

sea
explorer
ADVANCED
SEAMANSHIP
workbook

FOR SEA SCOUTS
BOY SCOUTS OF AMERICA



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BOY SCOUTS OF AMERICA

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This workbook supplies the illustrations necessary to support the presentations in the eight sessions of the Advanced Seamanship course. Each person taking the course should have colored pencils for coloring in buoys, lights, flags, etc., as he goes along. The colors that he will need are red, green, yellow, orange, and black.

Color key:

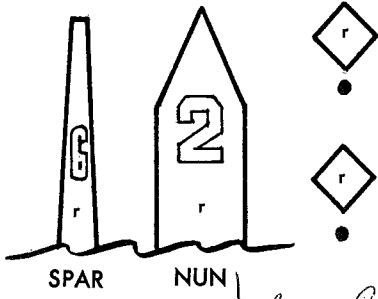
r—red

g—green

y—yellow

o—orange

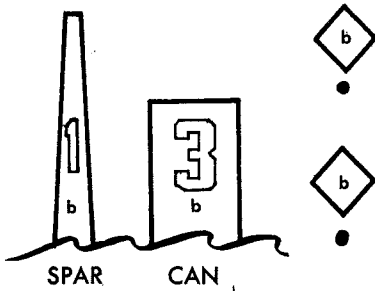
b—black



Red, even numbers. The right-hand limits of the channel from seaward.

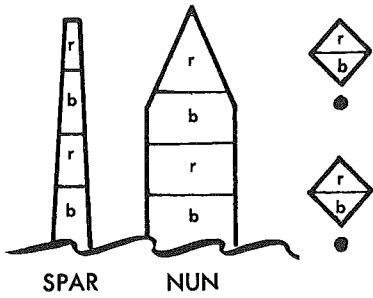
Red, Right, Returning

always Red

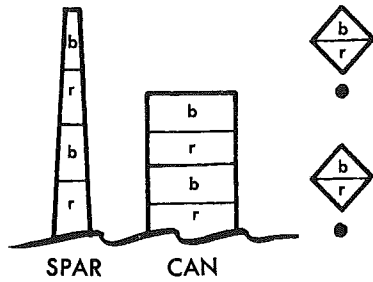


Black, odd numbers. The left-hand limits of the channel from seaward.

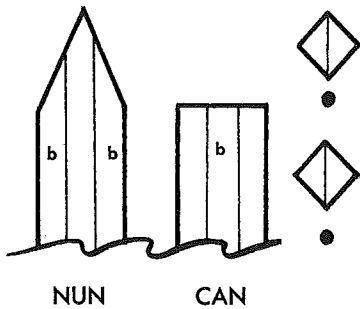
always Black



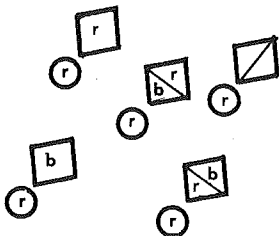
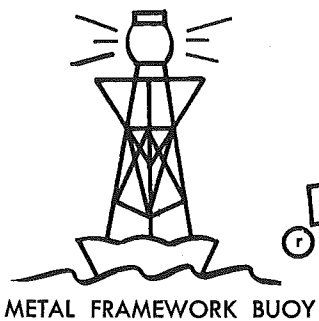
Red and black, no numbers. Junction, middleground, or obstruction. Pass on either side but not close aboard. Red top indicates preferred channel is to port, buoy treated as red.



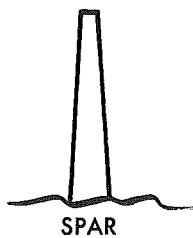
Black and red, no numbers. Junction, middleground, or obstruction. Pass on either side but not close aboard. Black top indicates preferred channel is to starboard, buoy treated as black.



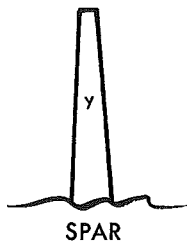
Black-and-white vertically striped. No numbers. Mid-channel or fairway, pass close aboard either side. Series alternate—can and nun.



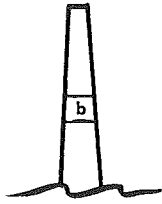
Lighted buoy. Colored and numbered according to use. Black, red, black and white, black and red. Note chart symbol.



Anchorage buoy, white.



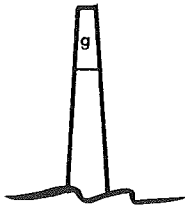
Quarantine buoy, yellow.



SPAR



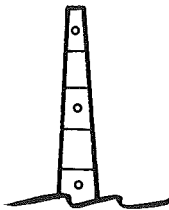
Fishnet, horizontally striped black on white.



SPAR



Dredging, green top.



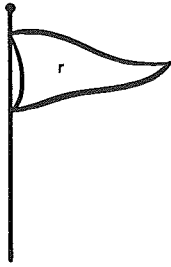
SPAR



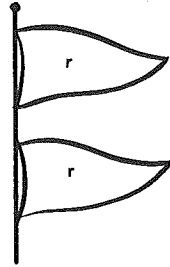
Special purpose buoy. Color is alternately banded white and international orange.

STORM WARNINGS

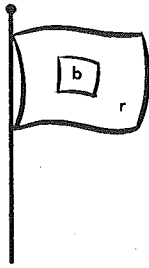
DAY SIGNALS



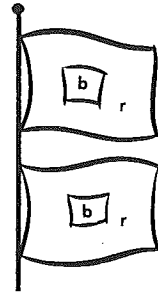
SMALL CRAFT



GALE




WHOLE GALE




HURRICANE

NIGHT SIGNALS


SMALL CRAFT

 WINDS UP TO
38 MPH. AND/OR
SEA CONDITIONS
DANGEROUS TO
SMALL CRAFT


WHOLE GALE

 WINDS FROM 55
TO 73 MPH.

GALE

 WINDS FROM 39
TO 54 MPH.

HURRICANE


 WINDS 74 MPH.
AND OVER


DAYMARKS

Daymarks are shown by boats operating under special conditions, such as towing or being towed, fishing, and dredging. The signal is made by a ball or cone shape. Small boats are not required by law to display daymarks, but every operator should understand and be able to read them on other vessels.


- (b) A vessel not under control in international waters shows a daymark of two black balls vertically arranged. Same signal is displayed by self-propelled suction dredges under way with suction on the bottom in inland waters.

- (r) Dredges held in stationary position show two balls in the daytime, vertically arranged in a position where they can best be seen.


-  Vessels moored or anchored and engaged in laying pipe or operating on submarine construction show two balls in a vertical line, upper alternate black-and-white vertical stripes, bottom in bright red.

-  A vessel towing a submerged boat in the daytime shows two shapes, one above the other. Two double cones base to base. Upper painted horizontal stripes of black and white, lower shape bright red.

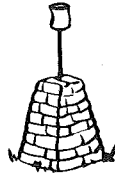
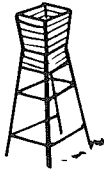
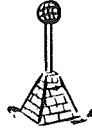
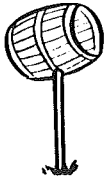
- (b) Steam vessel under sail alone and when anchored, show a single black ball as a day signal.

-  Steamers, lighters, and other vessels made fast alongside a wreck or moored over a wreck show two double cones base to base, both of which are bright red.

- (r) A cable vessel in the daytime shows a daymark top of which is red ball, center two cones base to base, and bottom another red ball. Cones are white. This applies to international rules.

-  A fishing vessel in the daytime may display a basket in the rigging.

Structures, not buoys, are called daybeacons. They are unlighted and of any shape depending upon how far they must be seen. They may be of masonry, single piling, or slatted towers, etc. They may be colored to show passing side.



**INTRACOASTAL WATERWAYS
RANGE MARKERS**



REAR



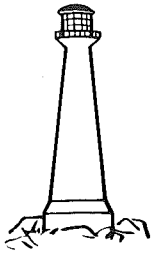
FRONT



Yellow borders on all intracoastal waterways aids. Main colors indicate passing side.



Lightships are stationed where needed and where it is impractical to place lighthouses. Completely described in the "light lists." Name is shown in large white letters on hull.



A typical lighthouse. Earliest aids to navigation were lighthouses. The Portland Head lighthouse at Cape Elizabeth, Me., went into commission in 1791. Its present light is 32,000 candlepower. First lighthouse in U.S. was established at the entrance to Boston Harbor in 1716 and is still in existence (rebuilt 1859).

