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DOI Motorboat Operator Certification Course

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Chapter 1 – Boat Orientation

Purpose:

Learning the parts of the boat and proper nautical terminology is important for all types of boating. The importance for using descriptive terms can easily be translated to increased safety and crew efficiency. Most importantly it prevents misunderstandings during emergencies and complex evolutions and can often save precious seconds that can be the difference between success and failure in a very dynamic environment.

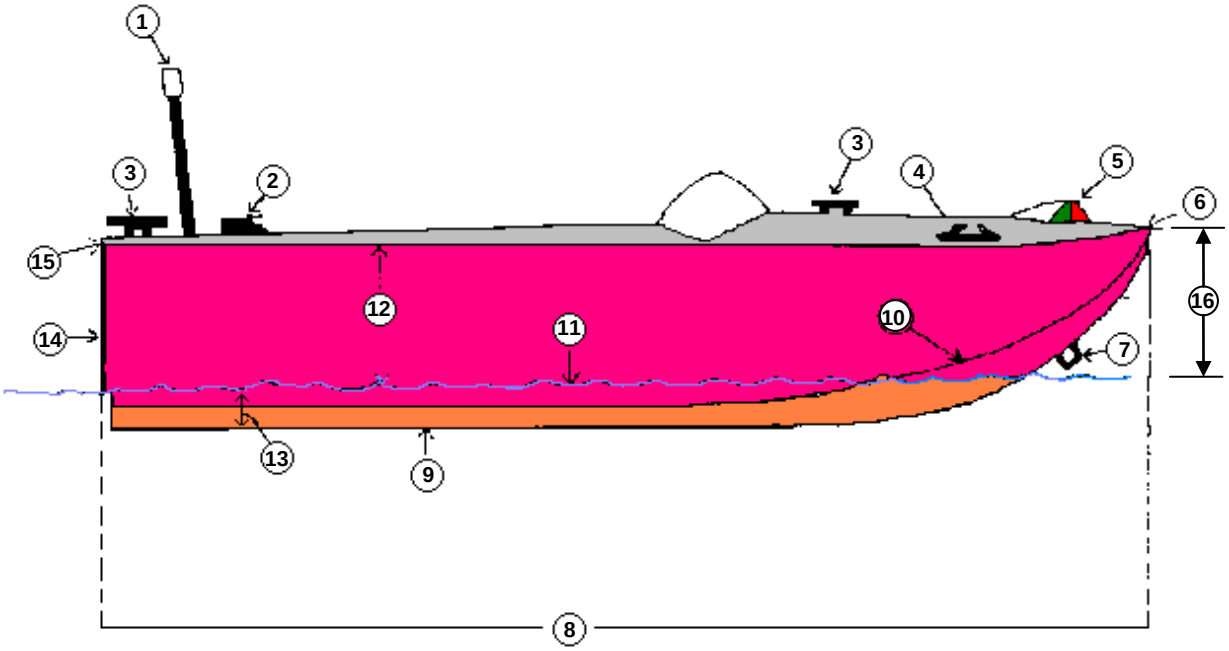
Performance Objectives:

By the end of this unit, the participant will be able to:

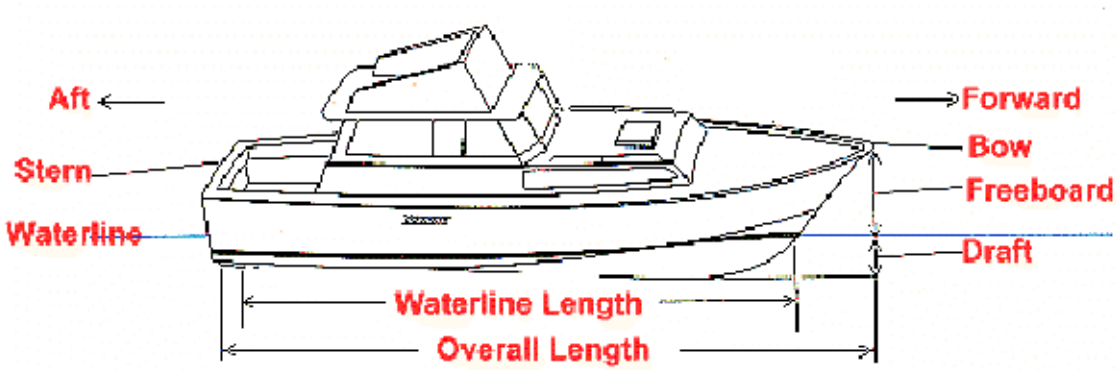
1. Use common nautical terminology.
2. Describe how boats are classified by the US Coast Guard.
3. Describe hull materials, design and uses with advantages and disadvantages of each.
4. Orient themselves with the boats which will be used during the practical portions of the MOCC

Terminology

Boating has a language all its own and just like any language which is foreign to our native tongue it requires practice and repetitious use to master. The parts of a boat are a good place to start. Each end and side of the boat has a special name. Its height and width also have special terms to describe them. For additional term definitions please see the glossary.

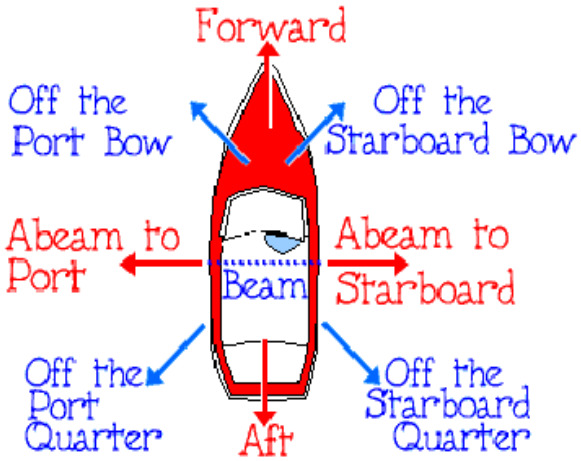


1 **All around light -** A light showing an unbroken light over an arc of the horizon of 360 degrees
2 **Cowl -** Topside duct of the vessels ventilation system
3 **Cleat -** A stationary device used to secure a line aboard a vessel.
4 **Chock -** Hole or ring attached to the hull to guide a line via that point
5 **Combination light -** Red/green light on bow of vessel
6 **Bow -** The front of a vessel
7 **Bow eye –** "U"-bolt mounted through the hull for maximum strength
8 **Overall length -** Refers to the length of a vessel, not including motor or attachments
9 **Keel -** The central structural basis of the hull
10 **Chine -** An angle in the hull
11 **Waterline –** The water level around a vessel's hull when afloat
12 **Gunwale -** Upper edge of the hull perpendicular to the sides of the vessel
13 **Draft -** The depth of a ship's keel below the waterline
14 **Transom -** The flat surface across the stern of a vessel
15 **Stern -** The rear part of a vessel
16 **Freeboard** - From waterline to gunwale



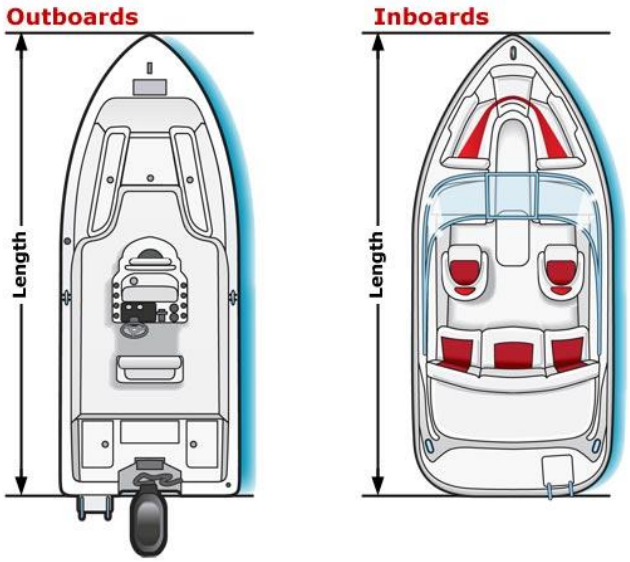
Relative Bearing

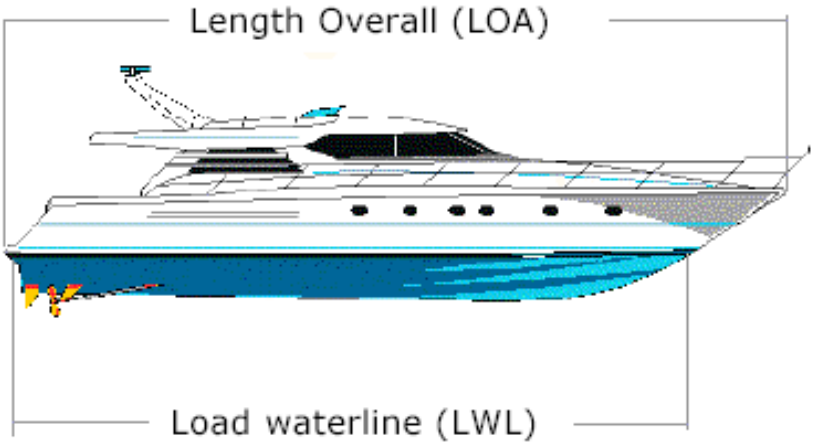
- **Forward** - toward the front of boat
- **Aft** - toward the rear of boat
- **Bow** - front of boat
- **Starboard** - right side of boat looking forward
- **Port** - left side of boat looking forward
- **Beam -** the greatest width of boat
- **Abeam** - at right angles to the keel of the boat, but not on the boat
- **Quarter** - sides of a boat aft of amidships
- **Amidships** - in or toward the center of the boat
- **Astern** - in back of boat, opposite of ahead



How to Measure Length

Length is measured from the tip of the bow in a straight line to the stern. This does not include outboard motors, brackets, rudders, bow attachments, or swim platforms and ladders that are not a molded part of the hull. This measurement is called the **length overall (LOA)**. You may also hear the term **length of waterline** or **load waterline (LWL)**. This is the length of the boat, parallel to its centerline, at the line where it meets the water.





Boat Length Categories

- A vessel's length class determines the equipment necessary to comply with federal and state laws.

- Vessels are divided into length categories:
  - Less than 16 feet
  - 16 feet to less than 26 feet
  - 26 feet to less than 40 feet
  - 40 feet to 65 feet

Boat Capacity Plate

Under the U.S. Coast Guard Federal Boat Safety Act of 1971, boats less than 20 feet powered with an inboard, outboard, or stern drive engine manufactured after November 1, 1972, must display a capacity plate defining the safe load limits. This plate must be mounted where you can see it when preparing to get underway.

This plate displays three important items:

(1) The maximum number of passengers allowed and maximum weight of persons on board in pounds,

(2) The maximum carrying weight of the vessel in pounds and

(3) The maximum horsepower recommended for the boat. (For Outboard Motors only, not required for Inboard motors)

Typical Capacity Plate information by boat type:

- **Boats powered by outboards:** the maximum capacity based on number of passengers <u>or</u> a maximum weight, maximum total weight capacity (persons, motor and gear) in pounds and maximum horsepower capacity.

- **Boats powered by inboards and stern drives:** the maximum capacity based on number of passengers <u>or</u> a maximum weight and maximum total weight capacity (persons and gear). (The Coast Guard Safe Powering Standard does not apply to inboards, stern drives, etc.)

- **Manually propelled boats:** the maximum capacity based on number of passengers <u>or</u> a maximum weight and maximum total weight capacity (persons and gear).

Should you own a boat that was built prior to the Federal law mandating capacity plates or have a homemade boat, the following formulas can be used to determine safe loading capacity.

Formulas for Safe Loading			
Horsepower Capacity for small, flat-bottom boats. Multiply boat length (ft) times transom width (ft).		**Person Capacity:** Average weight per person is 150 lbs.	
If answer is:	Maximum HP is:	Boat Length X Boat Width / 15	= Number of people
35 or less	3		
36-39	5		
40-42	7.5		
43-45	10		
46-52	15		
Note: For flat bottom, hard chine boats, with an answer of 52 or less, reduce one increment. (e.g. 5 to 3)		Boat length and width are measured in feet. Round fractions down to next lowest number.	

The limits shown on Capacity Plates assume good to moderate weather and sea conditions. It should also be noted that many manufacturers place capacity plates on boats not required to have them. This can be determined by the lack of the words U.S. Coast Guard on the plate.

Always check the capacity plate to make sure you are not overloading or overpowering the vessel. A motor larger than recommended will make the stern too heavy and can cause the boat to flip. The transom will ride too low in the water and could be swamped by your own wake or a passing boat's wake. Your boat will not sit properly in the water and will be difficult to handle.

Too many people and/or gear will also cause the boat to become unstable. Always balance the load so that your vessel maintains proper trim. Too much weight to one side or the other will cause the boat to list and increase the chance of taking on water. Too much weight in the bow causes the vessel to plow through the water and too much weight in the stern will create a large wake. All of these situations make the vessel difficult to handle and susceptible to swamping.

Remember that the capacity plate limits are suitable for normal operating conditions. In heavy weather, reducing or adjusting the load may be necessary to maintain optimum stability.

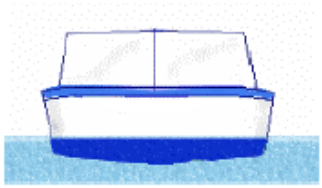
Boat Types

Choosing the right boat for the right purpose is the first step in operating a vessel safely. Just as you would not expect a small runabout to be able to cross the Atlantic, a large motor yacht would not be suitable to pull water skiers. Boats come in many sizes and configurations and each is designed with a particular use in mind. All boats that are propelled by propulsion machinery are considered motorboats.

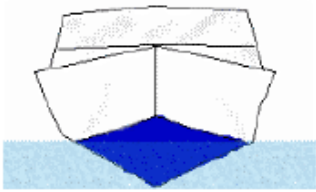
Boat Hulls

Boat hull designs, types and materials encompass a vast range depending on the specific mission for which the boat is used. Boat hull design affects handling, stability and use.

Hull Types

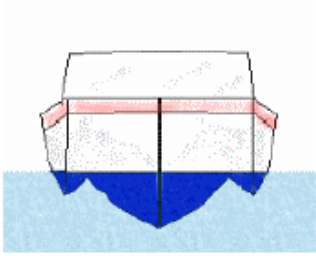


Flat bottom boat - These boats are generally less expensive to build and have a shallow draft. They can get up on plane easily but unless the water surface is perfectly calm they tend to give a rough ride because of the flat bottom pounding on each wave. They also tend to be less stable and require careful balancing of cargo and crew. Examples of flat bottom boats are Jon boats and some high-speed runabouts.



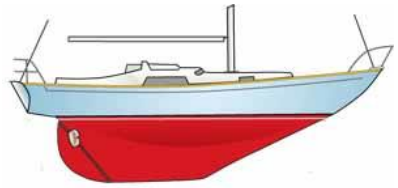
Vee bottom boat - The vee bottom tends to have a sharper entry into the water that provides for a smoother ride in rough water. They do, however, require more power to achieve the same speed as flat bottom or planing boats. Many runabouts use the vee-bottom design. They tend to be less stable than multi-hull boats.

Round bottom boat - These move easily through the water, especially at slow speeds. They do, however, tend to roll unless they are outfitted with a deep keel or stabilizers. Many trawlers, canoes and sailboats have round bottoms.



Multi- hull boat - Catamarans, trimarans, pontoon boats and some houseboats carry the multi-hull design. The wide stance provides greater stability. Each of the hulls may carry any of the above bottom designs.

Hull Designs – The two most common designs of boat hulls are displacement and planing.



Displacement vessels are designed to move through the water with a minimum of propulsion. They will have a large underwater profile and will ride comfortably although slowly. These hulls have the greatest cargo holding capacity. Trawlers and large sailing vessels are displacement vessels.

Planing vessels, however, are designed to actually rise up and ride on top of the water when power is applied. They require considerably more horsepower to get the boat up but they can attain much higher speeds from the reduced friction of moving on top of the water rather than through the water.

Hull Materials-Affects what the boat can be used for and maintenance needs

- **Aluminum** - relatively lightweight, strong, can be inexpensive, many different hull types, highly durable, some types oxidize badly in salt water, tends to be noisy and "sticks" to rocks.

- **Fiberglass**- strong, relatively inexpensive, is subject to impact damage, e.g. nicks and scrapes whenever in contact with bottom, beach or other vessels, wide variety of hull designs, difficult to repair. Double fiberglass hulls offer a foam core and provide excellent floatation if damaged.

- **Steel**- strong but heavy (makes for a slow boat), durable, expensive, not reasonable for small boat construction in most applications.

- **Inflatable** - provides high degree of crew safety, reduces possible impact damage to vessel or injury to crew when working around other vessels or structures. Many styles can be portable; can be punctured but usually under severe conditions. Tend to be wet in heavy seas and wind. Highly durable and versatile family of vessels, relatively inexpensive. Available in "hybrid" designs utilizing various hard hulls in combination with inflatable tubes.

- **Wood**- high construction cost, high maintenance, extremely costly repairs, limited styles, but quiet and warm.

- **Other**- feral cement, synthetic materials and closed cell foam.

Boat Motors

Each vessel, depending on its design and intended use, will require different types of propulsion. Most recreational vessels in the United States today use outboard engines and are less than twenty feet in length.

- Outboard
- Inboard/Outdrive
- Inboards

Propulsion

Choosing the right type of propulsion system for your boat is a very important matter. Its weight and horsepower will both have an impact on the performance of your vessel. If your vessel is underpowered its engine will work hard continually and will provide poor performance. Additionally if your vessel is overpowered it may exceed the safe operating speed that was designed for the vessel.

- Propeller
- Jet Drive

***Boat Motors and Propulsion will be covered in detail during Operating Systems**

Steering

On most motor boats, steering is controlled by a steering wheel or tiller arm.

Checklists

Checklists should be used to ensure you don't overlook any of the critical components of a vessel.

Chapter 2 – Operating Systems, Maintenance, and Inspection

Purpose

Mission safety and equipment serviceability requires an operator to understand the basic motorboat operating systems, routine maintenance & inspection, startup and shutdown procedures, and how to troubleshoot common causes of system failure.

Learning Objectives

Relative to basic motorboats, the participant will be able to:

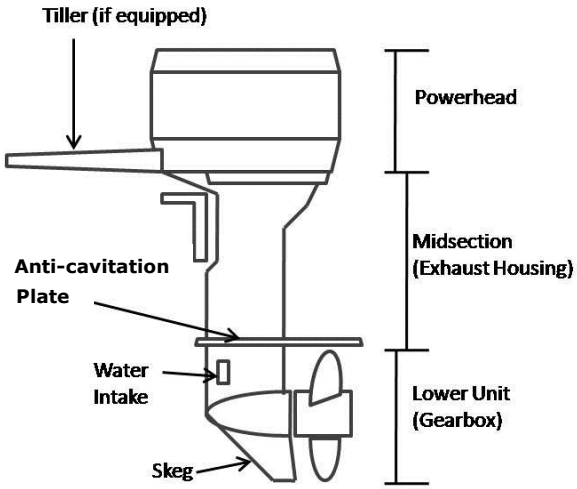
1. List operating systems, their major components and function.
2. Describe the safety aspects of a kill switch and Carbon Monoxide (CO).
3. List components that need to be routinely maintained and inspected.
4. List information that should be recorded in a log book.
5. Demonstrate startup and shutdown procedures.
6. List common causes of system failures.
7. List the priority for troubleshooting common system failures.

Basic Motorboat Operating Systems

- Motor/Propulsion (Outboard, Inboard/Outboard, Inboard; Propeller or Jet)
- Lubrication
- Fuel
- Cooling
- Electrical
- Throttle control
- Steering
- Bilge dewatering
- Anti-corrosion

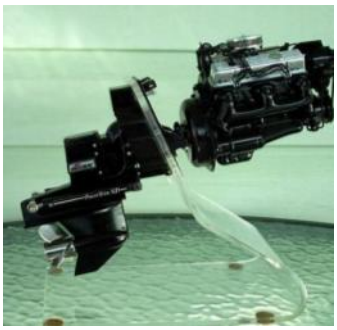
Motor Types

Outboard - Outboard motors provide a completely self-contained propulsion system composed of engine, transmission, and drive (propeller or jet pump. Outboard motors are typically mounted directly on the transom of the boat; however, you may find boats with a motor well. The entire motor swivels to provide easy steering as the drive system pushes the stern. Two (or "Twin") outboards are put on larger boats, and on boats used in remote areas so that if one fails, the other can be used to get to safety.



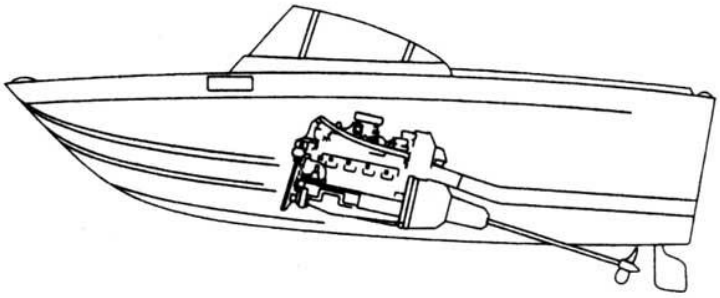
Outboard motors consist of a power head, midsection (exhaust housing), and lower unit (gear box).

Outboards can be tilted up and down (some manually, and some hydraulically) to trim the boat, and for increased clearance when on a trailer.



Inboard/Outdrive - These are also referred to as "I/Os" or "stern-drives". I/Os are generally heavier than outboards. They consist of a motor (typically four-stroke) mounted inboard and an outdrive attached low on the transom and has a lower unit like an outboard motor. The outdrive swivels from side-to-side to provide for the steering of the boat. It can also be tilted up and down to provide boat trim while underway, and for clearance when on a trailer.

Inboards (propeller & jet) – Inboards with a propeller drive and rudder are mounted forward compared to I/Os, and the motor connects directly to a transmission out of which comes a shaft that goes through the hull of the boat as it passes through the "stuffing box". The shaft is then attached to a propeller that turns to propel the boat. (The stuffing box is a cylinder through which the shaft passes. The shaft is surrounded by a stuffing material which when compressed between the cylinder wall and the shaft prevents excessive water from entering the boat.) Since the shaft is fixed and does not swivel from side to side, a rudder is mounted behind the shaft and propeller to deflect the flow of water to provide steering direction.



Inboards with a jet drive are mounted near the stern like I/Os. The motor links directly to the jet drive, although some inboard jet drives have a rudimentary transmission.

Propulsion Systems – Propeller

Materials common to modern outboards and I/Os

- **Aluminum** – Most common, low in price, and have reasonable durability, although relatively soft, and are repaired at a reasonable cost.

- **Stainless Steel** – Most efficient due to greater strength permitting stiffer blades, and a blade design that provides less slip. More expensive to purchase and repair than aluminum.

- **Composite** – Typically used as a backup propeller. Composite propellers are weaker than aluminum or stainless steel, but some composite propellers allow replacement of individual blades.

Design

- **Hub** – Most propellers have a splined bushing in the hub that attaches the propeller to the propeller shaft. The bushing is mounted to the propeller with flexible rubber. This rubber acts like a shock absorber. If the propeller strikes something hard, the rubber flexes and helps protect the gear case components from damage.

- **Diameter** – The distance across the circle made by the blade tips as it rotates. Diameter is usually determined by the RPM at which the blade will be turning (usually larger diameter on slower boats, smaller on fast boats). As a rule, slower turning, larger diameter propellers are more efficient than faster, and smaller diameter ones.

- **Pitch** – The distance that a propeller would travel forward through a soft solid, like a screw in wood. It is the function of diameter and the angle (or "rake") of the blades.

  Diameter and Pitch (in inches) are often stamped into propellers, e.g., 13X10 indicating the prop has a 13" Diameter and 10" Pitch.

- **Slip** – The difference between the pitch and the actual distance traveled in water.

Inspection and Removal - Check your propeller often for nicks, rolled tips, or bent blades. Any distortion from normal will cause a loss in performance and can create vibrations harmful to the engine. A propeller with worn blades will allow the engine to accelerate beyond the recommended operating range which can result in damage to the motor.

What to carry - It is recommended you carry a spare propeller, nut, locking device (cotter pins or tab washers), thrust washers, and any other components that can fail or be lost.

Other equipment to carry include: (a) adjustable wrench/prop tool (floating prop wrenches are available), (b) a block of wood for setting between the propeller and anti-ventilation plate when turning the prop nut, (c) spline grease.

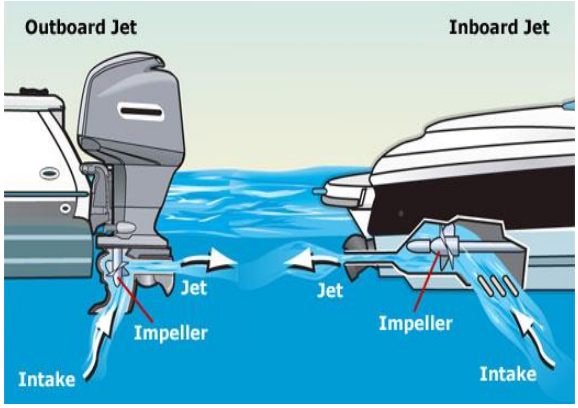
Steps for removal inspection

- **Turn the engine and master switch off, remove the key and/or kill switch, and set the gear shifter to neutral.**
- Straighten and remove the locking device (cotter pin or tab washer).
- Place block of wood (e.g., 10" piece of two-by-four) between the anti-ventilation plate and propeller blades to prevent rotation, and remove propeller nut.
- Pull propeller straight off shaft, remove front thrust washer.

- Remove any items wrapped around the prop and check for evidence of damage to grease seal.
- Coat propeller shaft with spline grease, wipe off extra and keep it clean.
- Install front thrust washer, propeller, rear thrust hub, and propeller nut onto shaft.
- Replace propeller nut and tighten to manufacturer's specification (e.g., 30 ft-lb). As a rule-of-thumb, the propeller nut is tightened until "snug". Secure propeller nut to the shaft with the locking device (cotter pin or tab washer).

Propulsion Systems – Jet drive

Jet propulsion systems utilizing one or more impellers (versus propellers) that pulls water up through an intake positioned roughly flush with the lowest part of the hull, and shoots it out behind the boat.



Compared to prop-drives, jet drives are less efficient. In addition, accessing and removing an impeller is more difficult, outboard jet drives are louder than outboard prop drives, jet pumps can get blocked by debris, many jet drives (particularly on outboards) respond sluggishly in reverse, and because there is no skeg or rudder, handling is comparably poor.

These disadvantages, however, are often outweighed by the jet-drive's ability to operate in shallow water.

Jet Drive – Components and features

- **Intake** - The intake is where the water first enters the pump.
- **Intake grate** - Metal slats designed to allow water to pass while preventing large debris from entering the pump.
- **Impeller** - The jet drive is equivalent to a propeller. Standard impellers for outboard jet pumps are made of aluminum. Stainless steel impellers are available which improve the efficiency of the pump, but are more expensive.
- **Wear ring** - A replaceable sleeve around the impeller that is designed to wear as the pump ages.
- **Nozzle** - The long tube where the water exits.

- **Reverse gate (cup)** - Designed to redirect water while passing exhaust.

- **Impeller shaft/shear pin/nut/shims** - There may be a shear pin on the impeller shaft. The shear pin is designed to break if the impeller gets bound. The impeller is held on with a nut, and shims are located between the nut and impeller (these are spares) and the impeller and pump housing. Often there is a pin that holds the nut in place.

- **Neutral -** Neutral is achieved by the proper adjustment of the reverse gate and not a transmission. Therefore, it's common to encounter boats with jet pumps that move (either forward or backward) while in "neutral".

