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VHF RADIO OPERATOR CERTIFICATE
&
INTERNATIONAL WATCHKEEPER / FLOTILLA SKIPPER CERTIFICATE

VHF RADIO OPERATOR CERTIFICATE
&
INTERNATIONAL WATCHKEEPER / FLOTILLA SKIPPER CERTIFICATE

INTRODUCTION

Today, radio communications are a central and essential part of life at sea. A very high frequency radio (VHF) is the absolute minimum a prudent skipper should have on board, even on local waters. Once a mariner ventures further offshore then the inventory of communications equipment grows to include SSB/HF radio, Satellite com munication, EPIRBs, SARTs etc. all of which will be explained in these notes

There are a number of purposes for good communications while at sea. These range from safety, which has absolute priority, to operational and business communications, both ship to shore and ship to ship. Familiarity with and correct use of, the various items of equipment is essential and in some instances compulsory.

This course aims to outline the various types of communications equipment, regulations concerning their correct use radio equipment and the correct procedures for emergency radio communications.

MODULE 7 / SECTION 2
BASIC RADIO THEORY

Transmitter, receiver, transceiver, antenna

A radio set consists of a transmitter and receiver combined in one instrument, usually called a transceiver. The transmitter is the part that can send out a radio signal and the receiver is the part that can receive a radio signal from another transmitter elsewhere. When you speak into the microphone the sounds of your voice are converted by the transmitter into radio waves, or signals, which are then sent out from the transmitter through an antenna. A receiver can pick up these radio signals through its antenna and convert them back into sounds which are heard coming from the radio speaker. When a radio station transmits a signal, it can be received on any other radio receiver if it is tuned to the same frequency as the transmitter, and it is within range of the transmitter.

Frequency

Radio transmitters send out their signal on a precise frequency and only a receiver tuned exactly to the same frequency will receive that signal. The frequency selected is usually indicated on the radio by a pointer against a printed scale or by a digital readout. In order to find the frequencies used by a specific station, a publication listing radio stations will have to be consulted. More sophisticated radio receivers may allow entry into a memory of frequencies of regularly used stations, so that by just pressing a numbered button the radio receiver automatically switches to the desired frequency. If the radio has this facility you can also switch from one frequency to another by simply pressing the correctly numbered button.

Radio waves/wavelength

Radio signals travel from a transmitter to a receiver in waves. Just as a pebble dropped on the surface of a lake forms concentric waves moving outwards from the point of entry, so do radio waves (invisible) move outward at constant velocity from an antenna in concentric circles.

Radio waves are electromagnetically propagated at the antenna (by the reversal of electrical current). As the rate of reversals is changed, so too is the length of the waves. Because all radio waves travel at the same speed (the speed of light) a transmitter that generates more waves per second produces shorter waves. Conversely one producing fewer waves per second produces longer waves. Thus the higher the frequency the shorter the waves and the lower the frequency the longer the waves.

Radio waves are described by the frequency with which these waves occur per second, in other words by the number of waves per second. The technical term used is a Hertz, named after Dr. Heinrich Hertz, a 19th. Century German physicist. 1 hertz (1Hz) means one wave per second, 1 kilohertz (1kHz) means 1,000 waves per second and 1 megahertz (1MHz) means 1,000,000 waves per second.

Radio Frequency Bands

Various radio frequencies are divided into bands:

BAND	BAND	FREQUENCY
VLF	Very Low Frequency	3 kHz to 30 kHz
LF	Low Frequency	30 kHz to 300 kHz
MF	Medium Frequency	300 kHz to 3000 kHz (3 MHz)
HF	High Frequency	3 MHz to 30 MHz
VHF	Very High Frequency	30 MHz to 300 MHz

UHF	Ultra High Frequency	300 MHz to 3000 MHz (3 GHz)
SHF	Super High Frequency	3 GHz to 30 HGz
EHF	Extremely High Frequency	30 HGz to 300 GHz

Three different frequency bands are reserved solely for marine communications.

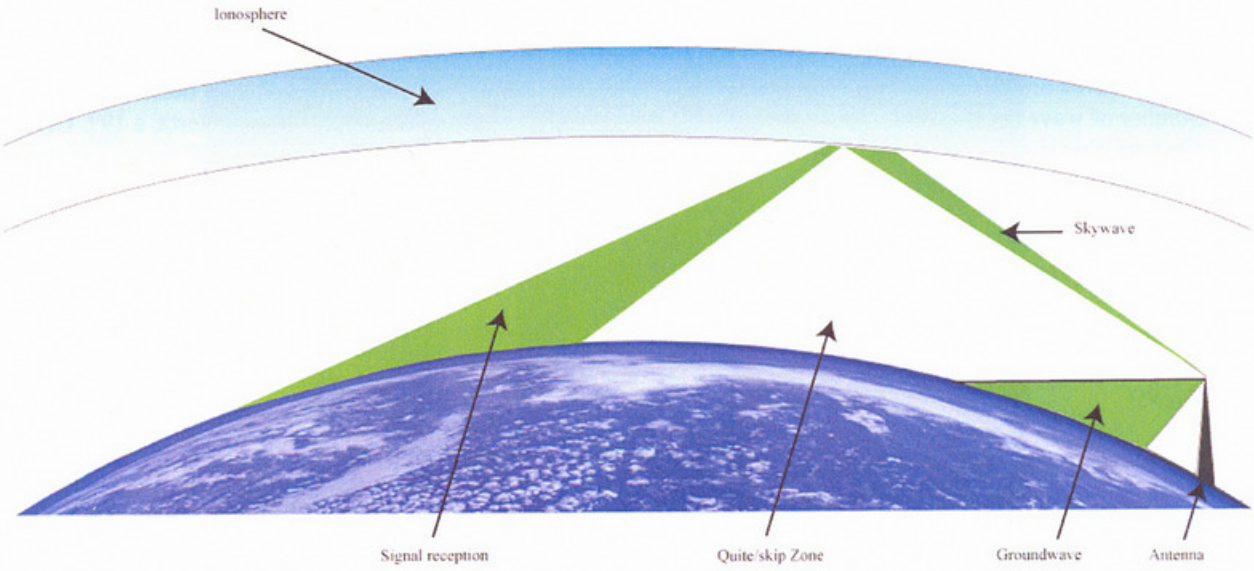
These are:

- HF (high frequency) from 4 to 25 MHz giving a range up to about 10,000 miles
- MF (medium frequency) from 1.6 to 4.2 MHz with a range of about 1000 miles
- VHF from 156 to 174 MHz with a maximum range of line of sight

Propagation simplified

Propagation is the way a radio wave moves from one place to another. The main factor which determines the path taken by a radio wave is its frequency. Basically low and medium frequencies will travel a path following the curvature of the earth and are known as ground waves and therefore range is determined by transmitter power. Higher frequencies will be reflected back from the ionosphere in the form of sky waves. Very High Frequencies and above become space waves which are not reflected back to earth.

Sky waves make long distance radio communications possible. The transmitter sends a radio wave up to the ionosphere which "bounces back" at an angle and returns to earth. The area between the transmitter and the return area is known as the skip zone. Skip distance is the shortest distance beyond the ground wave at which communication is possible, this is the point where the sky wave first comes to earth.



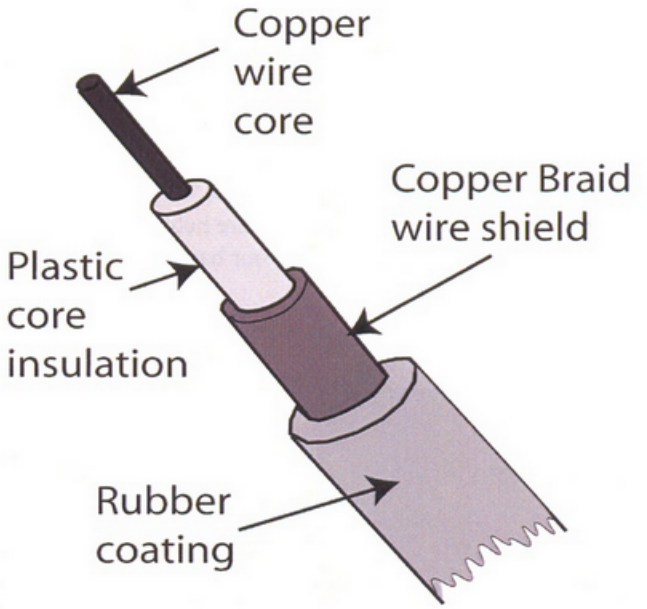
Propagation of radio waves.

MODULE 7 / SECTION 3
SUBSIDIARY EQUIPMENT

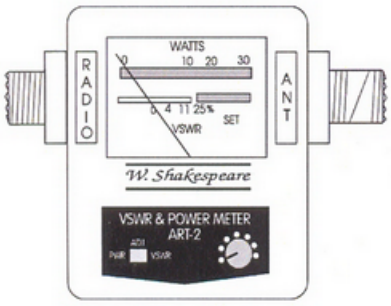
Antennas
The antenna requirements vary with each type of communications system and are discussed in the appropriate section.

Lightening
Modern radio transceivers are vulnerable to atmospheric electricity and may be damaged by lightening even without being hit directly. The electrostatic field surrounding an aerial in the vicinity of an electrical storm may cause severe damage to the radio. In these conditions, disconnect the aerial connection from the radio set and earth the cable, if possible.

Aerial cable
The cable used to connect the aerial to the radio is a special type of two wire cable called 'co-axial' cable. It is very important that only the correct grade of co-ax cable is used and it is of equal importance that the outside insulating sheath remains unbroken. If the cable insulation is damaged, water will penetrate to the wire causing corrosion which will reduce the power output from the aerial. The damaged cable should be replaced, not 'repaired' with insulating tape.



"Through deck" connectors will also lead to power loss if not kept corrosion free. It is usually preferable to pass the aerial cable through a raised watertight gland at the deck and make the connection inside he boat if possible. Cables exiting the mast base should be protected from physical damage from feet, winch handles, halyard falls and so on.



SWR Meter
A special meter, called a "standing wave ratio meter" (SWR meter), can be used to quickly check the transmitter power output and to determine how much of the power generated by the transmitter is actually being radiated from the aerial.

Batteries
Power is usually supplied to a fixed radio by a 12 volt, or 24 volt, rechargeable lead acid battery similar to a car or truck battery. The battery is normally charged by the boat's engine or by an independent generator. Transportable or hand-held radios use small internal rechargeable or replaceable dry cell batteries.

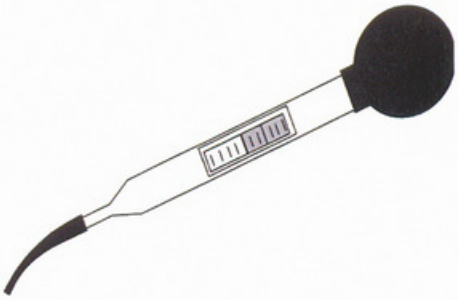
Battery Maintenance
A VHF transmitter will not deliver full power unless the battery is fully charged. Lead acid batteries with removable cell covers can have their state of charge checked using an hydrometer.

- A specific gravity of 1.250 or more indicates the battery is fully charged.
- A specific gravity of 1.150 or less indicates the battery is discharged.

Cells should be topped up with distilled water to about 6mm or 1/4 inch above the top of their plates if required. Batteries that are sealed can be checked with a voltmeter connected across the terminals. The battery should not be on charge while this test is carried out. A reading of 12.6 volts or more indicates the (12v) battery is charged.

Batteries should be kept clean and dry. The battery terminal connections should be tight, clean and covered with petroleum jelly to protect them from corrosion.

The wiring to the radio should be of sufficient cross sectional area to avoid a drop in voltage while transmitting.



Hydrometer

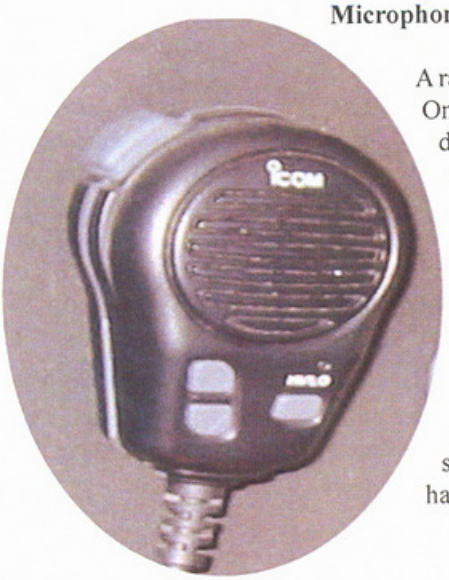
Safety

Be careful when working with batteries. The liquid in a lead acid battery is sulfuric acid, which is highly corrosive; wear protective gloves and eye protection when handling an hydrometer.

Hydrometers are made of thin walled glass and should be handled carefully.

Batteries are heavy, make sure they are held down securely in an acid resistant (e.g. lead lined) enclosure in the boat and be especially careful of your back when lifting heavy batteries. A battery under charge gives off explosive hydrogen gas.

Microphone



Hand Microphone

A radio transmitter has a microphone into which you speak whilst transmitting. On the microphone is a switch called the 'press to transmit' switch (PTT) which does exactly what its name suggests. This switch, when pressed, switches off the receiver section of the radio and switches on the transmitting section, thus allowing your message to be transmitted. You cannot transmit and listen at the same time when using a VHF radio of this type because when you are transmitting the receiver is switched off and when you are listening the transmitter is switched off. Two types of microphone are available. A 'telephone handset' and a 'fist mike'. A telephone handset looks exactly like a normal telephone except that it has its PTT switch somewhere in the middle of the handle between the earpiece and the mouthpiece. The fist mike is smaller being designed to fit in the palm of the hand and has its PTT switch somewhere on its side or top. Hand held portable VHF radios usually have the microphone built into the side of the radio.

MODULE 7 SECTION 4
COMMON RADIO TERMS

Simplex operation
Both stations use the same frequency and therefore the transceiver only allows the operator to either speak **or** listen but not both at the same time. This is known as simplex operation. Most VHF and single side band (SSB) frequencies are simplex.

Duplex operation
Each station transmits on its own frequency and at the same time receives on the other stations' transmitting frequency, similar to an ordinary domestic telephone on which you can both speak and listen at the same time.

For duplex operation to work, two frequencies are required for each channel/station instead of one. The transceiver is more expensive and two aerials, or a special duplex filter, are also required, making the whole set-up more expensive and difficult to install. With Single Side Band (SSB) this is standard for a number of frequencies, but for VHF, whereas it may seem attractive to have a duplex system it is not really of any real advantage and therefore not readily available.

MODULE 7 / SECTION 5
REGULATIONS / LICENSING REQUIREMENTS

Certificates of Competency

Under international law, every radio installation must be licensed and every operator must have a Certificate of Competency in Radiotelephony. In the USA the Federal Communications Commission (FCC) will issue a VHF operators' license (Operators Permit) upon payment of a fee but there is no test of competence or exam, as there is in most other parts of the world. Any operator on commercial vessels must have a VHF license as does anyone operating an SSB also.

General Regulations

1. Every radio installation (Station) must be licensed and the license displayed.

2. Every radio installation must be operated by a qualified operator or under the supervision of a qualified operator.

3. The master is responsible for all radio messages sent.

4. Stations must obey instructions from Coast Radio (i.e. Coast Guard Radio) stations.

5. Stations must identify themselves when transmitting, by using the station's name or call sign.

6. Before transmitting a station must first listen to make sure that its transmission will not interfere with communications already in progress.

7. Channel 16 is the international VHF distress frequency, and is used for distress, urgency and traffic safety.

8. Channel 16 is used for the initial calls and replies required to establish communication between stations but as soon as contact has been established both stations must transfer immediately to an appropriate working channel/frequency.

9. To facilitate reception of distress calls, all transmissions on Channel 16 should be kept to an absolute minimum.

10. Swearing and profanity is forbidden and any and all information gained by hearing or interception must be kept secret and can not be used for personal benefit.

11. All ships fitted with VHF radios must keep the maximum watch possible on Channel 16.

12. An entry must be made in the ship's official log book of:
    a) the times when, and the reasons why, listening to Channel 16 was discontinued,
    b) all communications relating to distress, urgency and safety traffic received or transmitted on the ship's radios.

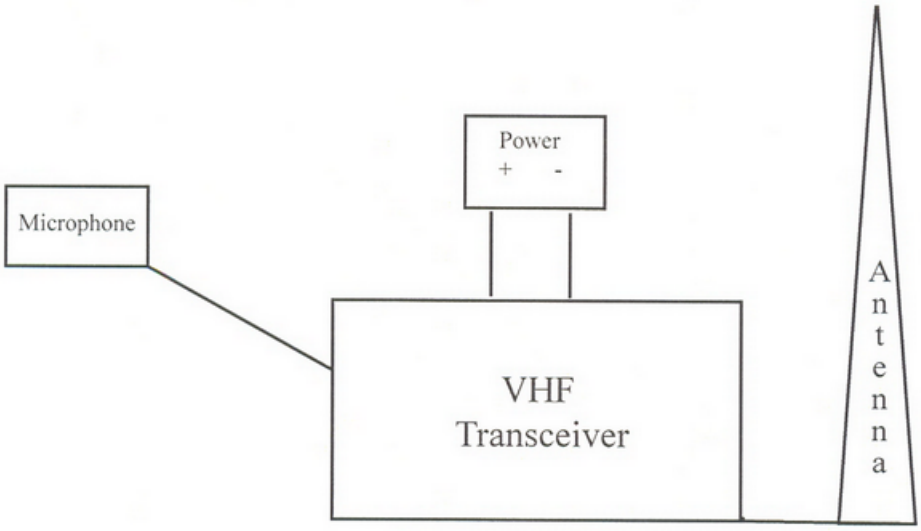
13. On the marine VHF band, channels are designated for communications between ships and coast radio stations, ships and port radio stations and between ships. Ships equipped with VHF radios must be able to send and receive on:
    Channel 16 (distress, urgency, safety and calling) and
    Channel 6 (the primary international intership channel)

MODULE 7 / SECTION 6
VHF RADIO EQUIPMENT

A VHF radio may be used efficiently for communications between vessels at sea and between a vessel at sea and shore based services. A VHF radio is still arguably the single most important piece of safety equipment carried and it is also affordable.

VHF
VHF stands for Very High Frequency, that is the frequency band within which the short range marine radio transmitter and receiver is designed to work.

Why VHF?
VHF's range might seem short but coverage is very good due to the amount of shore based radio stations and to the number of commercial shipping and pleasure boats. VHF is also cheap to purchase and install and easy to operate. It is not prone to interference from external electrical equipment and (nearly) always receives a good clear signal. It does not require much electrical power to operate and is therefore suitable for hand held sets with rechargeable batteries. Aerials for VHF radios are simple to install and inexpensive.



Typical VHF Set up

Channels
VHF radio transceivers for marine use operate between 156 MHz and 174 MHz and within this range there are 57 frequencies each of which is used, by international agreement, for a specific purpose. It would be far too difficult to memorize each specific frequency and to make this unnecessary, each frequency has been given a simple one or two figure number, called a 'channel'. For example 156.8 MHz, the international distress, safety and calling frequency is simply called '**Channel 16**'.

To select a specific frequency on a modern VHF radio all that is required is to turn a knob or press the number on a keypad which corresponds to the channel you require.
Although there are 57 international channels they are not numbered from 1 to 57. Channel numbers start at 01 and finish at 88, there are no channel numbers between 29 and 59. Each channel is allocated for a specific purpose.

Typical modern VHF transceiver

VHF sets
There are so many different VHF sets available that it is not practical to explain how each individual model is operated but essentially the functions of the controls on all types are similar. The model shown is typical of a modern fixed VHF transceiver which has all the international channels and the facility to fit private channels, if required.

On / Off / Volume
The set is switched on and off by turning the on/ off knob; this knob usually controls the volume of sound from the speaker as well. Note that adjusting the volume control only increases or decreases the sound coming from the speaker, it *does not* increase or decrease the power output from the transmitter.

Squelch
The 'squelch' control increases or decreases the sensitivity of the receiver. In practice the set is switched on and the squelch control is adjusted until continuous loud background noise is heard. The squelch control is then turned back slightly until the background noise disappears; at this setting the receiver is tuned to its maximum sensitivity allowing it to pick up all signals within range.

Channel (CH)
The rotary knob marked 'CH' is turned to select the required channel. As a safety feature most modern sets automatically select channel 16, the Distress and Safety channel, when first switched on. The channel selected is indicated by the number (16 in the figure) displayed in the window of the set. When it is desired to use another channel the knob is turned until the number of the required channel is seen in the window. Some sets use digital keypads, similar to the keypad on a calculator, to select the required channel.

DIM
For night time use the display can be lit by pressing the dim button. On some sets the brightness of the lighting can be controlled as required.

Dual Watch (DW)
Channel 16 is the Distress, Safety and Calling channel so it makes sense to listen to this channel at all times; in fact it is a legal requirement for commercial shipping to do so. However it is often desirable to be able to listen in to another channel at the same time; for example perhaps you may wish to listen to 22a (in the U.S.) in order to hear a marine weather advisory. A dual watch facility allows you to listen to both channel 16 and any one other channel at the same time. To use dual watch, select the channel you wish to listen to, say channel 22a, and then press the DW button. The receiver will then switch momentarily from channel 22a to channel 16 and back to 22a again and will repeat this cycle continuously until the dual watch is switched off. If the receiver detects a signal on Ch 16 it will lock on to that channel when in dual watch mode.

1/25
The maximum power output from a VHF set allowed by law is 25 Watts. A lot of the time a much lower output is quite sufficient, for example when talking to another boat which is in close proximity. Virtually all fixed VHF sets can (in theory) transmit at the legal maximum power of 25 Watts and most sets also have a switch which reduces the power output to 1 Watt for close range communications.

The number showing which channel is in use indicates which power option has been selected. 'HI' indicates 25 Watts and 'LO' indicates 1 Watt. Simply pushing the button marked 1/25 changes the power output. Note that this only affects the power output when transmitting and has no effect on the set's ability to receive signals.

USA / International / Canada
Selects the mode for the area in which the vessel is operating. The channel allocations vary in the 3 areas.

16
Most sets have a facility to go directly to channel 16, the distress and safety calling channel, quickly in an emergency. Pressing the button marked '16' automatically selects channel 16, high power.

Transmit (Tx)
Tx is 'shorthand' for transmit. When you are transmitting some sets show a little red light to confirm that the set is transmitting. ('Rx' is shorthand for receive.)

Microphone (MIC)
The lead from the microphone cable is plugged in to the socket marked 'MIC'.

Aerial socket
Somewhere on the back of the set is a socket into which the aerial lead is connected. On no account press the transmit button on a radio without an aerial being connected because serious, or irreparable, damage to the transmitter may result.

Hand held VHF radios
Small hand held portable VHF transceivers are readily available and their operation is similar to that of the fixed set explained above. Hand held radios have a self contained, rechargeable battery and an aerial connected directly to the top of the set. The maximum power output is normally between 3 to 5 watts; more power would make no difference to the possible range of the set due to the low aerial height.
If you wish to extend the range of a hand held it is possible to make up an adapter cable to connect the hand held to a fixed aerial mounted as high up as possible. Most hand held radios have the full range of channels, various different methods being used to select them. The microphone is usually incorporated in the body of the set and sometimes the battery pack is removable allowing a fully charged spare to be carried. Some sets have provision for an external microphone to be fitted.

Nowadays most hand held radios are waterproof. Chargers suitable for mains and 12 volt are usually supplied with the set; never let the batteries remain flat for any length of time or they may not recharge. A hand held radio is useful on a small boat and makes an ideal back up for the larger boat. In the case of an emergency a hand held radio will allow communications from the life raft or dinghy. The regulations and licensing requirements for hand held radios are the same as for fixed sets, remember it is the ship that is licensed, not the radio.

Range

Essentially the maximum range of a VHF signal is 'line of sight'. VHF radio waves travel in a straight line but the surface of the earth is curved, therefore the maximum range between two VHF transceivers will depend on the height of the transmitting aerial and the height of the receiving aerial. The higher the aerial the greater the range which is why coast radio stations put their aerials on top of hills.

Due to earth's curvature the sailing boat, with the higher aerial, has a greater VHF radio range than a motor boat.

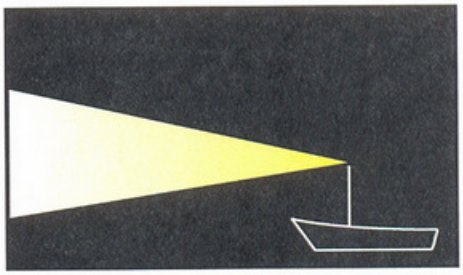
Range versus aerial heights

The approximate ranges which may be expected are as follows:

Receiving aerial height, Feet	Range, Miles	Transmitting aerial height, Feet
10	8	10
10	10	20
10	14	50
20	12	20
30	15	30
50	20	50
60	42	500

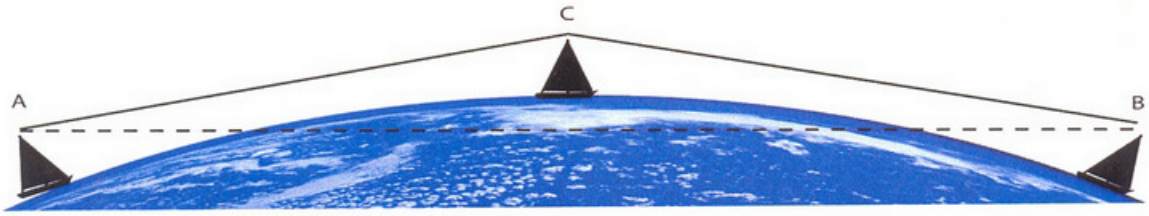
Aerials

If you could see the radio signal being radiated from an aerial it might look something like the beam from a torch, the beam starting out as a point of light and increasing in width the further it moves away from the aerial. As the power input is the same anywhere along this beam it can be seen that the signal strength becomes weaker as the distance from the aerial increases. Therefore a point must be reached after which the signal will be too weak to be of any use, irrespective of the height of the aerial.



Relaying messages

It may sometimes be possible to "relay" messages through a station between you and the station you wish to talk to.



A and B cannot talk to each other but they can relay their message through C

VHF Channel Allocations

Channels
Each channel is allocated for a specific purpose:

- International Distress, Safety and Calling. (Channel 16)
- Ship to Ship. (Channel 06 is the primary inter-ship channel.)
- Ship to Port. (12,14)
- Ship to Coast Radio Station. (24 - 28)
- Digital selective calling for distress and safety, i.e. automatic distress alarm (70)
- U S Coast Guard (22A) The A indicates a US channel, not International.

Note that all VHF transceivers must, by law, have both Ch 16 and Ch 06 fitted.
Lists of channels used by all stations are given in Admiralty Lists of Radio Signals, Vol. 1 (ALRS Vol. 1) and in the Reeds Nautical Almanac, or on Channel Assignment Charts.

Some **International** channels (in order of priority) which may be used for the different services are:

Ship to Coast Stations
26, 27, 25, 24, 23, 28, 04, 01, 03, 02, 07, 05, 84, 87, 86, 83, 85
Ship to Port Stations
12, 14, 11, 09, 68, 71.
Ship to Ship
06, 08, 72, 77, 10, 13, 09, 73, 69, 15, 17.

Channel 16
Channel 16 is reserved for Distress, Urgency and Safety messages, the precise meanings of which are described later. Ch 16 is also used as a calling channel. Because every station should keep a continuous watch on Ch 16 it follows that any station you wish to contact will hear you if you call them on Ch 16. As soon as contact is established you will both change to an appropriate working channel to continue the conversation. The absolute minimum time possible must be spent transmitting on Ch 16, in order to leave Ch 16 clear for its designated purpose. The *maximum time allowed on channel 16 is 60 seconds*, apart from Distress Urgency or Safety traffic. You can of course, by prior agreement, arrange to call another station on a working channel in order not to take up time on Ch 16, and wherever possible this should be done.

Yachts and small boats are not required by law to listen at all times to Ch 16 but should do so whenever possible so that they will be aware of any distress situation and, of course, in order to hear any station trying to contact them. There are 57 internationally allocated channels. Each one of these channels is reserved for one or more specific purposes. It is not necessary to know all of the channels off by heart, but you must memorize a few of them. **You should know that every VHF radio must have both Channel 16 and Channel 6 and possibly Channel 13.**

Channel 13
Channel 13 is a 'bridge to bridge' channel used for communications between shipping relating to safety of navigation. All commercial vessels are required by international law to monitor a separate radio tuned to Channel 13 when in coastal waters. Ships greater than 20 meters or 65 feet must maintain a listening watch on this channel in US waters.

Ship to Coast Radio Station
Ship to Coast Radio channels are used for a vessel to talk to a shore based radio station, such as the Miami Marine Operator. Coast Radio Stations have been set up at various strategic places around the coast so that they can control communications and broadcast messages such as safety information, navigation warnings, gale warnings and weather forecasts. Coast Radio stations are also intended to link ships and boats into the telephone network ashore ('link calls'). Channel 16 is monitored continuously by Coast Radio stations as well as their working channels.

Ship to Port Station
Channels are allocated for radio traffic between a ship and harbor or port authority and might be used, for example, when requesting a pilot or when seeking permission from the Harbor Master to enter a port.

Ship to Ship
Ship to ship channels are for one ship or boat to talk to another ship or boat. Every VHF radio must have the primary intership channel 06.

Weather Channels
In the U.S. WX 1 – WX8 are "receive only" channels and are operated by the National Oceanagraphic and Atmospheric Administration (NOAA) and broadcast a continuous weather synopsis. The channels are geographical in coverage and designed to minimize interference with each other.

Channel 22A
Channel 22A is used by the U.S. Coast Guard solely for safety communications with ships, yachts and fishing vessels.

Digital Selective Calling (DSC) on Channel 70.
In 1992 a worldwide system intended to co-ordinate search and rescue communications came into being. This system is called 'Global Maritime Distress and Safety System' or GMDSS for short.

GMDSS contains provision for VHF sets to have Digital Selective Calling (DSC) equipment incorporated, or added on, allowing the radio operator to send distress alerts in an automatic digital form which will be picked up by Coast Radio Stations and ships keeping an automatic watch on Ch 70.

Channel 70 is reserved for Digital Selective Calling and must not on any account be used for speech transmissions.

You must, wherever possible, use the correct channel but if for example you received no reply to a distress message sent on channel 16 it would be proper (and sensible) to try any other channel on which you think you may be heard. (You will not be heard on channel 70)

Listen before transmitting to ensure that the channel you intend to use is not in use.

Radio check, Maximum time 10 seconds.

MODULE 7 / SECTION 7
RADIO PROCEDURES

Correct radio procedure has been developed in order to reduce to the absolute minimum the amount of time used during communications. One of the ways this is accomplished is by using an internationally agreed format, thus cutting out all unnecessary words and reducing the risk of misunderstandings which require extra time to clarify.

DO NOT use phrases like "are you receiving me" or "are you there". If the station being called is not there or not receiving your signal, it certainly will not reply. Always finish each individual transmission with the word 'OVER' which indicates that the station transmitting is now ready to receive a reply.

When you have finished working with the other station finish your final transmission with the word 'OUT'. **NEVER say "OVER AND OUT".**

PROCEDURE WORDS
Procedure words are single words which are used to define a specific and unambiguous meaning. They are used internationally for the sake of brevity and clarity.

ALL AFTER	Everything that follows word or phrase indicated
ALL BEFORE	Everything before word or phrase indicated
CORRECT	Confirms that station has correctly repeated message.
CORRECTION	I have made an error (followed by I SAY AGAIN …..)
IN FIGURES	The following figures are to be written as figures (i.e. '2')
IN LETTERS	The following numerals are to be written in letters (i.e. 'two')

I SAY AGAIN I repeat (e.g. important words). Used with the pro-words WORD AFTER, WORD BEFORE, ALL AFTER, ALL BEFORE.

I SPELL	I will spell the last word using the phonetic alphabet
OVER	Invitation to reply
OUT	End of working (*NEVER SAY "OVER AND OUT"*)
RADIO CHECK	Please tell me the strength and clarity of my transmission
READ BACK	Receiving station will now repeat the message received
RECEIVED	Receipt acknowledged (*NOT 'ROGER'*)
SAY AGAIN	Repeat your message
STATION CALLING	Used when a station is uncertain of the identity of the station calling
TRAFFIC	Radio / telephone communications
THIS IS	This transmission is from the station whose name follows

WRONG	The message has been read back incorrectly
WAIT....MINUTES	If a station is unable to accept traffic immediately it will indicate how long before it can accept traffic.
NOTHING HEARD	When there is no reply from a station being called.

The Phonetic Alphabet

Sometimes it will be necessary to spell words, call signs, etc. and in order to avoid confusion the following phonetic alphabet has been adopted internationally and must be used. If it is necessary to spell a word the spelling is preceded by the words "I spell". When giving numbers say each individual digit.

For example: "..and I expect to arrive at Miami, - I spell: Mike India Alpha Mike India, (Miami) , - at One Five Zero Zero tomorrow afternoon". (1500)

The phonetic alphabet is given below and must be learnt off by heart.

Letter	Word to use	Letter	Word to use
A	Alfa	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

Figure	Spoken as
0	Zero
1	Wun
2	Too
3	Three
4	Fo-wer
5	Fifer
6	Six
7	Seven
8	Ait
9	**Niner**

Numbers are more or less pronounced normally with the exception of the number '9' which is pronounced "NINER". The reason for this is to distinguish between 'nine' and 'five' which, under bad conditions, can sound similar over the radiotelephone.

You must learn the phonetic alphabet off by heart.

Using VHF

Remember that VHF design means that whilst you are using a channel, no one else within a large radius can use the same channel so always try to keep your traffic or message as brief as possible.

