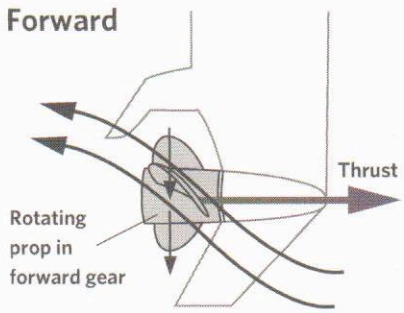
Propulsion: Prop or Jet?

Propulsion systems generally consist of two major components: an engine that produces power and a drive unit that propels the boat. There are two essential types of powerboat drive units:

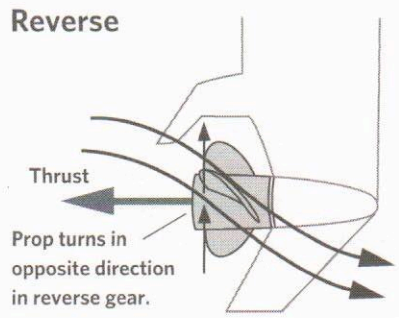
- a propeller (prop)
- a water jet (jet drive)

How a Propeller Works

A rotating propeller produces thrust that moves the boat. When an engine is in forward gear, the thrust from the rotating propeller drives the boat forward. When the gear is shifted into reverse, the propeller turns in the opposite direction driving the boat backward. Because propeller blades are optimized for forward thrust, their performance in reverse is drastically reduced.

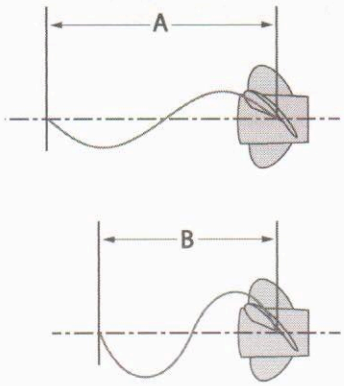


Thrust generated from a rotating propeller drives a boat forward.



A propeller rotating in the opposite direction drives a boat backward.

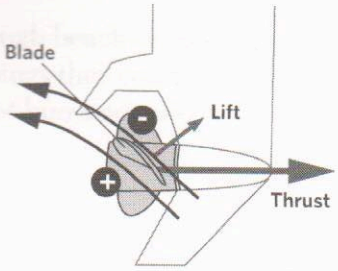
When viewed from behind, if a propeller generates forward thrust by rotating in a clockwise direction, it is defined as a right-hand propeller. If it rotated in a counterclockwise direction in forward gear, it would be left-handed. Whether a propeller is right- or left-handed will become important when "prop walk" is discussed in Chapter 3.



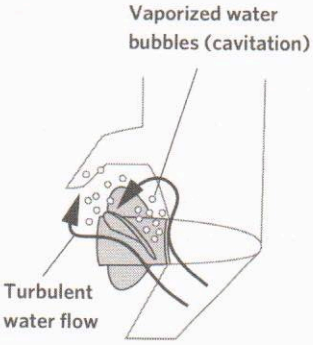
A low-pitch propeller (B) moves forward a smaller distance than a high-pitch propeller (A). The higher the pitch number, the greater the pitch (distance traveled per revolution).

Propeller size is defined by its *diameter* and *pitch*, and these factors have an important effect on the performance of a boat. Pitch is the distance that a propeller would move forward in a solid material in one full rotation. For example, a propeller with a 17-inch pitch would advance 17 inches. Since water is a fluid, the propeller would actually travel a distance less than 17 inches. Larger diameter propellers with less pitch that rotate at lower rpm (revolutions per minute) are used for slow-speed boats or towing vessels, while smaller propellers with higher pitch operating at higher rpm are used for high-speed boats. A wrong propeller size may result in engine overheating and/or a boat not reaching its designed speed.

Water flowing over the surfaces of a propeller blade produces a higher pressure on one side than the other. This pressure difference generates lift which results in thrust as well as a sideways force (torque). If pressure on the low-pressure side of the blades gets too low, bubbles of vaporized water (low temperature steam) will form on the blades. This bubbling action disrupts the water flow, causing the blades to lose lift and thrust and the engine to speed up. This phenomenon is called cavitation. When it occurs, reduce throttle and allow the propeller to "re-grip" the water. Cavitation can happen when too much throttle is applied too quickly, or if the propeller is damaged or not the right size.

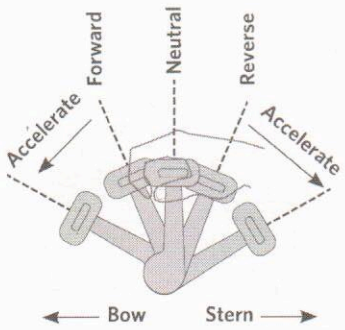


As a propeller rotates through the water, the pressure on one side of the blades is higher (+) than the other (-), which generates lift and thrust.



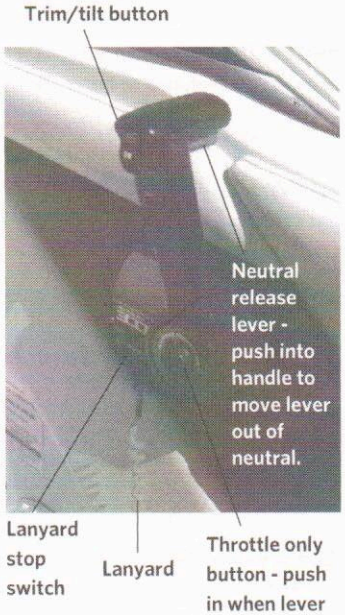
Cavitation causes the blades to lose lift and thrust.

How a Combined Throttle/ Gearshift Lever Works



Engine Controls

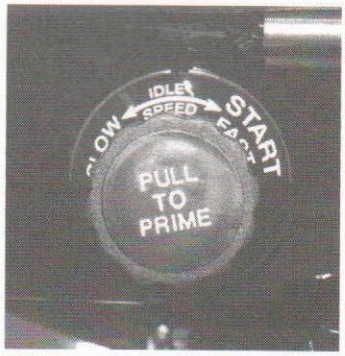
Remote throttle and gearshift controls are located at the steering stations, and the most common type for propeller-driven watercraft is the dual-function control with a single lever that combines throttle (speed) and gearshift (forward, neutral and reverse gears). It usually has a feature that will disengage the gearshift to allow you to increase the throttle when starting or warming up the engine. Another feature of many lever controls is not allowing the engine to be started unless the gearshift is in neutral. If nothing happens when the ignition key is turned on, check to make sure the lever is in the neutral position. When shifting from forward to reverse or reverse to forward, pause briefly in neutral (do a 1-2-3 count) to prevent possible damage to the gears.



Trim and Tilt Control

On stern drives and many outboard motors (typically above 25 hp) and jet drives, the angle of the drive unit to the boat can be changed (trimmed) while the boat is underway to achieve better performance. This is usually done by hydraulic rams, which are activated by a toggle button normally located on the throttle control lever. These hydraulic rams can also be used to tilt the drive out of the water when leaving the boat in the water or hauling out for storage or trailering. When operating in the trim range, the drive unit will move slowly, but once beyond the maximum UP trim position, the hydraulic speed will suddenly increase until the drive reaches its maximum tilt position. For more information on trim and how it affects a powerboat, see Chapter 3.

Twist-grip throttle and gearshift. For outboards with a separate gearshift lever on the side of the motor, the twist grip throttle will usually have a shift position marked on it to which the throttle should be set before shifting the lever into forward, neutral or reverse so as to prevent serious damage to the outboard.



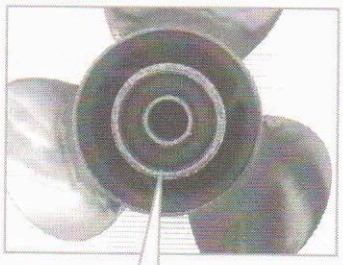
This primer pump knob works differently from the traditional choke.

Shear pins and safety sleeves. All outboards have a designed weak link between the propeller and the propeller shaft to protect the engine and drive train if the propeller hits an object. Most outboards use a neoprene sleeve (neoprene hub) that is bonded to the propeller hub. When impact occurs, the bonding is broken, which protects the outboard. Although the bond has failed, there is usually enough friction in the neoprene hub to allow the engine to turn the propeller very slowly, often enough to return to safety. The propeller must then be removed and repaired. Smaller outboards may use a soft metal pin called a shear pin, which will break upon impact. Once the pin is sheared the propeller will no longer turn and it must be removed to replace the shear pin.


A shear pin breaks upon impact with the propeller, protecting the engine and the drive train from damage.

Outboard Inspection

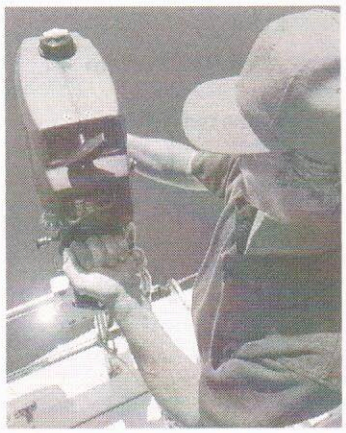
- ▶ Outboard controls operate smoothly.
- ▶ Propeller blades, neoprene sleeve or shear pin are intact.
- ▶ Cooling water intake is clear.
- ▶ Oil level (applies to four-stroke or two-stroke with separate oil tank); add oil if indicated.
- ▶ Fuel tank level; add if indicated.
- ▶ Condition of fuel line (no cracks or sponginess) and connections.
- ▶ Any leaks in fuel system or gasoline odor in bilges.
- ▶ Condition of battery cables (no cracks, abrasion or frayed wire) and battery (no corrosion at terminals and proper fluid level).
- ▶ Cables securely fastened to battery.
- ▶ Condition of lanyard with one end securely connected to the lanyard stop switch.
- ▶ Attachment of safety chain, wire or line to boat and motor (applies to outboards fastened to the transom with screw clamps).


Most modern outboards use a neoprene sleeve bonded to the propeller hub that breaks upon impact with the propeller.

Outboard Starting Procedure

For best results, follow the procedures described in manufacturer's manual.

1. Complete the inspection.
2. Turn battery switch to correct setting.
3. Lower outboard into down position.
4. Pump the fuel primer bulb until it is firm (if using a portable or integral tank, open its air vent before pumping the bulb). Also pump oil bulb, if applicable.

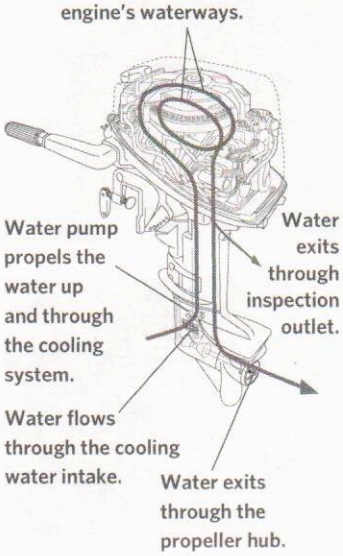


Retrieval line connecting motor and boat prevents motor from sinking to bottom if you lose your grip.

5. Center outboard motor.
6. Put gearshift in neutral and throttle to start position.
7. If starting manually, activate the primer pump or pull the choke out all the way, then pull the starter cord until the engine starts. When using the cord remove any slack in it before pulling; don't yank on it or let it snap back on the rewind. On an outboard with a choke, once the engine fires, push choke in all the way (unless it is very cold). If after the third pull on the starter rope, the engine hasn't started, push the choke in halfway and pull the rope again. If using an electric starter, activate primer pump by holding ignition key in while turning to ON position. It may be necessary to cycle the pump two or three times before engine fires. NOTE: if starting a warm engine, do not use primer pump or choke.
8. Adjust throttle to steady idle.
9. Check for a stream of water flowing from the inspection outlet for cooling water discharge. Important: If there is no water, turn off the outboard motor immediately to prevent damage from overheating.
10. Check gauges, if applicable. NOTE: If engine won't start and there is a smell of gasoline, wait several minutes before attempting to start it again.

