used by FM radio and some television
300 to 3,000 MHz.	1 to .1 M.	Ultra High Frequency (UHF)	Used by some television
3,000 to 30,000 MHz.	.1 to .01 M.	Super High Frequency (SHF)	Used by satellite-to ground links
30,000 to 300,000 MHz.	.01 to .001 M.	Extremely High Frequency (EHF)	Also used for satellite communication

Above 300000 megahertz (300 **giga**hertz), electromagnetic energy is manifest as (in ascending order of frequency): infrared radiation, light, ultraviolet radiation, X rays, gamma rays, and cosmic rays.

How Radio Waves Travel

As stated before, radio waves at different frequencies or wavelengths behave in different ways. (See Table 1 for a description of the different segments of the radio spectrum.) There are three basic types of radio propagation—groundwave, skywave, and direct wave (see Figure 2). Each type is prevalent at different frequencies.

Groundwave transmission occurs when radio waves follow the curvature of the earth. This is most common at the lower radio frequencies, up to 3,000 kHz. The lower the frequency, the farther a groundwave will travel. For example, a radio signal at 500 kHz. travels much farther than a signal at 1500 kHz. using the same amount of power.

Skywave. Radio signals can also be aimed upward to the **ionosphere,** a layer of the atmosphere about 50 to 400 kilometers above the earth. Under the right conditions, these signals will be refracted back to earth, allowing radio signals to travel great distances. Skywave works at frequencies above 300 kHz. and up to about 30,000 kHz., depending on various conditions. In general, skywave works best at night on the lower frequencies (below 12 MHz.) and during the day on the higher frequencies. Skywave is also affected by the season of the year, because there is more darkness in the winter and more daylight in the summer.

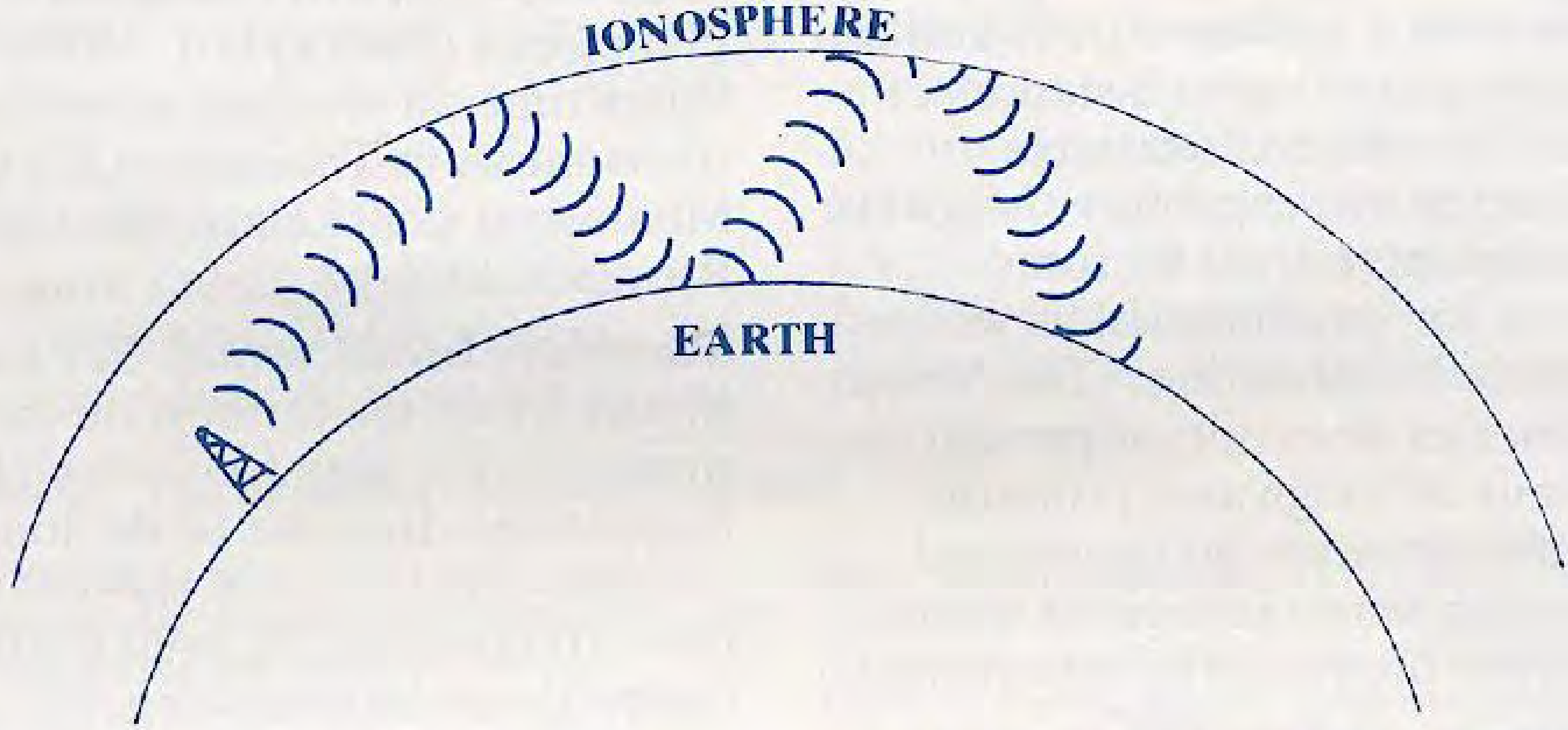
Another influence on skywave transmission is solar activity, particularly sunspots. Sunspot activity follows a cycle of 11 years (more or less). Late 1986 was the low point in the current cycle, with the next peak due in 1992. Higher shortwave frequencies work better during periods of high sunspot activity, lower frequencies are favored during low sunspot activity.

