

# 10 COMMUNICATIONS

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## INTRODUCTION

### **SAFETY**

Possibly one of the best ways to ensure your safety when on the water is to have appropriate communications equipment onboard with the ability to communicate easily with other vessels and shore stations when the need arises. It could be argued that anyone who operates a boat almost anywhere should be required to have a radio onboard and know how to use it.

Sound and whistle signals, discussed in the *Navigation Rules* chapter, are okay for negotiating agreement on passing or crossing situations with other vessels; however, using a radio for this purpose is a safer way and has become common practice. And when you need to make that emergency call for help; a radio call is much more intrusive and more likely to get attention than a signal flare, which requires someone to just happen to be looking in your direction. A handheld VHF radio can be had for as little as \$99, so there's really no excuse for not having one onboard.

### **TYPES OF MARINE COMMUNICATIONS EQUIPMENT**

These days there are lots of choices when it comes to types of marine two-way communication equipment, what with marine radiotelephones, citizen's band radios, cellular phones, satellite phones, satellite radios, etc. Of course, the one thing all these have in common is they are all, at heart, a type of radio.

All these communication devices can be somewhat arbitrarily lumped within one of two broad categories that we'll define here as:

- **Point-to-point communications:** The everyday telephone in our houses, the cell phone and the satellite phone are all examples of point-to-point communication devices. You call a specific location and talk only to the person at that location. No one else hears the conversation (at least they're not supposed to).
- **Two-way broadcast communications:** Marine purposed VHF and SSB radios and also CB radios fall within this category. When you transmit, you are heard by everyone who is within range and has similar equipment tuned to

the frequency you transmit on. Similarly, when someone responds, they are also heard by everyone in range.

Two-way broadcast equipment is what should be on any vessel, even if cell or satellite phones are available. Specifically, a marine VHF radio should be installed or available, and for cruising offshore a SSB shortwave radio should also be installed. (Note: VHF and SSB are described later.)

Here are some reasons for using VHF or SSB rather than a cell phone:

1. The Coast Guard continuously monitors VHF channel 16 in all areas (and so does everyone else) so that a transmission on channel 16 will be heard by the Coast Guard. SSB frequency 2182 KHz is also monitored by the Coast Guard.
2. Everyone in your area will also hear your VHF 16 transmission, so if it's an emergency call for help, vessels nearby can respond and come to your aid. A cell phone call to the Coast Guard might get through but those nearby vessels won't hear it.
3. In an emergency situation the Coast Guard can, if necessary, home in on your VHF signal to help locate you.
4. VHF range is from 5 to 25 miles. Digital cell phone range is not much greater than 5 miles.

This chapter is confined to discussion of the most commonly used types of marine two-way communications and does not address many one-way (receive only) services such as weather fax broadcasts, email services, NAVTEX, and the myriad other information services available to the serious cruiser. New services seem to be starting up at an every increasing rate so there will be even more choices over the next few years.

## **TWO-WAY BROADCAST COMMUNICATIONS**

### ***INTRODUCTION***

There are several types of two-way radio communications available to the recreational boater. These include:

- VHF marine radio
- SSB MF/HF marine radio
- CB (citizens band) radio
- FRS (family radio system) radio
- Ham shortwave radio

Of these, the VHF radio is the most relevant to the average recreational boater and will be covered in some detail here. The SSB marine radio is of importance to those cruising offshore, and I'll describe what this is and how it works, but I won't get into too much detail. CB and FRS, although not designed for marine use, can also be handy to have, so I've included few remarks on both of these. Information on the ham radio is omitted since an onboard ham radio station is not likely to be of interest to anyone but an already licensed ham radio operator.

## **VHF MARINE RADIO**

### **Regulations**

Much of the information in this chapter on U.S. regulations regarding radio licensing was found at [wireless.fcc.gov/marine](http://wireless.fcc.gov/marine).

#### ***Who Is Required to Have a Radio?***

The VHF radio is the workhorse marine radio that every boater should have whether it's legally required or not. In the United States, any recreational vessel over 20 meters (65.6 ft) in length is required to carry a radio, as are most commercial vessels. These are known as ***compulsory ships*** because they are compelled to carry a radio. Recreational vessels less than 20 meters are not required to carry a radio, but may do so, and if they do are known as ***voluntary ships***.

#### ***Radio Licensing—United States***

Any vessels that have a SSB radio installed, or a satellite communications system installed, must have a ship ***radio station license***. In the United States, a recreational vessel is not required to have a station license for a VHF radio, radar, or EPIRB on a voluntary ship unless the vessel voyages to a foreign country (including to Canada). Note that this requirement is as per U.S. FCC regulations, and that the foreign country to be visited will usually expect you to be licensed also. If your vessel is licensed, all communications equipment onboard is authorized under a single ship radio station license.

If you plan to dock in a foreign port you must also have a ***Restricted Radiotelephone Operator Permit***, also referred to as an ***individual license***. The ship radio station license and the restricted radiotelephone operator permit are both obtained by filing FCC Form 159 and 605 with the FCC. No test is required.

Forms are available by any of the following:

- Call the FCC Forms Distribution Center at 800-418-FORM (3676).
- FCC Fax-On-Demand system. Call 202-408-0177 from the handset of your fax machine. Follow the recorded instructions to have forms 150 and 605 faxed to you.
- On the Internet, go to [www.fcc.gov/formpage.html](http://www.fcc.gov/formpage.html).

### **Radio Licensing—Canada**

In Canada, a vessel is not required to have a ship radio station license if the vessel is operated only within Canada or the United States and if the radio equipment onboard can only operate on frequencies allocated to maritime communications. This applies to vessels with SSB equipment as well.

If the vessel operates in any other foreign countries then a station license is required. Application for the license is to your local Industry Canada Office (there are far too many to list here—the Ontario Region number is 416-973-5000).

A Restricted Radiotelephone Operator Certificate (ROC) is required in Canada for anyone who operates marine radio equipment, regardless of whether a station license is required. You must pass the Industry Canada exam for the ROC. The Canadian Power and Sail Squadrons are the designated authority for issuing the ROC to recreational boaters.

### **How VHF Works**

Most VHF communications are *simplex (push-to-talk)* where only one station transmits while the other listens. The person transmitting pushes a button to transmit and releases it when finished transmitting. This is necessary because a single radio frequency does not support simultaneous two-way communication.

Simultaneous two-way, or duplex, communications, like you have on your home phone or cell phone, requires the use of two separate frequencies, so that conversation in one direction uses one frequency and conversation in the opposite direction uses the other frequency.

VHF radios are available in both *fixed-mount* or *handheld* units. Fixed-mount radios are limited by regulation to a maximum of 25 watts transmit power, whereas handhelds are limited to a maximum of 6 watts. All VHF radios are required to also be able to transmit at low power or 1 watt.

