FIS: 308 ELEMENTARY SEAMANSHIP AND NAVIGATION (2 UNITS)

COAST LIGHT AND LIGHT VESSELS

Courses should be set to pass all floating aids to navigation with sufficient clearance to avoid the possibility of collision from any cause. Experience shows that floating aids to navigation cannot be safely used as leading marks to be passed close aboard, but should always be left broad off the course, whenever searoom permits. When approaching a lightship, superbuoy, or a station on a submarine site on radio bearings, the risk of collision will be avoided by insuring that the radio bearing does not remain constant. Most lightships and large buoys are anchored with a very long scope of chain and, as a result, the radius of their swinging circle is considerable. The charted position is the location of the anchor. Furthermore, under certain conditions of wind and current, they are subject to sudden and unexpected sheers which are certain to hazard a vessel attempting to pass close aboard. During extremely heavy weather and due to their exposed locations, lightships may be carried off station. The mariner should, therefore, not implicitly rely on a lightship maintaining its precisely charted position during and immediately following severe storms. A lightship known to be off station will secure her light, fog signal, and radiobeacon and fly the International Code signal “LO” signifying “I am not in my correct position.” *Russian* lightships are on station during periods of navigation and leave their stations only when forced to because of ice and are then replaced as soon as possible. Lightships by day show a ball over a yellow flag with a blue St. George's cross. if a vessel is seen standing into danger the signal “NF” of the International Code of Signals is hoisted, and if not immediately seen, rockets with two explosions and bright stars may be fired every minute: by night the rockets only are used.

When not on their proper stations, the light vessels discontinue their characteristic lights and fog signals and, if possible, will lower their daymarks. They will show instead two black balls, one forward and one aft, or two red lights, one forward and one aft. In addition they will hoist the International Code signal “LO” or will show ared and a white flare-up light or flash simultaneously at least every 15 minutes. Red flags in place of the black balls and red and a white light shown simultaneously may be used in place of the flare-up light or flash. A lightship under way shows the same lights and makes the same sound signals as other vessels under way and, if preceding under its own power, hoists two black balls, one forward and one aft.

Relief lightships are painted red, with two masts. By day they display a red ball at each mast, and by night exhibit a fixed red light from the same positions. Fog signals are sounded and the warning signals described above are employed. Fog bells at *Russian* lighthouses and lightships are sounded, unless stated otherwise, in the following uniform manner: (a) at lighthouses: in groups of double strokes, the interval between the groups being not more than 3 minutes.

(b) at lightships: in groups of triple strokes, the interval between the groups being not more than 2 minutes. When the fog signal of an approaching vessel is heard, the intervals between the double and triple strokes in the groups are reduced and the bell is sounded continuously in double or triple strokes until the vessel is past the light or clear of danger. Due to a lack of information it is not possible to ensure that the details of navigational aids are correct. In *France, Lebanon* and *Tunisia* lights may be shown by day in poor visibility. In *Spain* and *Morocco* lights are shown from 15 minutes after sunset until 15 minutes before sunrise. Oil rigs in *Angolan* waters marked by Mo (U) W 18s Siren 20s are moored inside the 600 fathom contour. Such lights are not included in this list. It has been reported that the lights of *Guinea* and *Liberia* are unreliable.

Coast Guard Regulations for Boat Lighting

The Coast Guard requires lights on all boats between sunset and sunrise.

The United States Coast Guard sets regulations for all vessels that travel any waterway in the U.S. Lights on boats perform the same function they do on automobiles, and more. Lights not only alert other boats to your location, they tell them what kind of boat you are on. Each type of boat has specific regulations to make it easy to recognize.

Power Boat Light Requirements

1. Boats under power include sailboats with an optional engine. Boats less than 39.4' need either a white masthead light and white stern light or a single all-around white light. On boats less than 39.4' lights are required on each side, a separate light on each side (red on the port side, and green on the starboard side) or a single red/green light with the beams oriented in the proper directions. Boats over 39.5' must have separate masthead and stern white lights. Other lights requirements for larger boats are the same as for smaller ones. Boats more than 164' require a second masthead light positioned higher than the original forward white light.

Sailboat (Powerless) Light Requirements

2. All sailboats must have red/green side lights and a white stern light regardless of size. These may appear as a single tri-color light above mid-ship on the mast as long as all beams are oriented properly, i.e., red on the port side, green on the starboard side and white to the rear, or they can all be individual lights in the appropriate positions.

Visibility

3. Size determines the visibility distance required on boat lights. The masthead light and stern light (or the single all-around light) on boats under 39.4' must be visible at a distance of two nautical miles in a 112.5-degree arc. On boats over 39.5' the masthead must be visible at a distance of three nautical miles; stern lights, or the all-around light, stays at two miles. Side lights on boats less than 39.4' require a visibility of one nautical mile; the distance increases to two nautical miles on boats over 39.5'.

Placement

4. Stay away from fancy fittings, in-hull lights or other unusual light fixtures either manufacturer installed or user installed. Some manufacturers attempt to make their boats stand out from others by creating unique designs for the lighting. Situations where lights are flush mounted or sunk into the hull obstruct the visibility of these types of configurations. Many of these fancy styles are not functional, and they are illegal. They do not comply with visibility requirements set by the U.S. Coast Guard.

   State Boating Laws

5. States make their own laws regarding many boating regulations and have some that may not exist in other states. You are responsible for knowing what the laws are in the state where you plan on boating. However, those areas where the Coast Guard clearly demands compliance are not negotiable within each state. Lights, safety gear and other Coast Guard requirements are in effect regardless of where you are boating and are identical in all states. This is important because it allows boaters to recognize what they are looking at when they see light configurations in the dark, when it may be impossible to see any other part of another boat. The Coast Guard enforces all boating laws in all states. You must always allow a Coast Guard vessel to approach and officers to board your boat.

Lightvessel

Lightship Finngrundet, now a museum ship in Stockholm. The day markers can be seen on the masts.