The characteristics of skywave transmission are further complicated by the geographic locations of the transmitter and receiver. North-south transmissions often behave differently than those which are east-west. Furthermore, skywave signals which cross over polar regions are often disrupted by unfavorable ionospheric conditions.

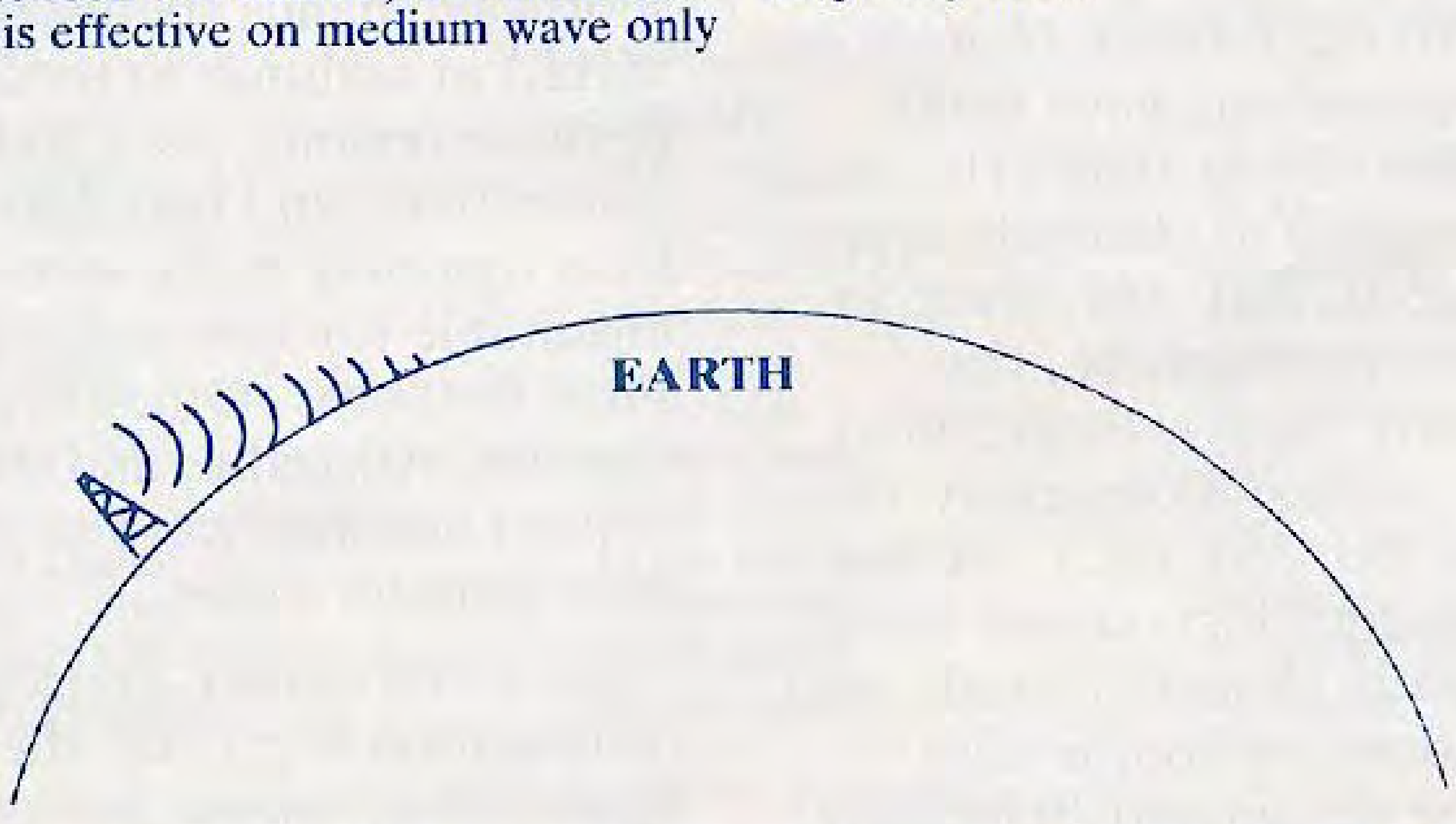
Direct wave. Above 30 MHz., skywave is much less common. Furthermore, at these higher frequencies radio waves tend not to follow the earth's curvature but travel in a straight line. For this reason, a radio transmitter must almost literally 'see' where it is broadcasting. This is why television and FM radio antennas, which use these very high frequencies, are placed as high above ground as possible.

Figure 2

Groundwave transmission follows the curvature of the earth. It is most prevalent at frequencies below 3,000 kilohertz, which include the longwave and medium wave broadcast bands.



Skywave transmissions refract off the ionosphere and thus can be heard long distances from the transmitter. It occurs mostly between 300 and 30,000 kilohertz. Skywave is effective on medium wave only at night. On shortwave (3,000 to 30,000 kHz.), skywave has longer range and works throughout the day, depending on the frequency used.