CHARACTERISTICS OF LIGHTS

FIXED WHITE



FLASHING WHITE



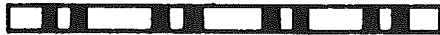
GROUP FLASHING



OCCULTING



GROUP OCCULTING



FIXED AND FLASHING



ALTERNATING FLASHING
WHITE AND GREEN

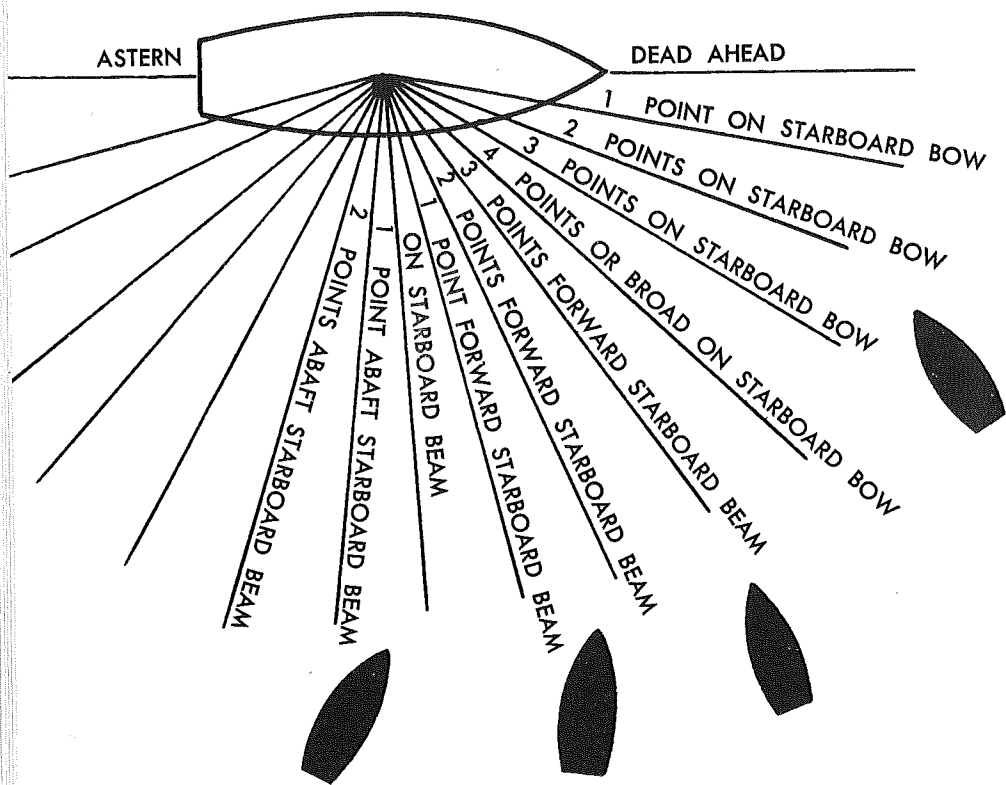


ALTERNATING
WHITE AND RED



FIXED WHITE
ALTERNATING GROUP
FLASHING RED

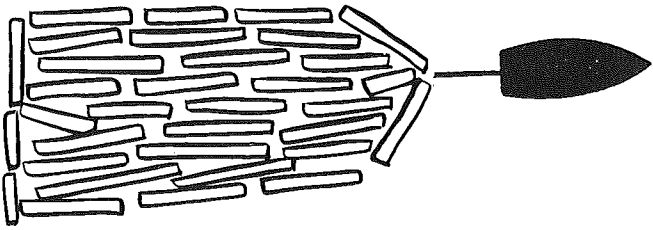




All of these boats have the right-of-way.

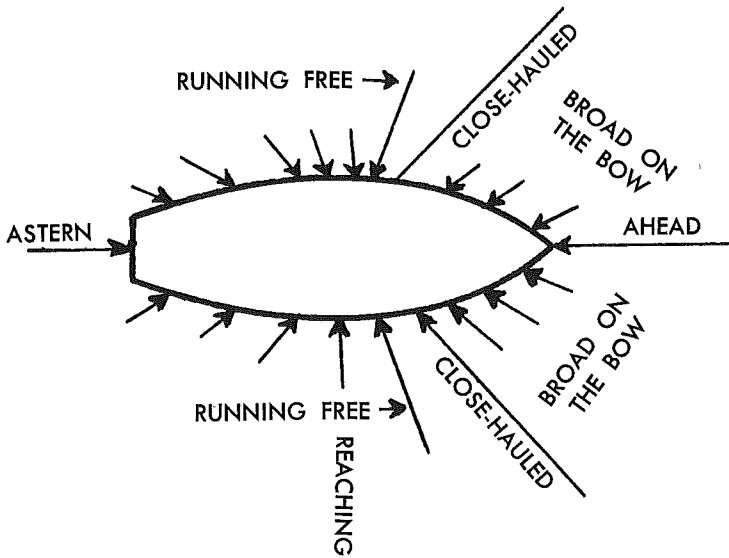
"Danger zone" is from dead ahead to two points abaft the starboard beam. All vessels in this area have the right-of-way.

In the situation below, although the small boat might feel that it has the right-of-way over the tug with the log raft in tow it does not, the operator must take into consideration that the tug with tow is very difficult to maneuver and stay clear.

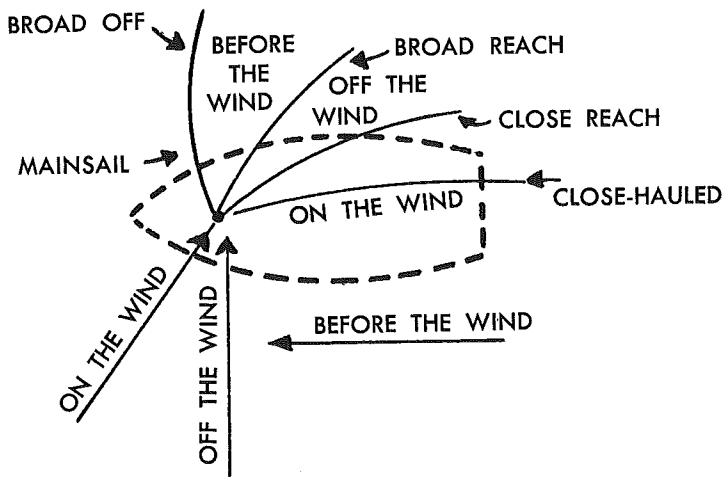


Be courteous, stay clear.





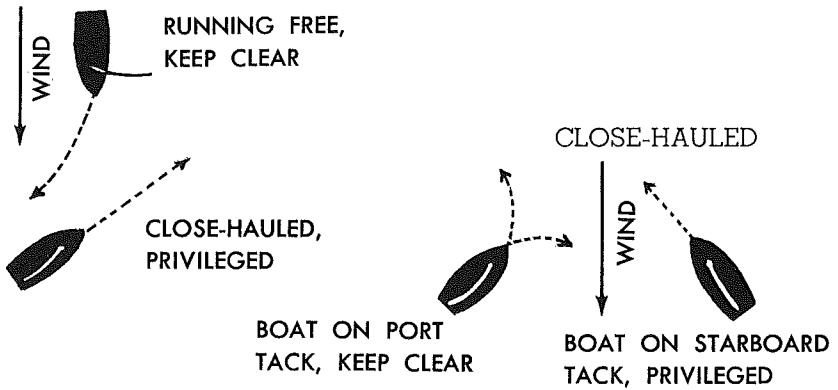
Points of sailing. Arrows indicate wind direction. "Free" is with the wind from 6 points on the bow to anywhere on the quarter.



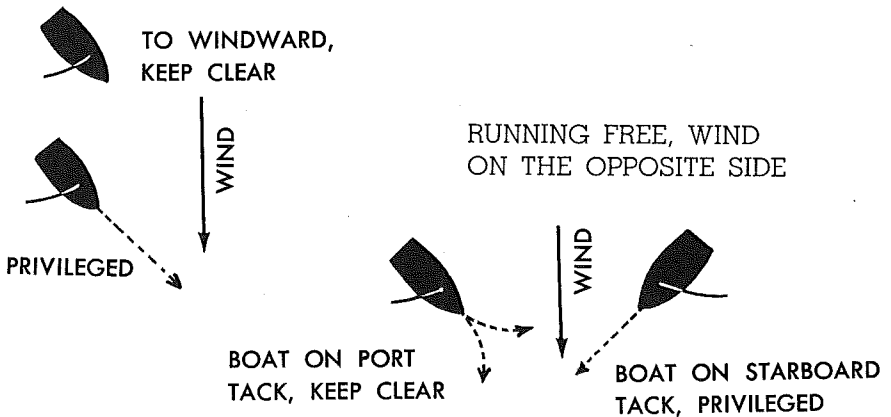
Sail positions on different points of sailing. This diagram shows mainsail only. Many right-of-way situations are controlled by the set of the sails. In this illustration the boat is on a port tack, that being the side over which the wind is taken.

A sailboat that is running free shall keep out of the way of a sailboat that is close-hauled. A sailboat that is close-hauled on a port tack shall keep out of the way of one that is close-hauled on a starboard tack. When both are running free, with wind on different sides, the vessel that has the wind on the port side shall keep out of the way of the other. When both are running free with the wind over the same side, the sailboat to windward shall keep out of the way of the sailboat to leeward.






**RUNNING FREE v.
CLOSE-HAULED**



RUNNING FREE, WIND ON THE SAME SIDE

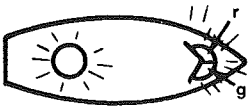


INLAND RULES

				
32 points white, 2 miles	20 points white, 2 miles	12 points white, 2 miles	20 points combination red and green, 1 mile	Separate 10 point red 10 point green 1 mile

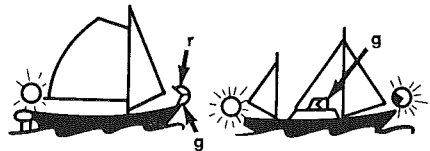
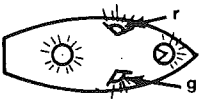
These lights are legal on inland waters, the Great Lakes, and Western rivers. They must be shown on inboards, outboards, auxiliaries, and straight sailboats.

Applies to power vessels under 65 feet and sail vessels. Auxiliaries are considered powerboats.



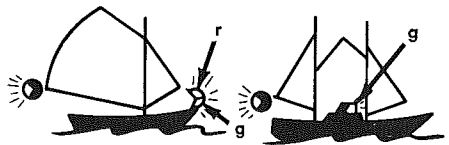
Class "A" and "1" combination red and green, 32 point white.

Class "2" and "3" separate red and green — 20 point white and 32 point white light.



SAIL AND POWER





A manually propelled craft, canoe, or small rowboat must have a white light to show in time to prevent collision. No specified visibility range is required.