Lifting an outboard. A small outboard motor of 20 horsepower or less can usually be lifted and attached to a boat without too much effort. Although this is best done on land, when doing it on the water, tie the boat so it won't move around during the transfer. Have someone pass the outboard to a person in the boat. As a precaution against accidentally losing the motor overboard during the transfer, tie a retrieval line to the motor and fasten it to the dock or boat.

Outboard Cooling System



Outboard Cooling System

Most outboard motors are water cooled. The illustration tracks the flow of cooling water which enters through the cooling water intake, and is pushed up the water feed tube by a water pump and then circulates through waterways in the engine block. The water then flows back down the leg where it mixes with the exhaust gases and exits through the propeller hub. During its journey down the leg, a bit of the cooling water is diverted through the inspection outlet for cooling water discharge to let you know that the cooling system is working. Outboards smaller than five horsepower will usually have their exhaust outlet located just above the propeller instead of through the propeller hub.

3. *Boathandling Concepts*

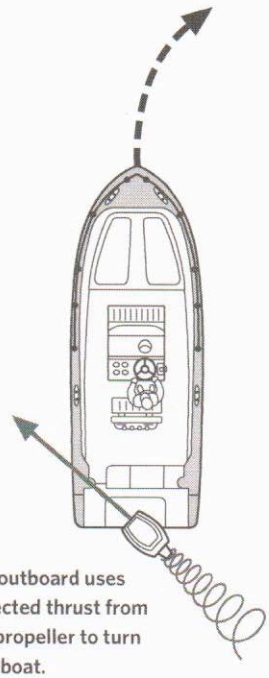
KEY CONCEPTS

- ▶ Steering with directed thrust
- ▶ Steering with a rudder
- ▶ Prop walk
- ▶ Wheel & tiller steering
- ▶ Boat's pivot point
- ▶ Windage
- ▶ Minimum control speed
- ▶ Balance & trim

Steering with Directed Thrust

All boats with outboard motors, stern drives and jet drives use the directed thrust of the propeller or jet to steer the boat. To generate directed thrust, the propeller has to be turning (in forward or reverse gear) or the jet drive has to be pumping water through it. If the engine or jet drive is in neutral, the boat will have minimal response to changes in steering.

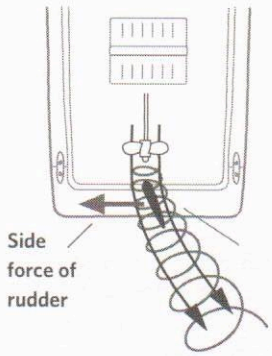
When the outboard motor is turned, the directed thrust from the propeller swings the stern (back end) of the boat, causing the boat to turn. To make a tighter turn, turn the outboard all the way to the side and increase the amount of thrust by increasing the throttle.



An outboard uses directed thrust from its propeller to turn the boat.

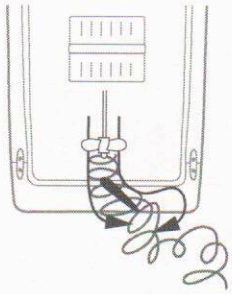
Steering with a Rudder

Boats with a "fixed" propeller drive use a rudder to produce a sideways force to turn the boat. Water must be flowing past the rudder to create this steering force. This flow is produced by the boat's motion through the water and by the propeller. As a boat moves faster, the steering ability of the rudder improves because the side force it generates increases as the speed of the water flow increases. To increase the effectiveness of a rudder in forward motion, it is normally placed behind the propeller to take advantage of the additional flow of water generated by the propeller (called prop wash). At very slow forward speeds you can use a burst of prop wash (by briefly increasing the throttle) to increase the flow of water passing the rudder, which increases the turning force. This is a technique often used when maneuvering at slow speeds in a confined area.

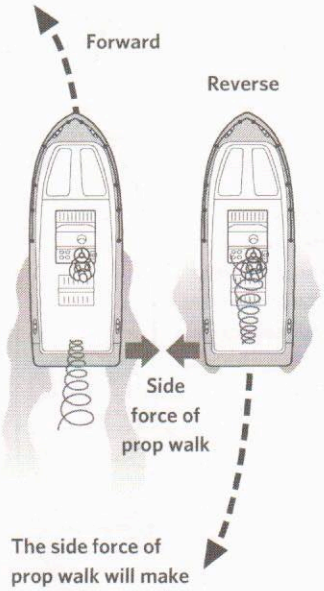


A boat with a fixed propeller uses a rudder to turn the boat.

When a rudder is turned, it creates greater water pressure on one side than the other. This pressure difference generates lift as a sideways force that is used to turn the boat. For a rudder to work most effectively, the water must flow past it smoothly. If the rudder is turned too far or too quickly, water flow around it will "stall" and steering control will be lost or adversely affected.



A rudder requires smooth water flow around it to function. Turning the rudder too sharply can stall flow and cause loss of steering.



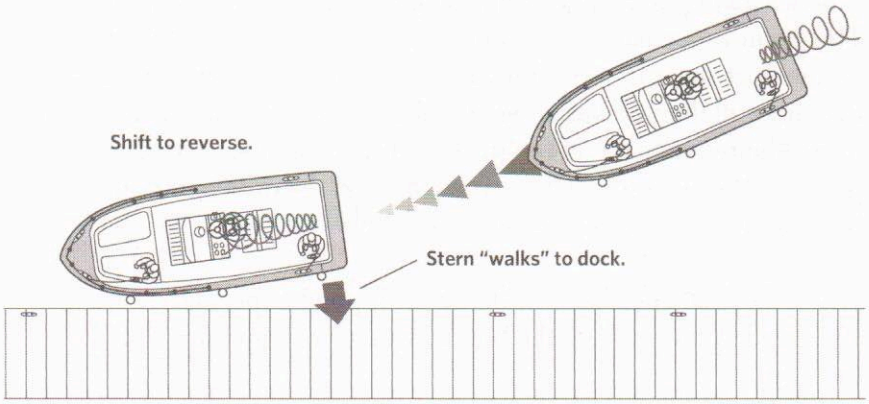
The side force of prop walk will make a boat turn slightly in forward and reverse.

Steering with Prop Walk (What is Prop Walk?)

Prop walk is a side force produced by the rotation of the propeller. This side force causes your boat to turn slightly rather than go in a straight line. Prop walk is most noticeable when the engine and propeller are operating in reverse on boats with a fixed propeller and rudder. A right-hand propeller in reverse "walks" the stern (back end) to port (left). A left-hand propeller will "walk" the stern to starboard (right). Increasing the throttle will increase the amount of prop walk, which will swing the stern even more.

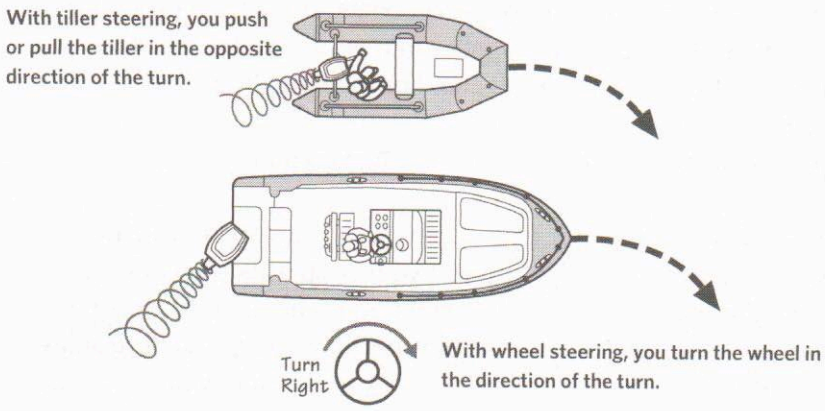
This tendency can be put to good use if you anticipate which way it will move your boat. You can test your prop walk direction by putting the boat in reverse while still tied to the dock. Center the wheel and compare the amount of water flow (wash) on both sides of the boat. The stern will move away from the side with the greatest flow when in reverse.

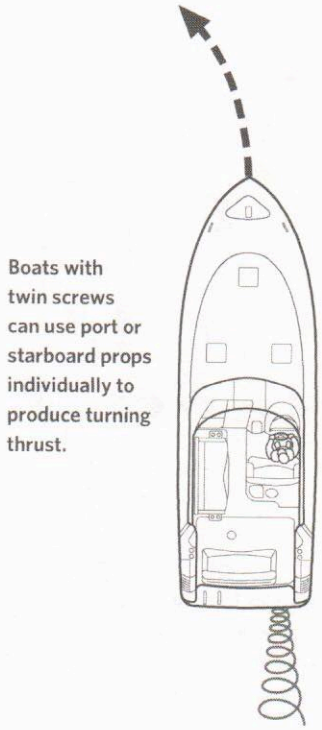
Prop walk can be used to advantage in docking when the propeller is operating in reverse gear. You will want to approach the dock along the side of your boat that "walks" toward the dock. As you reach the dock, reverse your engine and let the stern "walk" right alongside.



Using a Wheel to Steer

On boats equipped with wheel steering, turn the wheel in the direction you want to turn just as you would a car.





Using a Tiller to Steer

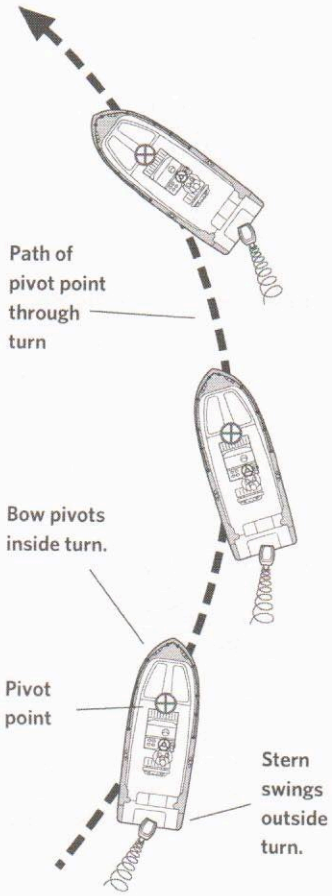
On boats equipped with tiller steering, move the tiller opposite to the direction you want to turn.

Pivot Point

A boat's pivot point is the point around which it appears to turn. This point is normally located from 25% to 40% aft from the bow. As the boat starts to move forward, the pivot point shifts slightly forward and then moves aft as speed increases. When a boat turns, the relationship of the turning thrust at the stern to the pivot point causes the bow to rotate toward the direction of the turn and the stern to swing away from it.

When the boat goes backward, the pivot point appears to move aft considerably, causing the bow to swing in a wider arc than the stem.

Many good drivers imagine they are steering just the pivot point. They visualize the path they wish their pivot point to take over the water and then steer the point along that path. When a boat makes a turn, the first part of the turn will be wider than the rest of the turn.

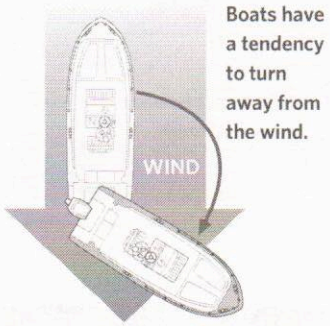


Wind Direction Clues
- smoke from a smokestack
- flags onshore
- boats on moorings (usually point into the wind unless being affected by current)
- ripples or waves
- wind on your face (boat has to be stopped)

Windage

Wind will have an important effect on almost all of your boathandling maneuvers, especially when you operate at lower speeds in moderate to strong wind conditions. The wind's impact also varies with the amount of the boat's surface area (windage) that the wind can push against. Boats with high topsides, cabins and flying bridges have greater windage than boats with lower profiles.

When drifting, the wind will usually cause the bow to "fall off" until the boat lies across the wind or even with the stern toward the wind. This tendency to turn away from the wind is an important consideration when holding a boat in position.