  Although all jet pumps work on the same basic principal, there are many different designs, each suited for a different application.

Outboard jet

Design – Nearly all of the outboard jet pumps on the market today are designed the same, and vary only in size. They replace the lower unit of an outboard motor, and have a single impeller.

Exhaust - One major difference in outboard pumps (compared to inboard pumps) is that the exhaust pipe is located within the pump nozzle (exhaust systems in an inboard are separate from the pump). Outboard jet pumps are loud compared to propeller driven boats because the exhaust exits above the water line when the boat is on plane.

Maintenance

- **Lubrication** - Most pumps have a grease fitting above the bowl. Typically there is a short section of hose that allows grease to exit. The pump should be greased after each use. Grease should be added until all water is evacuated through the exit tube.

- **Intake** - The intake should be kept free of any debris. Due to the inherent inefficiency of jet pumps, a very small object blocking the intake can result in a large reduction in performance.

- **Wear ring** - Because the wear ring is designed to slowly wear, adjustment is needed periodically using shims. Typically on a new pump there will be two to three shims between the pump and the impeller. One way to determine if a shim needs to be added is by checking the rpm's of the engine. If the engine rpm is operating within specs, then the impeller is likely adjusted correctly. If the rpm's are high, then a shim may need to be added to reduce the gap between the impeller and wear ring. Extra shims are typically stored between the nut and impeller. After adding shims, check to see if the impeller is making deep gouges in the wear ring. If so, remove a shim, or re-diagnose the problem.

- **Reverse gate** - Due to normal wear, the reverse gate may periodically need adjustment to maintain neutral. There's typically an adjustment nut.

- **Spare parts and tools** - Some spare parts should be carried. These include spare impeller nuts, shims, shear and locking devices (cotter pins or tab washers), and spare impeller. Carry a wrench (or wrenches) to fit the nuts for the intake and impeller shaft. Also, carry a screw driver or other prying device to remove debris from the intake grate and the area between the exhaust pipe and nozzle walls. A small file may also be useful for sharpening the impeller.

Inboard jet

Impellers/Stages - One major feature that determines the performance of inboard jet pumps is the number of impellers. In addition to single impeller (commonly referred to as "single stage") pumps, there are two- and three-stage pumps. The more stages there are the better the pump handles white-water, although multiple stage pumps are more expensive to purchase and repair, and louder than single stage pumps.

Engine/boat/pump/impeller/nozzle combinations - Matching the engine/boat/pump/impeller/nozzle combination for the best performance and economy is not an exact science. As a result, there is wide variability in how different boats perform. It's important to keep detailed records of how a jet boat operates when new. Note the rpm at which the vessel gets on plane under a given load, and whether you can "punch it" without the motor winding up, and what the max rpm is. If these values begin to change over time, it may be a sign that parts in the pump need replacement or adjustment (reduce the gap between the impeller and wear ring).

Wear ring – Some inboard jet pumps have a replaceable wear ring, while with others the impeller must be built up and machined to obtain the proper gap.

Debris - A change in pitch, vibration, sudden loss of speed, usually (not always) indicates there is debris (sticks, leaves, ice, slush) blocking the pump.

Methods for removing debris from the pump include:

- **Flush -** Shutting down engine while the vessel is still moving sometimes allows the obstruction to be swept away.

- **Access plate -** With many inboard jet pumps you can access the area between the intake grate and the impeller through a removable plate. The access plate can either be on the dry or wet side of the transom. If inside the engine compartment, it may be below the water line. If so, it may be necessary to shift the load forward, beach the vessel, or work real fast (*If the access is in the engine compartment, turn off the master switch before working in the vicinity of the drive shaft.*).

- **Rake -** There are rakes designed to reach the intake grate from the stern of the boat.

- **Mask and snorkel -** If the air and water are warm enough, a mask and snorkel can prove to be the quickest fix (also very valuable if repairs need to be made on the wet side of the pump.)

Reverse gate types - There are different styles of reverse gates, each with different performance characteristics. In general, the style where the nozzle changes direction while the reverse gate remains stationary is the most responsive. And with that type, the style with a "whale tail" reverse gates is the most responsive.

Hydraulic systems - Some reverse gates are hydraulically controlled. Hydraulic reverse systems are easy to operate and allow faster maneuvering (stopping), but are not easily repaired in the field, can be noisy, and cause a power drain.

Motor Lubrication

Two-cycle motors – Instead of being lubricated like an auto engine, with oil in a pan and checked using a dipstick, two-cycle motors are lubricated by oil that is mixed with gas (mostly outboard engines).

Two-cycle oil is different than the oil used in an automobile.

Older two-cycle motors require mixing the oil directly in the gas tank. The typical proportions are 50 parts gas to 1 part oil. Newer two-cycle motors have an automatic oil injection system with an oil reservoir that needs to be routinely checked and filled.

Traditional 2-cycle motors are carbureted, and produce high levels of unburned 2-cycle oil. The latest generation of 2-cycle motors are computerized to meet emission standards. In some bodies of water the use of carbureted 2-cycle motors are prohibited.

Four-cycle motors – These motors are like auto engines in that they are lubricated by an isolated oil system. Four-cycle motors are generally heavier than 2-cycle engines but are usually quieter and less polluting. They use oil that needs to be changed per manufacturer's specifications (e.g., 50-100 hours), and checked prior to each trip using the oil-pan dipstick. The oil type and oil change interval varies by model.

Note: Boat motors can have an alarm that sounds when the engine runs low on oil. Refer to the boat motor owner's manual.

Outboard lower unit – The lower unit of outboards with propellers contains gear oil (e.g., SAE 80W-90) that needs to be changed periodically per manufacturer's specifications (e.g., 3-6 months, 50-100 hours). The process is easy. There are two screws; the lower removed first, then the upper, to drain the old oil. New oil is then squeezed or pumped into the lower screw hole until it starts flowing out the upper screw hole. With the oil squeeze bottle or pump still sealing the lower hole, the upper screw is replaced. The oil squeeze bottle or pump is then removed and the

lower screw is replaced. Milky-looking gear oil indicates the unit is damaged and water exists.

Fuel System

Fuel systems are comprised of one or more tanks (portable or installed), valves, lines, pumps and filters. Each of these elements, if left un–serviced, can be potentially hazardous. Check your tank often for potential corrosion that could cause leakage. Inspect the shutoff valves, lines, and pumps periodically for corrosion or wear. Check and change filters frequently in order to be assured of clean fuel entering your engine. Use de–watering liquid additive in fuel tanks to ensure that water is not present.

Many fueling stations offer only gasoline-ethanol mixes (e.g., E10). Ethanol can damage boat fuel systems, and foul the fuel tank by taking on water from the atmosphere. If possible, only use non-ethanol gasoline (often available for commercial use and at marinas). If you have to use gasoline-ethanol mix then use a marine fuel additive designed to prevent damage that can be caused by ethanol.

The most important tool you have to diagnose problems in the fuel system is your nose. Do the "sniff test" each time you board your vessel. If you smell fuel, find the problem.

Fueling procedures –

- Secure boat to dock
- Switch engine off
- Extinguish all open flames
- Do not use electrical switches
- No smoking
- Close doors, ports, hatches
- All passengers ashore
- Portable tanks should be filled ashore
- Contact fuel nozzle with boat before pumping, & <u>maintain contact</u>.
- Do not overfill
- Wipe up any spillage
- Open doors, ports, hatches to ventilate after fueling
- Inboards: Turn blower on for 4 minutes minimum
- Inboards: Do the "sniff test"
- Start engine
- Re-board passengers
- Untie from dock and cast off

Remember this: The greatest cause of a boat fire or explosion is gasoline fumes in the low part of the boat.

Amount of fuel to carry – As a rule of thumb plan to carry at least enough fuel to use only one third getting out, a third getting back, and having a third left over.

Fuel gauges – Fuel gauges on boats are known for not accurately representing the amount of fuel in fixed fuel systems. Consider customizing the fuel gauge by filling the fuel tank (when completely empty and at an aspect that mimics how the boat typically sits in the water) and putting marks on the gauge where the needle sits at prescribed increments (e.g., 10 gallons).

Fuel Management Systems – Fuel management systems (including fuel flow meters) are available that accurately measure fuel consumption, and can be reset when refueling.

Cooling System – Boat motors are not equipped with radiators as cars are, but still must somehow dissipate the heat generated by the friction of the moving parts.

Outboards - Outboards pull in water through an intake on the lower unit. A water pump consisting of a rubber impeller inside a stainless steel housing circulates water around the motor and out the exhaust which exits around the propeller hub. This discharge has two benefits. It cools the exhaust and also muffles the sound of the exhaust. Outboards have a "weep hole" that discharges a stream of water to indicate when the cooling system is functioning.

New outboard engines come with ports for connecting to a hose to flush engines after use in salt water (refer to manufacturer owner's manual).

For older engines you can attach a flusher connected to a 5/8 inch garden hose, and operate the engine for about 5 minutes.

NOTE: Do not start the motor without water being supplied to the cooling system. (Refer to Owners Manual)

In outboards, the water pump impeller will burn out very rapidly without water to cool and lubricate it and you risk the possibility of the engine seizing because of overheating.

NOTE: Make sure when you initially start your vessel that water is being discharged from the exhaust system. This indicates that the cooling system is operational.

Inboards - An inboard cooling system functions like an automobile engine in that it has antifreeze circulating through the motor. However, rather than cooling the antifreeze using air that passes through a radiator, raw water cools the antifreeze by passing through a "heat exchanger". Inside the heat exchanger there are small tubes through which the antifreeze flows. Raw water is pumped around the tubes to dissipate the heat and is then expelled through the exhaust.

NOTE: Boat motors often have an alarm that sounds when an engine gets overheated, and the engine will sometimes automatically reduce in RPMs to idle. This is one of the reasons it is good to carry a copy of the owner's manual onboard the boat.

Electrical System

System failures are often caused by corroded electrical equipment. Frequently inspect electrical systems and keep them clean and corrosion free. Clean battery terminals, electrical connectors, etc. and spray them with a corrosion–retarding agent. Use only "marine grade" batteries and connectors.

Many boats have two batteries and a "Master Switch" labeled "Off, 1, All, 2" that is used to shut the electrical system off, isolate the batteries so they can be used individually, or used in combination. Refer to the manufacturer for information on battery use for specific vessels. Often there is no special use for either battery, and there are two so that there is always a fresh battery available in case of emergency. The boat motor should not be relied upon as the sole charging system. For vessels stored on land, battery charge should be maintained by a multi-stage onboard battery charger that is plugged into an AC outlet while the vessel is being stored. When operating a vessel with two batteries, consider using battery "1" on odd days, and battery "2" on even days so that each battery stays operational.

Battery Installation

- Install in well–ventilated area.
- Protect from extremes of heat/cold.
- Close to appliance served.
- Keep away from fuel fumes.
- Secure against horizontal/vertical movement.
- Cover with non–conductive material.
- Keep accessible.

Battery Maintenance

- Minimize or eliminate deep–discharge cycles.
- Install a multistage onboard battery charger to improve battery life.
- Maintain electrolyte level.
- Keep battery and terminals clean and connectors tight.
- Provide good ventilation.

Throttle Control System

With outboards and inboard/outboards, the throttle-control systems are often linked to the propulsion directional (forward/reverse) control. All controls should move freely, and be serviced if they do not. There is often a friction screw that can be adjusted to help maintain throttle control.

Motor Kill Switches

A basic kill switch is activated when a key, connected by lanyard to the operator, is pulled. This shuts off the motor, protecting the operator if accidently thrown from the helm. Kill switches are preinstalled on outboards with tiller steering, but not always on boats with a helm. Aftermarket kill switches can be installed if not present but required or prudent.

Kill switches come in many designs. Those designed using a toggle can be deactivated without a key. Some that need a key to be deactivated have a spare key mounted nearby the switch.

If there is a single kill switch on a vessel, and no practical way to restart and operate the motor without it, then it is critical to equip the vessel or crew with a backup kill switch in case the operator is thrown from the boat.

Universal kill switch lanyards are recommended for personnel who operate a variety of vessels.

Steering System

Grease fittings on steering systems must be lubricated periodically according to manufacturer's recommendations. Hydraulic steering systems have an additional fluid reservoir that must be checked and filled.

Bilge-Dewatering System

The simplest bilges are in open boats and have a single drain plug; dewatering can be accomplished using a bucket, manual pump, or by removing the plug while operating at minimum planing speed. Boats that are moored need at least one automatic bilge pump, and should have a separate switch that allows the auto-bilge to operate when all other systems are turned off by the master switch. Some boats, especially those used in heavy-weather conditions or for running rivers, are equipped with an automatic and a manual bilge pump.

NOTE: Keep the bilge clean so that any new leaks (e.g., oil or antifreeze) can be detected quickly.

Anti-Corrosion System

Outboard motors and metal boat hulls have sacrificial anodes attached to reduce corrosion on critical parts. Anodes are traditionally made of zinc, and should be replaced when they have eroded to about 50% of their initial size.

Carbon Monoxide Poisoning – Carbon monoxide (CO) is a colorless, odorless, and tasteless gas known as the "silent killer". It is produced when a carbon-based fuel — such as gasoline, propane, charcoal, or oil — burns. Sources on your boat may include motors, gas generators, cooking ranges, space heaters and water heaters.

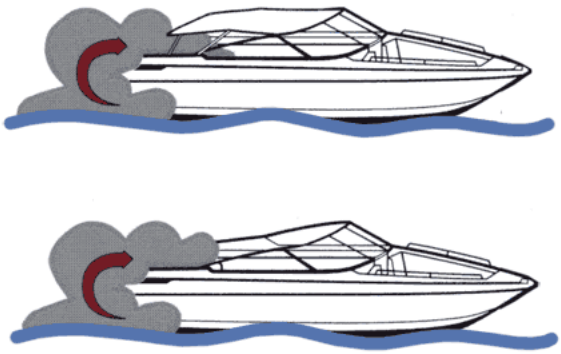
Carbon monoxide (CO) enters your bloodstream through the lungs, replacing the oxygen your body needs.

Prolonged exposure to low concentrations or very quick exposure to high concentrations of CO can kill you. It is important to know the early symptoms of CO poisoning.

Early symptoms of CO poisoning include irritated eyes, headache, nausea, weakness, and dizziness. These symptoms are often confused with seasickness or intoxication, so those affected may not receive the medical attention they need.

How can CO accumulate?

- Inadequately ventilated canvas enclosures
- Exhaust gas trapped in enclosed places
- Blocked exhaust outlets
- Another vessel's exhaust
- "Station wagon effect" or back drafting.
- At slow speeds, while idling, or stopped.
- Be aware that CO can remain in or around your boat at dangerous levels even if your engine or the other boat's engine is no longer running.



How can you protect others and yourself?

- Know where and how CO may accumulate in and around your boat.
- If you can smell engine exhaust, you are inhaling CO.
- Follow all warnings and instructions for canvas, engine operations, etc.
- Maintain fresh air circulation throughout the boat at all times.
- Know where your engine and generator exhaust outlets are located and keep everyone away from these areas.
- Stay off the back deck and the swim platforms while the engines are running.
- Never enter areas under swim platforms where exhaust outlets are located unless the area has been properly ventilated.
- Although CO can be present without the smell of exhaust fumes, if exhaust fumes are detected on the boat, take immediate action to ventilate these fumes.
- Treat symptoms of seasickness as possible CO poisoning.
- Get the person into fresh air immediately. Seek medical attention—unless you're sure it's not CO.
- Install and maintain marine grade approved CO detectors.
    - Every alarm requires immediate action.
    - Replace detectors as recommended by the manufacturer.
- If CO is suspected, open all hatches, windows and ports to ventilate
    - Changing course and speed to place boat heading into the wind can improve ventilation.
- Maintain your engine in accordance with manufacturers' recommendations. Engines that are not tuned properly produce more CO.
- Get a Vessel Safety Check.

Maintenance and Inspection

Maintain all equipment per manufacturer's specifications. Frequently inspect working components, and clean, lubricate, tighten, repair, and replace when needed. For replacement, use only "marine grade" components. If at all possible, keep a copy of equipment/system owner's manual on board each vessel.

To prevent problems, periodically conduct more extensive inspections of all components attached to the vessel. Create a checklist for each vessel identifying the components that should be inspected, along with the date and engine hours at the time of the inspection.

Here are some examples of what to include on the checklist:

- Engine condition (check for leaks, loose hardware)
- Fuel lines, including under-deck
- Remove propeller
- Impeller blades and gap between impeller and wear ring
- Pump hardware and steering/reverse linkages
- Cooling lines (inboard), including inside heat exchanger
- Electric wiring and fuses
- Batteries (secure, terminals clean, cable condition, electrolyte levels, charge)
- Throttle linkage
- Steering linkage
- Bilge condition
- Bilge pump condition

- Zinc anodes
- Paint
- Hull bottom and topside
- Cabin exterior & Interior
- Hatches/ports/hinges
- Navigation and accessory lights
- Windshield wipers
- Canopy

Boat Logbooks

Keeping adequate records is essential for maintaining vessel serviceability. This is typically accomplished using a boat logbook wherein vital readings, problems/symptoms, and maintenance actions are recorded.

Engine hours of operation are a typical measure used for prescribed engine checks and maintenance. Consider installing an hour meter if your vessel does not have one; for tiller-steered outboards that typically do not come with an hour meter, one can be purchased and fixed under the engine cowling. To function it only requires one wire that is wrapped around one of the spark plug wires.

In addition to engine hours of operation, seasonal or annual intervals are often referenced for prescribed maintenance.

Vital information to be recorded along with engine hours in a logbook includes:

- Gallons of fuel used per hour and per trip. This information is very useful for tracking engine and propulsion system performance and for determining fuel needs.

- Point-to-point fuel use for longer trips. This can be valuable for avoiding running out of fuel.

- Engine RPM, temperature, oil pressure, and voltage output at idle, cruise, and wide-open throttle (record the vessel load). These values are useful for tracking engine and propulsion system condition.

- Maintenance and repairs performed

- Problems/symptoms.

- Logbooks may also contain information about mission, weather, crew, and more depending on station needs.

- Risk assessment.

Vessel Startup and Shutdown procedures

Starting and shutdown procedures can range from short and simple on smaller vessels to long and complex on larger vessels.

Startup and shutdown includes a check of all vessel operating systems, and needs to be customized to individual vessels. Consider keeping a hardcopy of vessel-specific startup and shutdown procedures in each vessel, particularly when the vessel is used by more than one operator

Here is an example startup and shutdown procedures checklist for a basic motorboat:

Prior to starting:

- Boat Logbook - Insert prescribed information, check that problems/symptoms are resolved
- Bilge - Check that bilge plug is in, bilge pump screens are clean, and bilge switch is set to auto
- Fuel System - Fuel level, valves, vent engine compartment, secure fuel caps, prime bulb
- Cooling System - Openings clear, no leaks, anti-freeze level good
- Electrical System - Turn master switch on, check that batteries are secured, filled and charged
- Kill Switch (if installed) - Attach lanyard, if not toggle, check that spare key(s) are available
- Anti-Corrosion System - Check that anodes are attached and >50%
- Outboard lower unit - Check for leakage
- Four-cycle engine oil - Check that oil level is good, no leakage
- Two-cycle engine oil - Injection reservoir full, no leakage, or oil is mixed with fuel
- Throttle Control System - Moves smoothly, locks as designed
- Steering System - Moves freely, controls engine or jet-pump as designed
- Propulsion System - Inspect propeller/impeller for damage, working parts functional & free of debris
- Hull Condition - Clean and not leaking
- Motor Trim - Propeller is lowered to optimal position
- Other - Hardware, fittings, additional systems clean, firmly attached, operational

Start engine:

- Cooling System - Check for overboard discharge
- Bilge - Check for leakage
- Fuel System - Check for leaks
- Throttle Control System - Moves smoothly, locks as designed
- Steering System - Moves freely, controls engine or jet-pump as designed
- Propulsion System - Engages into forward and reverse as designed
- Boat Logbook - Check gauge readings against default records
- Other - Test additional systems, and start and make sure auxiliary motor is operational

Shutdown Procedures:

- Turn off engine
- Remove ignition key and store in designated place
- Put shift control in neutral
- Turn off all switches (master switch)
- Turn off fuel valve
- Secure/store equipment
- Close/lock hatches and ports
- Trailer boat if appropriate

- Remove boat plugs, if appropriate
- Wash/flush boat and motor(s)
- Refuel
- Fill-in/close boat logbook

Troubleshooting

Creating a comprehensive list of solutions for system failure is difficult if not impossible due to the wide range of causes that can result in a single failure. However, when it comes to basic motorboats, typical causes of failure can be tabulated and valuable for mission success. Consider keeping a hardcopy of Troubleshooting Procedures in each vessel.

Remember! Work from simple to complex. The priority for troubleshooting system failures is eliminating the simplest possible causes for a problem before putting time and effort into more complex possibilities.

NOTE: Whenever working near moving parts of a motor, make sure power to the motor (master switch) is off.

The following list identifies possible causes for common system failures:

1. **Engine hard to start or will not start** *(More likely not to start than to quit while running)*

- Empty gas tank
- Fuel quality bad (water in fuel)
- Primer bulb not firm
- Gas tank air vent closed
- Fuel valve closed
- Fuel line kinked, clogged, cracked, or not attached
- Fuel filter clogged
- Water or dirt in system
- Motor must be choked
- Carburetor adjusted too lean
- Ignition timing off
- Choke linkage bent or out of adjustment
- Ethanol-related problems (Consult engine manufacturer)
- Engine compartment hot causing vapor-lock (fuel-injected inboards)

2. **Low speed miss**

- Too much or too little oil
- Ignition timing
- Carburetor
- Weak coil
- Loose or broken ignition wires

3. **High speed miss**

- Bad spark plugs
- Loose or broken ignition wires
- Weak coil
- Water in fuel

4. **Runs well for a while and then quits**

- Weeds or other debris on prop
- Insufficient cooling water
- Carburetor, fuel pump, filters or screens dirty
- Lower unit bind (lack of lube, or bent)

5. **Motor overheats**

- Motor not deep enough in water
- Not enough oil in gas (2-cycle only)
- Plugged water inlet/outlet
- Obstruction in water passages/heat exchanger (e.g., sand, ice, wood)

Note: Some new engines operate only at idle when overheating

6. **Engine runs well but lacks power while underway**

- Improper mounting
- Incorrect tilt angle or improper load distribution
- Fouled propeller or lower unit
- Damaged propeller blades or bushing assembly
- Shear pin or bushing may be stripped

7. **Engine Knock**

- Loose propeller
- Loose fly wheel nut
- Worn bearings, worn pistons, or by a broken engine mount spring

NOTE: Generally, if not readily remedied by tightening prop or flywheel, take it to a dealer.

8. **Electric starter inoperative**

- Shift lever not in neutral
- Kill-switch disconnected
- Master switch off
- Loose or corroded connections, no ground
- Starter circuit safety switch open
- Dead battery
- Faulty solenoid
- Blown fuse

9. **Electric starter won't engage, solenoid clicks**

- Loose or corroded connections, no ground
- Weak battery
- Faulty solenoid (turn off ignition, engage manually, then turn on ignition)
- Broken wire in harness
- Loose or stripped post on starter

10. **Fuel odor**

- **Always stop and find the source and fix the problem**
- Improperly fitted fuel filter
- Cracked fuel line or loose fitting
- Cracked fuel tank

11. **No water coming out of cooling system weep hole**

- Debris in weep-hole waterline – Check waterline, remove debris
- Intake clogged
- Water-pump impeller damaged
- Note: On some outboards, water does not come out of the weep hole until the engine is warmed up.

12. **Runaway or over-speed engine**

- Broken/damaged throttle cables

13. **Carbureted inboard engine running-on (Dieseling) turning the key to "off"**

- Turn starter key back to "on" while it's still dieseling; it should run normally again. If it dies, water was likely pulled into cylinders while running-on
- If engine won't turn over after run-on, then remove spark plugs and run starter
- Replace plugs when water is discharged from the cylinders
- Restart
- Run engine until all water is out of oil

NOTE: Always reduce RPM's to idle before shutting off to reduce chance of run-on

Chapter 3 – Required Equipment and Bureau Policy Requirements

Purpose: Knowledge of federal boating laws is essential for the safe and legal operation of all watercraft. Additional rules and requirements may apply for specific state laws and those regulations issued by individual agencies or institutional policies. The Federal Boating Safety Act of 1971, (FBSA/71) establishes **minimum safety standards** applicable to all states, waters and vessels subject to the jurisdiction of the United States. It is the responsibility of the boater to familiarize themselves and the crew with individual state and local area requirements.

Performance Objectives:

By the end of the unit the participant should be able to:

1. Determine the equipment requirements for different size boats.
2. Identify the legal requirements for equipment acceptability.
3. Identify and ensure proper storage locations for specific equipment
4. Inspect and determine the serviceability of the boats equipment.
5. Ensure compliance with USDOI boat equipment requirements.
6. Cite operator and crew responsibilities concerning pollution regulations.

Practical Exercise Objectives:

Using Manual Chapter 2-Required Equipment, "A Boater's Guide to Federal Requirements for Recreational Boats" pamphlet and "**MOCC BOAT ORIENTATION FORM**" or the "Pre-Departure Vessel Checks" handout, the participant will inspect a motorboat to determine that the required equipment is present and further identify recommended equipment specific to operations.

References:

- Pamphlet, "A Boaters Guide to the Federal Guidelines for Recreational Boaters"
- 33 CFR & 46 CFR
- Specific Federal Bureau Policies and directives
- NASBLA State specific guidelines

Definitions:

Vessel – All types of watercraft other than seaplanes.

Boats – Primarily used for non-commercial use, owned, leased rented or chartered for non-commercial activities, engaged in the carry of six or fewer passengers for hire.

Documented Vessels – Federally documented with the U.S. Coast Guard for commercial or recreational use.

Registered Boats – State registered for non-commercial use or limited commercial enterprise.

Public Vessels – Vessels owned by the federal government, a state, or political subdivision thereof, may be state registered or federally documented, *recreational type public vessels are subject to the rules of FBSA/71.*

The type, amount and condition of the boats equipment are essential components to safety and mission success. Every boater should strive to be SAFE, LEGAL and EFFECTIVE with each and every voyage.

Registration, Documentation, Numbering and Bureau Labeling

All motorized vessels must be registered, documented and/or properly labeled and marked as required for public vessels.

Public Vessels may mark and identify federal/state government boats with agency identifiers in lieu of registration and documentation requirements.

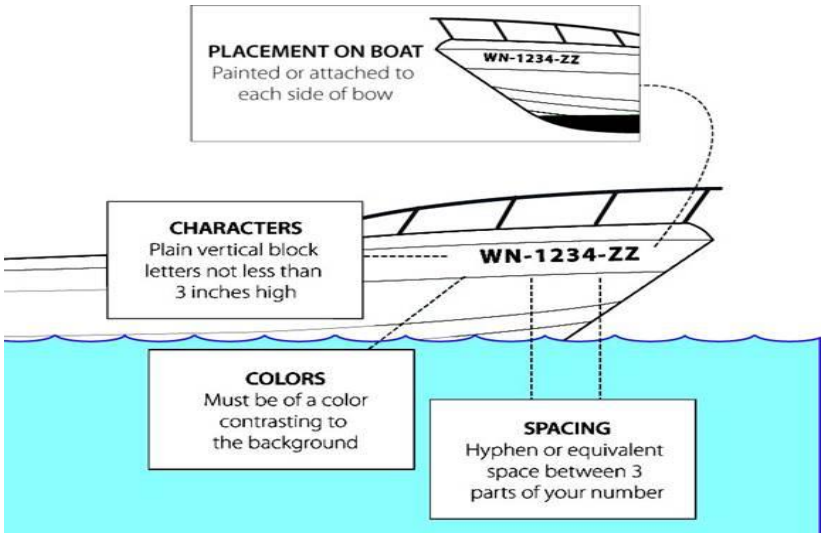
Federally Documented Vessels are vessels that are at least five net tons in size and owned by an American citizen and are "documented" with the U. S. Coast Guard. Documented vessels must display, minimum 4" in height, the boats name on and vessels home or hailing port in the same location on the hull.The vessels federal documentation number,must be permanantly affixed to a structurally integral part of the vessel in an accessable location at least 3" in height and preceded by "No." (eg. No 1234567.)