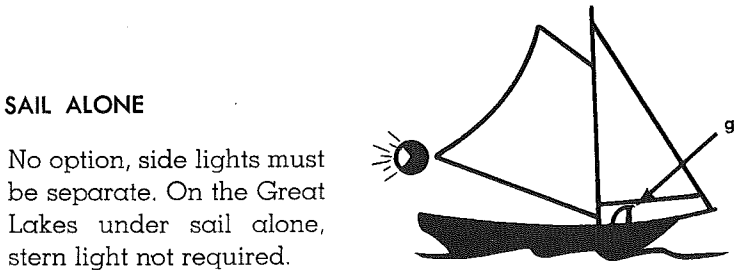
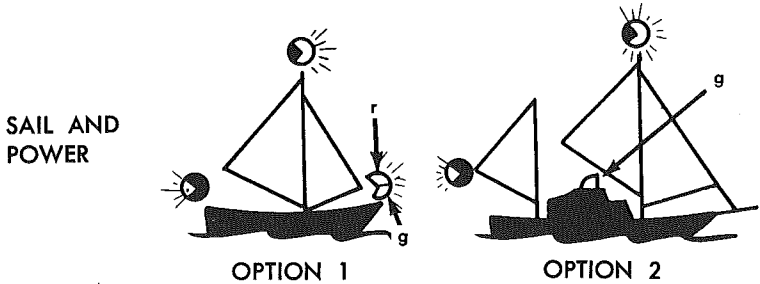
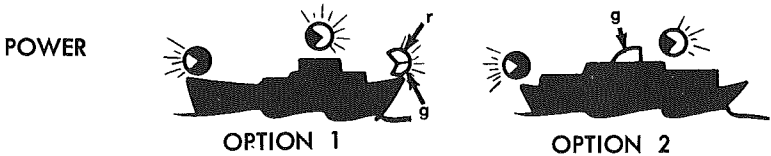
SAIL ALONE

INTERNATIONAL RULES

Required on high seas and international waters.

 20 point white 3 miles	 12 point white 2 miles	 20 point combination 1 mile	 Separate 10 point red 10 point green 1 mile
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Also legal on the Great Lakes, inland waters, and Western rivers. Powerboats over 65 feet must take second option, and the white lights be visible 5 miles, colored lights 2 miles.

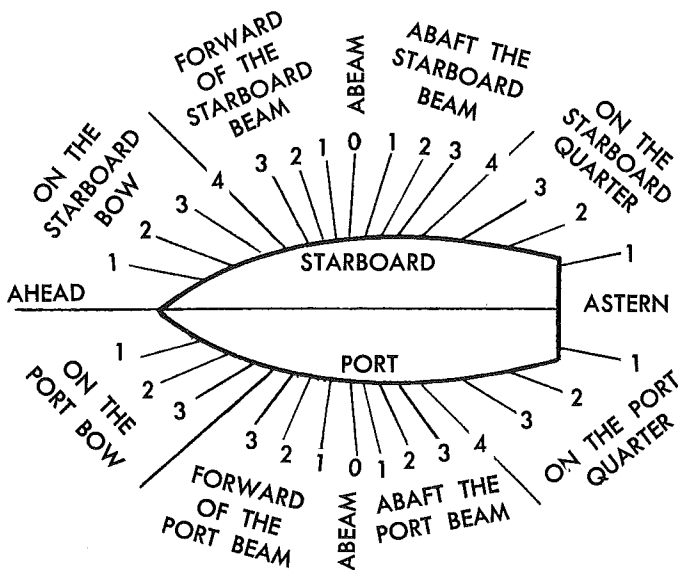


To show all of the required lighting displays for all types of vessels in all situations for the various Rules of the Road is not feasible here. Use a current reference book that illustrates those displays with which your ship must be familiar. For this, check the resource chapter of the *Sea Explorer Manual*.

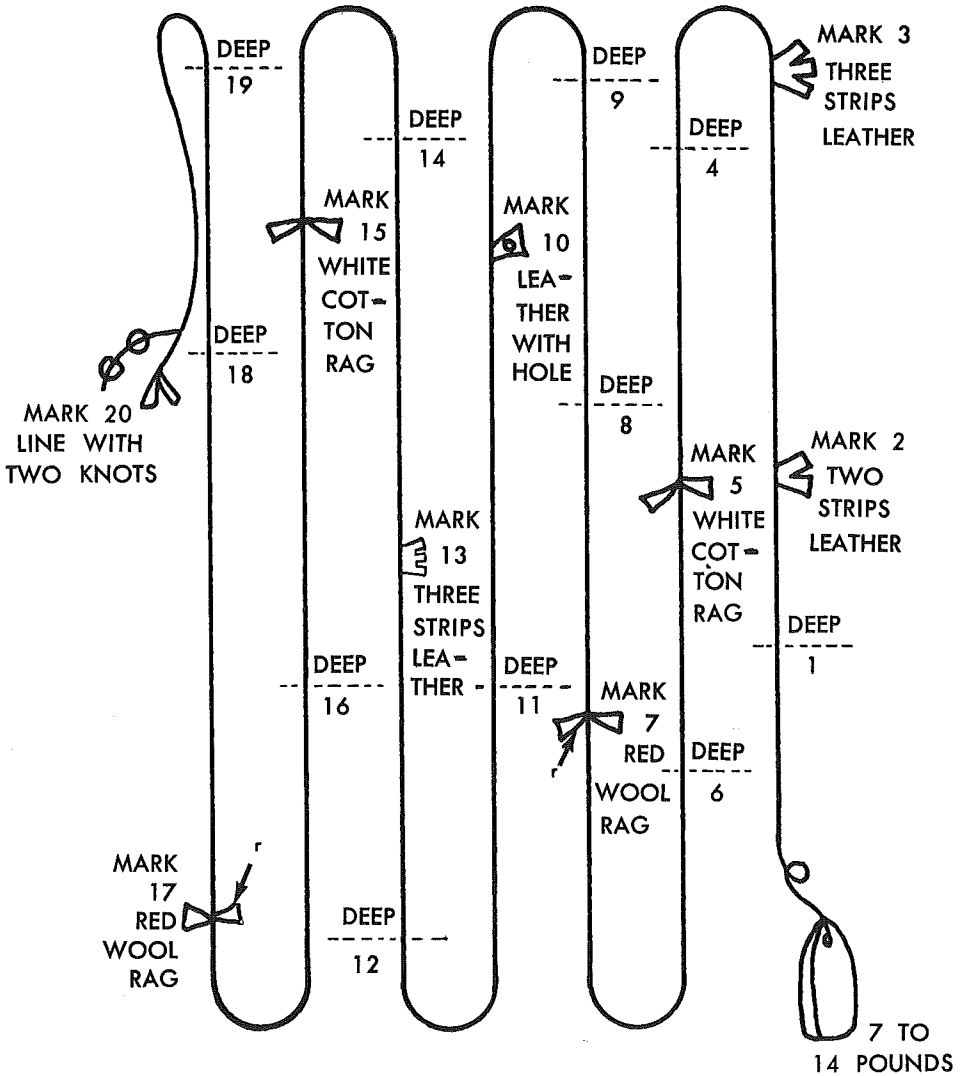
Secure a Rules of the Road pamphlet that applies to your area. These pamphlets may be obtained upon request from Coast Guard Marine Inspection Offices in the major ports or by writing the Commandant (CHS), U. S. Coast Guard Headquarters, Washington, D. C. 20226:

- Rules of the Road, International—Inland, CG—169*
- Rules of the Road, Great Lakes, CG—172*
- Rules of the Road, Western Rivers, CG—184*

RELATIVE BEARINGS



THE LEAD LINE



KNOTS



BOWLINE



OVERHAND KNOT



SQUARE OR REEF KNOT



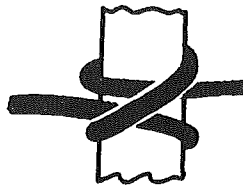
FISHERMAN'S KNOT



SHEET OR BECKET BEND



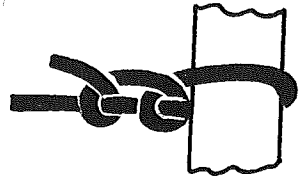
FIGURE EIGHT KNOT



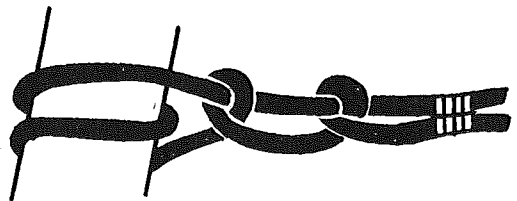
CLOVE HITCH



ROLLING HITCH



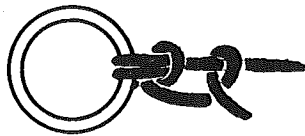
TWO HALF HITCHES



ROUND TURN AND TWO HALF HITCHES



MIDSHIPMAN'S HITCH



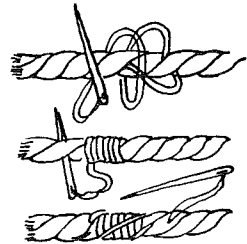
FISHERMAN'S BEND OR ANCHOR BEND



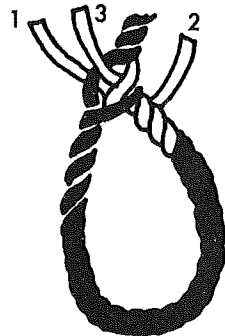
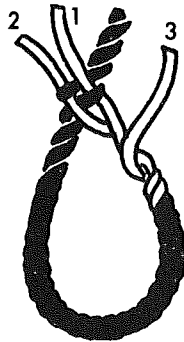
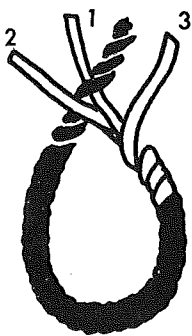
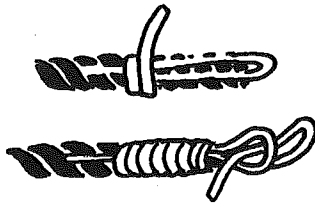
BELAYING TO A CLEAT



THE SHORT SPLICE



WHIPPINGS



EYE SPLICING

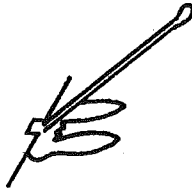
ANCHORS



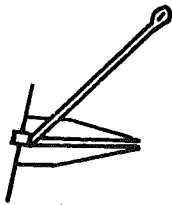
Old-fashioned or yachtsman's anchor.