Fehmarnbelt Lightship, now a museum ship in Lübeck

A **lightvessel**, or **lightship**, is a ship which acts as a lighthouse. They are used in waters that are too deep or otherwise unsuitable for lighthouse construction. Although there is some record of fire beacons placed on ships in Roman times, the first modern lightvessel was off the Nore sandbank at the mouth of the River Thames in England, placed there by its inventor Robert Hamblin in 1732. The type has become largely obsolete; some stations were replaced by lighthouses as the construction techniques for the latter advanced, while others were replaced by large automated buoys.

A crucial element of lightvessel design is the mounting of a light on a sufficiently tall mast. Initially this consisted of oil lamps which could be run up the mast and lowered for servicing. Later vessels carried fixed lamps, which were serviced in place. Fresnel lenses were used as they became available, and many vessels housed these in small versions of the lanterns used on lighthouses. Some lightships had two masts, the second holding a reserve beacon in case the main light failed.

Initially the hulls were constructed of wood, with lines like those of any other small merchant ship. This proved to be unsatisfactory for a ship that was permanently anchored, and the shape of the hull evolved to reduce rolling and pounding. As iron and steel were used in other ships, so were they used in lightvessels, and the advent of steam and diesel power led to self-propelled and electrically lighted designs. Earlier vessels had to be towed to and from station.

Much of the rest of the ship was taken up by storage (for oil and the like) and crew accommodations. The primary duty of the crew was, of course, to maintain the light; but they also kept record of passing ships, observed the weather, and on occasion performed rescues.

In the early 20th century, some lightships were fitted with warning bells, either mounted on the structure or lowered into the water, the purpose of which was to warn of danger in poor visibility and to permit crude estimation of the lightship relative to the approaching vessel. Tests conducted by Trinity House found that sound from a bell submerged some 18 feet (5.5 m) could

be heard at a distance of 15 miles (24 km), with a practical range in operational conditions of 1–3 miles.

Mooring

Lightship *Portsmouth* (LV-101) shows its mushroom anchor. It can be seen at downtown Portsmouth, Virginia, and is a part of the Naval Shipyard Museum.

Holding the vessel in position was an important aspect of lightvessel engineering. Early lightships used fluke anchors, which are still in use on many contemporary vessels. These were not very satisfactory, since a lightship has to remain stationary in very rough seas which other vessels can avoid, and these anchors are prone to dragging.

Since the early 19th century, lightships have used mushroom anchors, named for their shape, which typically weigh 3-4 tons. They were invented by Robert Stevenson. The first lightvessel equipped with one was an 82-ton converted fishing boat, renamed *Pharos*, which entered service on 15 September 1807 near to Bell Rock and had a 1.5 ton anchor. The effectiveness of these anchors improved dramatically in the 1820s, when cast iron anchor chains were introduced (the rule of thumb being 6 feet of chain for every foot depth of water).

Appearance

LV-11 (originally British lightship Trinity House) is docked in Rotterdam, Netherlands, as "Breeveertien" serving as a restaurant.

The North Carr Lightship showing large foghorn

As well as the light, which operated in the fog and also at night, from one hour before sunset to one hour after sunrise, early lightvessels were equipped with red (or very occasionally white) day markers at the tops of masts, which were the first things seen from an approaching ship. The designs varied: filled circles or globes, and pairs of inverted cones being the most common among them.

Later lightships, for purposes of visibility, normally had bright red hulls which displayed the name of the station in white upper case letters; relief light vessels displayed the word RELIEF instead. A few ships had differently coloured hulls. For example, the Huron Lightship was painted black since she was assigned the black buoy side of the entrance to the Lake Huron Cut. The lightvessel that operated at Minots Ledge, Cohasset, Mass. from 1854 until 1860 had a light yellow hull to make it visible against the blue-green seas and the green hills behind it.

Lightvessel service

The first lightvessel conversion to solar power was made in 1995, and all vessels except the '20 class' have now been converted. The '20 class' is a slightly larger type of vessel that derives its power from diesel electric generators. Where a main light with a visible range in excess of 20 nautical miles (37 km) is required, a '20 class' vessel is used, as the main light from a Trinity House solar lightvessel has a maximum range of 19 nautical miles (35 km).

The first United States lightship was established at Chesapeake Bay in 1820, and the total number around the coast peaked in 1909 with 56 locations marked. Of those ships, 168 were constructed by the United States Lighthouse Service and six by the United States Coast Guard, which absorbed it in 1939. From 1820 until 1983, there were 179 lightships built for the U.S. government, and they were assigned to 116 separate light stations on four coasts (including the Great Lakes).

The first United States lightships were small wooden vessels with no propelling power. The first United States iron-hulled lightship was stationed at Merrill's Shell Bank, Louisiana, in 1847. Wood was still the preferred building material at the time because of lower cost and ability to withstand shock loading. Wooden lightships often survived more than 50 years in northern waters where the danger of rotting was reduced. Lightvessel 16 guarded Sandy Hook and Ambrose stations more than 80 years. Lightvessel 16 had both an inner hull and an outer hull with the space between filled with salt to harden the wood and reduce decay. Several lightships built with composite wood and steel hulls in 1897 proved less durable than either wood or steel.

The first modern steel lightship in United States service was lightvessel 44 built in 1882. One of the last United States wooden hulled lightships built, lightvessel 74, went into service at Portland, Maine, in 1902. The first United States lightships with steam engine propulsion were built in 1891 for service on the Great Lakes where seasonal ice required prompt evacuation of light stations to avoid destruction of the lightships.

Some lightships, like this one in Amsterdam, were also equipped with a foghorn for audible signals at foggy times.

LIFE SAVING AND FIRE FIGHTING EQUIPMENT AND METHODS

Good seamanship skills are essential for staying safe on the water. Navigational skills will help get you from here to there safely and efficiently. Learn too how to be prepared for difficult conditions and what to do if an emergency strikes.