VHF radio operates on a line of sight basis, which means the communication range between two stations is limited by the earth's horizon. Thus the effective range is determined by the

height of the two antennas and the maximum transmission power of 25 watts.

## **VHF Permitted Communications**

### ***What VHF is Used For***

Use of VHF radio is restricted to certain types of conversations that must relate to safety, distress, vessel operations, or public correspondence (marine operator).

Bridge-to-bridge conversations concerning maneuvering (to avoid collision) are considered ***safety communications*** as are broadcasts of weather and other safety-related bulletins.

***Distress communications*** include Mayday, Pan-pan, or any other type of calls requesting help or indicating distress.

Planning a rendezvous location, discussing navigation, acquiring berthing instructions, reserving a slip, and arranging for repairs are all examples of ***vessel operations communications***.

***Public correspondence*** communications are VHF calls patched through to the land-based public telephone system and are arranged with a shore-based marine operator.

### ***What VHF Is Not Used For***

VHF communications concerning anything other than the above types of communications are prohibited by law.

Some communications the regulations explicitly disallow:

- It is unlawful to intentionally transmit a false distress alert, or to unintentionally transmit a false distress alert without taking steps to cancel that alert.
- Messages containing obscene, indecent, or profane words or meaning.
- Transmission from land. *This means you may not use your handheld VHF radio from land to communicate with your vessel.* In addition, if your vessel is on land, you may not transmit from the vessel's fixed-mount VHF.

Betting on this afternoon's ballgame, swapping recipes, social chitchatting, etc., are all definitely prohibited.

## **VHF Channels**

### ***Calling Channels and Working Channels***

Certain channels are designated as ***calling channels*** and the others are some form of ***working channel***. The idea is that all vessels monitor the calling channel to listen for calls. Once contact is established on the calling channel, the parties

Communication Type	Channels		
	United States	Canada	
		West	East
International distress, safety, and calling: Used to get the attention of another station (calling) or for emergencies. Ships carrying a radio maintain a listening watch on this channel. The Coast Guard monitors this channel.	16		
Supplemental calling channel for recreational boaters: Assigned by FCC to relieve congestion on channel 16.	09	---	
Working channels: these channels may be used as working channels by recreational boaters for vessel operations communications.	09 68 69 71 72 78 {79} {80}	{65A} 66A 67 {68} 69 71 72 73 74	{09} 10 {66A} {68} {71} 72 74
Navigation Safety (Bridge to Bridge): passing, meeting, overtaking, etc.	13 {67}	13	
Intership Safety: Intership safety messages & search and rescue messages.	06		
Coast Guard Liason: Used to talk to the Coast Guard (after calling on 16).	22A		
Maritime Safety Information Broadcasts: Canada: Continuous Marine Safety Broadcast (CMB).	22A	Wx1 Wx2 Wx3 21B {25B} {28B} {83B}	
Weather: National Oceanic and Atmospheric Administration (NOAA) broadcasts.	Wx1-Wx7		
Public Correspondence: used to call the marine operator at a public coast station to make and receive calls to shore based (public phone system) telephones.	24-28 84-87 {88}	01-03 23-28 60 64 84 86	24 26 27 85 87 88
Digital Selective Calling (DSC): -automated calling by radios equipped with DSC.	70		
Channels in {} See Table 10-1 Channel Notes On Next Page			

*TABLE 10-1: Summary of Channels Available for Recreational Boaters*

switch to an agreed upon working channel to continue the communication.

### ***Channel Numbers and Frequencies***

VHF channels are numbered in two series of consecutive numbers, the first from 1 through 28 and the second from 60 through 88. Channels 60 through 88 use frequencies interleaved with the frequencies of channels 1 through 28 so that the channels in order of increasing frequency are; 60, 01, 61, 02, 62, 03, 63, etc. Table 10-6 at the end of this chapter shows these channels and their frequencies. Additional channels, designated Wx1, through Wx7, are used for transmitting weather and other information.

All the channels are assigned frequencies in the range from 156 MHz to 163 MHz, and the frequencies are assigned in increments of 0.025 MHz which is also shown in table 10-6. The frequencies are provided in the table mainly for the curious, since the VHF operator only needs to know the channel numbers (as with a television set) and which channels are to be used for what purpose.

### ***Channel Assignments***

Only channels available to recreational boaters are summarized in table 10-1. Table 10-7 at the end of this chapter shows all the channels and the geographic regions where they are used in both the United States and Canada.

Table 10-1: Channel Notes { }

- Canada East includes East Coast, St. Lawrence River, and Great Lakes
- {09}{25B}{28B}{83B} East Coast and St. Lawrence up to Montreal only
- {65A} Alberta, Saskatchewan, and Manitoba—except Lake Winnipeg and Red River only
- {66A} Excluding St. Lawrence River and Great Lakes
- {67} Lower Mississippi only
- {68} Marinas and yacht clubs
- {71} Marinas and yacht clubs—including Lake Winnipeg
- {79}{80} Great Lakes only
- {88} Near Canadian border only

General notes regarding table 10-1:

- U.S. channels are derived from FCC chart at wireless.fcc.gov, which is based on FCC rules 47 CFR 80.371 & 80.373.

- Canadian channels are derived from Schedule IV of Industry Canada Publication RIC-13, Section 8, Schedule IV (available on the Internet).

### **Digital Selective Calling (DSC)**

*Digital Selective Calling* is a new automated calling system designed to replace the current voice calling system on channel 16. It also will work on newer MF/HF SSB radios. DSC allows automated calling of a particular station, or a group of stations, or all stations in an area.

A nine-digit *maritime mobile service identity* (MMSI) must be obtained and programmed into each DSC capable radio before using it for DSC transmission.

If your vessel requires a station radio license, the MMSI is obtained at the same time the radio license is obtained. If no station license is required, BoatUS, Sea Tow Service International, or MariTel all are authorized to issue a MMSI. In Canada, the MMSI is obtained from your Industry Canada local office.

To make a DSC call, you set your radio to the working channel you wish to use, then key in the MMSI of the station you wish to call. If the receiving station answers, DSC will set the receiving station to the working channel and ring an alert to tell the receiving operator that he has a call.

The most important feature of a DSC capable radio is the ability to send a distress alert call by pressing a distress button for five seconds. Your radio sends the distress alert on channel 70 identifying you by the MMSI and also transmitting your latitude and longitude (only if your GPS is connected). If you are able to stay by the radio after sending the DSC distress alert, you should then monitor and communicate on channel 16 to further clarify your emergency.

Since DSC currently is in the implementation process, Coast Guard monitoring of DSC distress calls may not work reliably in all areas. The USCG states on its website, "Until this system is installed, the Coast Guard cannot reliably receive VHF DSC distress calls." The current schedule calls for completion of the system by 2006.