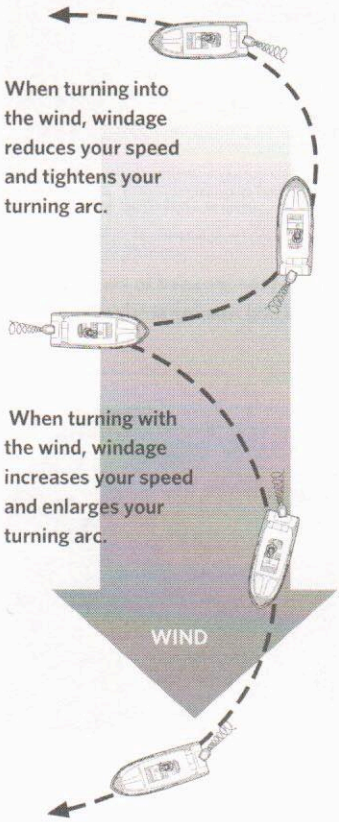
Boats have a tendency to turn away from the wind.

When turning into the wind, windage reduces your speed and tightens your turning arc. This can be beneficial when maneuvering in a confined area.

When turning with the wind, windage increases your speed and enlarges your turning arc.

Underwater Hull Shape

A boat's underwater hull shape will affect its steering characteristics. Boats with minimal underwater profile, such as soft inflatables, will tend to skid or sideslip along the surface of the water as they turn, thereby increasing the turning arc. Turning this type of boat in windy conditions in a confined area is a true boathandling challenge.



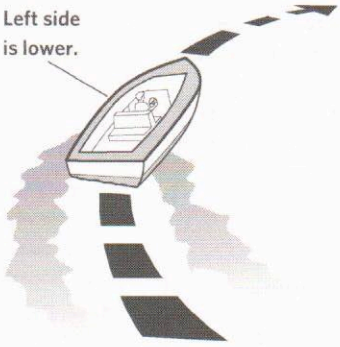
Minimum Control Speed

Minimum control speed (mcs) is the slowest speed at which you can operate and still maintain steering control. Typically, this is less than the speed produced when the engine is in gear and the throttle is set at idle rpm, and is accomplished by the use of intermittent power. With the throttle at idle rpm, shift from neutral to forward and back to neutral. This produces a short, gentle pulse of power to maintain steering control. Repeat this technique to keep the boat under control and moving slowly. Minimum control speed is used in many situations such as docking and operating in confined areas. It is shown in the illustrations by Joe Comeau (see page 30).

To make turns at minimum control speed, turn the wheel (helm) in the desired direction and shift into forward gear at idle rpm to start the turn, then back to neutral near the end of the turn. As a result of the directed thrust from the propeller (or increased water flow over the turned rudder), the boat will turn but not accelerate significantly. When using intermittent power to turn, avoid oversteering and using too much throttle to prevent loss of steering control.

Balance and Trim

Boat balance and trim affect not only boat speed and fuel consumption, but also steering. A boat that does not have a level balance from side to side will want to turn. When making tight, highspeed turns, a boat out of balance could lose steering control and possibly capsize. You can correct balance by repositioning the weight of your passengers or gear and adjusting the trim tabs.

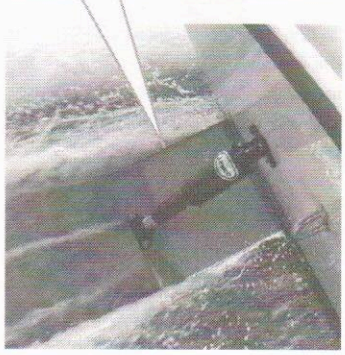


This boat is not balanced from side to side and will turn.

A boat with too much bow-down or bow-up trim will lose speed and is less responsive to steering. Too much bow-down trim may also bring the propeller too close to the water surface, causing it to ventilate and lose thrust. When this happens there will be a sudden increase in engine rpm and a sudden slowing in the boat.

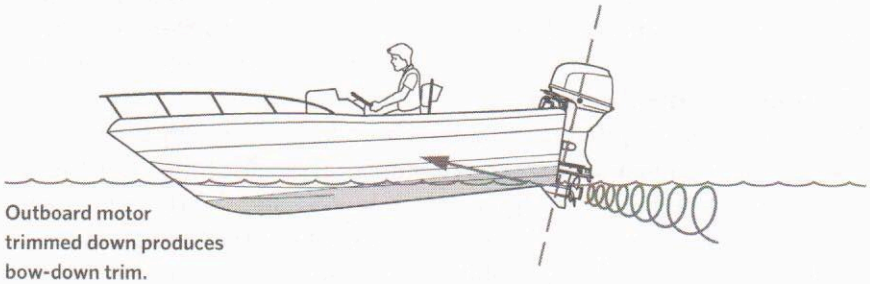
A boat's fore and aft trim can be controlled by adjusting the up/down trim angle of the propeller or by adjusting trim tabs. A hydraulic trim control is used on larger outboards to adjust propeller angle. Smaller outboards can adjust it by moving a pin in the tilt control bracket.

Trim tabs are used to keep boat level and running straight.

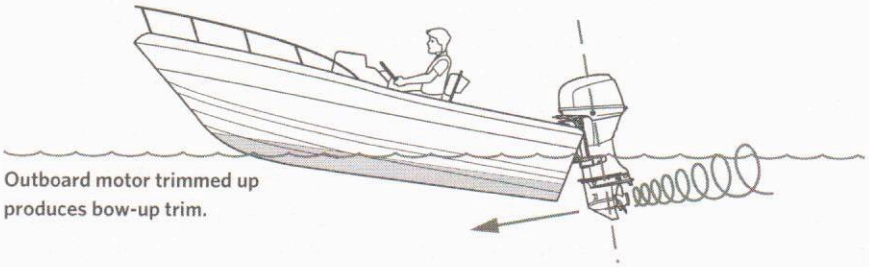


Speed Modes

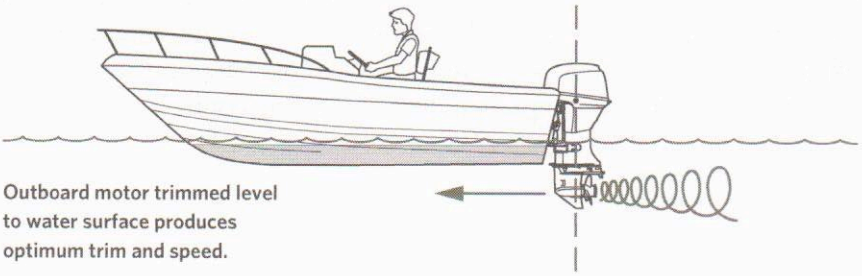
When a boat is moving, it will be operating in one of three speed ranges or speed modes:



Outboard motor trimmed down produces bow-down trim.



Outboard motor trimmed up produces bow-up trim.



Outboard motor trimmed level to water surface produces optimum trim and speed.

In displacement mode, a boat glides smoothly in level trim with minimum wake.

In semi-displacement mode, the boat labors behind a large bow wave in bow-up trim. Maximum wake is produced.

In planing mode, boat rides level on top of water with less wake.

Displacement Speeds. The boat rides through the water at almost level trim and is easy to steer and maneuver. As it approaches the semi-displacement mode, the stern squats and the bow rises as the boat's bow wave increases in size.

Semi-displacement Speeds. Most boats operate very inefficiently with high resistance at this speed. They have bow-high trim with the bow riding up the bow wave, producing maximum wave making (wake). They are sluggish to steer and maneuver. It requires a lot of power (throttle) to counteract the high resistance of the bow wave. In shallow waters, the stern will squat more, producing greater wake and the possibility of striking the bottom.

Planing Speeds. The boat rides on top of the water at close to level trim, supported by dynamic lift. Its wake has decreased in size, speed has increased significantly, and the boat responds quickly to small steering changes. Hydraulic trim controls can be adjusted to achieve optimum speed for a fixed throttle setting.

Changing Speeds

Increasing speed. The speed modes help to explain how a boat's operating characteristics change as power is added or reduced. As a boat increases speed, the bow raises and maintaining visibility becomes a problem, especially close ahead. Collision accidents are often the result of one or both boats operating in this mode of restricted visibility. Before opening the throttle, always check to make sure your course is clear of hazards. Whenever increasing speed raises the bow, either stand up (if the boat has a standup steering station or console) to maintain your close-ahead vision or do shallow S-turns.

Reducing speed. When slowing down from a planing speed to a displacement speed, the boat will transit through the semi- displacement range again, generating increased wake (waves).

This is why a sudden stop from high speeds can result in wake breaking over the transom unless a high-speed stop maneuver is used (see page 26).

Boat Wake

Be considerate about the wake produced by your boat. Adjust your speed to reduce your wake when passing:

- boats tied to a dock or slip or rafted alongside each other
- boats in a mooring area or at anchor
- a sailboat with a person aloft on the mast

Reduce wake by operating at slower displacement speeds (preferably) or planing speeds. Operating at planing speeds in an anchorage is unsafe because of higher collision risk with another boat operating at high speed that may be hidden from view behind a moored boat. Changing speed to reduce wake should be made well in advance since it takes at least several boat lengths for your wake to settle down.

4. Basic Boathandling

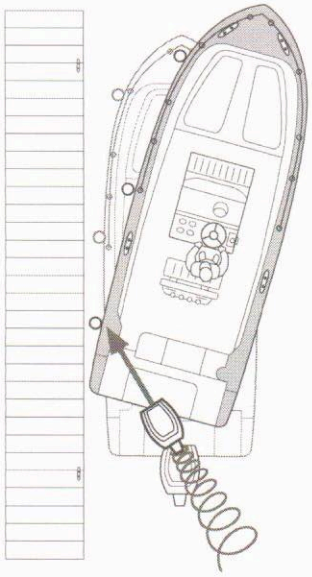
KEY CONCEPTS

- ▶ Leaving & returning
- ▶ Turning maneuvers
- ▶ Starting & stopping
- ▶ Securing a boat
- ▶ Holding position
- ▶ Knots & lines

An operator is responsible for the safety of the boat and everyone on board as well as others affected by his or her actions and attitude. A safe trip for all includes the following:

- Do not exceed the boat manufacturer's recommendations on the Maximum Capacities label. Exceeding either weight orhorsepower limits can harm your boat's performance or evenresult in capsizing or swamping.
- Reduce the risk of falling overboard when underway by sitting in the seats, not on seatbacks, bow or side decks. Keep a secure grip on the boat, especially if you have to move around.
- Always maintain a good lookout for other vessels, hazards, and swimmers and divers.
- Always operate your boat at a safe speed and observe speed limits.
- Know how your boat performs and its limitations.
- Don't make sudden changes in speed and direction that can cause passengers to lose their balance or fall overboard. If you have to make a sudden change, give a timely warning.
- Monitor fuel to ensure you have enough to return with an adequate reserve.
- Follow your navigation plan and keep track of your position.
- Be alert for any weather changes and listen periodically for weather updates on the weather channel of your VHF radio.
- Know the Navigation Rules and use them to avoid collisions (see Chapter 11).
- Avoid impeding the passage of tug and barge traffic and large vessels that can only navigate within a channel.
- Be considerate of others using the water. Minimize the effect of your boat's wake. You are responsible for any damage caused by your wake.
- Be aware of the hazards of a propeller to people in the water. Position the boat to keep the propeller away from anyone in the water.
- Avoid disturbing the natural habitat of wildlife. In some areas, large animals share the waters, such as the manatee in Florida, which is particularly prone to being struck by boats.

A responsible operator is always on the lookout for other vessels, hazards, swimmers and divers.



During a forward departure from a dock, the stern can swing into the dock, preventing the boat from completing its turn.

Leaving a Dock

The following departure methods apply for most powerboats. In some cases they may need to be modified for rudder-steered boats with fixed propeller drives to compensate for, or take advantage of, the prop walk effect. Since the magnitude of the prop walk effect varies with different boats and propellers, you should know how your boat reacts to achieve proficient docking skills.

Key Points

- Make sure everyone understands what to do with docklines and fenders.
- Check that no lines (ropes) are in the water before starting the engine.
- Start the engine using the manufacturer's recommended procedure.
- Stow docklines and fenders once clear of the dock.

Back-Away Departure. Backing away from a dock usually offers the best maneuvering control. It also avoids a problem inherent to forward departures when the boat starts to turn and its stern (back end) swings into the dock, preventing the boat from departing cleanly.