How to Rescue a Man Overboard in a Sailboat

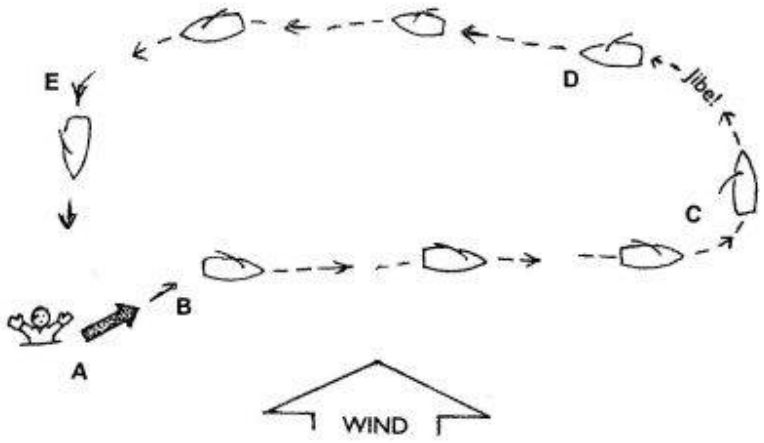
A man overboard (MOB), also called crew overboard (COB) or person overboard (POB), is a very serious boating emergency. Most boating deaths result from falling overboard. Sailors should know how to quickly return under sail to a person overboard in the water and stop the sailboat beside the person for recovery. Here are step-by-step descriptions of the best methods for sailors to do a man-overboard maneuver.

Seamanship - Preparing for a Sailing Crisis

Sailing can rapidly become a crisis if something unexpected goes wrong - and it often does. Good seamanship calls for having the right equipment on board in case of a problem or

emergency, as well as the knowledge of what to do. A good skipper stays prepared by thinking about “What if” scenarios and knowing what to do. Here are some common things that can go wrong and steps to take to be prepared.

Principles for Man Overboard Rescue



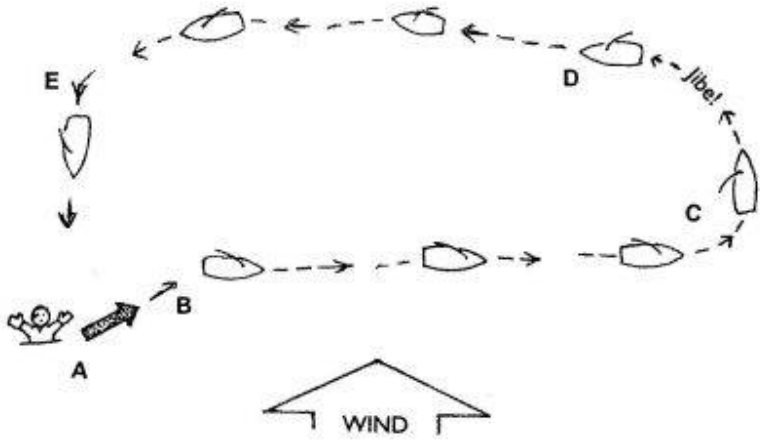
A man overboard (MOB), also called crew overboard (COB) or person overboard (POB), is a very serious boating emergency. Most boating deaths occur after falling overboard. Since you can't trust your engine to start immediately, and since most MOBs don't occur in flat water in calm conditions, you must know how to efficiently turn the boat around and return to and stop beside the person under sail.

First, remember these general principles for any MOB:

1. Immediately throw floating objects in the water near the person, including life rings, boat cushions - anything that will float, and the more the better. The person can hold onto these things to help stay afloat until you return - important even if the MOB is wearing a lifejacket. Things in the water also make it easier to locate the area of the MOB, which can be critical in high waves or at night.
2. Get all crew on deck to help. Assign one person to keep watching and pointing at the MOB at all times while the rest of you handle the boat.
3. Press the MOB button on your GPS unit or chartplotter, if you have one. You might think you can easily return to and find the person in the water, but it can be easy to lose track in poor conditions, and knowing the person's GPS position may be necessary.
4. Start the boat's engine, if you have one, to assist with or manage your return to the victim. Loosen the sheets as needed so that you're not fighting the sails when you turn. Remember to be in neutral or turn the engine off when you near the victim.

Next we'll look at the steps for maneuvering the boat under sail to return to and stop beside a man overboard.

The "Beam Reach-Gybe" Method



Art modified from International Marine

This diagram shows a simple method for turning the boat back to the MOB and stopping. Different MOB maneuvers have been developed for different kinds of boats and different conditions (we'll see others in the next pages), but if you want to remember just one that can be used by all boats and in all conditions, this is a good one that is easy to practice and remember. Here are the key steps:

1. While throwing floating things overboard (point A on illustration) and gathering other crew to help, the helms-person immediately turns the boat onto a beam reach (B). If needed, sails can be quickly trimmed to keep forward momentum and steering. Note the compass heading.
2. When crew are ready, gybe the boat (C) and head back on the other beam reach. You will be on a reciprocal course (D) after this 180-degree turn and can use your compass to confirm you are on course.
3. Because it typically takes two to three boat-lengths to gybe, you will be about that distance downwind when you reach the person in the water. Depending on the boat and conditions, it may also take two to three boat-lengths for the boat to come to a stop when you turn into the wind (E) to reach the MOB. Ideally you stop just beside the person. If there is any risk of stalling before reaching the MOB, angle your reciprocal course (D) to approach closer before turning into the wind.

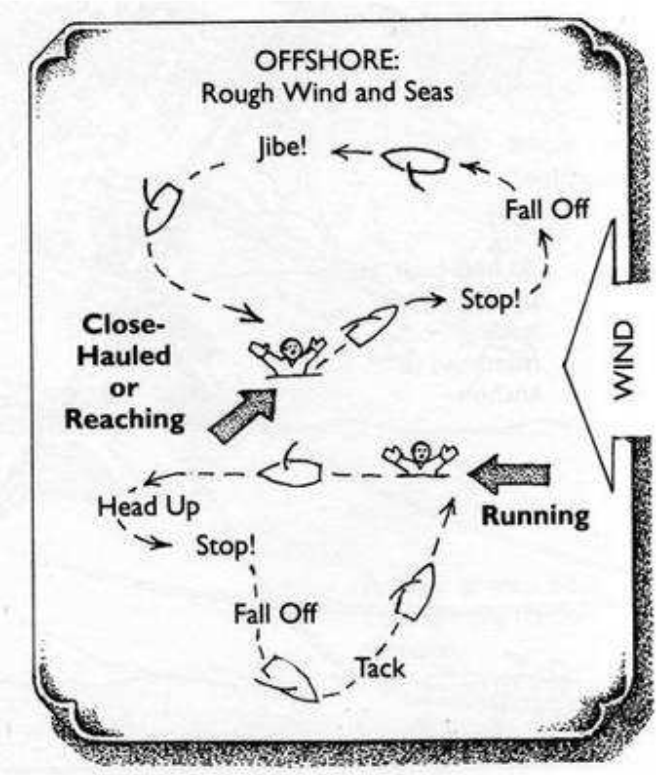
Advantages of the beam reach-gybe maneuver include:

- Starting on a beam reach means you can always return on a reciprocal course to where you started.
- If you lose sight of the MOB, sailing the same length of time on both beam reaches will put you in about the same place.
- When you return to a spot just downwind of the MOB, it is more likely you will see the person or things you threw overboard as they drift downwind toward your position.