Direct wave transmission follows a straight line. It occurs mainly above 30 megahertz, in the range of frequencies used by television and FM broadcasting.

II. The Broadcast Bands

By international agreement certain segments, or 'bands,' of the radio spectrum have been specifically allocated for broadcast purposes. **Broadcasting** refers to the direct, one-way transmission of information or entertainment to the general public.

Longwave broadcasting. In some parts of the Eastern Hemisphere, longwave (or low frequency/LF) frequencies from 150 to 285 kHz. are used for broadcasting. For example, the BBC has a station on 200 kHz., and Algeria broadcasts on 254 kHz. Longwave stations have high power (some with 2 million watts!) and can send groundwaves to distances of several hundred kilometers. Because of this capability, longwave broadcasting is used by some stations for international as well as domestic broadcasting. (The Voice of America does not, at present, transmit on longwave, primarily because there are no unassigned unused channels in regions where longwave broadcasting is prevalent.)

Medium wave broadcasting. Medium wave is the best known and most widely used broadcast band. It is known as the 'AM' band in North America. In the Eastern Hemisphere, the medium wave band extends from 525 to 1605 kHz., with stations assigned to channels every 9 kHz. (i.e., 531, 540, 549, etc.). In the Western Hemisphere, the medium wave band is from 535 to 1605 kHz., with stations every 10 kHz. (540, 550, 560, etc.). (A few stations transmit just outside these internationally allocated bands, and some broadcast on frequencies between the designated channels.)

Medium wave signals travel by groundwave, from just a few miles to over 150 kilometers, depending on transmitter power, terrain, soil conductivity, etc. Medium wave signals can also be propagated by skywave, but only during darkness. At night, it is possible to hear medium wave broadcast stations thousands of kilometers away. For this reason, medium wave is often used for international as well as domestic broadcasting.

VOA has medium wave transmitters in West Germany (1197 kHz.), Greece (792 and 1260 kHz.), Botswana (621 kHz.), Belize (1530 kHz. and 1580 kHz.) and the Philippines (1143 kHz.). VOA also leases time on medium wave transmitters in Thailand (1575 kHz.), Montserrat (930 kHz.), and Costa Rica (930 kHz.).

Shortwave broadcasting. Skywave signals travel the farthest on the shortwave (or high frequency/HF) frequencies. Because of the long distance capabilities of shortwave, these frequencies are used for most international broadcasting.

Shortwave is also used for some ***domestic*** broadcasting. Certain countries in the tropics use the lower shortwave bands (between 2 and 5 MHz.) in addition to medium wave. In these regions, poor soil conductivity and high levels of static from lightning make medium wave unsuitable for broadcasting beyond short distances. Other countries (e.g., Canada, Australia, and the Soviet Union) use shortwave to broadcast to their remoter areas.

As noted earlier, shortwave propagation is greatly affected by time of day, season, sunspot activity, and geography. Higher frequencies are best during the daylight hours; lower frequencies are better at night. This is why shortwave stations change frequencies during the day. They may also change frequencies as the seasons change. Lower frequencies are used more during the winter when the nights are longer; the opposite is true for the summer.

Sunspots, which greatly affect shortwave reception, vary according to an 11 year cycle. An ebb in sunspot activity is expected to occur late in 1986. This will result in generally poor propagation on shortwave frequencies above 12 MHz. The next sunspot peak is expected around 1992, when higher frequencies will provide better reception.

You can observe the effects of daylight versus darkness on your shortwave radio. At dusk, tune around the 6 MHz. (49 meter) broadcast band. At this time of day, there is darkness to the east of you, and daylight to your west. Since 6 MHz. signals propagate better at night, you will be hearing mostly stations to the east. If you tune to the 6 MHz. band at dawn, you are more likely to hear stations to the west, where darkness now prevails. The opposite would occur at higher frequencies, such as the 17 MHz. band.

Table 2 shows the shortwave frequencies allocated to international or tropical domestic broadcasting. The remaining shortwave frequencies are used by other types of communications, including aeronautical and maritime messages and amateur radio. Some broadcast stations operate outside the bands allocated for broadcasting, usually within 200 kHz. above or below these bands. (A provision of the international radio regulations allows this, provided there is no interference to

Table 2 The Shortwave Broadcast Bands

The frequencies listed below are allocated, by international agreement, for **broadcasting** (as opposed to other types of radio communications). These bands are used for international broadcasting, except for the 120, 90, and 60 meter bands, which are intended for domestic broadcasting in tropical countries. As a result of the World Administrative Radio Conference of 1979, some of the broadcast band frequencies will change at a date to be determined by an international radio conference to be held in January 1987.

Frequencies in Kilohertz (present)	Frequencies in Kilohertz (future)	Meter Band Designation
2300-2495	2300-2495	120 Meter (Tropical)
3200-3400	3200-3400	90 Meter (Tropical)
3900-4000	3900-4000	75 Meter*
4750-5060	4750-5060	60 Meter (Tropical)
5950-6200	5950-6200	49 Meter ~~(Tropical)~~
7100-7300	7100-7300	41 Meter*
9500-9775	9500-**9900**	31 Meter
11700-11975	**11650-12050**	25 Meter
(new band)	**13600-13800**	22 Meter
15100-15450	15100-**15600**	19 Meter
17700-17900	**17550**-17900	16 Meter
21450-21750	21450-**21850**	13 Meter
25600-26100	**25670**-26100	11 Meter

*Used for international broadcasting in the Eastern Hemisphere only.

