# Chapter 2
# Watermanship And Safety

## WATERMANSHIP

Watermanship is defined as the art of handling a boat or raft afloat. Although the basics of watermanship can be explained in this manual, watermanship skills can only be attained by extensive training under varied conditions. This section provides those personnel who operate or supervise the operation of watercraft with applicable navigation rules, and gives an appreciation of some of the forces which act upon those craft under different river conditions.

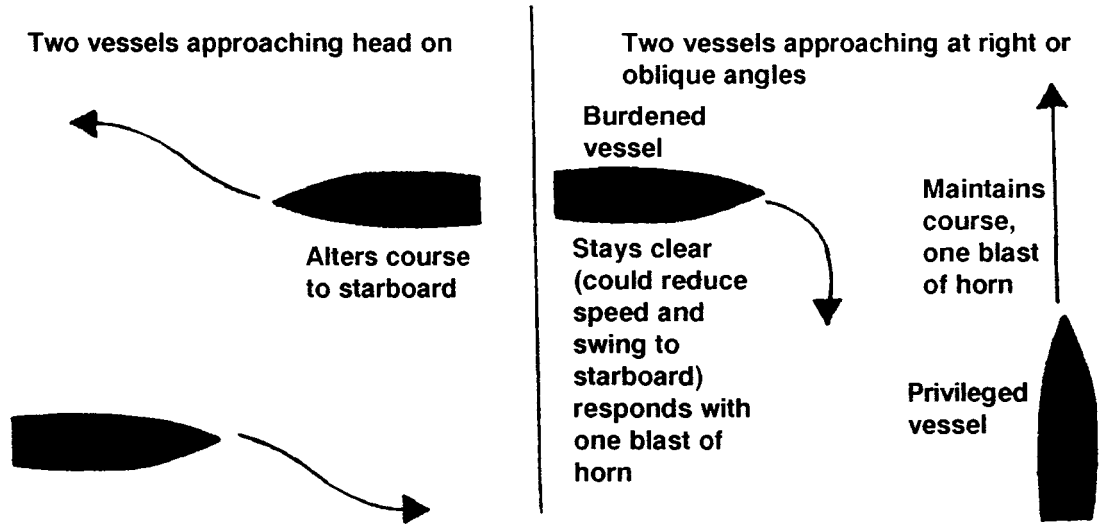
### Navigation Rules

It is the duty of the commander of any craft to avoid collisions at all times. Navigation rules are established to provide for the safe operation of ships at sea or ships and boats in inland waters. They apply to all vessels except those which are anchored, aground, or made fast to the shore.

All operators should be familiar with the following rules:

1. Maintain a reasonable speed when operating among other craft.
2. Attempt to keep to the right (starboard) side of any channel.
3. By law, most vessels will display at least four lights:
   - *white masthead light*
   - *green starboard light*
   - *red port light*
   - *white stem (rear) light*
4. The following whistle or horn blasts are considered standard
   **ONE** blast: "I am altering my course to the right (starboard)"
   **TWO** blasts: "I am altering my course to the left (port)"
   **THREE** blasts: "I am going astern (to the rear)"
   **ONE** long and **FOUR** short blasts "I am experiencing a breakdown or am out of control"
5. When two vessels are approaching each other head on, or nearly head on, each vessel should swing to the right (starboard). Always attempt to pass left side (port) to left side (port). Both vessels give one blast of the horn or whistle.
6. When two vessels are approaching each other at right angles or oblique angles, the vessel which has the other on the left (port) side is considered to be the PRIVILEGED vessel and will maintain course. The second vessel which has the other on the right (starboard) side is considered to be the BURDENED vessel and must keep out of the way. The PRIVILEGED vessel shall give one blast of the horn or whistle, and the BURDENED vessel shall respond with one blast.
7. If for some reason two vessels are on a collision course and it seems more suitable

*Rules of the road*



to pass right side (starboard) to right side (starboard), then the PRIVILEGED vessel shall swing to the left (port) and give two blasts of the horn. The signal shall be answered with two blasts from the BURDENED vessel which shall also swing to the left (port).