- There is less risk of running over or past the MOB when your final approach is into the wind rather than on another point of sail.

Nonetheless, other MOB sailing maneuvers are useful in some situations. The next two pages show other effective methods.

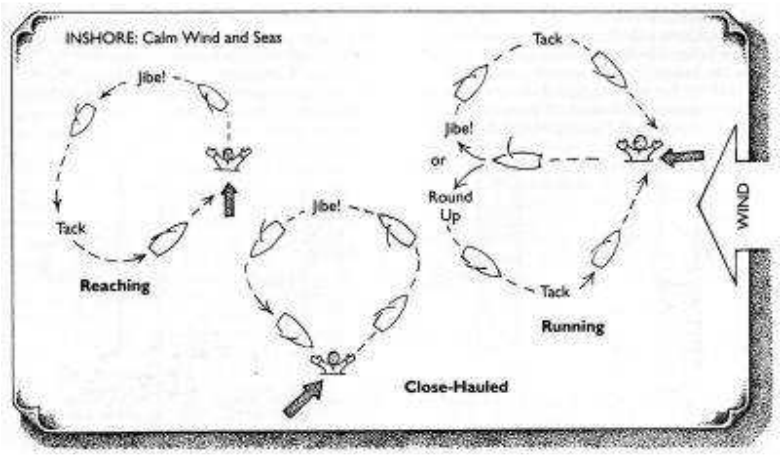
Offshore MOB Quick-Stop Maneuvers



When sailing offshore in a larger boat, especially in conditions where it is more difficult to keep an eye on the person in the water, you might use one of the two quick-stop methods shown here. Both involve very quickly turning into the wind, as soon as possible after the MOB is recognized, so that the boat stays close nearby. Because the boat will stall when headed up into the wind to stop it, you will then need to fall off the wind again in a controlled manner to gain way and turn back to the person.

Although these two methods may at first seem more complicated or more difficult to remember, both actually use one very similar principle: turn right away into the wind to stop, and then fall off again and turn in the most natural manner to return to the person.

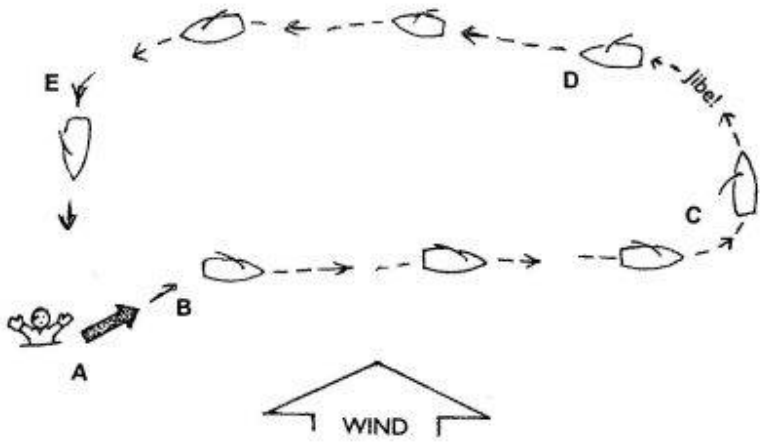
Inshore MOB Maneuvers



Inshore, especially in calm water and lighter wind, when it is easier to keep the person in sight and to turn the boat quickly, you can simply turn back to the MOB in a tight circle. Just remember to turn in a way that brings the boat in its final approach into the wind.

Examine the left and center illustrations, for example, where the boat is reaching or close-hauled on a starboard tack. In either of these, if the helms-person turned the wrong way, turning right and then tacking instead of turning to port and gybing, then the circle would be completed upwind of the MOB instead of downwind. In that case it could be difficult to stop the boat beside the person in the water, as it is very difficult to stop a boat that is moving downwind.

Figure-8 Variation on Beam Reach-Gybe Maneuver



Art modified from International Marine

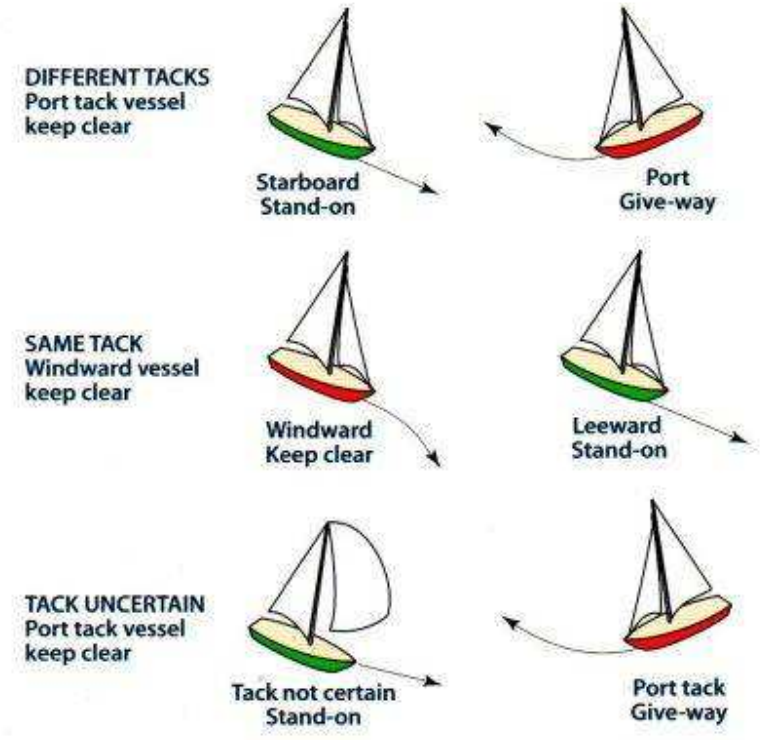
Shown here again is the "beam reach-gybe' method described earlier. Again, this is one method you can almost always use, regardless of conditions and boat size - if you want to remember and practice only one technique. It has a major disadvantage for large sailboats, however, which can be dangerous or tediously slow to gybe in a strong wind.