Some broadcast stations operate outside these officially allocated bands, especially on frequencies just above or below the bands (plus or minus about 200 kilohertz).

non-broadcast stations registered in the international table of frequency allocations.)

Some of the shortwave broadcast bands will expand in the late 1980's, as shown in Table 2.

Shortwave broadcast stations use channels spaced every five kHz. (e.g., 9505, 9510, 9515, 9520, etc.)

Even though shortwave radio signals can travel long distances, there are limits to how far shortwave broadcasts can be heard reliably. For this reason, some international broadcast stations maintain relay stations outside their home countries.

VOA uses shortwave relay facilities in West Germany, Greece, Liberia, Morocco, the Philippines, Sri Lanka, and the United Kingdom. VOA programs are fed by satellite from the United States to the relay sites.

Television and FM radio broadcasting. Television and FM radio broadcasts are transmitted at frequencies above 30 MHz., in the VHF and UHF portions of the spectrum. Although signals at these frequencies travel shorter distances (generally not more than 100 kilometers), there is room here for the wide swaths of radio spectrum needed for television and FM radio transmissions. Television channels are at various frequencies, depending on the country involved. For example, channel 2 in the United States is from 55.25 to 59.75 MHz., which includes both the video and audio portions of the signal. The most common FM radio broadcast band is from 88 to 108 megahertz, although Japan uses 76 to 89 MHz., and the Soviet Union 66 to 73 MHz.

III. Radio Receivers and Antennas

Choosing a radio. In most places, it is not difficult to find radios with at least one shortwave band. It is, however, more of a challenge to find a reasonably-priced shortwave radio of sufficient quality to provide reliable reception of distant stations. Here are a few tips to help you select a shortwave radio:

Shortwave emphasis. There are a great many multi-purpose radios which feature a cassette tape recorder in addition to shortwave and medium wave reception. However, the best shortwave radios concentrate on good shortwave reception and do not have built-in cassette recorders. If you want to record what you hear, most good shortwave radios have a tape recorder output jack or an earphone jack, which you can connect to the microphone or auxiliary input of a tape recorder.

If you are also interested in medium wave listening, most good shortwave radios also perform well on the medium wave frequencies.

Frequency coverage. A good shortwave radio should cover as many of the shortwave broadcast frequencies (listed in Table 2) as possible. It should at least receive the broadcast bands between 6 and 22 MHz. (49 through 13 meters).

Frequency display. The best shortwave radios have digital frequency display, in which the frequency is shown by means of illuminated numbers. Digital sets tell you exactly what frequency you are tuned to, but they are rather expensive. The other (and more common) type of frequency display is non-digital or 'analog,' usually involving a slide rule type of dial. Among analog radios, there are two basic kinds. The first type picks up an entire range of shortwave frequencies, say from 4 to 18 MHz., which includes other forms of radio communication as well as broadcasting. The second type receives only those segments of the shortwave spectrum allocated to broadcasting. Because radios of the second type tune across narrower ranges of frequencies, they are usually able to separate the stations better in the crowded shortwave broadcast bands.

Dual conversion. A shortwave radio with dual conversion circuitry (also known as 'double superheterodyne') provides superior performance and reduces much of the interference common to shortwave listening. Most shortwave radios with dual conversion state this on their front panels, or at least in their advertising brochures.

Sensitivity. A shortwave radio capable of receiving weak signals from distant stations is considered 'sensitive' (rather than 'powerful'). If you are shopping for a shortwave radio, listen to a weak signal on more than one model and compare the audibility of the signal. (This test is valid only if the receivers are at the same location and use comparable antennas.) It may be possible for a receiver to be *too* sensitive, thus allowing strong signals to appear at several frequencies where they should not be. (See the discussion of overloading in the antenna section, below.)

Selectivity. Selectivity is the ability of a radio to provide an audible signal from a station on one frequency without interference from stations on adjacent frequencies. This is very important, given the increasingly crowded conditions in the shortwave broadcast bands. We will not attempt to explain how selectivity is measured. If you find a shortwave radio that advertises its good selectivity, chances are that it will provide above-average reception. Also, try to compare several receivers before you buy one. Note how well they separate stations on adjacent frequencies.

Ease of tuning. To be sure, tuning a shortwave radio will always take a bit more effort than tuning to local stations on a medium wave set. Nevertheless, some shortwave sets are easier to tune than others. You might want to avoid a shortwave radio that takes a long time to tune from, say, 6100 kHz. to 17800 kHz. And you may not want a radio that has too many buttons and dials for tuning.

Audio quality. Some shortwave radios have good sensitivity and selectivity, but have poor audio fidelity. This can make voice broadcasts difficult to understand and music unpleasant. Don't expect high fidelity from a shortwave radio, but do listen to determine if it will bring you reasonably comfortable listening. On the other hand, good selectivity and sensitivity are worth some sacrifice of audio quality.

Shortwave radio manufacturers. Manufacturers of portable radios designed for good shortwave reception include General Electric, Grundig, Philips, Panasonic/National, Sony, and Toshiba.

Antennas

A good antenna can greatly improve your reception of distant radio stations. But with some shortwave radios (including many that feature cassette recorders and hi-fi speakers), a large antenna can also let signals from nearby radio or television stations appear on your dial where they do not belong. This is known as 'overloading.'