### **VHF Operation**

#### *Monitor 16*

You are required to always monitor channel 16 when underway. Although channel 09 has been designated a calling channel for recreational boaters in the U.S., channel 16 should be monitored if your VHF is only capable of monitor-

ing one channel. If it can monitor two channels then monitor both 16 and 09. The reason for this is that distress calls and Coast Guard alerts will always be on channel 16.

### ***Voice Calling Procedure for Nondistress Calls***

If you have DSC and your friend has DSC, and you both have obtained your MMSI (like you should have), then by all means use DSC to make calls between you. This will help free up overcrowded channel 16. Always try to make first contact at low power (1 watt).

If calling a coast station, call on their assigned channel unless you don't know it. Call other vessels on channel 16.

When initiating a call you must not call for more than 30 seconds. If there is no reply, you must wait at least two minutes before calling again. After three tries you must wait at least 15 minutes before calling again.

#### To Make a Call

1. Select the calling channel (usually 16).
2. Listen and wait until the channel is quiet.
3. Assume here the calling vessel is "Wandering Star" and the vessel being called is the "Puffin."
4. Press the transmit button and say, "Puffin, Puffin, this is Wandering Star." Include your call sign at the end if applicable. The name of the vessel being called or your vessel name can be repeated up to three times although once should be enough if you speak slowly and clearly.
5. If Puffin hears you, Puffin responds, "This is Puffin, switch to 72." This means Puffin is asking you to switch to working channel 72.
6. You reply, "Roger Puffin 72" to indicate you understand and are switching to 72.
7. You both switch to 72 and carry out the communications.
8. At the end of the communication, you say "Wandering Star out," Puffin says "Puffin out," and you both switch back to 16.

Some other points to consider when communicating by radio:

- Don't use CB terminology such as "do you read me?" or "come to me." *"Ten" radio codes are not used.*
- **Over** is used to end each transmission, although this is often left unsaid, since it's usually apparent when the other station has released the talk button.
- **Out** is used to sign off and end the communication.
- **Roger** means that the transmission is understood. It doesn't signify agreement.

- **Wilco** means the transmission is understood and you will comply. Roger wilco is redundant since roger is implied in wilco.
- **Affirmative** means yes.
- **Negative** means no.
- Only use the radio alphabet when it's important to get the letters correct. For example, use W-A-1-2-3-4 instead of Whiskey-Alpha-1-2-3-4 for a call sign, but if you are sending your MMSI to someone to program into their radio, use the radio alphabet to ensure accuracy.
- The radio alphabet is listed in table 10-5 on page 592 at the end of the chapter.
- Be careful to press the talk button *before* you start talking.
- When you are dreaming up names for your boat, you might want to consider that you will often be using your boat's name when using the radio, and an easily pronounced and understood name will be to your advantage.

### **Emergency Distress Calls**

The spoken international emergency signals are:

**Mayday** is used to indicate that the vessel or persons onboard are threatened by grave and imminent danger and request immediate assistance.

**Pan-pan** is the urgency signal used when the safety of the ship or person is in jeopardy.

**Securite** (pronounced saycuritay) is used for safety or navigation messages or important weather warnings.

Figure 10-1 gives an example format for an emergency Mayday call. Post this or a similar form near the VHF so that anyone onboard can make the emergency call if need be. A larger size Adobe .pdf copy of this form can be downloaded from [www.anchorcovepublishing.com](http://www.anchorcovepublishing.com).

Figure 10-2 is an example of a vessel information form that will be useful when a description of your vessel is requested. This should also be posted near the radio.

Latitude and longitude are the preferred way to describe your position.

## **SSB MARINE RADIO**

### **Introduction**

Whereas VHF radio range is limited to approximately 30 miles; **MF/HF (medium frequency/high frequency)** Marine radio range is measured in hundreds or even thousands of miles. MF/HF overcomes the horizon line of sight limita-

## MAYDAY Call Procedure

Use the MAYDAY call only when you are in distress. Distress is a situation where you or your boat are threatened by grave or immediate danger.

1. If within VHF range use VHF rather than MF/HF radio.
2. Make sure the radio is ON.
3. Set VHF channel 16 or MF/HF 2182 kHz
4. Transmit: MAYDAY MAYDAY MAYDAY
5. This is: _____ Boat Name Boat Name Boat Name
6. Our position is: Latitude ____ deg ____ min N or Longitude ____ deg ____ min W Our position is _____ Distance (miles, ft, km, m, etc.) Direction (NE, SW, or bearing deg) Navaid or Landmark
7. State problem: _____ We are sinking, on fire, or have a heart attack, etc.
8. State urgency _____ How long you can stay afloat, etc.
9. We need: _____ Describe assistance required, pumps, tow, medical, etc.
10. Number of persons on board is _____ and _____ adults children The number of injured is: _____
11. Our vessel is a _____ foot powerboat / sailboat
12. OVER
13. Release transmit and listen for a reply If no-one answers repeat steps 4-13

FIGURE 10-1: Mayday Example Call Procedure

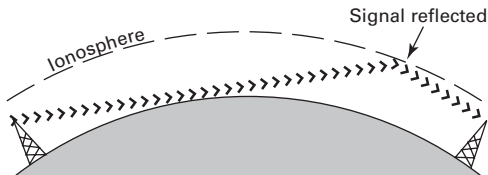
## Vessel Description

Vessel Name: \_\_\_\_\_

Home Port:			
Make and Year:			
Country / Flag			
Registration / Documentation / License No.			
Length:		Displacement	
Color: Hull		Cabin	Trim
Type:	Sail <input type="checkbox"/>	Power <input type="checkbox"/>	Fuel: Diesel <input type="checkbox"/> Gas <input type="checkbox"/>
Drive:	Inboard <input type="checkbox"/>	Outdrive <input type="checkbox"/>	Outboard <input type="checkbox"/>
Communication Equipment			
Type	Freq / Number	Type	Freq / Number
VHF		Cell Phone	
DSC		Sat Phone	
SSB		CB	
Navigation Equipment			
Compass <input type="checkbox"/>	GPS <input type="checkbox"/>	Charts <input type="checkbox"/>	Radar <input type="checkbox"/>
			Loran <input type="checkbox"/>
Survival Equipment			
Life Jackets <input type="checkbox"/>		Horn <input type="checkbox"/>	
Flares <input type="checkbox"/>		Dinghy / raft <input type="checkbox"/>	
Mirror <input type="checkbox"/>		Paddles <input type="checkbox"/>	
Smoke Signal <input type="checkbox"/>		EPIRB 121.5 / 243.0 <input type="checkbox"/>	
Anchor <input type="checkbox"/>		EPIRB 406 <input type="checkbox"/>	
Flashlights <input type="checkbox"/>		EPIRB 406 w. GPS <input type="checkbox"/>	

FIGURE 10-2: Example Vessel Description

tion, by using frequencies that allow radio signals to bounce off the ionosphere and back to earth. The MF/HF radio is also commonly called a *SSB (single side band) radiotelephone* or *marine radio*.