The figure-8 technique lacks some of the advantages of the beam reach-gybe method, but it avoids having to gybe in a larger boat. You begin the same way, heading onto a beam reach to start. Instead of gybing, you then tack and head back to the MOB. The issue now is that if you sail a reciprocal beam reach back, you will be upwind of the person on your return. So instead, while coming back, you fall off downwind somewhat so that your return track crosses your outbound track (in a figure-8), putting you downwind of the MOB in the same manner as with the beam-reach gybe method. You can then angle up close-hauled to the MOB and loosen sheets to stop the boat, or go below the MOB and head straight into the wind to stall.

Regardless of which MOB maneuver you choose for your own boat, it's critical to practice it until you can do it smoothly and efficiently, almost without thinking. This is a good way to improve your sailing skills while having fun with your crew. Choose an unexpected moment and toss a life ring or fender overboard while yelling "Man overboard!" Practice until you can return and stop the boat where you can reach the object with a boat hook. If it's hard to be that exact at first, you'll see why it's so important to practice until you can do it well in case of a real emergency.

And don't forget that after you stop the boat, you still need to get the person out of the water and back on the boat - often no easy feat. Consider a LifeSling for the best solution for both rescue and recovery.

Rules When Sailboats Meet



Collisions occur between boats more often than you might think, usually because one or both captains did not know or were not applying the Rules of the Road. The rules come from the International Regulations for Preventing Collisions at Sea (COLREGS), with which the U.S. regulations are consistent. Following are the basic rules that apply to all sailboats in U.S. waters.

Whenever two boats come close to each other, the rules designate one as the **stand-on** vessel and the other as the **give-way** vessel. The rules are designed to prevent a situation like two people walking toward each other on a sidewalk who both step out each other's way in the same direction and thus run into each other. The **stand-on vessel** must continue on its course and the **give-way vessel must** turn away to avoid collision. Therefore both captains must understand the Rules of the Road and know whether, in any given situation, their boat is to stand on or give way.

Sailboat vs. Sailboat

The Rules are simple when two boats meet under sail (engines not running), as shown in the illustration above:

- *If the boats are on different tacks* (sails on different sides of the boat), then the **sailboat on the starboard tack** (wind coming from the starboard side, with sails thus out to the port, or left, side) is the **stand-on vessel** and the **boat on the port tack** must **give way.**

The port-tack boat must also give way to a sailboat whose tack is uncertain (such as when sailing downwind using a spinnaker).

- *If the boats are on the same tack*, the **leeward (downwind) boat** is the **stand-on vessel**, and the **windward boat** must **give way**.

In sailboat races there are additional rules about the start line, rounding marks, and so on, but the basic rules above apply when boats meet in open water.

Sailboat vs. Powerboat

Remember that a sailboat running an engine, even if sails are up, is legally categorized as a powerboat. In a congested area it is best not to run the engine with sails still up, because captains of other boats may not be aware of your engine running and may assume you are operating under sailing rules.

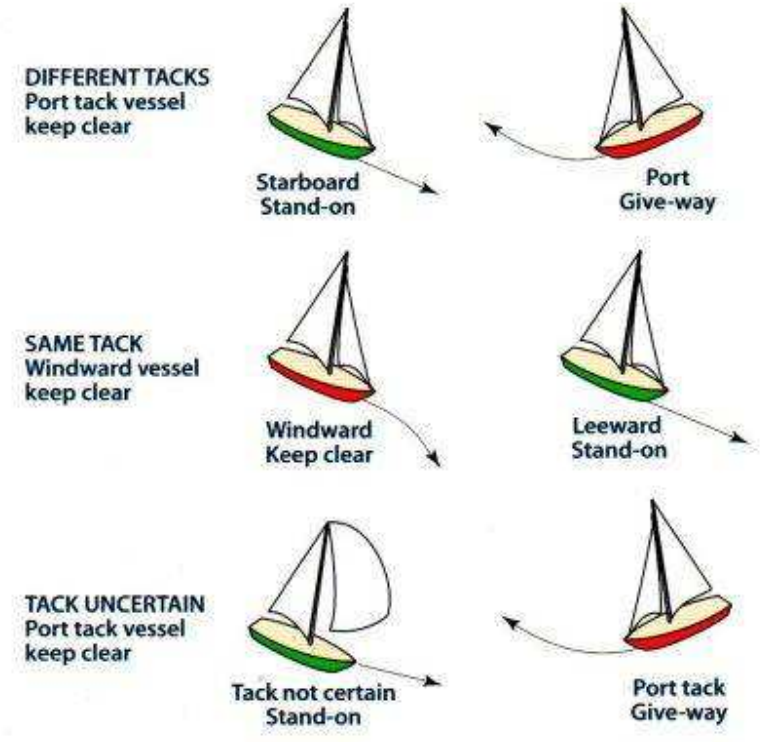
The Rules are simple when a sailboat and a small recreational powerboat meet:

- *In most situations* the sailing boat is the **stand-on vessel** and the powerboat must **give way**.
- *If the sailboat is overtaking a powerboat*, the powerboat is the **stand-on vessel** and the sailboat must **give way**.
- Any boat with more maneuverability must **give way** to any boat with less maneuverability (see below).

Maneuverability Is Key!

Sailboats under sail generally have right of way over most *recreational* powerboats, because sailboats are assumed to have more restricted maneuverability than powerboats (for example, a sailboat cannot turn and sail straight into the wind to avoid a collision). But by the same principle, sailboats must give way to any boat with less maneuverability.