State Registered Boats depend on individual state requirements, registered boats will be titled with the certificate of number/registration and a copy should be kept onboard when operating on state waters. If a vessel does not have a motor it may still need to be registered depending on the specific state laws and the length requirements for individual state registration. These registration and titling requirements can differ and you should consult the State in which you are operating your boat for state by state specific information.

Registering your boat means applying with your state boating authority for a certificate of number. All undocumented vessels equipped with propulsion machinery MUST be registered in the state of principal use, except for qualifying public vessels.

The registration number is actually a combination of letters and numbers normally beginning with the abbreviation of the State in which the boat is registered and must be

displayed on the forward half of the boat. A validation decal is required to be placed along side the numbers on the sides of the vessel.



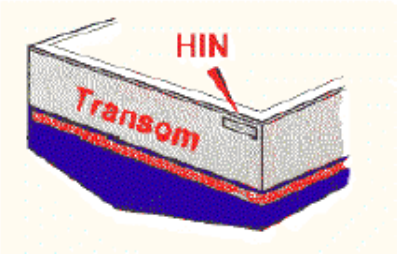
Proper display of boat registration numbers

- The figures are read from left to right.
- They must be displayed on the forward half of each side of the bow of the boat.
- Numbers must be in bold, block letters of good proportion.
- Numbers must be not less than 3 inches high.
- They must be of contrasting color to the boat hull or background.
- They must be as high above the waterline as practical.
- No number other than the number assigned can be displayed on the forward half of the vessel.
- Letters must be separated from numbers by spaces or hyphens.
- The validation decal must be displayed within six inches of the number.

Service Vessels, (eg. Fire/Life Guard) **or Public Vessels** must be identified through State registration and/or agency markings (emblems that are conspicuously displayed).

Hull Identification Number

Boats built since 1972 are required to have a Hull Identification Number (HIN) permanently attached to the transom on the starboard side above the waterline. This number is a serial number exclusive to your boat and is necessary to title and register it. You should record this number in a safe place. In case of theft it may help identify your boat. In 1984 a new regulation was passed which requires the HIN number to also be permanently attached in a second unexposed location, typically assigned and known by the manufacturer.



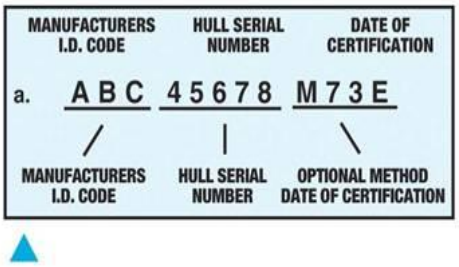


FIG. 2-2a–Hull Identification Number
Nov. 1, 1972-July 31, 1984

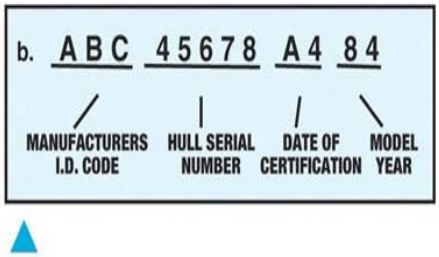


FIG. 2-2b–Hull Identification Number
New format since August, 1984

Required Equipment

All boats are required to carry certain equipment. Equipment requirements are determined by the length of the boat, its' design functions and specific use. Most items must be approved by the U. S. Coast Guard and kept in good and serviceable condition and should be used only for their designated purposes. It is important that you understand that the federal requirements are **minimum** requirements and **do not** guarantee the safety of your vessel or its' crew. In addition to the federal requirements there are recommended items and you should check your Bureau policy and state regulations for any other required items.

Personal Flotation Devices / Lifejackets (PFD's)

Selecting the appropriate PFD for the activity and conditions is an absolute priority; it should be U.S. Coast Guard approved**,** and properly fitted to the individual; size and weight appropriate, and in good and serviceable condition. PFD's should be worn when on board a boat, and must be readily accessible for all persons on the vessel.

PFD's should be tested for proper buoyancy and serviceability, PFD's can be customized for the intended wearer and mission activities, yet this should be done without altering the manufacturers designed functions of the flotation device and should be used according to the label instructions. Though not required by federal law, PFD's should be worn at all times when the vessel is underway.

PFD's **should not** be stowed in areas that restrict access such as, locked or closed compartments or under other gear. When the PFD is not required to be worn it must be readily accessible, meaning you must be able to put them on in a reasonable amount of time in an emergency 5-10 seconds, (vessel sinking, fire, etc.) While underway the boat operator should be alert to changing boating conditions and inform all passengers when to wear their PFD or upgrade to a more protective PFD.

Throwable flotation devices must be immediately available for use, 1-5 seconds.

All boats must carry one Type I, II, III or V PFD for each person aboard.

Type V PFDs are special use PFD's and must be worn to be counted toward the vessel outfit requirements. They must be used according to their label instructions.

Any boat 16 ft and longer (except paddle craft) must also carry at minimium one Type IV (throwable) PFD.

PFD Types and Characteristics

The TYPE I PFD, or OFFSHORE LIFE JACKET- provides the most buoyancy. It is effective for all waters, especially open, rough, or remote waters where rescue may be delayed. It is designed to turn most unconscious wearers in the water to a face-up position. The TYPE I comes in two sizes: The adult size provides at least 22 lbs of buoyancy, the child size provides at least 11 lbs of buoyancy.

A TYPE II PFD, NEAR-SHORE LIFE JACKET is intended for calm, inland water or where there is a good chance of quick rescue. This type may turn some unconscious wearers to a face-up position. The TYPE II comes in three sizes: An adult size provides at least 15.5 lbs buoyancy; a medium child size provides 11 lbs of buoyancy. The infant and small child sizes each provide at least 7 lbs of buoyancy.

A TYPE III PFD, FLOTATION AID (WORK-VEST/RECREATIONAL LIFE JACKET) is good for calm, inland water, or where there is a good chance of quick rescue. It is designed so that wearers may have to tilt the head back to put themselves in a face-up position in the water. The TYPE III has 15.5 lbs of buoyancy. Float coats, fishing vests, and vests designed for various water sports are examples.

A TYPE IV PFD, or THROWABLE FLOTATION DEVICE is designed to be thrown to a person in the water and grasped and held by the user until rescued. It is not designed to be worn. Type IV devices may include buoyant cushions, ring buoys, and horseshoe buoys.

A TYPE V PFD, or SPECIAL USE DEVICE is intended for specific activities and may be carried instead of another PFD only if used according to the approval condition on the label. Some Type V devices provide hypothermia protection. Varieties include deck suits, work vests, board sailing vests, and hybrid PFDs. A TYPE V INFLATABLE PFD is not inherently buoyant and must be inflated mechanically or manually to float the user. ALL type V PFD's must be worn when underway to be counted towards the carriage requirements.

POLICY NOTE: DOI and Bureau policies prescribe mandatory use parameters for the wearing and use of PFD's.

Characteristics of a properly fitted PFD:

- A properly sized PFD fits comfortably snug and allows easy breathing when in the water.
- PFD does not rise above the shoulders and neck area while immersed in water.
- The PFD does not inhibit an effective range of body motion for the user.

PFD Maintenance

- Do not alter the PFD design
- Perform regular buoancy checks
- Wash with fresh water and mild soap solution
- Drip dry/air dry after use
- Store in well ventilated place, away from direct sunlight
- Do not expose to artificial heat sources
- Check all straps, buckles and/or zippers regularly
- Check for mildew, frayed material and decay
- Check PFD shell material regularly for wear, tears and soiled areas
- Replace the PFD if serviceability is compromised

Customizing Your PFD (highly recommended, not required)

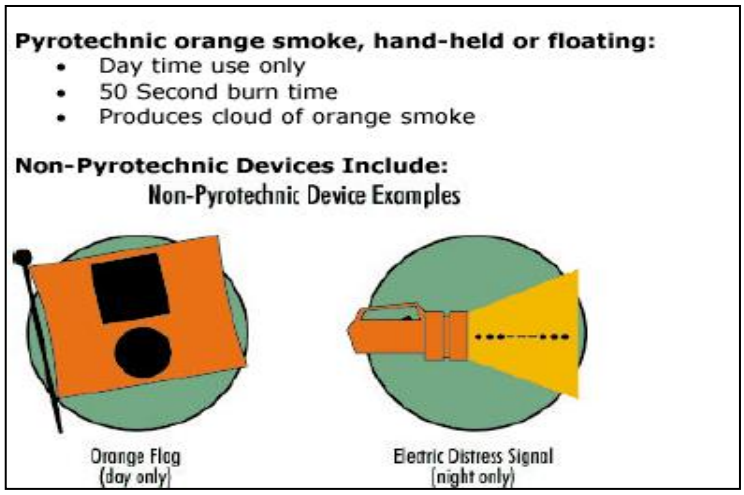
- Whistle
- Strobe/marker light
- Signal Mirror
- Rescue/emergency knife
- Slings
- Carabiners
- Sunscreen
- Flares
- Space blanket
- Snacks in sealed bag

Visual Distress Signals

Most recreational boats, and all boats operating in coastal waters, the Great Lakes and the high seas, must be equipped with visual distress signals. These signals must be U. S. Coast Guard approved; they are categorized for day use, night use or combination day and night.

The U. S. Coast Guard regulations prohibit false display of distress signals and they should only be used during authorized training and when a distress situation actually exists.

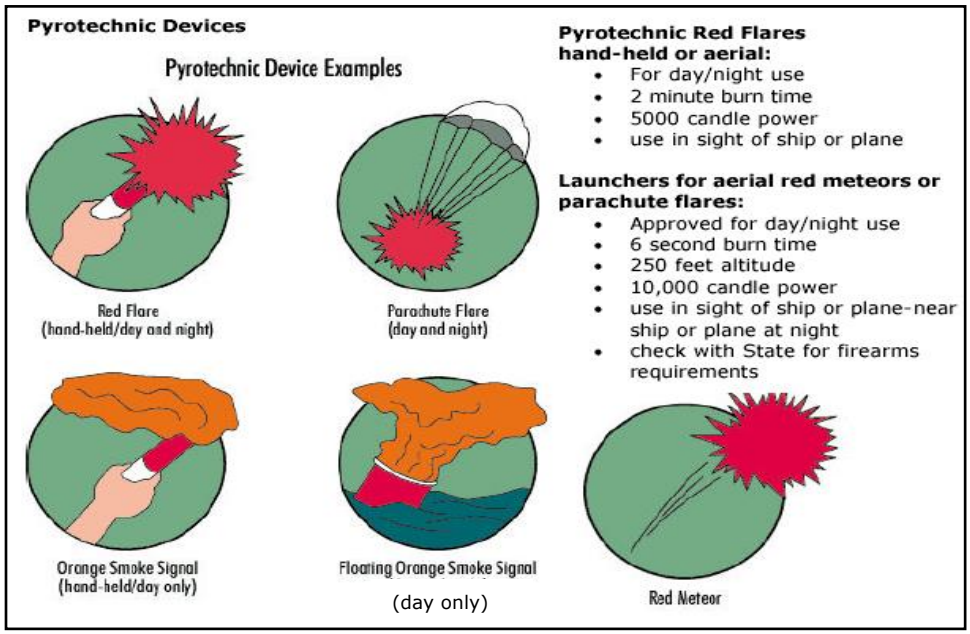
These visual distress signaling devices must be in serviceable condition and stowed where they are readily accessible. Pyrotechnic devices must be visibly marked with an expiration date. The vessel operator must ensure they have not expired. (Distress flares, smoke flares and meteor rockets have expiration dates typically 42 months after the date of manufacture.)



The use of distress signals should be relative to the type and location of assistance expected for the area, users want to ensure the highest probability of detection. There are many types of

distress signals that may be recognized internationally by other boaters, yet there are only certain types of signals that count towards the vessels carriage requirements.

The U. S. Coast Guard recognizes both pyrotechnic and non-pyrotechnic devices with proper U.S.C.G. approval numbers.



General Flare Storage and Use Tips

- Read and understand the manufacturer instructions
- Note expiration date and replace as necessary
- Protect devices in a watertight container
- Store where readily accessible and ready to use
- Use only in case of an emergency
- Elevate to increase line of sight
- Hold lighted flares downwind and away from the boat
- Do not point them at anyone and hold away from your body
- Avoid use near flamable materials
- Wear protective equipment to avoid burns

Carriage Requirements (only applicable in areas where VDS are required)

The following vessels are not required to carry day signals but must carry night signals when operating from sunset to sunrise:

- Recreational boats less than 16 feet in length.
- Boats participating in organized events such as races, regattas, or marine parades.
- Open sailboats less than 26 feet in length not equipped with propulsion machinery.
- Manually propelled boats.

Vessels 16 feet to 65 feet must carry both: Day and Night signals!
(3 day / 3 night for Pyro).

Any of the following signals, when carried in the number required, can be used to meet the requirements. Note the "time of day" approved as compared to the time of operation.

Acceptable Visual Distress Signals Pursuant to 33 CFS 175.130

46 CFR Approval #	Device Description	Meets Requirements for	# Required
160.021	Hand Held Red Flare	Day and Night	3
160.022	Floating Orange Smoke (5 min)	Day Only	3
160.024	Parachute Red Flare	Day and Night	3
160.036	Hand-Held Rocket Propelled Parachute Red Flare	Day and Night	3
160.037	Hand-Held Orange Smoke	Day Only	3
160.057	Floating Orange Smoke (15 min)	Day Only	3
160.066	Red Aerial Pyrotechnic Flare	Day and Night	3
161.013	Electric Distress Light	Night Only	1
160.072	Orange Flag	Day Only	1

U.S.C.G. Recreational Grade

S.O.L.A.S. (Safety of Life at Sea)

Fire Extinguishers

U.S. Coast Guard approved marine-type fire extinguishers are required on most boats and in areas where a fire hazard could be expected from engines, electrical and fuel sustems.
Extinguishers are classified by a letter and number symbol. The letter indicates the type of fire(s) the unit is designed to extinguish, the number indicates the size or amount of extinguishing agent in the cylinder, hand-portable extinguishers will be either (B-I or B-II). Fixed fire extinguishing systems, typically mounted in machinery spaces, only count as a B-I extinguisher due to the lack of portability.

NOTE: All fire extinguishers must be U.S.C.G. approved and mounted, if possible, in readily accessible location.

Fire Classes

- **Class A** combustible solids like wood

- **Class C** electrical

- **Class B** flammable liquids like gasoline

- **Class D** combustible metals like magnesium

Some boat fires involve burning wood and paper (Class A) fires, these fires can be put out with water. **Do not** use water on (Class B, or C) fires. Water causes gasoline and oil fires to spread and electrical current is conducted through the water. For (Class D) fires it is usually best if the material can be removed from the vessel.

Inspect Fire Extinguishers regularly and prior to each voyage. They should be properly stored, charged and undamaged. Portable extinguishers should be mounted where they are accessible and away from immediate fire areas. Check the gauge to make sure the extinguisher is still charged; inspect the seals to make sure they have not been tampered with. Dry chemical extinguishers should be agitated regularly to prevent the extinguishing agent from compacting at the bottom of the cylinder, Replace cracked or broken hoses and keep nozzles free from obstruction. CO2 extinguishers must be weighed to ensure that they are good and serviceable.

If a fire extinguisher is discharged it should be immediatley removed from service and replaced or recharged.

Extinguisher Agent Types –vs- Class of Fire

Extinguisher Type	Class of Fire	Size/Lbs		Rationale:
		B-I	B-II	
CO2	B,C	4	15	High pressure gas agent, cools and displaces oxygen, ideal for extinguishing electrical fires
Halon or Halotron	A,B,C	2.5	10	High pressure gas that displaces oxygen and vaporizes quickly. (*Typically fixed/installed in enclosed machinery spaces*)
Dry Chemical Sodium/Potassium Bicarbonate or Mono Ammonium Phosphate	A,B,C	2	10	Pressurized powder agent, smothers fuel base. Highly corrosive on marine parts and electronics.
Foam- AFFF Aquious Form Filming Foam	A,B	1.2	2.5	Water based agent, quenches, cools, blankets and smothers, can separate the vapor layer in class 'B' fires.

Minimum Number of Hand-Portable Fire Extinguishers Required

Vessel Length	No Fixed System	With Fixed System
< than 26'	1 B-I	0
26' to less than 40'	2 B-1 or 1 B-II	1 B-I
40'-65'	3 B-I or 1 B-II and 1 B-1	2 B-I or 1 B-II

DOI and bureau policies regarding fire extinguishers exceed Federal requirements for recreational vessels.

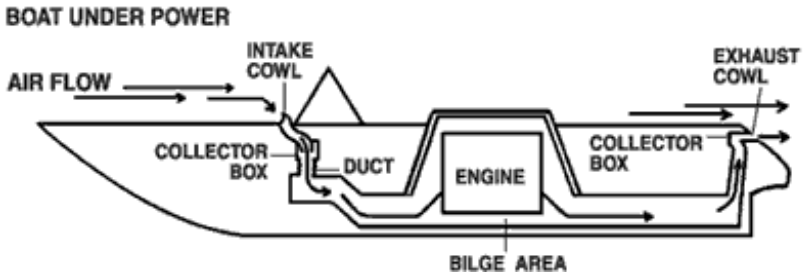
Ventilation Systems

Boats that use gasoline for mechanical power, electrical generation, or propulsion are required to be equipped with a ventilation system. The ventilation system may be either natural or powered:

1. A **Natural Ventilation** system consists of at least two ventilator ducts, fitted with cowls or their equivalent:

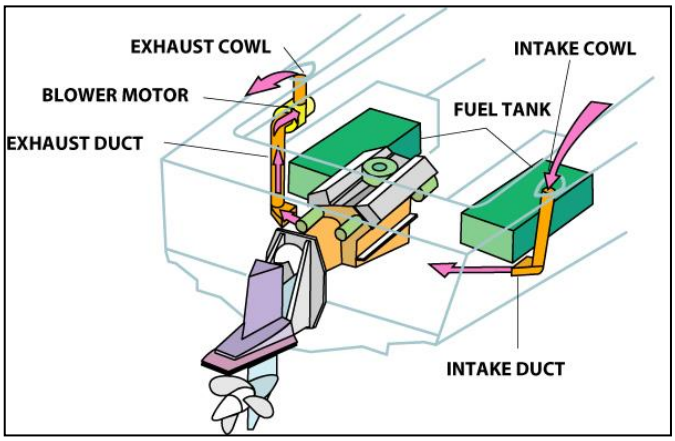
    a. A minimum of one exhaust duct installed so as to extend from the open atmosphere to the lower portion of the bilge; and
    b. A minimum of one intake duct installed so as to extend to a point at least midway to the bilge or at least below the level of the carburetor air intake.

2. **Natural Ventilation** is <u>REQUIRED</u> for each compartment that:
    a. Contains a permananetly installed gasoline engine.
    b. Has an adjacent opening between it and a compartment requiring ventilation.
    c. Contains a permanently installed fuel tank and an electrical component that is not ignition-protected.
    d. Contains ANY fuel tank that vents into a compartment.



1. A **Powered Ventilation** system consists of one or more exhaust blowers. Each intake duct for an exhaust blower should be in the lower one-third of the compartment and above the normal accumulation of bilge water.

2. A **Powered Ventilation** system is REQUIRED for each compartment in a boat that has a permanently installed gasoline engine with a cranking motor for remote starting.



    a. <u>ALL blower motors installed in exhaust ducts MUST be in working condition</u> regardless of date of manufacture.

Ventilation Maintenance- Operators are responsible for keeping their boat's ventilation systems in operating condition: Ensure openings are free of obstructions, ducts are not blocked or torn, blowers operate properly, and worn components are replaced with marine grade equipment.

Boats built after Aug 1, 1980, which contain power exhaust blowers in gasoline engine compartments, **must have the following warning sticker** near the instrument panel:

⚠ WARNING

GASOLINE VAPORS CAN EXPLODE, RESULTING IN INJURY OR DEATH

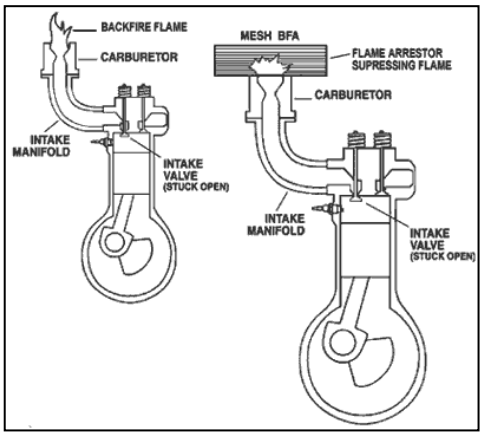
BEFORE STARTING ENGINE:

- Check engine compartment bilge for gasoline vapors, and
- Operate blower for four minutes, and
- Verify blower operation

RUN BLOWER WHEN BOAT IS OPERATING BELOW CRUISING SPEED

Note: The best test of a properly ventilated space is the "sniff" test! If you smell fumes or vapors, correct the problem prior to ignition.

Backfire Flame Arrestor



Gasoline engines installed on a motorboat must be equiped with an acceptable means of backfire flame control, except outboards. The backfire flame arrester must be suitably secured to the air intake with a flame-tight connection, thus preventing the ignition of flammable vapors in an enclosed speace.

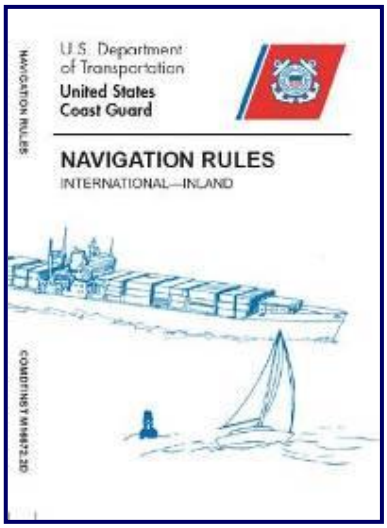
The backfire flame arrestor must be U. S. Coast Guard-approved, or comply with UL 1111, or SAE J-1928 safety standards. Other acceptable means of backfire-control include air and fuel induction systems (personal watercraft), velocity stacks (race boats), and reed type (outboards).

NOTE: It is important to insure that your Flame Arrestor is clean, undamaged and properly fitted.

Sound Producing Devices

Navigation Rules require sound signals to be made under certain circumstances. Meeting, crossing, and overtaking situations are examples of situations when sound signals are required. All boats less than 12 meters in length must carry an efficient sound producing device which can be heard for one half mile.

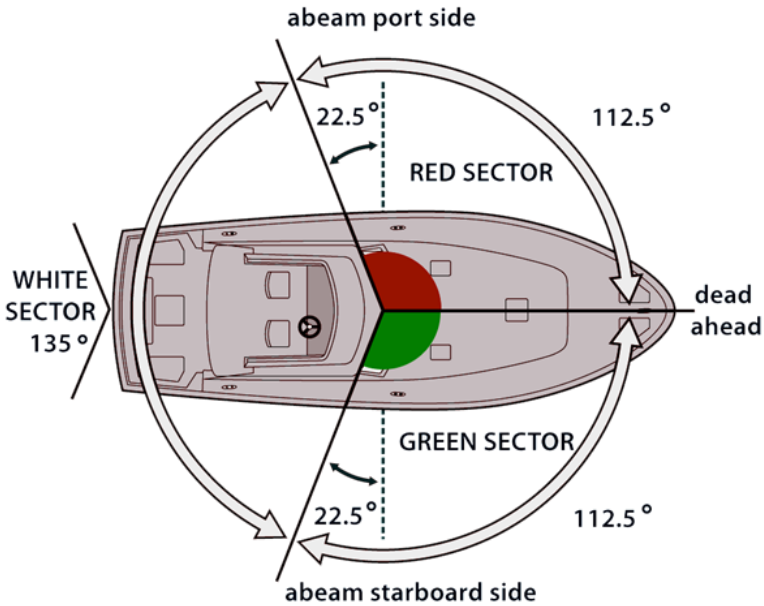
All vessels are required to use sound signals while underway or when at anchor. Most often these are whistles or horns. Boats over 20 meters (65.6 feet) in length must also carry a bell. The rules of the road, both inland and international, specify that boats give sound signals to communicate intentions in heavy traffic, and to alert other skippers of your presence in fog, heavy rain or other times of restricted visibility.



Vessel Navigation Lights

Federal and International Law from the 72 COLREGS prescribe specific lighting configurations that are required for vessels <u>operating between sunset and sunrise</u> or in <u>times of restricted visibility</u>.

The U.S. Coast Guard Navigation Rules, International-Inland specifies lighting requirements for every description of watercraft. A copy must be kept onboard for vessel greater than 26’.



Definitions:

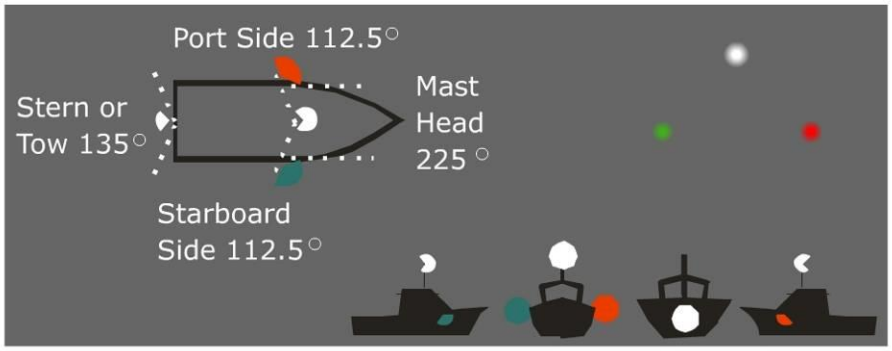
Sidelights – red and green lights can be separate or combined and are visible to another boat approaching from the side or head-on. The red light indicates a boat's port side; the green light indicates a boat's starboard side. Each light must show an unbroken light over a 112.5-degree arc from dead ahead to 22.5 degrees abaft the beam on their respective side.

On a vessel less than 20 meters the sidelights may be combined into one fixture placed on the boat's fore-aft centerline.

Sternlight – a white light seen from behind the boat showing an unbroken light over a 135-degree arc from dead astern to 67.5 degrees on each side of the boat's centerline.

Masthead Light – A white light placed over a vessel's fore and aft centerline, showing an unbroken light over a 225-degree arc from dead ahead to 22.5 degrees abaft the beam on either side. Required on all powerboats. If the boat is greater than 50 meters a second masthead light is required.

All-round light – Shows an unbroken light over a 360-degree arc. This light may be white, red, green or yellow depending on its descriptive function.



Some of the various options are illustrated here, it's the operators responsibility to make sure the vessel shows the proper lights prescribed for its size and the nature of operations for the waters in which it is being operated.

Requirements:

Power-Driven Boats when operating between sunset and sunrise or in times of restricted visibility – If less than 20 meters long, the required lights are:

1. **Red and Green sidelights** visible from at least two miles (or if less than 12 meters long, at least one mile);

2. **Both a masthead light and a sternlight (Fig 1) or an all-round white light (Fig 2)** which must be visible from at least two miles. The all-round white light (or the masthead light) must be 1 meter higher than the sidelights. For boats less than 12 meters, a white All-round light may be displayed in lieu of the masthead light and stern light.