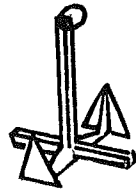
Navy or patent anchor.



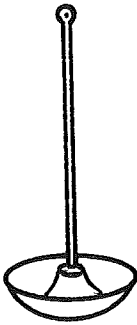
Improved Navy anchor—
note rod through crown.



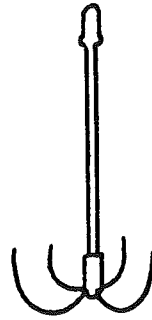
The Danforth, lightweight,
good holding power.



Light folding anchor, North-hill type. Easily stowed.



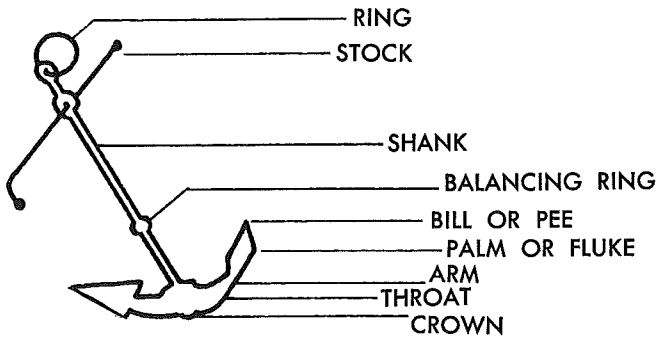
Mushroom anchor. Good for permanent moorings.



Grapnel anchor, good in weeds and rocks. May be difficult to retrieve.



Plow anchor. This is good for kedging.



CHECKLIST FOR SAFE OPERATION

EQUIPMENT

Lifejackets	
Bilge pump or bailing bucket	
Horn	
Bell	
Emergency light	
Anchor	
Anchor line	
Mooring lines	
Charts	
First aid kit	
Firefighting equipment	

BOAT PREPARATIONS (check as completed)

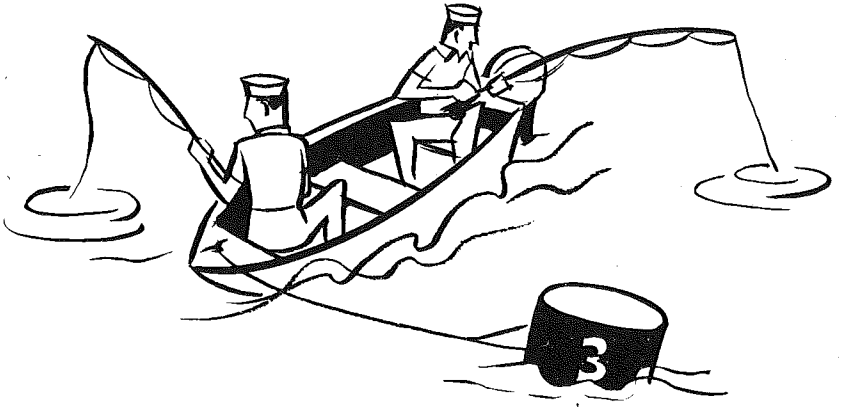
Pump bilges or bail	
Check boat for damage	
Check wind or current	
Check fuel and fill tanks if needed	
Check fresh water	
Test switches and running lights	
Run blowers	
Check motor oil	
Start and check engine or motor	
Cooling water discharge	
Post station bills	

This is an example of a station bill developed for a Sea Explorer ship. It should be worked up according to your needs.

S.E.S. EXPLORER			STATION BILL		
			COLLISION	FIRE	MAN OVERBOARD
			BLAST OF WHISTLE	RAPID RINGING OF BELL	BY THE CRY "MAN OVERBOARD"
			WORD PASSED	WORD PASSED	WORD PASSED
NO.	NAME	RANK	BILLET	STATION AND DUTY	STATION AND DUTY
	M. DAVIS	SK	MASTER	BRIDGE	BRIDGE
	P. ADAMS	M	EXEC. OFFICER	FOREDECK	AFTERDECK
1	EVERT	AB	#1 CREW BOS'N	DAMAGE CONTROL	FOREWARD FIRE CONTROL
2	SMITH	OR	NAVIG.	HELM	HELM
3	PELTE	OR	ENGINE RM.	ENGINE ROOM	ENGINE ROOM
4	B. JONES	AP	ENGINE RM.	ENGINE ROOM	ENGINE ROOM
				PORTABLE EXT. PUMPS	ENGINE ROOM PUMPS

5	WHITE	AP	DECK	FORE DECK	FOREDECK FIRE HOSE	FOREDECK WATCH FOR VICTIM
6	VERNON	AP	DECK	SCENE OF DAMAGE	FCSL FIRE EXTINGUISHER	1ST AID
7	SEVERS	AP	GALLEY	GALLEY DAMAGE	GALLEY FIRE EXTINGUISHER	1ST AID
8	R. JONES	QM	# 2 CREW BOS'N	ASSIST ON BRIDGE	ASSIST ON BRIDGE	ASSIST ON BRIDGE
9	L. ECKE	AB	C/L DECK	ASSIST DAMAGE CONTROL	SUPERVISE FIRE FIGHTING	AFTERDECK W/ BOAT HOOK
10	J. ECKE	AB	C/L ENGINE ROOM	SUPERVISE ENGINE ROOM	SUPERVISE ENGINE ROOM	SUPERVISE ENGINE ROOM
11	JARVIS	OR	COOK	GALLEY	GALLEY FIRE CONTROL	1ST AID
12	L. ADAMS	AP	NAVIG.	SHIP'S PAPERS	SHIP'S PAPERS	1ST AID
13	JUNOR	AP	ENGINE RM.	SCENE OF DAMAGE	CREW QTRS FIRE EXTINGUISHER	PREPARE TO SWIM
14	DEVLIN	AP	ENGINE RM.	SCENE OF DAMAGE	BILGE PUMPS	JACOB'S LADDER
15	BURKE	AP	DECK	AFTERDECK ISSUE LIFE JACKET	AFTERDECK FIRE HOSE	AFTERDECK ASSIST VICTIM
16	WASHBURN	AP	DECK	ISSUE LIFE JACKET	PORTABLE PUMP	AFTERDECK ASSIST VICTIM

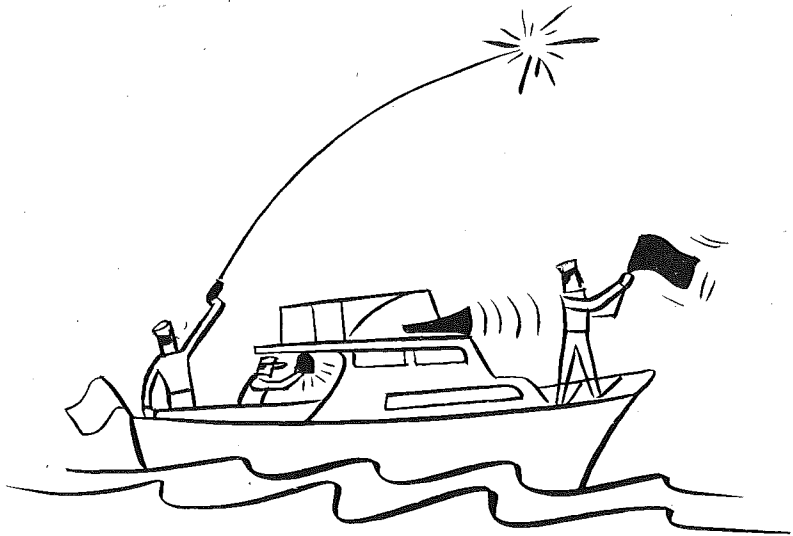
The situations should be practiced at least once on each cruise. It is good policy to practice before leaving the dock, making sure each person aboard knows his station and duty.



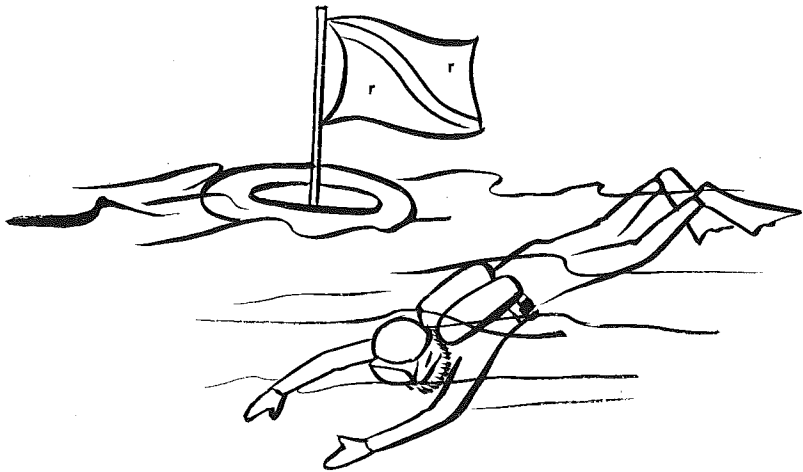
Never tie to a buoy or other navigational aid. They are not moorings.