*FIGURE 10-3: MF/HF Radio Waves and the Ionosphere*

The MF/HF radio is actually a shortwave radio designed specifically for marine use and has selectable channels much like a VHF radio.

A MF/HF radio should be considered a necessity by anyone venturing offshore even though some form of satellite communications might also be available. Marine safety bulletins, weather broadcasts, and even weather faxes can be received with a HF radio. In addition to the safety aspect, marine nets have become commonplace, where like-minded cruisers discuss topics of mutual interest at sea.

Email services are also available for HF, although they are slow and need favorable conditions. If you can afford it, some form of satellite communications is a better alternative for email.

### **MF/HF Channels**

Use of the MF/HF radio is somewhat similar to the VHF radio, in that there are calling channels and working channels; however, the MF/HF radio differs in that there are a number of frequency bands with a number of channels in each band and within each band there are calling channels and working channels. The frequency bands used are 2 MHz, 4 MHz, 8 MHz, 12 MHz, 16 MHz, 18 MHz, 22 MHz, and 25 MHz. The 2 MHz band is a MF band and the 4 MHz through 25 MHz bands are HF bands.

Channels numbers are constructed by appending a number, that increments sequentially starting from 01, to the one or two digit band number. For example in the 4 MHz band the chan-

nels would be numbered 401, 402, 403, etc. The channels in the 16 MHz band would look like 1601, 1602, 1603, etc.

In the MF band the international distress channel (similar to VHF 16) is at frequency 2182 kHz (2.182 MHz). The Coast Guard monitors this channel but at some time in the future may discontinue monitoring it in favor of DSC. As of February 1, 1999, commercial ships were required to have DSC radio equipment operational and were no longer required to monitor the 2182 kHz distress channel after that date.

The Coast Guard also monitors the following HF channels:

ITU Channel Number	Coast Transmit	Ship Transmit
424	4426 kHz	4134 kHz
601	6501 kHz	6200 kHz
816	8764 kHz	8240 kHz
1205	13,089 kHz	12,242 kHz
1625	17,314 kHz	16,432 kHz

*TABLE 10-2: Coast Guard Monitored HF Channels*

Channels and frequencies for each channel are listed in the radio operating instructions and are not detailed here.

### ***Distance Versus Frequency***

In general, the lower frequency bands are used for communicating over shorter distances, and the higher bands are used over longer distances.

The maximum communication distance varies with the seasons, with day and night, and with sunspot activity. Approximate distance ranges associated with various frequency bands are:

Freq From	Freq To	Min. Distance	Max. Distance
2 MHz	6 MHz	200 nm	800 nm
4 MHz	12 MHz	800 nm	1500 nm
6 MHz	22 MHz	1500 nm	

*TABLE 10-3: MF/HF Communications Range*

There are charts and graphs available that indicate the best frequencies to try, depending on the time of day and desired communication range.

### **Installation and Cost of HF Radio**

Installation of HF radio equipment is far more difficult than a VHF installation. Proper antenna selection and installation

is critical for successful HF radio operation. Even more critical is the installation of a proper grounding system, which consists of a long copper strip along the outside of the hull. Ideally, this work is done as the boat is being built.

MF/HF marine radio purchase cost is in the range of \$1000 to \$3000 (not including installation) but unlike satellite communications, once it's installed, there is no operating cost.

### **CB RADIO**

A *citizens band* (CB) radio is a fixed mount radio similar to an installed VHF radio; however, it is not meant for marine communications and is not monitored by the Coast Guard or other boaters and thus is not suitable for distress related communications.

It can be useful, however, for nonoperations conversations of a type not allowed on the VHF radio. Here you can discuss the fish you caught, exchange recipes, organize a party, etc. Of course, the boat you communicate with must have one installed too, so CB will be most useful among two or more boats similarly equipped and traveling together. Aside from this, a CB is not a particularly useful thing to have on a boat.

The CB can transmit at up to 4 watts and has a whip antenna so range will be a little less than a VHF radio. There are 40 channels available for CB radios that are distributed from 26.965 MHz to 27.405 MHz. Channel 09 is reserved for emergency communications or traveler assistance. There are no officially designated calling or working channels.

### **FRS RADIO**

*Family Radio System* (FRS) radios are handheld radios that look much like a handheld VHF radio or walkie talkie. Since you are not allowed to use a handheld VHF radio on shore, an FRS radio provides an ideal means of communication between a vessel and someone on shore. It also provides a means of communicating between vessels cruising together, and unlike VHF allows for idle chitchat of a nonoperational nature.

Since these can be used on land, they are also useful for hikers, skiers, hunters, or even for maintaining contact between two cars traveling together.

FRS radios have 14 channels and transmit at a maximum of 0.5 watts. No license is required to operate these. Transmitting at 0.5 watts will give you a range of about 2 miles over water. Table 10-4 shows the channels and frequencies for the 14 FRS channels.

Many FRS radios also include *General Mobile Radio Service* (GMRS) capability. FRS/GMRS radios have channels as shown in table 10-4. GMRS allows greater transmit power but requires an FCC license to operate. A five-year renewable license is currently \$75 and is obtained by filing FCC Form 605 or filing online with the FCC Universal Licensing System (ULS) found at <http://wireless.fcc.gov/uls/>.

Channel	Type	Frequency (MHz)	Typical Power (Watts)
1	GMRS/FRS	462.5625	1 to 5
2	GMRS/FRS	462.5875	1 to 5
3	GMRS/FRS	462.6125	1 to 5
4	GMRS/FRS	462.6375	1 to 5
5	GMRS/FRS	462.6625	1 to 5
6	GMRS/FRS	462.6875	1 to 5
7	GMRS/FRS	462.7125	1 to 5
8	FRS	467.5625	0.5
9	FRS	467.5875	0.5
10	FRS	467.6125	0.5
11	FRS	467.6375	0.5
12	FRS	467.6625	0.5
13	FRS	467.6875	0.5
14	FRS	467.7125	0.5
15	GMRS	462.5500	1 to 5
16	GMRS	462.5750	1 to 5
17	GMRS	462.6000	1 to 5
18	GMRS	462.6250	1 to 5
19	GMRS	462.6500	1 to 5
20	GMRS	462.6750	1 to 5
21	GMRS	462.7000	1 to 5
22	GMRS	462.7250	1 to 5

TABLE 10-4: FRS and GMRS Channels (United States)

Note that in Canada, use of FRS was legal, but GMRS was not until September of 2004. For more information go to <http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/en/sf08145e.html>, or if you don't want to type all that in, just do a search on "Canada gmrs frs regulations."