Figure 1

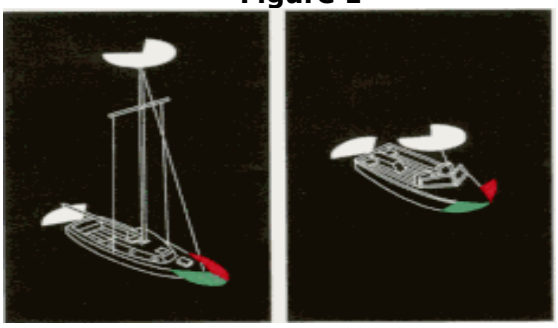
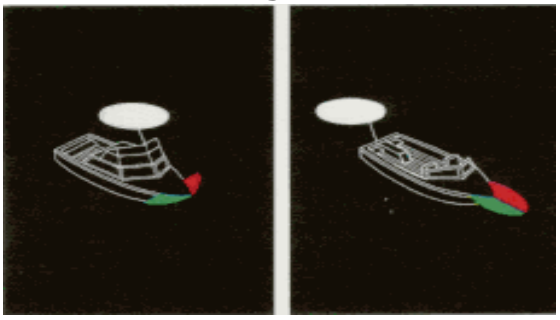


Figure 2



Sailing Vessels and Vessels Paddled, Poled or Rowed between sunset and sunrise or in times of restricted visibility – If less than 20 meters long:

1. **Red and Green sidelights** visible from at least two miles (or if less than 12 meters long, at least one mile);

2. **Sternlight (Figure 3)** which must be visible from at least two miles.

Figure 3

If less than 7 meters long, try to exhibit the same as above or at least have on hand one lantern or flashlight for shining a white light (Figure 4).

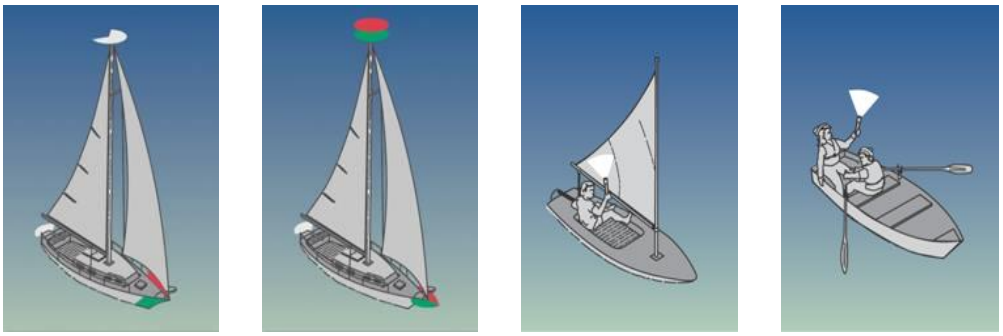


Figure 4

Pollution Regulations

Annex V of MARPOL 73/78 prohibits throwing, discharging or depositing any refuse matter of any kind (including trash, garbage, oil and other liquid pollutants) into the waters of the United States.

It is illegal to dump:
Inside 3 miles and in U.S. Lakes, Rivers, Bays and Sounds and anywhere on the Great Lakes no matter how far from shore: Plastic, dunnage, lining, and packing materials that float and any garbage except fishwater/graywater/fresh fish parts.
3 to 12 miles Plastic, dunnage, lining, and packing materials that float and any garbage not ground to less than one square inch.
12 to 25 miles Plastic, dunnage, lining, and packing materials that float.
Outside 25 miles Plastic

Regulations Controlling Disposal of Garbage

The U.S. Coast Guard regulations prohibit dumping of plastic refuse, and garbage mixed with plastic, into any waters. These restrictions apply to all U.S. vessels wherever they operate (except waters under the exclusive jurisdiction of a State), and any foreign vessels operating in U.S. waters out to and including the Exclusive Economic Zone (200 miles).

MARPOL Annex V places limitations on the discharge of garbage from vessels. It is ILLEGAL to dump PLASTIC ANYWHERE in the ocean or navigable waters of the United States, and inland waters of the Great Lakes.

Obligations & Responsibilities

Do not dispose of plastic in any waters. Learn and conform to the regulations regarding disposal of other garbage. State and local regulations may further restrict the disposal of garbage. Make sure you know the regulations covering the waters upon which you will be boating.

If you observe any boat not complying with these regulations regarding water pollution, report it to the nearest Coast Guard unit or the Americas Waterway Watch Hotline: 1-877-24-WATCH for pollution or suspicious activities.

SOS/MARPOL Placard

Boats 26 feet in length and over must display a MARPOL or Save Our Seas Placard that outlines the rules of dumping waste offshore. These placards may be purchased from local marinas, boat dealers, and marine equipment suppliers.

Oil and Hazardous Substances

The Federal Water Pollution Control Act prohibits the discharge of oil or hazardous substances that may be harmful into U.S. navigable water.

Vessels 26 feet in length and over must display a "oil pollution placard" at least 5 by 8 inches, made of durable material, fixed in a conspicuous place in the machinery spaces, or at the bilge pump control station, stating the following.

Regulations issued under the Federal Water Pollution Control Act require that ALL vessels with propulsion machinery must have a capacity to retain oily mixtures on board. A fixed or portable means to discharge oily waste to a reception facility is required. A bucket or bailer is suitable as a portable means of discharging oily waste on recreational vessels. No person may intentionally drain oil or oily waste from any source into the bilge of any vessel.

You must immediately notify the U.S. Coast Guard if your vessel discharges oil or hazardous substances in the water. Call toll-free 800-424-8802 (In Washington, D.C. (202) 267-2675). Report the following information:

- Location
- Source
- Size
- Color
- Substances
- Time Observed

Waste Management Plans

U.S. recreational boats 40 feet or more in length and equipped with a galley and berthing are required to carry a Waste Management Plan describing procedures for collecting, processing, storing and discharging garbage, the plan must designate the person(s) in charge of carrying out the plan.

VESSEL WASTE MANAGEMENT PLAN
All crew and persons onboard this vessel must dispose garbage and waste in the trash and recycling recepticles provided in the galley, berthing and machinery spaces. The recepticles will be emptied daily, or upon order from the captain, and stored in the aft compartment until the vessel returns to shore. The first mate and engineer are hereby charged with the proper removal and disposal at the appropriate shoreside facilities. **~By order of the Captain~**

Marine Sanitation Devices

All recreational boats with Installed Toilets must have an operable USCG Approved Type I, II, or III Marines Sanitation Device as required by the 'Clean Water Act'. Installed toilets that are not equipped with an MSD and discharge raw sewage directly over the side are illegal. **It is illegal to discharge raw sewage from a vessel in territorial waters of the United States (within the 3 mile limit), the Great Lakes, and navigable rivers.**

Portable toilets or "porta-potties" are not considered installed toilets and are not subject to the MSD regulations. Portable toilets are subject to disposal regulations that prohibit the disposal of raw sewage within territorial waters (3 mile limit), the Great Lakes, or navigable rivers.A boat can be equipped with any type of MSD permitted under the regulations. However, whenever a vessel equipped with a Type I or Type II MSD (these types discharge treated sewage) is operating in an area of water that has been declared a No Discharge Zone, the MSD cannot be used and must be secured to prevent discharge. The method chosen must be one that presents a physical barrier to the use of the valve.

Holding & Treatment Tank

Marine Toilet

Discharge Pump

No Discharge Zones:

No Discharge Zones are areas of water that require greater environmental protection and where even the discharge of treated sewage could be harmful. When operating in a No Discharge Zone, a Type I or Type II MSD must be secured in some way to prevent discharge. Closing the seacock and padlocking, using a non-releasable wire-tie, or removing the seacock handle would be sufficient. Locking the door to the head with a padlock or a door handle key lock is another acceptable method of securing the MSD while in a No Discharge Zone.

Generally, all freshwater lakes (and similar freshwater impoundments or reservoirs that have no navigable connections with other bodies of water), and rivers not capable of interstate vessel traffic, are by definition considered No Discharge Zones.

In addition, States may (with the specific approval of the U.S. Environmental Protection Agency) establish No Discharge Zones in other waters within the State. Boaters should check with their State Boating Law authority for more specific information on the location and limits of No Discharge Zones.

Recommended Equipment

In addition to the minimum equipment that the U. S. Coast Guard requires onboard vessels; there are many other essential items that SHOULD be kept onboard as additional carriage requirements.

POLICY NOTE: DOI regulations and Bureau Policies stipulate added requirements;

"... additional basic safety devices are required to ensure department watercraft will be outfitted, based on location and expected conditions, to include- all other equipment necessary for the safety of the crew and the safe operation of the vessel ..." These items should be selected based on the size, mission location and specific uses of the boat. **Thus, recommended equipment may become policy required equipment based upon the circumstances the vessel is operated in.**

Additional Equipment & Supplies to be carried aboard:

- VHF-FM Marine Radio
- E.P.I.R.B. (Emergency Position Radio Beacon)
- Anchor(s) / Line and ground tackle
- Bilge Pump and/or Bailing Device
- Compass
- Charts/Publications and Navigation Tools
- Mooring Lines and Heaving Lines/Throw Bags
- Fenders and Boat hook(s)
- First Aid Kit
- Tool Kit and Spare Parts
- Extra Fuel and Oil and Absorbent Materials
- Spare Battery or Jumper Pack
- Spare propeller/s
- Alternate means of propulsion (oars, paddles, kicker engine)
- Flash Light w/ Batteries
- Search Light / Radar
- Detectors and Alarms (CO, Fire, High Water etc..)
- Signal Mirror, Die Markers, Chem Lights, Extra Flares
- Tow Line, Bridle and Hardware
- Sun screen and sun glasses
- Survival gear (exposure suit, space blanket, shelter, fire making tools, etc.)
- Extra clothing, Food and Water
- Cargo Net, Webbing, Customized PFD (see section on PDF'S)
- Binoculars
- Cell Phone
- AM/FM Radio

Chapter 4 – Navigation Rules

Purpose

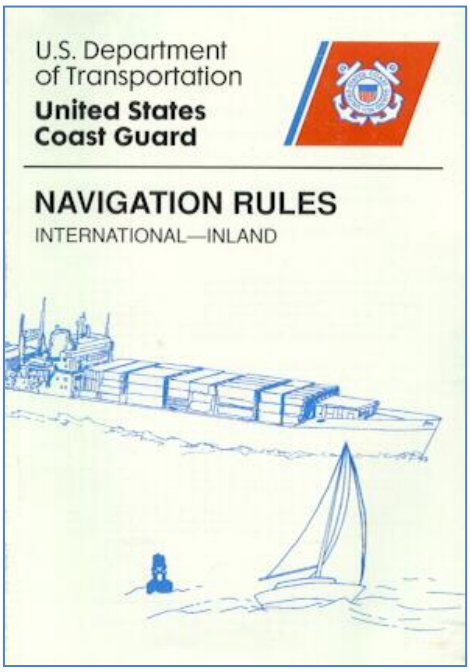
To prevent collision, property damage and the loss of life, an operator needs to demonstrate good seamanship and safe operation of a vessel in accordance with established Navigation Rules.

Learning Objectives

Relative to basic motorboats, the participant will be able to:

1. Define the Navigation Rules relative to vessel hierarchy, over-taking, head-on and crossing situations.
2. Define stand-on and give-way.
3. Describe a technique to determine if risk of collision exists in a crossing circumstance.
4. Describe the four basic navigation lights, colors, configuration and arcs of visibility.
5. Describe the purpose of navigation lights and when they are required.
6. Describe sound signals use for maneuvering, obstructed vision and danger.
7. Describe the flags required for diving (e.g., scuba).
8. Describe boating-related situations wherein homeland security comes into play.

Navigation Rules



Navigation Rules (Rules) establish right-of-way procedures for the water just as highway traffic laws do for the road.

These Rules were developed to address real world accidents involving loss of life and property throughout maritime history. They stress the notion of individual responsibility to know the Rules and apply them consistently. It should also be remembered that the operator or "master" of the vessel is ultimately responsible for all actions taken, or not taken, in any given situation. The master of the vessel is "in command", regardless of the rank of any on board. The vessel and the safety of all on board are the master's responsibility.

The Navigation Rules establish actions to be taken by vessels to avoid collision. The Rules are divided into two parts, **INLAND and INTERNATIONAL**. Inland Rules apply to vessels operating inside the line of demarcation while International Rules apply outside. Demarcation lines are printed on most navigational charts and are published in the Navigation Rules. **The MOCC focuses on Inland Rules.**

NOTE: The operator of a vessel 12 meters (39' 4") or greater is responsible for having on board and maintaining a copy of the Inland navigation rules (COLREGS).

Signals (sounds, lights, day shapes & flags)

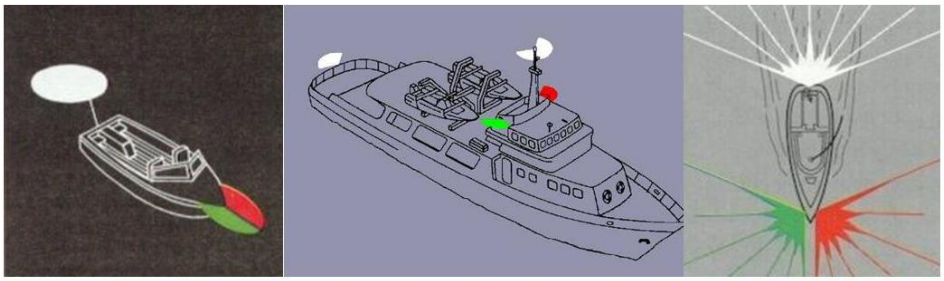
Safe navigation requires an understanding of how signals (sounds, lights, day shapes & flags) are used to indicate what a vessel is, its maneuverability/activity, and/or what action the operator intends to take.

Sound Signals – Navigation Rules define responsibilities during vessel encounters, and how to communicate vessel status and intent to maneuver. Sound signals are one of the means of communication defined in the Rules. The minimum signal acceptable is a sound signal using a whistle. Through the use of sound signals the initiator tells the other operator what s/he intends to do. The other operator, if in agreement must sound the same sound signal to indicate agreement. If the vessel does not agree it must sound the "Danger Signal" (five short blasts), and both are responsible to take appropriate precautionary action until a safe agreement for the encounter is made.

The signals prescribed in the Rules are:

- **One short blast**- I intend to leave you on my port side.
- **Two short blasts**- I intend to leave you on my starboard side.
- **Three short blasts**- I am operating astern propulsion.
- **Five short blasts**- Danger, I don't understand your signal, or am in doubt that sufficient action is being taken to avoid collision.
- **One prolonged blast**- Obstructed vision signal, used for "blind bends" or leaving a dock or berth.
- **One prolonged blast, every two minutes**- Restricted visibility signal used in day or night, i.e. fog.

Lights and Day Shapes – Different combinations of lights and day shapes are used to indicate what a vessel is and what it is doing. Three common examples are depicted below, featuring red and green sidelights, a white all-around light, a white masthead light, and white stern lights. Red and green sidelights and the white masthead light cannot be seen 112.5° back from the bow (0°). The white stern light cannot be seen forward of 112.5°. The white all-around light is visible from any direction (360°). Information on powerboat lighting is also presenting in the Required Equipment chapter.

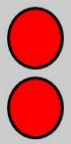
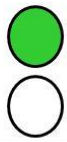


Powerboat <12m underway | Powerboat 12m to <50m underway | Sailboat under sail

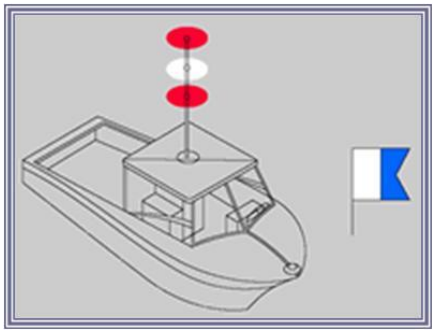
There are a wide range of vessel activities (levels of maneuverability) that require additional lighting configurations. And since lights cannot be seen during the day, corresponding "day shapes" are required to indicate activity (maneuverability) during the daytime.

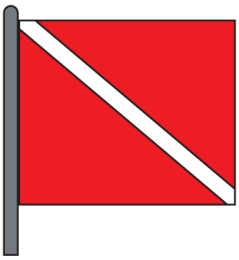
An example of a light used to indicate level of maneuverability is the white all-around light required for use while at anchor (covered in Required Equipment).

Here are some other examples of lights and day-shape configurations you might encounter:

Vessel Status	Lights	Day shape
Not under command		
Engaged in Fishing		
Towing	Two white masthead (225°) lights in a vertical line, yellow stern light	

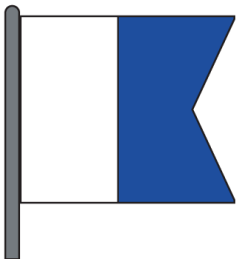
Informational/Warning Flags and Pennants – Flags are another indicator of maneuverability. Although there are scores of flags used in maritime operations, the red and white "Diver-Down" flag, and the blue and white "Alpha" flag are pertinent to small craft operations.





Diver Down Flag- indicates that divers are operating in the area. Keep well clear of this flag, divers are susceptible to underwater currents and surfacing at random locations. Many states have requirements for boats to maintain a specific safe distance, usually 100' to 300 feet. Know the state regulations.

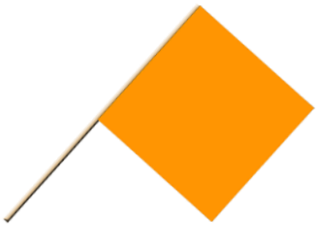
Rigid Alpha Pennant- indicates that a vessel is restricted in ability to maneuver due to the nature of its work and may be displayed by a vessel engaged in diving operations. It is required on International waters and most areas seaward of the boundary line.



The "Alpha Pennant" does not substitute for the "Diver Down" flag in state waters that require the "Diver Down" flag. Often both will be displayed.

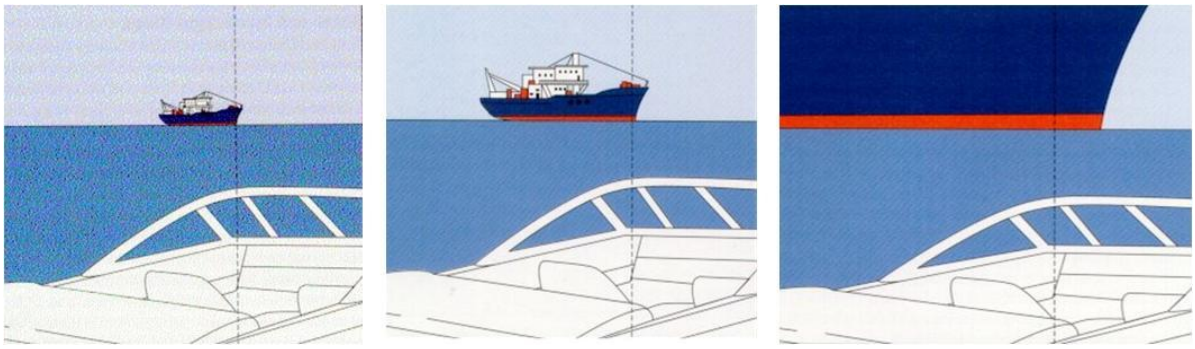
NOTE: Alpha Pennants are recognized when displayed from a vessel. Diver Down flags may be displayed from a vessel or a dive float trailing divers in the water, or both.

Waterskiing and Recreational Safety Flags: indicates that a vessel is engaged in activites that has placed a person and/or equipment, (ski rope, rafts, innertube, etc.) in the water. Maintain a sharp lookout and keep a safe distance relative to the vessel, typically 100' to 300'. These flags are required in most states for vessels engaged in sporting activities from boats, know the state regulations.



Rules of the Road

Collision Course – The need to know which vessel has the right-of-way comes into play when vessels are on a collision course. Every operator must use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists; if there is any doubt, such risk shall be deemed to exist.

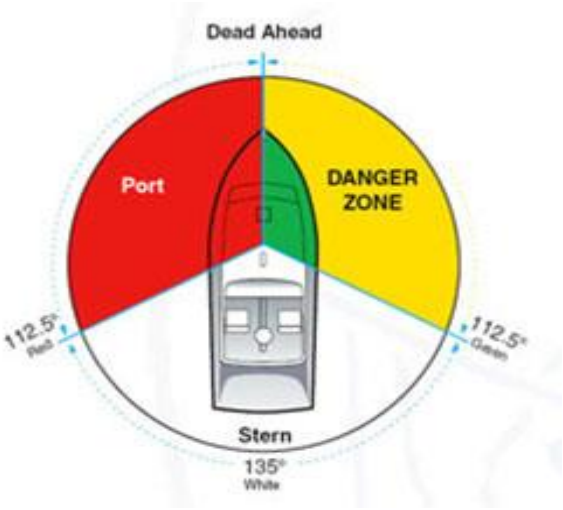


A constant bearing with decreasing distance (range) is always a "risk of collision". Three images illustrate a time sequence (left to right) of two vessels underway that are clearly on a collision course because the position of the larger vessel stays in line with a single spot (i.e., a constant bearing) on the smaller vessel, and the range decreases over time.

Right-of-Way and action to avoid collision – The Rules define who has the right-of-way when vessels encounter each other on the water. The vessel that has the right-of-way is called the "Stand-On" vessel, and is required to maintain course and speed. The vessel that does not have the right-of-way is called the "Give-Way" vessel, and is required to change course and/or speed and keep well clear of the Stand-On vessel.

Any action taken to avoid collision should be unmistakable. Operators need to make "early and substantial" alteration in course/speed to avoid collision. This change is course should be large enough to be readily apparent to another vessel observing. This can even mean coming to a complete stop, or turning around.

The most basic rule governing right of way on the water is that a boat must yield to any boat that is in the angle extending from the front of the boat forward and from the rear starboard (right) corner of the boat perpendicular to the boat. This area is known as the **"danger zone,"** and boats are obliged to yield to any other vessels in their danger zone.



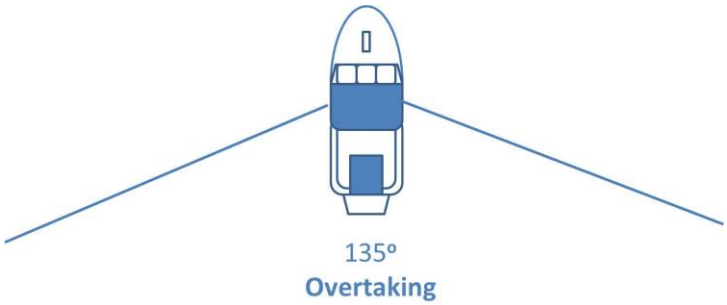
Maneuverability and Vessel Hierarchy - The Rules are written with the understanding that not all boats can maneuver with the same ease. Therefore, certain vessels have the right-of-way over other vessels by virtue of their ability to maneuver. In order to accommodate these differences a Vessel Hierarchy ("pecking order") has been devised with lower listed vessels being the Give-Way vessel to all that are above it on the list:

- **Vessel not under command**- vessel unable to maneuver e.g. broken rudder, engine failure, adrift.
- **Vessel restricted in her ability to maneuver**- due to nature of work, restricted in ability to maneuver, e.g. Cable laying; dredging; underwater operations etc.
- **Vessel engaged in fishing**- fishing with nets, lines, trawls, or other fishing apparatus that restricts maneuverability, not including vessels trolling lines or other fishing apparatus that do not restrict maneuverability e.g. shrimp trawler with nets out.
- **Sailing vessel**- vessel under sail, not propelled by machinery if present . (Note: when a sailboat has its motor running, it is considered a power-driven vessel).
- **Power- driven vessel**- vessel propelled by machinery.
- **Seaplane**

Given this hierarchy, a sailboat must keep out of the way of a vessel engaged in fishing, which in turn must keep out of the way of a vessel with restricted maneuverability. And everyone must keep out of the way of a vessel not under command.

Overtaking - Any vessel overtaking any other shall keep out of the way of the vessel being overtaken. When overtaking at night, initially you will be able to see the (white) stern (135°) or all-around (360°) light, but not the sidelights of the vessel being overtaken. The vessel being overtaken is the Stand-On vessel, and the overtaking ("Give-Way") vessel is required to sound whistle signals to indicate how it proposes to pass the other vessel.

Note: As the overtaking vessel goes around the other vessel it will pass from the "overtaking" zone into the "crossing" zone. This does not change the situation. The overtaking vessel remains obligated to complete the maneuver, keeping clear of the other vessel until past and clear.

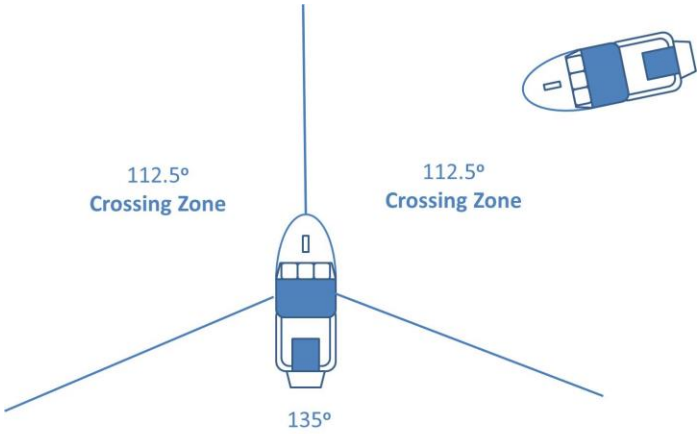


Head-on Situation – When two power-driven vessels approach each other head-on or nearly head-on, each are required to alter course (both are give-way vessels). If operating a boat at night in a head-on situation you would see the other vessels all-around or masthead white light, and both sidelights.

Sound signals are required, and either operator can initiate. In North America the common maneuver is turning to starboard so that the vessels pass port-to-port. However, vessels may pass starboard-to-starboard if proper signals are given.

NOTE: The rule does not apply to two vessels that will pass clear of each other if each maintains course and speed.

Crossing Situation – If a risk of collision exists and you are not head-on or overtaking, then you are in a crossing situation. At night, in a crossing situation you will only see one of the sidelights.



In a crossing situation the vessel on the right (to starboard) is the stand-on vessel and must hold its course and speed (consider it similar to the traffic rules at a four-way stop, when the vehicle on the right has the right-of-way). The other vessel, the give-way vessel, shall maneuver to keep clear and pass to the stern of the stand-on vessel. If necessary the give-way vessel should even stop or reverse until the stand-on vessel is clear.

Responsibility Rule

This rule essentially states that you must do everything possible to avoid collision, including departing from the other rules.

Proper Lookout

The Rules are very specific about maintaining a proper lookout. We must keep eyes and ears open to observe or hear something that may endanger someone or affect their safety.

NOTE: A good rule to follow is to designate one or more lookouts that have no other assigned tasks

Most recreational boats do not "post" a lookout, but courts have ruled that the lookout must be a trained seaman with no other duties. While the Rules do not prohibit single handed or short-handed sailing, in the event of a collision the burden of proof is on the operator to establish that a "proper look-out" could not have prevented the occurrence.

Homeland Security Concerns

In light of new security measures brought about by the events of September 11, 2001, it is critical that all boaters be aware of and complies with new homeland security measures set forth by federal, state and local governments. These should include, but are not limited to, keeping a safe prescribed distance from military and commercial ships and avoiding commercial port operation areas, observing all security zones, following guidelines for appropriate conduct such as not stopping or anchoring beneath bridges or in a channel, and observing and reporting suspicious activity to proper authorities, such as:

1. Suspicious vendors in waterfront areas.
2. Suspicious persons renting or attempting to procure or "borrow" watercraft.
3. Unknown persons photographing or creating diagrams (e.g. of underside of bridges, facilities near military, cruise-line, or commercial vessels).
4. Suspicious persons conducting unusual activities, such as near bridges or high security areas on or near the water.