8. When one vessel is overtaking another vessel headed in the same direction, she shall ask permission of the slower boat to pass either side by signaling one blast for starboard, or two blasts for port. The overtaken boat shall give permission by answering with the same signal. If for some reason permission cannot be given, the overtaken boat shall answer by giving the danger signal (four or more short blasts).
9. Powered craft always give way to sail craft.
10. All craft will give way to a vessel that is restricted in its ability to maneuver.
11. During tactical operations—

- Craft proceeding across a river in the direction of the enemy have right of way.
- Returning craft must always give way.
- Boats and tugs will give way to all rafts and amphibians. Power boats will give way to boats that are paddled. When in doubt, however, the smaller craft must give way to the larger.

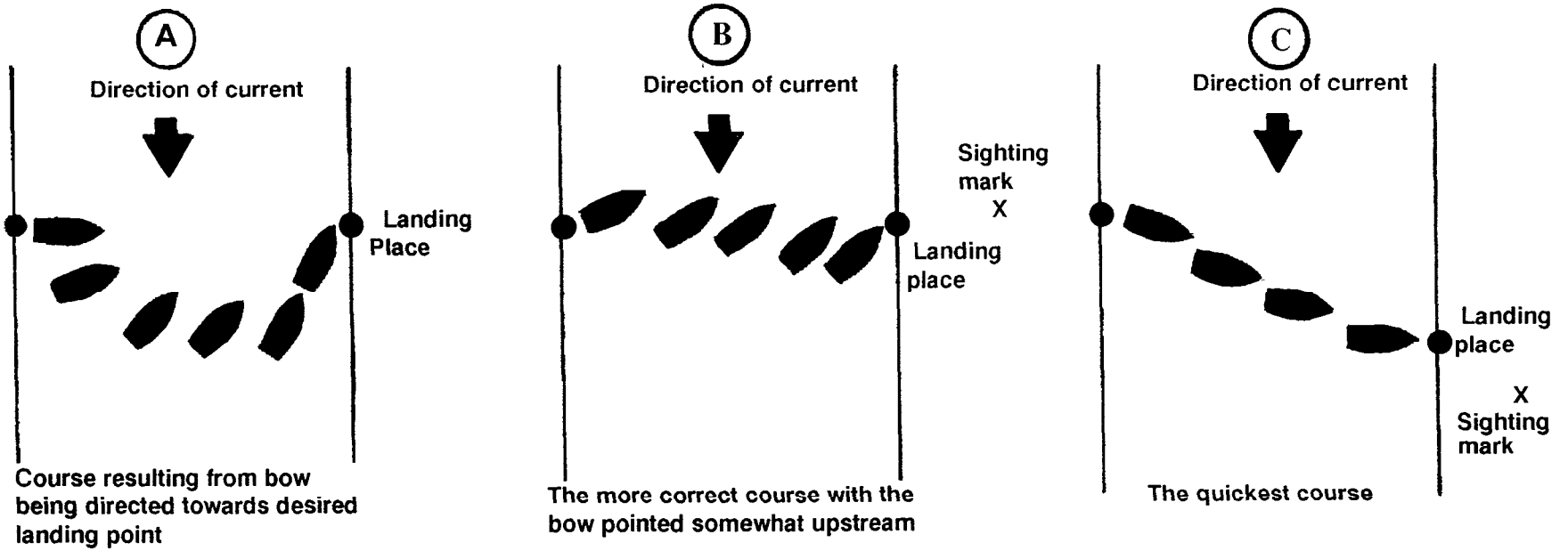
## Handling of Boats

The movement of a craft on the water is affected by the speed and direction of the current, the strength and direction of the wind, and the capabilities of the craft's system of propulsion. Of the three, the boat commander can only control the power of the boat propulsion. The commander must exercise judgment with regard to the effects of wind and current on the craft to obtain the greatest advantage or least degree of obstruction.

### Current

Consider first a straight stretch of river as shown below. Note in **A** that when the boat is steered from the start so that the bow is pointing continuously to the landing place, it will be

*Crossing a straight stretch of river*



swept downstream by the current and the course will arc as shown. The last part of the trip, in this case, must be made almost totally against the current.

A better method of crossing this river is with the bow of the boat pointing somewhat upstream of the landing place so that the boat's course is as shown in **B.** This course is best maintained by identifying two sighting marks on the far shore, and keeping in line with those marks.