- Switch the radio on.
- Select the required channel and adjust squelch control.
- Listen, to ensure channel is not in use.
- Engage brain before opening mouth.
- Press the PTT switch.
- Speak clearly into the microphone.
- Keep your message as brief as possible.

- Finish your message with the word "OVER".
- Release the PTT switch and wait for a reply.

Procedure Cards

A procedure card, similar to the one shown below, explaining how to use the VHF radio in an emergency should be placed directly beside the radio on board your boat. In an emergency, the person who is left to work the radio may not understand how it is operated.

TO USE A RADIO WHEN IN DISTRESS

- TURN RADIO ON
- SELECT CHANNEL 16
- PRESS TRANSMIT SWITCH ON MICROPHONE
- SAY:

  "MAYDAY, MAYDAY, MAYDAY
  THIS IS
  'NAME OF BOAT', 'NAME OF BOAT', 'NAME OF BOAT'

  MAYDAY
  'NAME OF BOAT'

  POSITION
  NATURE OF EMERGENCY;
  NUMBER OF PEOPLE ON BOARD;
  ASSISTANCE REQUIRED;
  OVER."

- RELEASE TRANSMIT SWITCH;
- LISTEN FOR REPLY
- REPEAT IF NO REPLY AFTER 1 MINUTE

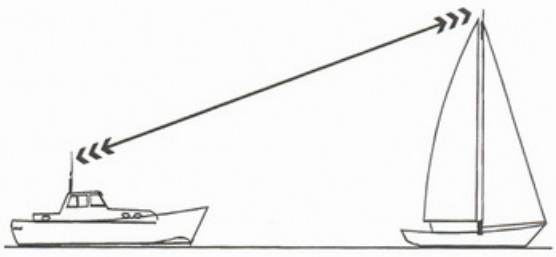
Ship to Ship calls

In order to establish contact with another ship, or boat, contact is made initially on Ch 16 (unless a working channel has been previously agreed upon). As soon as contact has been established both stations will immediately change to an appropriate agreed working channel, such as a ship to ship channel in this case.

First listen to ensure that no other station is transmitting then press the microphone switch and the initial call to establish contact then proceed. In the following example a yacht called 'Celtic Mist' wishes to talk to a motor boat called 'Warrior'. The call begins with the name of the boat being called followed by the words "this is" followed by the name of the calling boat given twice. The calling boat then nominates an appropriate working channel, Ch 09, 68,69,71,72,&78A, and finishes with the word 'over'.

Example:

"WARRIOR
THIS IS
CELTIC MIST , CELTIC MIST
CHANNEL 09,
OVER"



'Elaine' replies on channel 16 and agrees to use channel 09:

**"CELTIC MIST
THIS IS
WARRIOR
CHANNEL 09
OVER."**

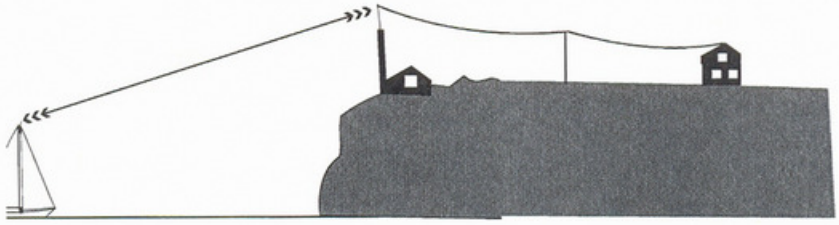
Both boats now switch their radios to channel 09 to continue their message.

If reception conditions are bad for any reason, the names of the calling and called boats may be repeated not more than three times. It is not usually necessary to repeat the names of each boat three times unless reception conditions are bad. The person on board Warrior will normally recognize the name of their own boat quickly but might have difficulty catching the name of the calling boat with which they may not be familiar. For this reason the name of the calling boat can be repeated not more than three times. If a boat has a particularly odd or difficult name it may be better to use the boat's call sign rather than her name.

Should no reply be received to the initial call wait three minutes before repeating the call again.

Link Calls

A link call is simply a telephone call made by linking the VHF signal into the normal telephone system through a Coast Radio Station. Therefore a link call can be made to a telephone subscriber anywhere in the world, provided the calling station is within range of a Coast Radio Station. Most countries have a comprehensive VHF Coast Radio station network and a boat in these waters should have no difficulty in setting up a link call. The yacht 'Warrior', whose call sign is WTC 4705, wishes to make a link call through Miami Marine Operator. The boat has checked that Miami's working channel is Ch 26 and she therefore switches to Ch 26, listens to make sure no one else is using the channel and then establishes contact with Miami. The call would proceed as follows:



**"MIAMI MARINE OPERATOR
THIS IS
WHISKEY TANGO CHARLIE 4705, WHISKEY TANGO CHARLIE 4705
'WARRIOR'
ONE LINK CALL PLEASE
OVER."**

The marine operator will reply and ask for the details of the phone number 'Warrior' requires, payment for the call (usually set up prior to sailing) and any other relevant information. 'Warrior ' would then be asked to 'stand by' (remain listening on Ch 26) until the operator has reached the number required. If reception conditions are not good, due for example to engine noise or sea conditions, the name of the station being called and the call sign of the calling station would each be repeated not more than three times.

Link calls can also be made from a telephone subscriber ashore to a boat by dialing 1-800-SEACALL and asking for a "ship's radio telephone call", giving the name of the ship, its approximate location and the name of the person you wish to talk to.

Traffic Lists

Traffic Lists are lists of the names/call signs of vessels for which there is a telephone call waiting. If you hear your boat's name or call sign in the traffic list wait until the traffic list is finished and then call the Coast Radio station on its working channel (after first listening to make sure the channel is clear). The call would be as follows:

"MIAMI MARINE OPERATOR
THIS IS
WHISKEY TANGO CHARLIE 4705, WHISKEY TANGO CHARLIE 4705
YOU HAVE TRAFFIC FOR ME, OVER."

The marine operator would reply and ask you to stay listening on the working channel until they make the connection to the telephone subscriber who wishes to contact you.

MODULE 7 / SECTION 8
EMERGENCY RADIO COMMUNICATIONS

DISTRESS (MAYDAY)

A Distress signal is the most important transmission that can be made and as such takes precedence and has priority over all other radio transmissions. Nothing is allowed to interfere with a Distress message. Because of the importance given to a Distress message it is defined clearly and this definition must be understood.

DISTRESS: "THE DISTRESS SIGNAL INDICATES THAT A SHIP, AIRCRAFT, OR VEHICLE IS THREATENED BY GRAVE AND IMMINENT DANGER AND REQUESTS IMMEDIATE ASSISTANCE."

The key words are GRAVE **AND** IMMINENT. If these two conditions are not simultaneously fulfilled the situation does not justify the sending of a distress message. The skipper, or person in charge, decides whether a situation is both grave and imminent.

Under International Radio Regulations 1982, (amended in 1985) the use of the word Mayday is strictly limited to situations where the ....ship, aircraft or other vehicle is threatened by grave and imminent danger...; there is no mention of a *person*. In order to include a person in the definition an International Conference on Safety of Life at Sea held in 1979 redefined Distress to include a person. Since 1991 it has been accepted practice to use Mayday in cases of man overboard. To date, the International Telecommunications Union have not accepted this definition.

The **Distress signal** is the spoken word **"MAYDAY"**
(Mayday comes from the French "m'aidez", which means "help me")

The distress call:

MAYDAY, MAYDAY, MAYDAY

THIS IS

"WARRIOR", "WARRIOR", "WARRIOR"

followed immediately by the Distress Message:

MAYDAY

"WARRIOR",

POSITION IN LATITUDE AND LONGITUDE
OR
DISTANCE AND BEARING FROM A KNOWN POINT

NATURE OF DISTRESS AND ASSISTANCE REQUIRED

ANY OTHER USEFUL INFORMATION

OVER

The distress procedure is in two sections:

A Distress call is transmitted on VHF Channel 16, using high power (25 watts) or 2182,4125, 6215 etc. on SSB. Your position should be given first, as accurately as possible, either in latitude and longitude or as a bearing and distance

FROM a known feature. For example "position 2 miles East from Port Everglades". A position as a bearing and distance from a place might mean that someone nearby will realize they are close to you faster than if they have to first plot the latitude and longitude on a chart.

The nature of the distress is given next so that the rescue services know what assistance is most appropriate for the circumstances. The number of people on board is the next most important piece of information so that the rescuers will know how many people to search for in the event of the crew being unable to remain together. If there is sufficient time, give any other information that may be relevant. Finally finish with the word "over".

Acknowledgment of receipt of distress call:
Ships, which receive a Distress message from a station in their immediate vicinity, must acknowledge receipt of this message immediately. However, in our coastal waters it is likely that a distress message will be picked up by a Coast Radio Station and for this reason wait a short time before acknowledging receipt of the Distress message. It is reasonable to assume that anyone in a distress situation may have very little time to spare sending distress signals so it is vital that a distress message be acknowledged as soon as possible to allow the sender time to save himself. It could happen that for some reason you may be the only one to hear the distress message and if this is the case you must then acknowledge receipt.

If you hear a distress call

- *Write down the position*, name of boat and nature of distress at once.
- Wait a few moments, if no other station responds to the distress call,
- Acknowledge receipt of distress call yourself.

A distress call is acknowledged as follows:

Distress signal once only	**"MAYDAY"**
Name of station in distress 3 times	**"WARRIOR", "WARRIOR", "WARRIOR",**
	THIS IS
Name of station acknowledgin receipt	**MY BOAT, MY BOAT, MY BOAT**
	RECEIVED MAYDAY"

The key words to remember here are **RECEIVED MAYDAY.** If you have to acknowledge receipt of a distress message you must, as quickly as possible, let the vessel in distress know your present position and how long it will be before you can reach her. You may also have to relay the distress message; how to do this will be explained later on.

Control of distress traffic.
Most distress situations will require on-going communications and to avoid confusion the distress traffic will be controlled either by the station in distress or by a Coast Radio Station. Distress traffic has absolute priority over all other messages. Stations not involved in the distress communications must not transmit on the channel being used for distress working or interfere with the distress traffic in any way.

Imposing Radio silence
A station may be unaware that a distress situation exists and may attempt to transmit on the channel being used for distress working. In this case radio silence will be imposed on the interfering station by the controlling station using the words **'SEELONCE MAYDAY'** followed by the name of the controlling station. *Only the controlling station*

may use this expression.

"MAYDAY"

SEELONCE MAYDAY, SEELONCE MAYDAY, SEELONCE MAYDAY.

THIS IS COASTGUARD MIAMI, COASTGUARD MIAMI

OUT"

A station other than the controlling station may impose radio silence if it feels that this is essential by using the expression **'SEELONCE DISTRESS'**, followed by its own name in a similar form as shown in the example above.

Note that all transmissions made by stations involved with an on-going distress situation start with the word **'MAYDAY'** spoken *once only*.

Restricted radio working may resume
If the controlling station feels that complete radio silence on the distress frequency is no longer necessary it may allow *important* traffic to resume. It will make this known by using the word **'PRUDONCE'.**

Canceling Radio silence
When the distress situation is over or when radio silence is no longer considered necessary the controlling station will use the words **'SEELONCE FEENEE'** as follows:

"MAYDAY - ALL STATIONS, ALL STATIONS, ALL STATIONS - THIS IS
NAME of station sending the message, TIME of the message,
NAME of the station that was in distress
SEELONCE FEENEE"
You should continue to listen to distress traffic until you are sure you cannot be of assistance in any way.

Mayday Relay
Transmission of a Distress Message by a ship not itself in Distress
If you hear a Distress call which no other station has heard you must first acknowledge receipt and then send a 'Mayday Relay' in the hope that a Coast Radio station will pick up your signal. If you see a distress signal of any form, flares etc. you should broadcast a "Mayday Relay" in the format set out below. In essence you will become the radio "go between", relaying messages between the vessel in distress and the Coast Radio Station and vice versa.
You may also have to send a distress message on behalf of a ship in distress which cannot, for some reason, send a distress message herself.

It is very important that you learn the correct procedure for a Mayday Relay *because a mistake could well generate confusion as to exactly who is in Distress or even start a second search and rescue situation.*

Mayday Relay Call:

MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY,

THIS IS,

"MYBOAT", "MY BOAT", "MY BOAT"

Repeat the distress message sent by the station in distress:

THE FOLLOWING DISTRESS MESSAGE WAS RECEIVED FROM "name of boat in distress"

AT "time" HRS

MESSAGE BEGINS" ----------"

MESSAGE ENDS

On seeing a
distress signal

MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY,

THIS IS,

"MY BOAT", "MY BOAT", "MY BOAT",

MY POSITION IS,

TYPE OF DISTRESS SIGNAL SEEN
TIME DISTRESS SIGNAL WAS SEEN

POSITION OF DISTRESS SIGNAL SEEN OR BEARING FROM YOUR POSITION'

ANY OTHER USEFUL INFORMATION,

OVER.

False Alarms
Some people seem to take pleasure in sending hoax distress calls.
Except in the case of distress, the use of the Distress signal is absolutely forbidden. The master of the ship can be prosecuted for misuse of the Distress signal.

SUMMARY

THE DISTRESS SIGNAL IS THE SPOKEN WORD "MAYDAY"

DISTRESS signal may be sent when there is GRAVE AND IMMINENT DANGER

Learn how to send a Distress call and message:

"MAYDAY, MAYDAY, MAYDAY"

THIS IS

"MY BOAT", "MY BOAT", "MY BOAT"

MAYDAY,

"MYBOAT",

POSITION,

NATURE OF DISTRESS AND ASSISTANCE REQUIRED,

ANY OTHER USEFUL INFORMATION,

OVER.

Learn how you would acknowledge receipt of a Distress message:

"MAYDAY

NAME of station in distress repeated 3 times,

THIS IS

"MY BOAT", "MY BOAT", "MY BOAT"

RECEIVED

MAYDAY"

RADIO SILENCE IS IMPOSED BY:

CONTROLLING STATION	"SEELONCE MAYDAY"
ANY OTHER STATION	"SEELONCE DISTRESS"
RESTRICTED WORKING MAY RESUME	"PRU-DONCE"
NORMAL WORKING MAY RESUME	"SEELONCE FEENEE"

Learn how to send a Mayday Relay:

MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY,
THIS IS

"MY BOAT", "MY BOAT", "MY BOAT"

THE FOLLOWING DISTRESS MESSAGE WAS RECEIVED FROM "name of boat in distress"
AT time HRS

MESSAGE BEGINS "repeat message"
MESSAGE ENDS

OVER

URGENCY **(PAN PAN)**

An Urgency message takes precedence and priority over all other radio communications except Distress. It is therefore the second most important message that can be transmitted.

The URGENCY PRIORITY for an Alert and the URGENCY SIGNAL indicates that a VERY URGENT MESSAGE

follows concerning the SAFETY of a BOAT or the SAFETY of a PERSON.

The **Urgency Signal** consists of the words **"PAN-PAN".**
The signal shall be said THREE times in an Urgency Call.

The use of the URGENCY PRIORITY for an alert and the use of the URGENCY SIGNAL shall be used only on the authority of the Master or person responsible for the ship.

The Urgency call Message is normally sent on the distress frequencies.
However, the Urgency **MESSAGE** may be sent on a **working frequency** in case of a long message or medical message or for a repeat of a message in areas of heavy radio traffic.

PAN-PAN, PAN-PAN, PAN-PAN,

ALL STATIONS, ALL STATIONS, ALL STATIONS,

THIS IS

"MY BOAT", "MY BOAT", "MY BOAT",

MY BOAT
POSITION

NATURE OF URGENCY AND ASSISTANCE REQUIRED,
ANY FURTHER RELEVANT INFORMATION,

OVER.

Medical Emergency
If you require urgent medical advice and/or assistance use the Urgency call with the addition of the word "MEDICO".
(i.e. "**PAN-PAN MEDICO, PAN-PAN MEDICO, PAN-PAN MEDICO**", etc.)
This will alert the Coast Radio Station that you require medical advice and they will immediately start to arrange telephone contact with a doctor at the hospital on duty. As medical advice is liable to be lengthy you will be asked to change to a working channel/frequency in order to leave the calling channel/frequency clear.

SAFETY (SECURITE)
The **safety signal** is "**SECURITE" (pronounced "say-cure-e-tay")**

The safety call is normally only used by a Coast Radio Station and it warns that a message of importance to shipping is about to follow. The message may be regarding a navigational hazard or a gale warning for example. The Safety signal will be transmitted on the calling channel/frequency but the message will usually be sent on a working channel/ frequency, which the Coast Radio Station will announce.

An example of a safety call might be:

"SECURITE, SECURITE, SECURITE,

ALL STATIONS, ALL STATIONS, ALL STATIONS,

THIS IS U.S. COASTGUARD MIAMI, US COASTGUARD MIAMI,

U.S. COASTGUARD MIAMI,

FOR REPETITION OF NAVIGATION WARNING LISTEN CHANNEL 22A/2670KHz".

If you wish to hear the navigation warning switch to channel 22A/2670KHz, the navigation warning will be transmitted after a minute or so.

You should listen to Securite messages until you are sure that they do not concern you and you should of course not interfere with these messages by transmitting on the same channel while they are in progress.

Mobile Telephones

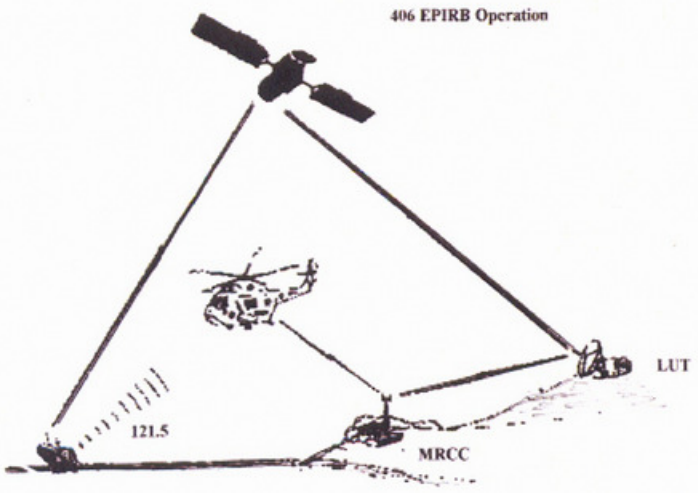
It should be stressed here that a mobile phone is *not* as good as a VHF radio with regard to distress messages because:

- A distress message transmitted on channel 16 will be heard by all ships and Coast Radio stations in the vicinity, a phone call will not.
- VHF coverage around the world is extremely good, mobile phone coverage at sea is not continuous.
- Coast Guard Radio stations will act immediately on hearing a Mayday; a telephone call will have to be re-routed to the search and rescue authorities.
  Search and Rescue helicopters and surface vessels can use VHF transmissions to help locate the vessel in distress but the equipment does not work with mobile phones.

MODULE 7 / SECTION 8
EMERGENCY POSITION INDICATING RADIO BEACON (EPIRB)
&
SEARCH AND RESCUE TRANSPONDERS (SARTS)

EPIRBS

These operate on 406 MHz and include a signal on 121.5/243.0 MHz which the Search and Rescue authorities can use to home in on. Older EPIRBS that operate on 121.5 MHz only (Civil aircraft distress frequency) may still be found, but they have created many false alarms and are being phased out.



EPIRB

The system employs Polar orbiting satellites evenly spaced East -West around the earth, which provide total global coverage, supplemented by geostationary satellites, relying on "Doppler shift" for positional information. The satellites communicate with a network of earth stations known as Local User Terminals (LUTs) who can pass distress alerts and location data to Rescue Coordination Centers (RCCs) via Mission Control Centers (MCCs).
By using several satellites in displaced orbital planes the system provides a complete world wide distress alert monitoring facility with an average notification time of 90 minutes.

When activated, the EPIRB will transmit a distress signal containing the identity of the ship or aircraft which is relayed by the orbiting satellite back to an earth station. The LUT uses doppler shift measurement techniques to compute the position of the beacon and then alerts the appropriate RCC. A distress message can be relayed from under one minute to one and a half hours, dependent mainly on the latitude. The nearer the equator the greater the potential time lag. On 406 MHz the average position accuracy is from 3-5 km (Although in one actual distress the position was only 70 yards (64m) out).

121.5 MHz is used as a homing frequency, primarily by Search and Rescure (SAR) units. However, accuracy on this frequency is reduced to 12-20 km. Once a shore terminal is alerted by a signal via satellite, a search and rescue operation is commenced. SAR and rescue units use the 121.5MHz signal to home in on the distress. Surface craft can use 3cm radar to home in on SART transmissions. Hand held vhf radios are used for on scene communications.

INMARSAT

These operate on L-Band (1.6 GHz) employing geostationary satellites, with positional information coming from an integrated GPS system. With INMARSAT, IAT (Initial Alerting Time) on average is 2 minutes (potentially up to 5 minutes) with advertised accuracy of 100m, although in practice it is usually in the order of 3-5 m.
Complies for use by ships sailing in areas Al, A2 and A3.

Operation

When activated, the EPIRB will transmit a distress signal containing the identity (MMSI No) of the ship or aircraft which is relayed by the orbiting satellite back to an earth station (LUT). The LUT uses doppler shift measurement techniques to compute the position of the beacon and then alerts the appropriate RCC.

An EPIRB must be:

1. Installed in an easily accessible position
2. Ready to be released manually and capable of being carried by one person into a survival craft and being operated manually.
3. Capable of floating free in the event of the ship sinking, and automatically transmitting when afloat. The EPIRB should be fitted in a float free position on board ship, well away from any hazards which may prevent its release.

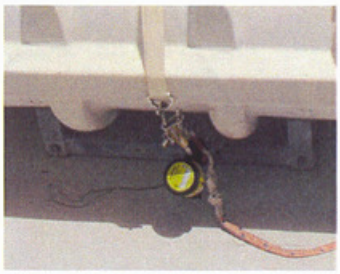
Testing

The EPIRB should be removed from its stowage and tested once every month. Follow the manufacturers instructions carefully, most require pressing a TEST button for a few seconds, an indicator light will flash indicating a successful test, release the TEST button.

The EPIRB battery has a life of 5 years, and the expiry date should be clearly marked on the EPIRB. Operating life is typically 48 hours. Usually a *Hydrostatic Release mechanism has a life of 2 years, and should be replaced when required. The expiry date should be clearly marked on the mechanism. The bracket also has an expiry date of 8 years after purchase.

Having been activated either manually or automatically the EPIRB requires no further input from the operator.

*Liferafts should have a hydrostatic release attached to them for automatic deployment in the event of a sudden sinking. The hydrostatic release unit is mounted between the liferaft and the cradle which holds it. If you do not have a chance to manually deploy the liferaft when the ship is sinking, at a depth of 10-15' the Hydrostatic Release Unit will allow the raft to inflate and float free automatically.



Hydrostatic Release attached to the liferaft

SART

One SART is compulsory for vessels over 24 meters (80 feet) and less than 50m or 500 grt; vessels over this size must now carry at least two SARTs, one each side of the vessel, located so that they can be rapidly placed in a survival craft. Alternatively one transponder can be carried in each survival craft, the SART being carried in lieu of a radar reflector in a liferaft.

The SART is a location aid, operating on a radar frequency (9GHz) with only a short range, of line of sight. ie. A SAR helicopter at 3,000' would give a range of 30 miles. Once activated the SART will "paint" a marker on the screen of any vessel's operating radar display as an easily recognized series of 12 dots. When the SART is about 1 mile away the markers become arcs and finally concentric circles.

Many of the available SARTs include visual and/or audible warning when illuminated by radar. They should be positioned as high up as possible for maximum detection.

A ship's radar will transmit a stream of high power pulses on a fixed frequency between 9.2 GHz and 9.5 GHz. It will collect the echoes received on the same frequency using a display known as a Plan Position Indicator (PPI) which shows the ship itself at the center of the screen, with the echoes dotted around it. Echoes further from the center of the screen are thus further from the ship, and the relative or true bearing of each echo can be easily seen.

The duration of operation of the SART is 96 hours in standby condition, followed by a minimum of 8 hours of transmission while being continuously interrogated.

Testing

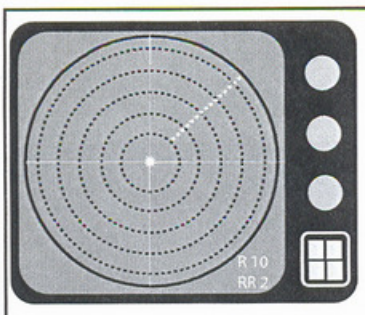
Regular testing should be carried out.

Locate the SART within the line of sight of an operating radar. Insert the test probe carefully into the 3mm diameter hole in the center of the activation switch, taking care not to damage the security label. Pushing the test probe into the hole, activates the test cycle, the red LED will be "On" continuously and the buzzer will sound every two seconds. The SART will signal on the radar. To switch off SART, insert the probe through the small hole at rear of switch and push firmly until switch clicks off.

Note: Only test for a few seconds as a live distress call may be received by other vessels in range.

Battery

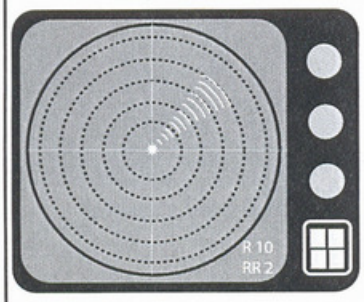
The battery should be changed 5 years from the date shown on the label.



SART POSITION IS THE 12th DOT NEAREST CENTRE OF RADAR.
DOT SPACING IS .64 MILES

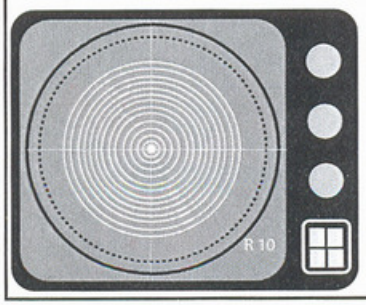
SART 2 MILES FROM RADAR

RADAR RANGE = 10 MILES
RANGE RINGS = 2 MILES



SART 1 MILE FROM RADAR

RADAR RANGE = 10 MILES
RANGE RINGS = 2 MILES



SART 0.2 MILES FROM RADAR

RADAR RANGE = 10 MILES
RANGE RINGS = 2 MILES

SART
Search And Rescue
Transponder
3 cm radar band

MODULE 8 / SECTION 1

INTRODUCTION

It is assumed that a candidate now has a basic understanding of sailing / boat handling, nautical terminology and safety at sea. The aim of this module is to increase the candidates' nautical knowledge base to competently take on the duties of a bareboat flotilla watchkeeper or skipper. The objectives of this module are to increase the student's confidence level in nautical matters and practical skill-set, appropriate to this modular level including:

The responsibilities of a watchkeeper
Types of charts
Chart symbols, dangers, heights, navigational marks and buoyage
Navigational techniques, position lines, transits, plotting, DR, and EP
The effects of tide, currents, and leeway
Position fixing, 3 bearing fix, accuracy of fixing and depth contours
GPS, DGPS and electronic aids to navigation
Compass types and use
Variation, deviation and applying error
Courses, true and magnetic
Pilotage
IALA areas A & B
Cardinal buoyage system

As with all IYT courses, depth of knowledge increases as students progress through the various levels of training. *This is not a beginner's course.* This book is generic in content. The contents of these notes are designed to be general in nature and when chartering in different locations, should be accompanied by local charts, local cruising guide, tidal information, local navigation rules and local sources of weather information.

Additionally, included in the beginning of International Watchkeeper / Flotilla Skipper are revision sections on Safety and Nautical Terminology.

SAFETY
(Revision)

When it comes to survival at sea, there is nothing more important or comforting than being adequately prepared. This preparation could some day save your life. Understanding the dangers that can overcome you and your vessel while at sea is a crucial part of surviving. It is vitally important to thoroughly know your boat, your equipment, your crew, and your safety systems.

Life Jackets / Personal Flotation Devices (PFD's)

There should be at least one lifejacket per person on board every vessel, including small sizes for any children. A life jacket is designed to support a person's weight with their head turned upward with nose and mouth above the water.

There are many different types and designs of lifejackets such as Safety of Life at Sea approved (SOLAS). SOLAS jackets are recommended as they carry reflective tape, a light and a whistle. Essentially the jacket is placed over the wearer's head and is then tied or clipped around the front and sides. The buoyancy may be provided by a solid material that has extremely buoyant properties, or by CO2 or a combination of both. Some CO2 filled jackets have an automatic inflation device which inflates when the lifejacket is submerged in water.

Inflatable Lifejacket

SOLAS Approved Lifejacket

Adult Lifejacket

* Children's Lifejacket

Personal Flotation Device
(PFD)

* Children's Buoyancy Aid

* Note the groin straps on children's lifejackets and buoyancy aids.

Buoyancy Aids / Flotation Aids

Buoyancy aids are designed to provide buoyancy but will not turn an unconscious person upright or provide as much support as a lifejacket. They are mainly used for watersports such as windsurfing, dinghy sailing, water skiing and kayaking. They are best suited to inland waterways, coastal operations and calm waters where there is a good chance of quick recovery. They are useful on smaller vessels where bulky life jackets may be impractical. Generally, they are the most comfortable for continuous wear and are available in many colors and styles. All PFDs must be kept in operable condition by regular checks and maintenance.

Pyrotechnic Distress Signals (Flares)

Flares are used to attract attention in the event of emergencies at sea. There are four basic types of flares. These devices, being pyrotechnic, are in themselves dangerous and must be treated with respect. They must always be kept dry, such as in a watertight container. They must also be in date. They will only be of benefit if they are used when there is a high probability that there is someone in your immediate vicinity that will see the flares. When using one of these devices hold them away from the body and point downwind.

The four types are:

Red Parachute flare - These are magnesium flares on a parachute which go up to around 300m or 1000ft and then gradually float back down. Used to attract the attention of distant vessels.

Red Hand-held flare - These flares are used at night and produce a bright red light for around 60 seconds.

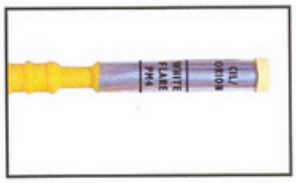
Orange Smoke - These flares are used during the day and produce a plume of orange smoke for around 3 minutes.

White hand-held flare - These flares burn bright white and are used to alert other vessels to the risk of collission.


Red Parachute

Red Handheld

Orange Smoke


White Handheld

SOLAS flares are recommended above all others due to their high luminescence and burn rate.

Life Raft (Requires annual inspection to keep in date)

A life raft is an inflatable survival craft packed in either a hard plastic canister or a soft valise which should be accessible in the event that the crew need to evacuate the boat in an emergency. They come in various sizes such as 4, 6, 8, 12, and 24 man capacities depending on the size of the vessel. There is a saying that one should only ever step "up"


Canister Liferaft


Valise Liferaft


Inflated Liferaft

Hydrostatic Release attached to the liferat

into a life raft, i.e. it is a last resort. After the disastrous 1979 Fastnet Yacht race in England, many of the yachts that were abandoned were later found afloat, however, many of the life rafts were never found. A liferaft should have a hydrostatic release attached to it for automatic deployment in the event of a sudden sinking (more details to follow). At least one member of the crew should have received basic sea survival training from a recognized authority.

The **Hydrostatic release** unit is mounted between the liferaft and the cradle which holds it. If you do not have a chance to manually deploy the liferaft when the ship is sinking, at a depth of 10-15' the Hydrostatic Release Unit will allow the raft to inflate and float free automatically. It has a 2 year life then it must be replaced.

Basic First Aid Kit

Every vessel however small should carry a basic first aid kit. There should also be a First Aid Manual on board for quick reference. The longer the voyage intended to be undertaken, the more comprehensive first aid contents should be. Any crew member taking prescription medications should ensure an adequate supply and notify the captain. At least one member of the crew should have received some first aid training from a recognized training authority. Contents of a basic first aid kit usually include the following: bandages & various gauze pads, aspirin, antiseptic wipes, motion sickness tablets, antacid tablets, insect bite relief swabs, alcohol prep. pads, cotton swabs, tweezers, synthetic gloves, eyewash & pads, calamine lotion, ice pack, antibiotic cream and first aid instruction booklet.

Fire Extinguishers (Requires annual inspection to keep in date)

It is imperative to know where the fire extinguishers are located on every vessel and how to use them. In general, fire extinguishers on boats will be either a dry powder or foam that smothers the fire or CO2 which starves the fire of oxygen. It is recommended that one of the crew members complete a basic fire fighting course from a recognized training authority.

There are four main types of fire extinguishers:

1. **Water - ordinary combustibles (class A)**
2. **Dry powder/chemical - multi purpose (class A,B,C)**
3. **Carbon Dioxide (CO2) smothering agent for gas, liquid and electrical fires (class B,C)**
4. **Foam - smothering agent for flame inhibition (class A,B)**

If a fire does break out, it must be contained and extinguished as quickly as possible. The correct actions must be taken as promptly and efficiently as possible otherwise the chances of containment are slim. The following is worth remembering:

FIRE: F = Find
I = Isolate and Inform
R = Report and Restrict
E = Extinguish or Escape

Safety Harness

Safety Harnesses

Mainly used on sailing vessels, safety harnesses are worn by crew members when on deck in bad weather, at night and if the crew member feels safer with one on. The harness comprises webbing shoulder straps and waistband which are adjustable,

and a tether of rope or webbing which has a karabiner clip on both ends. The wearer clips on to strong points on the vessel or onto a "jack stay" (a rope or webbing line attached at the bows and stern of the vessel) when moving up and down the deck.

Horseshoe Buoy / Ring Buoy

Horseshoe Buoy

These are type IV Personal Flotation Devices. They are lightweight, highly visible, throwable flotation devices which are used in the event of a man overboard (MOB). These devices are designed to be thrown to a person in the water to assist in keeping them afloat while the vessel manouvers to recover the person. All vessels should be equipped with at least one.