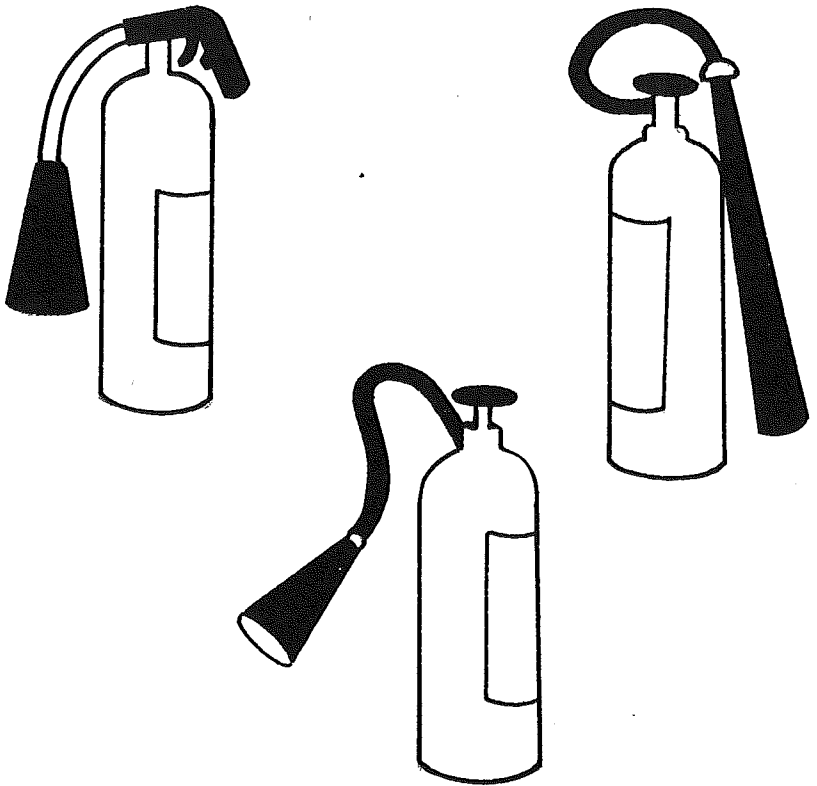
Watch your wake! You are responsible for the damage it causes.



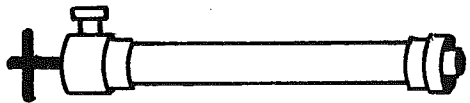
Distress signals: Flares. Rapid ringing of bell. Waving flag or arms. Blasting horn. Displaying flag upside down.



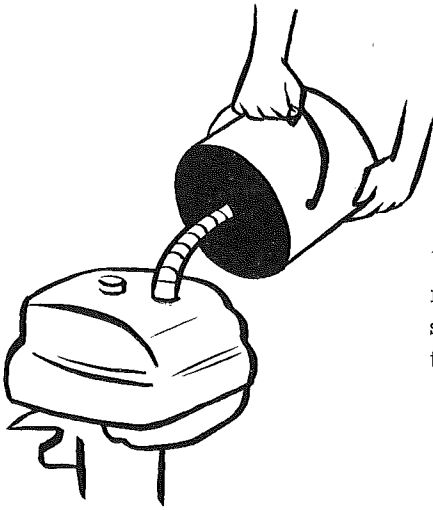
Stay clear when you see a red flag with diagonal white stripe. It means there is a skin diver nearby. Shut down engine if within 100 feet. If you see air bubbles, do not pass over. If you must go by, reduce speed and proceed cautiously.



Three CO₂ fire extinguishers. Make sure they are of the approved variety. Many of the dry chemical extinguishers are also approved.



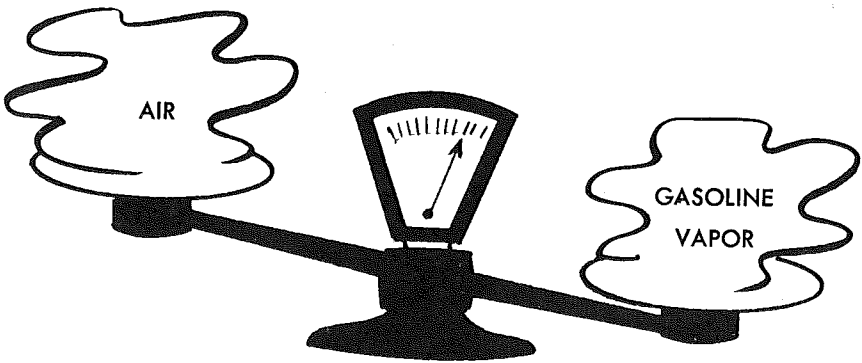
The portable bilge pump is also a good piece of fire-fighting equipment where water will suppress the fire.



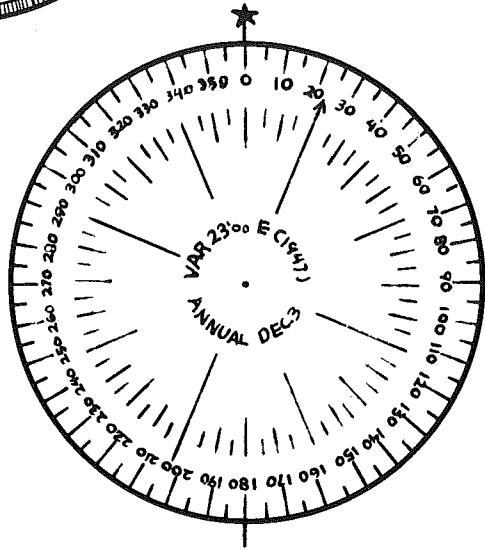
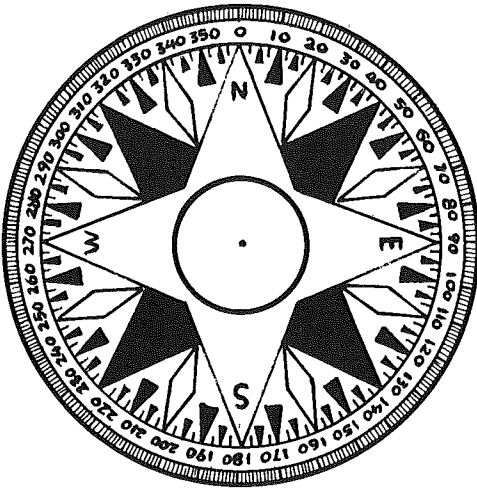
When fueling, ground the metal nozzle to the tank. The same applies to the fixed tank on inboards.



Never overload the boat, it is too easily swamped.



Gasoline vapor is heavier than air and sinks into the bilges.



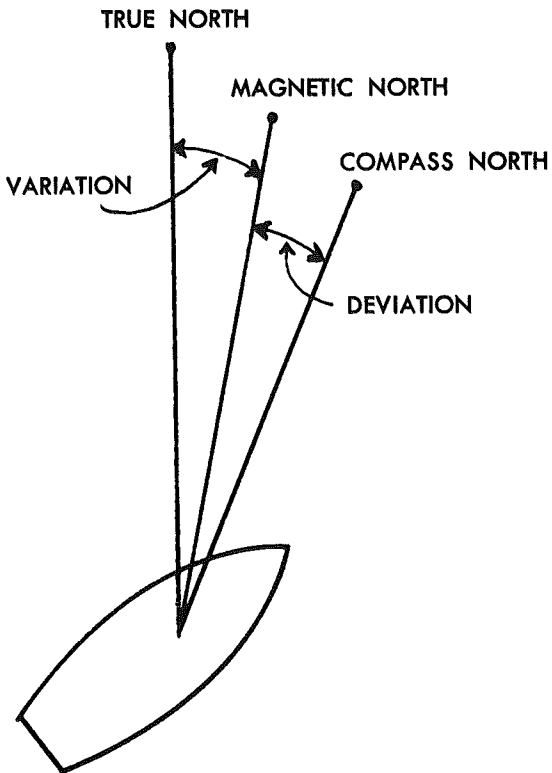
In the lower right is an example of the compass rose from a chart. Note that variation is given for a given date, and annual decrease is noted. Modern charts have an inner rose corrected to variation, and a line drawn through the center on the projected course will give both magnetic and corrected course according to variation.

DEVIATION TABLE
S.E.S. HORNBLLOWER

SHIP'S HEAD P.S.C.	DEV.	SHIP'S HEAD P.S.C.	DEV.	SHIP'S HEAD P.S.C.	DEV.
0°	14°W	120°	15°E	240°	4°E
15°	10°W	135°	16°E	255°	1°W
30°	5°W	150°	12°E	270°	7°W
45°	1°W	165°	13°E	285°	12°W
60°	2°E	180°	14°E	300°	15°W
75°	5°E	195°	14°E	315°	19°W
90°	7°E	210°	12°E	330°	18°W
105°	9°E	225°	9°E	345°	17°W
				360°	14°W

A simple deviation chart carried alongside the compass or in the charting area. Note readings are taken every 15 degrees on the compass. This

chart should be checked and corrected periodically as needed.



A simple demonstration of the difference between variation and deviation.

Note that the difference between true north and magnetic north is labeled variation. The difference between magnetic north and what the ship's compass shows north to be is the deviation.

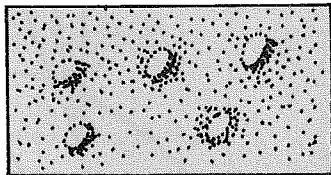
CHART SYMBOLS

The list of chart symbols is long and complex. In fact, the symbols are classified under 21 lettered headings in a 25-page pamphlet entitled *Chart No. 1, Nautical Chart Symbols and Abbreviations*. You can get a copy by writing the U. S. Coast and Geodetic Survey, Washington, D.C. 20235. A few examples of these symbols as they appear in this pamphlet are shown here to illustrate some of the classifications.