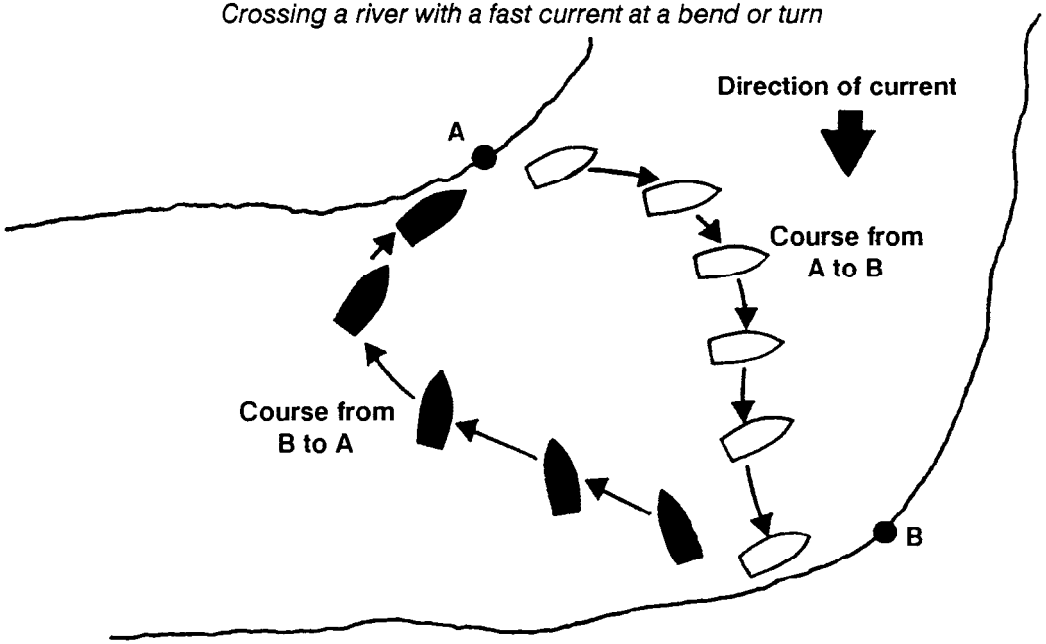
If it is necessary to cross the river as quickly as possible and a choice of launching sites is permitted, launch the boat upstream of the landing place and then across at right angles to the current as shown in **C.**

Consider the more difficult problem of crossing a fast flowing river at a bend or turn. The current in this case is usually greatest near the bank on the outside of the bend. Quite often a reversal of current will be encountered near the bank on the inside of the bend. When crossing from the inside of the bend, it may be best to first gain ground upstream by keeping close inshore where the current is slack and then to go straight across to the other bank, swinging at the last moment to come alongside the far bank against the current.

## Wind

The effect of the wind on a watercraft is directly proportional to the surface area of the craft and that of the load that is exposed to the wind. Since this exposed area changes as the craft's course changes, and since the strength of the wind is rarely constant, the effect of the wind will vary continually. It is the raft commander, more than the boat commander, who will be most affected since the surface area of a boat and the occupants exposed to the wind is usually small.

*Crossing a river with a fast current at a bend or turn*




## Propulsion

Inexperienced boat operators must first understand that boats do not react in the same manner as a car. All movements take additional time since the grip which is maintained between the skin of the boat and the water is not nearly as strong as that which exists between the tires of a car and the road. The heavier the boat, the longer the boat's reaction time.

Generally, the faster a boat moves through the water, the easier it is to control. When going downstream, the speed of the boat relative to the banks can give a false impression of speed through the water. Unless the craft commander remembers this, there is a temptation to reduce the power output of the boat's engine/motor with a consequent loss of control. A downstream crossing can best be made by heading the craft upstream and keeping her moving forward relative to the water while allowing the current to carry her downstream relative to the banks. By using this method, control of the boat can be maintained at all times.