Ring buoy

Lifesling

A lifesling is another type of throwable man overboard (MOB) recovery device. It is normally attached to the sternrail or stanchion. They are commonly used aboard sailboats and are deployed by opening the bag and dropping the sling into the water. Forward momentum of the vessel will draw out a long line. The vessel is then manouvered in a wide circle around the MOB enabling the person to grasp the line and work back to the boat. The person places the sling under his arms, when ready and secure, the crew will recover the MOB by pulling the line back on board. Getting the MOB back on board may be as easy as dropping the swim ladder or may involve the use of a winch, halyard, or block and tackle to assist in MOB recovery.

VHF Radio

The Very High Frequency (VHF) radio is a transmitter and receiver combined in one instrument, called a "transceiver". When a message is sent from one transceiver it can be received by another transceiver provided that it is within range and tuned to the same channel or frequency. Both transceivers MUST be tuned to the same frequency to enable a conversation to take place.

VHF Radio

Microphone

VHF Handheld Radio

VHF radios are an essential piece of equipment in the event of on-board emergencies. Uses also include weather and coastguard information as well as routine ship to ship traffic and are used to transmit "Mayday", "Pan Pan" and "Securite" information. A "Mayday" call is used when danger is imminent, a "Pan Pan" call is used when a vessel has a problem but danger is not yet imminent. A "Securite" call is used to alert other vessels of hazards to navigation.

A full explanation of the operation of a VHF radio is contained in the VHF Radio Operators notes.

Safety Checks, Engine Checks and Checklists

A series of checks should be carried out prior to every trip or voyage. It is important to know that the vessel and her equipment are in good order and everything is working properly. It is also a good opportunity to use the checks as a way to introduce the location of equipment and safety gear to new crew and as a reminder to those who have been on board before.

Hull Checks - Check the condition and operation of the following:

- Location and condition of through hull fittings
- Through hulls and sea cocks operate easily, hoses in good condition, hose clamps fitted (double)
- Spare hose clamps should be carried (two or three of each size)
- Through hull plugs attached to each sea-cock
- Bilges are clean and dry, bilge pumps operational
- Grab rails, life-lines in good condition

Safety Equipment

- Check all safety equipment is in date and has not expired
- Fire extinguishers in date
- Signal flares and other signaling devices with current expiration dates
- Life jacket suitable for each person on board, readily accessible, in good condition
- MOB equipment and throwable flotation easily accessible to helmsperson
- Flashlight and extra batteries
- Horn working.
- Bell
- First aid kit, with sunscreen, pain relievers and any special medications for crew
- VHF working and in good condition

Housekeeping Items

- Water tanks full with extra bottled water for emergencies.
- Propane gas including spare bottle, in outside locker with drain

Dinghy - Check the condition and operation of the following.

- Stowed properly
- If inflatable ensure it is in working order
- Paddles or oars.
- Outboard motor maintained and stowed properly
- Spares
- Safety equipment etc for dinghy
- Sufficient fuel for operation

NAUTICAL TERMINOLOGY
Revision

Types of Vessels

As the Greek philosopher Archimides discovered over 2000 years ago , All vessels float in water because the water creates an upward buoyant force. Different vessel shapes have evolved over time to maximize the efficiency of different methods of propulsion. For example, a sail boat has a deep keel to help with sailing efficiency and stability whereas a fast powerboat will have very little keel under the water which allows it to minimize resistance in the water and thus go faster. The keel is a weighted projecting fin which provides stability and reduces sideway drift of a vessel. Essentially there are two distinct types of hull, (and within these are many variations), **"displacement"** hulls and **"planing"** hulls.

Hull Types

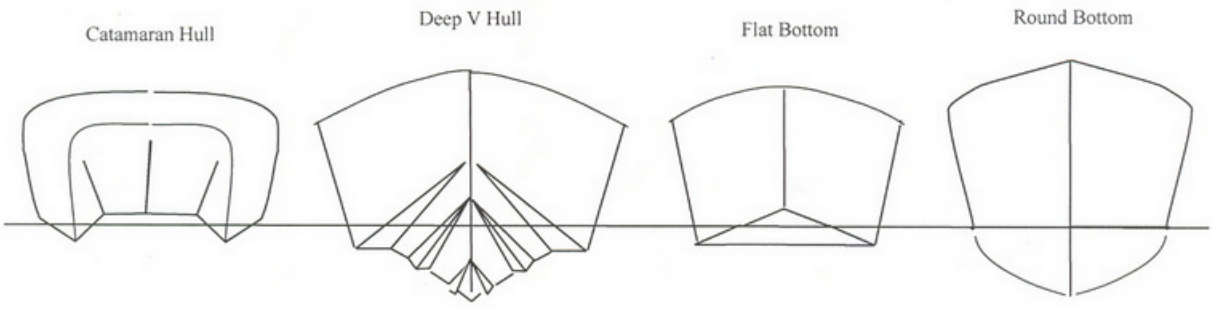
There are many types of vessel with an assorted combination of hull and engine configurations.

Planing Hull

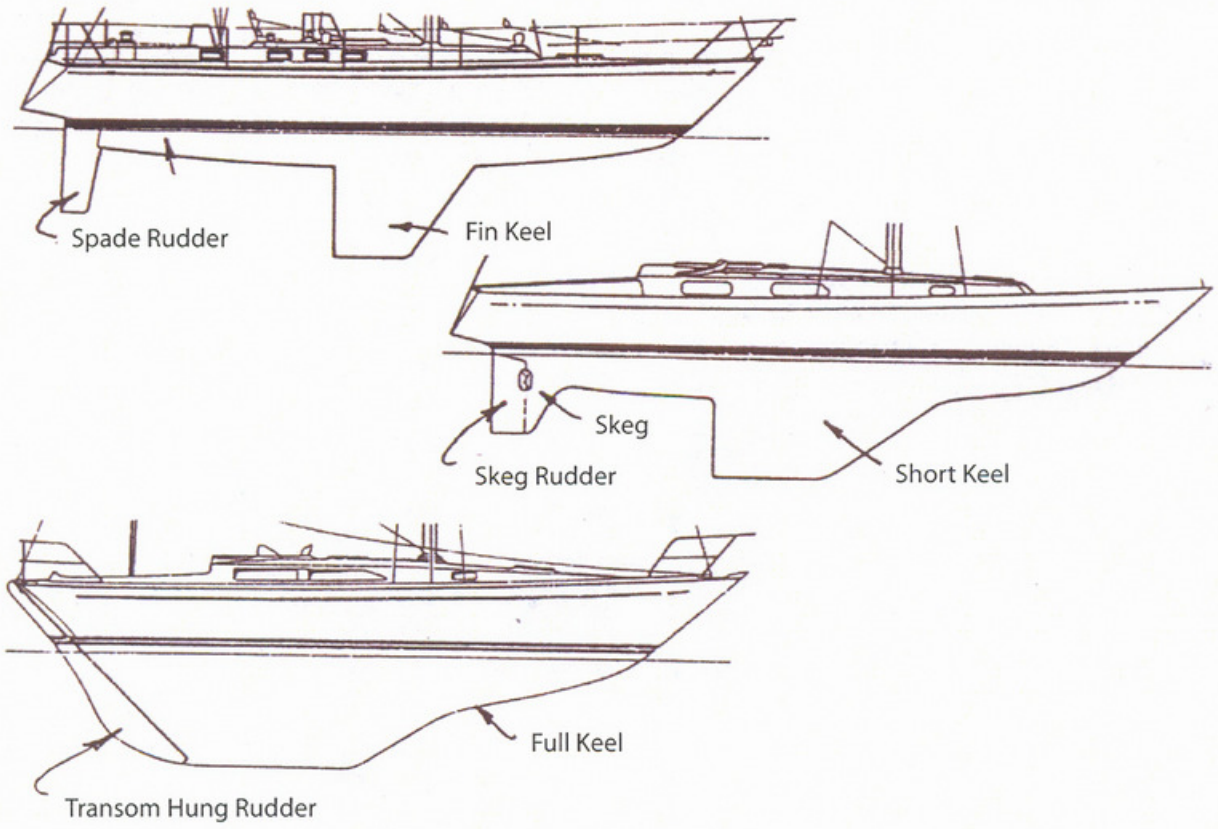
Displacement hulls, such as sailing boats and trawler type boats, are supported by the buoyancy created by the hull in the water. These types of vessels have a maximum speed based on the waterline length and no addition of power will increase this maximum speed. The advantages of a displacement hull are lower power requirements than a planing hull allowing a longer cruising range and increased load carrying ability.

Planing hulls are lifted clear of the buoyant support of the water by means of a combination of hull shape together with high power converted to speed. The vessel is lifted higher in the water as the speed is increased reducing the drag of the water as less of the hull is actually in the water. The advantages of a planing hull are shorter journey times, but this must be offset against the increased cost of larger more powerful engines and consequent increase in fuel consumption.

Power Vessel Hull Shapes



Sailing vessel hull shapes



Vessel Construction

Methods of construction and materials used in vessel construction are a subject in their own right and there are many reference books available for those who wish to pursue this subject in depth.

The earliest vessels were constructed from natural materials, mainly an all timber construction. Some boats are still built in this fashion. Most modern series production boats are built in a mold from man-made materials and composites such as glass-fiber, glass reinforced plastic (GRP) impregnated with resins or materials such as carbon fiber and Kevlar for their higher strength for the equivalent weight of materials. Large yachts are generally constructed from steel or aluminium or a combination of materials.

Inflatables & RIBs (Rigid Inflatable Boats)

The difference between a RIB and an Inflatable is essentially that the bottom of the RIB is made of aluminum or fiberglass, both have inflatable compartments or pontoons (inflated tubes which make the sides of the RIB). Inflatables have no rigid components and as a result are easier to stow. Both have good stability, are relatively lightweight and have generous carrying capacity. Designed initially for the military and rescue/service work they are increasingly popular with recreational users. Each configuration has advantages and disadvantages.

Rigid Inflatable Boat (RIB)

Definitions of types of vessels.
There is no globally accepted definition for when a boat becomes a yacht or when a yacht becomes a ship. However, a yacht can be carried on a ship but a ship cannot be carried on a yacht.

To be more specific and to further clarify the term yacht, these notes refer to "motor yachts" as those vessels that are driven by one or more engine, and those driven by sails as "sailing boats". Sailing boats for the most part also have engines for ease of manoeuvering in crowded marinas and anchorages where there is insufficient room to sail safely. These are commonly called auxiliary engines. In these notes, the word "boat" describes a recreational craft/vessel, either driven by engines or sails, or both, with covered accommodation and facilities which allow the individual to spend a night on board.

The word "yacht" also refers to the very large Motor and Sail vessels that can be seen in such exotic locations as the Caribbean and Mediterranean. Some of the larger Megayachts are really small ships and many operate for commercial purposes. This means that they carry passengers for hire or reward. Below are various types of boats.


Cabin Cruiser


Sailboat


Rigid Inflatable Boat (RIB)


Sportfish


Day Fisher


Day Cruiser


Speedboat


Dinghy


Multihull / Catamaran


Megayacht

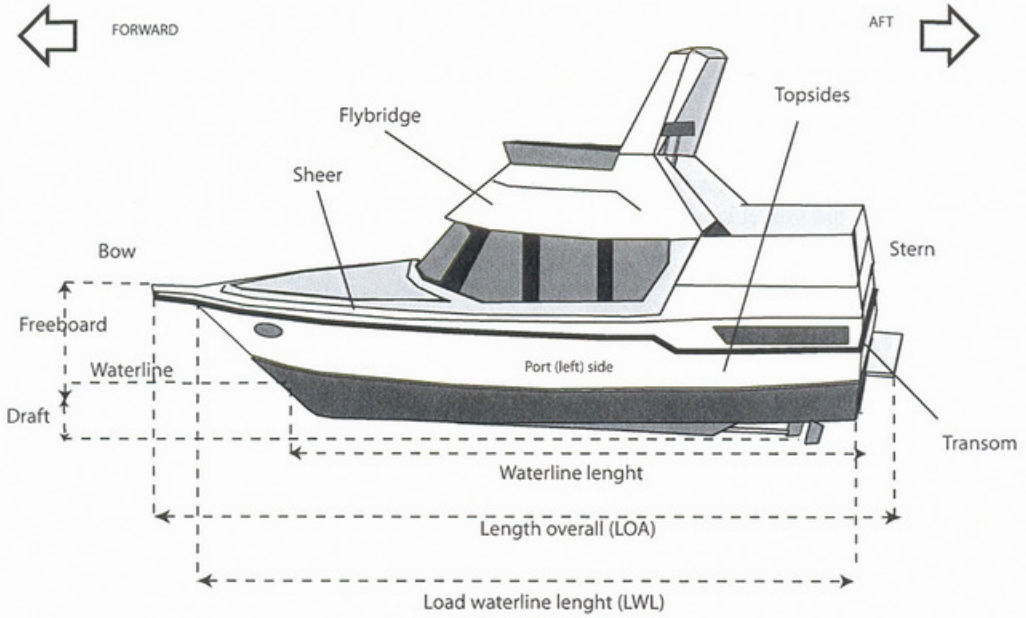

Sailing Catamaran


Container Ship

Parts of A Vessel and Nautical Terminology

General Terms to define a vessel.
When any vessel is in the water, the level that the water reaches on the hull is known as the **"waterline"**. The area that is below the waterline is painted with a special paint which inhibits growth of weed and shell fish and is called "antifouling paint"; the depth that this underwater area extends down is known as the **"draft"**. The distance from the water line to the upper edge of the hull is known as **"freeboard"**.

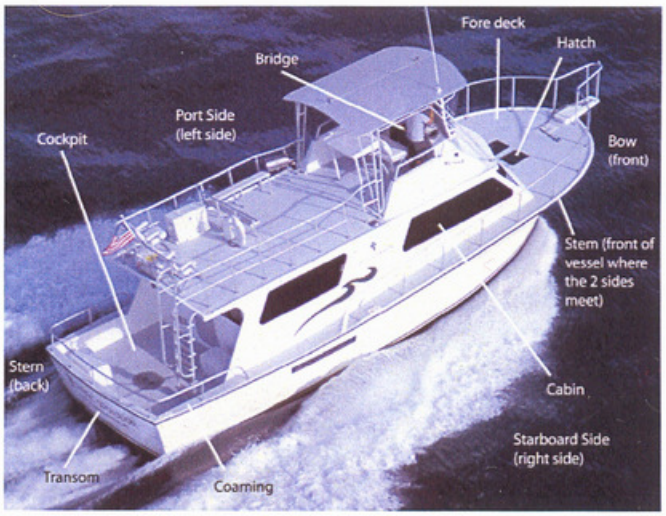
Length overall (LOA), The overall fore and aft length of the hull.
Waterline, The line where the surface of the water reaches on the hull.
Load waterline length (LWL), The fore and aft length of the hull measured at the waterline.
Beam, The width of a vessel at its widest point.
Freeboard, The height of the side of a vessel above the water.
Draught, The depth of the lowest part of the vessel in the water
Keel, A weighted projecting fin fixed on the centerline of a vessel which provides stability and reduces sideways drift.



Parts of a Hull

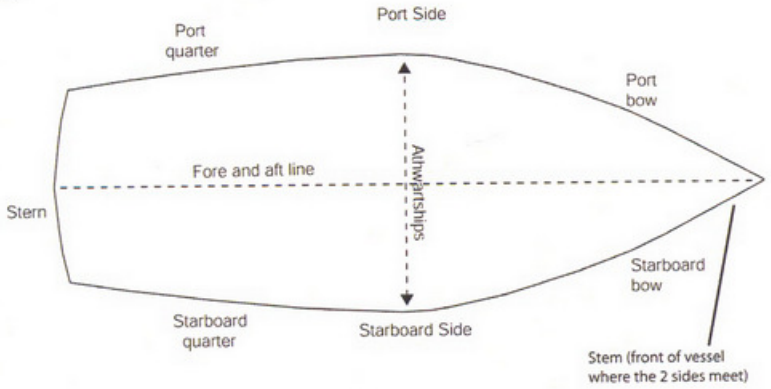
The **"stem"** is the front part of the vessel where the two sides meet. The two sides of the hull where they meet at the stem are known as the **"bows"**. This comprises the **"forward"** section of the vessel. The mid section of the vessel is known as **"midships"** and going towards the rear, **"aft"**, to the back of the vessel which is known as the **"stern"**. The actual flat part of the back of the vessel is known as the **"transom"**.

The right hand side of a vessel is known as the **"starboard"** side, and the left is known as the **"port"** side. A useful memory jogger is the phrase



"There is a no RED PORT LEFT in the bottle", so that red, port and left all refer to the same side. The inclusion of "red" is also a reminder that the color of the port side navigation light is red, and the starboard side is therefore green.

Nautical terminology is vast, and there are nautical dictionaries naming thousands of nautical terms, some of which are contained in the glossary at the back of this book. However, in this module, we will address only the most commonly used terms.



Alongside

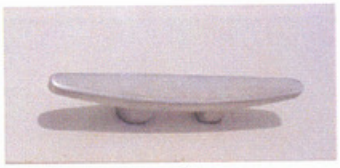
Generally a yacht will be kept in a Marina, which, depending on size, may have spaces for a few boats or thousands of boats. When tied up to a dock there will be a number of lines securing the vessel "alongside". These are known as **"mooring lines"**. The lines will be attached to secure points on the dock called **"cleats"** and lead through special fittings with smooth edges on the vessel known as **"fairleads"**. These are designed to prevent fraying or **"chafing"** and are secured to the vessel's cleats.

Deck Equipment and Fittings

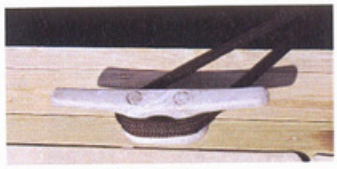
The docking lines required to secure a vessel properly are:

1. Bow line. A line that is lead forward from the bow of the boat.
2. Stern line. A line that is lead aft from the stern of the boat.
3. Spring lines One line leads from the bow of the vessel aft of midships to the dock and one from the stern of the vessel lead forward of midships to the dock. These stop the boat moving fore and aft and should be taut.

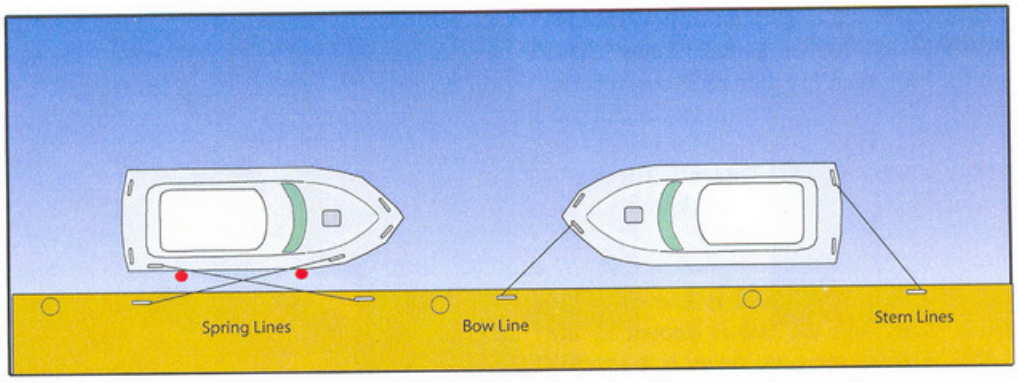
Fairlead



Boat Cleat



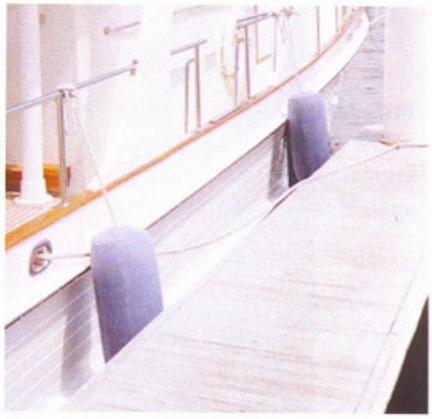
Dock Cleat



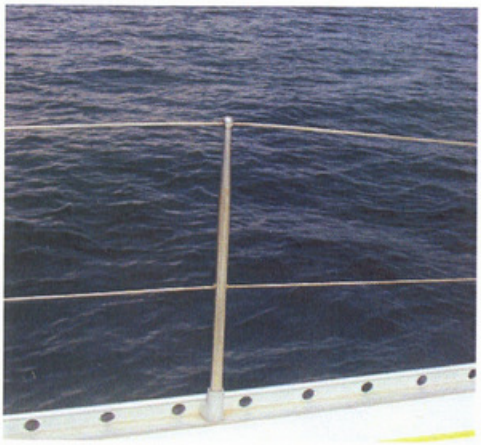
Inflated plastic or rubber cylinders or spheres protect the hull from damage while in contact with the dock or other vessels and are called **"fenders".** Adequate fenders both in size and quantity must be used to protect the hull and topsides.

When the vessel is attached to a **"mooring buoy"** or "anchored" away from the land, access to the vessel will then be by a smaller boat such as a RIB or dinghy. Dinghys and safe operation of dinghys are addressed in a later section.

Mooring Buoy



Fenders



Stanchion

Stanchions On deck there will generally be a protective rail to prevent a person falling overboard. These may be solid walls, "bulwarks" or wire ropes, attached at the bow and stern and supported at intervals by upright metal poles called "stanchions".

Pulpit

Pulpit On most boats there is usually a metal frame around the bows called the **"pulpit".** Additional protection at the stern will be the **"stern rail / taffrail"** or **"pushpit".**

Power Boat Pulpit

Sailboat Pulpit

Power Boat Stern Rail

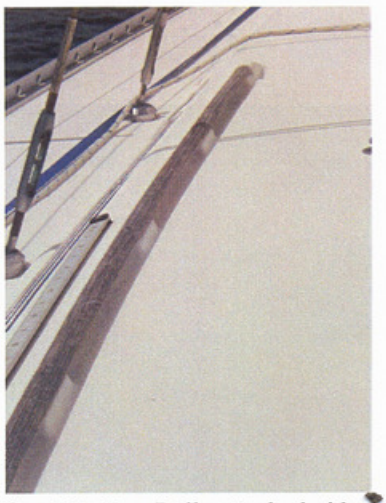
Sailboat Stern Rail

Foredeck The forward part of the deck in front of the mast or raised accommodation on a boat is known as the foredeck. The foredeck houses the anchor chain and line for anchoring a vessel.

Power Boat Foredeck

Sailboat Foredeck

Coach Roof The raised part of the deck to create headroom below decks.



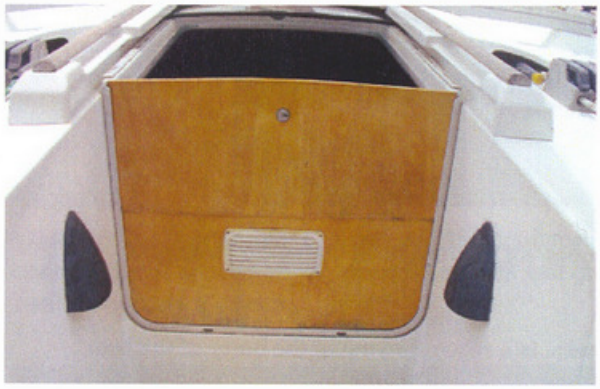
Grab Rails Rails attached either to the coach roof or inside the cabins for holding on to while at sea.

Jackstay A wire or webbing strap attached at the front and back of a vessel along the deck to which a safety harness line may be clipped. (mostly found on sailboats)

Toe rail A low timber or metal strip running around the outer edge of the deck to assist the crew in maintaining a foothold.

Cockpit A self draining recess in the after part of a vessel.

Companionway Steps giving access from the deck to the cabin.



Washboards Boards used to seal off the companionway to prevent the entry of water.

Hatch An opening in the deck that gives access to the space below.

Bowsprit A spar which projects from the bow of some boats to allow headsails to be secured further forward.

Dodger A demountable cover rigged over the companionway and the forward end of the cockpit to protect the crew from wind and water spray.

Bimini Top: A canvas canopy to shade an area of deck or cockpit from the sun.

Windlass: A winch which is positioned on the fore-deck and used for hauling in anchor chain and rope.

Anchor: A device attached to rope or chain which is lowered to the seabed to hold a vessel in place.

Saloon: This is the living room on board a boat and will consist of seating and possibly contain music, TV and entertainment center. The larger the boat the more lavish the equipment and fittings are likely to be.

Dinette: The dining area of the boat may be simply a small table with bench seating to a full scale dining room setting on a large boat.

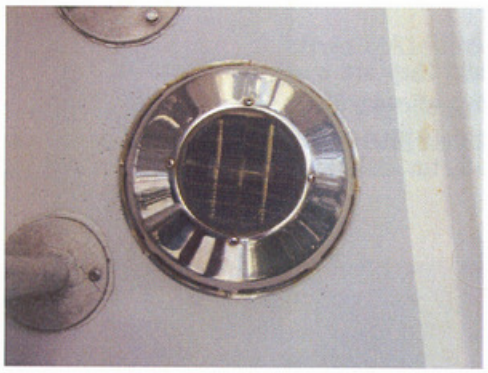
Accommodation: In a vessel the floor is known as the **"cabin sole"**, the walls are **"bulkheads"** and the ceilings are **"deck heads"**.

Cabins/Staterooms: These are the **"bedrooms"** and may consist of a single **"bunk"** or bed to king size suites on megayachts.

Wardrobes are referred to as **"hanging lockers"**.

Forepeak: Is a space forward in the bows of the boat. Often this is where the anchor chain is stored.

Dinette



Ventilators: Movable devices fixed to the deck to carry fresh air below without permitting the entry of water. These are found both on power and sailing vessels.

Galley: The kitchen on a vessel and the equipment contained will depend on the size of the yacht and the number of crew it carries.

Console: Steering console, instrumentation and throttle control

Throttle Control / Transmission Control: Selects forward, neutral and reverse gears and controls propeller speed.

Typical **Twin Outboard** motor set-up.

Engines and Drives

Outboards are by far the most popular type of motor for small craft. They are a demountable self-contained unit available in 2 stroke or 4 stroke configurations with a wide range of power/size applications. Easily removed for maintenance, storage and cleaning they have the ability to be raised/tilted hydraulically or manually for shallow water operations.

A Kill Cord is an engine cut-out device, one end of which is attached to a switch near the throttle and the other to the driver's body. In the event of the helmsman falling overboard this device will stop the engine. Runaway powerboats cause serious injuries and even deaths. Use the cord at all times. Carry a spare one on board so that the engine can be restarted to pick up the person in the water.

Kill Cord

Outboard Motor

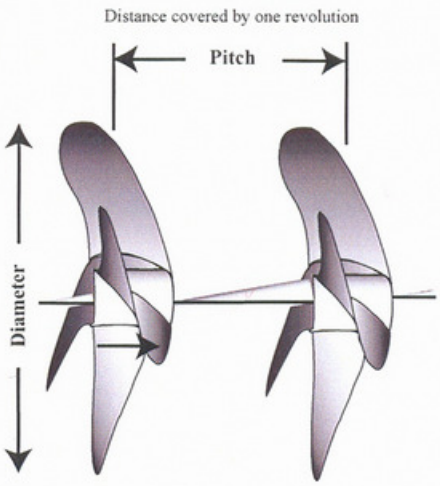
Console Steering & Throttle Control

Steering/Propellers

Smaller outboards steer the boat by turning the whole motor using the attached tiller, which is fitted with a twist-grip type throttle control. On RIBs and larger vessels controls are center console mounted. Steering is normally wheel controlled through hydraulic rams or cables and steers just like a car.

Propellers

A power driven vessel requires an engine or engines to drive a "**propeller**" commonly known as a "**screw**" which is a rotating device with a number of different "blades", from 2 to 5 depending upon hull type and performance requirements. Propellers are classed by 3 different features- "**hand**", "**diameter**" and "**pitch**". For example a 3 bladed prop may be R 10" x 28" which means it will turn "**right hand**" or clockwise in forward gear, has a diameter of 10 inches and the pitch (the angle that the blades are set) is 28 inches which is the (theoretical) distance the prop would travel in one rotation.



Thru hull fitting

Thru hull fitting

Thru hull fittings are designed to allow water to pass through them from inside a boat, such as the sinks, toilets, impellers and for engine water cooling.

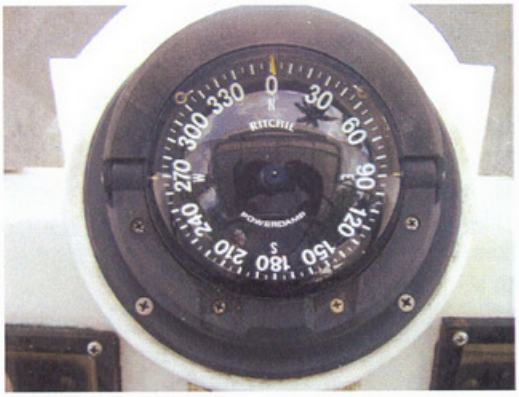
Instruments and Electronic Aids to Navigation

Not all vessels will be equipped with all the instruments discussed below. There are many different types and makes of instruments but the information they relay is the same.

Hand-bearing Compass

The Magnetic Compass

The compass is perhaps the most important instrument on a boat. It is essential for navigation when out of sight of land, during the hours of darkness and at times of restricted visibility, e.g. fog, rain etc. when the compass is used to steer pre-determined magnetic courses. A hand-bearing compass is also used for some position fixing techniques.



Gimballed Compass

How does a Compass work?

A magnetic compass is an instrument used to find direction. All magnetic compasses operate on the same principle; the compass is simply a circular card, graduated with 0° - 360° (degrees) marked on it's circumference and supported on a pivot point in a sealed bowl filled with a water/alcohol mixture which dampens or slows the movement of the card on the pivot. Two or more bar magnets are attached to the underside of the card, aligned to the north/south (0° - 180°) axis of the card. The bar magnets in the instrument follow the magnetic lines of force that circle the earth and the compass card "north point" will always point to the north magnetic pole. (These lines of force are generated by the earth's magnetic field).

The compass is "gimbal" mounted which means that no matter how the vessel heels/rolls or pitches the compass card will remain level.

The inside of the compass bowl is marked with a "lubber line" which is aligned exactly parallel to the fore and aft centerline of the yacht. The direction of the vessel's heading or the "compass course" being steered is indicated by the card graduation nearest the lubber line. There will be a small light in the compass to enable it to be read at night.

Depth Sounder

Depth Sounder

A depth sounder determines the depth of water beneath a vessel. The equipment comprises of a transmitter with a digital or pictoral display screen close to the helm, and a transducer sensor mounted through the vessels hull near the bottom of the hull. The transmitter sends pulses through the transducer, which picks up the returned pulse after it has "bounced" off the sea floor. The time the returning echo takes to return is interpreted by the transmitter, which displays the water's depth on the screen.

Barometer

A barometer is an instrument which indicates the atmospheric pressure. A single reading of barometric pressure gives no worthwhile information, it is the rate of change of pressure that is important in itself and this can only be gained from a series of readings, hence the importance of recording barometer pressure in the boat's log book. A **"barograph" is** available which records the pressure variance either on paper charts or electronically.

Barometer

Log

The log is an instrument for measuring the vessel's speed through the water. Boat speed is usually measured in "knots" (nautical miles per hour, that is approximately 2000 yards per hour). One "knot" is approximately 1.15 statute mile. The navigator uses this to determine how far the vessel has traveled and to estimate likely arrival time at the destination.

The log comprises a receiver with a digital display close to the helm, and a paddle wheel impeller mounted through the hull near the bottom of the boat. As the vessel moves through the water the paddle wheel spins and sends the information to the receiver which computes the speed through the water. The impeller requires regular maintenance in the form of cleaning to ensure that the paddle wheel has not become jammed with marine growth or debris.

GPS (Global Positioning System)

The current "state of the art" satellite radio positioning system is called 'Global Positioning System' or GPS for short. GPS was developed by the U.S. Government for use by the US Navy, Army and Air Force and offers precise position in latitude and longitude 24 hours a day, world-wide. The GPS navigation system is composed of 29 active satellites (24 fully operational in 1999) in orbit around the earth together with a land based master station based in Colorado.

GPS is a global navigation system using radio signals from a transceiver which communicates with a number of satellites and automatically computes the vessels location, heading and speed. The transceiver will have a display mounted close to the helm. There is a digital read-out of the vessel's speed and position (Latitude and Longitude) together with additional information for use by the navigator. The GPS receiver may have a charting function or may be connected to a "Chart Plotter" which will show the position of the vessel graphically on a chart displayed on the screen.

GPS System

Each satellite knows its exact position and sends out an individual signal, which is picked up by the receiver. The receiver then measures how long it took for this signal to reach the receiver. Using this information, the receiver can calculate its distance from the satellite. In other words, the receiver has found a position centered on the satellite's known position. A second position from another satellite will give a position fix and a third position will confirm this fix with greater accuracy.

GPS Accuracy

The GPS satellites transmit signals on two frequencies, one solely for military use and one for civilian use. The frequency available to civilians gives less precise accuracy than the military frequency. The design parameters for GPS are that it provides an accuracy of 8 meters horizontally, 10 meters vertically, speed to 0.1 of a knot and time to a fraction of a microsecond.

Selective Availability (SA)

In order to reduce the potential threat that the accuracy of the civilian signals allows, the U.S. introduced what is called Selective Availability. The U.S. can introduce random errors, degrade the signal available on the civilian frequency as and when they wish. Selective availability is at present in operation giving an expected inaccuracy of between 100 and 150 meters 95% of the time. This is of course more than adequate for normal navigation. However,

this accuracy can, and will, be further degraded if and when required, nor will there necessarily be any prior warning to civilian users. The civilian frequency can also be switched off totally should the U.S. military decide to do so.

Differential GPS (DGPS)

DGPS has been introduced commercially in some parts of the world in order to cancel out the effect of selective availability. With DGPS the GPS signal is received at a place (such as a lighthouse), the exact position of which is known. The signal error is removed and the corrected signal re-transmitted to suitably equipped receivers. A special (add on) DGPS receiver must be purchased to avail of this information.