Rules of the Road



Maneuverability Is Key (cont'd)

Following is the order of increasing maneuverability. Any boat lower on the list must give way to boats higher on the list:

- A disabled boat
- A boat that is difficult to maneuver, like a dredge or barge in tow
- A boat whose maneuverability is restricted by size or draft, like a freighter
- A boat engaged in commercial fishing, like a trawler
- A boat being rowed
- A sailboat
- A recreational powerboat

Powerboat vs. Powerboat

Remember that your sailboat is considered a powerboat when the engine is running. Then you need to follow the Rules for two powerboats meeting in open water:

- *When meeting head-on*, the boats should pass port side to port side, just like cars on a two-way road (in America).
- *When crossing*, the boat on the other boat's port (left) side must **give way**.

- *When one powerboat overtakes another from behind*, the overtaking boat (the **give-way vessel**) must use a sound signal to indicate which side it intends to pass on (one short blast for starboard, and two for port). The boat being passed signals approval by repeating the same sound signal back - or may use the danger sound signal (five short blasts) to indicate it is not safe to pass now on that side.

The ultimate rule is always to avoid collision. This may mean slowing or stopping your boat, even if you are the stand-on vessel, to avoid collision with another boat that fails to give way. Use common sense along with the Rules of the Road, and if in doubt of the intent of a large boat posing a danger, you can always hail them on your VHF radio for clarification.

Typical Small Sailboat

Photo © Tom Lochhaas

The Hunter 140 shown here is a typical centerboard sailboat used for learning how to sail and for sailing in protected waters. It can hold two adults or three children. It is easily rigged and sailed. We will use this boat throughout this Learn to Sail - Full Course.

Shown here is the boat as it is typically left on a dock or mooring, with sails and rudder removed. (You'll see how to rig the gear and sails in Part 2 of this course.)

The mast and boom are usually left in place on the boat. The forestay holds up the mast from the bow of the boat, and a single shroud on each side of the boat holds the mast side to side. The shrouds are mounted back of the mast, so they also keep the mast from falling forward. The stay and shrouds are made of flexible wire that can be disconnected to trailer or store the boat.

On most large sailboats, there are multiple shrouds to support the mast, along with a back stay support to the stern. Otherwise, this boat is representative of the basic standing rigging of a sloop, the most common type of modern sailboat.

The Mast Step

Photo © Tom Lochhaas

Here's a close-up view of the bottom of the mast atop the boat. The stainless steel mounting piece affixed to the boat is called the mast step. In this boat model, a pin emerging from the mast on both sides simply fits into a slot in the mast step. The mast is lightweight and easily raised by hand.

Once the mast is stepped, it is held securely in place by the shrouds and forestay, as shown in the previous photo.

The Rudder

Photo © Tom Lochhaas

On most small sailboats, the rudder is mounted on the stern of the hull, as shown here. The rudder is a long, thin blade hanging vertically from a simple set of hinges (which varies somewhat among different boats). The rudder pivots on a vertical axis, swinging side to side, which turns the boat when it is moving through the water. (We'll describe steering in Part 3 of this course.)

The rudder may be stored on the boat or removed, like the sails, after sailing. Here, the rudder is being reinstalled. On this model the rudder has a kick-up feature, which allows it to swing up if the boat strikes bottom.

The Tiller

Photo © Tom Lochhaas

The rudder is turned side to side by the tiller, the long metal arm seen here extending from the top of the rudder about 3 feet into the cockpit. On many boats the tiller is made of wood.

Note the black handle on top of the metal tiller arm. Called a tiller extension, this device mounts near the end of the tiller and can be moved far out to the side of the boat or forward. The extension is needed because when sailing close to the wind, sailors may need to move their body weight far out to the side (called “hiking out”) in order to keep the boat balanced. We’ll see this in Part 3 of this course.)

Most large sailboats use a wheel apparatus to turn the rudder, because the forces on the boat’s rudder can be so much larger that it would be difficult to steer with a tiller.

Boom Gooseneck

Photo © Tom Lochhaas

The boom attaches to the mast with a fitting called a gooseneck. The gooseneck allows the boom to swing far out to both sides as well as to pivot up and down.

This photo also shows the vertical slot in the mast used to hold the mainsail's front edge (the "luff") to the mast (as you'll see in Part 2 of this course). The sail "slugs," fittings on the sail's luff, slide up the mast in this slot.

A similar slot can be seen in the top of the boom, to hold the foot of the sail.

The L-shaped metal pin at the forward end of the boom holds the forward bottom corner of the mainsail, called the tack.

The Halyards

Photo © Tom Lochhaas

Halyards are the lines that pull the sails up the mast. A typical small sloop like this sailboat has two sails, the mainsail and jib, and thus has two halyards – one to pull up the top corner ("head") of each sail. (We'll see this is Part 2 of this course.)

At the end of a halyard is a fitting, called a shackle, that attaches the sail to the line. The line then runs up to a block (pulley) at the masthead, and comes back down alongside the mast as you see here. Pulling down on this end of the halyard hoists the sail up.

When the sail is up, the halyard is tied off tight to the mast cleat using a cleat hitch, as shown here.

Halyards are part of the boat's running rigging. "Running rigging" refers to all the lines that control the sails or other rigging, which can be moved or adjusted while sailing - unlike the fixed rigging, the usually metal, fixed parts of the rig (mast, boom, stays, shrouds).

Mainsheet Block and Tackle

Photo © Tom Lochhaas

Another key part of a boat's running rigging is the mainsheet. This line runs between the boom and a fixed point in the cockpit (as shown here) or cabin top. As the line is let out, the boom and mainsail can swing farther out from the boat's centerline. As described in Part 3 of this course, moving the sails in or out, called trimming the sails, is necessary for sailing at different angles to the wind.

Even in a small sailboat the force of the wind in the mainsail can be considerable. The use of a block and tackle in the mainsheet provides a mechanical advantage so that the mainsail can be managed by one person, with one hand, while sailing.

On most larger sailboats, the mainsheet mounts from the boom to a traveler rather than to a fixed point. The traveler can move the attachment point side to side for better sail shape.