## Rafting Operations

The principles regarding the effects of wind and currents on boats also hold true during rafting operations. A raft moves and steers differently from a boat for two reasons. First, it is usually heavier and therefore takes longer to start and stop. Secondly, partly because of the weight and shape, it has a much greater reluctance to start turning, and once turning, to stop, A boat will tend to move straight ahead under power. A raft, on the other hand, may continually tend to rotate or swing unless the raft commander is constantly alert to such movements.

### Attaching boats to rafts

Bridge erection boats (BEBs) may be used to propel rafts in support of river crossing operations. The connection of the boat to a raft is the first major step in proper operation of the raft. Rafts are normally pushed rather than pulled. This permits a shorter turning radius with positive backing of the raft and the direct application of steering power to the raft. In large bodies of rough water it may be more advantageous to tow rather than push the raft. Some general rules for the rigging of boats to rafts are as follows:

1. Boats are in forward gear at idling speed when lines are rigged.
2. Wet all lines prior to use to minimize stretching.
3. Steering lines are most important in controlling a raft. They are made of the newest and best rope available and of sufficient size. Normally, 7/8-inch diameter polypropylene rope is used. This rope is durable and easy to handle and will float if dropped overboard. Steering lines must be rigged as tight as possible to maintain the correct centerline alignment of the boat and raft.

**Warning!**

**Never use steel cables as steering line. During an emergency the operator may be unable to cut steel cable, resulting in loss of life and equipment.**

4. The exact positioning of boats will depend upon the rafting method selected. More precise guidance for the exact methods of tying boats to specific rafts is given in the rafting section for each particular type of floating equipment.

### Loading and unloading of rafts

The loading and unloading of rafts can be the most difficult part of a rafting operation. The approaches to the raft may be slippery or somewhat steep. Deck space is limited and there is a danger of the loaded vehicle overshooting or driving off the side of the raft's roadway. Often, the raft will tilt during loading with the possibility of the inshore boat and bay grounding, or even sinking.

Prior to loading vehicles onto a raft, the raft commander must ensure that —

- Vehicle dimensions (length, width and classification) do not exceed the capabilities of the raft.
- The raft is secured to the shore with tag lines or approach guys. These lines help to prevent the raft from moving away from the shore, or swinging left or right when vehicles are loaded. The thrust of the boats will also be required to prevent raft movement during loading.
- All crew members are in position and are prepared to load the raft.
- The operators of the loaded vehicles understand the hand signals which will be used to control the loading of the raft. Some signals which might be used are shown on page 9.

Normally, position vehicles on rafts so that the center of gravity of the vehicle is slightly to the downstream side of the raft centerline, and slightly to the rear (shore side) of the raft. This maximizes the raft's freeboard. Freeboard is the distance from the waterline to the top rim of the raft or boat. Inadequate freeboard will cause the raft to swamp once the raft is underway.

When loading more than one vehicle on a raft, normally load the heavier vehicle last (toward the rear of the raft). Ensure that the overall center of gravity of the load is slightly to the downstream side of the raft centerline, and to the rear of the raft. Once vehicles are positioned, place chock blocks in front of and behind the wheels to prevent vehicle movement in the event of any sudden raft movement.