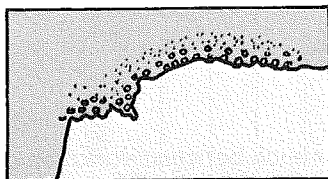
A. The Coastline



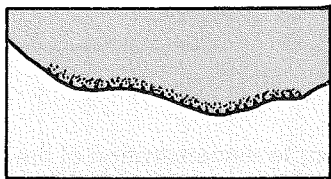
3a Rocky coast



5 Stony or Shingly shore



4 Sandhills; Dunes






6 Sandy shore



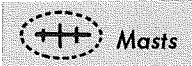
S. Quality of the Bottom

<u>1</u>		Ground	10	St	Stones
2	S	Sand	11	Rk; rky	Rock; Rocky
3	M	Mud; Muddy	11a	Blds	Boulders
4	Oz	Ooze	12	Ck	Chalk
5	Ml	Marl	12a	Ca	Calcareous
6	Cl	Clay	13	Qz	Quartz
7	G	Gravel	<u>13a</u>		Schist
8	Sn	Shingle	14	Co	Coral
9	P	Pebbles	(Sa)	Co Hd	Coral head




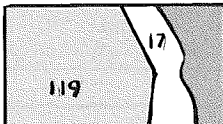
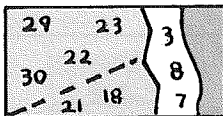



K. Lights

1		Position of light
<u>5</u>	 Bn	Light beacon
6		Light vessel; Lightship



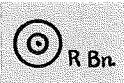



O. Dangers

	5a Shoal sounding on isolated rock (replaces symbol)	11 	11 Wreck showing any portion of hull or superstructure above sounding datum
<u>21</u> Rk <u>21</u> Wk <u>21</u> Obstr	6a Sunken danger with depth cleared by wire drag (in feet or fathoms)		12 Wreck with only masts visible above sounding datum

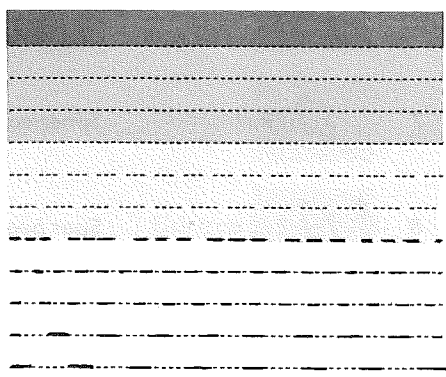
Q. Soundings

- | | | |
|-----|---|--|
| 1 | SD | <i>Doubtful sounding</i> |
| 2 | 65 | <i>No bottom found</i> |
| 3 | | <i>Out of position</i> |
| 4 | | <i>Least depth in narrow channel</i> |
| 5 |  | <i>Dredged channel (with controlling depth indicated)</i> |
| 6 |  | <i>Dredged area</i> |
| 7 | | <i>Swept channel (See Q-9)</i> |
| 8 |  | <i>Drying or uncovering height in feet above chart (sounding datum)</i> |
| 9 |  | <i>Swept area not adequately sounded (shown by green tint)</i> |
| 9a |  | <i>Swept area adequately sounded (swept by wire drag to depth indicated)</i> |
| 10 | | <i>Hair-line depths</i> |
| 10a |  | <i>Figures for ordinary soundings</i> |
| 11 |  | <i>Soundings taken from foreign charts</i> |
| 12 |  | <i>Soundings taken from older surveys or smaller scale charts</i> |

M. Radio and Radar Stations

- | | | |
|----|---|---------------------------------|
| 1 |  | <i>Radio telegraph station</i> |
| 2 |  | <i>Radio telephone station</i> |
| 3 |  | <i>Radiobeacon</i> |
| 11 |  | <i>Radar station</i> |
| 12 |  | <i>Radar responder beacon</i> |
| 13 |  | <i>Radar reflector (See Lj)</i> |

R. Depth Contours and Tints (see General Remarks)

Feet	Fathoms	
0	0	
6	1	
12	2	
18	3	
24	4	
30	5	
36	6	
60	10	
120	20	
180	30	
240	40	

L. Buoys and Beacons

1



Position of buoy

2



Light buoy

3



Bell buoy

3a



Gong buoy

4



Whistle buoy

5



Can or Cylindrical buoy

6



Nun or Conical buoy

7



Spherical buoy

8



Spar buoy

cont.



Fairway buoy (BWVS)



Mid-channel buoy (BWVS)



Bifurcation buoy (RBHB)



Junction buoy (RBHB)



Isolated danger buoy (RBHB)



Wreck buoy (RBHB or G)



Obstruction buoy (RBHB or G)



Quarantine buoy

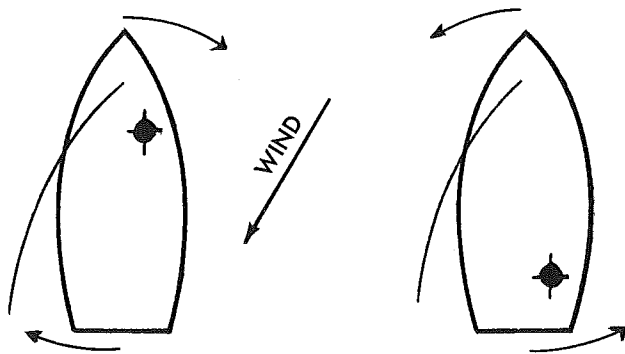
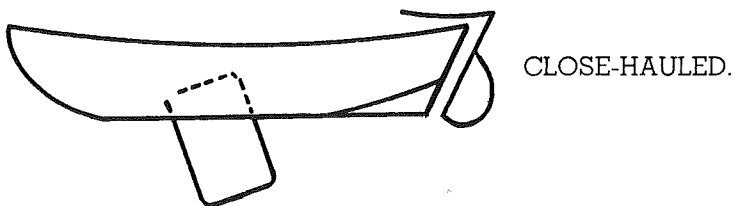
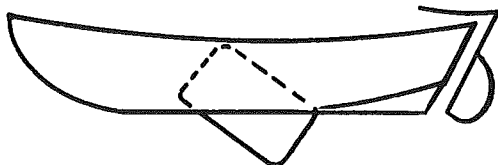


Fish trap buoy (BWHB)

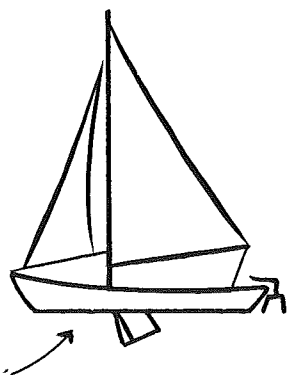
CORRECT CENTERBOARD POSITIONS FOR VARIOUS
POINTS OF SAILING



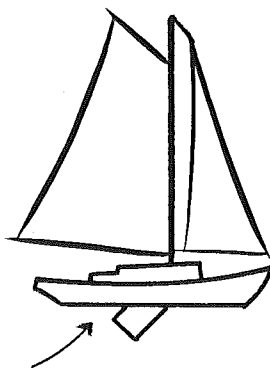
REACHING.



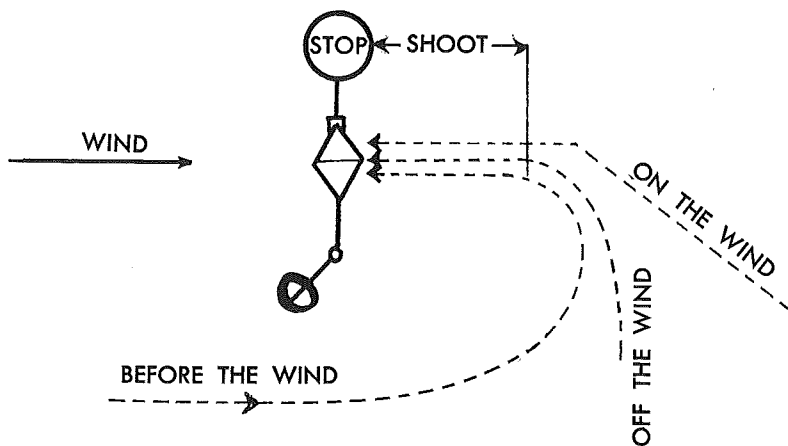
Effect of ballast shift on helm.
Boat follows arrows.



To cure mild lee helm, reduce jib area, rake mast aft, drop centerboard.

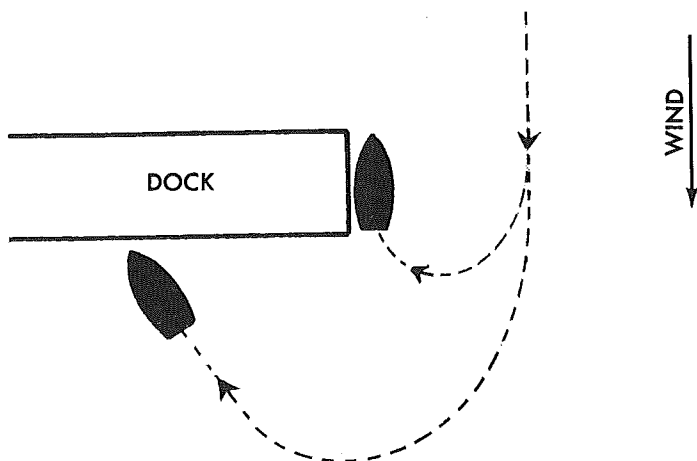


To cure mild weather helm, partly hoist centerboard, rake mast forward.