Finally, notice the cam cleat where the mainsheet exits the block and tackle. This cleat holds the mainsheet in place after being adjusted.

Jibsheet and Cleat

Photo © Tom Lochhaas

When the jib sail is put on the forestay ("bent on"), a sheet is run from its aft corner (the "clew") on each side of the mast back to the cockpit. The jib sheets allow the sailor to trim the jib, as described in Part 3 of this course.

Each jib sheet is led back through a cam cleat, as shown here, which holds the line in place. The jaws of the cam cleat allow the line to be pulled back but not slip forward. To release the jib sheet, the sailor jerks the line up and out of the jaws (into the open space below the top red piece shown).

The Centerboard

Photo © Tom Lochhaas

The final part we'll look at in this boat introduction is the centerboard. You can't actually see most of the centerboard, however, because it is in the water below the boat. This photo shows only its top edge protruding from the centerboard trunk down the middle of the cockpit.

The centerboard is a long, thin blade mounted at one end on a pivot point. When its control line is let out, the centerboard swings down into the water – usually about 3 feet down on a boat of this size. The thin board slices cleanly through the water as the boat moves forward, but its large flat side provides resistance to prevent the wind from blowing the boat sideways. In Part 3 of this course we'll discuss how the centerboard is used while sailing.

Note the centerboard control line running back on the right side of the centerboard trunk. The cleat that holds the line and keeps it from moving forward is called a clam cleat because of its shape. With no moving parts, this cleat holds a line squeezed into it. It is not as secure as the cam cleat for the mainsheet and jibsheets, but the force on the centerboard line is much less.

BASIC SAILING TECHNICS

Basics of Steering

Photo © Tom Lochhaas - sailor Tom Gynan

As soon as the sails are drawing and the boat is beginning to move, be sure you are sitting on the side of the boat the wind is coming over – opposite the sails (as shown here). The wind against the sails will make the boat heel (lean) over, and your weight is needed on the high side to keep the boat from capsizing.

As soon as the boat is moving, water is streaming past the rudder and the boat can be steered with the tiller (see tiller in Part 1). If you have ever used an outboard motor on a small boat to steer by pushing the motor's tiller arm, then you already know how to steer a small sailboat, since the tiller works the same way.

If you have never steered with a tiller before, it takes a bit to get used to, because it seems to work the opposite of what you might expect. **To turn the boat to the left (port), you move the tiller to the right (starboard). To turn the boat to starboard, you move the tiller to port.**

This makes sense when you look at how the rudder is hinged to the stern of the boat. Moving the tiller one direction rotates the rudder to the other side, and water moving against the rudder pushes the stern of the boat the other direction. Look at this photo and think through these steps to better understand:

1. Move the tiller toward the port (left) side, as this sailor is doing.
2. This swings the rudder out a little on the starboard (right) side.
3. The water against the rudder's starboard side causes a pushing motion that moves the stern the other direction, to port.

4. Moving the stern to port means the bow now points more to starboard. Steering by moving the stern is very different from steering a car, where the front wheels turn the front of the car. A boat steers by pushing the stern one way or the other – like driving a car in reverse.

Don't worry if this sounds confusing - you'll learn this very quickly on the water! **Most important, make *very small* movements of the tiller until you get a feel for steering!**

It is easiest to learn to sail a boat from a mooring (a permanent anchor line in the water). The wind will blow the boat straight back, such that the bow faces into the wind. This is the one direction in which we can't sail, so the boat has to be turned so that the wind is coming across the boat from either side.

To turn the sailboat after it is released from the mooring line, simply push the boom out to either side. The wind will now blow against the back of the sail (rather than past it on both sides), and the boat will rotate – this is called "backing the sail." Now the boat can begin to sail as you pull in the mainsheet to tighten the main sail.

It is a little more difficult to learn to sail off a dock or beach. If the boat is being blown sideways against the dock, it can be almost impossible to get started. In this case, walk the boat to the end of the dock and turn it there to face outward into the wind. Then you can back the sail to get started.

Remember that the boat can't move if the sails are loose and flapping in the wind. But as soon as they are tightened up when the wind is coming over the side, the boat will begin to move forward. The next pages describe how to manage the sails and steering.

As soon as the sails are drawing and the boat is beginning to move, be sure you are sitting on the side of the boat the wind is coming over – opposite the sails (as shown here). The wind against the sails will make the boat heel (lean) over, and your weight is needed on the high side to keep the boat from capsizing.

As soon as the boat is moving, water is streaming past the rudder and the boat can be steered with the tiller (see tiller in Part 1). If you have ever used an outboard motor on a small boat to steer by pushing the motor's tiller arm, then you already know how to steer a small sailboat, since the tiller works the same way.

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4. Moving the stern to port means the bow now points more to starboard. Steering by moving the stern is very different from steering a car, where the front wheels turn the front of the car. A boat steers by pushing the stern one way or the other – like driving a car in reverse.
5. Remember that the sheets pull in and let out the sails. Pulling the mainsheet brings the mainsail closer to the centerline of the boat. Pulling the jibsheet brings the jib closer to the centerline.
6. Once the boat starts moving forward, position the tiller so that the boat is not turning to either side. If the sails are loose and flapping, pull in the mainsheet just until the mainsail stops flapping and takes shape – you will feel the boat speed up. Then pull in the jib sheet until the jib also stops flapping.
7. There is one simple general principle for where to position your sails. The closer you sail toward the wind (close hauled), the more you pull in the sails. The farther you sail off the wind (broad reach), the more you let out the sails.
8. The photo at left shows the sails far out to the side as the boat sails downwind. (The wind here is blowing from right to left.) The photo at right shows the sails brought in close as the boat sails upwind. Notice the boat heels over more the closer it sails into the wind.

Safety a Big Issue for Small Boats

Give your Boat a Quick Inspection Before Heading Out on the Water

It doesn't require a 40 ft. cabin cruiser to enjoy the nation's many lakes, rivers, and coastal waterways, but those operating small boats to engage in water-related activities do need to be aware of their boat's limitations and behave accordingly.