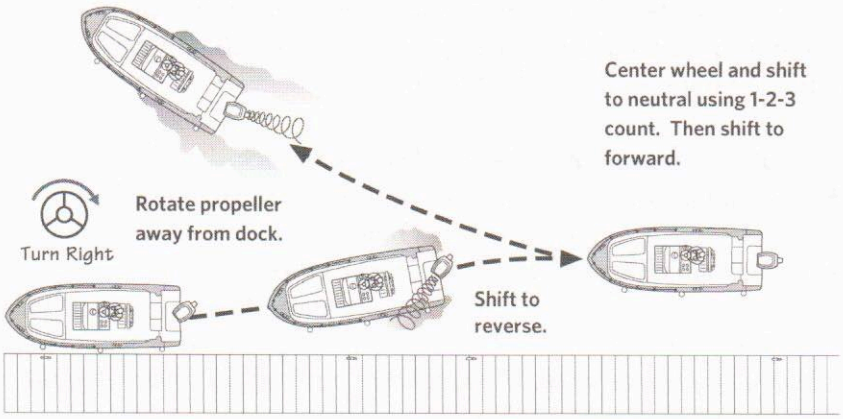
Departure Using Directed Thrust Steering

Turn wheel away from dock, which rotates propeller away from dock. If using a tiller, move it toward dock.

Shift into reverse, stern (back end) swings away from dock as boat backs away. To avoid scraping the bow (front end) against dock, keep your turn small until bow clears dock.

When clear of dock, turn wheel or tiller in opposite direction to turn boat parallel to dock.

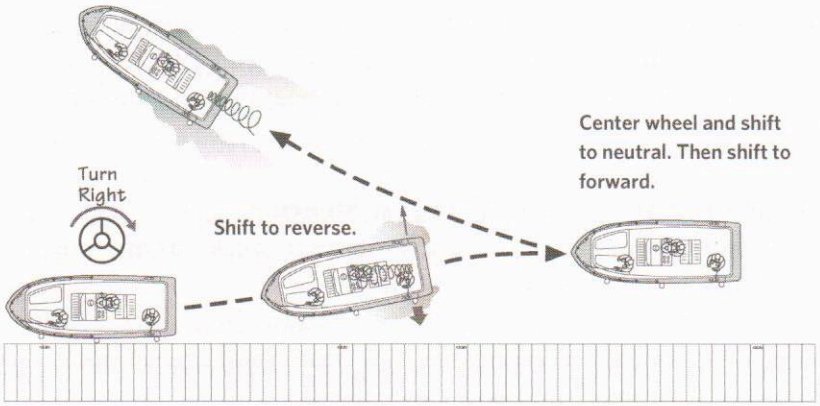
Center wheel or tiller, pause briefly in neutral while counting 1-2-3, then shift into forward.



Departure Using Rudder Steering and Prop Walk. For boats where prop walk will swing the stern (back end) toward the dock in reverse gear, you will have to use the rudder to counteract prop walk. As the boat gains backward speed, the rudder will become more effective allowing you to reduce rudder angle. If the prop walk force is too strong to overcome with the rudder, you will have to use a spring line.

For boats where prop walk will swing the stern away from the dock in reverse, you can usually center the wheel and rudder and let prop walk do the turning.

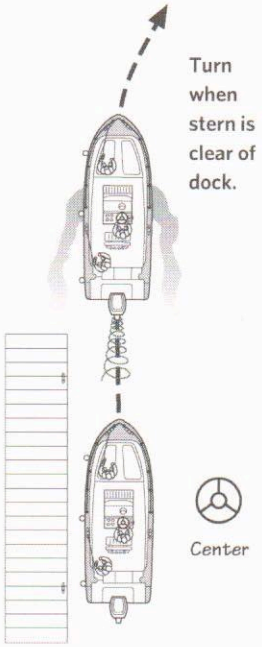
- ▶ Turn wheel and rudder away from dock.
- ▶ Shift into reverse, rudder side force overcomes prop walk, and stem swings away from dock.
- ▶ Center wheel and rudder, and shift into forward after pausing briefly in neutral while counting from 1 to 3 (the 1-2-3 count).

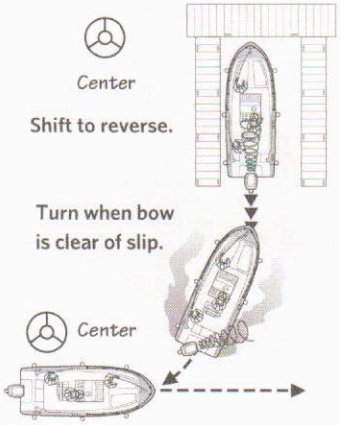


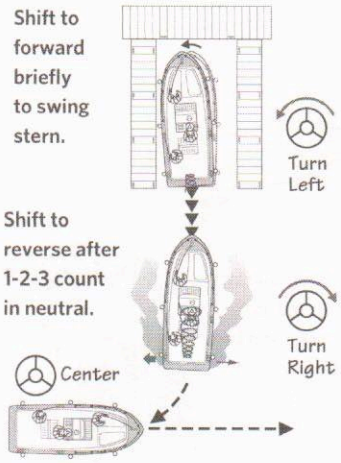
Straight-Ahead Departure. This method is often used when a boat is positioned near the end of a dock and can clear the dock with little, if any, turning. It can also be used if a crosswind or crosscurrent will make the boat drift clear of the dock. Remember that when turning, your stem (back end) will swing outside your intended track and could hit the dock.

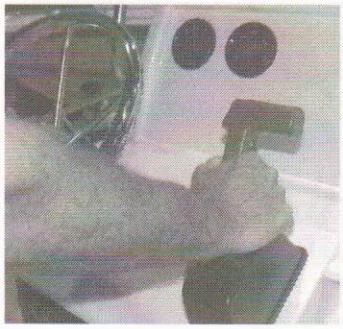
- ▶ Center outboard (or rudder), release docklines.
- ▶ Shift into forward gear and steer a straight course until clear of dock.
- ▶ Turn when clear of dock.

CAUTION: An injury could occur when using a hand or foot to push a boat away from a dock. If you have to push off, sit or stand in the cockpit and use a boat hook (pole).









Steady your throttle hand against the base in conditions where wake or waves are present.

Leaving a Slip

Departure Using Directed Thrust Steering

1 Center wheel (or tiller) and shift into reverse, slowly backing straight out.
2 Turn boat once bow is clear of slip.
3 Center wheel (or tiller) and shift into forward after pausing in neutral for the 1-2-3 count.

Departure Using Rudder Steering and Prop Walk. With many boats, you can counteract the effect of prop walk by using the rudder to back straight out of the slip. Once your bow clears the slip, the rest of the steps are similar to those described for boats with directed thrust steering (see above). However, if the prop walk effect is so strong that the stern swings into the dock even with the rudder turned against it, you will have to get someone on the slip to move the boat far enough out of the slip so the stern and the bow clears it or use the pivoting maneuver described below. Another alternative is to use a spring line to pivot the boat, which is covered in Chapter 5.

1 Turn wheel and rudder toward dock and briefly shift into forward, just enough to swing stern away from dock (in opposite direction of prop walk) without moving forward.
2 Shift into neutral and allow pivoting momentum to continue until boat has pivoted enough to offset prop walk.
3 Turn wheel and rudder away from dock and shift into reverse, slowly backing out. If boat swings too close to dock, shift into neutral and repeat steps 1, 2 and 3.

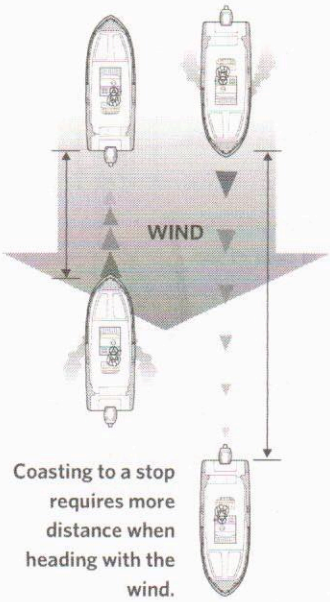
Starting

Putting a boat in motion involves shifting into forward or reverse gear at a low throttle setting and then adjusting the throttle to achieve the desired speed. *The key concept to remember when shifting to forward, neutral or reverse is that it should be done at idle rpm to prevent damage to the engine or transmission.*

Using the Throttle Control. Changes in the throttle control should be done in a smooth gradual manner. When operating in conditions where the boat could impact waves or wakes, steady your hand on the base of the control and adjust the throttle with thumb and fingers.

Stopping

When stopping or slowing down rapidly, steering control will initially be reduced because the boat's speed is not slowing as quickly as thrust is being reduced. In fact, if a boat traveling at high speed has its power cut suddenly, you may lose steering control completely. Whenever possible, put your boat on a straight course before slowing down and stopping.

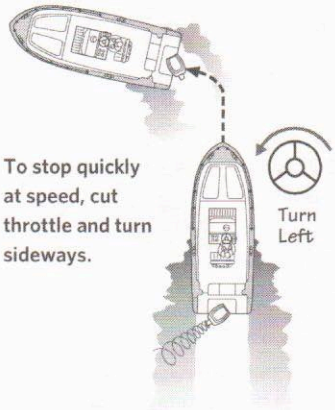


Coasting to a stop requires more distance when heading with the wind.

Coasting Stop. To stop, reduce the throttle gradually, then shift into neutral. You can stop without using reverse, but you need to allow distance for coasting to a stop. Less coasting distance is needed if you stop heading into the wind. Larger and heavier boats carry more momentum and coast farther than small boats. The larger the boat, **the more distance it will coast.**

Quick Stop. If a boat needs to be stopped more quickly in a shorter distance:

1. Gradually reduce throttle to idle rpm.
2. Shift into neutral and pause while you count 1-2-3.
3. Shift into reverse and increase throttle slightly to overcome forward momentum and stop boat.
4. Immediately bring throttle to idle rpm and shift into neutral.



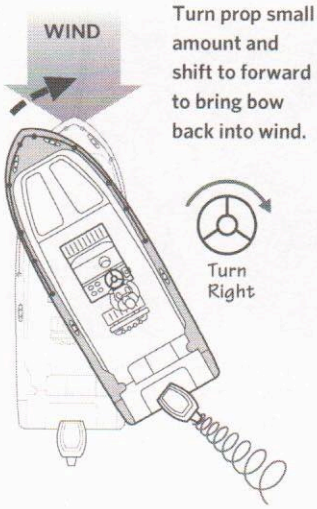
To stop quickly at speed, cut throttle and turn sideways.

High-Speed Stop. While it's recommended to gradually reduce boat speed before stopping, you may be faced with a situation where you need to stop quickly at higher speeds. In addition to the possibility of momentarily losing steering control, there is a risk in some boats of the boat's wake coming over the transom and filling up the well or cockpit. To avoid this flooding problem, use the following maneuver:

1. Reduce throttle to idle rpm.
2. Make a 90-degree turn.
3. Shift into neutral.

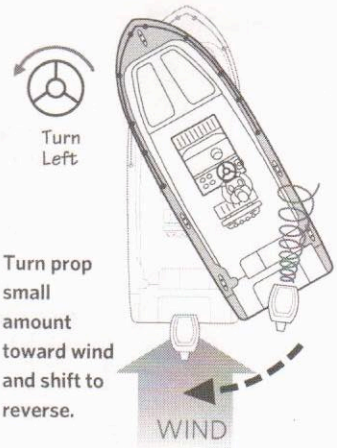
Holding Position

There are times when you may have to hold your boat in a specific location such as helping a boat in trouble, waiting for a bridge to open or waiting for room at a dock. The key to holding position is to anticipate boat drift and make small, gentle corrections early rather than large powerful corrections late.



Turn prop small amount and shift to forward to bring bow back into wind.

Holding Bow into Wind. Since the bow will usually have a tendency to turn away from the wind, you will have to compensate for this by periodically shifting into forward and reverse gears and making slight steering corrections to bring the bow back into the wind. Don't let the bow fall off (turn away from the wind) too much. When the bow is



Turn prop small amount toward wind and shift to reverse.