The built-in whip antennas on many portable shortwave radios are designed for optimum sensitivity. You can often improve the performance of your radio just by placing it close to a window, or near an outside wall. You can also place your radio next to an electrical appliance (telephone, lamp, etc.); the appliance and surrounding wires thus act as an antenna. On the other hand, this technique may make reception worse if the electrical device is a source of interfering radio noise. (Do not let your radio or antenna touch any bare wires or metal that have electricity running through them.)

Fortunately, antennas for shortwave listening do not require precise or complicated designs. For listening, any random length of wire or metal is worth trying (as long as it does not have current from your electric mains or telephone systems running through it). You can connect a few feet of wire to the antenna terminal of your radio and extend it near a window, along a wall, in an attic, or outside. If your radio does not have an antenna terminal, you can use an 'alligator' clip or similar clamping device to secure the wire to your radio's built-in whip antenna. Instead of wire antennas, some shortwave listeners have used bed springs, metal window screens, water pipes, and even aluminum foil, with varying degrees of success. High-conductivity metals such as copper or aluminum work best, but any conductive metal can be used.

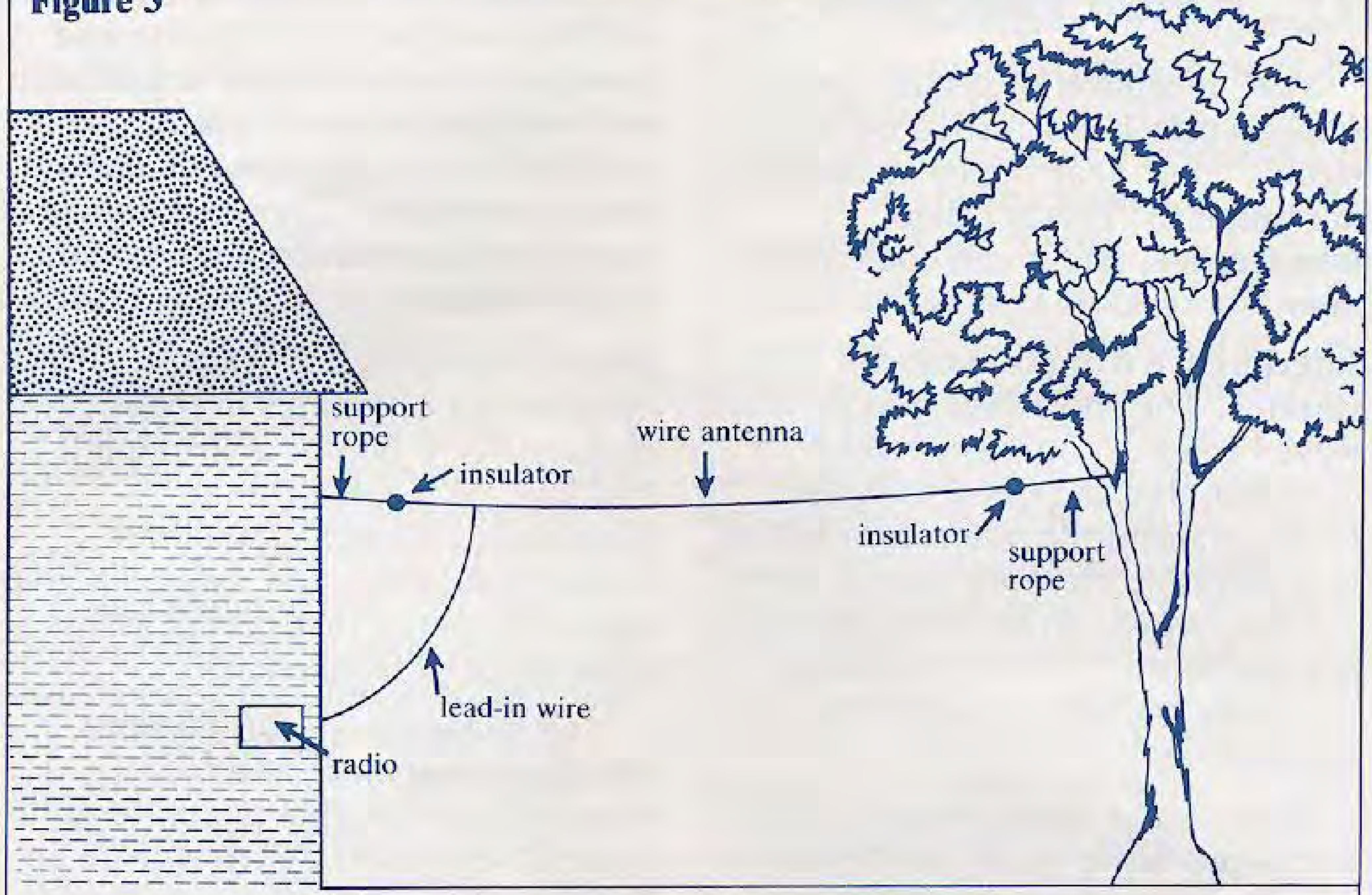
You can determine how big an antenna may be used with your radio by trying out the longest piece of wire that can fit in or around your home. If your radio becomes overloaded with signals from nearby stations, reduce the length of the antenna wire until the overloading drops to a reasonable level. Or you can try connecting the antenna to your radio indirectly by coiling insulated wire around your built-in whip antenna. (Insulated wire has some kind of material, usually plastic, covering it.) The more turns you make, the more sensitive your radio becomes. If it becomes *too* sensitive, picking up too many unwanted strong signals, then reduce the number of turns.