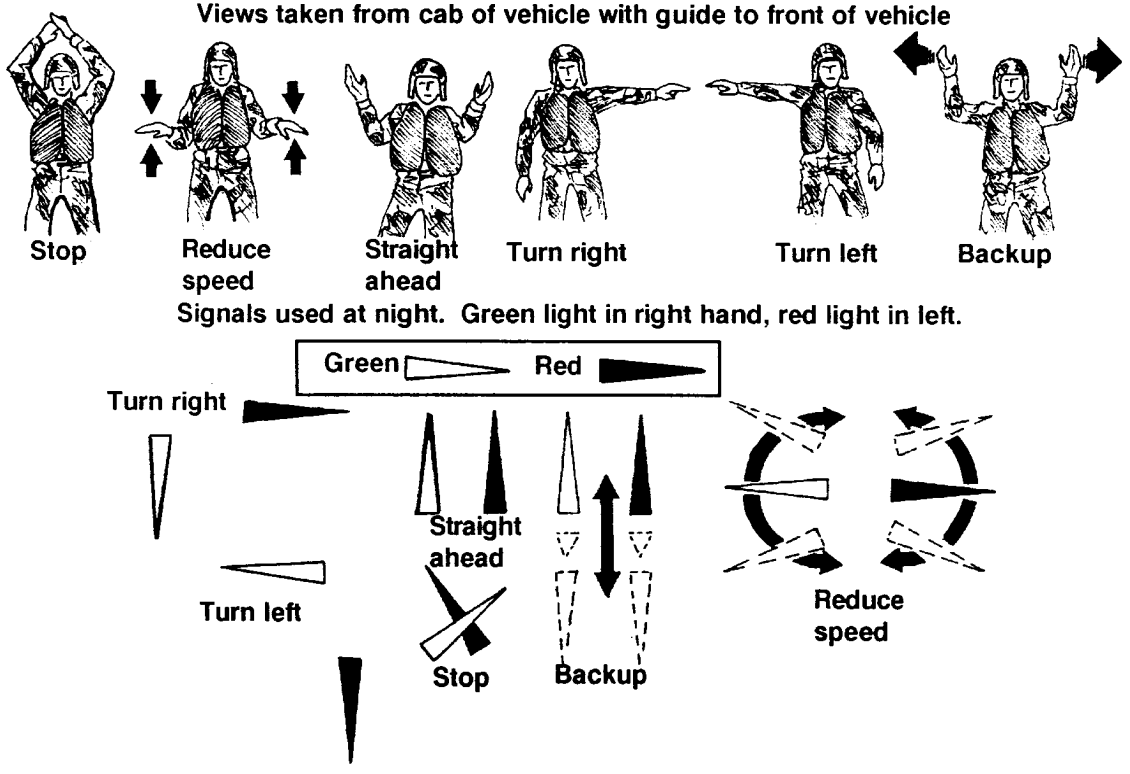
### Methods of rafting

All US heavy floating rafts are propelled using BEBs. There are two methods of attaching these boats to rafts prior to rafting operations: *conventional* and *longitudinal*.

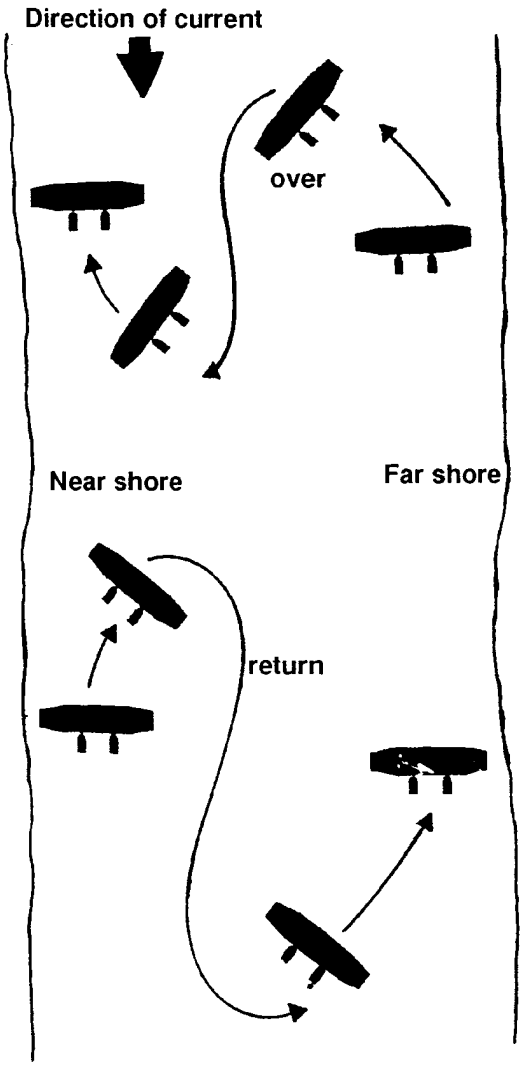
**Conventional.** When rafting in a conventional configuration, all boats are tied off to the downstream side of the raft, perpendicular to the raft's roadway. The conventional method is always used to propel M4T6, Class 60, and light tactical rafts. Ribbon rafts may also use this method. When leaving shore, the raft should be backed out at a slight angle with the bow of the boat upstream. When there is enough room to turn, steer riverward and move ahead. In crossing a river, head the raft into the current at an angle so the force of the current does not cause the raft to drift downstream. The angle at which the raft is propelled will vary with the velocity of the river. Guidelines to be followed when physically attaching boats to rafts are provided in the appropriate rafting section for each type of floating equipment.