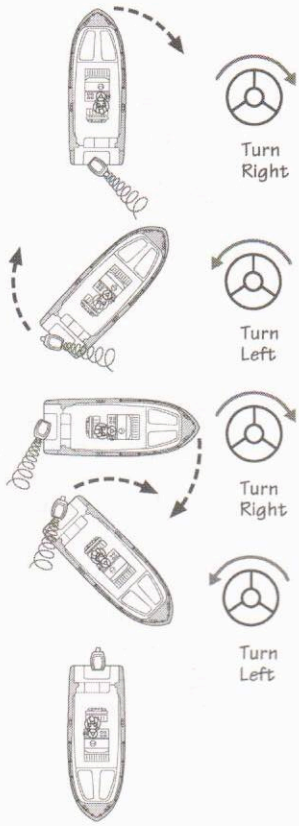
pointed into the wind, shift back to neutral and drift back to your holding position. If the boat drifts downwind of the position, shift into forward gear to bring it back in position. Repetitive small adjustments must be made to maintain a holding position, especially as the wind increases. When current has more influence than wind, hold position with the bow or stern into the current, not the wind.

Holding Stern into Wind. Because the bow wants to turn downwind, it is usually easier to hold position with the stern into the wind, provided waves don't come over the transom (back end). Shift into reverse to keep the stern headed into the wind and to compensate for drifting. In windy conditions, you may have to switch to holding the bow into the wind to avoid exposure to exhaust gases or taking water over the back of the boat.

Turning Maneuvers

When making a turn, a key concept to remember is that a boat rotates around a pivot point, which causes the stern to swing out wide of your turning path. Keep this in mind when passing close to an object in the water. While your boat's bow and pivot point may clear the object, your stern could hit it. Remember, the pivot point for every boat differs and is influenced by a boat's windage and underwater shape.

Pivot Turn



Low-Speed Turn. At low speeds, the thrust from a propeller or jet is reduced in proportion to the effects of windage, causing some loss of turning maneuverability. In tight maneuvering situations in marinas or windy conditions, it may be necessary to use pulses of increased thrust by intermittently increasing the throttle a bit to improve turning control or achieve tighter turns.

Pivot Turn Using Directed Thrust. This is a maneuver frequently used in marinas or other very confined spaces to rotate a boat within a space of one to two boat lengths.

1 Starting at rest, turn wheel hard over and shift into forward gear at idle rpm to initiate pivot turn.

2 Shift into neutral and turn wheel hard over in opposite direction, while counting 1-2-3.

3 Shift into reverse at idle rpm to continue turn.

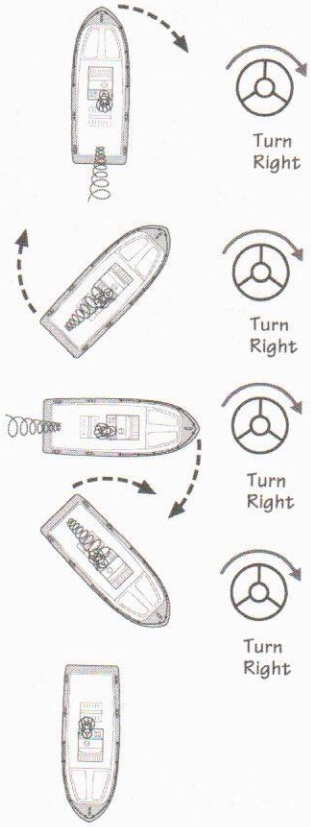
4 Shift into neutral and turn wheel hard over in opposite direction, while counting 1-2-3.

5 Repeat until boat has completed its turn.

NOTE: To rotate the boat in the opposite direction, just reverse the direction of the wheel listed in steps 1, 2 and 4.

Pivot Turn Using Rudder Steering and Prop Walk. Use prop walk and water flow (prop wash) over the rudder to help turn the boat. Remember, water must be flowing past the rudder for it to have any effect. It is important to know the direction of the side force (prop walk) generated by the rotation of the propeller in reverse. If your boat "walks" its stern to port (left) in reverse, then you should rotate the boat clockwise by following these steps:

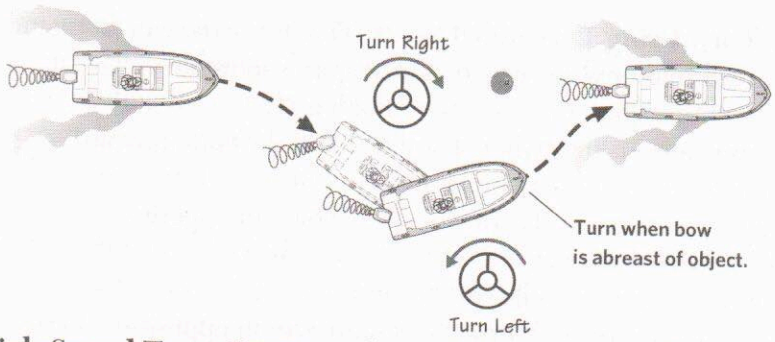
- Starting at rest, turn wheel hard over to starboard (right) and shift into forward gear, adding a small, gentle amount of throttle to generate water flow over rudder to initiate turn.
- Before gaining headway, shift into reverse (after pausing in neutral for the 1-2-3 count) and prop walk will swing stern to port. Keep wheel hard over to starboard throughout turn.
- Shift into forward gear (after pausing in neutral for the 1-2-3 count).
- Shift into reverse (after pausing in neutral for the 1-2-3- count) and use prop walk again.
- Repeat until boat has completed its turn. If your boat kicks its stern to starboard in reverse, then rotate the boat counterclockwise by reversing the direction of the wheel in step 1.



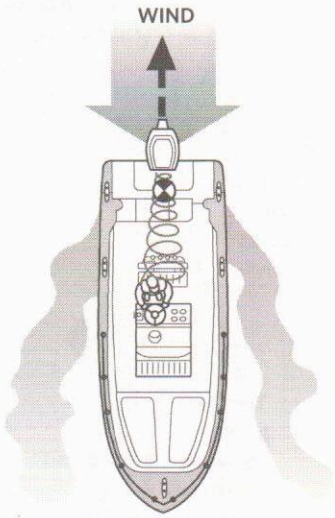
Sharp Turn. (Executing this maneuver at high speeds can be dangerous and is not recommended.) Prior to executing a sharp turn, look around to make sure it is safe to turn and alert your passengers to hold on for the turn. Once this has been done, turn the wheel hard over and advance the throttle. When making a sharp turn most small powerboats will roll or heel significantly.

If the turn is executed at too high a speed, air may be drawn into the propeller, resulting in loss of thrust and a sudden increase in engine rpm. If this happens, reduce the throttle and the turn.

Avoidance Turn. This maneuver is used to prevent the stern of your boat from swinging into an obstacle when you've turned too late or too close. As soon as the bow is abreast of the obstacle, you should quickly reverse the turn to swing the stern back away from the obstacle.



High-Speed Turn. Prior to making a high-speed turn, check to see that it is clear and safe to turn, and alert your passengers. Turn the wheel gradually and deliberately to maintain control throughout the maneuver.



When backing a boat, use small steering adjustments to keep it under control.

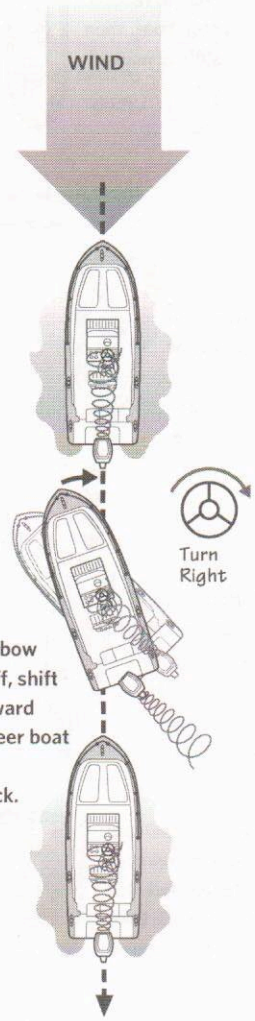
The greater the speed, the wider and more gradual the turn should be. If the turn is too sharp, the propeller will ventilate and turning control will be lost.

Driving Backward
Key Points

- Wind direction: the bow will tend to turn downwind.
- Sea conditions: backing smaller outboard boats into waves may result in water coming over the transom and flooding the well or cockpit. If this starts to happen, abandon this maneuver.
- The pivot point will move aft in reverse, and depending on the boat's underwater shape and windage, it may move essentially to the propeller. This is particularly true for outboards or stern drives.
- Steering control: when backing and turning in reverse, use small steering adjustments. Too large or too fast adjustments can lead to a loss of control.
- Prop walk: on boats that are steered with a rudder, you will have to use the rudder to counteract the turning tendency of prop walk. On some boats, prop walk may be too strong for the rudders to overcome.

Backing Toward the Wind. The combination of windage and pivot point will help you hold your course.

Backing Downwind. It may be more difficult to maintain your course when backing downwind. If the bow falls off too much, you will lose steering control. Before this happens, shift to forward gear and bring the boat back on course. Then back up again with perhaps a slight steering correction to compensate for the wind's effect.



When bow falls off, shift to forward and steer boat back on track.

Returning to a Dock

To master this important maneuver you need to be aware of how your powerboat steers and reacts to changes of throttle and gearshift in different wind and current conditions. Here, your ability to maneuver at minimum control speed (mcs) will play an important role. A common mistake, especially with boats that use directed thrust steering, is to oversteer at slow speeds, which result in loss of control of direction. It is far better to use small steering adjustments at minimum control speed with only an occasional brief, small increase in throttle to make a sharper turn. The critical time for a safe and successful docking usually starts as you make your final turn to come alongside the dock and ends as you reverse to stop the boat. Here, you'll need precise adjustment and coordination of throttle, gearshift and wheel (or tiller).

Key Points

- *Place fenders at dock level and prepare docklines before making the final approach.*
- *Be sure everyone knows in advance what to do with the docklines.*
- *Whenever possible, come alongside the dock with the bow pointing into the wind or current, whichever is stronger*
- *Make your approach at minimum control speed, which will avoid or minimize damage should reverse suddenly not be available.*
- *In the absence of wind or current, boats with rudder steering should approach the dock in a direction where prop walk will swing the stern toward the dock in reverse.*

Docking Tips. *Minimum control speed allows you to make a smooth easy turn. Faster approach speeds require a more abrupt turn and timing becomes more critical. Always have an escape plan in case you misjudge your approach.*

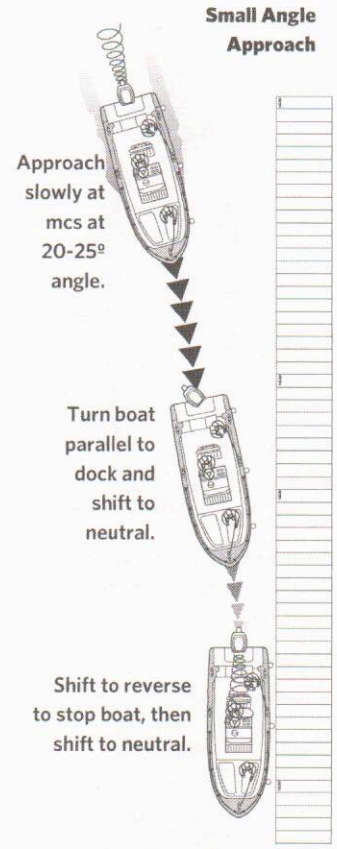
Small-Angle Approach. This is the easiest approach to use because it requires only small adjustments of steering and power controls. It also accommodates temporary changes in wind conditions (unlike an approach parallel to the dock, which requires more precision and is less tolerant of changing conditions).

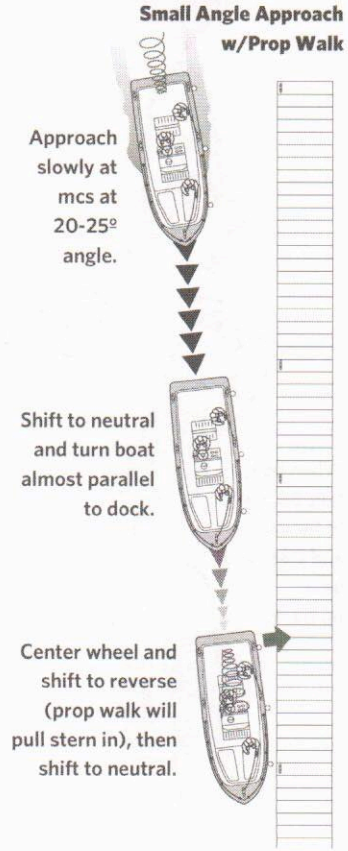
1. Approach dock slowly at a 20 - 25 degree angle. If approach speed is too fast, shift into neutral to slow boat and use intermittent power to maintain minimum control speed (mcs).
2. When bow is about 1/2 to 1 boat length away from dock, make a smooth turn to bring boat parallel and close to dock. As bow starts to turn, shift into neutral.
3. Reverse to stop boat.
4. Shift to neutral. After boat is tied to dock, turn off engine.