Accuracy using DGPS is often quoted in terms of about 10 meters or 33' and sometimes figures of 5 meters are quoted, - BUT remember that in many cases charts are not produced to anything like this level of accuracy, indeed some charts are based on surveys carried out in the 1800's. Note the warning from the British Admiralty at the end of this section. Generally speaking, it would seem to be most unwise to attempt to navigate in a fashion totally dependent upon quoted accuracies of these magnitudes.

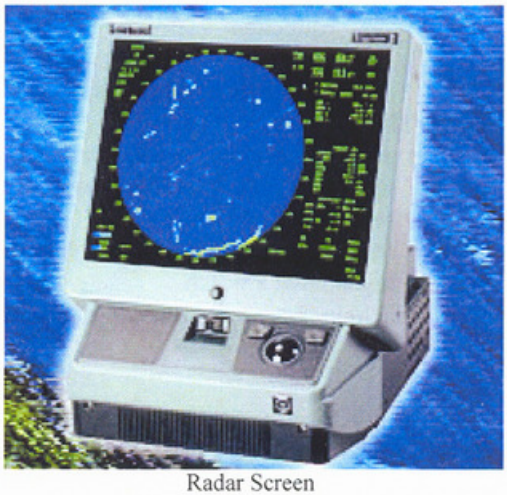
GPS Instruments

A GPS set actually consists of a radio receiver tuned to receive the signals transmitted from the satellites and a computer, which processes these signals to display the receiver's position in terms of latitude and longitude. Many different models, either fixed or handheld (portable) are available but essentially they all do the same thing and give the user the same range of information. Fixed models generally use the boat's battery whereas handhelds use replaceable portable batteries.

Using a GPS

When switched on, a GPS may take from a couple of minutes to 15 minutes to work out its position which, when found, will be shown on the display in latitude and longitude. Once it has worked out its initial position it will continue to update this position every second or so until it is switched off, thus when the boat moves, the latitude and longitude shown on the GPS display will change.

The art of navigation is based on being able to find your position at any moment in time because it is from your position that most other navigational information is derived. When the GPS knows your position it will also be able to give you information such as speed, direction, estimated time of arrival and so on.


Radar Screen

Radar

Radar is used to detect another vessel or object, and show the "range" (distance) and bearing to the object. Detection is achieved by transmitting a short burst of electromagnetic energy so that it can strike an object, reflect back, and be detected by the receiver. The data is then processed and displayed on a screen mounted close to the helm.

The main purpose of radar is collision avoidance but obviously it is most useful at night and in periods of restricted visibility. The International Regulations for Preventing Collisions at Sea states (Rule 7b) "Proper use shall be made of radar equipment if fitted and operational, including long range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects". Assumptions shall not be made on the basis of scanty information, especially radar information. (Rule 7c). An increasing number of smaller vessels have radar installed. The prudent mariner is encouraged not only to thoroughly read and understand the operators manual but also take a dedicated radar operator course.

MODULE 8 / SECTION 2
RESPONSIBILITIES OF A WATCHKEEPER

Rested and Alert Crew

For safety reasons it is important that the captain and crew are rested and alert. Regular periods of rest and a healthy diet will ensure that all members of the crew will be able to maintain a proper watch and be alert to the needs of the vessel in changing conditions.

The affects of fatique are:

- slow mental process including the following:
  - visual perception
  - decision making
  - mental calculations
- reduced reaction time for simple and complex tasks
- errors of omission
- slower / lower productivity
- decreased morale resulting in lack of motivation
- poor communications
- sleeping on watch

Navigational Duties/ Responsibilities of Watchkeepers

During the course of any voyage the crew must:

- maintain a proper lookout (sight and sound) at all times
- maintain a continuous record of:
  - speed
  - direction
  - position
  - positions of other vessels and hazards (Charts and Logbook)

The crew also needs to:

- maintain an effective radio watch
- safeguard against pollution and protect the environment.

Crew members are required to:

- respond in a timely and efficient manner to all instructions and orders of the captain
- to maintain a watch
- help in the general running of the vessel.

When to call the Captain

The skipper is responsible at all times for operational safety of the vessel and the welfare of the crew, even when asleep or down below. The captain will generally have specific instructions as to circumstances (often written in the log book) when he/she requires the crew to call him on deck. The general rule is if you have ANY doubts whatsoever alert the captain immediately.

MODULE 8 / SECTION 3
CHARTS AND CHARTWORK

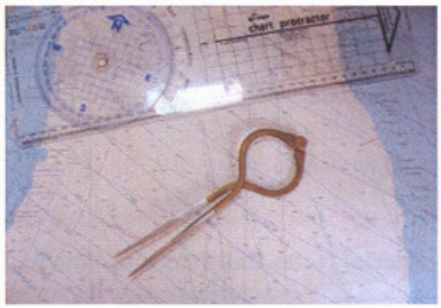
The practical navigator does not require expensive equipment to work effectively. The basic needs are as follows:

Pencils - 2B pencils should be used for chartwork to avoid scoring the surface of a chart and to allow easy removal. Mechanical pencils work well as they do not require sharpening.

Parallel Rules - Used to measure courses, bearings, lines of position etc. by reference to a compass rose printed on a chart. Worked by walking or rolling (depending on type) the rule across the chart to/from compass rose. These are not very accurate in a rolling sea or in bad weather.

Dividers - Used to measure distances (in nautical miles from the latitude scale.). A cheap school type is adequate, but the single-handed brass type makes life easier.

Breton Type Plotter - (preferred instrument) this comprises a circular protractor mounted on a rectangular base, all made of plastic. The protractor is marked in degrees and incorporates a grid for easy alignment. The rectangular part acts as the ruler.



Breton Plotter (top)
Dividers (bottom)

This type of plotter eliminates the need for the compass rose on the chart, can be used on rough surfaces, and on any size vessel. This is the most accurate of plotters having a correction factor of 1°.

Using a chart, parallel rules or plotter/protractor and dividers, most basic navigational problems can be solved. It is possible to determine the position (latitude and longitude) of a given point on the chart, plot a position on the chart whose latitude and longitude are known, plot a course from one point to another, plot bearings and lines of position and measure and mark off distances.

Other useful items include:
Note book.
Pencil sharpener.
Eraser.

Charts

Charts are essentially maps of sea areas showing coastlines and their prominent features, depths, objects in on and under the water and include many other pieces of useful information. They are intended primarily for use by mariners to assist in route planning, pilotage and navigation, as well as to find information concerning the depth of water, hazards to navigation, aids to navigation, channels, anchorage areas, harbors, tides, water levels, magnetic variation and information on currents. Many maritime nations have agencies that publish charts which are readily available through nautical suppliers. In addition to charts there are a number of other publications required by the navigator.

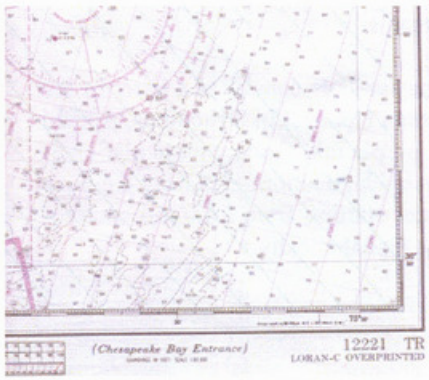


Chart showing latitude @ 36° North and longitude @ 075° West

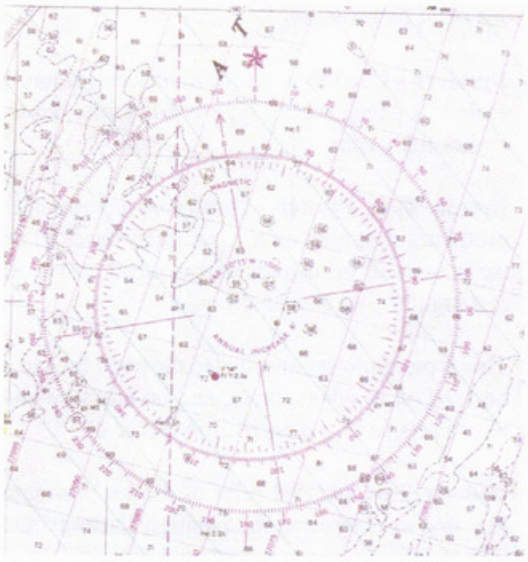
Scale

The scale to which the chart is drawn is important as it indicates how much detail is included. Large-scale charts are used when more detail is required, for example harbor charts which show a small area in great detail. Smaller scale charts are used when detail is less important and show a larger area in less detail. As the scale of the chart increases, a smaller area is shown with more detail. It is best to use the largest scale of chart available.

Distances are measured using the latitude scale of the chart, with one minute of latitude being equal to one nautical mile.

Heights and Depths

In the USA the standard of measurement will be imperial rather than metric. Depths or soundings will be given in feet or fathoms (1 fathom = 6 feet) and heights of objects will be shown in feet, these will be marked on the title block and on the upper/lower margins, "SOUNDINGS IN FATHOMS". European and some other charts are likely to be metric - these will be marked on the title block and on the upper/lower margins, "SOUNDINGS IN METERS".



Special Notes Cautions and Warnings

These lists certain features, dangers and other information in the area covered by the chart and which the navigator must make him/herself aware for safe passage making.

North/Compass Rose

True North is always at the top of the chart and South is always at the bottom. This may vary with strip charts and chart books. The compass rose is printed in several locations on the chart and the outer ring shows true degrees from 000° to 359° whilst the inner ring shows magnetic degrees from 000° to 359°. The difference between the two is the variation (at the time of printing). In the center of the rose the variation is noted along with the annual change.

Tidal Diamonds

Tidal Diamonds are symbols on British Admiralty Charts that indicate the direction and speed of tidal streams.

The symbols consist of a letter of the roman alphabet in a rhombus, printed in purple ink. On any particular chart each tidal diamond will have a unique letter starting from "A" and continuing alphabetically.

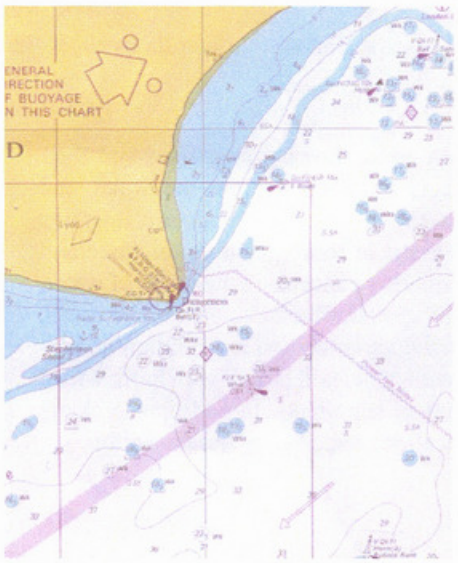


Chart Symbols and Abbreviations
NP 5011 (UK) or Chart No 1(USA) This publication illustrates all the symbols and abbreviations in use on most common charts.

(Where possible the symbols used are common sense.
e.g. the symbols for a church ….looks like a church…!)

Chart Information

Title and Number - Charts are titled and numbered according to the area they cover: e.g. Falmouth to Plymouth - English Channel - New York Harbour - Port Everglades.

Scale - Large or small scale.
Note: Anything colored yellow is dry land and its height is measured from mean high water springs (MHWS).

Anything colored green is land, which covers and uncovers with the tides. Drying heights (underlined) are measured from C.D. (chart datum) or L.A.T. (Lowest astronomical tide) up to MHWS.

Anything blue or white shows the soundings below the chart datum.

(With Tidal height there will nearly always be more depth than charted)

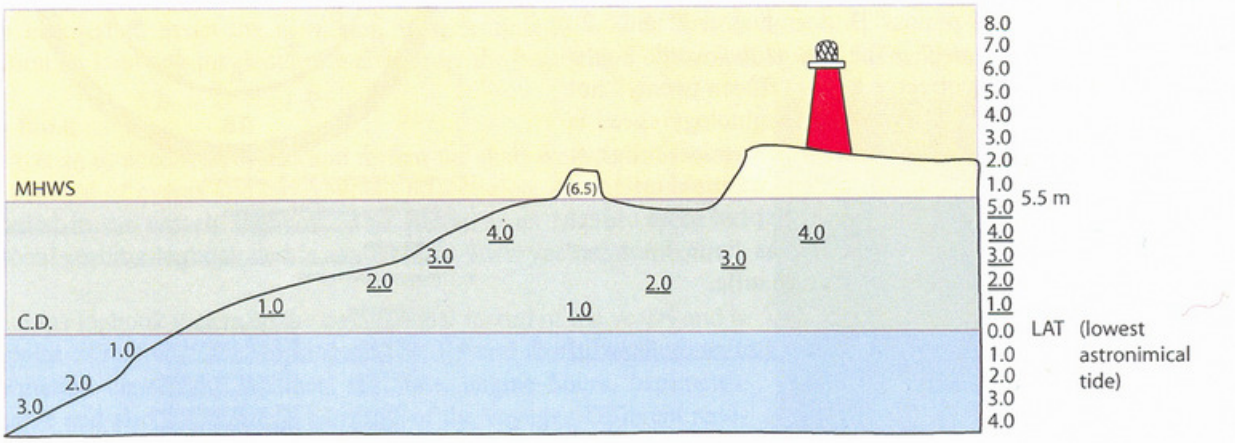
Traffic Separation acheme

Soundings – Fathoms, feet, or metric.

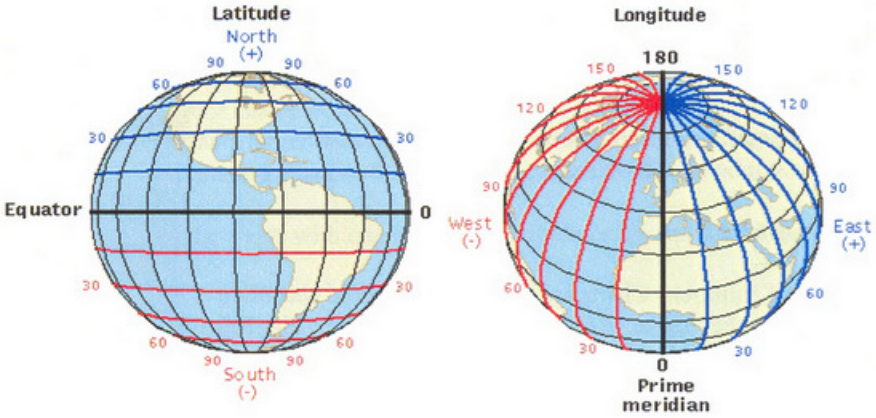
Cautions – Cautions draw the attention of the user to navigational instructions, hazards and dangers. Such as:
Traffic separation zones.
Restricted area.
Firing ranges.
Historic wrecks.
Radio reporting points etc…

ALWAYS READ THE CAUTIONS BEFORE USING THE CHART

Colors and Levels
Charts are laid out in the form of a grid, much like land maps, and these co-ordi-



nates enable the navigator to identify a position anywhere on the earth's surface.



Latitude
The imaginary lines which run East / West on the earth's surface are called Parallels of Latitude and are graduated from zero degrees at the equator to ninety degrees at the North and South Poles.

Longitude
The lines, which run North/ South from the poles, are called Meridians of Longitude. Longitude is measured East /West (0° - 180°) from the Internationally agreed 0° or "**Prime Meridian**" which runs through the Old Royal Observatory building in Greenwich, England.

Measuring the angular distance between two points on the surface and a point at the center of the earth derives both latitude and longitude.

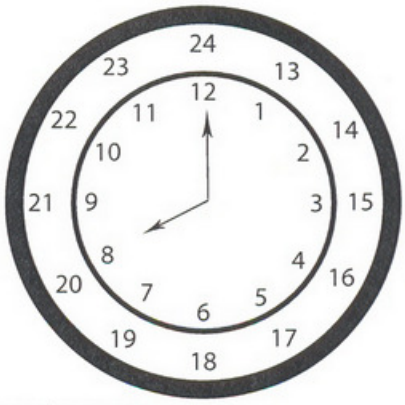
Course / Distance

Direction
The navigator needs to be able to express in the appropriate terms the direction to shape a **CTS** (course to steer) in order to get a vessel from one location to another as well as obtaining a bearing from the vessel to a specific object. Direction is measured as an angle starting at 000° (True North) and continuing clockwise (through East, South, West and back to North) to 360° or 000°. The position of a vessel can be described in relation to a feature on the chart by establishing the distance and bearing from that feature.
For example if you were approaching Port Everglades, Ft Lauderdale from due east you could describe your position as being 090° from Port Everglades entrance.

Time
Time is always expressed using the 24 hour clock format and not "am/pm". Ambiguity is avoided in this way. The day starts at 0000 hours (midnight) and progresses through the day to 2400 hours (midnight again).
e.g. 1.00 am is expressed as "Oh one hundred", 5.20 am as "Oh five twenty", 1.00 pm as "Thirteen hundred" and 5.20 pm as "Seventeen twenty". The use of the word 'hours' after the numbers is incorrect, e.g. say "fifteen twenty" **not** "fifteen twenty hours". In nautical terminology speed is expressed in knots, where 1 knot is one nautical mile per hour. **Remember, one knot equals one nautical mile per hour, therefore you would say that the speed of an object is "one knot" it is never expressed as "one knot per hour". One nautical mile = 1.1 statute mile.**

Never use the longitude scale at the top or bottom of charts to measure distance.

Twenty Four Hour Clock



Conversion of conventional time to marine time

1. Delete colons and AM/PM designators
2. Add first digit zero to hours between 1:00 a.m. and 9:00 a.m. to arrive at marine time.
3. Delete colons
4. Add 12 hours to all hours between 1:00 p.m. and 11:00 p.m.
5. Midnight is 2400 or 0000

Examples:

10:00 a.m.	=	1000 or ten hundred
9:00 a.m.	=	0900 or O nine hundred
12:00 noon	=	1200 or twelve hundred
1:00 p.m.	=	1300 or thirteen hundred
1:15 p.m.	=	1315 or thirteen fifteen
7:00 p.m.	=	1900 or nineteen hundred
10:05 p.m.	=	2205 or twenty two O five

Great care must be taken when going from one chart to another, be aware that the "new" chart may have a different scale. It is a common mistake to mark off the wrong distance because of a change in scale between two charts.

Navigational Techniques

Dead Reckoning Position (DR)

It is not always possible to fix the boat's position at regular intervals, because suitable objects from which to take bearings may not be available. In this case the navigator will keep a log of courses steered and distances traveled to enable an approximate position to be maintained, however the result will not be as accurate as a fix.

The position arrived at by this method, when only course steered and distance traveled are taken into account, is called a Dead Reckoning Position (DR) from Deduced reckoning. It is shown on the chart by a dot on the course line with a half circle around it, alongside which is written the time and the log reading in brackets.

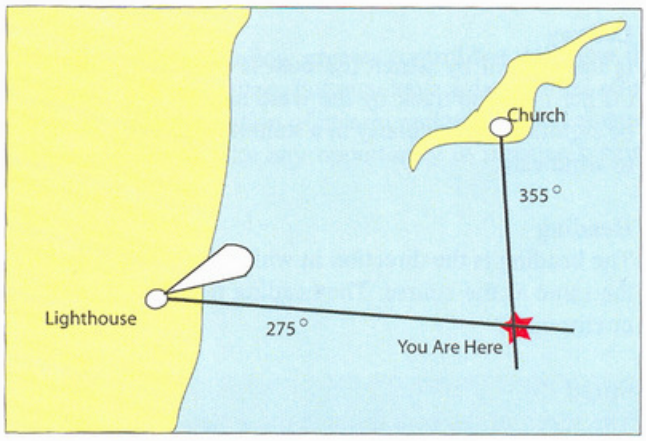
To "work up" a DR position, the plot must be started from a known position. The course steered, converted to true, is plotted and the distance traveled is marked on the line.
The accuracy of any DR position is only good if there is no current, tide or wind setting the vessel off course, the distance log is accurate and the course steered is accurate.

Position Line (LOP)

A position line is a line (drawn on the chart) somewhere on which the vessel's position lies. On its own, a single LOP cannot give the vessel's exact position, other information is required, but a single LOP, when plotted on a chart, can confirm that you are/are not close to a point of danger.

Fixes

A fix is a reasonably accurate determination of a vessel's position. It requires two or more LOPs, derived from simultaneous compass bearings, crossing each other to establish the position of the vessel fairly accurately. However, a fix that uses only two position lines is not as accurate as one that uses three. It is preferable always to take compass bearings of three different objects when possible.



Plotting a fix

Two Point Fix

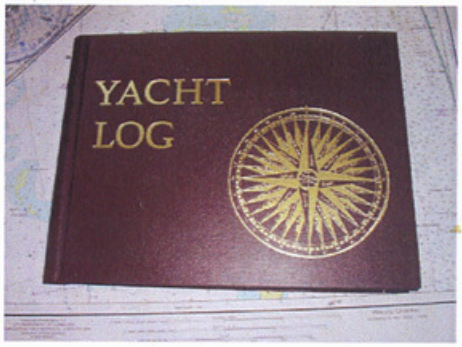
The point of intersection of two simultaneous bearings of two charted objects (LOPs) gives a reasonable fix of the position of the vessel.

Depth Contours

May be used to assist the navigator in determining position by knowing the depth of water under the boat which will coincide with the depth on the chart.

Log Book

There is an established process and format for chart work and for keeping a record of events and navigational information. All information is recorded in the vessels logbook. IYT produces an M.C.A. approved personal seatime logbook and is available on www.yachtmaster.com.



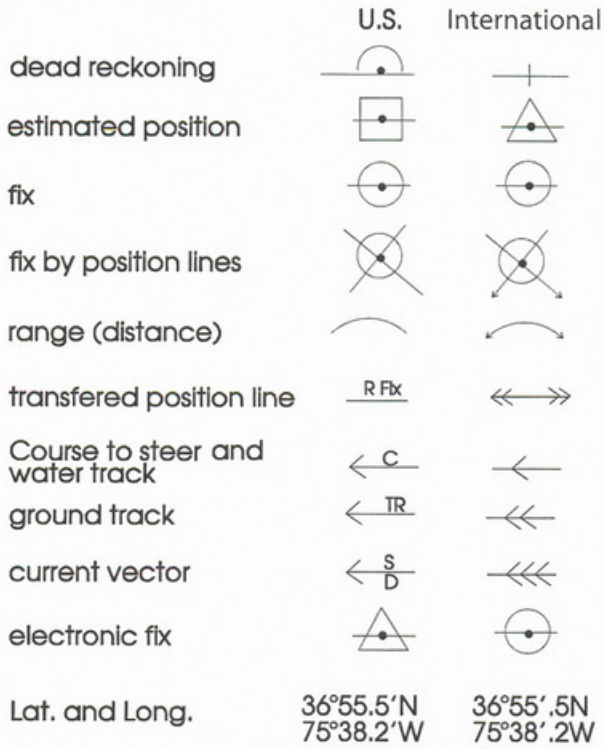
The ships logbook makes up the navigational record of the vessel and is the point of reference for working up DR, EP and fixes. It will contain information concerning weather, sea state, engine hours, barometric pressure and also sometimes a narrative of the voyage. Different navi-

gators have different requirements for what is included and will often design their own. It is possible to buy proprietary brands in boating stores, the use of which is a matter of preference. A typical logbook will have at least the following minimum:

Time
Log reading
Course steered
Barometric pressure
Wind speed and direction
Position in Lat. & Long.
Comments

Terminology

Chart Work Symbols
Symbols used in chartwork convey meanings of themselves. Different symbols are used for the U.S. than the rest of the world



Course to Steer (CTS)
The direction to be maintained to a destination point. A course line is drawn on the chart indicating the intended direction of travel; this is the Course To Steer abbreviated to CTS.

Leeway
Is the amount by which the boat is pushed off her intended track by the wind and may be significant particularly in a sailboat going to windward.

Heading
The heading is the direction in which the vessel is pointing as indicated by the ship's compass. Ideally this should be the same as the course. The heading may be different from the course due to leeway, and due to counteracting tide or current.

Speed (S)
The speed of the boat through the water. This may be different from speed over the ground, see Speed Made Good below.

Set (SET)
The direction in which the current or tide is affecting the vessel.

Drift (DFT)
The speed of the current or tide.

Course Made Good (CMG) Also Known As (AKA) Course Over Ground (COG)
The actual direction in which the boat is moving over the sea-bed, the ground track. This may differ from the Course through the Water because of the effect of current and leeway.

Speed Made Good (SMG) AKA Speed Over Ground (SOG)
The actual speed of the boat over the bottom. This may differ from the speed of the boat through the water because of the effect of current and leeway.

Tides
The prudent navigator requires a detailed knowledge of tides in order to make safe and comfortable passages. In this module we will only attempt a basic outline of the subject.

Tides are the vertical rise and fall in the sea level brought about by the movement of the earth, moon and sun and the effect of the gravitational attraction between these bodies. In effect the combined gravitational pull of the sun and moon causes a "tidal wave" to revolve around the earth. Tides originate in the open waters of the earth's seas and oceans, but are only noticeable and significant close to shore.

Tidal currents are the horizonal flow of water that result from the "tidal wave" meeting landmasses and shallow areas and are easily observed along beaches, bays, sounds and up rivers.

Currents
Currents are the horizontal movements of water from any cause, such as tidal phenomena, prolonged wind activity or river flow. A boat moving at a speed through still water where there is no current will be traveling at the same speed and direction over the bottom. When this same boat moves into a body of water that is affected by a current, it's speed and direction of travel over the bottom will change.

Effects of Wind, Tide & Current
Generally, the strongest element affecting a power boat (due to a shallow draft) is wind but close attention will have to be paid to the effect of tide or current on the vessel.

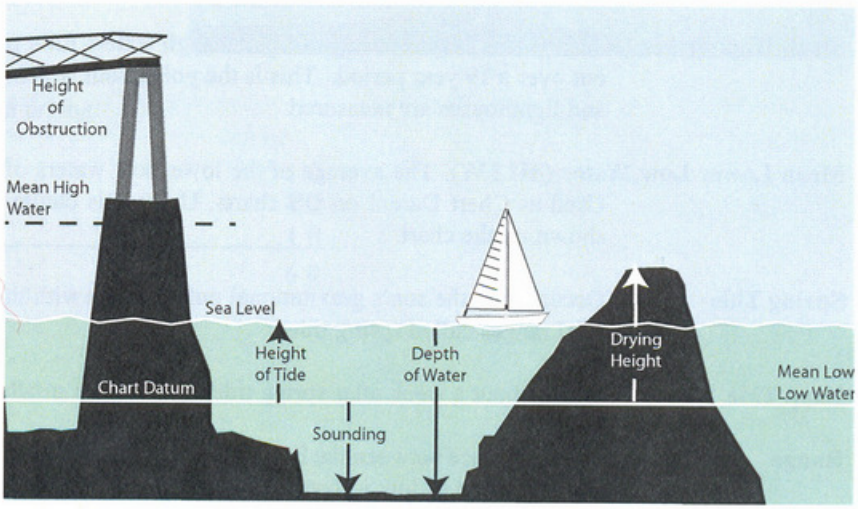
When turning, go for the strongest element, once the bow is through the wind or stream it will assist in pushing the bow in the desired direction. A shallow draft vessel not under control will rapidly assume a beam or one quarter to wind aspect. Reversing gently will allow the bow to stream downwind.

Streams of tides or currents will also have an effect. Pointing upstream will allow greater control but will slow the approach. Conversely, motoring with a stream will increase speed over the bottom but may have a detrimental effect on steerageway. Adequate allowances will have to be made once the combination of stream and wind are evaluated. This knowledge is gained with experience. The student is encouraged to take any opportunity to practice coming alongside and leaving docks and moorings.

Effects of Tides, Currents & Leeway

The navigator requires a detailed knowledge and understanding of tides in order that they may be used to help in making a safe and comfortable passage. Tides have two significant effects for the navigator, and these change constantly, vertical movement/depth of water and the speed of horizontal flow.

In most places there are two tidal cycles every day, comprising two high tides and two low tides, and this phenomenon is known as a semi diurnal tide. A few places have only a single tidal cycle each day, this is known as a diurnal tide. Still fewer places have a combination known as mixed tides.



Tidal Height Definitions

Tides
Tides are the vertical rise and fall in the sea level brought about by the movement of the earth, moon and sun and the effect of the gravitational attraction between these bodies.

Cause of Tides
Tides result from the differences between centrifugal forces and gravitational forces of mainly the moon and earth. (However to a lesser extent the sun also exerts gravitational pull). Although the mass of the moon is only a tiny fraction of that of the sun, it is much closer to the earth and its pull is about twice as powerful. As a result, tides are mainly lunar.

Tidal Definitions

Chart Datum Chart Datum is the reference point from which all depths and drying heights are measured on a nautical chart. American charts commonly use **Mean Lower Low Water** (MLLW). British Admiralty metric charts use **Lowest Astronomical Tide** (LAT).

Charted Depth The distance below chart datum of an object or feature is referred to as *soundings.*

Drying height This is the height of an object or feature above chart datum; these features may be uncovered at low water.

Duration This is the interval of time between successive high and low waters.

Height of Tide This is the height of water above Chart datum and is found by using the tide tables to find high or low water and then applying the corrections derived from the appropriate tables.

High Water The time at which a tide reaches its maximum height. The tide tables predict the times that high and low water are expected to occur as well as the heights expected. (These predictions assume normal weather conditions)

Low Water The time at which a tide reaches its minimum height.

Lowest Astronomical Tide (LAT) LAT is the lowest tide level that can be predicted to occur under normal meteorological conditions and so using this datum there will rarely be less water than is shown on the chart.

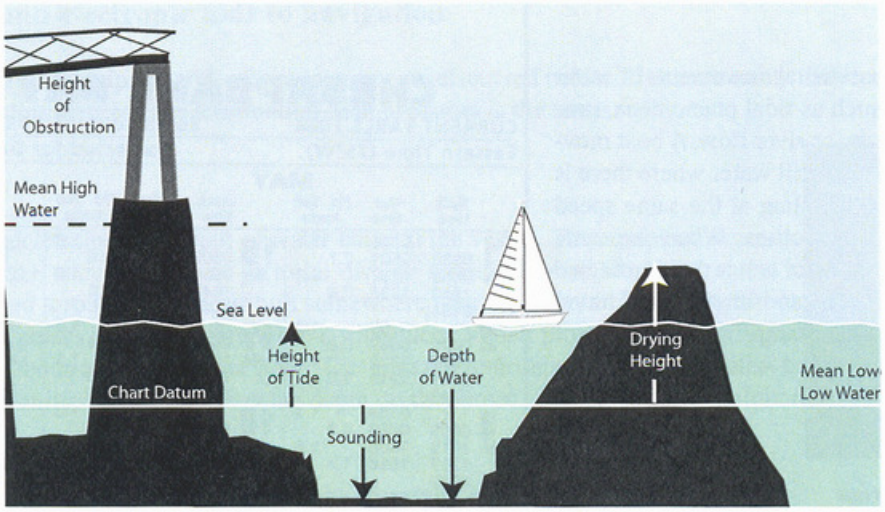
Mean High Water (MHW) This is the **average** height of high waters for a particular place: this average is worked out over a 19 year period. This is the point from which the height of structure such as bridges and lighthouses are measured.

Mean Lower Low Water (MLLW) The average of the lower low waters of each tidal day over a 19 year period. Used as Chart Datum on US charts. Using this datum there will often be less water than is shown on the chart.

Spring Tide Occur when the sun's gravitational pull lines up with that of the moon. This results in higher tidal ranges called spring tides.

Neap Tide Occur about a week after spring tides and feature smaller ranges therefore slower flows.

Range The difference between the height of successive high and low waters, this is found by subtracting the height of low water from the height of high water.



Examples of tidal height problems

Height for a time, time for a height

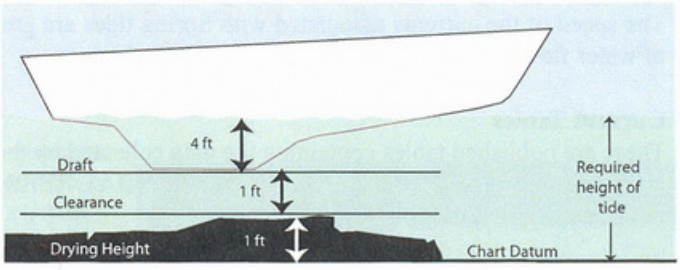
Remember that all the problems which involve working with tidal height problems will require that one of two things to be found:

1. the Height of Tide at a specific time, or
2. the Time for a specific Height of Tide

What is the latest time during the falling tide on the evening of June the 1st that a yacht can pass over an area near Boston shown on the chart as having a drying height of 1 ft? The yacht has a draft of 4 ft and an extra clearance of 1 ft will be allowed for safety.

A quick sketch is usually a help when you are trying to understand the problem. Here the height of tide to allow the boat to pass must be:

1 ft to cover the drying height
+ 1 ft for the safety clearance
+ 4 ft for the boat's draft.



The height of tide required to cover a drying:

height of 1 ft	1 ft
+ the draft of 4 ft	4 ft
+ the clearance of 1 ft	1 ft
Height of tide required	6 ft

Currents

Currents are the horizontal movements of water from any cause, such as tidal phenomena, prolonged wind activity or river flow. A boat moving at a speed through still water where there is no current will be traveling at the same speed and direction over the bottom. When this same boat moves into a body of water that is affected by a current it's speed and direction of travel over the bottom will change. The effects of currents are complex and will be looked at in greater detail in later modules, however it is useful to know...