**Longitudinal.** When rafting in a longitudinal configuration, one boat is tied off to each side of the raft, parallel to the raft's roadway. Use of this method is normally limited to ribbon rafts. Because the longitudinal method of rafting

*Visual signals for loading rafts*




*Conventional rafting*



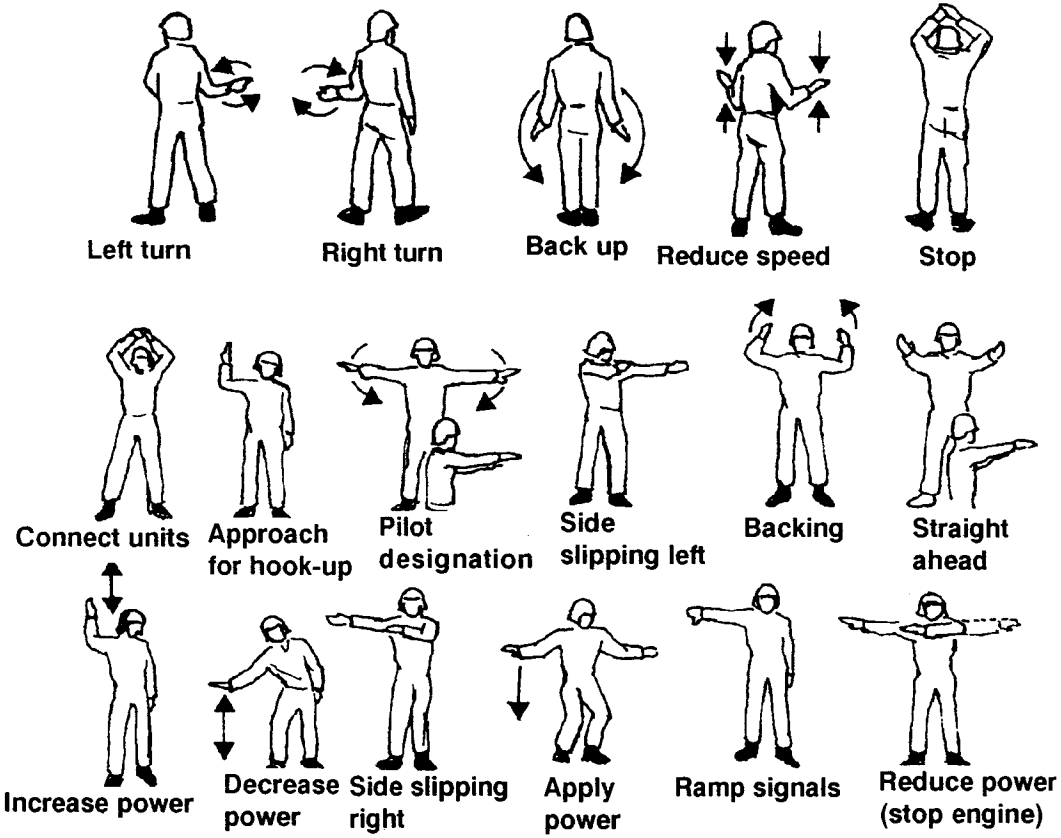
generally allows for faster, more efficient operation, longitudinal rafting is normally the preferred method when using ribbon equipment. Some factors which may influence the decision to raft longitudinally or conventionally when propelling ribbon rafts are provided in Chapter 4.

**Note.** Longitudinal rafting cannot be used when the river current in the loading and unloading areas exceeds a velocity of 5 FPS.