Small-Angle Approach with Prop Walk.

1. Approach dock slowly at a 20 - 25° angle on side where prop walk will pull your stern toward dock.
2. When bow is about 1/2 to 1 boat length from dock, shift into neutral and make a smooth turn to bring boat close to dock and almost parallel.
3. When bow is close to the dock, center rudder (wheel) and shift into reverse to stop. Prop walk will swing stern into dock. If stern needs to be brought in more or faster, turn rudder (wheel) toward dock and gently increase throttle.

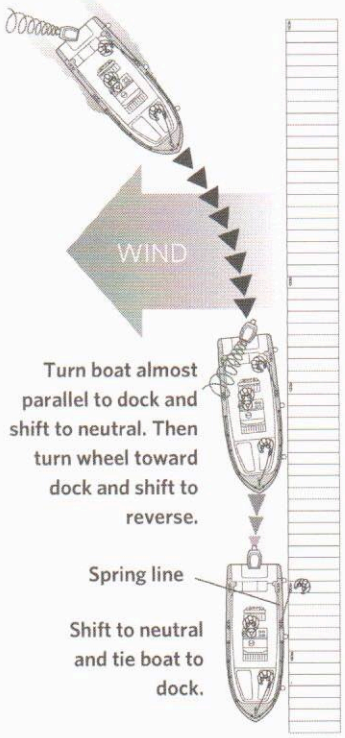
Large-Angle Approach. In a situation where the wind pushes the boat away from the dock during its approach, you should increase your approach angle to head more into the wind. This increased angle will result in a tighter turn, which will increase





Large Angle Approach

Approach slowly at mcs at 45º angle.



the momentum of the swinging stern. If the stern swings too fast, you can prevent it from hitting the dock with a small turn of the wheel away from the dock as you reverse to stop the boat. As you come alongside, the wind will try to blow the boat away from the dock, so it is important to stop quickly and pass a line (rope) to the dock without delay. The best line to use is one that is fastened to the boat halfway between the bow and stern (amidships) and led aft to a dock cleat. If the boat starts to drift away before the other docklines are tied, you can put the boat in forward gear at idle rpm and the spring line will bring the boat alongside the dock again and hold it there.

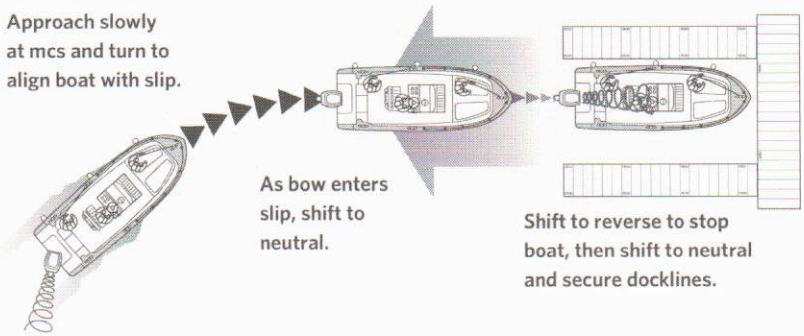
As the velocity of the wind increases, the power required to maintain minimum control speed (mcs) will have to be increased to overcome the increased drag from windage, which reduces the forward speed of the boat.

1. Approach dock at approximately 45° angle at a minimum control speed that maintains steering control against the wind.
2. When bow is close to dock, turn boat almost parallel to dock, but maintain a small angle to compensate for the wind's tendency to push bow downwind.
3. When bow is a couple of feet from dock, shift into neutral, pausing briefly for the 1-2-3 count, and then shift to reverse, turning wheel toward dock and using a small amount of throttle to bring stern in as the boat stops.
4. As soon as boat is alongside, shift into neutral and quickly tie aft spring line in case it's needed to hold boat to dock. After other docklines are tied, turn off engine.

Returning to a Slip

Upwind Approach. In this situation you can use the wind to help slow the boat as you bring it into the slip. Have docklines ready to help stop the boat moving forward or backward too much in the slip.

1. Approach at minimum control speed (mcs) and make a wide turn to line up boat to slip.
2. As bow starts to enter slip, shift into neutral to slow boat.
3. Reverse to stop boat, then shift to neutral and secure docklines.



Securing a Boat

A powerboat can be tied alongside a dock with two spring lines and single bow and stern lines or it can be positioned in the middle of a slip with two bow lines and two stern lines.

7. *Equipment & Responsibilities*

KEY CONCEPTS

- Preparation
- Required equipment
- Proper use of equipment
- Knowledge of rescue & emergency procedures

Preparation

Proper preparation improves the effectiveness and safety of on-water training sessions as well as the response to emergency and rescue situations. Safety/rescue boat related preparation can be broken down into the following components:

- Know what equipment should be on board the safety boats.

Know how to operate the safety/rescue boats and use the safety/rescue equipment.

- Know the local hazards in your area.
- Know your program's emergency and rescue procedures.
- Know your program's towing procedures.

Required Equipment

Safety boats should have the following equipment on board:

- Federal and state required equipment
- Safety and rescue equipment required by your organization

The safety/rescue boat's equipment should be neatly stowed (lines coiled in drainable plastic buckets or milk crates), secured, and readily available for quick use. Your organization should have a standard storage system on all its safety boats so everyone knows where to stow the equipment -- and where to find it.

Proper Use of Equipment

- Know how to operate all the safety boats in your program and safety/rescue related equipment so you can supervise, assist and rescue your students efficiently and safely.

NOTE: *Check with your organization's manager/director concerning any local, state or Coast Guard licensing requirements that apply to the operation of your safety boat.*

- Be aware of the strengths, weaknesses and limitations of the different types of safety boats. If your program has a variety of safety boats, select the type best suited for the type of operation and wind/water conditions. For example, displacement hulls are good for towing and directional stability (tend to hold straight course) but are slower, leave bigger wakes,

need more maneuvering room and usually have a high freeboard that make it more difficult to recover people from the water. Both the planing cathedral (the classic Boston Whaler shape) and rigid inflatable boats are fast, maneuverable, good teaching platforms with a low freeboard, but can be wet and uncomfortable. The cathedral hulls are excellent for sheltered waters, while the inflatables are seaworthy, good in waves, easy to beach, and the shape and softness of their sides are ideal for bringing a person into the boat from the water.

▶ Your organization should have the following procedures and checklists that you should follow:

✓ Inspection of safety boats and equipment
✓ Fueling
✓ Starting and shutting down safety boats
✓ Getting underway
✓ Operating guidelines and limitations for safety boats
✓ Tying-up and securing safety boats and equipment

▶ Ensure reliability of the safety boat and its safety/rescue equipment through compliance with operating guidelines as well as regular inspection and maintenance.

Awareness and Identification of Local Hazards

For safe operation it's important that you know the local hazards (rocks, shoals, submerged objects, shipping channels, powerlines over the water, etc.) in your operating area. If you plan to operate outside your normal area, review the relevant chart(s) as well as the Local Notices to Mariners beforehand. To ensure the safety and control of your class or event, make sure all of your students or competitors are fully aware of the location of local hazards as well as the boundaries of their sailing area.

Local Notices to Mariners are published weekly by the District U.S. Coast Guard and can also be downloaded from the websites of the National Imagery and Mapping Agency (NIMA), http://www.nima.mil, or the U.S. Coast Guard Navigation Center (NAVCEN), http:// www.navcen.uscg.mil.

Comprehension of Rescue and Emergency Procedures
Be thoroughly familiar with your program's emergency and rescue procedures for:

- Rescue of a person in water (conscious, injured, or unconscious)
- Assisting a capsized or swamped boat
- Rescue of a boat aground
- Retrieval of damaged boats
- Severe weather (squalls, thunderstorms, or fog) emergencies as well as the communication procedures involving shore base, paramedics, and applicable authorities (police, harbormaster, Coast Guard, etc.). Most programs conduct periodic training and review sessions for their instructors and rescue personnel to ensure the safety and effectiveness of carrying out the recommended procedures.

Use of a VHF Radio
The marine VHF radiotelephone system is a line of sight, very high frequency system designed to:

- provide monitored distress and safety frequencies
- provide information on the navigation and movement of vessels.
- allow communication between private vessels and local federal agencies
- provide a communications link for vessels and stations engaged in commerce.
- provide telephone services for vessels afloat
- meet the communication needs of the recreational boater

As a line of sight system, the ranges of marine VHF are limited by the horizon. Average ship-to-ship ranges are about 10 -15 miles. Shore stations generally have higher antennas. Communication with these can be extended to 20-30 miles. Power output, particularly at the low setting, can limit these ranges.

The Marine VHF system operates in the 156-162 MHz frequency band with preset channels spaced at 25 kHz. The system provides a total of 73 channels of which 55 are authorized for use in the United States. For the most part the boater need not be concerned with the frequencies of the various channels. They are preset in the VHF unit and need only be dialed to transmit or receive. Most of these channels transmit and receive on a single frequency. They are called **simplex** channels, that is both transmitting and receiving would occur on 156.450 MHz. Other channels are **duplex**. They transmit on one frequency and receive on another. For example a boat conversing with a shore station on the Marine Radio Telephone channel #25 would be transmitting on 157.250 MHz and receiving on 161.850 MHz. The shore station on the other hand is transmitting on 161.850 and receiving on the boat transmit

frequency. The operator needn't concern himself with this since these two frequencies are automatically selected when he dials in channel 25. They can't be changed. This means that equipment designed to operate as a commercial shore station is different than that designed to be used at sea. The frequencies on the duplex channels are reversed. This normally isn't a problem except for the boater that wants to monitor a communication between a vessel and a duplex shore station. He will only be able to hear the shore station's side of the conversation.

Each channel is authorized for a specific purpose. For example, there are only four channels authorized for routine communication between recreational vessels. The channels of greatest interest to the recreational boater are as follows:

- **Channels 1,2,3,4 - Weather**. Provide continuous local marine weather conditions and forecasts, including storm warnings and watches.
- **Channel 16 - Distress, Safety and Calling.** All stations must monitor this channel (or channel 9) when operating, except when communicating on another channel. Calls to another vessel or station are initiated on this channel and then, except in an emergency, transferred to a working frequency. ***Routine radio checks are prohibited on this frequency.***
- **Channel 9 - Secondary Calling Channel.** The Coast Guard does not monitor it but will transmit emergency broadcasts and announce marine information broadcasts. Channel 9 should be used as the general purpose-calling channel. Vessels monitoring channel 9 are exempt from the requirement to monitor channel 16.
- **Channel 6 - Intership Safety Channel.** It is used for Search and Rescue communications and intership safety purposes. It is a required channel for all VHF equipped vessels and must be used for safety purposes only.
- **Channel 13 - Navigational (Bridge to Bridge).** This channel is available to all vessels and is a requirement for vessels over 20 meters (65.6 feet) in length. It is the primary method of exchanging navigational information among large vessels such as meeting and passing situations. Small craft when operating in the vicinity of large ships can gain valuable information as to their intent by monitoring this channel. Often large vessels will turn down the volume on Channel 16 because of the chatter in coastal areas. If you need to contact them they will be on channel 13. This is also the primary channel used at locks and bridges. Channel 13 is limited to 1 Watt power output. Most radios automatically switch to low power when set to this channel.
- **Channel 22A - Coast Guard Liaison and Maritime Safety Information Broadcasts.** This is the principal channel for communication with the Coast Guard. It is monitored constantly and the source for Marine Information Broadcasts.

▶ **Channel 70** - This channel has been reserved for the Digital Selective Calling System (DSC or Selcall) which requires specially configured equipment. It should not be used except for this purpose.