Statistically, more than 80 percent of all boating fatalities occur in boats less than 26 feet in length, often the result of capsizing or falls overboard. In many cases, a contributing factor is one or a combination of the Coast Guard's Big 4: excessive speed, reckless operation, operator inattention/inexperience, and boating under the influence.

But other factors point to hazards particular to smaller craft. In small, open-constructed boats, the wave-size-to-boat ratio is much less than on a larger boat, and a small boat will fill with water more quickly if washed over by a large wave, or even a small one. Transoms and helm station areas are wide open and the boats have smaller and fewer bilge pumps, or none at all. Also, decks are not watertight, and water can enter and damage the control cables, leaving the boat stranded.

Even empty, such boats have little to no freeboard – the distance between the rail or top edge of the boat and the waterline – and even less when fully loaded with occupants, food, and gear. It's easy to overload these vessels unintentionally, and an overloaded boat is more likely to capsize, even in relatively calm waters.

So keep in mind your boat's maximum load capacity. On most mono-hull boats up to 20 feet long, this information can be found on the capacity plate, permanently affixed to the hull by the

manufacturer. It notes the maximum horsepower rating and maximum load weight at which the boat can safely operate. If a capacity plate isn't present, one easy formula for calculating the maximum load for a mono-hull boat is to multiply the boat's length times its width and divide by 15. As such, a 6 ft. wide, 18-foot boat can carry up to 7 people safely.
To make capsizing even less likely, be sure your load is distributed evenly to keep the boat balanced. Standing for any reason in small boats, even changing seating positions, can raise the center of gravity and make the boat less stable. The same is true for sitting on the gunwales or seat backs, or on a pedestal seat while underway. A raised center of gravity means that a wave, wake, or sudden turn can result in a person falling overboard.
For safety's sake, complete a pre-departure checklist prior to launch to make certain your boat is in good working order and has all the necessary safety equipment on board. And, big boat or small, be sure to check the weather report and waterway conditions, bearing in mind that conditions considered safe for a 40-foot boat might be unsafe for one half that size.
Small boats are a lot of fun and important to many water-related activities. Take a moment to do a 15-minute inspection before launch, watch your load, and mind the Big 4. Make sure that all of your small boat journeys are safe ones.

Complete this Pre-Departure Checklist
To make sure your small boat is "seaworthy" and that all essentials are on board, set aside 15 minutes for a quick inspection before launch.
□□Check the operating condition of your boat: motor, steering, battery, hoses, clamps, bilge pumps, wiring, fuel tanks, lines, float switches, and lights.
□□Make sure you have a U.S. Coast Guard-approved life jacket of correct size and type for you and every passenger (and, on the water, make sure they are worn, not just stowed).
□□If your boat is greater than 16-feet in length, be sure you also have a Coast Guardapproved throwable flotation device – i.e. buoyant cushion, ring buoy, or horseshoe buoy (kayaks and canoes are exempted from this requirement).
□□Check for other safety equipment appropriate to the size of your boat and the area where it will be operating; for example, flashlight, tool kit, first-aid kit and sunscreen, paddles, oars, binoculars, anchor and anchor line, fire extinguisher, spare battery, visual distress signals, charts of the local area, and a VHF-FM marine radio.
□□Check the capacity plate (if affixed to the hull) or calculate the maximum load to make sure you don't overload the boat with passengers and gear.
You can also download a Pre-Departure Checklist from the U.S. Coast Guard at

Sea-Terms

Basic Sailing Terminology for the Beginner Sailor
When you are learning to sail, the first thing you will notice is that it is full of confusing terminology. For the beginner it can be quite overwhelming, but everyone has to start somewhere, even British Olympic heroes such as Ben Ainslie or Sarah Ayton. So if you don't know your sheets from your booms, or your port from your

starboard, here are some definitions of some of the most common sailing terms.

The Bow and the Aft

The bow is the name given to the forward part of the boat, and the aft is the name given to the back half. However, the aft is slightly more problematic because it is also known as the stern. The bow is important to know because its location directly relates to two of the most important terms in sailing: port and starboard.

Port and Starboard

Port refers to the left-hand side of the boat when you are looking forward towards the bow. Starboard is the opposite, referring to the right-hand side of the boat. Beginner sailors often think that it would be easier to use ‘left' and ‘right', but these could refer to something else whilst out on the water and become confusing. It is important to know these two terms because many sailing rules regarding the rights of way that oncoming boats have refer to them. One common way to remember them is that ‘port' has the same amount of letters as ‘left', but they will soon roll off the tongue easily.

Windward and Leeward

As you will already know, sailing is intricately linked to the wind and what direction it is coming from. It therefore comes as no surprise that we have our own names to refer to these directions. Windward therefore refers to the direction in which the wind is blowing, and leeward the direction opposite the way the wind is blowing. People tend to confuse these quite a bit to start with, so don't worry if it takes a while to remember them.

The Boom, the Rudder and Sheets

These are all objects found within a sailing boat. The boom refers to the horizontal pole that connects to the foot of the sail. It moves from side to side to harness the power of the wind, and can be quite dangerous if the sailor is not paying attention to it. The rudder is the flat piece of plastic or wood that is positioned under the boat, and is responsible for steering. It is controlled with a sheet, which is the name given to any rope that is used to control either the boom, the sail or the rudder. Sheets also have different names according to their role, but we won't go into that here.

Tacking and Jibing

These are two of the most common manoeuvres in sailing. Tacking is accomplished by turning the bow through the wind, allowing the wind to change from one side of the boat to the other, and the boat moves towards an upwind location in a zig-zag manner. Jibing is essentially the opposite of this, and involves turning the stern of the boat through the wind in order to travel downwind. However, the manoeuvre is often a lot quicker and less controlled than tacking, and the quick-moving boom can make it more dangerous.

a-back	A sail is a-back when its *forward* surface is acted upon by the wind.
a-baft	the hinder part of a ship - behind - thus, *abaft the fore-mast*, means anything between the stern and the more-mast

a-board

In the ship: as, the cargo is *a-board*. A ship is said to *fall aboard* when she runs foul of another. To get *aboard* the main deck is to bring the clew of the main-sail down to the chess-tree.