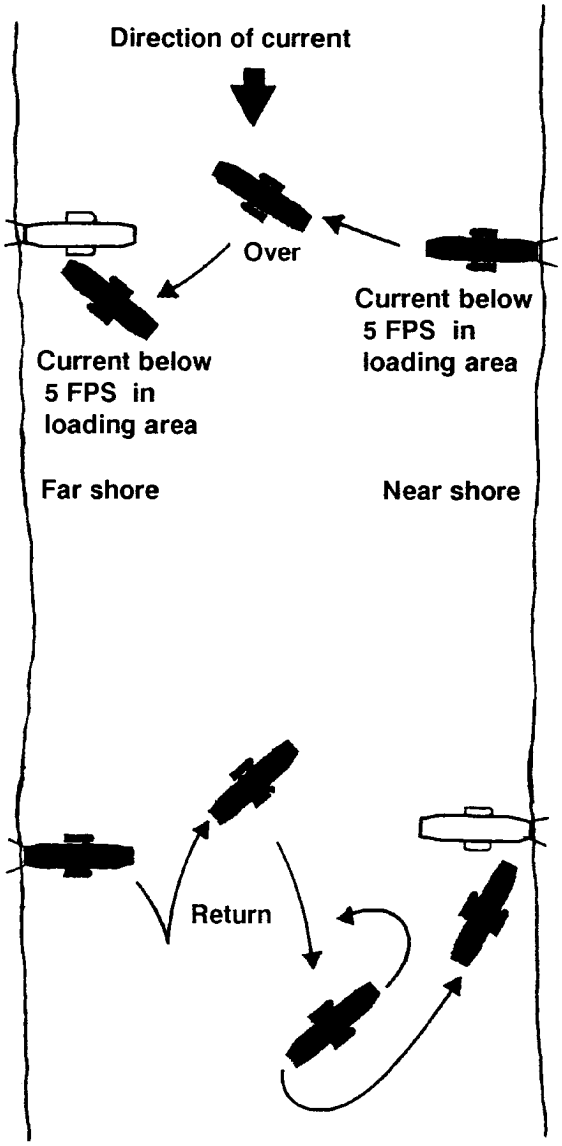
### Controlling raft movements

It is impossible for the boat operators to independently control the direction and speed of raft movements. Because of this, the raft commander must accomplish this task. In order to give directions to the boat operators, the raft commander should be located in such a position that the river and shoreline can be observed in the direction of movement, and where the boat operators can clearly see all signals given. (See below.) These signals apply whether

*Standard rafting signals*




*Longitudinal rafting*



boats are used alone or in combination. It is critical that the raft commander understand not only rafting operations, but also the principles of maneuvering the BEBs.

**Rafting operations under special conditions**

**River bends or near obstructions.** When operating a raft or any type of boat in swift water, it is essential to understand the flow of water in an open or natural channel. The current flow in a curved channel causes the water to pile up to the outside of the bend, depending upon the sharpness of the curve. This causes the river to run much faster on the outside of the bend than on the inside. The composition of the riverbed may be such that erosion occurs, forming sandbars and shelves. Such sandbars or shelves may be seen from a distance by observing the surface action of the water. The peculiarities of such surface action can be learned only by actual observation and experience. In some riverbeds, sandbars are found in unexpected places having been formed by large rocks, trees, or other debris which have become freed to the riverbed. Frequently, there are whirlpools just above and below such obstructions. These whirlpools are exceptionally dangerous to the operation of rafts, especially when rafts are lightly powered or where sufficient steering power may not be available. When such a current or obstruction is encountered, it is generally best to stay in the swiftest part of the current and proceed with caution until the direction of the flow of the current is determined and the danger point is passed. If the direction of the raft is changed, it must be done with caution since the steering power must be positive and powerful when the direction of the raft changes from the direction of the current. Turns in such a restricted channel should be attempted only when absolutely necessary, and then, only by experienced operators.

**Downstream through a channel.** The speed of the raft together with the speed of the current causes abrupt changes of direction when traveling through a narrow, swift channel. There is little time for the raft commander to react and control the raft. A mistake in estimating speed downstream can seldom be corrected as most boats do not have the power to stop a loaded raft from grounding in a high velocity current. Due to the speed of the raft and narrow width of channels, there is frequently insufficient room to swing the raft. If a corner of the raft grounds, the raft will turn crosswise to the current and often capsize. It is necessary that the raft commander decide upon possible courses of action through the entire channel prior to initial entry. Once the raft has entered, there is little choice. The dependability of equipment and the care with which the boat has been rigged to the raft are of utmost importance when rafting in swift streams and narrow channels.