▶ **Channels 68, 69, 71 - Non-Commercial Vessels.** These channels are set aside for intership and ship to shore communication for recreational watercraft.

▶ **Channel 72 - Non-Commercial Intership.** Like 68. 69 and 71, this channel is set aside for non-commercial use. It is, however, restricted to intership use only.

▶ **Channels 24-28.** These are channels set aside for the marine operator. They are duplex channels. You must switch to one of these frequencies to call the Marine Operator. They will not answer on Channel 16 but will call you on that frequency if you have an incoming telephone call.

Typical Transceiver Controls

Your VHF marine radio, whether an installed unit or a handheld portable, is a combination transmitter and receiver, hence it is technically called a transceiver. Most VHF transceivers have the following controls:

▶ **Volume Control.** It functions very much like the volume control on a standard radio except that its use must be coordinated with the squelch control. On some radios it is possible to set the volume so high that and incoming signal cannot break squelch. This is usually the on/off switch as well. The volume control affects receive volume only.

▶ **Squelch.** This control allows you to select the strength of the incoming signal that your receiver will receive. It is adjusted to eliminate unnecessary background noise and activate the receiver only when a sufficiently strong signal is received. When transmitting to another station it is important to hold your microphone button down for about one second to activate or "break" their squelch.

▶ **USA/INT.** This switch selects between the USA special frequencies and international frequencies. In the USA position you still receive most of the international channels except those that are switched to simplex operations and those designated international only.

▶ **High Power/Low Power.** This switch is provided to allow the user to select a high or low power transmitter setting. On some radios even when in the low power setting, the transmitter is automatically set to high when switched to channel 16. Operations on channel 13, Bridge to Bridge, should normally be set to low and again is automatically set on some radios. In fact, most operations should be attempted on low power and then only turned to high if required. Very often if a boat is trying to talk to someone close aboard, high will overpower his radio. Switching to low power will provide much clearer communications. Low power output is set at one watt while high power output is restricted to 25 watts maximum. Handheld VHF transceivers normally operate in the 4 to 6 watt range in high power.

- Channel selector. VHF transceivers come with a variety of channel selectors. They may be manual or electronic with a digital display. Not all VHF radios come equipped to monitor a complete range of channels. Most have a switch that allows the operator to switch immediately to channel 16. Newer VHF transceivers also allow immediate switching to channel 9. Others have a dual watch capability that allows them to monitor channel 16 and another channel essentially simultaneously. The channel selector also allows the user to switch and receive the NOAA weather channels which are a separate set of channels with low channel numbers.

Licensing and Requirements

Most recreational vessels under 65.6 ft/20m in length do not have to carry a marine radio. Marine Radio Operator permits are not required if operating in U.S. waters except for vessels carrying more than six passengers for hire. Bridge to Bridge Radiotelephone regulations require that all power driven vessels 20 meters (65.6 feet) and greater, passenger vessels of 100 gross tons or greater carrying more than one passenger for hire and towing vessels of 26 feet and greater maintain a Marine VHF radio on their bridge. In addition a listening watch must be maintained on channel 13 except for portions of the lower Mississippi. The person maintaining the listening watch **must be able to speak English**. Vessels carrying more than six passengers for hire must also have an installed VHF.

When using Marine VHF the following guidelines and rules should be followed:

- Must identify self, using station call sign at the beginning and end of a series of transmissions or every 15 minutes during the transmission. Telephone calls through the Marine Operator need only be identified at the beginning and end.
- All transmissions must be kept to the minimum length.
- Log all distress calls with pertinent information.
- Do not use profanity
- Transmissions on the calling channels are limited to determining a working frequency and any one transmission must not take more than 30 seconds with no more than two minutes for a single series. If no reply is received wait two minutes before trying again. After three attempts wait 15 minutes.

Procedures. Over the years a number of procedures have evolved based on practical experience, which have proven effective. It should be a matter of pride that every user of Marine VHF know and use them. One sure way to establish effective communications is to know and use established international Procedure Words or PROWORDS. Unfortunately these words have been overworked by the movie industry and often used incorrectly hence the many "over and out" phrases heard everyday on the radio. It is either over or out -- not both. The operator should not be embarrassed to use them provided they

are used correctly. They are in everyday use on commercial ships, airlines, ham radio and military communications stations worldwide. Every marine VHF operator should know the basic ones as follows:

PROWORD	MEANING
OUT	This is the end of my transmission. No response is desired or required.
OVER	This is the end of my transmission and a response is desired. Go ahead and transmit. Note: Notice the major difference between "over" used during a message exchange and "out" used at the end of an exchange.
ROGER	I have received and understand your last transmission.
WILCO	Your last message has been received, understood and will be complied with. Traditionally only the person on board in command should use this.
FIGURES	Used to introduce numbers during a message.
SAY AGAIN	Repeat. Can be used with "all after" if entire message does not need to be repeated.
BREAK	To separate the text from other portions of the message or one message from one immediately following.
WAIT	I must pause briefly. Stand by for further transmissions. Do not use with "over."
AFFIRMATIVE	You are correct.
NEGATIVE	No or you are incorrect.
SILENCE	Cease all transmissions (said three times). Silence will immediately maintained until lifted. Technically should be pronounced with the French pronounciation of SEELONSS. Best use both in American waters. Silence is used only by the vessel in distress of the controlling station.
SILENCE DISTRESS	Used by a third party to advise another to keep off the air due to a distress in progress.
I SPELL	I shall spell the next word phonetically.
MESSAGE FOLLOWS	A message that requires recording follows.
SILENCE FINIS	Silence is lifted.
THIS IS	This transmission is from the station whose name or call sign immediately follows.

Vessel-to-Vessel Operating Procedures

- Switch briefly and listen to working channels to find one that is clear.
- Return to channel 9 or 16.
- Call the boat you wish to call.
- Say: (Name of boat being called)
  This is (your boat's name and call sign)
- Once contact is made on Channel 9, you must switch to a ship-to-ship channel.
- After communications are completed, each ship must give its call sign and switch to Channel 9 or 16.

Vessel-to-Shore Operating Procedures. The procedures for calling a shore station are the same, however, if the shore station has an assigned operating frequency call them on that frequency instead of channels 9 or16.

Distress, Urgency and Safety Calls

- Distress calls are transmitted when a vessel or person is threatened by grave or imminent danger requiring immediate assistance. The call includes MAYDAY (French pronunciation of "m'aidez," or Help me!") spoken three times; the words, "This is..."; and the call sign (or name, if no call sign assigned) spoken three times, followed by the distress message (remember the three W's: WHO you are, WHERE you are, and WHAT is your type of distress, situation and seaworthiness). For example:
  - ▶ Distress Signal: "MAYDAY, MAYDAY, MAYDAY"
  - ▶ Identify: "This is yacht Lead Balloon, Lead Balloon, Lead Balloon."
  - ▶ Position: either a GPS readout of lat./long, DOUBLECHECKED, or "5 nautical miles east of Cape Fear light."
  - ▶ Nature of distress: "Sinking," "On Fire and Taking Water," etc.
  - ▶ Assistance required: "Request immediate assistance."
  - ▶ Number of persons on board: "Two adults on board."
  - ▶ Any further information: boat length, color and type of vessel, "sending up red parachute flares," or "activating EPIRB" - anything that may help you to be found or identified.
  - ▶ "OVER." Now wait for acknowledgment. If none comes, try again after a minute or so.

- **Urgency** calls are sent when there is a very urgent message concerning the safety of a vessel or of some person on board or within sight that is not life threatening (such as engine or rudder failure).

The signal is PAN-PAN (pronounced pahn) spoken three times. When medical assistance or advice is needed sometimes the words "pan-pan" are followed by "medico," creating a "pan-pan-medico" message. The Coast Guard may "patch" you through to a doctor.

- **Safety** calls are used to send a message concerning the safety of navigation or giving important meteorological warnings. The signal is SECURITE (pronounced see-cur-eetay) spoken three times.

Procedure Upon Hearing a Distress Message

- Maintain silence. Do not transmit.
- Log all details
- If no one responds, you must answer and offer assistance.
- If you relay the distress message use the proword MAYDAY RELAY
- In any event try to determine if your vessel is in a posi tion to assist. If so call the distressed vessel stating MAYDAY RECEIVED. After he acknowledges continue with your offer of assistance.
- If you are not in a logical position to render assistance - remain silent.

Marine VHF users should also be familiar with the International Phonetic Alphabet.

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

8. Concepts & Considerations for Emergencies & Rescues

KEY CONCEPTS
- Priorities
- Assistance & supervision
- Flexibility
- Communication

Priorities
The basic underlying concept for all emergency and rescue situations is **PEOPLE FIRST - EQUIPMENT SECOND.**
That establishes the following priorities:
1. **Determine condition of people.** Account for all students or sailors involved in the situation; look for injuries and determine severity.
2. **Determine level of assistance and implement.** Know when and what kind of assistance to give.
3. **Ensure proper supervision.** When dealing with an emergency, make sure the rest of class or fleet has adequate supervision.
4. **Minimize damage to watercraft.** Be mindful of causing damage to a boat or sailboard in distress as well as the safety boat, and try to avoid or minimize damage. If you have to abandon boat, clearly identify and (if possible) anchor it, and inform the appropriate authorities (i.e., local water police, harbormaster, Coast Guard, etc.) of its existence and location.
5. **Recover equipment after people have been rescued**.

Flexibility of Response to Emergencies
There are usually a variety of options that you will be faced with when responding and assisting. Each situation will be different and you will have to **be flexible and adjust your response** to fit the situation. Your response will be affected by:
- Wind (light or strong) and water (temperature and waves) conditions,
- Seriousness of rescue,
- Physical fitness and limitations of people,
- Experience level of the class or fleet,
- Type of boat(s),
- Communication systems,
- Availability of additional outside assistance,
- Number of safety boats supervising on-water session and the number of people manning them.

A key factor is to organize the equipment (including safety boats) and develop emergency and rescue procedures that will maximize your options.

Assistance and Supervision
Levels of Assistance. Two of the more difficult decision-making calls you will have to address are determining what kind of assistance to give and ensuring the safety of all students or sailors -- not just the people you are assisting but the rest of the class or fleet.

Three basic levels of assistance:
1) Advice and encouragement
2) Minimal assistance
3) Full assistance

Number of Safety Boats and Personnel. This affects the ability to respond as well as maintain supervision. The ideal number of people in a safety boat is a minimum of two, especially in situations where potential rescues are high (strong winds and inexperienced sailors or when conditions are near the sailors' upper limit regardless of whether they be novice, intermediate or experienced. With two people one can operate the boat while the other helps to recover a capsized boat, deal with an injury, handle towlines, or supervise the rest of the class/fleet. If your organization has a policy of one person per boat, the procedures for response, rescue, well being of an injured person and class supervision have to be carefully developed to deal with this limitation.

DECISION-MAKING QUESTIONS
If there is only one safety boat and an injured person has to be rushed ashore, what action could you take to ensure the safety and supervision of the othe sailors? What would you do if the safety boat is manned by one person, or by two people? What would you do if outside assistance were available?

Condition of People. When dealing with people who need assistance, your first concern should be their well-being.

- Never lose sight of a person in the water.
- Approach a person in water or a disabled boat slowly at no-wake speed, in control and bow first -- keep the propeller away from the person.
- Check for signs of injury, fatigue, hypothermia, heat stress, etc. and determine severity. Determine whether the victim can be brought into the safety boat or if he/she must be stabilized in place to prevent further injury.
- Get injured, fatigue, and cold people into safety boat and apply first aid (with keelboats -- another option is for the safety boat operator/crew to get on board and apply first aid).
- Exercise extreme caution when assisting a person who may have back and neck injuries. They may have to be stabilized in place until out side professional assistance arrives at the scene. Apply first aid recommendations for this type of injury.
- Exercise extreme caution with a person in the water who is panicked. Don't get in the water or let them pull you into the water.

- Help students/sailors being assisted overcome their fears -- make eye contact, speak calmly and reassure them.
- Take into account their physical fitness and limitations when giving instructions.
- Encourage and coach them to follow safe procedures.