CHESAPEAKE BAY ENTRAN

CURRENT TABLE 2004 — 36°58.80'N 75°59.88'W

Eastern Time (75°W) — Corrected for Daylight Saving Time

MAY

	Slack time	Max time	Fld knots	Ebb knots
1 Sa	0330	0016	0.7	1.1
	0855	0601		
	1558	1237	0.9	1.3
	2154	1838		
2 Su	0420	0108	0.8	1.2
	0937	0642		
	1631	1319	1.2	1.5
	2243	1915		
3 M	0509	0159	0.9	1.4
	1019	0726		
	1707	1403	1.4	1.6
	2329	1956		
4 Tu ○	0557	0250	0.9	1.6
	1103	0815		
	1748	1449	1.5	1.7
		2042		
5	0016	0338		1.7
	0648	0906	0.9	
16		0153		1.2
Su	0502	0709	0.6	
	0959	1345		1.2
	1648	1936	1.0	
	2314			
17 M	0547	0241	0.6	1.3
	1032	0750		
	1721	1421	1.0	1.2
	2351	2011		
18 Tu	0631	0322	0.5	1.3
	1104	0833		
	1754	1454	1.1	1.2
		2049		
19 W ●	0028	0358	0.5	1.2
	0714	0915		
	1137	1525	1.0	1.2
	1830	2126		
20	0104	0432		1.2
	0757	0956	0.5	

JU

	Slack time	Max time	Fld knots	Ebb knots
1 Tu	0448	0136	0.8	1.4
	0937	0657		
	1636	1330	1.5	1.6
	2308	1926		
2 W ○	0538	0230	0.8	1.6
	1030	0748		
	1723	1423	1.6	1.7
	2358	2016		
3 Th ○	0629	0321	0.9	1.7
	1124	0843		
	1813	1516	1.6	1.7
		2108		
4 F	0049	0411	0.9	1.7
	0723	0938		
	1220	1607		1.7
	1907	2201	1.6	
5	0142	0502		1.7
	0819	1031	0.9	

Definition of Terms

Flood Stream
This usually refers to the flow of water associated with an incoming tide.

Ebb Stream
The "falling" or outgoing tide is called the EBB, so a tide may be said to be ebbing or flooding dependant upon whether it is going out or coming in.

Slack Water
Slack is the period between the flood and ebb tides when the movement of the water tails off sometimes to a complete stop before the tide turns and flows in a new direction.

Spring and Neap rates
The speed of the currents associated with Spring tides are greater than those of Neaps because of the greater volume of water flowing between high and low water at Springs.

Current Tables
These are published tables containing the data collected by the U.S. National Ocean Service (NOS) and the Canadian Hydrographic Service (CHS) British Admiralty (BA). REEDS Nautical Almanac publishes tide tables and information for the East Coast of North America.

Direction
The information about direction is always given in degrees true so can be plotted directly on the chart without correction.

Instruments and electronic aids to navigation

Not all vessels will be equipped with all the instruments discussed below. There are many different types and makes of each of the instruments but the information each produces is the same.

Depth Sounder

A depth sounder determines the depth of water beneath the vessel. The equipment comprises a Transmitter with a digital or pictorial display screen close to the helm, and a transducer mounted through the vessels hull somewhere near the bottom of the hull. The transmitter sends pulses of energy through the transducer, which picks up the returned pulse after it has "bounced" off the sea floor. The time the returning echo takes is interpreted by the transmitter, which displays the depth on the screen.

Barometer

A barometer is an instrument which indicates the atmospheric pressure. A single reading of barometric pressure gives no worthwhile information, it is the rate of change of the pressure that counts and this can only be seen from a series of readings, hence the importance of recording barometer readings in the ship's log book. Barometers are available which record the pressures either on paper charts or electronically in a 24 hour memory.

Log

The log is an instrument for measuring the vessel's speed through the water. Boat speed is usually measured in "knots" (nautical miles per hour). The navigator uses this to determine how far the vessel has traveled and to estimate likely arrival time at the destination.

The log comprises a Receiver with a digital display close to the helm, and a paddle wheel impeller mounted through the hull near the bottom of the hull. As the vessel moves through the water the paddle wheel spins and sends the information to the receiver, which computes the speed the wheel is turning to boat speed through the water. The impeller requires regular maintenance in the form of cleaning to ensure that the paddle wheel has not become jammed with marine growth. A watertight cap will be attached to the through hull fitting so as to seal it while the impeller is being cleaned.

GPS (Global Positioning System)

The current state of the art satellite radio positioning system is called 'Global Positioning System' or GPS for short. GPS was developed by the USA for the US Navy, Army and Air Force and is intended to offer precise position and altitude, 24 hours a day, worldwide.

The GPS navigation system is composed of 29 active satellites (24 fully operational in 1999) in orbit around the earth together with a land based master station, based in Colorado and a receiver on board the vessel.

Each satellite knows its exact position and also sends out an individual signal, which is picked up by the receiver. The receiver then measures the time it took for this signal to reach the receiver; using this information the receiver can work out its distance from the satellite. In other words the receiver has found a position circle centered on the satellite's known position. A second position circle from another satellite will give a position fix and a third position circle will confirm this fix with greater accuracy.

Micrologic GPS

The GPS transceiver will have a display mounted close to the helm. There is usually a digital read out of the vessel's speed and position (Latitude and Longitude) together with additional information of use to the navigator. The GPS receiver may have a charting function or may be connected to a "Chart Plotter" which will show the position of the vessel graphically on a chart displayed on the screen.

Electronic Chart Plotter

GPS Accuracy

The GPS satellites actually transmit signals on two frequencies, one solely for military use and one for civilian use. The frequency available to civilians (you and me) gives less precise accuracy than the military frequency. The design parameters for GPS were that it would provide an accuracy of 8 meters horizontally, 10 meters vertically, speed to 0.1 of a knot and time to a fraction of a microsecond.

Selective Availability (SA)

In order to reduce the potential threat that the accuracy of the civilian signals allows the U.S. introduced what is called Selective Availability. Quite simply the U.S. can, by introducing random errors, degrade the signal available on the civilian frequency as and when they wish. Selective availability is at present in operation giving an expected accuracy of between 100 and 150 meters 95% of the time. This is of course more than adequate for normal navigation. Remember, however, that this accuracy can, and will, be further degraded if and when required, nor will there necessarily be any prior warning to civilian users. The civilian frequency can also be switched off totally.

Differential GPS (DGPS)

DGPS has been introduced commercially in some parts of the world in order to cancel out the effect of selective availability. With DGPS the GPS signal is received at a place, such as a lighthouse for example, the exact position of which is known, the signal error is removed and the corrected signal re-transmitted to suitably equipped receivers. A special (add on) DGPS receiver must be purchased; in some areas this DGPS signal is free and in others an annual rental is charged. Accuracy using DGPS is often quoted in terms of about 10 meters or 33' and sometimes figures of 5 meters are quoted, - BUT remember that in many cases charts are not produced to anything like this level of accuracy, indeed some charts are based on surveys carried out in the 1800's. See the warning from the British Admiralty at the end of this section. Generally speaking it would seem to be most unwise to attempt to navigate in a fashion totally dependent upon quoted accuracies of these magnitudes.

GPS Instruments

A GPS set actually consists of a radio receiver tuned to receive the signals transmitted from the satellites and a computer, which processes these signals to display the receiver's position in terms of latitude and longitude.

Many different models, either fixed or handheld (portable) are available but essentially they all do the same thing and give the user the same range of information. Fixed models generally use the boat's battery whereas handhelds use replaceable (flashlight) batteries. Some models may have more buttons than others and different manufacturers use different words to describe each individual function.

Using a GPS

When switched on a GPS set may take anything from a couple of minutes to as long as 15 minutes to work out its position which, when found, will be shown on the display in latitude and longitude. Once it has worked out its initial position it will continue to update this position every second or so until it is switched off; thus when the boat moves, the latitude and longitude shown on the GPS display will change.

The art of navigation is based on being able to find your position at any moment in time because it is from your position that most other navigational information is derived. Now that the GPS knows its position it will also be able to

give information such as speed, direction, estimated time of arrival and so on.

Radar

The radar is used to detect another vessel or object, and show the "range" (distance) and bearing of the object. Detection is achieved by transmitting a short burst of electromagnetic energy so that it can strike an object, reflect back, and be detected by the receiver. The data is then processed and displayed on a screen mounted close to the helm.

Radar

The main purpose of radar is collision avoidance but obviously it is very useful at night and in periods of restricted visibility. The International Regulations for Preventing Collisions at Sea states (Rule 7b) 'Proper use shall be made of radar equipment if fitted and operational, including long range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects'. Assumptions shall not be made on the basis of scanty information, especially radar information. (Rule 7c). An increasing number of smaller vessels have radar installed. The prudent mariner is encouraged not only to thoroughly read and understand the Operators Manual but also take a dedicated Navigation and Radar Course.

MODULE 8 / SECTION 4
COMPASSES & MAGNETISM

Compass Types and their Uses

The Magnetic Compass

The magnetic compass comprises a magnetic needle mounted on a pivot and a card that is divided into 360° increments, called degrees, 0° and 360° being the same, also labeled north. Most modern compasses have the needle attached to the card and it operates by the needle pointing to magnetic north whilst the compass card indicates the vessels magnetic direction of travel.

The vessel's compass is mounted on or parallel to the fore and aft centerline of the vessel.

A compass is used to steer a course, that is, the direction in which the vessel wishes to travel, or to take bearings, which is the direction/bearing of an object for charting purposes.

Lubber Line

A lubber line is located on the fixed part of the compass and is positioned on the fore and aft line of the vessel, to enable accurate reading of a course or bearing. Most compasses have lubber lines etched on the forward and after part of the compass (to indicate reciprocal direction).

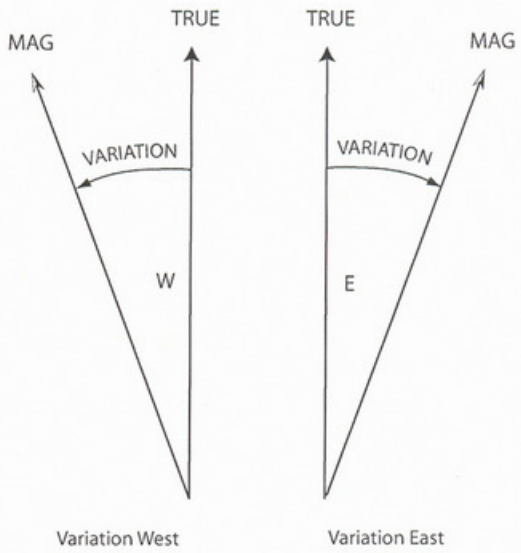
Compass Error

Magnetic north and true north are not in the same geographic position , therefore the difference between compass north and true north is called compass error. Compass error is therefore the algebraic sum of variation and deviation. Note that there are now three headings for bearings and courses: True, Magnetic and Compass. A bearing or course is useless unless it is followed by (T) or (M), or(C).

Variation, Deviation and Applying Error

Variation

The direction of True North and Magnetic North are both graphically shown on the chart as two compass cards overlaid on each other, known as a compass rose. Variation is the angular difference between the direction of True North, and the direction of Magnetic North. If the compass points east of True North, variation is named east and vice versa. The variation can be found printed in the center of the compass rose and it notes also the annual change.

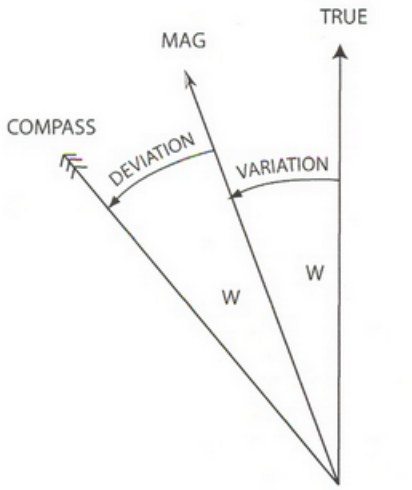


Deviation

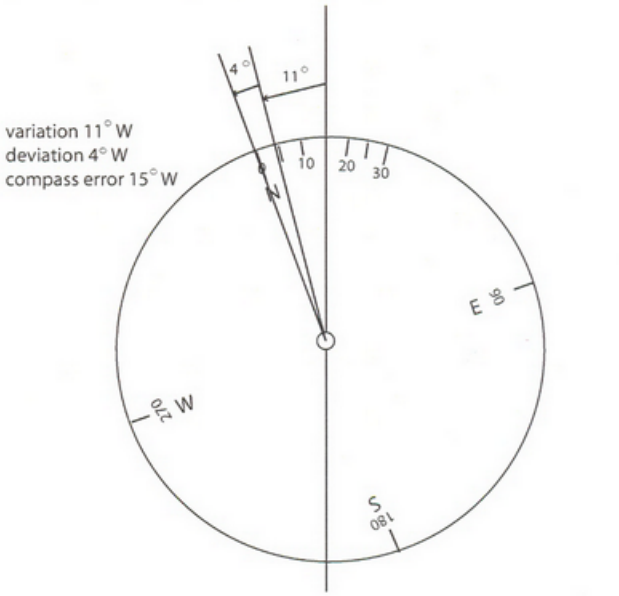
The earth's magnetic field will cause the compass to point to Magnetic North, however any magnetic effects on a particular vessel will cause the compass to be deflected east or west from Magnetic North. This is named deviation and is also calculated east or west. Deviation is caused by ferrous objects on board (nearby). Electrical equipment will also produce a magnetic field and if in close proximity will contribute to deviation.

Vessel heading will also affect deviation.

A professional Compass Adjuster can usually eliminate most of the deviation by the judicious use of magnets placed around the compass. Not all deviation will be corrected so a compass adjuster makes up a deviation card for selected compass headings.



Variation is the angle between compass north and magnetic north



The sum of variation and deviation is called compass error. Here the compass error is 15°W. In order to steer 000° (T) with this compass the compass course would be 015° (C)

Causes of deviation

Deviation is caused by ferrous objects (those containing iron) being close to the compass. Engines, iron and steel keels, electric motors and cookers can all cause deviation and small portable objects such as pen knives, can cause deviation if they are close enough to the compass. Speakers in radios and VHF transceivers contain powerful magnets and if mounted too close to the ship's compass can cause large values of deviation. Steering compasses on steel boats are particularly prone to deviation whereas fiberglass and wooden boats are much less susceptible. Hand bearing compasses which are designed to be held close to the face can be effected by steel framed spectacles.

Deviation is not static as it changes as the direction of the boat changes and deviation caused by an iron or steel keel may change as the boat heels. Motor boats often have their compass close to a lot of instruments, many of which create magnetic fields.

When to check for deviation.

Deviation should be checked at least at the start of any passage, at the beginning of the season and whenever any new equipment has been fitted which might cause deviation. Deviation should also be checked on a new, chartered, or borrowed boat.

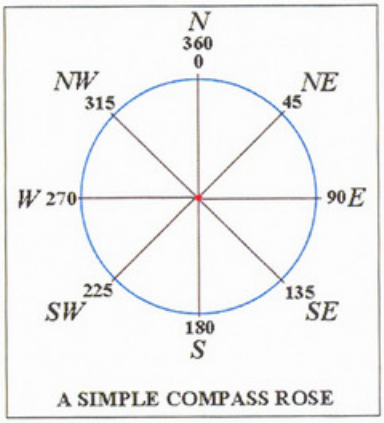
Navigation has three languages:

True (T)

The true compass rose and Parallels of Latitude & Meridians of Longitude on the chart all refer to true north as a datum.

Magnetic (M)
Takes into account or is affected by Variation only, for example Hand-bearing compass gives readouts in magnetic when used at a location on the vessel which is unaffected by deviation.

Compass (C)
Uses magnetic north as its datum and takes into account or is affected by both variation and deviation.



A SIMPLE COMPASS ROSE

Everything is converted to "True" for plotting on the chart.
Everything is converted to "Compass" for instructions and work on deck.
True North
True North is the North Pole, the point at the top of the globe where all the meridians of longitude meet.

Magnetic North
Unfortunately, Magnetic North is not at the same place as True North. The north magnetic pole is situated in the vicinity of Bathurst Island in northern Canada, about 1600 km (about 1000 miles) from the North Pole (it is also permanently in motion). This means that from almost everywhere on the earth's surface True North will vary from Magnetic North. The direction of Magnetic North is shown on the compass rose on the chart, as is the annual change.

Using a hand bearing compass
One way of checking quickly whether the ship's steering compass is subject to deviation is to stand in a deviation free area at the aft end of the cockpit and sight along the fore and aft line of the boat using a hand bearing compass. Both the boat's steering compass and the hand held compass should show the same bearing, if they do not the difference between the two readings is the deviation of the steering compass on that particular heading.

In order to use this method it is obviously necessary to know that the area in which the hand bearing compass is being used is free from deviation; furthermore if an area in the boat can be proved deviation free this area can be used with confidence for all future bearings taken with a hand bearing compass.

True Virtue Makes Dull Companions
The corrections for variation and deviation must be carried out in the correct sequence:

from true to compass = True ~ Magnetic ~ Compass,
from compass to true = Compass ~ Magnetic ~ True.

The mnemonic True Virtue Makes Dull Companions might help in remembering the sequence. If you have any difficulty working compass error problems use the mnemonic by making boxes as shown. Then fill in the figures you know and the values in the remaining blank space(s) should become obvious.

Applying Variation

In order to apply the correct variation it is necessary to 'work-up' the up to date variation figure. This is done by finding the nearest compass rose on the chart, reading the variation and year and applying the annual increase or decrease. Remember, all work on charts is True, whilst all information used to steer or plot courses is Magnetic.

Therefore to correct:
True to magnetic add west and subtract east variation (Add on).
Magnetic to true subtract west and add east variation (Subtract).

A good mnemonic is:
"Error west compass best (Add on).
"Error east compass least (Subtract)

True	Var	Mag	Dev	Compass
079°	11°W	090°	4°	086°

"Courses, True, Magnetic

True north - The direction to the geographic North Pole.
Magnetic north - The direction to the 'magnetic' North Pole.
Compass north - The direction towards which the compass actually points.
Variation - The angle between the direction of true north and magnetic north.
Deviation - The angle between the direction of magnetic north and the direction towards which the compass actually points. OR: The angle between magnetic north and compass north.
True Course - The angle between a yachts' centerline and the direction of true north.
Magnetic course - The angle between a yacht's centerline and the direction of magnetic north.
Compass course - The angle between a yacht's centerline and Compass north.

MODULE 8 / SECTION 5
BUOYAGE

Pilotage

Pilotage is the name we give to the techniques that a navigator uses to find his way around a local area or through a more confined area than the open sea. It will rely more upon visual references rather than the plotting and charting that is needed when navigating offshore. The helmsman will still need a course to steer but the progress and position of the vessel is likely to be monitored by reference to buoys, channel markers, land features etc.

Pilot books and Sailing Directions
There are published books of pilotage information which provide localized information about dangers and how to best avoid them, which channels to use and which to avoid in different tidal or weather conditions.

Nautical Almanacs
These will usually contain information about harbors, lights, tidal and other navigational information. There are locally produced editions for small areas as well as national publications like REEDS who publish one book with information for the whole Western Seaboard of the US and another for the Caribbean Sea.

Pilotage Plans
Planning a departure is easier as you have a well-defined starting point whereas if you are approaching a harbor from seaward you will need to choose a clearly defined and easily confirmed starting mark.

- Draw the track of your planned route and try to plan the track to pass some easily recognized marks to keep up with your progress.
- Check along your track to see if the depth of water is going to be a critical factor and if so draw up the tidal information for the time of your passage.
- Check the published information to see what, if any, the harbor regulations are and what VHF Channels are used to control and monitor traffic movements, bridge openings and marina traffic.
- Once you have drawn up a pilotage plan and begin to execute it resist the temptation to shortcut, stick to the plan and make sure that you positively identify each mark, do not rush, stop if you need to, make sure of your position.
- Check what you see ahead of you against the bearing you have taken from the chart to confirm the identity of the next mark.
- Don't neglect the echo sounder as a way of checking, it will often warn you of the location of the channel edge and if you set an alarm will alert you to the danger of running aground before the boat shudders to an unexpected halt.
- Leave the steering to someone else but make sure that your instructions to him or her are clear and accompany all directional instructions with a compass course as a check. This will eliminate many potential mistakes.
- Try to keep track of your last point of reference, as this will be a place to return to if you become uncertain of your position.
- Never be afraid to slow down or stop or even to turn around and back track to your last known position then ask the crew to hold the boat in that position while you resolve the problem.
- Your pilotage plan will be part of you overall PASSAGE PLAN.

All activities on the water are governed by a set of international regulations. These regulations are known as the INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA, (1972). This includes the buoyage system which is briefly described herein.

IALA areas A& B and Cardinal Buoyage System

To help ensure safety and to clearly mark out obstacles and hazards that exist both in and under the water there exists and internationally agreed sets of marks and lights. These are developed with the assistance of the "International Association of Lighthouse Authorities" (IALA.) There are two major systems.

Region A (IALA A) covers all of Europe and most of the rest of the world except for the areas covered in Region B (IALA B) which is The Americas, Japan, The Philippines, Korea and the Caribbean. Fortunately most of the differences between the two systems are few. The most important is that which deals with the "direction of buoyage" which defines on which side of a channel the Lateral or Channel Buoys or Marks are placed.

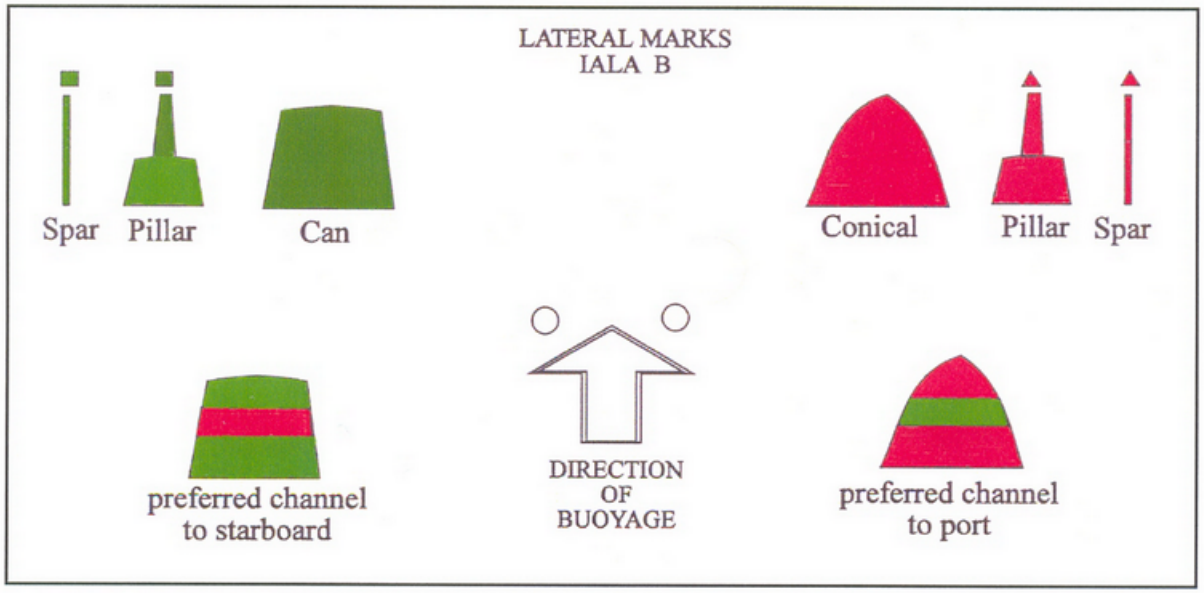
Under IALA B red (port) buoys or marks are on the right hand side of the channel when proceeding in from the sea i.e. going into a harbor (red right returning). Under IALA A the red (port) markers are on the left hand side of the channel when heading into a harbor. These Lateral or Channel Marks define the limits of the navigable water across a channel, though designed in principle to define the limits for large commercial ships they are also vital for the safety of smaller vessels. It is almost never wise to attempt to pass between a channel mark and the shore behind.

Starboard Mark

Marks can either be a buoy floating in the water or a pole set into the rocks or sea bed which will be painted in the correct colour and carry the required shape at the top.

Port Marks are Red in colour, flash a red light at night and Cone Shaped for IALA B.

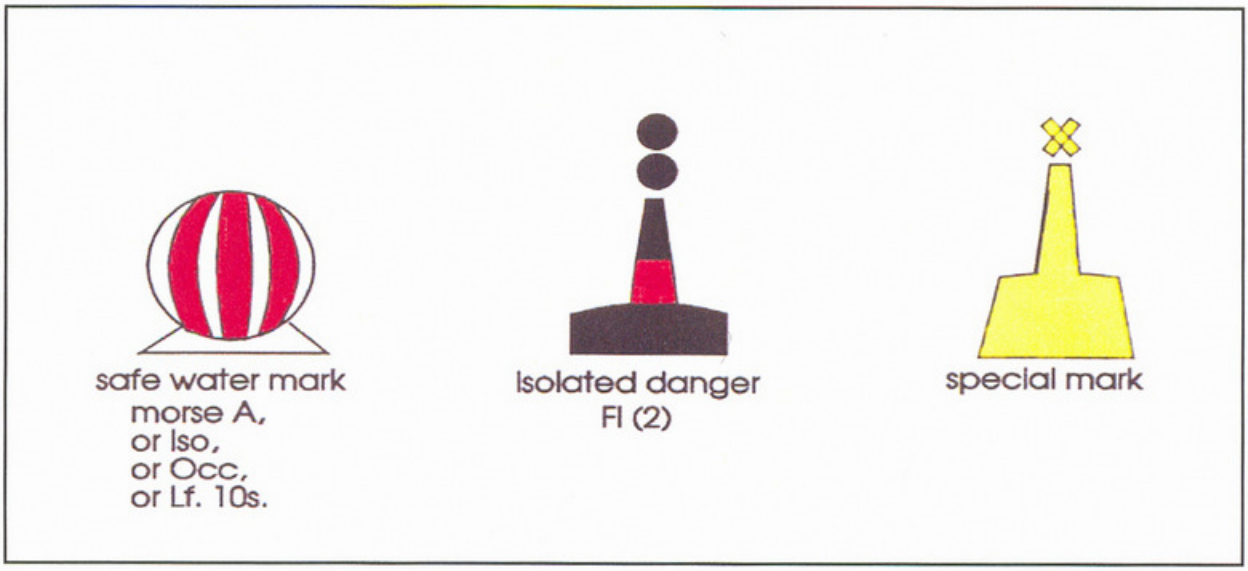
Starboard Marks are Green in colour, flash a green light at night and are Can shaped for IALA B.



Safe Water Marks are red and white vertical stripes; the other striped marks have horizontal stripes and usually have a continuous white light.

Isolated Danger Marks indicate a point of potential hazard, are Red and Black in Colour, have two round black balls at the top and flash a white light in a group (e.g. two flashes) at night.

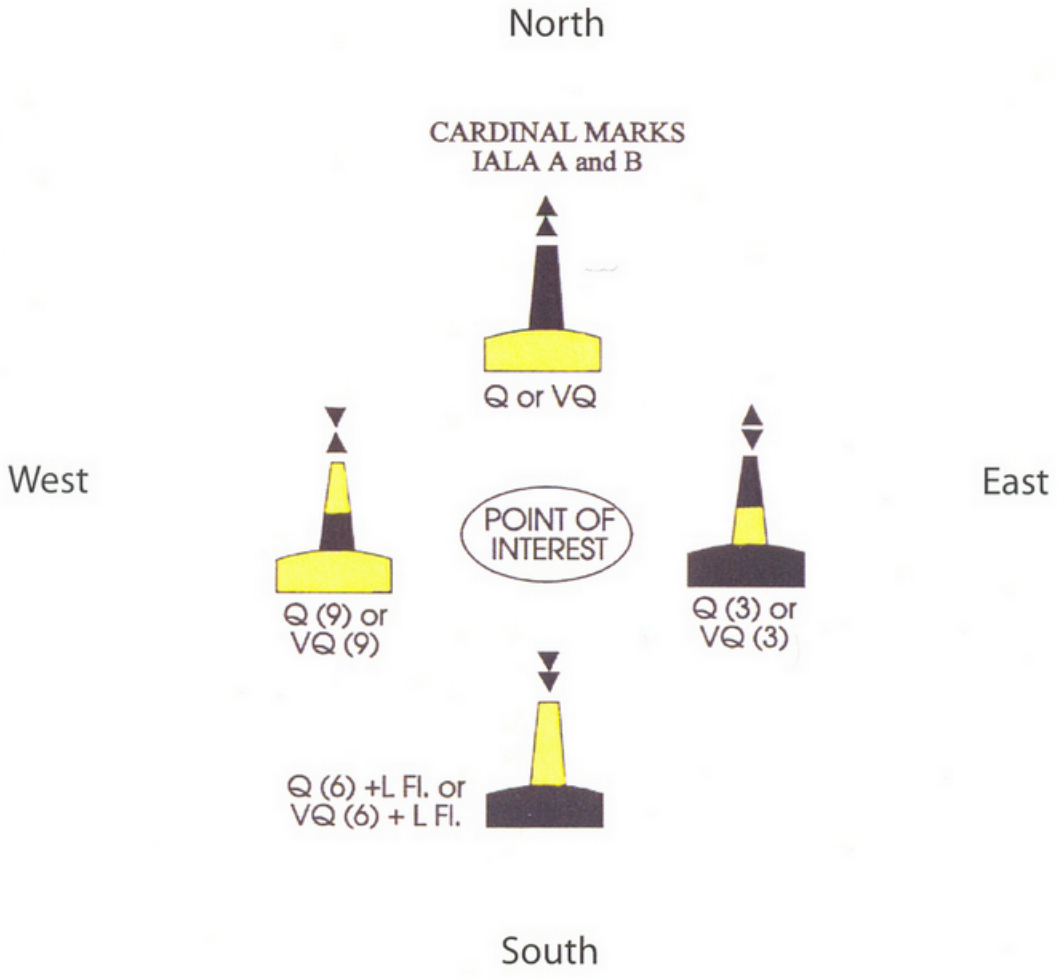
Special Marks are yellow in color and display a yellow light if lit. They are not intended to assist in navigation but rather to alert the mariner to some special feature such as: spoil reas, Pipelines, Traffic Separation Schemes, jetties or naval exercise areas.



Cardinal Buoyage System

Cardinal Marks (rare in US waters) indicate the safe side to pass a hazard. e.g. a North Cardinal Mark indicates that a vessel should pass to the north of the marker. Each Cardinal Mark has a unique pattern, color scheme and is defined by a white flashing light.

North Cardinal	Black over Yellow	Triangle point up	Continuous flash
East Cardinal	Black/Yellow/Black	Triangle point away	Flash in a Group of 3
South Cardinal	Yellow over Black	Triangles point down	Flash in a Group of 6, followed by 1 long flash
West Cardinal	Yellow/Black/Yellow	Triangle points in	Flash in a Group of 9



Q (9)	This indicates quick flashing flight 9 times
VQ (9)	This indicates very quick flashing flight 9 times
Q (6) + L Fl.	This indicates quick flashing light 6 times and a long flash

MODULE 9
PRACTICAL SUBJECTS

These modules are aimed at increasing a candidates' nautical knowledge that is required to be an active watchkeeper or responsible as a flotilla skipper on board a Yacht. Candidates should have completed the IYT International Crew Certificate or show evidence of successful completion of prior similar training courses provided by an accepted and accredited body.

This module contains the following subjects:

Taking over a vessel & vessel checkout
- hull and rig checks
- machinery and systems checks
- instrument checks
- safety equipment checks
- fuel and water capacity

Charts and publications

Meteorology information sources

Man overboard techniques

The galley:
- provisioning and housekeeping
- propane
- cooking while underway
- a balanced diet

Power boat handling skills
- engine failure
- single engine handling
- picking up mooring buoy
- coming alongside

Sailing boat handling skills
- slab reefing
- storm sails
- spinnaker, MPS, and poling out
- roller reefing
- short handed sailing
- tacking and gybing
- coming alongside under power
- picking up mooring buoy under power and sail

MODULE 9 / SECTION 1
TAKING OVER A VESSEL & VESSEL CHECKOUT

Your instructor will cover the following:

- ✓ Hull and rig checks
- ✓ Machinery and systems checks
- ✓ Instrument checks
- ✓ Safety equipment checks
- ✓ Spares, tools and equipment
- ✓ Fuel and water capacity, range
- ✓ Menus, quantities
- ✓ Float plan / Trip plan lodged with responsible person ashore

MODULE 9 / SECTION 2
SAFETY BRIEF / PRACTICAL SUBJECTS

Charts & Publications

National Oceanic and Atmospheric Administration (NOAA) charts

U.S. charts are published in Washington, D.C., by the National Oceanic and Atmospheric Administration (NOAA) by the Department of Commerce.
The main agencies involved in the production of US nautical charts of interest are the
National Ocean Service (NOS) who produce charts of the U.S. and its possessions, and the Defense Mapping Agency Hydrographic/Topographic Center (DMA or DMAHTC) who produce charts of the oceans and areas other than U.S. territorial waters.
Chart catalogs are available from the publishers and stockists, for example NOS chart catalogs are available, free of charge, as follows:

Nautical Chart Catalog 1
the Atlantic and Gulf Coasts including Puerto Rico and the Virgin Islands.
Nautical Chart Catalog 2
the Pacific Coast including Hawaii, Guam and Samoa Islands.
Nautical Chart Catalog 3
Alaska including the Aleutian Islands
Nautical Chart Catalog 4
the U.S. Great Lakes and Adjacent waterways.

These catalogs show, in pictorial form, the small craft charts, harbor charts, coast charts, general charts and sailing charts available for the area covered together with their respective chart numbers. Written details are also given of the title and scale of each chart.
The names, addresses and telephone numbers of US and foreign agents from whom the charts may be obtained are included together with brief information on other publications such as marine weather services charts, Coast Pilots, tidal current tables, tide tables and so on.
Other agencies, such as the DMA and National Imagery and Mapping Agency (NIMA), also produce charts, maps and other publications.