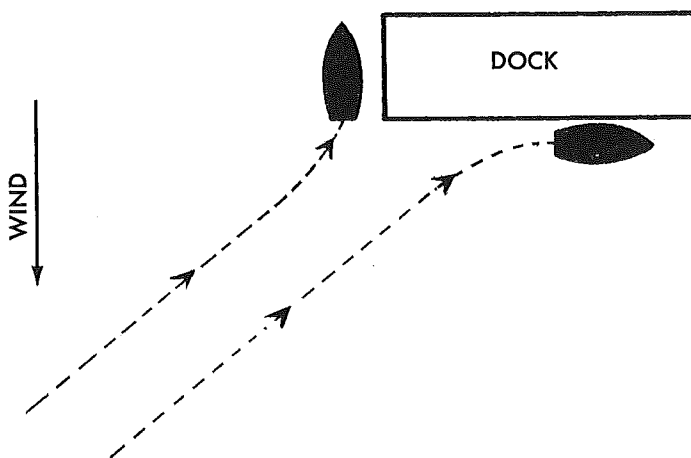


In making a landing or in picking up a mooring, the object is to sail the boat to the point where she will sail no more or, in other words, is in irons. This should be the position where it is estimated that her own momentum will carry her forward to the desired location. It takes practice to learn boat habits and the distance of "shooting" under different wind velocities.

Sailboat landing, leeward side of dock. Made whenever possible in preference to windward landing.



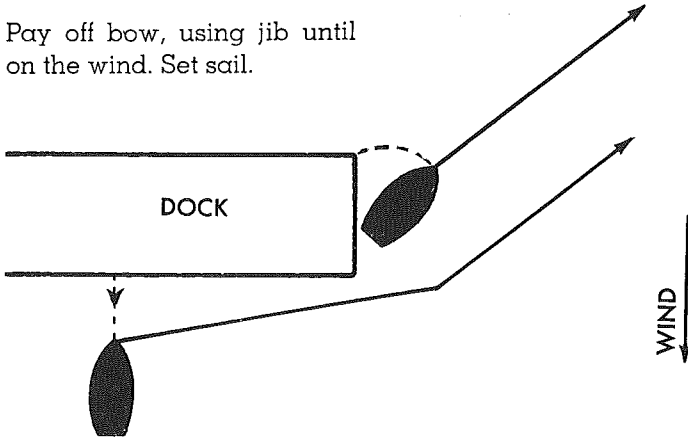
Lines and fenders ready at all times. Immediately dock is made, raise centerboard, lower the jib, let sheets run.



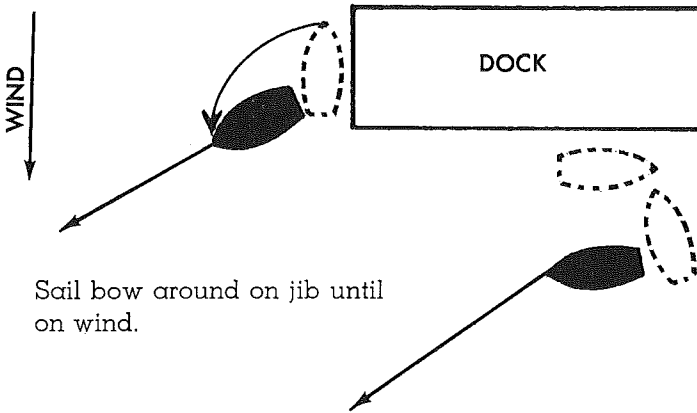
Take current (if any) into consideration on these landings. If wind is light, use all canvas. If wind is strong, use the jib alone.

Getting away from dock, leeward side.

Pay off bow, using jib until on the wind. Set sail.



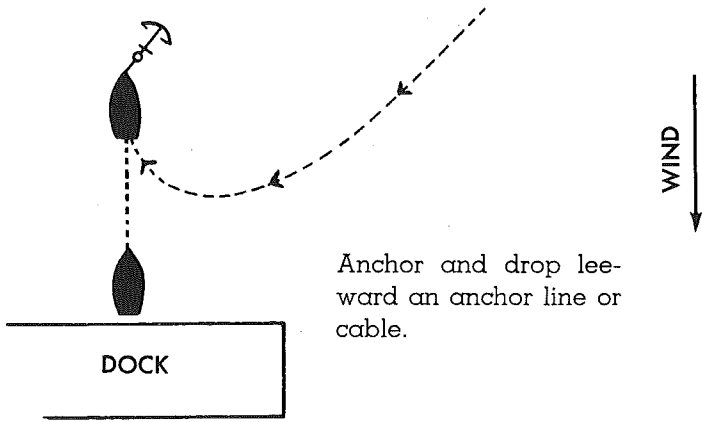
Pay off bowline or back sail your vessel until you are in position to swing onto the wind.



Sail bow around on jib until on wind.

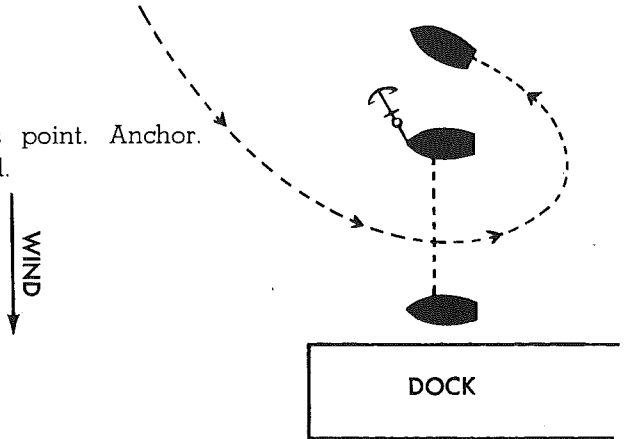
Sail stern around while holding bow on line until jib can be used to complete maneuver to get on the wind.

Sailboat landing, windward side of dock. Not recommended for novices.



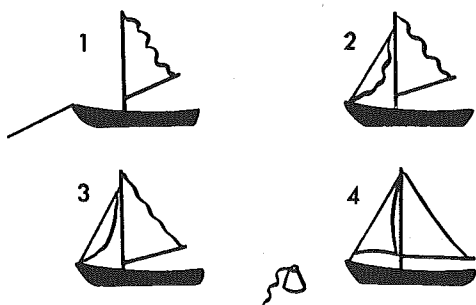
Anchor and drop leeward an anchor line or cable.

Luff at this point. Anchor. Sails doused.



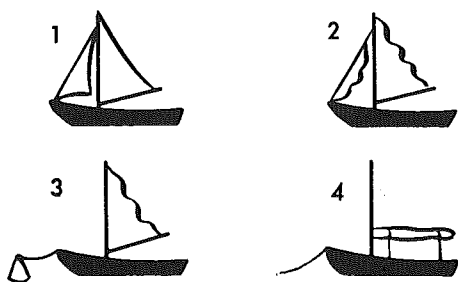
If wind is not too strong, set boat away and abreast to windward. Let sheets run or douse sail. Wind on hull will bring her it. In this event proper fending with fenders, feet or boathook is indicated. Extreme care is used. To get away on windward side, use anchor line to pull boat into position. Pay head around to desired tack. See moorings below.

STEPS IN GETTING AWAY FROM A MOORING

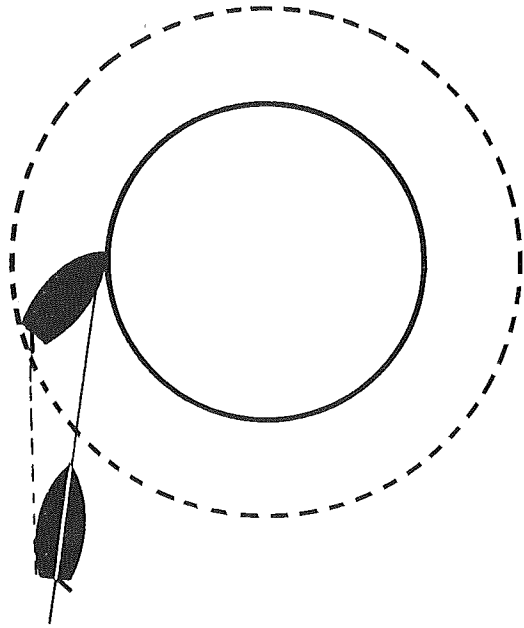


1. Get ready all gear, raise mainsail, lower centerboard. Bend jib but do not raise. Let mainsheet run, do not belay.
2. Raise jib but do not belay sheet. Draw boat to mooring or prepare to cast off mooring warp.
3. Hold weather jib sheet on tack desired to sail on. As head pays off, cast off mooring.
4. Sheet in main and jib. Trim both.

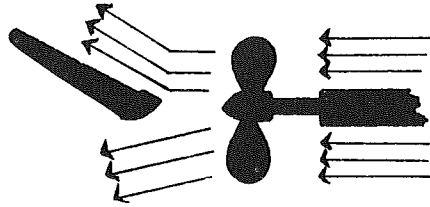
STEPS IN PICKING UP A MOORAGE



1. Sail at mooring from leeward.
2. Luff and shoot into the eye of the wind, at mooring.
3. Let all sheets run. Pick up mooring and drop jib.
4. Drift back on mooring warp, douse main, and snug down.



"Advance" is the distance the vessel moves in the direction of her original course after the helm has been put over. The stern kicks away from the direction in which the rudder moves, and the boat slides along obliquely along the course until she settles into a turning circle. The bow describes a smaller circle than the stern.



When the helm is set over, water "bunches up" and adds pressure on the side of the rudder, swinging the stern.

Single screw: turning around. Boat will back easily to port (with right-hand screw).



Boat starts turn, leaving room for stern to swing. Check headway at position 2 by reversing prop.

Leave rudder in right position. Back from 2 to 3 position.

Power ahead again, sternway checked and swinging movement continued.



Back again, checking headway. Can be repeated until desired position attained.

Go ahead again, bringing rudder amidships when ready to proceed.

Same boat turning in opposite direction. Swing will be obtained by going ahead.