If you find that a fairly large antenna does not cause overloading problems, you might consider erecting a more permanent outside antenna.

The most common antenna for general shortwave listening is the random wire antenna (sometimes called an 'inverted L'). (See Figure 3.) The antenna itself is a length of wire (at least six meters long) mounted as high as possible. The wire can be secured between a house and a tree, between two trees, or between any two safe and sturdy supports.

The antenna should be made of copper wire, although any conductive metal wire is suitable. It can be insulated or uninsulated. But if you

Figure 3



A typical random-length antenna is as long and as high as possible. Do not allow the antenna or lead-in wires to extend above or below electric power lines.

live near the sea or near areas of heavy industry, insulated antenna wire (especially enameled copper wire) will help prevent corrosion. The antenna wire should not be attached directly to the supports, or radio energy will be lost. Instead, suspend the antenna at both ends using rope or more wire; these should be separated from the antenna by ceramic insulators or any other object made of nonconductive material (such as plastic).

The radio energy from the antenna is fed to your radio by another single wire. The junction between the lead-in wire and the antenna should be soldered, if possible, to make the best electrical connection. (Use solder designed for electrical work.) If it cannot be soldered, clamp it securely. From time to time remove rust and corrosion from the connection. The lead-in wire should be insulated to prevent loss of radio energy to objects it may brush against (especially the wall of your house).

Very important: Do not extend your antenna or lead-in wire above or below electric power lines. If a power line should touch your antenna system, high voltage could travel into your radio, causing serious damage or injury.

When lightning is in your area, disconnect any outside antenna from your radio. There are commercial lightning arrestors available, but these cannot guarantee you or your radio protection from direct lightning strikes. It is also a good idea to unplug your radio from electric mains sockets during lightning storms, as electricity from lightning strikes can also enter your radio by this means.

IV. Radio Interference

Your reception of distant radio stations may be disturbed by other signals on or near the frequency you are tuned to. This is called **interference,** and it can come from many sources.

Interference from other radio stations. The shortwave and medium wave broadcast bands are very crowded, and the trend towards higher transmitter power is resulting in greater interference among radio stations. Most of this interference is not deliberate; it is just the result of too many stations vying for too few frequencies.

There is not much you can do to overcome this type of interference except to tune very carefully, and retune occasionally, because some radios tend to drift off frequency. Also, try all of the frequencies used by the station you wish to listen to, including frequencies not specifically directed to your area.

There is a technique you can try on **medium wave** to reduce interference. On most radios, the antenna for medium wave is inside the radio. This antenna has directionality; that is, it gets best reception from stations whose signals are perpendicular (broadside) to the radio. By turning the radio, you might be able to 'null out' interference from unwanted stations.

Deliberate interference is known as **jamming.** The great majority of jamming transmitters are in the Soviet Union and Eastern Europe, where jamming is used to try to prevent people from hearing some VOA and other Western broadcasts. Because of the long-distance capabilities of shortwave, these jamming transmitters are often heard well beyond the Soviet Union and Eastern Europe. They interfere with the reception of many stations in addition to the ones they are trying to block. Sometimes they even create interference on the frequencies of Radio Moscow!

Local interference. Local interference originates in the listener's own house, apartment building, or neighborhood. Lightning, electrical appliances, fluorescent lights, and wires can give off radio energy that occurs across a wide range of frequencies.

Unfortunately, in this modern age, there are more and more electrical devices that generate radio noise. If the interference is from an appliance or wires, you might be able to locate the source of interference by walking around with a battery-operated radio. The noise will get louder as you approach the interference source. If the interference is coming from electric mains equipment (outside wires, insulators, or tranformers), contact your electric utility company. They may be willing to correct the problem because the source of noise for you is also a source of lost energy for them.

Sometimes local interference can be reduced by using batteries to power your radio instead of electric mains. This will eliminate the noise that can enter your radio through the mains electric system. Another method to reduce local interference is to use an outside antenna, especially one as far as possible from electric mains wires. This will give distant radio signals a fighting chance against signals generated from within your house or apartment building.

V. The DXing Hobby

DXing is the hobby of trying to pick up as many countries or stations as possible on your radio. ('DX' is an old radiotelegraph abbreviation for 'distance.') There are several specialties of DXing, the most popular of which is shortwave broadcast DXing. Other DXers listen to non-broadcast shortwave communications (often called **utility** DXing), or medium wave broadcast stations, or longwave stations. There is even DXing in the VHF and higher frequencies, where atmospheric conditions occasionally allow long distance reception of television, FM, and other signals.

Many DXers collect QSL cards from the stations they hear. 'QSL' is another radiotelegraph term meaning 'verification.' To receive a QSL, you must write a **reception report** to the station. This should indicate what date and time you heard the station, and on what frequency. A reception report should also include a few notes about the station's programs to prove that you heard them and some details about the quality of reception. A typical system for doing this is the SIO code. (See Table 3.)

Be honest and accurate when describing reception conditions; it does not help to flatter the station with an overly generous assessment. If there is interference from another station, try to identify that station. If the interference is from a local source, such as a nearby lightning storm or an electrical appliance, state this in your report.