## POINT-TO-POINT COMMUNICATIONS

### CELL PHONES

It's a good idea to have a cell phone onboard any boat, but not as a substitute for a VHF marine radio.

The original cell phone system was analog and some of the car phones and the old “bag” phones operated at 3 watts, while most cell phones sold now are digital and transmit at a maximum power of 0.6 watts. Most digital cell phones revert to analog mode if a digital signal is not available, but they still are limited to 0.6 watt power. With this low power you’ll be lucky to get a digital cell phone to operate more than 5 miles from the nearest cell phone tower which is, of course, located on the shore somewhere. As you know from personal experience, once you get far away from towns or highways, the chances of hooking up are slim.

You can purchase cell phone amplifiers and antennas that will considerably improve your communication range and quality with cell phones. Just the use of a good antenna mounted high on the boat will improve operation considerably and adding an amplifier that can boost the signal to 3 watts (the legal limit) can increase useful range to 10 or 15 miles and maybe a little beyond.

## **SATELLITE COMMUNICATIONS**

### **Introduction**

Discussions herein are limited to two-way communications systems; broadcast radio and television communications are not covered.

*INMARSAT*, *Iridium*, and *Globalstar* are the leading providers of two-way satellite communications services of interest to recreational boaters. INMARSAT has been providing service since the late 1980s and uses four high earth orbit geosynchronous satellites whereas the newer providers, both Iridium and Globalstar, use many low earth orbit satellites.

There are other suppliers currently in this market and more are entering all the time. Change is taking place so rapidly, particularly with respect to Internet access, that any discussion beyond the big three providers is likely be obsolete by the time this book gets published, so we’ll restrict ourselves to a brief discussion of these three.

Anyone planning to invest in a satellite communications phone needs to understand that each of these systems has definite strengths and weaknesses, and the homework needs to be done before committing to any particular system. Example prices shown here are from various Internet sites and are current as of 2005. Prices are generally trending downward for all the satellite services, so expect to do as well or better for any of these services in the future.

**Inmarsat**

This is the original satellite system designed to provide point-to-point, voice and data marine communications, and has about 90 percent market share in the marine satellite communications business. Various versions of the system have been implemented as INMARSAT A, B, C, D, E, and M. Inmarsat A through D are suitable only for ships or larger yachts. Inmarsat Mini-M is designed to use smaller equipment suitable for use on smaller size vessels and is the system of interest to off shore cruisers.

Inmarsat claims to be the most truly global system with virtually no dead spots in the areas it covers. Almost all the earth to 75 degrees latitude is covered. Because geosynchronous satellites are stationary (relative to any location on earth) calls are not dropped as often they are with low earth orbit systems, as satellites move out of view to be replaced by others.

A Mini-M portable phone can be purchased for about \$2400 and an installed system from \$3000 to \$5000 and up. The portable phone is the size of a small laptop computer and weighs in at about 5 pounds and like all portable satellite phones must almost always be used outdoors. Since the Inmarsat geosynchronous satellites are 22,000 miles high versus just a few hundred miles for the Iridium and Globalstar systems, the equipment is heavier, has a larger antenna, and requires more power to operate. The Mini-M voice phones also support data and fax at 2400 baud.

Call pricing is about \$1.75/minute for calls within a zone that includes the United States, Canada, and Europe. A worldwide pricing plan is about \$2.15/minute. These are pay-as-you-go plans since there are no monthly minimums or fees with either plan.

**Iridium**

The Iridium system consists of 66 satellites plus 6 backup satellites in low earth orbit (about 500 miles). When you make a call, you will be routed through one of the nearest satellites, then through other satellites to the ground station nearest your call destination. As the nearest satellite moves away, your call is transferred to another satellite much as you are transferred from tower to tower with a cell phone. Additionally, as with a cell phone, calls are sometimes dropped during the transfer attempt.

Theoretically, the entire earth including the poles is covered; however, there are claims of a few spots where calls cannot be made.

Permanently installed phones are available for approximately \$2500 and handheld phones are available for around \$1100. As you might expect, the permanently installed phone will give considerably better service. The permanent install phone may be used with any standard desk or cordless phone connected via a standard RJ-11 phone jack.

The hand held phones weigh about 13 ounces, not as large as the original old-style cell phones but quite a bit larger than the typical modern cell phone. Iridium offers data at 2400 baud through the voice phones. Generally, handheld satellite phones must be used outdoors.

A typical monthly plan is \$35/month plus \$1.50/minute. Other higher volume plans can get this down to about \$1/minute. These rates are from anywhere in the world to a land phone anywhere else in the world.

### **Globalstar**

Globalstar is also a low earth orbit system using 44 satellites plus 4 backup satellites; however, unlike Iridium, calls are routed through ground stations to the destination, rather than through other satellites. Similar to the Iridium system, calls can be dropped as satellites move overhead. Globalstar's website claims it has better voice quality and fewer dropped calls than other carriers. At the time of this writing, Globalstar provides service in North and South America (including the Caribbean), Europe, Russia, and Australia. The Middle East and China can expect coverage in the near future. Africa, India, and Indonesia are not currently covered. More than about 200 miles offshore is generally not covered so this is not a system for the high seas. However, this is an excellent system for use with coastal cruising.

A Globalstar phone for permanent mounting in your boat will cost about \$1000 for voice only and \$2300 to \$2600 for a voice and data unit. The Globalstar fixed phone may be used with any standard desktop or cordless phone for access from anywhere in the vessel. Data transfer rates on these is 9600 baud.

A handheld phone is priced around \$500 and weighs in at about 14 ounces and it also supports data at 9600 baud. These are tri-mode phones that can also be used as cell phones on CDMA 800 networks and the older AMPS analog networks; however, you will probably use your own cell phone company

for these ground-based services and will need to have a different phone number (in the same phone). Like the Iridium handheld phone, this phone must usually be used outdoors.

Although Globalstar isn't truly global, they have generally cheaper rates if one is willing to commit to a monthly plan, much as one does with a cell phone. Examples of monthly plans for the United States and Caribbean zone include: 50 minutes for \$50/month = \$1/minute, 150 minutes for \$65/month = \$0.43/minute, or 4000 minutes for \$550/month for a unit cost of \$0.14/minute. Calls outside of the domestic zone (roaming) are about \$1.39/minute and don't use up minutes from the monthly plan. This includes calls to and from Europe. Calls from Canada are just \$0.75/minute.

### Satellite Phone Rentals

All the three types of satellite phones are available for rental on a daily, weekly or monthly basis which may make sense for cruising less than a month a year. These are also handy if you need to make calls from a cruise ship as the rates are much cheaper than the ship's rates which can be over \$10 per minute.