Outside Assistance. If you determine that outside assistance is needed, activate the prearranged communication or signal. Outside assistance can differ depending on the circumstances. It can consist of:

- Another safety boat coming to assist in the rescue, class supervision, or towing the class/fleet back to shore.
- Outside medical assistance (EMS) arriving at a designated shore location to take over the care of the victim.
- Outside rescue or medical assistance (police, Coast Guard) arriving at the scene by boat.

Supervision. A concern that an instructor or safety boat operator has to be aware of is getting so involved in a rescue that he or she forgets about the rest of the class/fleet. If there is more than one safety boat conducting an on-water session, there should be minimal impact on class supervision. But if you are shorthanded, you will be faced with a difficult decision of determining a response that minimizes the risk to the safety and well-being of everyone. Your options will vary depending on whether self-rescue dinghies or keelboats are involved, weather conditions, and experience level of class, and may include: calling for another safety boat; putting your assistant on a student's boat to supervise the class while you deal with the rescue; signaling the rest of the fleet to execute a control maneuver (i.e., safety position, capsize, or reach back and forth to windward of you) until help arrives or the rescue is completed. You must evaluate and analyze the situation and exercise your best judgment as to what is the safest and most reasonable response.

DECISION-MAKING QUESTIONS

If you have an assistant, do you put him or her on one of the sailboats to supervise the class while you run an injured student ashore or do you keep him or her in the safety boat to care for the student? Do you run the person in or call for another safety boat? If immediate help were available, what would you do? If it is a life threatening situation and you must run a student to shore and can't get any assistance to supervise the class, what should you tell your class to do?

Communication

With Students/Sailors. Use the basic visual signals to determine whether students/sailors are okay (thumbs up or the big "0" with thumb and finger) or in trouble (waves arms above head -- international distress signal), and tell them to come closer, use the safety position, etc. Speak clearly and calmly. Position the safety boat so the engine noise is not in the line of communication and shift into neutral, or turn off the engine.

With Shore Base. Two-way radio (VHF) is best, but smoke flares, whistles or flags can also be used. The FCC rules for operating marine VHF radios are contained in FCC Rules and Regulations, Volume IV, Parts 81 and 83 available from the U.S. Government Printing Office.

Reporting Accidents

Accident Reporting. Immediate notification is required if a person dies or disappears as a result of a recreational boating accident. The following notification should be provided the nearest state boating authority.

- Date, time and location of the accident
- Name of each person who died or disappeared
- Number and name of the vessel
- Name and address of the owner and the operator

A formal report must be submitted within 48 hours if a person dies or there are injuries requiring more than first aid. A formal report must be submitted within ten days for accidents involving more than $500.00 damage or the complete loss of a vessel. Accident report forms can be obtained at any office where boats may be registered. A vessel operator involved in an accident must render all practical and necessary assistance possible to the victims without seriously endangering his or her own vessel or the persons aboard. The operator of a vessel involved in an accident shall give his name and address and vessel identification number to the injured person of owner of the damaged property.

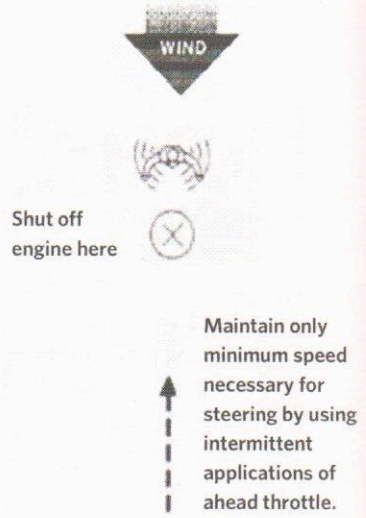
9. *Rescues*

Rescue of Person in Water

KEY CONCEPTS
- ▶ Final approach
- ▶ Recover from water
- ▶ Assess condition
- ▶ Make contact & attach to boat
- ▶ First aid

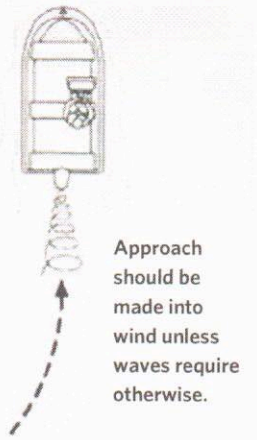
Make Final Approach

1. Do not steer directly towards the victim. Steer so the victim is on the side or the other of the boat. This way, if you misjudge your speed, the boat will overshoot the victim without running them over.
2. Approach slowly with minimum controllable speed (using intermittent power), bow first and headed into wind or waves (whichever has stronger effect on boat) with the victim on the operator's side.
3. Never lose sight of the victim.
4. Communicate and reassure.
5. As you get close to the victim, shift into neutral and stop, keeping propeller away from victim.
6. As soon as the engine is within one boat length's distance from the victim, turn off the engine. Do not turn the engine on again until the victim is aboard the boat, or the engine has drifted more than a boat length away from the victim.
7. Make contact with the victim by extending a paddle, or boat hook, or throwing a line. You may have to maneuver with a paddle or oar. Keep communicating and reassuring. Calm a thrashing or panicked person before attempting to get him/her out of the water.



Attach Victim to Boat and Recover from Water

1. If the victim is at risk, pass a looped safety line around them, remove any slack and attach the line to the boat. This will ensure that you don't lose the victim if he or she weakens and cannot hold on any longer.
2. Be certain that the victim has sustained no injuries that would prevent them from being hauled aboard, such as spinal injuries. If the victim requires stabilization prior to hauling them out of the water, wait for emergency personnel to provide treatment or aide the victim to the extent of your training (i.e. securing them to a backboard).
3. Recover from the water and administer First Aid (as appropriate).

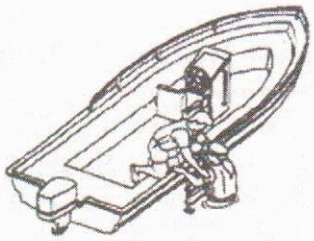


Often the low point of a small powerboat's topsides is at the transom, and some people use the outdrive or cavitation plate as a step. But if the victim needs help getting into the boat the engine may be an obstacle. A swim ladder is usually the best alternative.

Assess Condition and Treat the Victim

1 Assess condition. Is the victim conscious, unconscious, or injured? Check for injuries, hypothermia, fatigue, and if person has PFD. Ask how he or she feels -- look for the "okay" sign.

If there are any problems getting the person aboard and there is a grave and imminent threat to the life of the person, make a Mayday call on Channel 3 of your VHF radio (see Chapter 7) or use your cellular phone to make an emergency call.



Boarding Ladder Method
Use with: boats with high freeboard or with people unable to climb into boat.

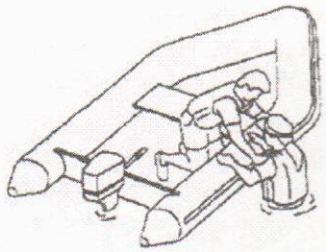
Rescues 101

Recovery from Water

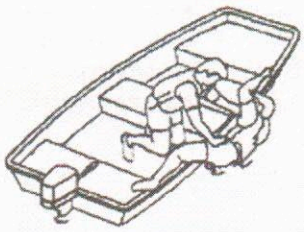
Two major factors that affect getting a person out of the water and into the safety boat are: 1) the height of the sides of the boat and 2) the condition of the person, including whether the person is able to assist. If there is any doubt about the condition of the person or being able to get him or her into the boat, call for assistance.

Person Able to Assist in Recovery - There are a number of methods that can be used to get people out of the water, some of which are described below. In all cases allow the person to assist as much as possible, not only will it make it easier to get him or her out of the water, but it will help prevent injuries while doing it.

- Boarding ladder method
- Two-arm/PFD lift method - use only when person is conscious and able to hold arms at side.
- Leg and arm roll method
- Scoop method - Use sailboat to scoop up person by capsize scoop recovery
- Recover and transfer method - recover using a low free board boat (power or sail) and then



PFD Lift Method
Use with: Conscious person agile person Low freeboard
Note: Lift from under arms if person is weak or PFD is loose.

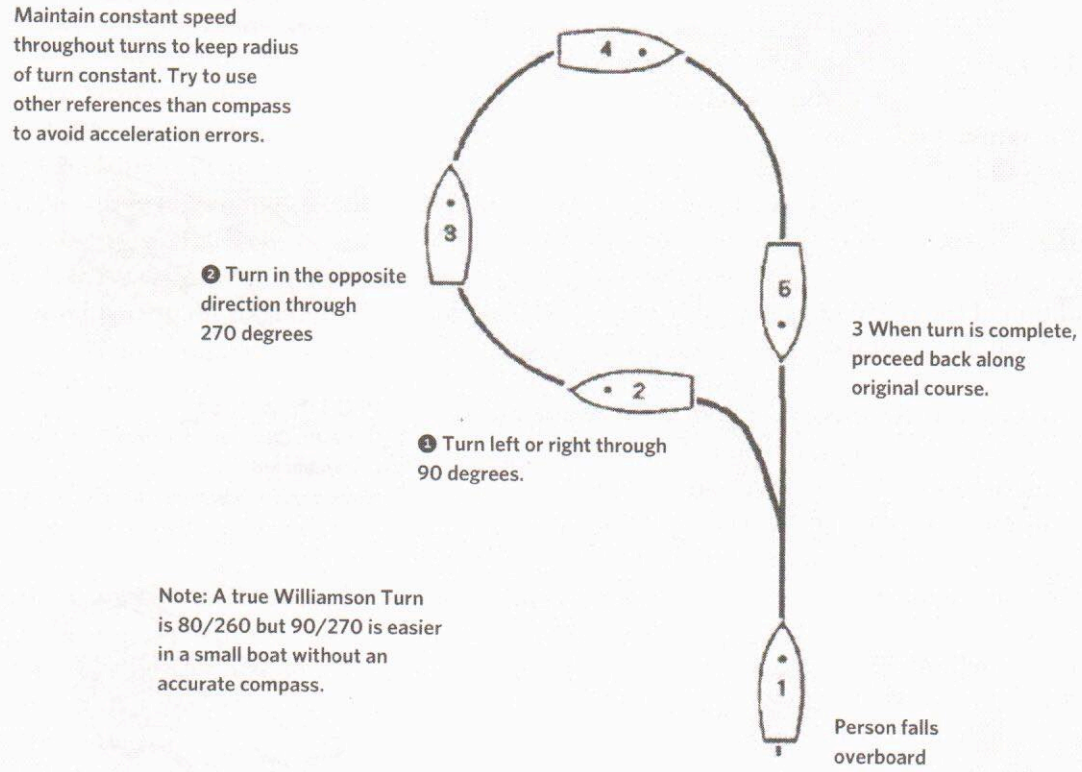


Leg and Arm Method
Use with: Moderate freeboard Weakened person 2 crew boat

Person Is Unconscious or Seriously Injured. Your on-water options will be affected by the seriousness of the injury, whether you can get outside assistance (another safety boat and/or water police, etc.) to the scene and if you have any assistants in the boat or nearby. If at all possible you should get professional assistance. If the person cannot be taken into the boat, then the safety boat should be anchored to prevent drift and, if necessary, allow the instructor to enter the water to stabilize the victim until outside assistance arrives.

Using the Modified Williamson Turn to Return to an Overboard Victim

If a person falls overboard and conditions (i.e., low visibility, at night or heavy weather) make it difficult to keep the victim in sight, use the Williamson Turn to return to a spot in the water or to return back down your track.



Rescue of a Drifting Boat

KEY CONCEPTS

- ▶ Assess situation (condition of sailors & proximity to danger)
- ▶ Approach angle & speed
- ▶ Attach towline
- ▶ Turn sailboat toward wind and away from danger

If a drifting sailboat needs to be rescued, adjust your speed and approach angle to make a smooth interception. Instruct the people on the sailboat to keep their sails luffing (or to let them out if the sails are not luffing) and to steer their boat at a fixed object, i.e., a building, a point of land, or a buoy. You don't want the sailboat to turn downwind at any point during this maneuver else the sails will fill and the sailboat could overrun you. This is the reason for approaching the sailboat on its leeward side so as you make contact, it will get turned toward the wind ensuring the sails keep luffing and you have the sailboat under control.