British Admiralty charts (BA)
BA charts are published by the Hydrographic Office of the British Ministry of Defence and are available from approved chart agents. BA chart agents will also supply, free of charge the, 'Home Waters Catalogue' (NP 109) which is a catalog of BA north European charts from Denmark to Bordeaux on the Atlantic coast of France. NP109 also lists other useful BA publications such as tidal stream atlases, pilot books, etc., for the area covered and includes names, addresses and telephone numbers of chart agents in Ireland and the UK.
A full catalog of all BA charts called 'Catalogue of Admiralty Charts and other Hydrographic Publications' (NP 131) is also available for viewing at every BA chart agent. Both are published annually.

Small craft charts
Charts intended specifically for use aboard small craft, often called 'yachtsmen's charts' are produced by various chart publishers. For example International Sailing Supply of Punta Gorda publish their chart #62 of New York Harbour which is a reproduction of portions of NOAA chart #12327.
Imray Laurie Norie and Wilson Ltd of Cambridgeshire in England publish 48 Imray-Iolaire yachting charts of the Caribbean Sea. These charts are based on information from British Admiralty charts and 'other sources' such as US, French and Dutch charts together with survey information by Donald M Street Jnr. These charts carry a disclaimer that "....no national hydrographic office has verified the information in this product and none accept liability for the accuracy....."
Yachting charts are generally made to fold into a convenient size and have discarded information which the publishers

do not consider of use to the small boat navigator. These charts may also use different colors to indicate land, sea, drying areas and so on. Many of these charts are produced on waterproof and tearproof paper which has obvious advantages but erasing pencil lines can be a problem. Yachting charts often include very useful 'chartlets' of harbors and anchorages together with their approaches. Some may have also have useful information, such as pilotage/buoyage notes printed on the reverse side.
DMA and NOS charts are not copyright and full size black and white photocopies of these charts on high quality paper are available. These copies are about half the price of the originals but are not always as easy to use as they are in black and white only.

Suppliers
Charts are available from chart agents and nautical book stores worldwide; most chandlers can also supply a limited number of local charts for the immediate area.

Meteorology Information Sources

Meteorology may be defined as the study of movements and phenomena in the earth's atmosphere, especially with regard to weather forecasting. Meteorologists obtain information from a wide range of different sources including dedicated weather satellites, weather balloons, ocean weather ships, aeroplanes, commercial shipping, weather buoys, manned and unmanned weather stations, radar installations, and so on. This information is the basis from which, using a combination of skill, experience and massive computer systems, meteorologists produce weather predictions or forecasts. Despite the sophisticated equipment and techniques the forecaster's expertise still plays a very significant part in the forecasting process.

When we use the term 'weather' we mean the atmospheric conditions existing at a specific place over a relatively short period of time. The conditions of general interest to us normally are whether it is warm or cold, raining or dry, sunny or cloudy, foggy or clear, windy or calm and so on. Yachtsmen and women are interested principally in wind strength and wind direction as these are usually the two single factors which have the most effect on anyone taking a small boat to sea, both from the point of view of safety and of enjoyment. Nowadays we are lucky to have easy access to many different sources of high quality weather forecast information.

Weather forecasts for the coastal waters of USA are available from various different sources but NOAA weather on VHF radio WX channels are of a very high quality. When cruising away from coastal waters a SSB MF/ HF radio receiver is required but sometimes it can be difficult to catch all the forecast information – a small handheld voice recorder is a great help in this case.

The National Weather Service publishes a book entitled Selected Worldwide Marine Weather Broadcasts. This publication contains weather broadcast schedules, both U.S. and foreign, from all over the planet, covering radiotelephone, radiotelegraph (Morse Code), and radiofacsimile transmissions. These schedules list broadcast times and geographic areas covered by the broadcast information, as well as station call letters, transmitting frequencies, and station locations. Those who expect to sail outside of the areas covered by VHF transmissions should consult this book to determine what radio weather information will be available to them.

Additionally, there are many sources of weather information available to the mariner. Some are very general and may not give the information that is important when at sea. The list below is not complete and depending on your location other sources may be available.

a) Internet
b) Radio
c) Newspapers
d) Television
e) Marina Offices
f) Port Authority Offices
g) Coastguard Organisations
h) Telephone Company recorded forecasts
i) Weather fax

Monitoring the Forecast

All sources will give an overall picture upon which to base the decision to sail or not and to determine the probable weather during a voyage This information will help decide which route to take, where there are shelter and safe havens, if required. Forecasts should be monitored throughout the trip and most importantly constant personal observation of the weather signs must be made to determine whether the alternative plan needs to be used. Signs of change include changes in cloud formation, shift in wind direction and speed, sudden change of atmospheric pressure, changes in visibility etc. Read in conjunction with the issued weather forecasts the signs will help indicate the best course of action. If in doubt err on the side of caution and adopt the safest route or find the nearest safe haven.

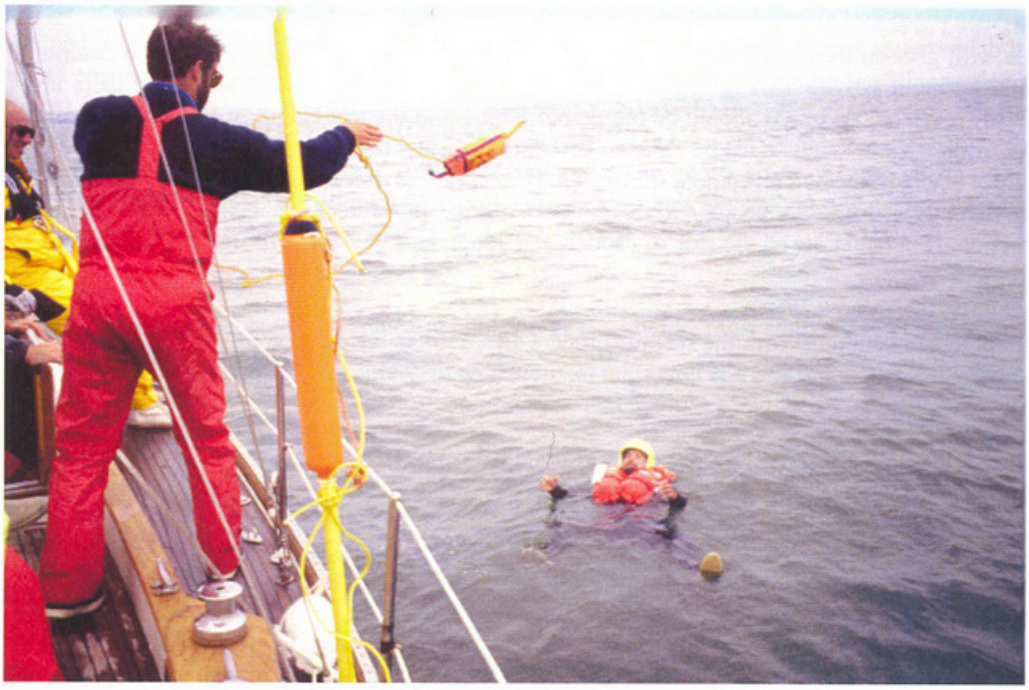
Man Overboard Procedure. (Sail)

In the event of a man being lost over the side the process discussed above must be followed. It may be necessary to carry out the process under sail and it is important to know how to do this in a prompt and efficient manner.

- ✓ Call "Man Overboard"
- ✓ A spotter is appointed, remember their sole job is to keep an eye on the in the water at all times; they should do nothing else.
- ✓ Throw anything that floats towards the man, not only to help them float but also to in crease the target area for the helmsman.
- ✓ Immediately the helms man will bring the boat onto a beam reach, one reason is that this is because it is the most comfortable and controllable point of sail.
- ✓ The helmsman or skip per should reassure the crew.

Photos by John Rousmaniere and Phil Cowley

- ✓ After running off for somewhere between five and ten boat lengths the boat should tack. DO NOT GYBE THE BOAT, this is a stressful time and a moment's inattention could cause a violent gybe that might cause damage to the boat or even cause another person to be taken off the deck by the boom making the situation much worse.
- ✓ Come back onto a beam reach on the other tack, this is the other reason for going onto a beam reach after tacking the boat will be on a reciprocal course.
- ✓ Head slightly downwind of the man by approximately two boat lengths, he will be visible on the bow.
- ✓ Keep the yacht de-powered to avoid building too much speed and as the boat comes below the man turn up to windward and the boat will stall and come to a stop with the man on the windward side.
- ✓ The sails will be flapping around at this time if possible drop the sails.
- ✓ If the yacht has a "lifesling" this should be trailed so the man can catch it otherwise one crewmember should prepare a line with a large bowline so that the man can pass it around his body.
- ✓ Do not put another person in the water unless the first person is unconscious the second person must be roped onto the boat.
- ✓ Getting the man back onto the deck is another issue, some modern yachts have a boarding ladder on the "sugar scoop" at the stern which is easy in light weather, however in a heavy swell this could be dangerous as the yacht may rise and fall a substantial distance.



Photos by John Rousmaniere and Phil Cowley

MOB (Power)

This most effective technique should someone fall overboard on a power driven vessel is called the Williamson Turn; the procedure is as follows:

- ✓ Shout Man Overboard and throw over the side any life-rings or flotation aids.
- ✓ Appoint one of the crew to keep a good lookout on the person in the water. This person should do nothing else.
- ✓ Look at the compass for the course you were steering when the person fell.
- ✓ Put the wheel hard over towards the side where the person fell. This will take the stern of the vessel and the propellers away from the person in the water.
- ✓ Turn to about 60 to 70 degrees from your course and then put the wheel hard over to the other side.
- ✓ Come back on to the reciprocal of your original course. For example if you were steering 105 degrees then you would come back onto 285 degrees this will put you on course straight back towards the person.
- ✓ When you reach the person in the water stop the engines so they can be recovered safely.

Note: Under instruction, the candidate will demonstrate good practical understanding and application of MOB procedures.

MODULE 9 / SECTION 3
GALLEY / PRACTICAL SUBJECTS

Provisioning and housekeeping considerations

Sufficient food for three meals a day with snacks, soda and soft drinks, bottled water, tea, coffee, long life milk, etc. should be provisioned prior to departing port.

There should then be a reserve of provisions added to the required food and stores on board. This should take into account the possible adverse weather, unforeseen delays and a reserve to deviate course in the event of responding to a distress or having an incident on board (medical emergency etc).

Note any special food requirements of the crew and any food allergies.

Check availability of fresh water at ports en route and at the destination before departure

Ensure there are proper medical supplies onboard and that the crew carry any medications they may require.

Ensure there is plenty of propane gas for the stove and spare bottles.

Additional canned meats, vegetables and fruits should be carried in the event that the cooker breaks down or the propane supply is depleted.

Cooking while underway

Cooking while underway poses an interesting challenge. During rough or extreme weather situations when the boat is rolling or pitching, it is recommended not to attempt cooking hot food due to the likelihood of burning yourself or a fellow crew member. If you know that bad weather is on the way, it may be better to prepare sandwiches or foods that can be eaten without liklehood of spillage.

In order to facilitate cooking while you are underway, cookers or stoves are generally held in place by a gimbal which allows the cooker to swing, yet remain stable when the boat rolls. Pots are held in place by attaching "fiddles" around them which help to hold them in place and prevent them from falling off the stove or spilling on the cabin sole.

A balanced diet

Provisioning should be planned to incorporate foods included in a balanced diet. All diets should include:

proteins (meats, eggs, dairy products, soy products and legumes)
carbohydrates (fruits, vegetables and grains)

The daily recommended portions differ from one person to another based on age, sex and physical activity. The U.S. Government as an example has introduce "My Pyramid" which recommends the daily portion of vegetables, fruits, grains, proteins and beans and dairy.

A proper diet is extremely important to counteract the effects of heat, cold and seasickness. These can become critical factors when on open water.

MODULE 9 / SECTION 4
POWER BOAT HANDLING SKILLS / PRACTICAL SUBJECTS

Vessel handling skills

Traveling at Speed (Planing)
Always prepare your crew for any rapid changes of speed or direction. Make a full appraisal of the surrounding area and be alert for waves and wash generated by other vessels as well as yours. Keep a good lookout at all times.

Most of the power output of the engine will be needed to get the boat on "the plane". This is the most efficient use of hull design. When 'on the plane' ease back on the throttle to conserve fuel. Speed must be monitored constantly and adjusted to the proximity of traffic and conditions. A displacement or semi-displacement hull will not be able to plane, as top speed is limited by waterline length and hull design.

Do not try to plane the boat in rough seas. Make good use of 'trim tabs' if fitted to achieve efficiency in speed and fuel consumption. Do not engage in reckless manouvers. Keep a good lookout and be mindful of submerged objects.
A small wash may be safely crossed as long as all on board are holding on. A large wash needs some careful consideration. Slow down to a speed that allows for control to raise the bow and cross the wash at an angle of about 45 degrees. Adjust speed through wash to keep bow up. Resume safe operation once through the wash.

High Speed Turns
Make sure the crew are aware of your intentions, have plenty of space and good throttle control. Look out for wash, traffic and possible submerged obstructions. Do not turn so sharply that the prop starts to ventilate (suck in air) and lose grip. Careful throttle management and situational awareness is paramount. Trim down before starting to turn to maintain grip on the water. Do not exceed design limitations of the hull or motor(s).

Heavy Weather Operations
It is important to match your speed to sea conditions, this often means slowing down. Generally, waves are generated by wind and tend to come from the same direction. (there are important exceptions to this e.g. wind against tide/current which can make for a 'bumpy' ride)

Driving upwind/wave usually means 'trim' down with controlled power, ease throttle at the top of the wave to ensure you do not 'drop off' the wave. Gently accelerate down the back of the wave speeding up sufficiently to raise the bow as the trough is reached. Drive up the wave towards the next crest.

Meet each wave as it comes, where possible avoid steep and breaking waves.

Wavelength determines the level of speed and comfort. In short seas, the helmsman has little time to react to adjust the throttle so it may be easier to drive at an angle of 30 – 45 degrees to the wave front. This method may allow you to increase speed using a zig-zag course towards your destination.

Large, breaking beam seas can potentially capsize a small boat. Steer a course between breakers and if you are caught on the downwind side of a breaker steer and power over the crest or turn away and try to outrun the breaker.

Following seas can be most dangerous to small vessels. If a breaking wave catches the stern the confused water will adversely affect the props ability to grip the water. The following wave then will turn the vessel abeam thereby making a capsize almost inevitable.

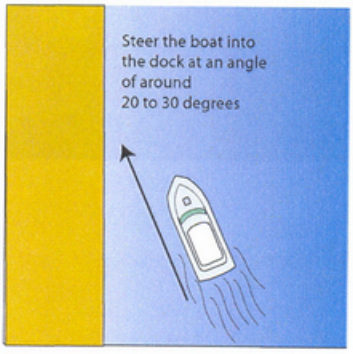
Match the vessel speed to the waves to avoid being overrun. If the vessel is going too fast down the face of a wave there is a danger of burying the bow causing the vessel to slow and pivot the vessel abeam causing it to be swamped or capsized. Sometimes, if surfing down a wave it may be prudent to put the engines in reverse to avoid burying the bow into the oncoming wave.

Sandbar/Harbor Bar
Large following seas at restricted/shallow entrances should be avoided. As the water shoals the waves get higher and confused, breaking more violently.

Engine failure
Engine failure or multiple engine failure can lead to very hazardous situations at sea. The most common causes are insufficient fuel or contaminated fuel. If such an event occurs, it is essential to be equipped with a VHF or SSB radio (depending on your distance offshore) in order to call for assistance. It is imperative that engines are serviced and maintained regularly to avoid engine failure. Thorough checks of fuel levels, oil levels and filter cleanliness are essential. A comprehensive tool box should be carried at all times to repair any faults should they arise.

Single engine handling
It is important that boats fitted with a single engine are regularly serviced and maintained to avoid engine failure. Vessels with one engine do not have the same handling characteristics of multi-engines so due care and attention should be taken when docking or berthing.

Picking up mooring buoy
Mooring is coming up to an object in the water, such as a mooring buoy.
Approach mooring buoy slowly and if possible into wind waves or current, whichever is strongest, when close select reverse gently to check forward momentum. Select neutral, pick up mooring painter secure. When leaving, use reverse to back off the buoy to keep prop. away from ground tackle. REMEMBER that a boat has no brakes. Many authorities strongly discourage the use of anchors for environmental reasons and will provide 'mooring fields' for use my small craft.



Coming alongside (wharf or dock)
Aim the yacht into the dock at an angle of around 20 to 30 degrees with just sufficient way on the vessel to have good control. When the bow is close to the wharf put the engine in neutral and then reverse, as this is done it will have the twofold effect of stopping the boat and the reverse thrust will tuck the stern in neatly alongside. Have your mooring line prepared in advance and crewmember designated to step ashore and tie up the vessel. Where there are mooring lines attached to the dock it may be easier to have the crewmembers who step on to the dock pass those lines to people on deck.

MODULE 9 / SECTION 5
SAILING BOAT HANDLING SKILLS / PRACTICAL SUBJECTS

These subjects will be taught by practical demonstration by your sailing instructor.

Slab reefing

Storm sails

Spinnaker (if available), MPS, and poling out

Roller reefing

Short handed sailing

Tacking and gybing

Coming alongside under power

Picking up mooring buoy under power and sail

MODULE 10 / SECTION 1
BASIC FIRST AID

Contents of Basic 1st Aid Kit

A comprehensive first-aid manual should be carried as well as a first aid kit designed for the length of voyage and operating area based on your specific needs. At least one member of the crew should have received some first aid training from a recognized training entity.

Basic contents should include a minimum of:

- Sunscreen
- Bandages/gauze pads of various sizes
- Band aids (various)
- Thermometer
- Antiseptic wipes
- Aspirin
- Motion sickness tablets
- Antacid tablets
- Scissors
- Tweezers
- Insect bite relief swabs
- Alcohol prep. pads
- Eyewash/cup and pads
- Calamine lotion
- Ice pack
- Antibiotic cream

Cuts, Stings and Burns

Cuts

Clean the wound thoroughly, applying antibiotic cream and a Band –Aid or small dressing, treat minor lacerations. In the case of deeper wounds control bleeding by applying pressure and seek immediate medical help.

Bites and Stings

Bites and stings may be no more than a minor irritation to potent venoms that may be life threatening. To treat a mild insect bite remove the sting by scraping rather than tweezers and apply ice pack or ointment. Some bites/stings may induce severe allergic reactions, which may occur within minutes or may be delayed for several hours or days. Again, if in doubt seek immediate medical help.

Burns

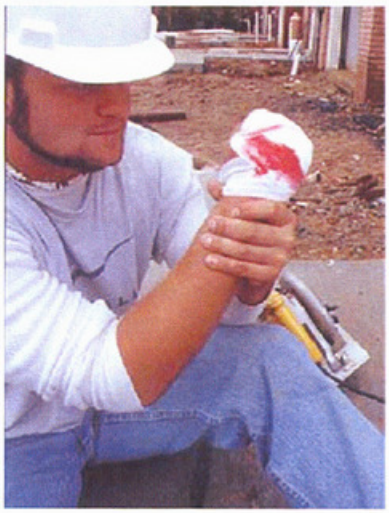
Burns are classified by degrees. First degree being superficial but burns to large areas of the body will need emergency medical help. The severity of burns should not be judged by the amount of pain a victim feels as nerve endings may be destroyed.

Minor burns over small skin areas may be cooled by the application of cool water (not ice) and soaked bandages or dressings. A dry sterile dressing may be applied after cooling (do not use any kind of grease or butter) cover with a bandage.

Second-degree burns are deeper, the victim's skin may be blistering or weeping. Immerse affected area in cold water. Proceed as for 1st. degree but do not pierce any blisters or remove any burnt tissue. Do not apply any antiseptic sprays or ointments, keep affected areas above the level of the victim's heart. Look for signs of shock. Call for emergency medical help and follow directions.

Third degree burns are characterized by white gray or black charring. If the area affected is small treat as second-degree, watch out for shock symptoms, do not give victim fluids or any kind of alcohol, call for immediate assistance.

Control of Bleeding



If possible, identify source of bleeding. External source should be fairly easy. Internal bleeding is hard to identify. You should attempt to minimize or stop the flow.

To control external bleeding apply direct pressure with sterile cloth or towel until bleeding stops. If a cloth or towel is not available have the injured person apply pressure using their own hand. As a last resort use your own hand taking suitable precautions (gloves, plastic wrap etc.). Wash hands thoroughly after contact with body fluids. Elevate the wound.

Internal bleeding may come from several sources, is hard to identify and can be life threatening. Severe internal bleeding will often be accompanied by symptoms of shock. (See Shock) Advanced medical training and equipment are required for the treatment of severe internal bleeding. Call for help and if you cannot transport the victim to medical help in a short time request helicopter evacuation.

Shock

Shock can be described as the collapse of the cardiovascular system. Blood flow slows or stops thus depriving vital organs of oxygen, which may result in death. Even after short deprivation of oxygen rich blood to certain organs, primarily the heart and brain, cells die and cannot be regenerated.

Shock may be induced by severe blood or fluid loss due to large open wounds or burns as well as internal bleeding. Nervous system damage and poor heart pumping action will also bring on shock symptoms. Signs may include cold, clammy skin, profuse sweating pallid skin color. Advanced stage symptoms include bluish lips, shallow labored gasping/breathing, weak rapid pulse, extreme thirst, nausea and vomiting.

Treatment for shock:

1. Clear and maintain airway. (see unconscious victim)
2. Lay victim on his back and elevate the feet 8 to 12 inches if there are no signs of head, neck or back injury. If victim is having convulsions, seizures or respiratory difficulties do NOT elevate feet. Reassure and comfort.
3. Control bleeding to minimize blood loss.
4. Do not give food or drink, keep victim comfortable and warm using blankets or clothing.
5. Call for medical assistance if symptoms persist.

Dangers of Heat and Cold

Heat Stroke

Heat stroke is a severe condition which occurs when the body's 'thermostat' stops working properly. The body stops producing perspiration and the lack of cooling can send body temperature so high that brain damage or even death may occur.

The symptoms are: High body temperatures, up to 106 F, hot, red, dry skin.
Progressive loss of consciousness, weak, rapid pulse and shallow breathing.

Treatment for heat stroke:

1. Call for immediate medical assistance.
2. Cool the victim by wrapping cool wet sheets around the body and ventilate by hand or electric fan.
3. Be alert for signs of shock.
4. If condition worsens, take further steps to cool the body using ice or icepacks placed at large blood vessel areas of the body such as wrist, ankles, neck, groin or armpits.
5. Continue to monitor the patient, maintain airway and be ready to perform CPR. (see unconscious victim)

Hypothermia

Hypothermia Is a condition whereby the body is cooled to a point where it cannot generate sufficient heat to maintain normal functional temperature. If you suspect hypothermia, call for immediate assistance.

The symptoms are: Shivering, dizziness, confusion, impaired judgment, glassy stare, weakness, drowsiness, apathy and irregular pulse. If hypothermia is not treated quickly, death can result.

Treatment for hypothermia:

1. Move victim to a warmer place, wrap in dry blankets or clothes and start a process of gradual re-warming.
2. Do not attempt to rapidly re-warm such as placing the victim in a hot shower or bath as this may cause irregular heart rhythms.
3. In severe cases such as those who's core temperatures have fallen to critical levels and are acting irrationally or becoming unconscious must be transported immediately to professional medical help. If medical help is not readily available try to arrange helicopter evacuation.
4. Monitor for signs of shock and be ready to give rescue breathing or CPR.

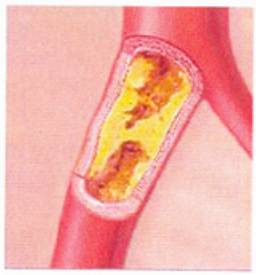
Heart Attacks & Strokes

Heart Attack

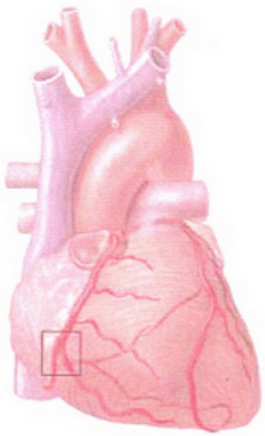
A heart attack is caused by one or more vessels feeding blood to the heart becoming clogged. As a result, the heart may stop pumping, (no pulse) causing the victim to stop breathing. This is a condition known as Cardiac Arrest and requires CPR (cardiopulmonary resuscitation) immediately. Courses in CPR are readily available through various organizations and it is highly recommended that anyone going to sea should have at the very least, CPR, Rescue Breathing (mouth to mouth) and First Aid training.

The victim of a heart attack whose heart continues to pump will often show no great signs of illness and may complain of heartburn or indigestion. This kind of attack is difficult to identify but the clock is ticking and urgent action is required.

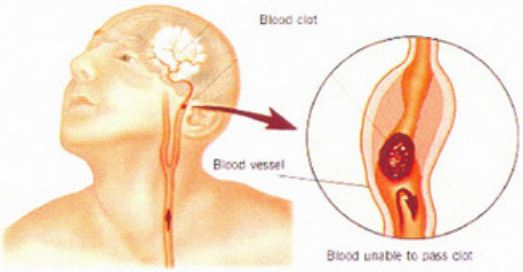
Be alert to the possible signs of a heart attack such as the victim complaining of pain in the chest area that may be described as 'crushing pressure', 'fullness' or 'squeezing' behind the breastbone but may radiate to other part of the torso and arms. Sweating, nausea, short or labored breathing are also early warning signs. Pains in the left arm can also be a sign of a heart attack. It has been medically proven that immediately taking aspirin can save a victims life.



Blockage in right coronary artery



Stroke



Strokes are the result of inadequate supply of oxygenated blood to the brain caused by blood clots forming anywhere in the body. The signs of stroke include complete or partial paralysis of the face muscles and/or extremities on one side of the body, varying levels of consciousness, confusion, dizziness, convulsions, headache, visual and swallowing difficulties. If stroke is suspected: open airway and reassure and comfort victim.

There is nothing that can be done onboard for a stroke victim to mitigate the outcome, which may range from mild temporary disability to death. Immediate evacuation for medical treatment is necessary.

A completely blocked airway however will render the victim speechless, unable to speak, breathe or cough.
Victim may make feeble wheezing sounds and communicate their distress by clutching the throat area.
If possible send a crewmember for medical assistance and perform 'Heimlich' maneuver. (Refer to First Aid Book for this procedure)

Unconscious Victim

Lie victim on their back and give 6 -10 abdominal thrusts
Lift the lower jaw, open the mouth and finger sweep for the obstruction.
Open the airway and prepare to give Rescue Breathing/Mouth to Mouth.
Give two full, slow breaths each 2 seconds duration and watch for signs of lung inflation (rising chest).
If the breaths go in, check pulse, breathing and control severe bleeding if any.

If there is a pulse but no breathing continue rescue breathing until help arrives. If there is no pulse or breathing administer CPR.

If Unable to Ventilate

While waiting for medical assistance continue to attempt to open airway until obstruction is removed or the victim starts to breathe or cough.

Radio for Help

Channel 16 is reserved for Distress, Urgency and Safety messages. Ch 16 is also used as a calling channel. Because every station should keep a continuous watch on Ch 16 it follows that any station you wish to contact will hear you if you call them on Ch 16. As soon as contact is established you will both change to an appropriate working channel to continue the conversation. The absolute minimum time possible must be spent transmitting on Ch 16, in order to leave Ch 16 clear for its designated purpose.

URGENCY (PAN PAN)

An Urgency message takes precedence and priority over all other radio communications except Distress. It is therefore the second most important message that can be transmitted.

The URGENCY PRIORITY for an Alert and the URGENCY SIGNAL indicates that a VERY URGENT MESSAGE follows concerning the SAFETY of a VESSEL or the SAFETY of a PERSON.

The **Urgency Signal** consists of the words **"PAN-PAN".**
The signal shall be said THREE times in an Urgency Call.

The use of the URGENCY PRIORITY for an alert and the use of the URGENCY SIGNAL shall be used only on the authority of the Master or person responsible for the VESSEL.

The Urgency call Message is normally sent on the distress frequencies. However, the Urgency **MESSAGE** may be sent on a **working frequency** in case of a long message or medical message or for a repeat of a message in areas of heavy radio traffic.

Example:

PAN-PAN, PAN-PAN, PAN-PAN,

ALL STATIONS, ALL STATIONS, ALL STATIONS,
THIS IS

"MY BOAT", "MY BOAT", "MY BOAT",

MY BOAT
POSITION - :

NATURE OF URGENCY AND ASSISTANCE REQUIRED,
ANY FURTHER RELEVANT INFORMATION,
OVER.

Medical Emergency

If you require urgent medical advice and/or assistance use the Urgency call with the addition of the word "MEDICO". (i.e. "**PAN-PAN MEDICO, PAN-PAN MEDICO, PAN-PAN MEDICO**", etc.)

This will alert the Coast Radio Station that you require medical advice and they will immediately start to arrange telephone contact with a doctor at the hospital on duty. As medical advice is liable to be lengthy you will be asked to change to a working channel/frequency in order to leave the calling channel/frequency clear.

Drowning

Do not enter the water to attempt to rescue a drowning person except as a last resort, avoid being a possible second victim! Throw any kind of floating object such as PFD, life ring, floating cushion etc. to assist and buy time so that the most practical and expedient way can be devised for recovery. If the victim is beyond effective throwing range then row or maneuver to pick up safely.

If all other methods are impractical than enter water wearing a PFD and approach victim from behind if you can and try to calm them down. Be alert to the possibility of a panicky victim pulling you under!

Remove victim from the water, open airway and check for breathing. Commence rescue breathing if necessary and be prepared to administer abdominal thrusts. If no spinal or head injuries are suspected, turn the victim's head to one side. If no pulse is present administer CPR and continue until medical help arrives. Near-drowning victims should always seek follow up medical care.

Choking

It is important to determine if the victim choking has a partial or full airway obstruction. A person with a partially obstructed airway will be able to cough forcefully, speak and take wheezy breaths between bouts of coughing. Do not interfere but observe and stand by to render assistance. If coughing persists, call for emergency medical help. Often the Heimlich Maneuver can unblock an obstructed air passage (consult a first aid manual).

Seasickness/Motion Sickness

Motion sickness is obviously not life threatening but can however be extremely unpleasant and may lead to dehydration with serious medical consequences. The malady is caused by a disruption of the balance mechanism in the inner ear triggered by the motion on and around the vessel. The best cure is prevention. Many remedies are available over the counter duch as sea sickness tablets, wristbands or "the patch" which is a type of band aid that contains a chemical and attaches behind the ear. These should be taken or applied some time before going to sea. Once at sea, encourage victim to keep eyes on the horizon and assign a task such as steering to assist in recovery. A severe bout of seasickness to the point of vomiting may result in complete recovery. This phenomenon is often described as "getting their sea legs". If violent vomiting continues return to land and advise victim to take liquid nourishment and if symptoms persist they should seek professional medical help.

Seasickness Tablets


Seasickness Wristband

MODULE 10 / SECTION 2
COLLISION REGULATIONS

The International Collision Regulations were agreed upon by a conference of the International Maritime Organization and are usually referred to as the COLREGS. Amendments have subsequently been made to the Rules bringing them to where they are today. It is not necessary to know all of the Rules off by heart but a thorough knowledge of the COLREGS is essential.

Definitions
Here are some important definitions contained in the Colregs. The type of vessel defined will dictate what action should be taken.
The word "vessel" includes every description of watercraft, including seaplanes, capable of being used as a means of transportation on water.
The term "power-driven vessel" means any vessel propelled by machinery.
The term "sailing vessel" means any vessel under sail provided that propelling machinery is not being used.
The term "vessel engaged in fishing" means any vessel fishing with nets, lines, trawls or other fishing apparatus which restrict maneuverability, but does not include a vessel fishing with trolling lines or other fishing apparatus which do not restrict maneuverability.
The term "vessel not under command" means a vessel which through some exceptional circumstance is unable to maneuver as required by these Rules and is therefore unable to keep out of the way of another vessel.
The term "vessel restricted in her ability to maneuver" means a vessel which from the nature of her work is restricted in her ability to maneuver as required by these Rules and is therefore unable to keep out of the way of another vessel. . (e.g. dredging, surveying, pipe or cable laying, towing, etc.).
The term "vessel constrained by her draught" means a power-driven vessel, which, because of her draught in relation to the available depth and width of navigable water, is severely restricted in her ability to deviate from the course she is following.
The word "underway" means that a vessel is not at anchor, or made fast to the shore, or aground.
The term "restricted visibility" means any condition, in which visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.

Outline of Steering and Sailing Rules

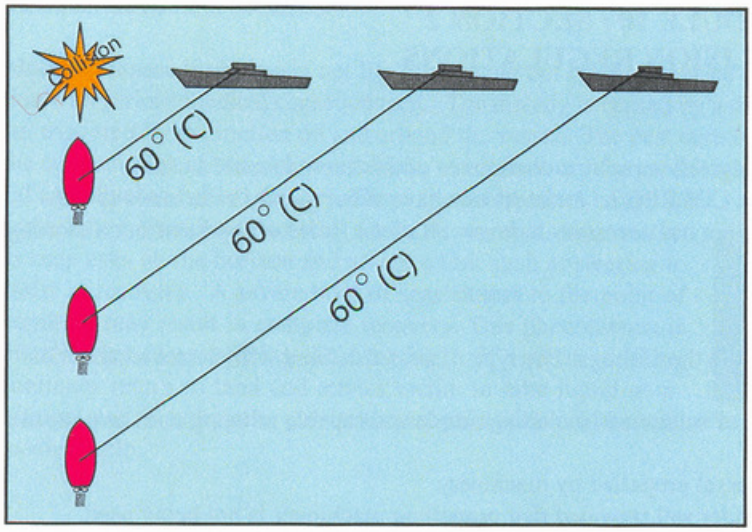
Section I - Conduct of Vessels in any Condition of Visibility

Rule 4 - Application
Rules in this section appy to any condition of visibility.