**Grounding.** An experienced operator can control the grounding of a boat or raft in swift currents. If a boat or raft is going upstream, the throttle/scoops must be adjusted immediately to hold the boat or raft steady and keep it from drifting downstream thus preventing further damage to the raft or boat. Check damage immediately and, if possible, make repairs. The extent of the obstruction is then determined and a plan for removal of the raft or boat must be decided upon. It may be necessary to rig lines to assist in pulling the raft from an obstacle. If a raft is grounded high, it may be possible to anchor it to the obstruction, release a boat, and allow the boat to drop anchors downstream. The boat could then be rerigged to the raft and the engines used to pull the raft free. Additional boats or winches rigged from vehicles on the banks may be used to assist in freeing grounded boats or rafts.

**Operation above obstacles.** When operating rafts above bridges, dams, mine booms, or other obstructions extending across a river, sufficient room must be allowed for maneuvering and positive action in the event of an emergency. In fast water (currents greater than 5 FPS), light rafts and boats should remain 400 to 900 feet above any obstacle. Heavy rafts should allow at least 1,800 feet as a minimum safe distance.

## SAFETY

Safety is always a primary consideration when soldiers are required to work near or over the water. Because of the variety of missions that can be performed around the water and because no two rivers are exactly alike, it is difficult to prescribe safety guidelines which can be applied to all, or even most, situations. The Department of the Army has therefore instructed that all subordinate commands establish a standard operating procedure (SOP) for water safety. Army Regulation (AR) 385-15 requires that this SOP be based upon the missions required of each respective unit, and on the environmental conditions under which each unit is expected to perform the mission. Some considerations to assist in the formulation of an SOP are provided in subsequent paragraphs.

## Personnel

Personnel required to work near or around the water should be capable of meeting the minimum swimming standards in FM 21-20 and should periodically receive drownproofing training to ensure these standards are maintained. In situations where nonswimmers must work over the water, these personnel should be identified beforehand and paired with a "buddy" who is a strong swimmer.

All personnel required to work over the water should be provided with a life jacket or life vest. Personnel should be inspected prior to waterborne operations to ensure that the vests are properly worn and fitted.

Personnel working near or over the water should unblouse the trousers from their boots. Overshoes should not be worn when working over the water.

All personnel should receive a safety briefing prior to the conduct of waterborne operations. This briefing should explain to the soldiers any hazards which might exist around the work site, such as particularly swift currents, shoals, sandbars, or other obstructions in the water, and any dangerous weather conditions such as high winds or low visibility. The briefing can also be used to train or retrain soldiers in skills such as the emergency/man overboard drills, watercraft discipline, methods of signaling the safety boat in an emergency, and first aid.

The commander should designate a safety officer who is responsible for the conduct of operations near or over the water. This safety officer's primary responsibilities are to ensure that the safety SOP is adequate, that all unit personnel are aware of the contents of the SOP, and to ensure that personnel follow the SOP during all operations.

*Table 4. Standard equipment on a safety boat*

| |
|---|
| **Anchor and line** |
| **Boat hook** |
| **Life bouy and rope** |
| **First aid kit** |
| **Blankets (these may be held on the bank)** |
| **Radio** |
| **Powerful source of white light (searchlight, hand torch, or flares)** |
| **Navigation lights** |
| **Note.** This list should be adapted to suit site conditions. |

## Safety Boats

When conducting operations over the water, the commander should always consider designating one of the watercraft as a safety boat. This boat must be large enough and powerful enough to cope with the conditions at the work site. The safety boat should be crewed by at least two persons who are qualified and experienced helmsmen. Both crew members should be trained in the correct methods of recovering personnel from the water, basic first aid artificial respiration, and correct radio procedures. At least one of the members of the safetv boat crew must be a strong swimmer (preferably trained in lifesaving techniques). The safety boat should be equipped, as a minimum, with the items listed in Table 4. The designated safety boat should perform no duties other than to standby, usually downstream from, but within a safe distance of the work site. The safety boat may also be required to warn off civilian craft or other vessels which might create a hazard or might otherwise interfere with the conduct of the operation. In situations where the waterway is extremely busy, when the current velocity is swift, or where the work parties are quite large or spread over a great distance, the commander might be required to designate more than one safety boat for each work site.