## TABLES

### THE RADIO ALPHABET

A	Alpha	N	November
B	Bravo	O	Oscar
C	Charlie	P	Papa
D	Delta	Q	Quebec
E	Echo	R	Romeo
F	Foxtrot	S	Sierra
G	Golf	T	Tango
H	Hotel	U	Uniform
I	India	V	Victor
J	Juliet	W	Whiskey
K	Kilo	X	X-ray
L	Lima	Y	Yankee
M	Mike	Z	Zulu

TABLE 10-5: The Radio Alphabet

**VHF CHANNELS**

Channel		Xmt MHz	Rec MHz	Channel		Xmt MHz	Rec MHz
	60	156.025	160.625	18A		156.900	156.900
1A		156.050	156.050		78A	156.925	156.925
1		156.050	160.650	19A		156.950	156.950
	61A	156.075	156.075		79A	156.975	156.975
2		156.100	160.700	20A		157.000	157.000
	62A	156.125	156.125	20		157.000	161.600
3		156.150	160.750		80A	157.025	157.025
	63A	156.175	156.175	21A		157.050	157.050
4A		156.200	156.200	21B			161.650
	64A	156.225	156.225		81A	157.075	157.075
	64	156.225	160.825	22A		157.100	157.100
5A		156.250	156.250		82A	157.125	157.125
	65A	156.275	156.275	23A		157.150	157.150
6		156.300	156.300	23		157.150	161.750
	66A	156.325	156.325		83A	157.175	157.175
7A		156.350	156.350		83	157.175	161.775
	67	156.375	156.375		83B		161.775
8		156.400	156.400	24		157.200	161.800
	68	156.425	156.425		84	157.225	161.825
9		156.450	156.450	25		157.250	161.850
	69	156.475	156.475	25B			161.850
10		156.500	156.500		85	157.275	161.875
	70	156.525	156.525	26		157.300	161.900
11		156.550	156.550		86	157.325	161.925
	71	156.575	156.575	27		157.350	161.950
12		156.600	156.600		87	157.375	161.975
	72	156.625	156.625	28		157.400	162.000
13		156.650	156.650	28B			162.000
	73	156.675	156.675		88A	157.425	157.425
14		156.700	156.700		88	157.425	162.025
	74	156.725	156.725		WX2		162.400
15			156.750		WX4		162.425
	75		156.775		WX5		162.450
16		156.800	156.800		WX3		162.475
	76		156.825		WX6		162.500
17		156.850	156.850		WX7		162.525
	77	156.875	156.875		WX1		162.550

TABLE 10-6: VHF Channel Frequency Assignments

Channel	United States		Canada	Service
	United States	Canada		
				<b>Key:</b> Blank = service generally available in that country ✓ = service only in that area of that country X = service not available in that area P = service available in part of area
01A	U			Port Operations or VTS or Commercial Working
01		C		Public Correspondence (Marine Operator) duplex
02		C		Public Correspondence (Marine Operator) duplex
03		C		Public Correspondence (Marine Operator) duplex
04A		C		Canada Coast Guard Search & Rescue
		C		Working channel -commercial fishing only
05A	U	C		Port Operations or VTS
06	U	C		Search & rescue, Intership safety
07A	U	C		Working channel commercial
08	U	C		Working channel commercial (Intership only)
09	U			Working ch all vessels & Non-commercial calling
		C		Working channel all vessels & Ship movement
10	U			Working channel commercial
		C		Working channel all vessels & Ship movement
11	U			Working channel commercial, VTS some areas
		C		Working channel all vessels, ship movement
12	U	C		Port Operations. VTS in selected areas.
13	U			Nav Safety (Bridge-to-bridge), locks, drawbridges
		C		Navigation Safety (Bridge-to-bridge)
14	U			Port Operations. VTS in selected areas, Locks
		C		Port Operations. pilot information & messages
15		C		Environmental (Receive only). Class C EPIRBs.
		C		All vessels, ship movement (1 Watt)
16	U	C		International Distress, Safety and Calling
17	U			State & Local maritime control
		C		Commercial & Non-comm. ship movement
18A	U	C		Working channel commercial
		U		Working channel commercial
19A		C		Canadian Coast Guard only
		C		Government use
20	U	C		Port Operations (duplex) ship to coast
20A	U			Port Operations
21A	U	C		U.S. & Canada Coast Guard only
21B		C		Safety-Continuous Marine Broadcast Svc (CMB)
22A	U	C		Coast Guard Liaison & in the U.S. Maritime Safety Information Broadcasts
23A	U			U.S. Coast Guard only
23		C		Public Correspondence (Marine Operator) duplex

TABLE 10-7(1a): VHF Channels Areas of Operation

Channel	United States								Canada			Xmt MHz	Rec MHz	
	New Orleans	Lower Mississippi	Houston	Great Lakes	St Lawrence River	Seattle	Puget Sound	Str Juan de Fuca	Pacific Coast	Great Lakes (1)	St Lawrence River			Atlantic Coast (2)
01A	✓	✓											156.050	156.050
01									✓				156.050	160.650
02									✓				156.100	160.700
03									✓				156.150	160.750
04A									✓				156.200	156.200
05A	✓		✓			✓				✓	P		156.250	156.250
06													156.300	156.300
07A													156.350	156.350
08													156.400	156.400
09											P	✓	156.450	156.450
10										✓	✓	✓	156.500	156.500
11													156.550	156.550
12													156.600	156.600
13													156.650	156.650
14													156.700	156.700
15										✓	✓	✓	--	156.750
													156.750	156.750
16													156.800	156.800
17													156.850	156.850
18A													156.900	156.900
19A									X				156.950	156.950
									✓					
20													157.000	161.600
20A													157.000	157.000
21A													157.050	157.050
21B														161.650
22A													157.100	157.100
23A													157.150	157.150
23									✓				157.150	161.750

TABLE 10-7(1b): VHF Channels Areas of Operation

Channel	United States		Canada	Service
	U	C		
	<b>Key:</b> Blank = service generally available in that country ✓ = service only in that area of that country X = service not available in that area P = service available in part of area			
24	U	C		Public Correspondence (Marine Operator) duplex
25	U	C		Public Correspondence (Marine Operator) duplex
25B			C	Safety - Continuous Marine Broadcast Service (CMB)
26	U	C		Public Correspondence (Marine Operator) duplex
27	U	C		Public Correspondence (Marine Operator) duplex
28	U	C		Public Correspondence (Marine Operator) duplex
28B			C	Safety - Continuous Marine Broadcast Service (CMB)
60			C	Public Correspondence (Marine Operator) duplex
61A			C	Canadian Coast Guard Only
			C	Working channel -commercial fishing only
62A			C	Canadian Coast Guard Only
			C	Working channel -commercial fishing only
63A	U			Working commercial or Port Operations or VTS
64			C	Public Correspondence (Marine Operator) duplex
64A			C	Working channel -commercial fishing only
65A	U			Port Operations
			C	Multiple use
66A	U	C		Port Operations (1 Watt max Canada)
			C	Working channel all vessels
67	U			Working channel commercial intership, & locks and drawbridges
	U			Navigational (Bridge-to-bridge)
			C	Working channel all vessels
			C	Working channel -commercial fishing
68	U			Working channel non-commercial
			C	Marinas and Yacht Clubs
69	U			Working channel non-commercial
			C	Working channel all vessels
			C	Working channel -commercial fishing
70	U	C		Digital Selective Calling (voice communications not allowed)
	U			Working channel non-commercial
71		C		Working channel all vessels, ship movement
			C	Marinas & Yacht Clubs -East Coast & Lake Winnipeg
72	U	C		Working channel non-commercial (Intership only)
	U	C		Working channel commercial (Intership only)