Operators are responsible for knowing current Homeland Security zones and regulations for their operating area.

Chapter 5 - Aids to Navigation

Purpose:

To safely transit navigable waterways and prevent grounding, collision, property damage, injury or the loss of life, the vessel operator must use the established buoyage systems for prescribed areas of operation.

Performance Objectives:

By the end of this chapter the participant should be able to:

1. Identify the different ATON systems.
2. Identify the types and purpose of navigation aids used in the IALA-B system.
3. List the distinctive characteristics of lateral aids in the IALA-B system.
4. Identify the significance of the geometric shapes displayed on regulatory and informational aids to navigation in the Uniform State Waterways system.
5. Identify the symbols for aids to navigation as used on nautical charts and describe the aids using the information given on a chart.

On-Water Performance Objectives: given a motorboat during practical exercises the participant will demonstrate the following:

1. Operate boats in accordance with the prescribed navigational aids and the Rules of the Road for an assigned area.

References:

- Nautical Chart, pg 18
- Nautical Charts or Local Maps for prescribed areas of operation
- Light List
- Coast Pilot
- Navigational Rules (Inland-International)

Definitions:

"ATON" – Aid(s) to Navigation, ie. Buoys, Daybeacons, Range Markers deployed with specific identifying characteristics to help mariners determine position and safe water.

Buoy – - Floating ATON that is anchored to the bottom at a specified location.

Daybeacon – ATON that is permanently affixed to the bottom, land or a structure at a specified location. A.K.A.. "Daymarks"

Range Marker – ATONs that are fixed along a specific line to guide boaters along a course heading over safe water.

Lateral System – Marks the points along the safe edge of a channel or waterway.

Cardinal System – Indicates the safe direction to pass in relation to an isolated hazard by referencing the cardinal points on a compass.

"IALA A & B" – International Association of Lighthouse Authorities regulates the two main navigation systems that cover most of the world. The most significant difference between the two systems is that they use opposite color schemes marking the sides of the channel.

- IALA "A" – Buoyage and Navigation Aids serving the Eastern Hemisphere
    - Red is on the Left side when returning from sea.
- IALA "B" – Buoyage and Navigation System serving the Western Hemisphere, exceptions: Philippines, Japan and Korea
    - Red is on the Right side when returning from sea.

Intracoastal Waterway – ATON system marking the Inland Passage along the Atlantic seaboard and the Gulf of Mexico, indicated with yellow identifiers.

Western River System – ATON system utilized on the Mississippi River above Baton Rouge, Louisiana, and some rivers that flow toward the Gulf of Mexico. The buoy numbers have no Lateral significance, daymarks and light configurations vary and have specified significance for the different river crossings and transit routes.

Uniformed State Waterway Markings – ATON for state managed waterways, typically follows the Federal system for lateral and safe water ATON, also includes specific markings and identifiers for informational and regulatory aids, as well as mooring buoys.

Private Aids – ATON that have been approved by the USCG for specific government or private purposes, and the US Army Corp of Engineers for fixed structures, must follow federal design and be listed in the Local Notice to Mariners or Published in the Light List.

Introduction: Aids to Navigation "ATON" are the road signs for the waterways, they provide information that help boaters find their way safely from place to place on the water. In order to understand the significance of individual ATON markers boaters must understand the navigation system in place and be able to decipher purpose of an ATON.

Due to the many types and combinations of ATON, learning to understand them requires experience, practice and often the use of reference publications. However, the benefit of being able to navigate safely by using an ATON system is well worth the effort and has saved many vessels and lives since their inception.

There are three common ATON systems marking the waterways in the United States:

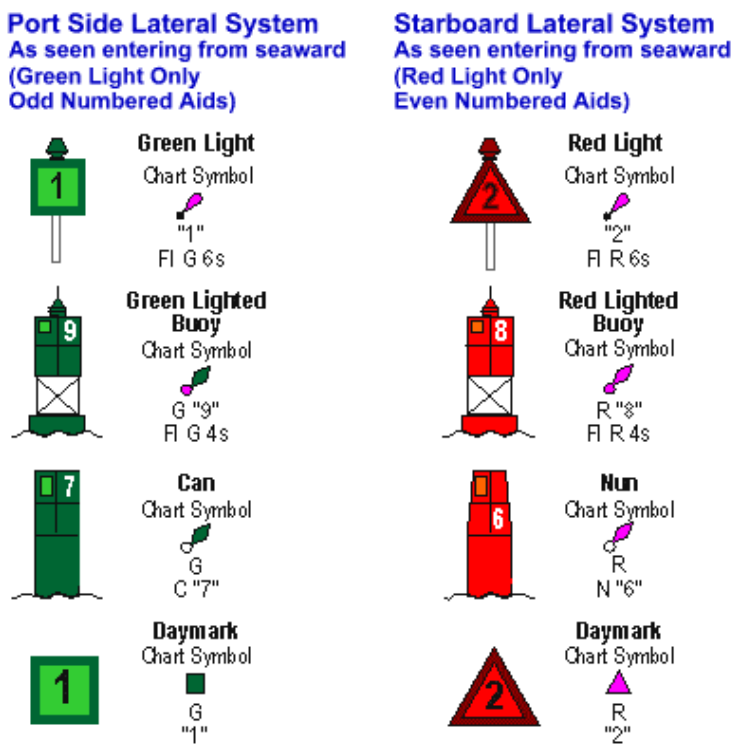
1. IALA "B" system
2. Intracoastal Waterway (ICW)
3. Western River System

The IALA-B System: (U.S. Federal ATONS - Maintained by the U.S. Coast Guard)

The buoys and beacons in this system conform to the International Association of Lighthouse Authorities (IALA) guidelines and are located in the Western Hemisphere, IALA Region B.

In this system, there are lateral and non-lateral aids or beacons, also called markers. The lateral markers indicate the navigable channel by their position, shape, coloring, numbering and light characteristics. The non-lateral markers are informational, safety or regulatory markers.

To navigate safely along a waterway or channel using the lateral markers, you should transit between the red and green markers. When returning to port, the red markers should be kept on the right or "starboard" side of the vessel. **"Red, Right, Returning"**



IALA-B Lateral Aids and Waterway Markers

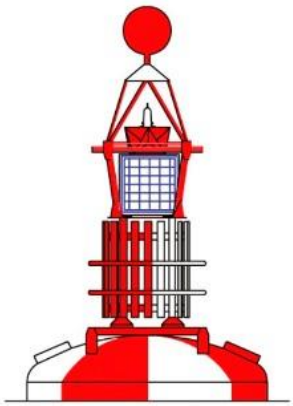
Lateral ATON indicate specific points along the edges of channels or a navigable waterway. Safe water is located between the Red and Green ATON. They are positioned with the Red markers referencing the direction *from seaward, returning to port, or up river*.

"Red, Right, Returning"

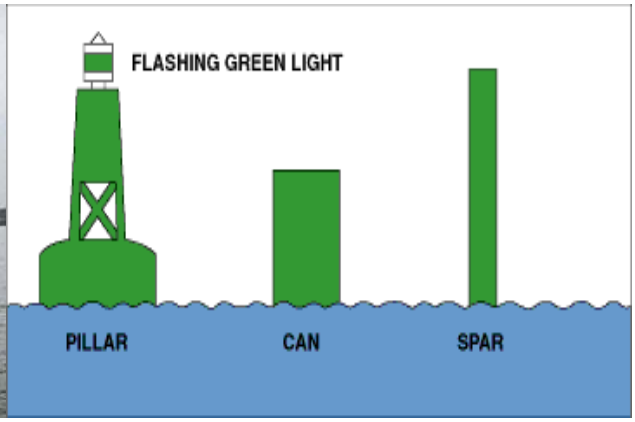
Along the U.S. coast line, ATON markers also identify certain hazardous areas and are positioned at specific areas along coastal routes. These are RED Buoys that should be kept on the shoreward side of the vessel for coastal passages. Venturing between these buoys and shore may expose the vessel and crew to hazardous conditions.

Buoys and Daymarks are interpreted by their basic designs which allow each ATON to maintain identifiable characteristics for easy navigational use. In new or unfamiliar areas, any confusion about placement of ATON can usually be quickly resolved by referencing the appropriate chart for the area.

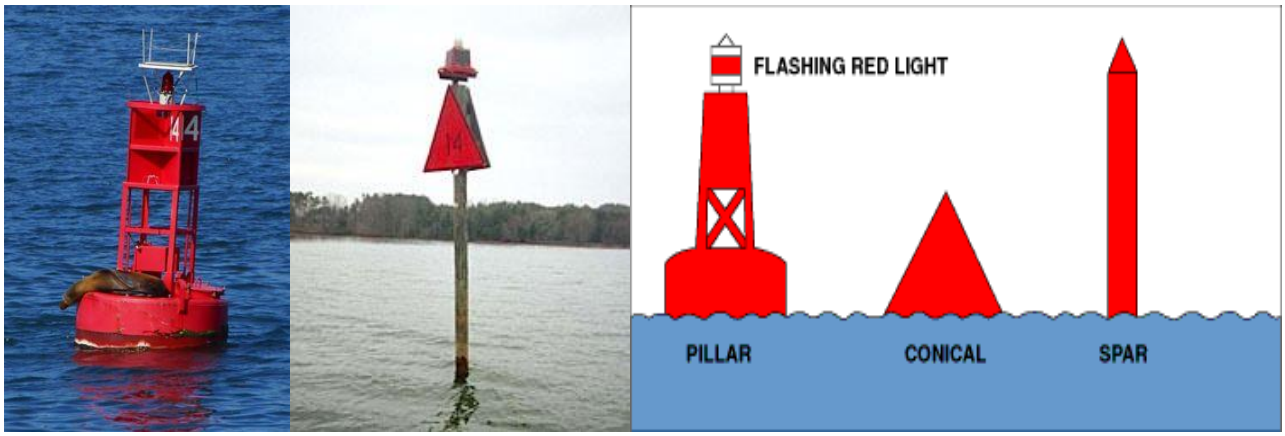
Safe Water Aids: These ATON indicate the beginning of "Safewater" when entering a harbor, port or channel when approaching from seaward or open water. They may be a floating or fixed ATON and are *vertically striped Red and White* in color and usually have a letter identifier, they are NOT numbered.



Green Lateral Aids: When approaching *from seaward, returning to port, or up river* ; beacons, buoys, daymarks on the Vessels' Left/Port side- are **Green in color, Square or Can Shaped with <u>Odd</u> Numbers**.



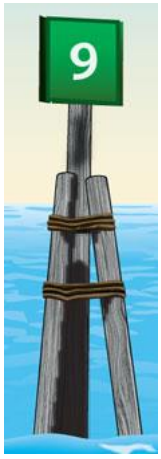
Red Lateral Aids: When approaching *from seaward, returning to port, or up river* ; beacons, buoys, daymarks on the Vessels' Right/Starboard side- are **Red in color, Conical or Nun Shaped with <u>Even</u> Numbers**……**"Red, Right, Returning"**

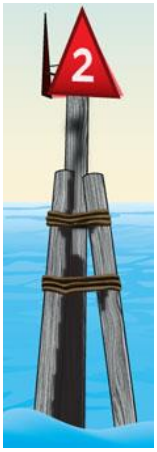


Buoys: Are floating aids that are anchored to the bottom and secured with chain at specific locations. They are identified on a chart or map with symbols and lettering that indicate their shape, color, markings lighting and sound signaling characteristics, when lighted or affixed with a sound producing device.

Caution: Buoys are not stationary and can move off station.

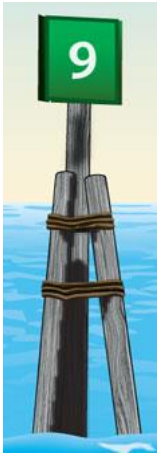
Daybeacons and Daymarkers: Are structurally fixed to the bottom, land or a shore based object at specific locations, they may vary in structural design. They too are identified on a chart or map with symbols and lettering that indicate their shape, color, markings lighting and sound signaling characteristics, when lighted or affixed with a sound producing device.

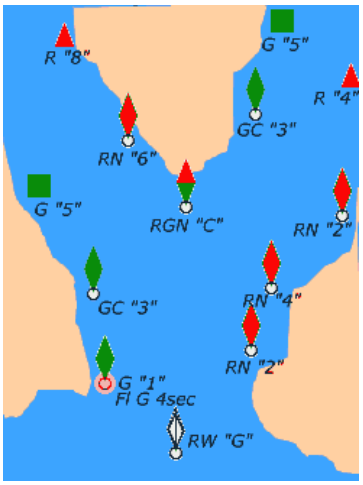


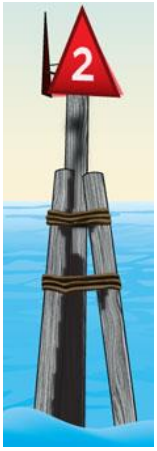


Interpreting Chart Symbols and Identifying the ATON: It is important that boaters are able to read a chart or boating map to interpret the chart symbols correctly and identify these symbols with the corresponding ATON. These are essential skills for all boaters to understand traffic patterns and navigate the boat along safe routes established for vessel traffic.

"Day Marks" are indicated with a square or triangle on the chart:

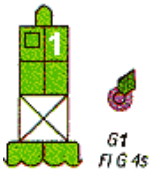




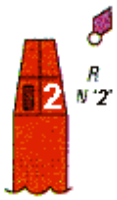


The ATON diagrams below correspond with the chart image above in the following order <u>when approaching from seaward.</u>

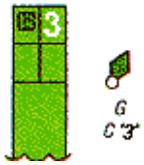
When approaching a channel or waterway from seaward or open water, typically the first ATON encountered will be the "Safe Water" ATON. In this example; The **RW "G"** indicating that it is a **R**ed and **W**hite striped ATON with the letter "**G**" on it.



In this example; the first lateral ATON after the safe water ATON is a <u>Lighted</u> buoy, as noted by the highlighted magenta circle at the base of the diamond chart symbol. The chart labeling; **G** "**1**" **Fl G 4 sec** indicates that the buoy is **G**reen, has the number **1** on it, and it **Fl**ashes **G**reen once each **4 sec**onds.

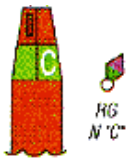


The next lateral ATON is an unlighted buoy, note the absence of highlighted circle at the base of the chart symbol; **R N "2"** indicating a **R**ed **N**un buoy with the number **2.**



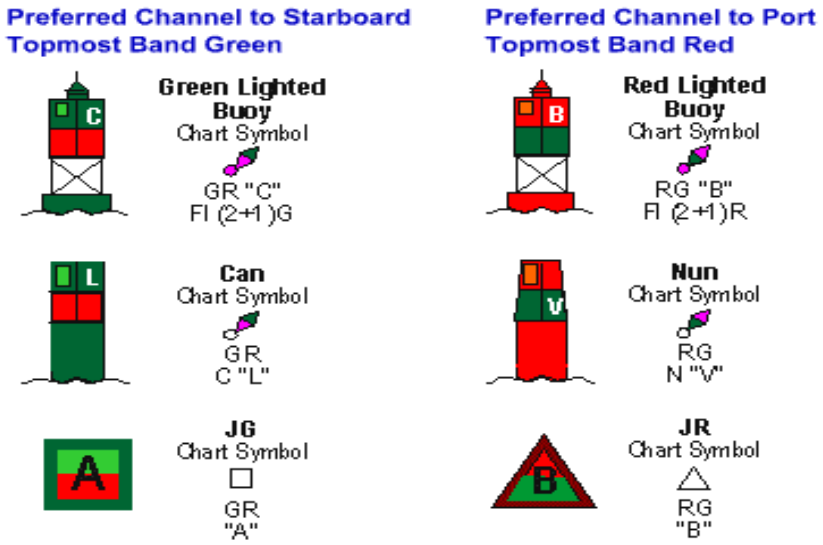
The chart symbol for the next lateral ATON; **G C "3"**, indicates a **G**reen **C**an buoy with the odd number **3**.

As the entrance channel approaches the junction, the chart symbol indicates a preferred channel marker, a buoy in this case; **RGN "C", R**ed and **G**reen **N**un buoy with a **"C"** on it.



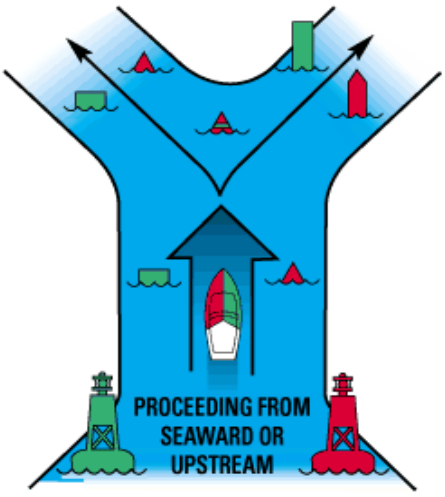
Preferred Channel Markers or Junction Buoys: This ATON indicates the preferred channel at points where the waterway splits or branches off in more than one direction. The ATON will consist of two colors; the purpose is to provide the boater with a means of identifying the primary channel. These buoys are NOT numbered but may be lettered.

When returning from seaward or open water, the top color indicates the side of the primary channel. The bottom color indicates the secondary channel. When referencing a chart you can also determine the primary channel by following the sequential numbering from seaward. The secondary channel, when marked with lateral aids will begin with a fresh numbering sequence.

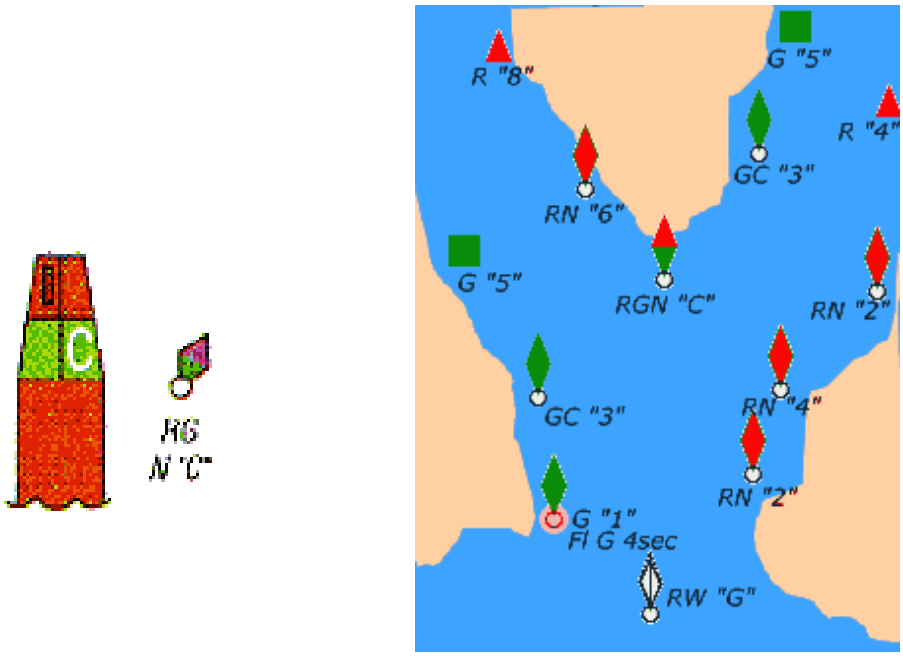


Using Preferred Channel Markers or Junction Buoys:

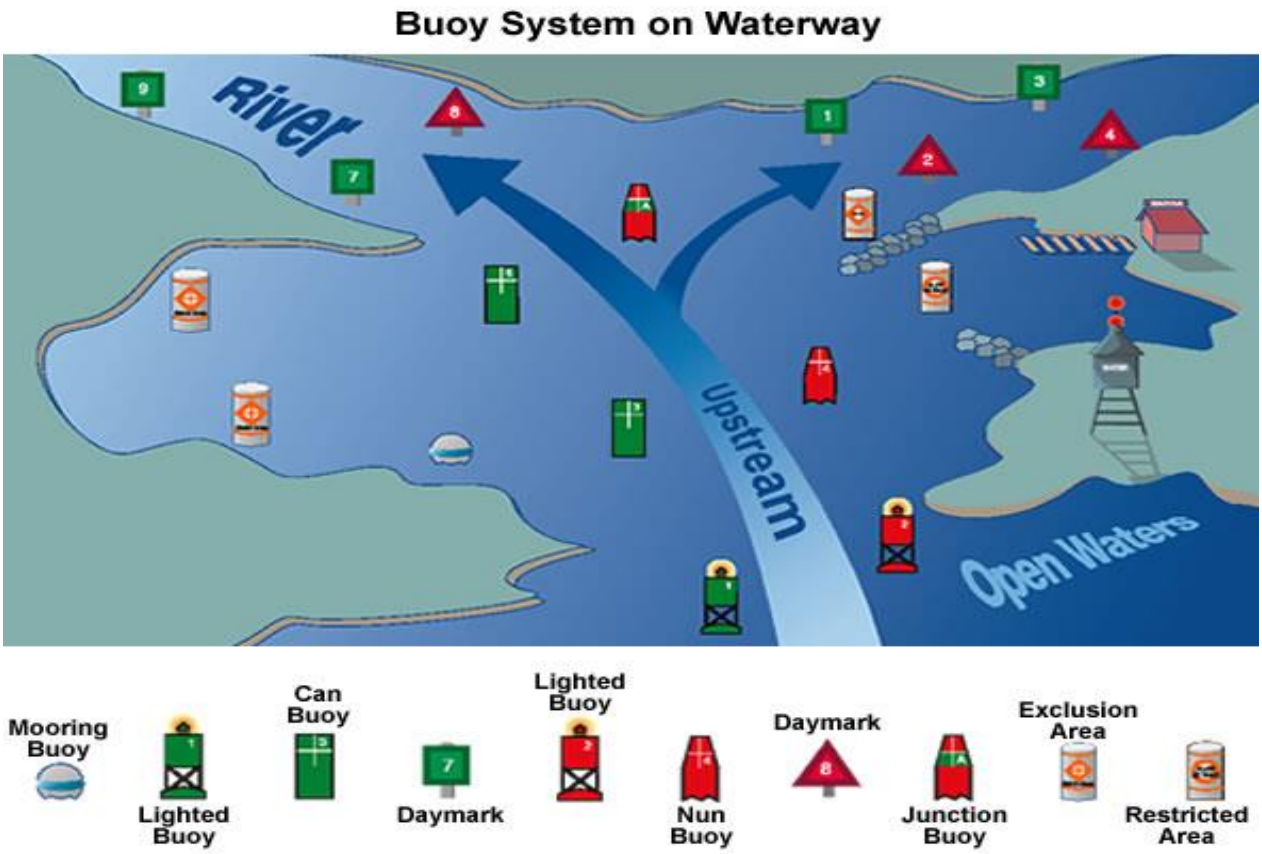
In the diagram to the right, the Preferred Channel Marker indicates the primary channel veers to the left and the junction buoy should be kept on the right "starboard" side of the vessel when approaching from seaward because red is on top. If the secondary channel is the chosen route the bottom or second color, green in this instance, should be kept to the left "port" side of the vessel when approaching from seaward.

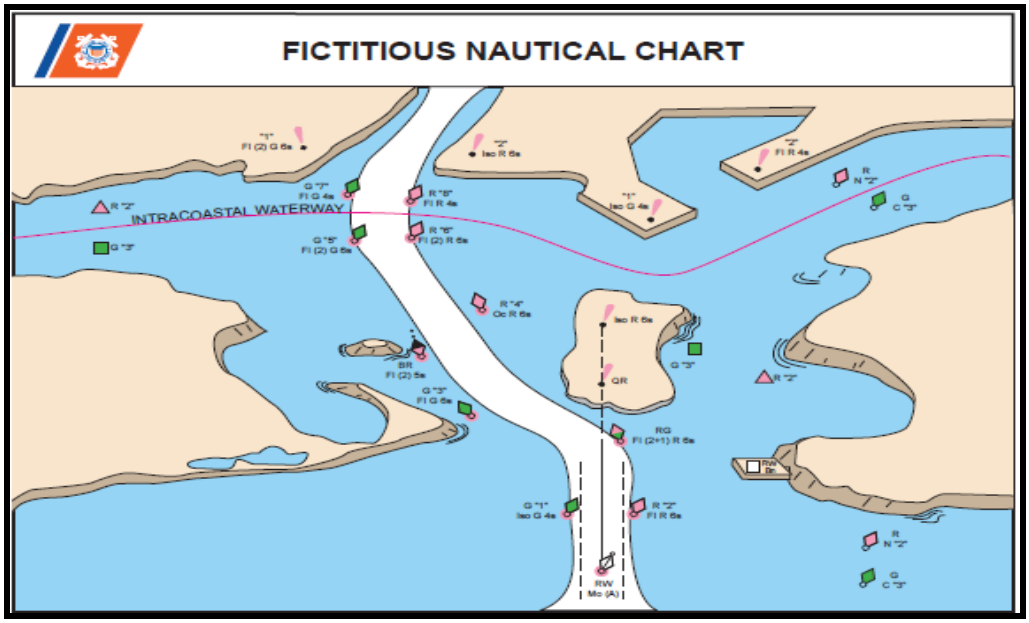


Viewing Lateral ATON and Preferred Channel Marks/Junction Buoys from the boat

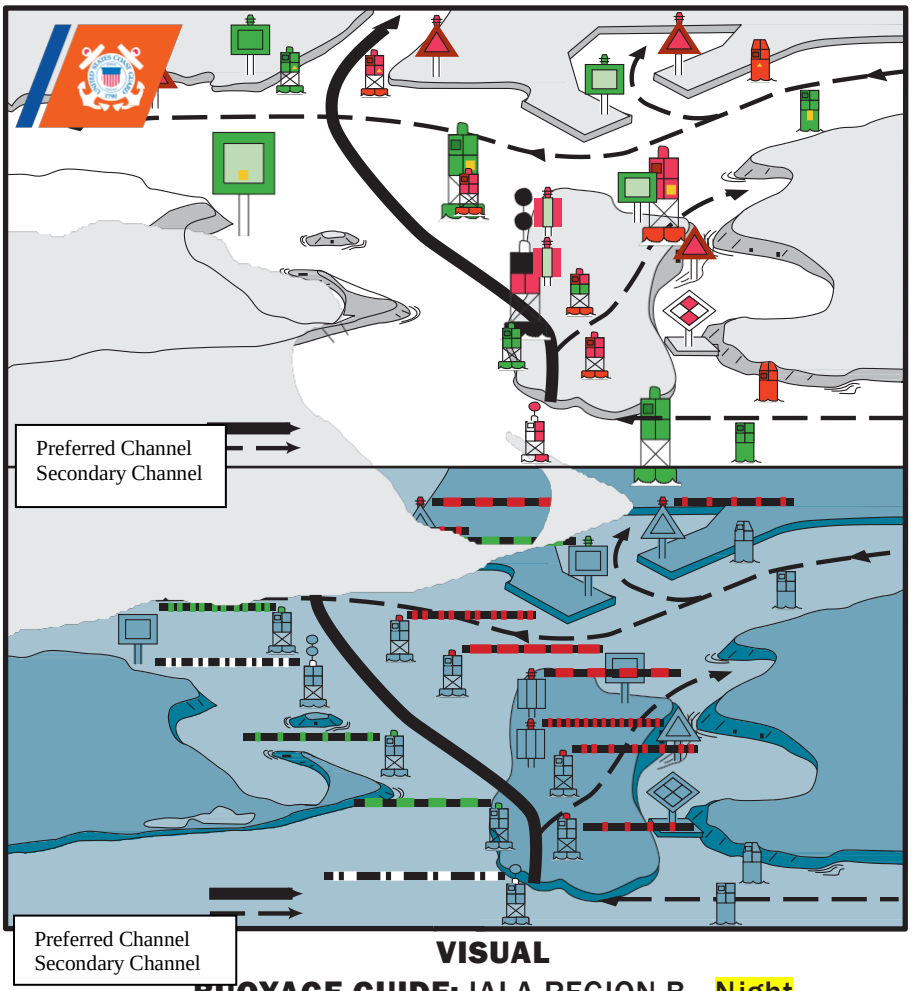


Reading Lateral ATON and Preferred Channel Marks/Junction Buoys on a Chart





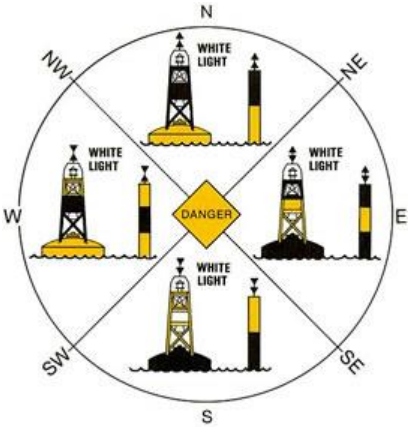
VISUAL BUOYAGE GUIDE: IALA REGION B – Day



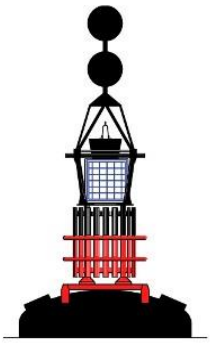
VISUAL BUOYAGE GUIDE: IALA REGION-B - Night

IALA-B Non- Lateral Aids

Cardinal Aids: These ATON have specific black and yellow color schemes with pointed day shapes on top, they indicate the safe direction to pass in relation to an isolated hazard by referencing the cardinal points on a compass.