There are several clubs throughout the world devoted to the DXing hobby. The federation of DX clubs in North America is the Association of North American Radio Clubs (ANARC), P.O. Box 462, Northfield, Minnesota 55057 USA. For a list of ANARC member clubs, send three International Reply Coupons (available at post offices in most countries). A similar organization in Europe is the European DX Council (EDXC), P.O. Box 4, St. Ives, Huntingdon, Cambridgeshire PE17 4FE, England. A list of its clubs is also available for three International Reply Coupons.

Amateur radio. A hobby related to DX listening is amateur radio. The difference is that amateur radio operators are licensed by their national governments to transmit as well as receive radio signals. For more information about amateur radio, contact the radio licensing authority in your country, or write to the American Radio Relay League, 225 Main Street, Newington, Connecticut 06111 USA.

Table 3 The SIO code

S (Signal Strength)	I (Amount of Interference)	O (Overall Merit)
5 Excellent	5 Nil	5 Excellent
4 Good	4 Slight	4 Good
3 Fair	3 Moderate	3 Fair
2 Poor	2 Severe	2 Poor
1 Barely Audible	1 Extreme	1 Unusable

VI. Sources of Additional Information

The World Radio TV Handbook. For the DXer and serious shortwave listener, or for anyone professionally involved in international broadcasting, the ***World Radio TV Handbook*** (WRTH) is an indispensable reference book. Published each year in January, the WRTH includes information on radio and television broadcasting in each country, with special attention to international broadcasting. Addresses, times and frequencies of operation, transmitter powers, and much other information is given. There is also a frequency-by-frequency listing of broadcast stations around the world. The book is somewhat expensive, about $20.00 in the U.S., but worth it for the active listener. For information, write to the World Radio TV Handbook, P.O. Box 88, DK-2650 Hvidovre, Denmark. (Although the book is edited in Denmark, it is printed in English.)

Worldwide Shortwave Spectrum* on VOA.** Several international radio stations have programs about radio communications, shortwave listening, and DXing. The Voice of America has the ***Worldwide Shortwave Spectrum Tuesdays during the second half of the VOA ***Magazine Show***.

VII. VOA Modernization Plans

A good radio, suitable antenna, and tuning skills will help you get better reception of the Voice of America. We at VOA are also working, at the transmitting end, to improve the audibility of VOA for listeners throughout the world.

In the 1960's the typical power of a shortwave broadcast transmitter was 100 kilowatts (100,000 watts). In the 1970's, the norm was 250 kilowatts. Now, in the 1980's, 500 kilowatt shortwave transmitters are very common. But the VOA, as of 1986, has no 500 kilowatt transmitters (although in some cases, two of our 250 kilowatt units are used in parallel to create the equivalent of a 500 kilowatt transmitter).

To improve the audibility of our broadcasts, VOA has embarked upon a major modernization plan. A large part of this effort is the addition of more modern and more powerful shortwave and medium wave transmitters. Several 500 kilowatt shortwave units will be added to many of our existing relay stations. In addition, VOA is negotiating to add new relay sites to improve our signal in many areas of the world.

Modernization at VOA involves more than new transmitters. A new automated control center, through which programs are channeled from the studios to the appropriate transmitters, has been constructed in the VOA's Washington headquarters. It replaced a 30-year-old master control console. New state-of-the art studios are also being built in Washington. These projects will greatly improve the reliability of VOA broadcasts, ensuring that VOA programs are not interrupted or delayed by technical breakdowns.

An important new computer system, the first of its kind, is now being developed at the VOA headquarters. It is called SNAP—System for News and Programming—and it will facilitate word processing of scripts in the varied alphabets of the 42 languages used by VOA. SNAP will also assist in the translation and transfer of broadcast scripts among the various language and programming services of VOA.

VOA modernization has also encompassed the following:

- Increases in VOA's news gathering capabilities, including new bureaus in eight cities around the world.
- The establishment of the VOA Office of Audience Relations, to improve the handling of audience mail, to produce publications such as VOICE magazine, to provide information about VOA through newspaper and magazine advertisements, to organize VOA exhibits, and to determine listeners' program preferences through audience research.
- The introduction of new programming services of interest to our listeners, including VOA Europe, a music-oriented service heard in western Europe via FM and cable outlets, and on medium wave.

In the near future, you will probably be able to hear the results of VOA's modernization plans, with stronger, crisper, and more reliable signals.

A final word: VOA exists to communicate with you, the listener. We are eager to hear your comments. Your thoughts can help us produce better, more useful programs. So, please, do write us from time to time. Thank you.