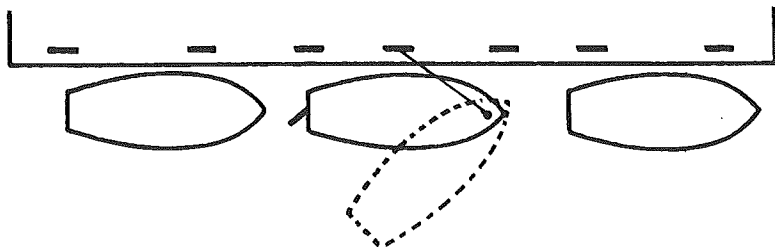
Start with right rudder and back to 2. Boat may not turn at all.

Shift to full left rudder and go ahead strong for a few turns.

Shift to right rudder and back down.

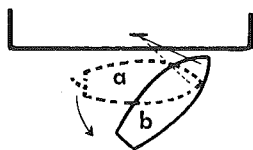
Full left rudder again with strong burst from engine. Practice until feel of boat is attained.

Dock moorings and boat handling at docks, single screw right-hand screw. Because of the tendency of the stern to swing to port; port-side landings are the easiest and are recommended wherever possible.

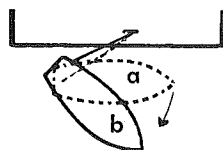


Landing at a dock between two boats, approach is made at 45 degrees or less, placing bow to dock and securing an after bow spring (from bow to point near midships of proposed berth). With wheel hard right (starboard) and tending line to prevent touching boat ahead, power ahead carefully against the spring line until stern swings into position. Secure.

Getting away in tight quarters:

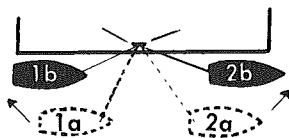


After bow spring. Hard left rudder, power ahead.



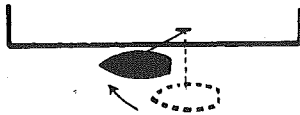
Forward quarter spring. Rudder amidships back down.

Two more port-side landing situations:

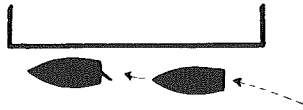


Forward bow spring—back down; forward quarter spring—power ahead.

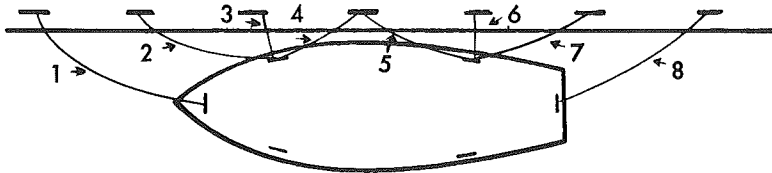
Starboard side landings:



On line, attach line as near amidships as possible. Go ahead slowly against the line until in position.



Landing without using lines. Approach with the starboard side of the boat toward the dock, slowly approach nearly parallel with the dock. Rudder is shifted to full left to swing stern to starboard. Kick engine ahead in short bursts, if necessary, and reverse to check headway.

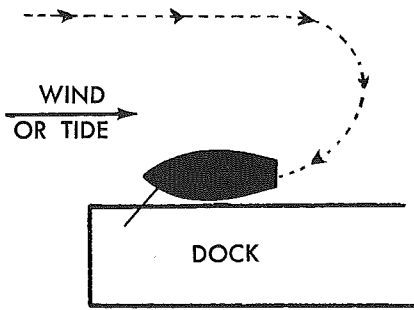


Larger vessels use breast lines in addition to springs. These are numbered from the bow aft. Terms forward and after refer to direction lines run from the vessel.

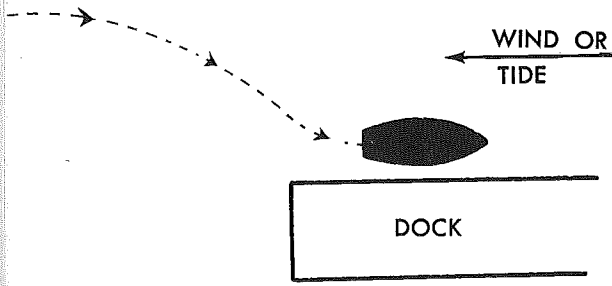
No. 1—Bow line.

No. 2—Forward bow spring No. 3—Forward (bow) breast No. 4—After bow spring No. 5—Forward quarter spring No. 6—After (quarter) breast No. 7—After quarter spring No. 8—Stern line. Do not burden small boats with all these lines. Springs can just as easily be run from bow and stern bits.

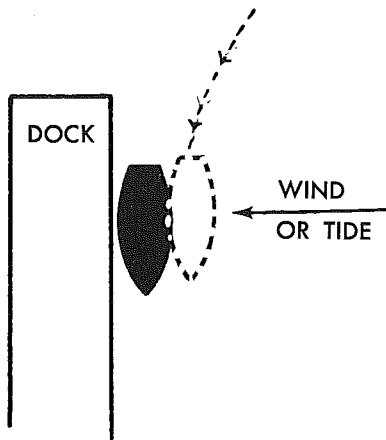
DOCKING



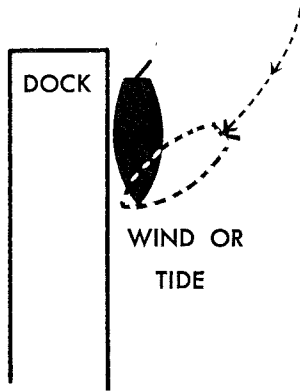
Approaching with the wind. Turn to face the wind, get the bowline out first, then let the stern drift in.



Approaching against the wind, maneuver alongside, get the bowline out and let the stern drift in.

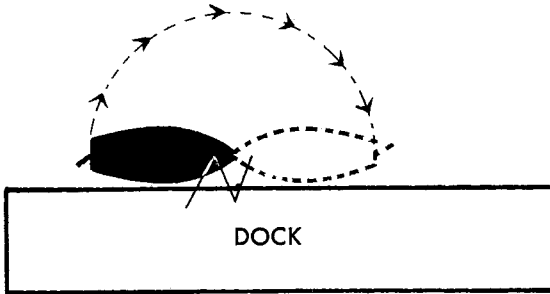


Approaching the windward side, stop alongside parallel and drift into the dock. The bow will probably touch first.



Approaching the leeward side, touch the bow at about a 45-degree angle and put a bow spring line out. Go forward under power with the rudder away from the dock to swing the stern in.

To reverse the heading while at the dock:

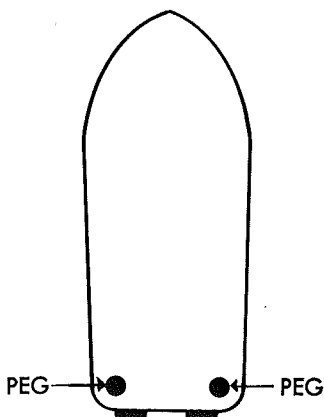


Put out double bowlines and swing the rudder toward the dock. Go forward under power and when halfway around, stop the engine, reverse until the bow strains against the opposite bowline, and again power ahead to swing the stern in. In the illustration the rudder is hard right.

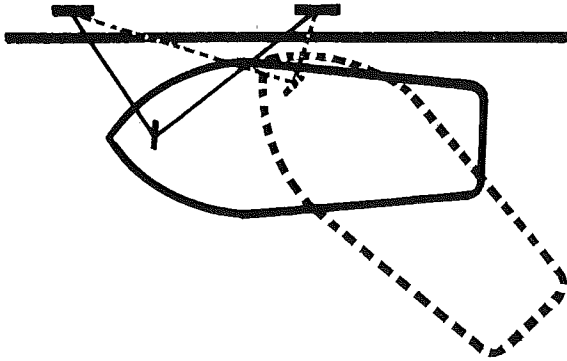
TWIN SCREW OPERATION

In order to practice the theory of twin screw operation as outlined, make a vessel from a flat piece of wood. Attach two wooden pegs (or nails) to the after corners as illustrated. By grasping a peg in each hand, the right hand being starboard engine, etc., maneuvers may be practiced by applying pressure as needed.

Most turns are made with twin screw vessels with the rudders amidships. Offsetting the rudders has a tendency to interfere with the propeller's stream and nullify the effect. Some twin screw vessels are made with the rudders offset from the propeller stream and are difficult to operate in close quarters in any manner except on engines alone.



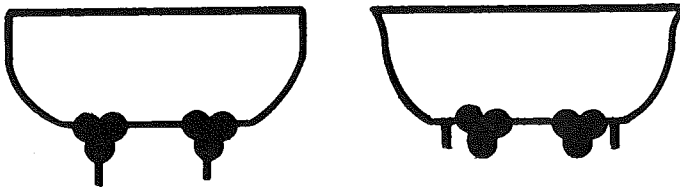
The bow will turn in the direction of the engine that is reversed. Thus, with port engine ahead and starboard engine reversed, the bow will swing to starboard. In making tight turns, remember that the boat goes more easily ahead and that it may be necessary to add a few turns to the engine that is reversed. Practice maneuvering with your model. It soon becomes apparent that this boat is much more easily handled in close quarters than the single screw job that requires way on in order to turn.



Loss of one engine on a twin screw vessel creates problems.

As the thrust is on a "corner," you will find that either forward or reverse will push or pull in the same direction. Lines become a necessity in making landings.

Here, with starboard engine only, bow is put to the dock and either a bowline or after bow spring put ashore. Natural tendency of the thrust will put stern against the dock. Landings will be easier if boat is landed on the side of the operating engine.



Most twin engine craft have the rudders directly behind the propellers. These react more favorably to rudder placement, and single engine landings are easier with them. However, some craft have their rudders outboard of the propeller stream, most notably the Air-Sea Rescue craft of the "Q" series. These rudders are not affected by the propeller stream and way is needed for rudder response. This can be corrected somewhat by enlarging the rudders, but extreme care is required in any case when an engine is lost to use.