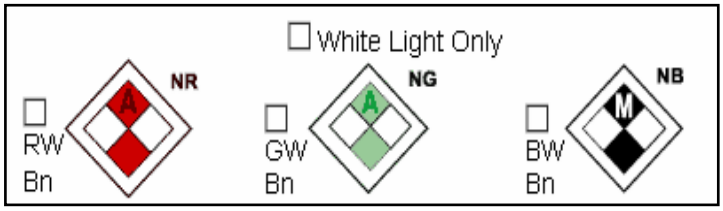


Isolated Danger Markers: These ATON are Black and Red, they may be lettered, and they indicate the location of an isolated danger and should be kept at a safe distance.



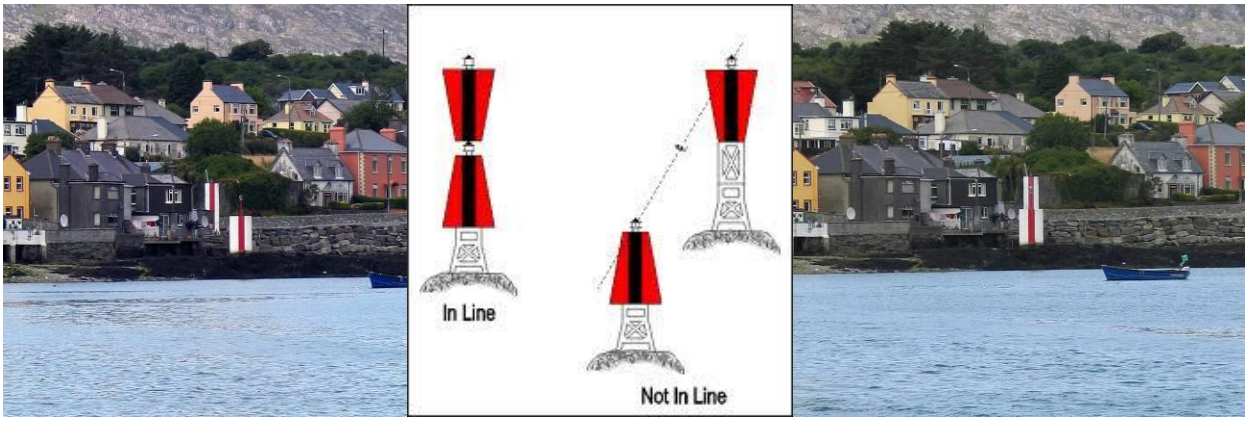
Special Markers: These ATON may vary in shape and size and are usually designed to establish specialty boundaries or the buoy itself serves a specific function. Typical specialty functions are for weather data collection or scientific analysis, protected areas or official security zones.

Non-Lateral Day Marks: These day marks have no lateral significance, they are used for reference to marked locations, they may be lettered, white light only when lighted.



Mooring Buoys: These buoys are <u>NOT navigation markers!!</u> These are buoys designed and labeled to indicate vessel moorage is allowed, typically white with a blue stripe. These areas should be approached with caution to avoid collision with other boats and/or the possibility of derelict lines attached to moorings.

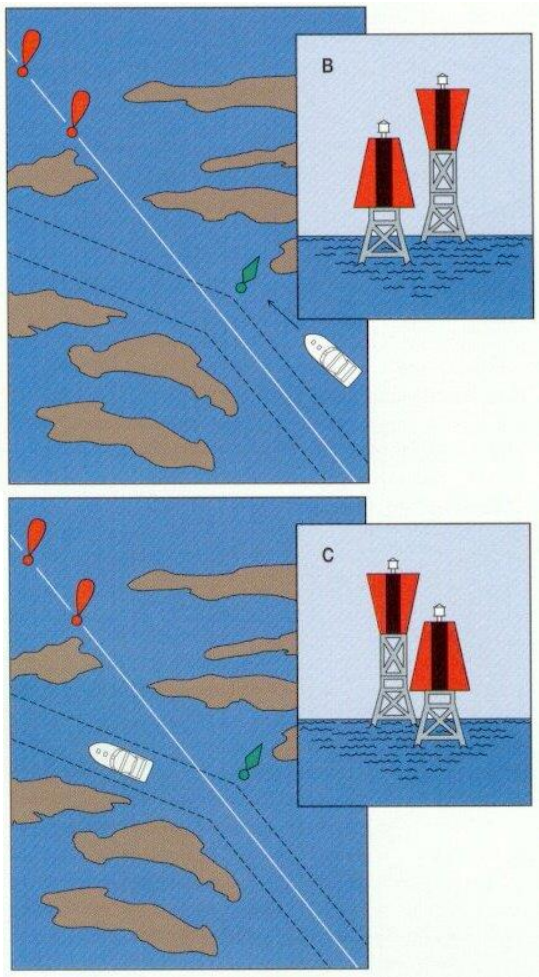
Range Markers: These ATON are attached to fixed structures on shore or pylons' that are installed in pairs and must be used in tandem, front/lower range marker, and the rear/upper range marker. They are designed to provide a visual reference along a straight line that indicates safe water and typically center channel. By aligning a boats heading with the range marker, the boater can steer a course to keep in a designated channel.



Some range markers will be lighted, typically the lower/front range will have a quicker flash than the rear/upper range, the flash patterns and colors vary depending on background lighting conditions and the number of range markers intersecting in certain areas.

Range markers should be used in conjunction with a chart for unfamiliar waters. In many locations there may be several sets of range markers where waterways cross and intersect. It is important to know when the channel turns or bends to select the proper sets of range markers and to avoid leaving the designated channel.

Aligning Range Markers: Steer towards the <u>front/lower</u> range marker.



Steer to port to align range markers

Steer to starboard to align range markers

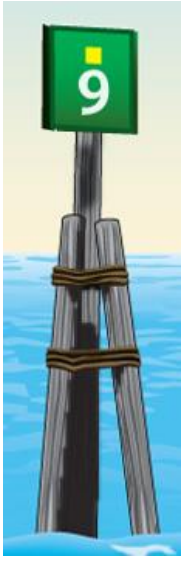
NOTE: Image (B) above depicts the view of the range markers for a boat cruising off course to the right of center channel. Image (C) shows the view of the range markers after the boat has cruised beyond the turning point, marked with a green can buoy.

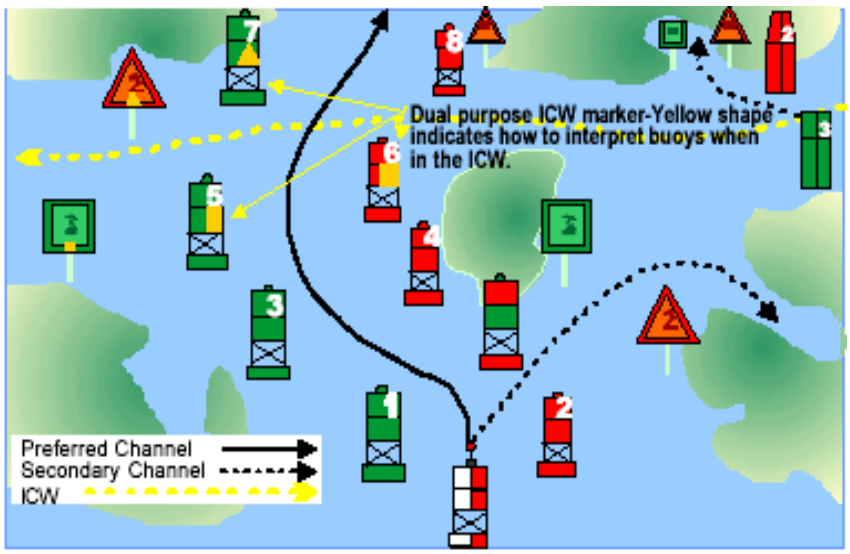
Intracoastal Waterway ATON System:

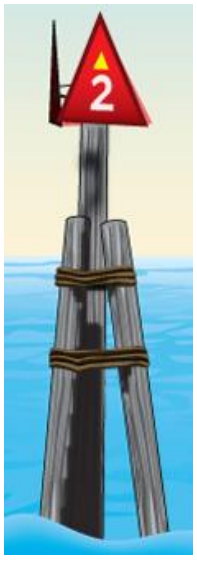
The Intracoastal Waterway (ICW) runs parallel to the Atlantic and Gulf Coasts from Manasquan Inlet, on the New Jersey shore to Brownsville, Texas at the Mexican border. ATON marking these waterways is observed in the same manner as IALA B lateral ATON.

The significant identifier for **"ICW ATON"** is a YELLOW identifier. The numbering will follow sequential patterns, but may begin anew in certain areas of transition, these number often correspond to statute miles along the ICW relative to specified geographical locations.

Red, Right, Returning also applies to the ICW markers. The direction of South inside the Atlantic seaboard, and South West inside the Gulf of Mexico are considered returning. There are some areas of the ICW along the West Coast of Florida where the ICW follows a northerly track en route to Texas, before turning southerly again. This does not change the buoyage system, color or numbering, the lateral ATON remain consistent relative to the channel.







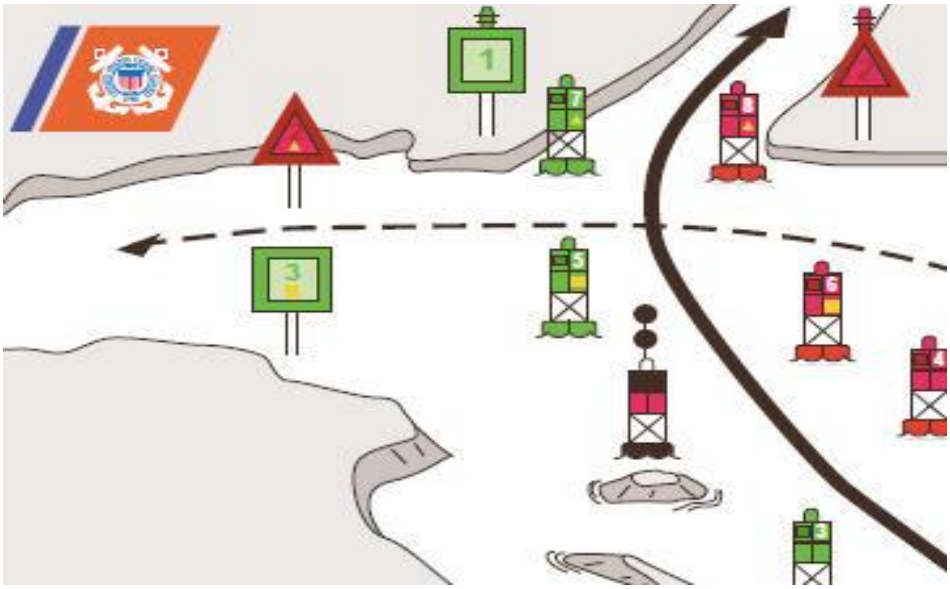
The Yellow identifier on the ICW ATON has a collating shape significance:

Yellow Triangle- The ATON should be read as Southerly or Returning for an ICW route.

Yellow Square- The ATON should be read as Northerly or Seaward for an ICW route.

Yellow Band or Rectangle- Signifies an ICW ATON for an ICW route, no lateral significance.

Intracoastal Dual Purpose Markings:



Green ATON with Yellow Square -- marks left side of the channel when traveling the intra-coastal waterway (south), and left side of channel when coming in from sea.

Green ATON with Yellow Triangle -- marks right side of channel when traveling the intra-coastal waterway (south), but left side of channel when coming in from sea.

Red ATON with Yellow Square -- marks left side of channel when traveling the intra-coastal waterway (south), but right side of channel when coming in from sea.

Red ATON with Yellow Triangle -- marks right side of channel when traveling the intra-coastal waterway (south), and right side of channel when coming in from sea.

Western Waterway Marking System:

This system is used on the Mississippi River and its' tributaries above Baton Rouge, LA, and some of the rivers that flow towards the Gulf of Mexico. There are several differences from the other U.S. systems already mentioned.

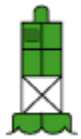
- Lateral ATON are not numbered.
- Numbered ATON represents statute miles typically from a fixed point at a river mouth.
- Diamond-shaped crossing boards indicate where a river channel crosses between banks.
- Lights show a single-flash characteristic.
    - Green ATON: Green or White
    - Red ATON: Red or White
- Safewater marks and Isolated Danger marks are <u>NOT</u> used

Port Side or Right Decending Bank

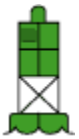
Green or White Lights

Flashing
ISO

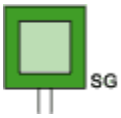
Center



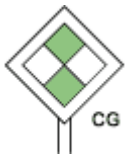
Lighted Buoy



Can



Passing Daybeacon



Crossing Daybeacon

May Be Lighted

Mile Board (Marker)

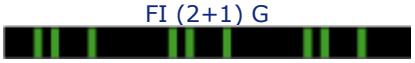
Preferred Channel

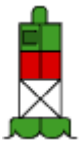
Mark Junctions and Obstructions
Composite Group Flashing (2)

Preferred Channel to Starboard

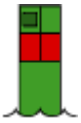
Topmost Band Green

FI (2+1) G

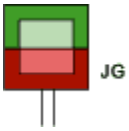




Lighted Buoy



Can

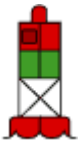


Passing Daybeacon

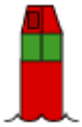
Preferred Channel to Port

Topmost Band Red

FI (2+1) R



Lighted Buoy



Nun

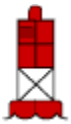
Passing Daybeacon

Starboard Side or Left Decending Bank

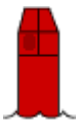
Red or White Lights

Flashing
ISO

Light



Lighted Buoy



Nun

Passing Daybeacon

Crossing Daybeacon

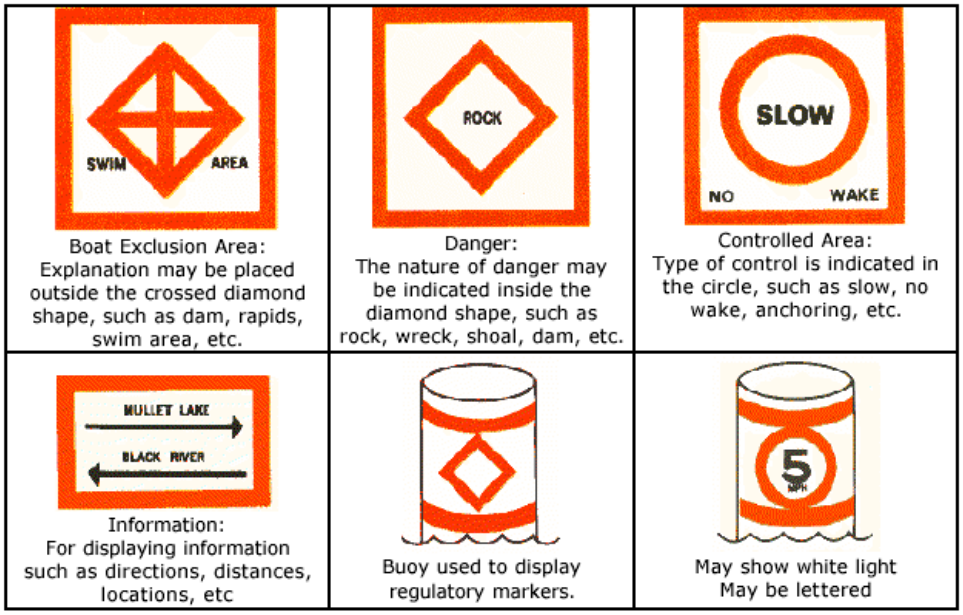
May Be Lighted

Mile Board (Marker)

Source : US Coast Guard

Regulatory and Informational ATON markers:

Used to advise of situations, dangers, directions or boat services. They can be identified by the orange bands on the top and bottom of each buoy.



- **Orange Circles**- *Regulate* areas where speed limits for boat traffic are imposed.
- **Orange Diamonds**- *Regulate* an area that is hazardous for boating or an exclusion area.
- **Orange Squares**- Provided to display *information* useful to boaters.

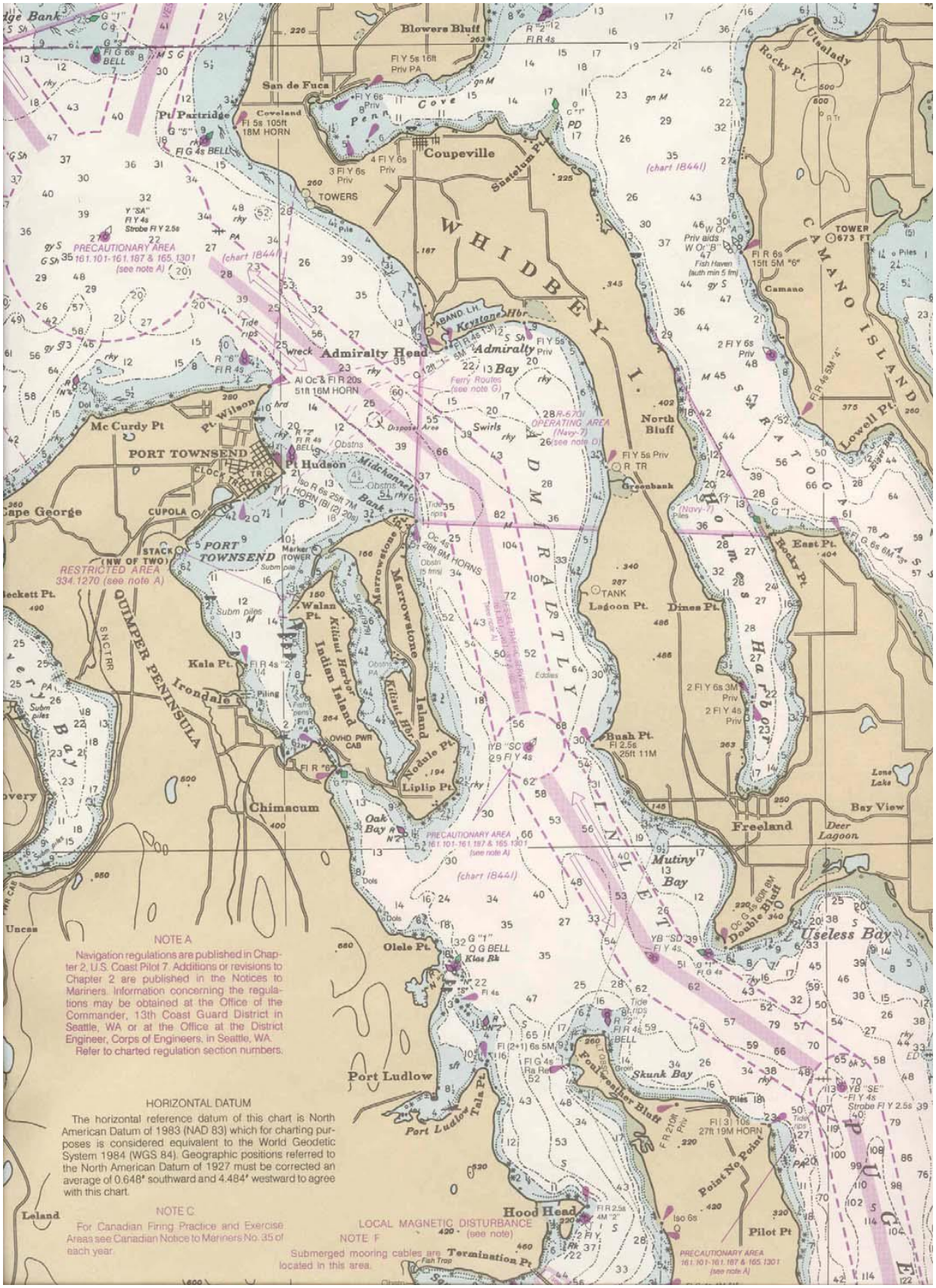
NOTE: Regulatory markers when lighted may show any light rythym other than quick flashing or Flashing (2).

ATON Discrepancies and Hazards to Navigation: Reporting hazards to navigation is a rule of good seamanship and a general responsibility that mariners assume for themselves and their fellow boaters. This can be done by issuing a "SECURITE" broadcast over the VHF-FM radio or by contacting the local authorities. Boaters can also creatively mark these hazards for others to increase detection until the hazard is removed.

Reporting ATON Discrepancies: When an ATON is observed to be damaged, missing "Off-station" or not Watching properly," boaters should report these findings and observations to the local U.S. Coast Guard unit, the Army Corp of Engineers, or the requisite Local Authority that has responsibility for maintaining the ATON in that area.

The local U.S. Coast Guard unit can be reached by phone or on VHF-FM radio channel 16 for verbal reports. The USCG Navigation Center can process ATON discrepancy reports via the internet at: http://www.navcen.uscg.gov/

Sample Chart



Chapter 6 – Communications and Risk Management

Purpose: To ensure safety and mission success, the vessel operator must effectively communicate the mission plan and ongoing status to inform the crew. Use VHF-FM marine radios to maintain safety communications with other vessels and shore contacts, and identify other means to effectively establish emergency communications.

Performance Objectives: By the end of this chapter the participant should be able to;

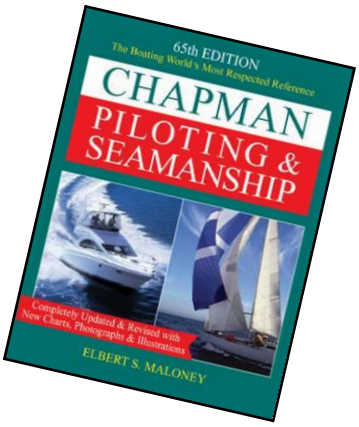
1. Maintain effective crew communications during operations.
2. Manage risk using the "G.A.R." Model for Mission Analysis and Operational Risk Assessment
3. Participate in a mission briefing.
4. Participate in a post-mission debrief.
5. Communicate a vessel float plan to a shore contact.
6. Operate a VHF-FM marine radio using VHF protocols in accordance with FCC regulations.
7. Select and use approved working frequencies for communications with a vessel or shore contact.
8. Monitor vessel traffic and identify the two safety broadcast: "Securite & Pan Pan"
9. Identify and describe procedures for an Emergency broadcast: "Mayday"

On-Water Performance Objectives: given a motorboat during practical exercises the participant will demonstrate the following:

1. Operate a VHF-FM Radio to conduct safety communications with other vessels and the designated shore-contact.
2. Communicate the mission and assess conditions to ensure vessel and crew safety.

References:

- FCC Radio Telecommunications Guidelines
- Chapman Piloting Seamanship and Small Boat Handling
- USCG Federal Requirements Pamphlet
- USCG TCT Manual
- USCG Navigational Rules of the Road
- VHF-FM Radio Owners Manuals
- NOAA/FCC EPIRB Regulations
- USCG Navigation Center http://www.navcen.uscg.gov/



Definitions:

Effective Communications – A process that allows team members to effectively use tools and skills for coordinating activities and behaviors essential to the mission plan to ensure safety and success.

Mission Analyses – The process by which mission plans and contingency plans are developed, to include identifying mission objectives and goals, allocating the necessary resources, identifying the critical tasks, ensuring team awareness and actions that are necessary for managing risks.

Mission Planning – The process of communicating specific human roles and behaviors, by providing step-procedures, protocols and secondary actions essential to maintaining safe working parameters and identifying the required materials and logistics

GAR Risk Assessment – A tool developed to provide operational teams with a format to perform on-going mission analysis and risk assessments, identify plan deficiencies and environmental changes and ensure effective communications are maintained to avoid unnecessary risk.

Emergency Management Plan – An operational contingency plan for a specific mission, team personnel and the prescribed environment. Designed to prevent additional risk, timely response and pre-determined emergency actions.

Float Plan – A tool developed to provide a shore contact or mother-ship; the essential elements of information about a boat crews mission, team personnel, the departure, return times and emergency protocols and contacts.

Marine Radio Telecommunications – Selected AM and FM radio frequency bands designated for the safe movement and management of vessels, providing ship to ship and ship to shore communications capabilities.

E.P.I.R.B. – Emergency Position Indicating Radio Beacon: an electronic device that affixes and transmits a position and distress signal to rescue personnel. The 406 mhz frequency is the designated marine signal, Aviation EPIRB's transmit on 121.5 mhz.

Communications

Good communications are one of the most important elements to boating safety; the process should begin during the mission analyses and planning stage and continue until the mission is complete. The mission is not complete until the final mission de-briefing, after the vessel is safely moored and all personnel have returned.

Often times people take communications for granted or assume messages have been communicated. This is a very dangerous habit of human complacency which can lead to complications or poorly coordinated actions that can put boats and their crews at extreme risk, and have resulted in unnecessary injuries and human fatalities.

'Effective Communications' is an ongoing process that is the responsibility of every team member, it is a process that requires effort and can be simplified or complicated by the individuals and the types of tools selected to maintain operational communications.

Often following any mishap or incident, during the post-situational debrief it will be discovered that communications was one of the most crucial and key elements that led to or further complicated a situation.

By contrast; good and effective communications is also often cited as the key element that led to a team's success.

There are four distinctive types of communications that will be discussed in this chapter:

1) **Mission Readiness Communications**
2) **Risk Management Communication**
3) **Radio and Tele-Communications**
4) **Navigational Communications**

Mission Readiness Communications

This section addresses communications associated with human error and risk based decision-making. Both greatly affect the safety of boat operations. Human error has been and continues to be a significant cause of boat mishaps. Ineffective risk management and poor communications has placed many boats and crews at greater risk than necessary.

Technical knowledge and skill alone cannot prevent mishaps. It also takes teamwork that recognizes, minimizes, and corrects human errors and requires a systematic process to continuously assess and manage safety risks. Prudent seamen have exhibited, and human performance researchers have described, critical skills that reduce the potential for human error-induced mishaps.

These skills are important processes that serve to;

- Mitigate Safety Hazards
- Maintain Situational Awareness
- Manage Risks
- Improve TEAM Performance and Effectiveness.