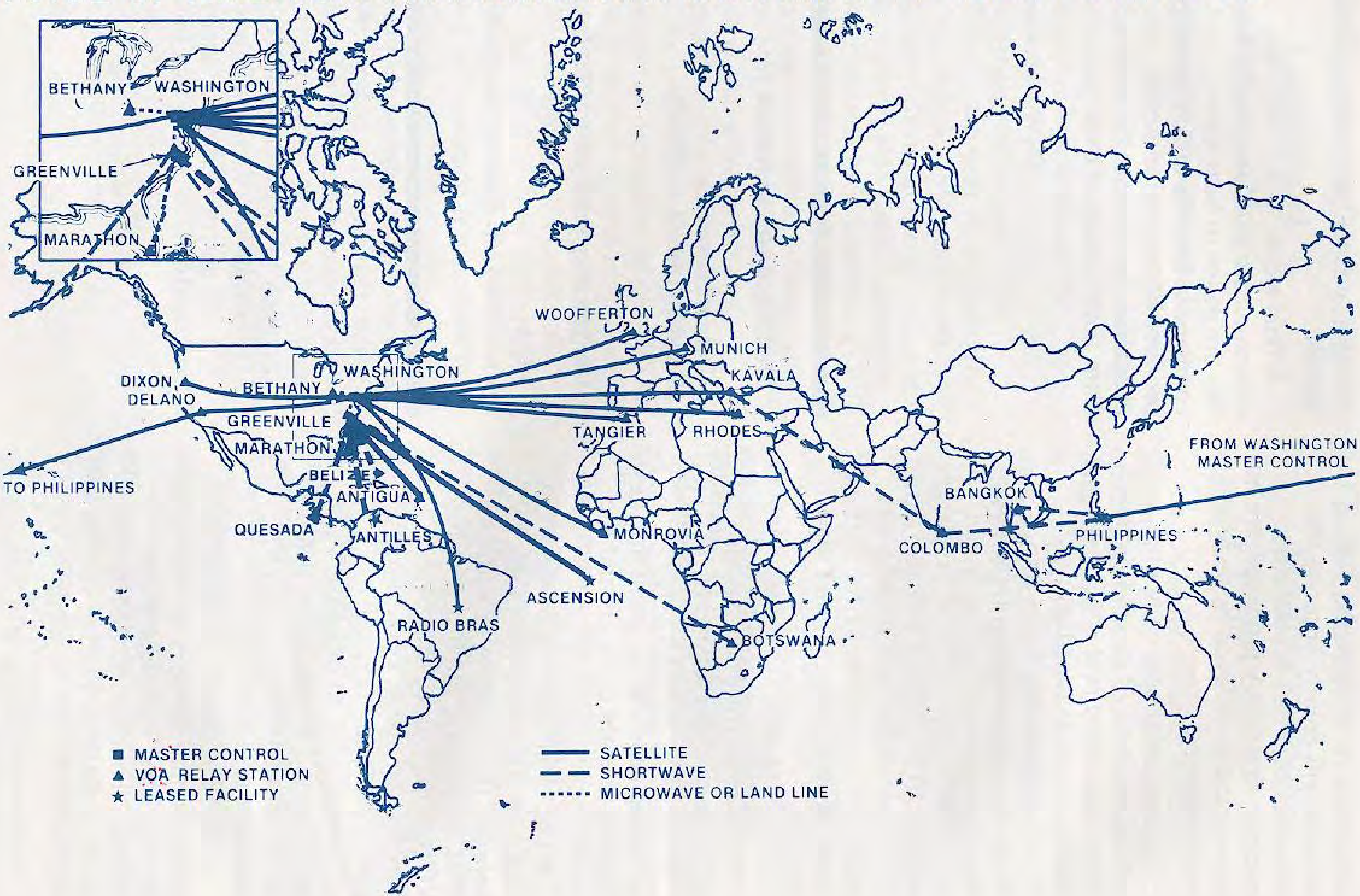
Mail should be addressed to:

Voice of America
Washington, D.C. 20547
USA

Or, you may send your letter to:

VOA
c/o USIS/U.S. Embassy in your country

VOICE OF AMERICA: TRANSMISSION METHODS TO RELAY STATIONS



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International Time

International radio stations broadcast to many different parts of the world, so they cannot announce the local time in all the places where their programs can be heard. For this reason, most international stations use a time system known either as Greenwich Mean Time (GMT) or Coordinated Universal Time (abbreviated UTC). To convert to your local time, note the GMT/UTC time announcements given on the VOA or other international stations. You can then use the chart below to compare the GMT/UTC to your own local time.

G.M.T./U.T.C.	Your Local Time	Your Local Summer Time (if different)
0000	______	______
0100	______	______
0200	______	______
0300	______	______
0400	______	______
0500	______	______
0600	______	______
0700	______	______
0800	______	______
0900	______	______
1000	______	______
1100	______	______
1200	______	______
1300	______	______
1400	______	______
1500	______	______
1600	______	______
1700	______	______
1800	______	______
1900	______	______
2000	______	______
2100	______	______
2200	______	______
2300	______	______

VOA Charter

The long-range interests of the United States are served by communicating directly with the people of the world by radio. To be effective, the Voice of America (the Broadcasting Service of the United States Information Agency) must win the attention and respect of listeners. These principles will therefore govern Voice of America (VOA) broadcasts:

(1) VOA will serve as a consistently reliable and authoritative source of news. VOA news will be accurate, objective, and comprehensive.

(2) VOA will represent America, not any single segment of American society, and will therefore present a balanced and comprehensive projection of significant American thought and institutions.

(3) VOA will present the policies of the United States clearly and effectively and will also present responsible discussion and opinion on these policies.

Gerald R. Ford
President of the United States
Signed July 12, 1976
Public Law 94-350

Our apologies for the following errors in A Guide to Radio Listening:

Page 2: The speed of light is, of course, 300 million meters per second.

Page 7: In table 2, the 49 meter band should not be listed as a tropical broadcast band. It is used for international broadcasting in all parts of the world.

Page 17: 1700 and 1800 GMT were left out of the time conversion chart.