Rule 5 - Lookout
Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Rule 6 - Safe speed
Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. This must take into account, visibility, traffic density, the maneuverability of the vessel, at night background light or back scatter, wind, sea and current, and the proximity of navigational hazards, the draught of the vessel.

Rule 7 - Risk of collision
Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist. Assumptions shall not be made on the basis of scanty information, especially scanty radar information. Such risk shall be deemed to exist if the



compass bearing of an approaching vessel does not appreciably change.

TAKE A BEARING OF THE VESSEL, IF IT DOES NOT APPRECIABLY CHANGE – RISK OF COLLISION EXISTS

Rule 8 - Action to avoid collision
Any action taken to avoid collision should be positive, made in ample time and with due regard to the observance of good seamanship. Any alteration of course and/or speed to avoid collision shall be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

Action should be sufficient, in good time and with due regard to good seamanship.

Rule 9 - Narrow Channels
A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the starboard side as is safe and practicable. A vessel of less than 20 meters in length or a sailing vessel shall not impede the passage of a vessel, which can safely navigate only within a narrow channel or fairway.

Keep to the starboard side of the channel and crossing vessels and small craft avoid impeding others.

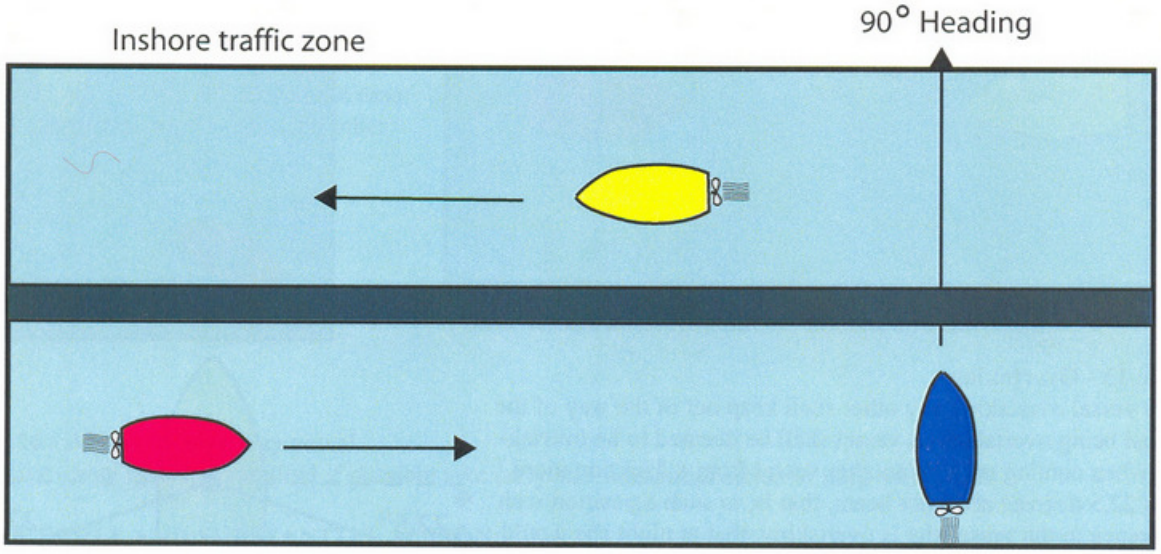
Rule 10 - Traffic Separation Schemes

Traffic separation schemes have been set up in area where there is a heavy concentration of shipping. They are designed to act in similar fashion to a divided highway by separating the opposing flows.

Vessels should:
proceed in the appropriate traffic lane in the general direction of traffic flow for that lane;
keep clear of a traffic separation line or separation zone;
normally join or leave a traffic lane at the termination of the lane, but when joining or leaving from either side shall do so at as small an angle to the general direction of traffic flow as practicable.
avoid crossing traffic lanes but if obliged to do so shall cross on a heading as nearly as practicable at tight angles to the general direction of traffic flow.
vessels of less than 20 meters in length, sailing vessels and vessels engaged in fishing may use the inshore traffic zone.
A vessel may use an inshore traffic zone when en route to or from a port, offshore installation or structure, pilot station or any other place situated within the inshore traffic zone, or to avoid immediate danger.

A vessel shall avoid anchoring in a traffic separation scheme or in areas near its terminations.
A vessel engaged in fishing shall not impede the passage of any vessel following a traffic lane.
A vessel of less than 20 meters in length or sailing vessel shall not impede the safe passage of a power-driven vessel following a traffic lane.

Crossing a Traffic Separation Zone



Use the TSS and always use correct lane, join at ahallow angle, cross at 90° heading. Do not use inshore zone without local knowledge.

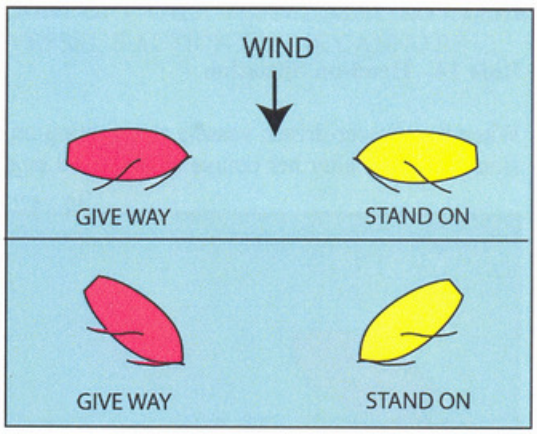
Section II - Conduct of Vessels in Sight of One Another

Rule 11 - Application
Rules in this section apply to vessels in sight of one another.

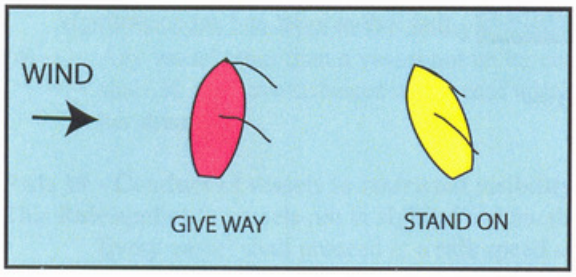
Rule 12 - Sailing vessels

When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows:

When each has the wind on a different side, the vessel, which has the wind on the portside shall keep out of the way of the other, a boat on port tack gives way to a boat on starboard tack.



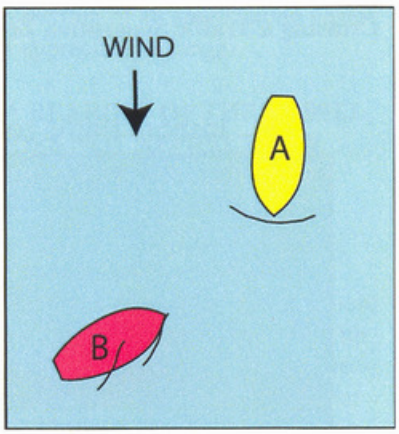
When both have the wind on the same side, the vessel, which is to windward, shall keep out of the way of the vessel, which is to leeward.



For the purposes of this Rule the windward side shall be deemed to be the side opposite to that on which the mainsail is carried.

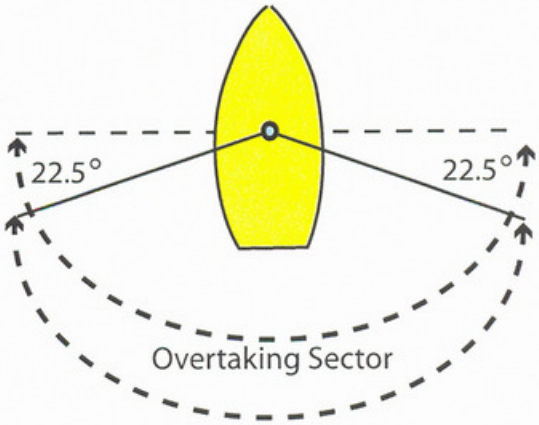
If a vessel with the wind on the port side sees a vessel to windward and cannot determine with certainty whether the other vessel has the wind on the port or on the starboard side, she shall keep out of the way of the other.

In this diagram the yacht B, on port tack, cannot see which side the mainsail of the other boat, A, is being carried on as it is obscured by the large head-sail.



Rule 13 - Overtaking

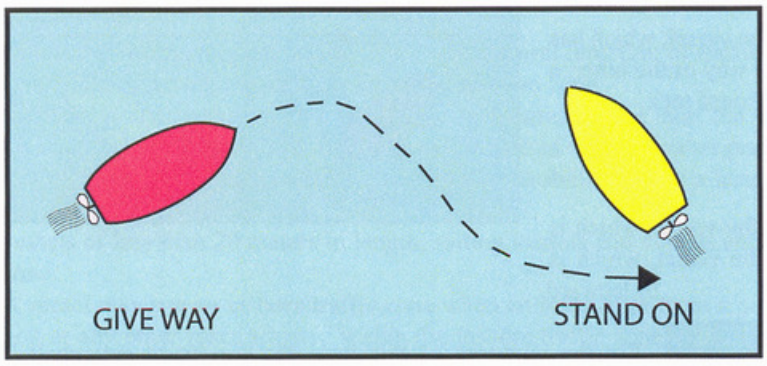
Any vessel overtaking any other shall keep out of the way of the vessel being overtaken. A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5 degrees abaft her beam, that is, in such a position with reference to the vessel she is overtaking, that at night she would be able to see only the stern-light of that vessel but neither of her sidelights. When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.



Assume overtaking vessel if more than two points abaft the beam, or any doubt. Always keeps clear, until past & clear.

Rule 14 - Head-on Situation

When two power-driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision each shall alter her course to starboard so that each shall pass on the port side of the other.

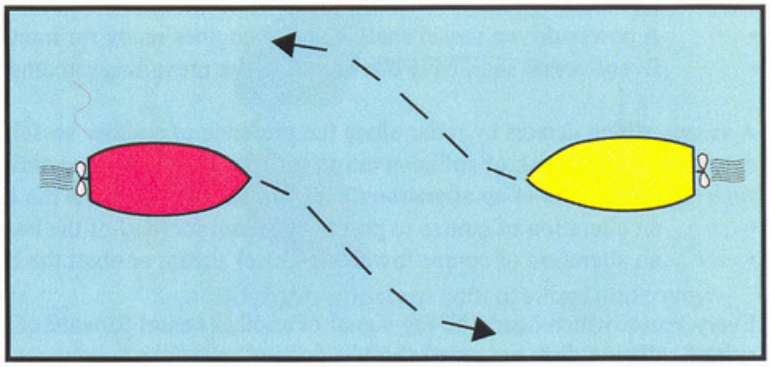


Power vessels crossing or converging: give way to vessel on your starboard side, stand on for vessel on your port side.

Such a situation shall be deemed to exist when a vessel sees the other ahead or nearly ahead and by night she could see the masthead lights of the other in a line or nearly in a line and/or both sidelights and by day she observes the corresponding aspect of the other vessel.

When a vessel is in any doubt as to whether such a situation exists she shall assume that it does exist and act accordingly.

Rule 15 - Crossing situation
When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.



Power vessels meeting head on - both turn to starboard.

Rule 16 - Action by give-way vessel
The give - way vessel, is required if possible take early and substantial action to keep well clear.

TAKE EARLY AND SUBSTANTIAL ACTION

Rule 17 - Action by stand-on vessel
The stand on vessel should maintain course and speed.
The stand on vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules. If the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

1. FIRST STEP STAND-ON,
2. MAY ALTER (Not to port for a vessel to port), WHEN DOUBT OF OTHER VESSEL KEEPING CLEAR
3. MUST KEEP CLEAR, WHEN ACTION OF GIVE WAY VESSEL'S ACTION ALONE CANNOT AVOID COLLISION.

Rule 18 - Responsibilities between vessels (Give way or Stand on?)

(a) A power-driven vessel underway shall keep out of the way of:
(i) a vessel not under command;
(ii) a vessel restricted to her ability to maneuver;
(iii) a vessel engaged in fishing;
(iv) a sailing vessel.

(b) A sailing vessel underway shall keep out of the way of:
(i) a vessel not under command;
(ii) a vessel restricted in her ability to maneuver;
(iii) a vessel engaged in fishing.

(c) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:
(i) a vessel not under command;
(ii) a vessel restricted in her ability to maneuver.

(d) Any vessel other than a vessel not under command or a vessel restricted in her ability to maneuver shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draught.

Rule 19 - Conduct of vessels in restricted visibility
This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.

- Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of

restricted visibility.

- A power-driven vessel shall have her engines ready for immediate maneuver.
- Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility.

A vessel, which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:

- an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken;
- an alteration of course towards a vessel abeam or abaft the beam.

Every vessel which hears the fog signal of another vessel forward of her beam (unless it has been determined that risk of collision does not exist) shall:

- reduce speed to minimum
- if necessary take all way off
- navigate with extreme caution until danger of collision is over.

ALWAYS GO AT A SAFE SPEED, ALL VESSELS KEEP CLEAR – THERE IS NO STAND-ON VESSEL IN RESTRICTED VISIBILITY
AVOID ALTERING TOWARDS VESSEL ABEAM OR ABAFT BEAM,
AVOID ALTERING TO PORT FOR VESSEL FORWARD OF BEAM

Lights, sounds and shapes

Lights

Lights using combinations of white, red, green and yellow colors are used at night to convey information regarding a vessel's

Direction of movement;
Method of propulsion;
Size.

Additional lights are used to indicate if the vessel is:

Towing;
Fishing;
Not Under Command;
Restricted in Ability to Maneuver;
Constrained by Draft;
Aground;
At anchor.

When attempting to decipher the meanings of a vessel's lights try breaking the lights down into sections by identifying the basic lights and then concentrate on the lights that remain. Usually the most important decision is whether risk of collision exists; if risk of collision does exist it is obviously necessary to work out details of the other vessel before deciding on the correct course of action.

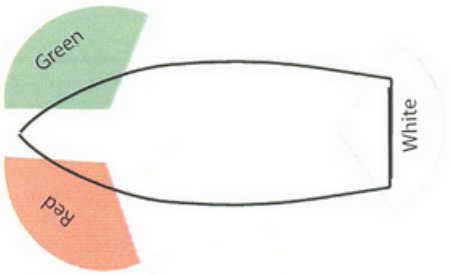
Perhaps the best sequence is to decide the vessels':

1. Aspect (ahead, astern, port, starboard);
2. Propulsion (i.e. under power, under sail, being towed);
3. Length;
4. Other information (i.e. towing, fishing, Restricted in Ability to Maneuver, Not Under Command, etc.)

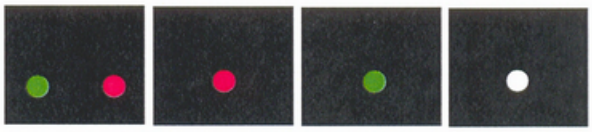
Side lights and stern light

A sailing vessel underway (not at anchor, or made fast to shore, or aground) shows three basic lights, two sidelights and a stern light:

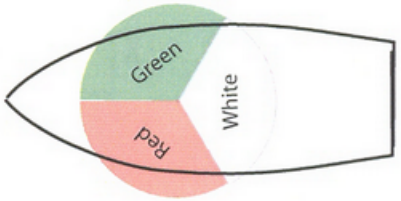
a green light on the starboard side,
a red light on the port side, and
a white light at the stern.



Sidelights and stern light of vessel underway

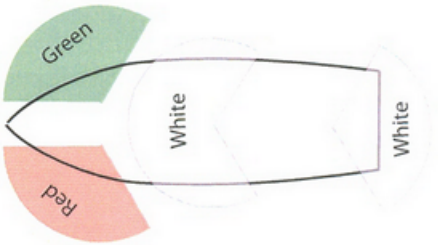


Or a sailing vessel less than 20 meters (65 ft) in length may combine side and stern lights in one lantern carried at or near the top of the mast. Note that this combined lantern must not be used when the yacht is using her auxiliary engine.

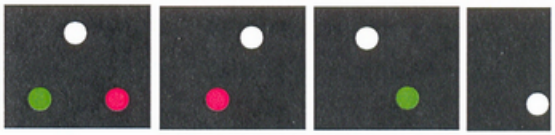


Sailing vessels less than 20 meters may use a combined side and stern light

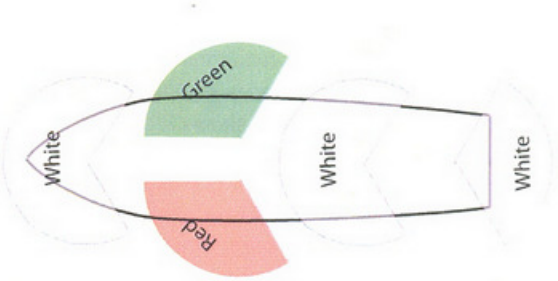
A power driven vessel underway less than 50 m (164 ft) in length shows a white masthead light above the sidelights. A masthead light covers the same arc as the sidelights combined. Also a white stern light



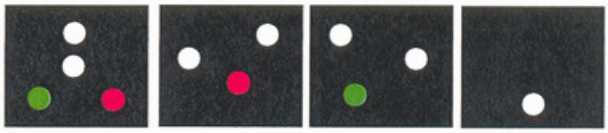
Power driven vessel underway, less than 50 meters in length



A power driven vessel underway greater than 50 m in length shows a white masthead light forward and a second masthead light behind and higher than the forward masthead light



Power driven vessel underway, greater than 50 meters in length



Seen From: Ahead Port Starboard Astern

Vessels at Anchor

A vessel at anchor, less than 50 m in length, must show an all round white light where it may best be seen.

A vessel at anchor, greater than 50 m in lenght, must show in the fore part an all round white light and a second all round white light at or near the stern which is lower than the forward light.

If a vessel at anchor is greater than 100 m in lenght she shall use available lights to illuminate her deck.

Vessels at Anchor

< than 50 m *> than 50 m, side, starboard* *> than 50 m, port side*

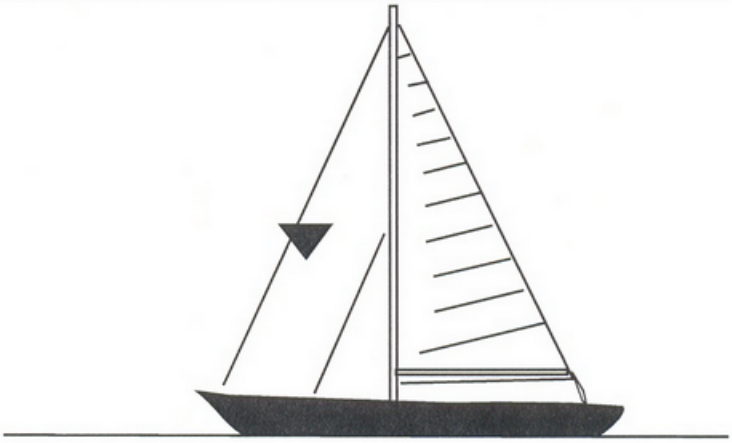
DAY SHAPES

Anchored

Fishing

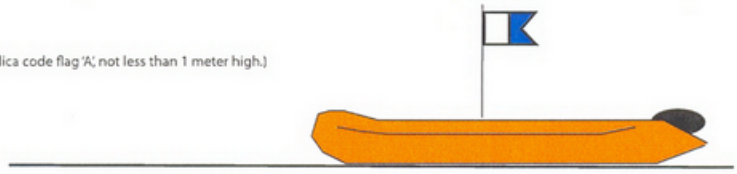
+, when outlying gear extends more than 150 m horizontally, cone, apex up, in direction of gear.

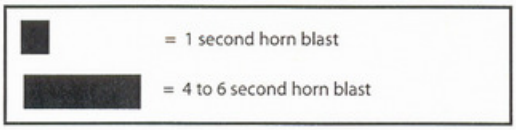
Motor Sailing



Diving Operations

(Rigid replica code flag 'A' not less than 1 meter high.)





Morse 'U'

Means "You are running into danger":
This signal is often used by oil rigs, etc.

Sound Signals In Poor Visibility

Sound Signal		Every
	Power underway, making way	2 min
	Power underway, not making way	2 min
	Vessel sailing; vessel fishing; restricted in ability to maneuvre; constrained by draft; not under command; vessel towing or pushing	2 min
	Last vessel of tow	2 min
	Warning from vessel at anchor	when required
	Pilot vessel on duty	
5 secs	Vessel at anchor: Rapid bell for 5 secs. (+ gong aft for 5 s if vessel > 100 m)	1 min
1 2 3 — — 1 2 3 5 secs	Vessel aground As for at anchor + 3 strokes on bell before & after rapid bell rings	

Maneuvering and Warning Signals For Vessels In Sight Of Each Other	
	I am altering course to starboard
	I am altering course to port
	I am operating astern propulsion
(Or More)	I do not understand your intentions! I doubt you are taking sufficient or appropriate action to avoid collision
	I intend to overtake on your starboard side
	I intend to overtake on your port side
	Agreement by overtaken vessel
	Approaching blind bend in channel
	Reply from vessel on other side of bend

ALL the different configurations of lights and shapes MUST be learnt by the seafarer in order to be safe at sea. These are just an introduction.

Learning the "Rules" is not easy, it takes lots of time and patience, however it is essential to know everything about the other vessels around you.

The above is an abridged version of the 'Rules'. The prudent mariner will undertake a full and thorough study the Rules.

MODULE 10 / SECTION 4
CUSTOMS, MANNERS & LEGAL REQUIREMENTS

Registration, Insurance, Salvage and Duty of Care

Vessel Documentation Requirements
Registration and Documentation on board - It is important to always carry a copy of the vessels registration and documentation.

Insurance Documents - Insurance documents may also be required in the event of an accident or if the Coastguard boards your vessel for a routine inspection.

Salvage
The word salvage in everyday language means saving almost anything in any way, whereas in maritime law it has a very specific and narrow meaning. Salvage is defined as a voluntary service which successfully saves, or assists in saving, Mariitime property in danger at sea. Salvage basically means that if a vessel rescues another vessel from a real danger then the rescuer has rights to the rescued vessel.

Duty of Care
The skipper of a yacht is required to provide reasonable duty of care for his crew. This includes:

- competent crew to operate the vessel.
- necessary safety equipment such as liferaft, flares, fire extinguisher, etc.
- a safe vessel (safe access, lighting, fencing of openings, slippery surfaces, ventilation, necessary warn ings)
- a safe system of work (the degree of supervision and enforcement depends on the nature of the work and circumstances)

This is relevant to both visitors and passengers.

Customs, Immigration & Crew Lists

Every vessel is required by law to clear customs and immigration upon entry into a foreign port. Just as one would do on arrival at any international airport. Customs forms will be provided by the customs officials at the port you are visiting. It is important to bring your vessel's documentation and registration ashore when clearing customs.

The master of every boat must furnish Immigration with a list of passengers and a crew list upon arrival. The vessels crew list should consist of name, nationality, passport number and date of birth of each crew member.

Fees for both customs and immigration authorities are usually charged in the local currency which you should plan to have in advance.

Cruising permits may also be required in many countries to cruise their territorial waters. A fee will also be charged for the permit.

Use of ensigns, burgees and other practices

Flag Etiquette

3 flags are raised at 0800 and lowered at sunset in order of priority:

1. Ensign (Country of boat registry -- flown from the stern)
2. Owner's pennant if applicable (Custom flag -- flown above all other flags on the boat)
3. Yacht Club flag if applicable (Pennant of the owner's yacht club -- flown from bow)

Flag Shapes

1. Burgee
2. Swallow tail

Specific Flags

1. Quarantine - solid yellow

2. Courtesy flag for different countries

3. Fueling - solid red flag 

4. Dive flags - if anyone is diving off your vessel be sure to use both flags.

   International dive flag is "A" Blue and White flag. (Australia uses this flag exclusively.) 

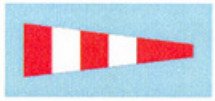
   Red with white diagonal stripe is the NAUI / PADI dive flag and is used in many countries especially U.S.A. and the Caribbean. 

Yachting today is practically standardized throughout the maritime world and all the rules governing ceremonies and routine aboard yachts and in yacht clubs have a distinct reason for their existence and have been found practical in their application. The observance of strict rules of etiquette in yachting, as in everything else, has been found conducive to pleasant relations between yachtsmen and the foundation of all rules of this kind is courtesy. Boating is fun and all who take part in the sport, whether they are owners of outboard runabouts or huge motor yachts, are expected to be fully conversant with the principles of proper conduct.

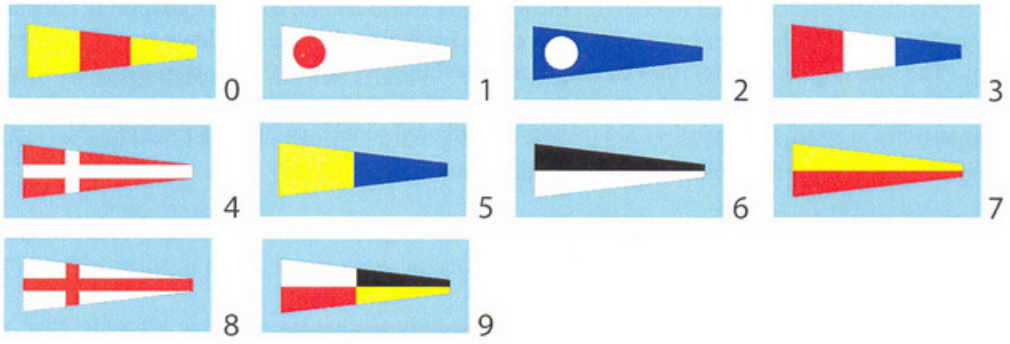
Flags and Pennants to be Used in the International Code

Alphabet Flags

Answering Pennant



Numeric Pennants



Substitute Pennants

Good practice

Etiquette in Marinas and Alongside

If lying alongside another boat for more than a short time, lines from the bow and stern should be made fast directly ashore. In the case of a raft of several boats this also relieves the strain on the cleats of the innermost boat and will stabilize the raft.

Adequate fenders must be placed between boats or between the boat and the dock/pontoon.

Sailboat spreaders should be staggered to avoid clashing in a swell.

When crossing another boat's deck, it should be done forward of the mast/deck house and not across the cockpit. Obviously cross as quietly as possible, taking care not to bring on dirt from shoes. If possible obtain permission first if there is someone aboard.

If on a sailboat, rig frapping lines to prevent halyards slapping the mast.

Keep noise to a minimum.

Etiquette in Anchorages

Always travel slowly through moorings and anchorages, particularly in tenders, dinghies and Personal Water Craft, speed creates a wake, which disturbs others and may cause damage.

When choosing a spot to anchor, allow plenty of room between you and your neighbors.

Should a change of tide or wind move you close to a vessel anchored before you arrived, you should move.

Noise levels from radios and other electronic equipment should be kept to a minimum.

At night sound travels across water therefore voices should be kept low, this avoids the embarrassment of comments being overheard and will allow others peace and quiet.

When leaving early in the morning leave as quietly as possible.

MODULE 11 / SECTION 1
PASSAGE PLAN
PRACTICAL SUBJECTS

Prepare a short passage plan

It is essential to all boat skippers and navigators to understand the importance of preparing a passage plan for any voyage they are about to undertake. An appraisal of information must be made before a detailed plan can be drawn up. This includes:

1. Charts containing sufficient detail to show navigation marks, known hazards and any other specific information that is appropriate for each part of the intended voyage.

2. Where possible, a Reeds Nautical Almanac (or similar) for the appropriate area and current year should be consulted. This will contain a list of lights and navigation marks, tidal information for the ports in the area, current and tidal atlases, traffic seperation schemes, list of appropriate radio signals, harbor radio and other useful information.

3. A local cruising guide giving information on locations of fuel, fresh water, pump out stations, supermar kets, hospitals and other information as appropriate to the voyage.

4. Vessels intending to go beyond 5 miles from any coastline should carry a minimum level of navigational publications and the operating manuals and maintenance instructions for all navigation aids, engines and equipment on board.

Passage plan headings for consideration:

- Date: does the timing coincide with adverse tropical weather systems
- Weather: do I have access to local weather inforrmation
- Charts: are current small and large scale charts available for the area
- Distance: what is the length of total passage and of each leg
- Boat speed: what is a reasonable average boat speed to expect
- Passage time: how much time should be allowed for the total / each leg
- Tidal information: what are the tidal restrictions, direction of flow, strong currents, overfalls, time of high and low water at points of departure and arrival
- Port information: what do I know about berthing, provisioning, medical care, fuel
- Harbors of refuge: shelter from adverse or changing weather, access or tidal restrictions
- Navigation marks : buoys and light characteristics and sequence
- Documents: boat registration papers, radio license (if applicaple) insurance, passports for all crew, return tickets (if applicable)
- Watch schedules: how will the watch routine be handled during day / night hours

In deciding what tactics to use to implement your passage plan, the following factors should be taken into account:

- The reliability and condition of the boats navigation equipment
- Estimated times of arrival at critical points for tidal heights and rates of flow
- Weather conditions especially areas prone to fog
- Daytime or night time passing of danger points
- Traffic conditions especially in busy harbors or thoroughfares

Having considered all of the above, the skipper must decide if any of the conditions introduce an unacceptable hazard to the safety of his vessel and crew or indeed if the passage should be undertaken given certain prevailing conditions. Consideration should also be given to the requirement of additional deck or engine room personnel if deemed appropriate.

Selecting an anchorage

Selecting a suitable anchorage is important for both the safety of the vessel and the comfort of its crew. The factors to be taken into consideration are:

- Wind speed and direction to determine the suitability of the anchorage. Winds generate swells which can be most uncomfortable to anchor in
- Tide and current information will ascertain if there is too much flow to anchor safely
- Navagational access to the anchorage is important in busy shipping areas and during heavy weather
- Depth of water will determine the amount of rode required, make sure you have sufficient depth under the boat at low tide to prevent grounding
- Type of holding (sand , shale, rock, turtle grass or mud) will determine what type of anchor to use
- Number of boats at anchor will determine if there is sufficient room to anchor and swing without risk of collision

It is always best to arrive at an anchorage in daylight hours to have sufficient time to thoroughly research the best position to anchor in

Navigation on short passages

- On the chart, draw in the ground tracks from start to finish, avoiding dangers by a safe margin, and taking advantage of navigation marks and lights wherever possible. These tracks are not courses to steer, specific tidal work will usually be done just before the passage starts.
- From the distances and the expected average speed of the boat decide how long the passage will take and how much of the passage will be completed within your daily time schedule. Note harbours or anchorages which may suit for overnight stops.
- Circle clearly any hazards on the chart which are not easily noticed.
- Look for headlands or other areas which may have strong tides or overfalls, these may dictate that you pass at a specific time relative to high, or low, water.
- Note any harbours that may be used as harbours of refuge in an emergency. It may not be possible to enter these harbours under all conditions so note carefully any shelter or tidal restrictions these harbours may have.
- If you are using GPS or Loran note the latitude and longitude of waypoints you intend to use. Check these carefully as it is only too easy to make mistakes when writing them out.
- Check whether the track passes through traffic separation schemes.
- If there is a tidal consideration, such as lock gates at your destination, it may be necessary to work back wards from this consideration in order to decide the time of departure. There is not much point in arriving 20 minutes after the lock gates have shut.
- Check which harbours have fuel and water available. The fuel consideration is of considerable importance to motor yachts. Always plan so that you have a reasonable amount of fuel in reserve and remember that adverse conditions may increase fuel, consumption dramatically. Check whether fuel, water, etc., is available on the dock.
- When deciding how long you will travel each day take into account the stamina and experience of the crew and the sea-worthiness of the boat. Remember that cruising is supposed to be relaxing and enjoyable, not a test of superhuman endurance.
- If a passage is expected to take longer than about 15 or 16 hours it is advisable to work out a suitable watch schedule.
- Decide the provisioning of basic food and water supplies.

Most important of all try to maintain a flexible approach to the whole plan as conditions may be adverse on the day; trying to complete a passage against difficult conditions can spoil a holiday and put you and your crew under a lot of pressure.

Delegation of responsibilities to crew

Boating is team work and requires input from all crew members for the safe and enjoyable running of the vessel.

- Each crew member should be fully aware of the location and uses of all safety equipment on board includ ing but not limited to lifejackets, life rafts, fire extinguishers, flares, ditch bag, VHF radio, horseshoe buoy, throw ring, and lifesling.
- It is important on every vessel that crew understand what their duties will be and that they are sufficiently experienced and trained to undertake such duties
- Crew should also know the safe operational procedures and location for the heads, stove, heater, engine, generator, tool box and other on board equipment.

MODULE 11 / SECTION 2
SHORT PASSAGES
PRACTICAL SUBJECTS

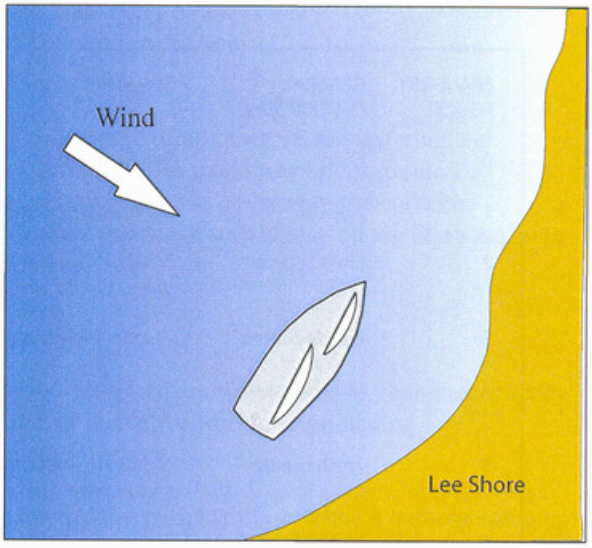
Heavy weather preparations, line squalls

Preparations for heavy weather should be made well in advance of the incoming system. It is important to:

- Close all hatches, put washboards and hatch covers in place
- Close seacocks
- Hoist radar reflector
- Secure all loose items on deck and below
- Make sandwiches or easy to prepare food
- Don heavy weather apparel, safety harnesses and lifejackets
- Appoint lookouts as visability can be significantly reduced
- Plot position accurately, manouver away from a lee shore · On sailboats, reduce sail and prepare trysail or heavy weather sails
- Head for a safe haven if heavy weather persists or is likely to continue

Leeshore

In rough weather there is always the danger of a leeshore on to which the wind is blowing and the seas breaking. A boat will be safer offshore in deeper water. Often, what appears to be a safe harbour requires an approach to a leeshore. This can result in large rolling waves at the entrance to the harbour which can cause a boat to "surf" down the waves out of control. Under such circumstances it may be wise to stay offshore until the weather calms down or to find an alternative harbour or safe refuge.