Mission Effectiveness: As a general rule of mission effectiveness, the use of team coordination, risk management, crew briefing, and crew debriefing are a part of standard boat operations.

It is important to describe the necessary skills, human performance standards, operator responsibilities and training requirements for each mission. The process of risk management, crew briefing and crew debriefing all require effective communications.

To promote these skills and processes, human performance and mission effectiveness can be assessed following each mission with crew debriefings, and during the mission analysis phase, or during training and crew readiness assessments.

NOTE: Because the majority of boat missions have inherent safety risks, effective coordination of the boat crew and the larger team is a cornerstone for mishap prevention.

Team Coordination: A team is a collection of people that uses the technical abilities of its members to achieve a common mission. This section discusses how team coordination can:

- Manage Human Error.
- Manage Safety Risks.
- Process for on- going TEAM Performance Improvements.

Members of the Team-The boat crew consists of the operator and crewmembers as a team. But it also is a part of a larger team. (Boat crews seldom perform missions without interacting with other people)

Members of this larger team may include:

- Unit Director
- Project Manager
- Supervisors
- The Boat Crew
- Colleagues and Support Staff
- Government Agencies
- General Public

Boat Operator-The operator wears two hats as:

- The person in charge of the boat and the crew.
- A member of the larger team.

Mission Specific Communication Skills – It is the responsibility of each boat crew member to actively participate in the communications and decision making process. This is a continual process that is essential to maintaining situational awareness. When essential communications encounter barriers or situations are minimized, the probability of human error increases.

'The Mission' *is the reason for getting the boat underway!*

Boat Crew Responsibilities: The following points outline the standards of communication for a boat crew.

- The boat crew and supervisor communicate about the mission as necessary.
- Standard terminology is used.
- Receivers acknowledge messages.
- Receivers ask questions when they do not understand.
- Senders pursue confirmation when there is no response.
- When changes to crew tasks occur, all hands are aware.
- The operator states risk decisions to the supervisor and crew.
- Time permitting, operator informs the crew of the reasons and any adjustments they have to make.
- Anyone may ask mission-related questions to clarify information.
- Monitor crew members for "task saturation", identify and mitigate

Operator Responsibilities: The following points outline the standards of communication for the operator.

- Use standard terminology in giving commands to the crew.
- Ensure that information and instructions conveyed to the crew are acknowledged by the intended receiver.
- Communicate intentions associated with risks to the supervisor and the crew.

Situation Awareness Skills:

Boat Crew Awareness: The following procedures outline the standards of situation awareness for a boat crew.

- The crew is aware of the mission status and maintains an effective lookout.
    - Current operations
    - Perceived location
- Changes to situation awareness are verbalized.
- Recognizing that a risk decision or action must be made.
- Offers suggestions or information to the operator / crew.
- If the crew perceives the boat operator or crew is taking unacceptable risks, positive action is taken to control the situation.
    - Stopping or slowing boat activities
    - Providing additional assets
- The boat crew checks each other's task performance for errors.
- Anyone who makes a mistake is informed and makes needed corrections.

Operator Awareness: The following procedures outline the standards of situation awareness for the operator.

- Not get underway without an understanding of the mission objective, the known risks, and a plan of action.
- Ensure that the crew understands the mission plan and assigned tasks.
- Remain alert to mistakes in planning and crew errors, empower the crew to double-check the operator's decisions and actions.
- Remain vigilant to changes in the situation.
- Remain alert for conflicting or ambiguous information that may indicate that the perceived situation is different than the actual one.
- Periodically update the supervisor and the crew; ask for big picture perspective.

Risk Management Communication Process:

Introduction: Risk management shall be performed during the planning and execution of missions. Risk management is an element of the mission analysis skill and is a process to identify and control unacceptable safety risks. Every mission event (getting underway, transit, on-scene operations, and mooring) has some level of risk and not all of the risks are known.

Every event requires that risks are kept within controls (safeguards) that have been designed to handle them. Examples of these controls include the proper use of installed communications and navigation systems and proper execution of operating procedures.

Effective risk management is highly dependent upon technical knowledge and experience.

Four Rules of Risk Management: To use the risk management process correctly, the team should follow the four rules.

Rule #1: Integrate risk management into all mission planning and execution.

- Risk management is a repetitive and continuous process.
- Risk management is most effective when it is proactive.
- It requires that when new information on risks is received, the ability to control those risks is reviewed.
- It requires the operator and crew to remain vigilant and think safely until the boat is secured and the mission is over.

Rule #2: Accept no unnecessary risks.

- Unnecessary risk does not contribute to the safe accomplishment of the mission.
    - Operating beyond the known capabilities of the crew and/or boat.
- Unnecessary risks are often taken when decision-makers rationalize that the boat is the only alternative or that urgency is more important than safety.
- Unnecessary risk taking constitutes gambling with lives and government/private property.

Rule #3: **Make risk decisions at the appropriate level.**

- Many times mishaps occur because the level of risk is not perceived by an individual.
- Understanding of risk is highly dependent upon technical knowledge and experience and expertise.
- Risk decisions must be made by clear-thinking, technically competent people with an understanding of the situation.
- The supervisor, operator and crew should work as a team in making risk decisions.

Rule #4: **Accept risks if benefits outweigh costs.**

- Eliminating unnecessary risk.
- Understand acceptable risks for mission accomplishment.
- He/she who owns the mission owns the risk.
- Some cases, mission directives outline what is acceptable (risking personnel injury and equipment damage to save lives).

- High stress situations, the line between acceptable and unacceptable may become fuzzy.
- Clear-thinking, technically competent people with an understanding of the situation must be involved in the risk decision.

NOTE: The Risk Management Process is continuous during the course of boat operations; it requires constant cycling through the risk assessment steps and constant crew communication!

Risk Category Description:

High Risk - Risks cannot be managed without constant control.
- Loss in terms of personnel injury or equipment damage is expected.
- The boat and/or crew is operating beyond their capability.
- If the risk is acceptable or not is dependent upon the mission objective.
- High risk <u>must</u> be communicated to the supervisor or higher up.

Caution- Risks are manageable with constant control.
- Loss is not expected if the situation remains stable, the crew adheres to all standard operating procedures, and boat systems respond as designed.
- The boat and/or crew are operating at their capability.

Low Risk- Risks are manageable with control as required.
- Loss is not expected because the mission has established margins of safety in place and the objective will be modified if the margins are reduced.
- The boat and/or crew are operating within their capability.
- Complacency is constant hazard for low risk operations.

NOTE: Each risk category must be examined in terms of severity, probability, and exposure to arrive at a subjective rating of risk. Again, it is useful to discuss individual perceptions of risk among the crew and between the operator, supervisor and project manager.

Risk Mitigation – Risks must be mitigated. What changes can be made to reduce risks to an acceptable level without changing the mission objective? This may be done by examining:

- Changes to the plan and operations tempo (ex. slowing the timeline).
- Command and control (ex. more guidance and/or supervision).
- Mission tasks (ex. simplifying).
- Timing of tasks (ex. sequential vs. concurrent or daylight vs. nighttime).
- Boat requirements or crew qualifications (ex. more capable or experienced).
- Number of assigned boats and/or crew (ex. additional boats, members).
- Required equipment and/or protective equipment.

Individual and Team Mission Analysis – Team discussions are essential to understanding the actual risks and potential risks of any mission. It is important that all members participate with an <u>equal voice</u> and are able to ask necessary questions to ensure <u>the entire crew has a thorough understanding of their roles and how risk will be managed.</u>

NOTE: If the discussion of options is limited to those that can be provided by the boat, few are available. This step needs to evaluate options that the larger team can recommend to reduce risk. The larger team may have additional resources. The larger team may be able to spread out the risk among personnel or transfer the risk to more capable assets.

Using the "G.A.R." Model for Mission Analysis and Operational Risk Assessment:

An integral component to mission analysis is performing a formal risk assessment for the mission. The GAR model is simply a tool to help communicate and compute the total level of risk for the six essential elements involved in every boating mission.

- Supervision
- Planning
- Crew Selection
- Crew Fitness
- Environment
- Event/Evolution Complexity

The mission risk can be visualized using the colors of a traffic light; **GREEN** / **AMBER** / **RED**. The GAR assessment should be measured by each individual member of the team and collectively as a crew prior to getting underway for the mission. It can be kept at the ready for on-going mission analysis and risk assessments during the actual operational evolution.

Calculating Risk: To compute the total level of risk for the six elements, assign a personal risk score for each risk category using a number between (0 through 10).

Zero = No Risk / Ten = Maximum Risk

Add the individual risk scores to achieve the missions "Total Risk Score." If the sum of the total risk score falls within the:

GREEN (Low Risk)	**Risk level is acceptable and minimal, take measures to avoid complacency.**
AMBER (Caution)	**Risk level is moderate, alternate plans and contingencies should be identified to minimize risk exposure and to identify changes that could elevate risk levels.**
RED (High Risk)	**Risk level is HIGH, alternate plans and/or mitigating measures must be implemented, the mission stopped/suspended until the risk level is manageable.**

GAR Model Scoring the Six Elements:

Supervision: This element extends control for mission suitability and performance thresholds. It consists of the vessel operator, but also includes supervisors and managers that may also be responsible for the over-all mission. The importance of including management in operational missions and decision making may be the deciding factor whether the mission is GO or NO-Go, or if the mission should be terminated due to changes in the operational environment. An important factor that the vessel operator must keep in mind; due to their level of operational involvement they may need to designate a "Safety Supervisor" to adequately manage safety parameters.

Planning: The planning phase is the most important, without an operational plan the boat should not get underway. The plan should present all levels of mission preparation, involve all members of the team, it should be clearly communicated and understood. The plan should cover assigned personnel, tools, resources, time parameters, primary and secondary objectives, the process and procedures, secondary plans and it should not be considered to be complete without an effective Emergency Management Plan.

Crew Selection: The crew selection process should consider all levels of personnel involved; individual qualifications, experience levels, specific roles, personnel limitations and back-up or safety crews.

Crew Fitness: Assessing the fitness level of the crew should consider the physical and mental state of assigned personnel. Team members should accurately characterize their individual rest and fatigue parameters, nutrition and hydration levels, illness or stress indicators, as well as personal performance thresholds and suitability for the required tasks.

Environment: The environment should be considered as the most dynamic of the six elements and is the reason why there are NO "Routine Missions." The environmental factors have a direct impact on the performance of the personnel and the boat and are always changing. There are two key environments that must be considered, the levels of safety in and on the boat, and the area around the boat. The hazards on the boat can be managed through human performance; (safety equipment, maintenance & inspections, securing gear, etc.). The hazards around the boat can be mitigated with sound decision making and on-going assessments; (time, visibility, temperature, water conditions and navigational hazards.)

Event/Evolution Complexity: The complexity of an event or evolution should consider the situation and the amount of time available, the longer the exposure and the more complex the event, the greater the risk! If an event or evolution is rarely performed or a new skill or tasking for the assigned crew it may be more complex initially. The greater frequency at which an evolution is conducted can increase proficiency, yet it also may increase exposure and the possibility of complacency amongst a crew.

Risk Calculation Worksheet - Calculating Risk Using **GAR** Model (GREEN-AMBER-RED)

To compute the total level of risk for each hazard identified below, assign a risk code of 0 (For No Risk) through 10 (For Maximum Risk) to each of the six elements. This is your personal estimate of the risk. Add the risk scores to come up with a Total Risk Score for each hazard. ***NOTE: Any category rated > 5 should receive specific mitigation.**

SUPERVISION –Supervisory Control considers how qualified the supervisor is and whether effective supervision is taking place. Even if a person is qualified to perform a task, supervision acts as a control to minimize risk. This may simply be someone checking what is being done to ensure it is being done correctly. The higher the risk, the more the supervisor needs to be focused on observing and checking. A supervisor who is actively involved in a task (doing something) is easily distracted and should not be considered an effective safety observer in moderate to high-risk conditions.

PLANNING – Planning and preparation should consider how much information you have, how clear it is, and how much time you have to plan the evolution or evaluate the situation.

TEAM SELECTION – Team selection should consider the qualifications and experience level of the individuals used for the specific event/evolution. Individuals may need to be replaced during the vent/evolution and the experience level of the new team members should be assessed.

TEAM FITNESS – Team fitness should consider the physical and mental state of the crew. This is a function of the amount and quality of rest a crewmember has had. Quality of rest should consider how the ship rides, its habitability, potential sleep length, and any interruptions. Fatigue normally becomes a factor after 18 hours without rest; however, lack of quality sleep builds a deficit that worsens the effects of fatigue.

ENVIRONMENT – Environment should consider factors affecting personnel performance as well as the performance of the asset or resource. This includes, but is not limited to, time of day, temperature, humidity, precipitation, wind and sea conditions, proximity of aerial/navigational hazards and other exposures (e.g., oxygen deficiency, toxic chemicals, and/or injury from falls and sharp objects).

EVENT or EVOLUTION COMPLEXITY – Event/Evolution complexity should consider both the required time and the situation. Generally, the longer one is exposed to a hazard, the greater are the risks. However, each circumstance is unique. For example, more iterations of an evolution can increase the opportunity for a loss to occur, but may have the positive effect of improving the proficiency of the team, thus possibly decreasing the chance of error. This would depend upon the experience level of the team. The situation includes considering how long the environmental conditions will remain stable and the complexity of the work. Assign a risk code of 0 (For No Risk) through 10 (For Maximum Risk) to each of the six elements below.

Supervision	_____
Planning	_____
Team Selection	_____
Team Fitness	_____
Environment	_____
Event/Evolution Complexity	_____
Total Risk Score	_____

The mission risk can be visualized using the colors of a traffic light. If the total risk value falls in the GREEN ZONE (1-23), risk is rated as low. If the total risk value falls in the AMBER ZONE (24-44), risk is moderate and you should consider adopting procedures to minimize the risk. If the total value falls in the RED ZONE (45-60), you should implement measures to reduce the risk prior to starting the event or evolution.

GAR Evaluation Scale
Color Coding the Level 0f Risk

0 – 23	23 – 44	44 – 60
1 – 23	24 – 44	45 – 60
GREEN (Low Risk)	AMBER (Caution)	RED (High Risk)

The ability to assign numerical values or “color codes” to hazards using the GAR Model is not the most important part of risk assessment. What is critical to this step is team discussions leading to an understanding of the risks and how they will be managed.

Crew Briefing and Debriefing Communications

Introduction: Crew briefings should be required before the boat gets underway. Briefings for the operator and the crew help create a shared mental picture of what is expected to happen and strives to set rules for the mission.

Crew debriefings should be performed after missions. The debriefing is the best opportunity to evaluate performance and recognize individual and team accomplishment. When correctly performed, the debriefing can serve as a valuable tool for continuous performance improvement. It can show the way from just 'doing things to knowing how to do "the right things right way".

NOTE: The GAR Model serves as an excellent template for "Crew Briefings."

Crew Briefing: The crew briefing should at minimum consist of the GAR model topics:

- **Supervision**- Leadership and Communications Goals
- **Planning**- Resources and Mission Objective.
- **Team Selection**- Duties, Roles and Responsibilities.
- **Team Fitness**- Personality, Attitude and Conditioning
- **Environment**- Natural and Human Hazards, Positive Climate for Teamwork.
- **Event & Evolution Complexity**- Duration, Frequency, Standards and Sequences.

Crew Debriefing: The informal crew debriefing should cover the following topics:

- Major Events.
- Level of Performance.
- Outcome of Events.
- Evaluation of Goals and Standards.
- Establishment of New Goals and Standards.

Suggested Debriefing Content:

- What was my experience from my perspective?
- What did others do that had an effect on my role and responsibilities?
- What did I do well that contributed the TEAM?
- What could I do differently in a similar situation?
- What lessons were learned, what resources are needed the next time?

Float Plans (See appendix D for Sample Float Plans)

The float plan is an integral tool for the safety of boat crews and affords a protective measure within the chain of communications and safety management to ensure boat crews return safely from the mission. It also provides emergency planning and response contingencies to afford timely notification and assistance or rescue should a boat crew not return as planned.

The float plan should be a simple process that becomes routine for all boat operations. Some float plans may be required to be very detailed, while others may only require the basic essential information regarding the mission.

Float plans should always be left with a responsible co-worker, supervisor, relative or friend that will ensure notifications and response measures are activated within a timely manner to avoid any delays in assistance should the boat crew not return as scheduled.

Types of Float Plans:

- Hand written Forms
- Electronic Forms
- Electronic Locater/Emergency devices (SPOT)
- Single Day
- Multi Day
- Single Vessel
- Multiple Vessels

Minimum Requirements for Float Plans:

- Vessel Name/ Numbers & Physical Description
- Number and Names of All Personnel onboard
- Trip Starting Location
- Trip Ending Location
- Navigational Routes
- Mission Specific Areas of Operation
- Safety Equipment Onboard
- VHF-FM or other radio working channels
- Phone #'s
- Towing vehicle used, if applicable
- Emergency numbers for the prescribed area
- Response time-line and Emergency Action Steps for the Float Plan Holder

Radio and Tele-Communications

Reliable communications are imperative for operating vessels. Operators must be aware of what works for their area.

VHF radiotelephone – A VHF (very high frequency) radiotelephone is used to communicate with other boaters, the Coast Guard, commercial vessels, draw bridge tenders, and lock operators. Recreational boats are not required by federal law to carry radiotelephone equipment, but they are highly recommended on larger waters. The Federal Communications Commission (FCC) regulates their use.

Boats carrying more than six passengers for hire, as well as many other commercial craft, are required to carry radio equipment. Operators of commercial craft should consult the nearest FCC office to determine the licensing requirements that apply to you and your boat. A copy of the station license must be kept on board near the transmitter; the license must be renewed every ten years with the FCC.

The U.S. Coast Guard enforces VHF regulations; fines for violations range to $10,000, imprisonment for not more than one year, or both.

The VHF band has many channels however recreational boaters have limited access; examples of channels as follow (See complete list on Page 6 – 18):

- **Channel 06** - inter-ship safety communications only.
- **Channel 09** - commercial and non-commercial inter-ship, ship-to-coast (commercial docks, marinas, and some clubs), secondary channel for hailing and distress, monitored by the Coast Guard.
- **Channel 13** - ocean going vessels, bridge tenders, tugs while towing, locks.
- **Channel 16** - distress safety and calling, call Coast Guard, establish general contact, must be monitored, not for "chit-chat," call "Mayday" only when "grave and imminent" danger threatens your boat and immediate help is required.
- **Channel 22** - U.S. Coast Guard liaison, vessels, shore stations, after establishing communications on channel 16; Maritime Safety Information Broadcasts.
- **Channels 24 to 28 and 84 to 88** - public telephone calls (to call the "marine operator").
- **Channels 68, 69, 71, 72 & 78** - non-commercial inter-ship (recreational boat working channels) and ship to coast (marinas, yacht clubs, etc).
- There are marine weather stations **(WX-1, WX-2, WX-3)** that broadcast the latest available weather information from the National Weather Service continually; updated every 6 hours.

NOTE: Radiotelephone users must familiarize themselves with broadcasting procedures; once contact is made on an appropriate working channel, the exchange of transmissions must be: of a legally permissible nature; and of the minimum possible duration.

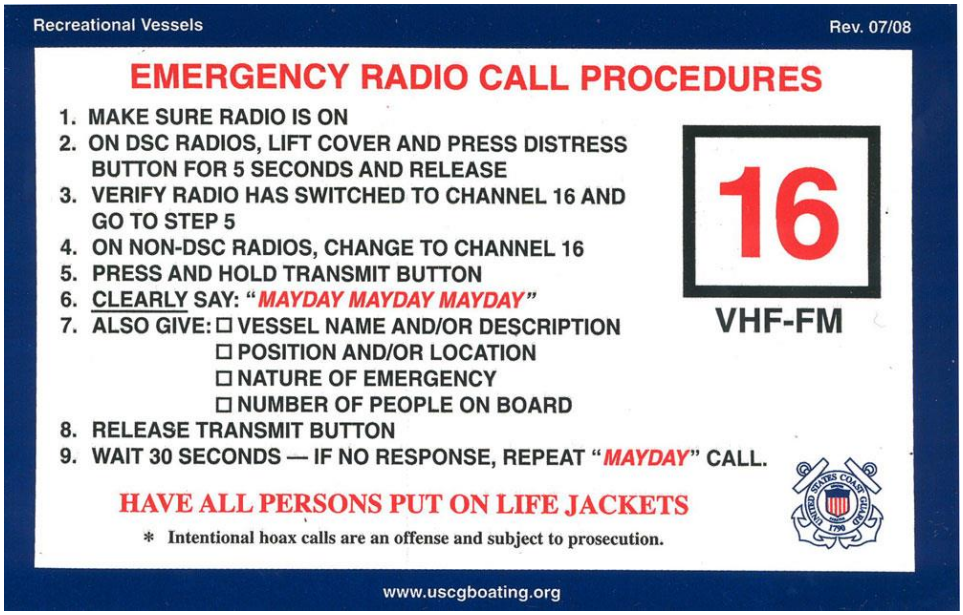
When not actively engaged on another channel, a voluntarily equipped vessel with its radio on is required to monitor Channel 16 (if possible monitor Channel 9 as well).

Call Priority (Channel 16)

- **MAYDAY**- calls involving imminent danger of loss of life or vessel.
- **PAN-PAN**- urgent communications concerning the safety of a ship, aircraft, other vessel or person in sight or on board.
- **SECURITE** - safety messages concerning navigation or weather.
- **Initial contact -** use this channel to hail another vessel and initiate contact on another, working frequency (can use Channel 9 too).

Transmitting a MAYDAY:

- MAYDAY...MAYDAY...MAYDAY
- THIS IS (boat name)...(boat name)...(boat name)
- MAYDAY (boat name) POSITION IS (vessel position in latitude and longitude or as a distance and magnetic/true bearing from a well-known navigation landmark).
- WE (nature of emergency).
- WE REQUIRE (type of assistance required).
- ABOARD ARE (number of adults and children on board) AND (safety equipment on board). (State conditions of any injured).
- (boat name) IS A (boat length in feet) FOOT (type: ketch, sport fisherman, etc.) WITH A (hull color) HULL AND (trim color) TRIM.
- I WILL BE LISTENING ON CHANNEL (16).
- THIS IS (boat name). OVER.



Single-Sideband (SSB) radio – Reliable, direct voice communications over about 25 miles (depending on antenna heights) requires the use of medium frequency (MF) and/or high frequency (HF) radiotelephones or uses satellite technology. MF and HF radiotelephones are collectively referred to as Single-Sideband or SSB radios.

SSB is amplitude modulated, and uses only a single sideband adjacent to, rather than double sidebands on either side of, a carrier wave. It is sometimes referred to

as AM radio, but this is a holdover from the days when marine MF and HF sets were of the double sideband (DSB) type, and no longer accurate.

A vessel must already be equipped with VHF-FM before being licensed for SSB. Due to crowding, "skip" and other factors, an SSB operator is required to attempt communication on VHF before using the 2-3 MHZ band or higher frequencies, unless the transmitting station is clearly beyond normal VHF range.

SSB radiotelephones are commonly available with output power of 50-150 watts. The range is affected in part by transmitter power. All marine SSB stations operating in the 2-3 MHZ band must be able to operate on 2182 kHz, the international distress and calling frequency. They must also be able to operate on at least two other frequencies. Most sets will have the desirable feature of one-button selection of 2182 kHz, and some will automatically generate the radiotelephone alarm signal on this channel.

The maximum effective range of SSB transmission in the MF band is 50-150 miles during the day. HF band transmissions can reach thousands of miles depending on various conditions. For those operating in areas where VHF and MF radio is not reliable, SSB sets should be capable of operating on the frequencies assigned to the Coast Guard's Contact and Long Range Liaison (CALL) system.

Digital Selective Calling (DSC) is now available on SSB sets, and can automatically alert the operator to an incoming call on any number of bands. This is desirable due to the large number of available frequencies.

Installation on other than large, metal ships requires the use of an auxiliary ground plane (usually a copper mesh panel). Generally speaking the installation process should be done by a qualified technician due to a number of adjustments and/or isolators/filters needed.

Satellite Communications and Tracking Systems – Satellite communications systems (SATCOM) beam signals around the world via a chain of earth-based and orbiting space relay stations. SATCOM systems are now available for vessels 40 feet or more in length. There are a number of systems available, each with varying services and limitations. Consult a qualified technician for advice before buying.

Citizen's band radios – May be used by boaters, but not monitored by the USCG. Range is limited, usually between 5-15 + miles.

Cellular phones – Are very useful but not as a substitute for a VHF radio. They work best in coastal areas near population centers. It is best to know the available emergency numbers in the location you are boating in. Program them into the phone and carry a waterproof card on board with the numbers printed on it.

Navigational Communications

Electronic Emergency Signaling Devices - The use of electronic emergency signaling devices has saved countless lives through the years and they have become more common place and often considered an essential piece of standard equipment to be carried on many vessels.

The **Emergency Position Indicating Radio Beacon** commonly called the **E.P.I.R.B.** has become an integral piece of safety gear on many boats and often is required depending on the nature of work and the operational environment for the vessel. They may also be standard issue in certain Life Rafts.

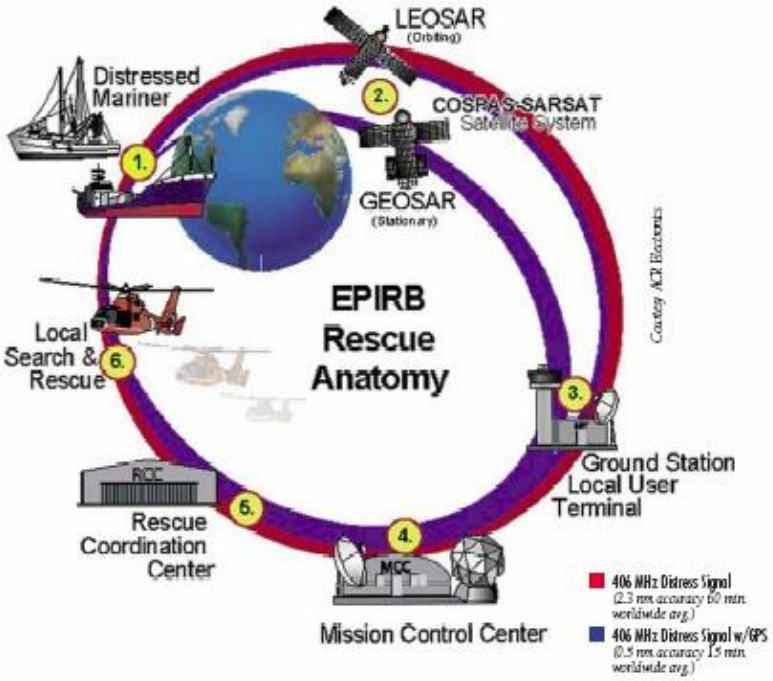
They are available in a variety of sizes and designs that can be situated for a variety of deployment options; *Class "A" units- Automatic or Float Free and Class "B" units- Manually Activated*.

Many units now have a GPS feature integrated for increased detection capabilities. Older models may only be accurate within 12-15 miles.

They can also be purchased for the use of an individual and may be referred to as a P.E.P.I.R.B. (Personal Emergency Position Indicating Radio Beacon) There are other personnel locater device options available, not all qualify as an E.P.I.R.B.

The beacons position is determined by a number of reports taken from orbiting satellites, signals may also be reported by passing boats and aircraft monitoring the emergency frequency.

E.P.I.R.B. units purchased for the use on boats should be ***406MHZ, and must be registered through NOAA and the FCC*** to ensure emergency distress reporting and detection. Maintenance intervals are key for proper use and functioning of the devices.