**TABLE 10-7(2a): VHF Channels Areas of Operation**

Channel	United States								Canada			Xmt MHz	Rec MHz	
	New Orleans	Lower Mississippi	Houston	Great Lakes	St Lawrence River	Seattle	Puget Sound	Str Juan de Fuca	Pacific Coast	Great Lakes (1)	St Lawrence River			Atlantic Coast (2)
24													157.200	161.800
25									✓				157.250	161.850
25B												✓		161.850
26													157.300	161.900
27													157.350	161.950
28									✓				157.400	162.000
28B												✓		162.000
60									✓				156.025	160.625
61A									✓				156.075	156.075
62A									✓	✓	✓	✓	156.125	156.125
63A	P	P											156.175	156.175
64									✓				156.225	160.825
64A										✓	✓	✓	156.225	156.225
65A													156.275	156.275
66A										X	X		156.325	156.325
67		✓											156.375	156.375
									✓					
68										✓	✓	✓	156.425	156.425
69									✓				156.475	156.475
										✓	✓	✓		
70													156.525	156.525
71									✓				156.575	156.575
													156.575	156.575
										✓	✓	✓	156.575	156.575
72													156.625	156.625
							✓	✓					156.625	156.625

TABLE 10-7(2b): VHF Channels Areas of Operation

Channel	United States		Canada	Service
	U	C		
				<b>Key:</b> Blank = service generally available in that country ✓ = service only in that area of that country X = service not available in that area P = service available in part of area
73	U			Port Operations
		C		Working channel all vessels, marinas north of Campbell River
		C		Working channel -commercial fishing
74	U			Port Operations
		C		Working channel all vessels, ship movement
75	U	C		Not available -guard band for channel 16
76	U	C		Not available -guard band for channel 16
77	U	C		Intership to pilots only
		C		Port Operations (1 Watt max)
78A	U			Working channel non-commercial
		C		Working channel commercial
79A	U	C		Working channel commercial
	U			Working channel non-commercial
80A	U	C		Working channel commercial
	U			Working channel non-commercial
81A	U			U.S. Government only - Environmental protection operations.
		C		Canada Coast Guard Use only
82A	U			U.S. Government only
		C		Canada Coast Guard Use only
83		C		Canada Coast Guard Use only (duplex)
83A	U			U.S. Coast Guard only
		C		Canada Coast Guard and Other Govt Agencies
83A		C		Safety -Continuous Marine Broadcast Svc (CMB)
84	U	C		Public Correspondence (Marine Operator) duplex
85	U	C		Public Correspondence (Marine Operator) duplex
86	U	C		Public Correspondence (Marine Operator) duplex
87	U	C		Public Correspondence (Marine Operator) duplex
88	U	C		Public Correspondence only near Canadian border.
88A	U			Working channel commercial intership
Wx1	U	C		NOAA Weather (CMB in Canada)
Wx2	U	C		NOAA Weather (CMB in Canada)
Wx3	U	C		NOAA Weather (CMB in Canada)
Wx4	U	C		NOAA Weather (CMB in Canada)
Wx5	U	C		NOAA Weather (CMB in Canada)
Wx6	U	C		NOAA Weather (CMB in Canada)
Wx7	U	C		NOAA Weather (CMB in Canada)

TABLE 10-7(3a): VHF Channels Areas of Operation

Channel	United States								Canada				Xmt MHz	Rec MHz
	New Orleans	Lower Mississippi	Houston	Great Lakes	St Lawrence River	Seattle	Puget Sound	Str Juan de Fuca	Pacific Coast	Great Lakes (1)	St Lawrence River	Atlantic Coast (2)		
73									✓				156.675	156.675
										✓	✓	✓		
74													156.725	156.725
75														156.775
76														156.825
77									✓				156.875	156.875
										✓	✓			
78A													156.925	156.925
79A				X									156.975	156.975
				✓										
80A				X									157.025	157.025
				✓										
81A													157.075	157.075
									✓	✓	✓			
82A									✓	✓	✓		157.125	157.125
83									✓				157.175	161.775
83A										✓	✓	✓	157.175	157.175
83B										✓	✓	✓		161.775
84									✓				157.225	161.825
85										✓	✓	✓	157.275	161.875
86									✓				157.325	161.925
87										✓	✓	✓	157.375	161.975
88				✓	✓		✓	✓		✓	✓	✓	157.425	162.025
88A				X	X		X	X					157.425	157.425
Wx1														162.550
Wx2														162.400
Wx3														162.475
Wx4														162.425
Wx5														162.450
Wx6														162.500
Wx7														162.525

TABLE 10-7(3b): VHF Channels Areas of Operation

**INTERNATIONAL CODE OF FLAG SIGNALS**

The flags for the letters A to Z and numerals 0 to 9 are shown in the color plates on page Q28 in the Quick Reference color plates near the center of this book. Table 10-8 gives one-, two-, and three-letter (flag) codes and their meaning.

This table does not give all the signals specified in the *International Code of Signals*; only the more common signals are listed. The complete text of the *International Code of Signals* is available as an Adobe .pdf download of *Publication 102* from <http://pollux.nss.nima.mil/pubs/>.

Flags are hoisted so that the flags are read from the top down.

A complete set of flags includes only one flag for each letter and numeral. The three *substitute* or *repeater* flags are used to repeat letters or numerals where necessary. Letters are considered one *class* of flags and numbers are another *class*.

- The 1st substitute flag indicates a repeat of the 1st flag in the class of flags preceding the substitute.
- The 2nd substitute flag indicates a repeat of the 2nd flag in the class preceding.
- The 3rd substitute flag indicates a repeat of the 3rd flag in the class preceding.

Here are three examples of how this works taken from *Publication 102*:

The signal VV is made as follows:

- » V
- » 1st substitute

The signal 1100 is:

- » 1
- » 1st substitute in the class (of numbers)
- » 0
- » 3rd substitute to repeat the 3rd flag in the class

The signal L233 is:

- » L
- » 2
- » 3
- » 2nd substitute –repeats 2nd numeral class flag
- » 0

The answering station responds with the code/answer flag.