Line squalls

A line squall during daylight hours is visable as a darkening line across the sky which sometimes contains short bursts of intensive rain and a sudden and dramatic increase in wind speed. They are generally short lived but can be severe and sometimes frightening during their short lifespan. Preparations for a line squall are the same as for heavy weather and it is always better to err on the side of caution in the event that you encounter one. This is especially important at night time when they may not be as noticeable against a dark sky.

Heavy weather tactics

Preperations for heavy weather should be undertaken as listed above. However, when heavy weather is approaching it is always best to head for a safe haven if at all possible.

For sailboats, it is possible to "heave to" during a storm which is probably the most comfortable option. This requires the reduction or reefing of both the mainsail and the headsail and the" backing" of the headsail which effectively leaves the boat dead in the water with little forward leeway.

The procedure is to tack leaving the foresail cleated, when the foresail backs, the helm is brought to leeward and secured. The mainsail should be adjusted according to the size of the foresail. With the foresail backed, this counteracts the foreward drive of the mainsail. The boats motion will be steady and gives the opportunity for a break or rest period. In the hove to position, the helm is lashed to leeward and the foresail sheeted to windward. Your sailing

instructor will demonstrate this procedure for you.

Another option for both powerboats and sailboats is the deployment of a sea anchor. This is usually a canvas or web type bag which looks like a small parachute and is deployed off the bow of the boat using the anchor rode to keep the bow into the swell. This is the safest position for small power boats as a heavy beam sea can capsize a boat quite easily. For maximum benefit, a sea anchor should always be deployed with enough rode to reach the crest of the oncoming wave.

sea anchor

When coastal cruising it is important to get regular weather forecasts allowing enough time to reach a safe haven in the event of incoming heavy weather.

The Beaufort Wind Scale

BEAUFORT FORCE	GENERAL DESCRIPTION	SEA STATE	WIND SPEED	WAVE HEIGHT
0	Calm	Sea like a mirror	0 - 1 kn	
1	Light air	Small ripples without foam crests	1 - 3 kn	
2	Light breeze	Small wavelets, short but more pronounced, crests glassy but do not break	4 - 6 kn	1/2 foot
3	Gentle breeze	Large wavelets, crests start to break, scattered white	7 - 10 kn	2 feet
4	Moderate breeze	Small waves becoming longer, fairly frequent white horses	11 - 16 kn	3 1/2 ft
5	Fresh breeze	Moderate waves, becoming longer. Many white horses some spray	17 - 21 kn	6 ft
6	Strong breeze	Large waves, extensive white foam crests and spray	22 - 27 kn	9 1/2 ft
7	Near gale	Sea heaps up, white foam streaks blown in wind direction	28 - 33 kn	13 1/2 ft
8	Gale	Moderately high waves, crests break off, visibility affected	34 - 40 kn	18 ft
9	Strong gale	High breaking waves, dense streaks of foam	41 - 47 kn	23 ft
10	Storm	Very high tumbling waves, sea looks white with large patches of foam, visibility badly affected.	48 - 55 kn	29 ft

Action in restricted visability

Fog

Air reaches its "dew point" when it saturated with water at a certain temperature. When the temperature drops below dew point fog can occur. It usually occurs when the land cools at night and the moisture laden air can drift across

coastal regions for several miles offshore. When the sun rises, it usually burns off the fog by raising the dew point. It can also disperse when warm dryer air raises the temperature.

Fog can be very disorientating as visability can often be reduced to just several yards. It is important to make the following preparations:

- Immediately obtain an accurate position of where you are. The logbook should be updated regurlarly with positions and courses
- Check your chart and steer a course to keep you clear of any obstructions, navigation hazards, shipping channels or traffic seperation schemes
- Avoid constantly altering course as this makes accurate navigation difficult
- Monitor your VHF and if in a shipping lane a "securite" should be broadcast giving the vessels current location
- Note all other vessels in the area
- Turn on radar and all available electronic navigation equipment
- Hoist a radar reflector as high as possible
- Slow your boat speed so you can stop quickly in an emergency or alter course as necessary
- Appoint a lookout to watch and listen for other shipping
- Have white flares close to hand
- Don lifejackets and know the location of your life raft and all safety equipment
- Maintain silence
- Sound the fog signal with your boats air horn (one long blast every two minutes)
- If close to a marked channel, stay outside the channel but close to the buoy

Negotiating a harbor entrance

- When approaching any harbor entrance it is essential to be aware of all other vessels entering and leaving the harbor. Larger vessels may be restricted in their ability to manouver or constrained by draught and it is important to know your light, sound and day shapes as covered in the collision regulations. Be aware of all traffic approaching from behind and make sure to stay on the Starboard side of the channel.
- Prepare your pilotage plan in advance
- Have ample crew on deck to assist you if required.
- Have your VHF radio switched on and close at hand.
- Prepare dock lines and fenders for arrival at the dock. It is always a good idea to have your anchor ready in the event of an engine failure should you need to anchor to avoid collision or grounding
- At night time, make sure your navigation lights are on and working
- Hoist your radar reflector as high as possible
- If approaching a leeshore, great care must be taken to control the vessel while entering a harbour entrance due to the possibility of large rolling waves at the entrance. In extreme circumstances such as this or when crossing a sandbar at an entrance, it is best to deploy a sea anchor off the stern of the boat to slow down the boat and avoid surfing.

Collision regulations on passage

It is important on all voyages to maintain a proper lookout at all times. Make sure your crew have a basic understanding of the collision regulations and if in doubt always call the skipper. Allow sufficient time for collision avoidance if you feel there may be a problem.

Any action to avoid collision should be made in sufficient good time with due regard for good seamanship. Any alteration of course or speed shall be large enough to be readily apparent to another vessel observing visually or by radar. Avoid a succession of small alterations of course and or speed. Make sure to avoid changing course into the path of another vessel.

MODULE 11 / SECTION 3
BOAT HANDLING SKILLS
PRACTICAL SUBJECTS

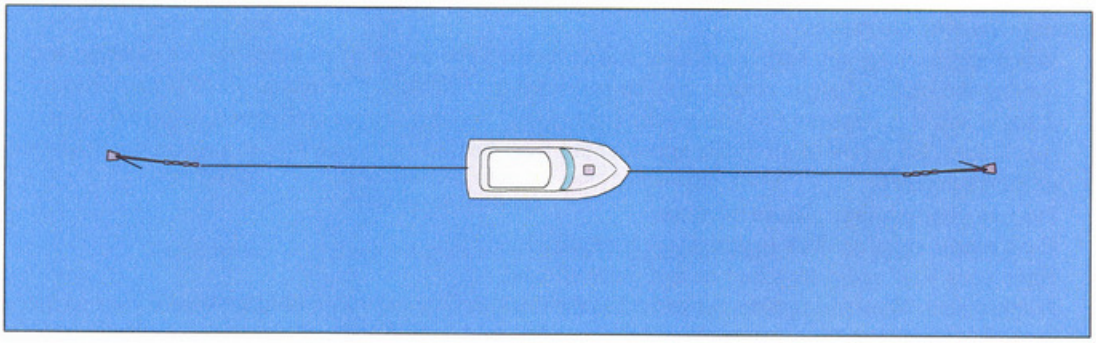
Anchoring

Laying A Second Anchor

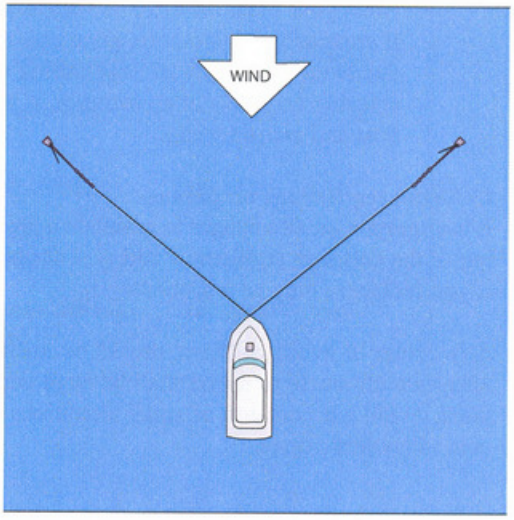
Sometimes it is necessary to lay a second anchor to reduce the swing or yaw of the boat due to tidal stream or strong wind, especially in a confined anchorage (the boat is then technically said to be moored)
Unfortunately not all boats, because of their different hull configurations, lie at the same angle in identical conditions. Some will lie more to wind and some more to tidal stream.

One method of laying two anchors is to lead both from the bows, the heaviest one in the direction of the strongest tidal stream and the other in the opposite direction. This method is only suitable for a strong tidal stream with little or no wind. In calm conditions both anchors can be led out over the bow, the heaviest one laid towards the strongest tidal stream.

Anchoring fore and aft is not normally suitable for a small boat as it induces too much strain in a cross-tide or a strong cross wind.



Another way is to position the two anchors well forward from the bows, with not too wide an angle between them. This method is used when expecting strong winds.



Kedging

Kedging is a method of getting a boat which has run aground back into deeper water. The method is to take the anchor in your dinghy and drop it into deeper water. You can then use the anchor windlass to pull the boat toward the anchor in order to refloat the boat. This process is repeated until such time as the boat is in deep water and is referred to as kedging.

Running Aground

Problems

Unintentional groundings may occur with or without warning. A disabled vessel may drift ashore if the anchors fail to hold her and there may be time to make preparations. A grounding due to errors in navigation may occur without warning.

All crew remaining on board should be wearing lifejackets. If the vessel is disabled, it is almost certain that a call for towage may be required. If the vessel starts to break up after grounding, it will be necessary to abandon her and preparations should be made in advance, even if the chances of having to do so appear slim.

After grounding, the situation must be assessed. The position of the vessel must be ascertained. Soundings must be taken of all tanks and spaces. Where possible a full internal inspection should be carried out to assess the damage to the vessel. Soundings must be taken all round the outside of the vessel to establish how much of the vessel is aground and how hard aground. There is no point in trying to refloat the vessel if she is so badly damaged that she will sink as soon as she reaches deep water. It would be better to keep her firmly aground and not grinding on the bottom and doing further damage. Much will depend on the state of the sea, the anticipated weather and the type of bottom. The decision to call for assistance or to try to refloat the vessel without assistance will be affected by all the above factors. If she is reasonably intact and not too firmly aground, it may be possible to refloat her by removing weights such as boats and stores. Before any attempt is made to refloat, the operation should be carefully planned. If possible, anchors should be placed to seaward by the vessel's dinghy. A careful survey of the proposed track of the vessel into deep water should be made using the dinghy. These may also be useful in towing the vessel. If possible, a diver's inspection should be carried out to check for damage and especially to check the rudders and propellers. Any repairs to the hull should be completed before trying to move the vessel. Obviously, the best time to start the operation is on a rising tide, soon before high water. If the main engines cannot be used, it is almost certain that assistance will be required.

If you run aground:

1. Make sure that all your crew are safe and free of injury.
2. Check your position, if the Watchkeeper knew where he was, then the vessel would probably not have run aground. Consider holding the vessel in position with anchors.
3. Monitor the situation and make regular checks on all compartments.
4. Sound around the vessel to determine the nature of the ground on which the vessel lies. How much of the vessel is actually aground.
5. Assess the degree of risk and this will depend on many factors, including the present weather and that forecast, the state of the tide and the amount of damage found. Divers may be required to make more a detailed inspection.
6. Arrange outside assistance, this may involve a Mayday, a Pan Pan or a call to arrange a tow.
7. Passengers and crew may have to be taken off.

Solutions:

1. If you have run aground at low water, the vessel will refloat as the tide rises.
2. Seek assistance from a passing vessel if at all possible.
3. Determine if she will survive the tow to a safe port or if extra water pumps will be needed.
4. Use your VHF radio to call a local towing company.
5. If a tow is engaged to pull the vessel off then good communications are essential between vessel and tow, together with an agreed plan of action.

6. In order to secure the tow, bearing in mind the strain on the towing gear in such an operation, it is worth considering using the heavy towing gear from the towboat. Give some thought as to how the line is to be secured aboard.
7. It may be useful to lay out an anchor to assist. Timing, weather, the state of the tide and daylight will effect this.
8. Where is the nearest port that will have the necessary facilities to make repairs?

MODULE 12

THEORY & PRACTICAL SUBJECTS / ASSESSMENT

Review:

- General revision of modules 8 - 11

Theory / Practical Assessment:

- Assessment of all theory components
- Practical Vessel handling assessment

  Either:

  - Power boat handling skills
  - Sail boat handling skills

De-Briefing

- Did the course achieve the objective

GLOSSARY OF TERMS

A

Aback.	A sail sheeted so that the wind fills the "back" of the sail.
Abeam.	At right angles to the side of the boat.
Aboard.	Situated on the boat.
Adrift.	A boat drifting without being propelled.
Aft.	At or towards the stern or behind the boat.
Aground.	A boat whose keel is touching the bottom.
Amidships.	Towards the center of the boat.
Apparent wind.	The wind aboard a moving boat
Astern.	Behind the stern of the boat.
Athwartships.	Across the boat from side to side.

B

Backstay.	The standing rigging running from the stern to the top of the mast, keeping the mast from falling forward.
Back.	1. To Sheet a sail to windward and fill the back of the sail and thus stop the boat or propel it backwards. 2. In the case of the wind - to shift counter clockwise from its previous direction.
Bail.	To empty the boat of water.
Ballast.	Weight in the keel of a boat that provides stability.
Barometer.	An instrument that measures air pressure, an aid to forecasting the weather.
Batten.	A thin wood or fiberglass slat that slides into a pocket in the leech of a sail, helping to maintain an aerodynamic shape.
Beam.	The width of a boat at its widest point.
Beam reach	(Point of sail) Sailing in a direction at approximately 90° to the wind.
Bear away.	To "fall off" or head away from the wind.
Bearing.	The direction from one object to another expressed in compass degrees.
Beating	A course sailed up wind.
Below.	The area of a boat beneath the deck.
Bend.	To attach a sail to a spar or a headstay or to attach a line to a sail.
Bight.	A loop in a line.
Bilge.	The lowest part of the boats interior where water on board will collect.
Bitter end.	The end of a line.
Blanket.	To use the sail or object to block the wind from filling a sail.
Block.	A pulley on a boat.
Boat hook.	A pole with a hook on the end used for grabbing hold of a mooring or retrieving something that has fallen overboard.
Boat speed.	The speed of a boat through the water.
Boltrope.	The rope that is sewn into the foot and luff of some mainsails and the luff of some jibs by which the sails are attached to the boat.
Boom.	The spar extending directly aft from the mast to which the foot of the main sail is attached.
Boom vang.	A block and tackle system, which pulls the boom down to assist sail control.
Bottom.	The underside of a boat.
Bow.	The forward part of the boat.
Bow line.	A line running from the bow of the boat to the dock or mooring.
Bow Spring.	A line running from the bow of the boat parallel to the dock or mooring that stops the boat from moving forward along the dock.
Bowline.	A knot designed to make a loop that will not slip and can be easily untied.
Breastline.	A short line leading directly from the boat to the dock.
Broach.	An uncontrolled rounding up into the wind, usually from a down wind point of sail.
Broad reach.	(Point of sail) Sailing in a direction with the wind at the rear corner (the quarter) of the boat. Approximately 135° from the bow of the boat.

Bulkhead. A wall that runs athwart6ships on a boat, usually providing structural support to the hull.
Buoy. A floating navigation marker.
Buoyancy. The ability of an object to float.
Bulwark. A solid side wall, often about waist high, from the outside edge of the deck to prevent someone falling overboard.
Burdened vessel. The vessel required to give way for another boat when the two may be on a collision course.
By the lee. A sailboat running with the wind coming over the same side of the boat as the boom.

C

Cabin. The interior of the boat
Can. In the U.S. an odd numbered green buoy marking the left side of the channel when returning to harbor.
Capsize To tip or turn a boat over.
Cast off . To release a line when leaving a dock or mooring.
Catamaran. A twin hulled vessel with a deck or trampoline between the hulls.
Catboat. A boat with only a mainsail and an unstayed mast located at the bow.
Centerboard. A pivoting board that can be lowered and used like a keel to keep a boat from slipping to lee ward.
Centerline. The midline of the boat running from bow to stern.
Chafe. Wear on a line caused by rubbing.
Chainplates. Strong metal plates which connect the shrouds to the boat.
Channel. A (usually narrow) lane, marked by buoys, in which the water is deep enough to allow a vessel safe passage.
Chart. A nautical map.
Charter. To rent a boat.
Chock. A guide mounted on the deck through which docklines and anchor rode are run.
Chop. Rough, short, steep waves.
Cleat. A nautical fitting that is used to secure a line.
Clew. The lower aft corner of a sail. The clew of the mainsail is held taut by the outhaul. The jib sheets are attached to the clew of the jib.
Close hauled. (Point of sail). The point of sail that is closest to the wind, when the sails are hauled close to the centerline of the boat.
Close reach. (Point of sail) Sailing in a direction with the wind forward of the beam (about 70° from the bow).
Coaming. The short protective wall that surrounds the cockpit or hatch.
Cockpit. The lower area of the deck in which the steering and sail controls are located.
Coil. To loop a line neatly so it can be stored, or a reel of line.
Come about. See tack.
Companionway. The steps leading from the cockpit or deck to the cabin below.
Compass. The magnetic instrument which indicates the direction in which the boat is headed.
Compass rose. The circles on a chart which indicate the direction of true and magnetic north.
Course. The direction in which the boat is being steered.
Crew. Besides the skipper, anyone on board whom helps run the boat.
Cunningham. A line running through a grommet a short distance above the tack of the mainsail which is used to tension the luff of the main.
Current. The horizontal movement of water caused by tides, wind and other forces.
Cutter. A single masted boat rigged with both jib and staysail.

D

Daysailer. A small sailboat.
Dead downwind. Sailing in a direction straight downwind.
Deck. The mostly flat area on top of the boat.
De-power. To reduce the power in the sails by:
1. Luffing, pointing the boat too close to the wind so that the sails are unable to draw power.

2. Easing the sheets so that the sails flutter.
3. Stalling. Sheeting the sails in so hard that the airflow over them stalls.

Dinghy. A small sailboat or rowboat.

Displacement. The weight of the boat; therefore the amount of water that it displaces.

Dock. 1. The quay or pontoon where a boat may be tied up.
2. The act of bringing a boat alongside to rest alongside.

Dockline. A line used to secure a boat to the dock.

Dodger. A canvas protection in front of the cockpit of some boats that is designed to keep spray off the skipper and crew.

Downhaul. A line used to pull down on the movable gooseneck on some boats to tension the luff of the mainsail. The cunningham has the same function.

Draft. The depth of a boat's keel from the waters surface.

E

Ease. To let out a line or sail.

Ebb. An outgoing tide.

F

Fairlead. A fitting that guides sheets and other lines in a way that reduces friction and therefore chafe.

Fairway. The center of a channel.

Fake (flake). Lay out a line on the deck using large loops to keep it from becoming tangled.

Fall off. (See also head down & bear away) Alter course away from the wind.

Fast. Secured.

Fathom. A measure of the depth of water. One fathom equals six feet.

Fender. An inflated rubber or plastic bumper used to protect a boat by keeping it from hitting the dock.

Fend off. Push off.

Fetch. The distance of open water to windward between the shore and the boat

Fid. A tapered spike used to open the lay of a rope when splicing.

Flood. An incoming tide.

Following sea. Wave pattern hitting the stern of the boat.

Foot. The bottom edge of the sail.

Fore. Forward.

Forepeak. An accommodation or storage area in the bow below the deck.

Foresail. A jib or genoa.

Forestay. The standing rigging running from the bow to the mast top and to which the foresail is secured.

Forward. Towards the bow.

Fouled. Tangled.

Fractional rig. When the forestay is attached to the mast some distance below the top.

Foul weather gear. Water resistant clothing.

Freeboard. The height of the hull above the water's surface.

Full. Not luffing.

Furl. To fold or roll up a sail.

G

Gaff. On some boats, a spar along the top edge of a four sided fore and aft sail.

Genoa. A large fore sail whose clew extends aft of the mast.

Give way vessel. The vessel required, by the regulations, to give way in a collision situation.

G.M.T. Greenwich Mean Time. The time at the prime meridian in Greenwich, London, England. Now referred to as Universal Time Coordinated U.T.C.

Gooseneck. The strong fitting that connects the boom to the mast.

Great Circle A line drawn on a chart which is accurate over a long distance, a section of the Earth which intersects the center of the Earth.

Grommet. A reinforcing ring set in a sail.

Ground tackle. Collective term for the anchor and rode (chain and line).

Gudgeon. A fitting attached to the stern into which the pintles of a rudder are inserted.
Gunwale. (gunnel) The edge of the deck where it meets the topsides.
Gybe. See jibe.

H

Halyard. A line used to raise or lower a sail.
Hank. A snap hook which is used to secure the luff of a foresail to the forestay.
Hard a-lee. (also Helms a-lee, lee oh, lee ho) The call given to the crew that will initiate the action of tack ing.
Hard over. To turn the helm or tiller as far as possible in one direction.
Hatch. A large covered opening in the deck.
Haul in. to tighten a line.
Head. 1. Top corner of a sail.
2. The toilet on a boat.
Headboard. The small reinforcing board affixed to the head of a sail.
Headed. A wind shift which causes the boat to head down or causes the sails to be sheeted in.
Heading the direction of the boat expressed in degrees.
Head down. To fall off , changing course away from the wind.
Head off. See head down.
Head up. To come up, changing course towards the wind.
Headsail. A jib, genoa attached to the forestay.
Headstay. See forestay. The standing rigging running from the bow to the top of the mast.
Head to wind. When the bow of the boat is dead into the wind.
Headway. Forward progress.
Heave. To throw.
Heave to. To hold one's position in the water by using the force of the sails and the rudder to counteract each other.
Holding ground. The seabed or bottom ground in an anchorage.
Hove to. A boat that has completed the process of heaving to with its aback, its main trimmed and its rud der positioned to hold the vessel close to the wind.
Heavy weather. Strong winds and large waves.
Heel. The lean of the boat caused by the wind.
Helm. The tiller.
Helmsman. The person responsible for steering the boat.
Hull. The body of the boat, excluding the rig and sails.
Hull speed. The theoretical maximum speed of a sailboat determined by the length of its waterline. The for mula is 1.4x the square root of the waterline length in feet.

I

Inboard. Inside of the rail of the boat.
In irons. A boat that is head to wind and unable to move or maneuver.

J

Jackstay. A wire or webbing strap attached at the front and back of a vessel along the deck to which a safety harness line may be clipped.
Jib. The small forward sail of a boat that is attached to the forestay.
Jibe. See also gybe. To change the direction of the boat by steering the stern through the wind.
Jibe oh. The command given to the crew when starting a jibe.
Jiffy reef. See slab reefing. A quick reefing system allowing a section of the mainsail to be pulled down and tied to the boom.
Jury rig. An improvised temporary repair.

K

Kedge. A smaller anchor than the main or bower anchor. Often used for maneuvering or kedging off.

Kedge off. To use an anchor to pull a boat into deeper water after it has run aground.

Keel. The heavy vertical fin beneath a boat that helps keep it upright and prevents it from slipping sideways in the water.

Ketch. A two masted sailboat on which the mizzen (after) mast is lower than the mainmast and is locat ed forward of the rudderpost.

Knockdown. A boat heeled so far that one of its spreaders touches the water.

Knot one nautical mail per hour.

L

Land breeze. A wind that blows over the land and out to sea.

Lash. To tie down.

Lay. To sail a course that will clear an obstacle without tacking.

Lazerette. A storage compartment built into the cockpit or deck.

Lazy sheet. The windward side jib sheet that is not under strain.

Lead. To pass a line through a fitting or block.

Lee helm. The boats tendency to turn away from the wind.

Lee shore. Land which on the leeward side of the boat. A potential danger because the wind will be blowing the boat towards it.

Leech. The after edge of a sail.

Leeward. The direction away from the wind that is the direction that the wind is blowing to.

Leeward side. The side of the boat or sail that is away from the wind.

Leeway. The sideways slippage of the boat in a downwind direction.

Lifeline Rope or wire supported by stanchions, around the outside of the deck to help prevent crew mem bers from falling overboard.

Lift.
1. The force that results from air passing by a sail or water past a keel that moves the boat forward and sideways.
2. A change in the direction of the wind which allows the boat to head up.

Line. A rope.

LOA. The maximum Length Overall fore and aft along the hull.

Lubber line. A line on a magnetic compass to help the helmsman steer the correct course.

Luff.
1. The leading edge of a sail
2. The fluttering of a sail caused by aiming too close to the wind.

Lull. A decrease in wind speed for a short duration.

LWL. The length fore and aft along the hull measured at the waterline.

M

Magnetic. In reference to the magnetic north rather than true north.

Mainmast. The taller of two masts on a boat.

Mainsail. The sail hoisted on the mast of a sloop or cutter or the sail hoisted on the mainmast of a ketch or yawl.

Mainsheet. The controlling line for the mainsail.

Marlinspike. A pointed tool used to loosen knots.

Mast. The vertical spar in the middle of a boat from which the mainsail is set.

Masthead. The top of the mast

Maststep. The fitting in which the foot of the mast sits.

Mizzen. The small aftermost sail on a ketch or yawl hoisted on the mizzenmast

Mizzenmast. The shorter mast aft of the main mast on a ketch or yawl.

Mooring. A permanently anchored ball or buoy to which a boat can be tied.

N

Nautical mile. Standard nautical unit of distance, equal to one minute of arc of the Earth's latitude or 6080 feet.

Navigation rules. Laws established to prevent collisions on the water.

No-go zone. An area into the wind in which a sailboat cannot produce power to sail.
Nun. A red even numbered buoy marking the right side of a channel when returning to port. Nuns are usually paired with cans.

O

Offshore wind. Wind blowing off (away from) the shore and out to sea.
Offshore. Away from or out of sight of land.
Off the wind. Not close-hauled.
On the wind. Sailing up wind, close-hauled.
Outboard. Outside the rail of a boat.
Outhaul. The controlling line attached to the clew of a mainsail used to tension the foot of the sail.
Overpowered. A boat that is heeling too far because it has too much sail up for the amount of wind.

P

Painter. The line attached to the bow of a dinghy.
Pay out. To ease a line.
P.F.D. Abbreviation for Personal Flotation Device such as a life jacket.
Pinching. Sailing too close to the wind.
Pintle. Small metal extension on a rudder that slides into a gudgeon on the transom. The gudgeon/pintle fitting allows the rudder to swing back and forth.
Point.
1. To steer close to the wind.
2. A compass point equals 11¼ degrees. Compass annotation used before headings were referred to in 360° notation.

Points of sail. Boats direction in relation to the wind - i.e., close hauled, reaching etc.
Port.
1. The left hand side of the boat when facing forward.
2. A harbor.
3. A window in a cabin on a boat.

Port tack. Sailing on any point of sail with the wind coming over the port side of the boat.
Prevailing wind. Typical or consistent wind direction.
Puff. An increase in wind speed.
Pulpit. A guardrail at the bows of a vessel.

Q

Quarter. The sides of the boat near the stern.

R

Rail. The outer edges of the deck.
Rake. The angle of the mast.
Range. The alignment of two objects that indicate the middle of a channel.
Reach. One of the several points of sail across the wind.
Ready about. The command given to the crew to prepare to tack.
Ready to jibe. The command given to the crew to prepare to jibe.
Reef. To reduce the area of a sail.
Reeve. To pass a line through a ring or block.
Rhumb line. A straight line drawn on a Mercator chart, which intersects all meridians at the same angle. Accurate enough for courses of less than 600 miles. For great distances a Great Circle route is used.
Rig.
1. The design of a boat's masts, standing rigging and sail plan.
2. To prepare a boat to go to sea.

Rigging. The wires and lines used to support and control sails.
Roach. The sail area aft of a straight line running between the head and clew of a sail.
Rode. The line and chain attached from the boat to the anchor.
Roller-furling. A mechanical system to roll up a headsail around the headstay.
Rudder. A vertical blade attached to the bottom of the hull which is used to steer the boat.

Run. Point of sailing when the wind is coming from dead astern.
Running rigging. The lines used to control the sails.

S

Sail ties. Lengths of line or webbing used to secure sails when they are dropped or to secure the unused portion of a reefed sail.
Schooner. A two masted boat whose foremast is the same height or shorter than its mainmast.
Scope. The length of anchor rode paid out in relation to the maximum depth of water.
Scull. To propel a boat with a single oar fixed in a notch through the transom.
Scupper. A cockpit or deck drain.
Sea breeze. A wind that blows from the sea onto the land.
Seacock. A valve which opens and closes a hole used as an intake or discharge from the boat.
Secure. The make safe or tie down.
Set. 1. The direction of the current
2. To trim the sails.
Shackle. A metal fitting at the end of a line used to attach the line to a sail or another fitting.
Shake out. To remove a reef.
Sheave. The wheel inside a block or fitting over which the line runs freely.
Sheet. A line used to control a sail by pulling it in or easing it out.
Shoal. An area of shallow water.
Shroud. Standing rigging at the side of the mast.
Singlehanded. Sailing alone.
Skeg. A vertical fin in front of the rudder.
Sloop. A single masted sailboat with mainsail and headsail.
Sole. The floor in a cockpit or cabin.
Spar. A pole used to attach a sail on a boat, for example the mast, the boom or a gaff.
Spinnaker. A large down wind headsail not attached to the head stay.
Splice. The joining of two lines together by interweaving their strands.
Spreader. A support strut extending athwartships from the mast used to support and guide the shroud from the top of the mast to the chainplate.
Spring line. A dockline running forward or aft from the boat to the dock to keep the boat from moving fore or aft.
Squall. A fast moving short intense storm.
Stanchions. Stainless steel or aluminum supports at the edge of the deck which hold the lifelines.
Standing rigging. The permanent rigging of a boat, including the forestay, backstay and shrouds.
Starboard. The right hand side of the boat when looking forward from the stern.
Starboard tack. Sailing on any point of sail with the wind coming over the starboard side of the boat.
Stay. A wire support for a mast, part of the standing rigging.
Staysail. On a cutter, a second small inner jib attached between the bow and the mast. Any sail which is attached to a stay.
Steerage Way. The minimum speed of the boat through the water that allows the rudder to function efficiently.
Stem. The foremost tip of the boat.
Stern. The aft part of the boat.
Stern Spring. A line running from the stern of the boat parallel to the dock or mooring that stops the boat from moving backward along the dock.
Stow. To store properly.
Swamped. Filled with water.

T

Tack. 1. To alter course so as to cause the bow of the boat to pass through the eye of the wind.
2. The forward lower corner of a sail.
Tackle. A series of blocks and line that provide a mechanical advantage.
Tail. To hold the end of a line so as to keep it under tension on a winch.

Telltales.	Short lengths of yarn or cloth attached to the sails which indicate when the sail is properly trimmed.
Tide.	The rise and fall of water level due to the gravitational effects of the sun and the moon.
Tiller.	A long handle attached to the rudder which is used to steer the boat.
Toe rail.	A low rail around the outer edge of the deck.
Topping lift.	A line used to hold the boom up when the mainsail is lowered or stowed.
Topsides.	The sides of a boat between the waterline and the deck.
Transom.	The vertical surface of the stern.
Trim.	To adjust the sail controls to create optimum lift from the sails.
Trimaran.	A three hulled vessel.
True wind.	The actual speed and direction of the wind as you would feel when standing still.
Tune.	To adjust the boats standing rigging.
Turnbuckle.	A mechanical fitting (a bottlescrew) attached to the lower ends of stays allowing the standing rig ging to be adjusted.

U

Underway.	A boat that is not attached to the ground by either anchor or mooring lines is said to be under way.
Upwind.	Towards the direction of the wind.
USCG.	United States Coast Guard.
U.T.C.	Universal Time Coordinated. The modern term for Greenwich Mean Time, this is the standard reference time which is used internationally for navigational information.

V

Vang.	See boom vang.
Veer.	A clockwise change in the wind direction.
Vessel.	Any sailboat, powerboat or ship.

W

Wake.	Waves caused by a boat moving through the water.
Waterline.	The horizontal line on the hull of a boat where the surface of the water should be.
Weather helm.	The tendency of the boat to head up towards the wind, this increases as the sailboat becomes overpowered.
Weather side.	See windward side.
Whip.	To bind together the strands at the end of a line.
Whisker pole.	A pole temporarily mounted between the mast and the clew of the jib. Used to hold the sail out and keep it full when sailing down wind.
Winch.	A deck-mounted drum with a handle offering mechanical advantage when used to trim sheets. Winches may also be mounted on the mast to assist with raising sails.
Windward.	Towards the wind.
Windward side.	The side of the boat closest to the wind.
Wing-and-wing.	Sailing downwind with the jib set on the opposite side to the mainsail.
Working sails.	The mainsail and the standard jib.
Working sheet.	The leeward sheet that is under tension.

Y

Yawl.	A two masted vessel on which the mizzenmast is mounted aft of the rudderpost.

VHF Operations Index

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