The transmitting station hoists the answer flag after the last hoist of signals.

Note: For pictures of signal flags see page Q28 of the color plates.

Flags	Signals
A	Diver down; keep well clear at low speed.
B	Loading, discharging, or carrying dangerous cargo.
C	Yes or affirmative.
D	I am maneuvering with difficulty; keep clear.
E	I am changing my course to starboard.
F	I am disabled; communicate with me.
G	I require a pilot.
H	I have a pilot onboard.
I	I am changing my course to port.
J	I am on fire and have dangerous cargo; keep clear.
K	I wish to communicate with you.
L	You should stop your vessel immediately.
M	My vessel is stopped; making no way.
N	No or negative.
O	Man overboard.
P	About to leave port; return to ship.
Q	Request pratique; ship meets health regulations.
R	No code.
S	Moving astern.
T	Keep clear.
U	You are running into danger.
V	I require assistance.
W	I require medical assistance.
X	Stop carrying out your intentions and watch for my signal.
Y	I am dragging anchor.
Z	I require a tug.
AC	I am abandoning my vessel.
AE	I must abandon my vessel.
AE1	I (or crew of vessel indicated) wish to abandon my (or their) vessel but have not the means.
AE2	I shall abandon my vessel unless you will remain by me, ready to assist.
AF	I do not intend to abandon my vessel.
AF1	Do you intend to abandon your vessel?
AN	I need a doctor.
BR	I require a helicopter urgently.
CB	I require immediate assistance.
CB4	I require immediate assistance; I am aground.
CB5	I require immediate assistance; I am drifting.
CB6	I require immediate assistance: I am on fire.
CB7	I require immediate assistance; I have sprung a leak.
CJ	Do you require assistance?

TABLE 10-8(1): International Code of Flag Signals

<b>Flags</b>	<b>Signals</b>
CK	Assistance is no longer required.
CV	I am unable to give assistance.
DX	I am sinking.
DV	I am drifting.
ED	Your distress signals are understood.
EF	SOS/Mayday has been cancelled.
FA	Will you give me my position?
GW	Man overboard.
IL	I can only proceed at slow speed.
IT	I am on fire.
IX	Fire is gaining.
IM	I request to be escorted until further notice.
IW	Fire is under control.
IZ	Fire has been extinguished.
JG	I am aground/in danger.
JH	I am aground. I am not in danger.
JI	Are you aground?
JL	You are running risk of going aground.
JO	I am afloat.
JW	I have sprung a leak.
JX	Leak is gaining rapidly.
KM	I can take you in tow.
KN	I cannot take you in tow.
LO	I am not in my correct position (used by light vessel).
MG	You should steer course...course follows.
NC	I am in distress and require immediate assistance.
NG	You are in a dangerous position.
NH	You are clear of all dangers.
PD	Your navigation lights are not visible.
PH	You should steer as indicated.
PI	You should maintain your present course.
PP	Keep well clear of me.
QD	I am going ahead.
QO	You should not come.
QP	I will come alongside.
QR	I cannot come alongside.
QT	You should not anchor; you are going to foul my anchor.
QQ	I require health clearance.
QU	Anchoring is prohibited.
QX	I request permission to anchor.
RA	My anchor is foul.
RB	I am dragging my anchor.

*TABLE 10-8(2): International Code of Flag Signals*

Flags	Signals
RN	My engines are out of action.
RY	You should proceed at slow speed when passing me (or vessel making signal).
RU	Keep clear of me; I am maneuvering with difficulty.
SC	I am underway.
SD	I am not ready to get underway.
SO	You should stop your vessel instantly.
SQ	You should stop or heave to.
UM	The harbor is closed to traffic.
UN	You may enter harbor immediately.
UO	You must not enter harbor.
UP	Permission to enter harbor is urgently requested. I have an emergency.
UW	I wish you a pleasant voyage.
VJ	Gale is expected from direction.
VK	Storm is expected from the direction indicated.
YU	I am going to communicate with your station with the International Code of Signals.
ZD1	Please report me to the Coast Guard, New York.
ZD2	Please report me to Lloyd's of London.
ZK	I cannot distinguish your signal. Please repeat it by...
ZL	Your signal has been received but not understood.
ZM	You should send (or speak) more slowly.

TABLE 10-8(2): International Code of Flag Signals

### INTERNATIONAL MORSE CODE

A ● —	R ● — ●	9 — — — — ●
B — ● ● ●	S ● ● ●	0 — — — — —
C — ● ● ● ●	T —	, — — — ● ● — —
D — ● ● ●	U ● ● —	; — ● ● ● ●
E ●	V ● ● ● —	: — — — ● ● ● ●
F ● ● — ● ●	W ● — —	. ● — ● — ● ● ●
G — — ● ●	X — ● ● ●	? ● ● — — ● ● ● ●
H ● ● ● ● ●	Y — — — —	' ● — — — — ● ● ● ●
I ● ●	Z — — ● ● ●	- — ● ● ● ● ● ●
J ● — — — —	1 ● — — — — —	= — ● ● ● ● ●
K — ● ● —	2 ● ● — — — —	/ — ● ● ● ● ●
L ● — ● ● ●	3 ● ● ● — — —	( — ● ● — — ● ● ●
M — —	4 ● ● ● ● —	) — ● — — — — —
N — ●	5 ● ● ● ● ● ●	Error ● ● ● ● ● ● ● ●
O — — — —	6 — ● ● ● ● ●	Wait ● — ● ● ● ● ●
P ● — — — ● ●	7 — — ● ● ● ● ●	End Msg ● — ● — — ● ●
Q — — ● ● —	8 — — — ● ● ● ●	End Work ● ● ● ● — — — —

TABLE 10-9: International Morse Code

**THE SEMAPHORE ALPHABET**





























1  A and 1	2  H and 8	3  P	4  Annul
1  B and 2	2  I and 9	3  Q	5  Number Follows
1  C and 3	2  K and 0	3  R	5  J or End Number
1  D and 4	2  L	3  S	5  V
1  E and 5	2  M	4  T	6  W
1  F and 6	2  N	4  U	6  X
1  G and 7	3  O	4  Y	7  Z

TABLE 10-10: *The Semaphore Alphabet*

The semaphore alphabet is shown here mostly as an interesting curiosity since no one except Boy Scouts uses it any more. The letters and numbers are shown here ordered here by their circles rather than in alphabetic order. The circle number is shown in the upper left hand corner of each box in figure 10-10. The circles are sequenced down the columns.

A number is sent by preceding the numbers with the “number follows” signal and following the numbers with the “end number” signal.