VHF Channels List

Channel Number	Ship Transmit MHz	Ship Receive MHz	Use
01A	156.05	156.05	Port Operations and Commercial, VTS. Available only in New Orleans / Lower Mississippi area.
05A	156.25	156.25	Port Operations or VTS in the Houston, New Orleans and Seattle areas.
6	156.3	156.3	Intership Safety
07A	156.35	156.35	Commercial
8	156.4	156.4	Commercial (Intership only)
9	156.45	156.45	Boater Calling. Commercial and Non-Commercial.
10	156.5	156.5	Commercial
11	156.55	156.55	Commercial. VTS in selected areas.
12	156.6	156.6	Port Operations. VTS in selected areas.
13	156.65	156.65	Intership Navigation Safety (Bridge-to-bridge). Ships >20m length maintain a listening watch on this channel in US waters.
14	156.7	156.7	Port Operations. VTS in selected areas.
15	--	156.75	Environmental (Receive only). Used by Class C EPIRBs.
16	156.8	156.8	International Distress, Safety and Calling. Ships required to carry radio, USCG, and most coast stations maintain a listening watch on this channel.
17	156.85	156.85	State & local govt maritime control
18A	156.9	156.9	Commercial
19A	156.95	156.95	Commercial
20	157	161.6	Port Operations (duplex)
20A	157	157	Port Operations
21A	157.05	157.05	U.S. Coast Guard only
22A	157.1	157.1	Coast Guard Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16.
23A	157.15	157.15	U.S. Coast Guard only
24	157.2	161.8	Public Correspondence (Marine Operator)
25	157.25	161.85	Public Correspondence (Marine Operator)
26	157.3	161.9	Public Correspondence (Marine Operator)
27	157.35	161.95	Public Correspondence (Marine Operator)
28	157.4	162	Public Correspondence (Marine Operator)
63A	156.175	156.175	Port Operations and Commercial, VTS. Available only in New Orleans / Lower Mississippi area.
65A	156.275	156.275	Port Operations
66A	156.325	156.325	Port Operations
67	156.375	156.375	Commercial. Used for Bridge-to-bridge communications in lower Mississippi River. Intership only.
68	156.425	156.425	Non-Commercial
69	156.475	156.475	Non-Commercial
70	156.525	156.525	Digital Selective Calling (voice communications not allowed)
71	156.575	156.575	Non-Commercial
72	156.625	156.625	Non-Commercial (Intership only)
73	156.675	156.675	Port Operations
74	156.725	156.725	Port Operations
77	156.875	156.875	Port Operations (Intership only)
78A	156.925	156.925	Non-Commercial
79A	156.975	156.975	Commercial. Non-Commercial in Great Lakes only
80A	157.025	157.025	Commercial. Non-Commercial in Great Lakes only
81A	157.075	157.075	U.S. Government only - Environmental protection operations.
82A	157.125	157.125	U.S. Government only
83A	157.175	157.175	U.S. Coast Guard only
84	157.225	161.825	Public Correspondence (Marine Operator)
85	157.275	161.875	Public Correspondence (Marine Operator)
86	157.325	161.925	Public Correspondence (Marine Operator)
87	157.375	157.375	Public Correspondence (Marine Operator)
88A	157.425	157.425	Commercial, Intership only.
AIS 1	161.975	161.975	Automatic Identification System (AIS)
AIS 2	162.025	162.025	Automatic Identification System (AIS)

Phonetic Alphabet

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

Chapter 7 – Survival and Rescue

Purpose:

To minimize injury or prevent the loss of life, in the event of an emergency, an operator and crew must be proficient in rescue and survival techniques.

Performance Objective:

By the end of this chapter the participant should be able to:

1. Demonstrate 2 techniques to re-board a boat from deep water
2. Use "Talk, Reach, Throw, Row, Go" rescue sequence
3. State the rescue priorities
4. Demonstrate the HELP and HUDDLE techniques.
5. Identify the 2 most common types of boating accidents that result in fatality.
6. Rescue a live person in the water.
7. Don Type I, II, III and V PFDs and enter the water
8. Demonstrate Visual Distress Signaling (VDS) techniques
9. Comply with State and Federal laws and FWS/DOI Policies regarding accident reporting

Major Types of Boating Accidents

- Collisions between vessels
- Collisions with objects
- Falls overboard
- Capsizing

Most collisions could be avoided by use of proper lookout, knowledge of "rules of the road", boat lighting requirements, and aids to navigation. Falls overboard are related to sea conditions, movement about the craft, and tripping/slipping

hazards on board. Capsizing accidents usually occur in small boats due to sea conditions and/or improper weight distribution.

Running Aground

Running aground can happen to even the best boat operator. Knowing how to properly navigate and having knowledge of the local area will greatly reduce the likelihood of running aground. Be sure to review navigation charts and maps as well as use a depth finder when navigating unknown waters. Keeping a lookout posted will also help reduce the chance of running aground.

Hard Aground – means you hit so hard that the hull imbeds into the bottom material. The hull may be breached or forward motion immediately stopped by a hard aground.

Soft Aground – means you bumped the bottom or moved into a very soft bottom material such as sand or mud.

Actions to Take if Aground:

- Remain calm; Don't panic.
- DO NOT reverse the engine in an attempt to dislodge the boat – this can cause additional damage to either the boat or the environment.
- Assess the damage
  - Check for signs of flooding. Listen for signs of rushing air as this suggests that water is rushing in and forcing air out. **Set a bilge watch.**
  - If you have bent the propeller, rudder or damaged the shaft or its support, you will notice a vibration (sometimes violent) when you engage the engine. If this is the case, stop the boat and set the anchor.
- If there is no structural damage assess if you can move the boat out of the area without causing damage – go slowly. Consider:
  - which way is the tide moving? Will it be enough to re-float the boat
  - can you safely use the engine to free the boat or do you have to do it manually (row, push off with a paddle/boat hook, etc.)
- If you doubt you can free the boat, call for professional assistance such as marine rescue.

Common Fatal Boating Accidents

Most fatal accidents are caused by persons falling overboard or the boat capsizing and the victims drowning because they are not wearing PFDs. Even if you are a good swimmer, the urgency of going into the water unexpectedly along with fatigue caused by stressors could render you helpless. The major determining factor in most fatalities is non-use of PFD's. Most deaths are due to drowning, with cold water shock and hypothermia being contributing factors. Most drownings occur within 10 feet of safety. Therefore, chances are most rescues will be a simple reach or throw. **Vessels less than 26 feet account for 80% of fatalities.** Ironically, small vessels have less stringent equipment requirements.

Major Factors in Boating Fatalities

- Drowning
- Cold Water Shock
- Hypothermia (and Cold Water Immersion)

A well-prepared boater must understand the basics of drowning, cold water shock, and hypothermia/cold water immersion in order to prevent them from occurring, or mitigate their effects in an accident.

Drowning

Usually defined as asphyxia due to submersion in a liquid, usually water. It is a leading cause of death among boaters and would be rescuers. Many people who fall in the water cannot swim well. For those who can swim well it usually results from underestimating the power of moving water, and/or the effects of hypothermia on swimming ability. In a rescue situation, failure to follow the rescue sequence puts the rescuer at additional risk.

Types of Drowning

- **Dry** – little or no water enters the lungs (10- 15% of all drownings).
- **Wet** – aspiration of water into the lungs (85- 90% of all drownings).
- **Secondary** – a person successfully revived, but dies later due to complications.
- **Cold Water Drowning** – a person who drowns in cold water, and may still be successfully revived.

NOTE: Any revived, near drowning victim must seek medical attention to avoid the risks of secondary drowning.

Cold Water Drowning Survival Factors

- **Age** – younger the better.
- **Length of submersion** – shorter the better (individuals have been successfully revived after being under water for over one hour.
- **Water Temperature** – colder the better (cold produces beneficial physiological changes).
- **Water Quality** – cleaner the better.
- **CPR Quality** – 2-person preferred; steady, high quality compressions/ventilations, confirmed circulation.
- **Victim Struggle** – less is better.
- **Physical condition of the Victim** – other injuries can complicate survival.

Care for Drowning Victim

- Remove from water.
- Ensure ABC's and initiate CPR as appropriate.
- Prevent further heat loss.
- Handle gently.
- Administer 100% oxygen.
- Transport to nearest medical facility that can handle emergencies. A drowning victim is not dead until they are warm and dead.

Cold Water Immersion – **1-10-1** is a simple way to remember the first three phases of cold water immersion and the approximate time each phase takes.

- **Cold Shock** – a sudden loss of breath when the body is suddenly plunged into cold water (temperatures under 70 degree F). That sudden loss of breath can induce involuntary gasping which may cause inhalation of water instead of air. The sudden shock of cold water can also place severe strain on the body causing cardiac arrest. Cold Shock will pass in about **one minute**.

- **Cold Incapacitation** – in the next **10 minutes** you will lose the effective use of your fingers, arms, and legs for any meaningful movement. Concentrate on self-rescue.

- **Hypothermia** – Depending on the temperature of the water, loss of consciousness may occur in as little as **one hour**.

Hypothermia

Even when the weather is warm, do not forget that in many areas the water can be very, very cold. A sudden unexpected wake or other "unbalancing event" can land you in the frigid water. Although the possibility of drowning from the initial shock of falling into the water is a real threat, so too is hypothermia.

Hypothermia is a condition that exists when the body's temperature drops below ninety-five degrees. This can be caused by exposure to water or air. The loss of body heat results in loss of dexterity, loss of consciousness, and eventually loss of life. Cold water immersion makes it very difficult to swim, even to keep yourself afloat.

Your body can cool down 25 times faster in cold water than in air. If you examine the chart below you will see that survival time can be as short as 15 minutes. Water temperature, body size, amount of body fat, and movement in the water all play a part in cold-water survival. Small people cool faster than large people and children cool faster than adults.

HYPOTHERMIA RATES

Water Temp	Loss of Dexterity (with no protective clothing)	Time to Exhaustion or Unconsciousness	Expected Survival Time
32.5 °F	Under 2 min.	Under 15 min.	Under 15 - 45 min.
32.5-40 °F	Under 3 min	15 to 30 min	30 to 90 min
40 - 50 °F	Under 5 min	30 to 60 min	1 to 3 hrs
50 - 60 °F	10 to 15 min	1 to 2 hrs	1 to 6 hrs
60 - 70 °F	30 to 40 min	2 to 7 hrs	2 to 40 hrs
70 - 80 °F	1 to 2 hrs	2 to 12 hrs	3 hrs to indefinite
> 80 °F	2 to 12 hrs.	Indefinite	Indefinite

PFDs can help you stay alive longer in cold water and immersions suits can vastly extend that time. You can float without using energy and they cover part of your body thereby providing some protection from the cold water. When boating in cold water you should consider using a flotation coat or deck-suit style PFD. They cover more of your body and provide even more protection.

Hypothermia does not only occur in extremely cold water. It occurs even in the warmer waters of Florida and the Bahamas.

Methods of Body Heat Loss

- **Conduction** – direct transfer of heat from body by direct contact with water, or some solid surface (rock, ground, boat deck).
- **Convection**- loss of heat by air or water moving across the body and carrying it away.
- **Radiation** – loss of heat energy to the environment from unprotected parts. Over 50% of heat loss is from the head, followed by the neck, armpits, chest and groin.
- **Evaporation** – conversion of perspiration into water vapor, cooling the body at the surface.
- **Respiration** – exhalation of water vapor carrying with it heat from the body.

Heat Loss Factors

- **Age** – children lose heat faster than adults.
- **Body Build** – thin people lose heat faster than heavier people.
- **Movement in Water** – a person swimming or aggressively moving in the water will lose heat faster than someone passively floating.
- **Alcohol/Caffeine** – dilates the blood vessels, causing victim to lose heat faster.

Cold Water Survival

Conservation of heat is the foremost objective for a person in the water.

- If sudden immersion occurs, cover mouth and nose to prevent gasping in water.
- Wear a PFD.
- Wear an immersion suit or other cold water survival gear.
- Keep clothes on.
- Don't swim unless you can reach a nearby boat or floating object. Any action generates heat that is absorbed by the water.
- Get out of the water as soon as possible, even part way (i.e. crawl up on top of overturned boat).
- Allocate resources for group survival. Rotate people into the "warmest" area regularly.

If you cannot get out of the water, use the **Heat Escape Lessening Posture (HELP)**, or the **Huddle position** (depending on number of people) to conserve body heat.

Huddle Position

HELP Posture

NOTE: According to the U.S. Coast Guard, water less than 70 degrees F is considered coldwater.

Hypothermia can cause death in and of itself given enough exposure time relative to the water/air/wind conditions. It can also hasten the onset of drowning in even the best swimmers due to its effects on the extremities. Many "good" swimmers drown attempting to reach shore or their boat due to cold water immersion.

Care for Hypothermia

- Ensure ABCD (airway, breathing, circulation, degrees-prevent further heat loss).
- Protect victim from cold environment.
- Remove wet clothing, wrap in dry clothing and/or blankets.
- Insulate from ground.
- Handle gently.
- Transport to medical facility as soon as possible.
- Beware of after-drop, as body re-warms, cold blood trapped in extremities moves into the core. The heart may be affected, causing arrhythmia.

Do not massage the victim's arms and legs. Massage will cause the circulatory system to take cold blood from the surface into the body's core, resulting in further temperature drop. Do not give alcohol, which causes loss of body heat, or coffee and tea that are stimulants and may have the same effect as massage.

Treatment of hypothermia can be accomplished by raising the body temperature back to normal. Re-establishing body temperature can be as simple as sharing a sleeping bag or blanket with another individual, or applying warm moist towels to the individual's head and body. A warm bath could be used for mild to medium hypothermia but never if the victim is unconscious. Do not attempt to raise the temperature too rapidly, gradual warming is recommended.

Capsizing - The majority of small pleasure boats, and all built after 1978, have floatation to keep them from sinking even if they capsize. If you should capsize it may be safer to stay with the floating boat than try to swim to shore.

A small unstable boat may capsize from the following causes:

- Overloading slows a boat down and reduces the amount of freeboard (area above the waterline). A low freeboard increases the possibility of swamping the boat or taking on water that will slow the boat even more. Don't overload your boat with passengers or equipment.

- Improper weight distribution can make the boat even more unstable. You must locate persons and equipment in order to balance the boat and keep water out.

- Waves can be a major factor in capsizing especially if they are unexpected. Anticipate all waves and aim the bow into them.

What to do if you capsize:

- Take a head count to make sure all crew and passengers are there and provide assistance if needed.
- Put on your PFD (if not already wearing it).
- Stay with the boat – try to get as much of your body out of the water as possible.
- Right the boat if possible.
- Orient the boat bow into the prevailing conditions using a sea anchor or other means of maintaining position.
- If signaling devices are available, use them to attract attention. Save at least one until you actually see a potential rescuer.
- Attempt to maneuver to the nearest shore or shallow water.
- Use the H.E.L.P. and Huddle positions
- Remain calm – do not panic.

Man-Over-Board (MOB)

Standing or riding on the gunwales or bow of a boat causes most crew overboard situations. If you must move around in a boat which is underway, stay low, hold on to both sides and have at least three points of contact with the boat at all times.

Man Overboard Procedure

1. Whoever first sees or hears someone go overboard should shout, "man overboard (port or starboard)". This person should become the spotter and continually point to the person in the water until the boat is safely alongside. Try not to lose sight of the crew overboard; it is extremely difficult to locate a person in the water.

2. Slowly turn the boat and make a gentle turn keeping the person in view.

3. Approach the person slowly into the wind or current.

4. When the person is alongside put the engine in neutral – keep engine running in case you need to maneuver quickly to adjust position.

5. Once alongside the person, use the **"Talk, Reach, Throw, Row, Go"** method described later in this chapter. Extend a boat hook or oar toward the person. If they cannot be reached, toss a line with a Type IV floatation device Your type IV throwable flotation device should always be immediately accessible and within reach of the helm.

6. Adjust the weight to keep the boat trimmed and help the person aboard. Usually over the stern.

Rescue Priority

- Self most important.
- Partner(s) second most important.
- Victim third important.

Self-Rescue

Boat operators and their crew should be able to rescue themselves in the event they end up in the water. This includes being able to get back onto the boat, or mitigate the effects of having to stay in the water. **It is ESSENTIAL that operators utilize their engine kill switch if applicable.** This small device can make the difference between life and death should you fall overboard. Many boaters have fallen over, only to watch their boat motor on out of sight, or worse yet, circle over them ("circle of death").

Self-Rescue – boat can be reached

- **Chin up bounce** – Difficult for most people, especially on high- sided boats. Grab stern or gunwale at lowest point and bounce up as if doing a chin up. On second bounce, try to get upper half of body over the gunwale and into boat, roll into boat.
- **Stirrup** – Try and find loose line hanging off the boat and tie in a loop. Step into loop; use line to climb back into boat.
- **Cavitation Plate** – If engine is out of gear, use cavitation plate on outboard engine or outdrive as a step. Climb onto transom using engine for support.

Victim rescue

Characteristics of a person in distress

- Can wave and yell for help.
- Has not yet reached the panic stage.

Characteristics of a person drowning

- Cannot speak, consciously wave for help, or consciously grab rescue device.
- Has reached the stage of panic. This is usually accompanied by inability to breathe. Victim is under the surface most of the time.
- May have as little as 20 to 60 seconds before they go under; or may disappear immediately.
- Appear to be doing a breaststroke with arms raised above head, head is tilted way back, and mouth is wide open. May have appearance of playing/splashing.

- Victim will probably attempt to climb onto you if you get too close to them.

Getting victim into the boat – Position victim alongside boat where freeboard is at a minimum. Usually this is the stern or as far astern as possible. The choice of technique is dependent on both the boat and the victim's condition/cooperation.

Weak or injured victim – Bounce Technique

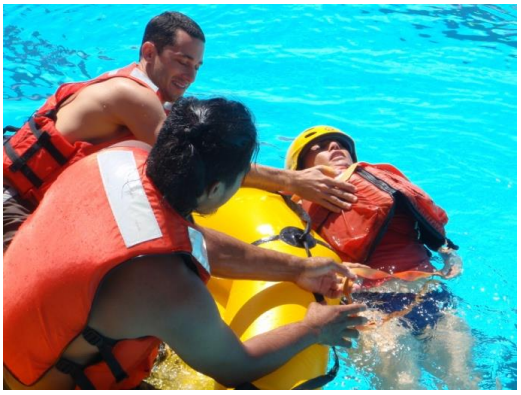
- Retrieval strap- Commercially available, padded loop with hand holds, or large loop tied into end of line. Put loop around victim under armpits. May need two rescuers.

- Grab victim's PFD, shirt, wrists, or armpits.

Unconscious or suspected spinal injury victim – Par-buckle Technique

- Cargo Net, blanket, tarp- Secure end of net by tying to rail or standing on it. Put rest of net in the water and place under the victim. Rescuers grab the outside of the net and pull up in unison.

- Retrieval strap, nylon webbing, line- Secure end of line to boat. Wrap line under victims shoulders. Secure second line to boat and wrap under victims waist. Pull in unison on both lines to roll victim into boat. May need two rescuers.



Rescue Sequence (listed in order of increasing risk to rescuer)

- **Talk** into self rescue
- **Reach**
- **Throw**
- Boat **(Row)**
- In-Water **(Go)**

Note: Maintain visual and verbal contact while using any rescue technique

Talk into self-rescue - Since most people end up in the water within 10 feet of safety; many rescues are simply a matter of getting the victims attention and directing them into one of the self-rescue techniques to regain entry into the boat.

Reach rescue - In this rescue some type of device is used to extend the rescuers reach to the victim. The proximity needed is determined by the device used, sea conditions, wind speed/direction, and ability of the rescuer. They are quick to deploy and leave the rescuer on a safe platform. Use boat hook, paddle, fishing pole, etc.

- Brace yourself - if possible get someone to hold you.
- Extend device to victim. Remember that a drowning victim cannot think rationally, tell him/her what you want them to do.
- Be careful that victim does not pull rescuer into the water, rescuer should be prepared to let go of reach device if the situation deteriorates.
- Pull victim to boat.
- Talk into self-rescue or assist into boat.

Throw Rescue- Use when victim is too far away to use a reaching device, or distance may increase quickly. Throwing devices have the same limitations as reaching devices, are quick to deploy and give a greater reach. Use the same techniques as described in the reach rescue. Typical devices include:

- Type IV throwables with 40'-70' polypropylene line attached- Offers flotation to victim, but requires skill and accuracy to land near victim.

- Throw bag or heaving line- Offers no flotation to victim, requires skill and accuracy to land near victim.

- Alternatives- Any type PFD (be sure to "handle" the device to make it easier to throw over distance). Anything that floats (cooler, tire, etc.), attach line if possible. Throw upstream or upwind so device will float to victim. Remember, when there is current, surface water generally moves faster than the victim.

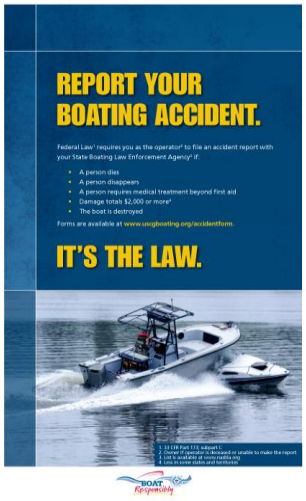
Boat rescue (Row)- Use when victim is too far away for a reach or throw. The boat serves as an extension of shore, placing the rescuer in the vicinity of the victim so that a less risky reach or throw can be executed.

- Approach victim from downwind or current for better control.
- When the victim is alongside the boat, the boat should be in neutral and helm turned towards the victim (if using a tiller motor, the tiller arm should be pointed away from the side the victim is on).
- Use reach and throw techniques.

In - water Rescue (Go)- Most dangerous form of rescue, should only be attempted by individuals who have been trained, have practiced, and who are in adequate physical condition. Used when condition of victim is such that he/she cannot help themselves, and it's not possible to maneuver the boat close enough for a reach rescue. Coldwater rescue (less than 70 degrees) requires use of cold-water survival suit.

Accident Reports

You must report <u>any</u> boating-related injuries or property damage accidents to your supervisor as soon as you are able.



Your supervisor will file an accident report using the DOT Safety Management Information System (SMIS) at: https://www.smis.doi.gov/

Loss of life, three or more people hospitalized, or property loss greater than $250,000 will be investigated by a bureau-appointed Serious Accident Investigation Team (SAIT).

The boat operator completes a **Boating Accident Report (USCG Form 3865)** whenever an accident occurs in US or territorial waters involves a DOI vessel including vessels under contract and vessels permitted to operate on Departmental waters) that results in **more than $2000 in property damage, an injury causing incapacitation for more than 72 hours, or loss of life.**

For more information or to download the USGS Form 3865 go to the USCG webpage:

http://uscgboating.org/recreational-boaters/accident-reporting.php

The boat operator also reports the accident to local authorities in the state where the accident occurred if required to do so by state law. State requirement may be more stringent than Federal (e.g. some states require that all boating accidents be reported immediately).

Supplemental Information

Appendix C: Accident Reporting

- SMIS Offline Accident Reporting Worksheet

Chapter 8 – Fire Suppression

Purpose:

To minimize injury or prevent the loss of life and property, in the event of an onboard fire, an operator and crew must be proficient in identifying the type of fire and the use of appropriate fire extinguishers.

Learning Objectives:

By the end of this unit, the participant will be able to:

1. Identify the most common types of fires aboard boats.
2. Prioritize response to fires aboard a vessel underway.
3. Choose the appropriate fire extinguisher based on the class of fire.
4. Discuss various configurations of fixed fire suppression systems
5. Using PASS technique, extinguish a small Class B fire

Fire Precautions

An onboard fire is one of the most dangerous and serious events on a boat. Fuel and fuel vapors are the two leading ingredients in all boating fires and explosions. The best policy is to avoid fires through proper safety precautions during fueling, and in the storage of fuel.

The fire triangle consists of fuel, oxygen and heat. All three elements must be present to start a fire and the removal of any single one can extinguish a fire.

The fumes fuels on boats are heavier than air and tend to collect in the cabin, bilge and other lower areas of the vessel. Because these fuels are surrounded by oxygen all that is necessary to start a fire is heat. A simple spark from an ignition component can ignite the fuel in an oxygen rich environment and result in an explosion and/or fire.

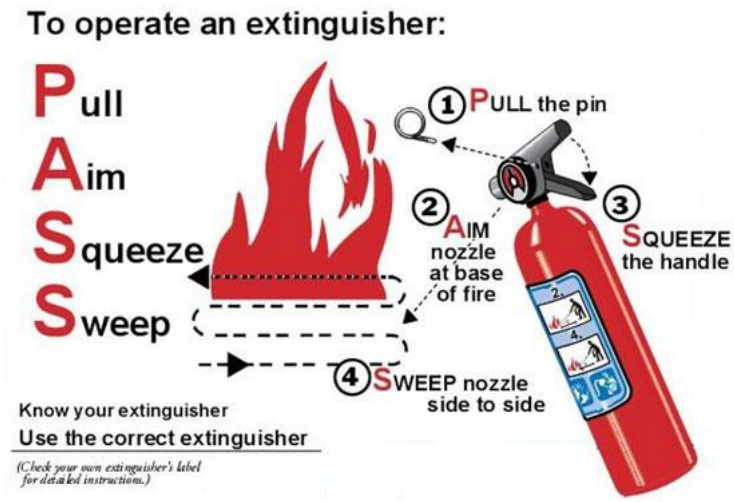
There are many other potential fire sources on boats such as electronics and electrical wiring applications, chemicals, flares and mechanical apparatus that produce heat. Maintenance, inspections, and safety protocols for these general areas and machinery spaces are essential precautionary steps to minimize fire hazards.

Fire Extinguishers

Extinguishers of appropriate type should be placed in a visible, accessible location. Placement near doors or hatches, away from major fuel sources is preferred.

You should familiarize yourself with the manufacturer's instructions on the label of the fire extinguisher(s).

When discharging an extinguisher the basic steps for use can be described using the **"PASS"** acronym:



Fire Classes

Fires are identified according to one or more fire classes. Each class designates the fuel involved in the fire, and thus the most appropriate extinguishing agent. Utilizing the correct type of fire extinguisher, based on fire class, increases, as well as avoiding unwanted side-effects.

Class A-Ordinary combustibles or fibrous material, such as wood, paper, cloth, rubber and some plastics.

Class B-Flammable or combustible liquids such as gasoline, kerosene, paint, paint thinners and propane.

Class C-Energized electrical equipment, such as appliances, switches, panel boxes and power tools.

Class D-Certain combustible metals, such as magnesium, titanium, potassium and sodium

Common Onboard Fire Types and Responses

Fire Type	Response/Extinguishing Agent
Gasoline, diesel, grease	**Class B foam, CO2 or Dry Chemical**
Engine Fire	**Shut off engine, generators, fans. Use Class B, hand-held extinguisher to fight fire. More may be necessary if on a large vessel.**
Electrical Fire	**Turn off electrical source; use Class B-C or C**
Galley Fire	**Shut off fuel source to stove. Use Class A-B-C to fight fire. DO NOT use Class A on grease fires.**
Below Deck Fire	**Most are fueled by wood, paper, or fabric. Use a Class A and remove oxygen by closing off compartment after using extinguisher.**

Priority of Response

If you are faced with a fire on board your vessel, **the priority is to save lives**, not property (boats). Fire fighting should be done to contain a small fire, enabling safe exit of you and your crew.

If a fire starts while the boat is underway:

1. Stop or slow the boat and position the vessel and/or people in such a manner that the fire is downwind.
2. Ensure personnel are moved to a safe location with PFDs on.
3. Make a distress call or emergency notification call as soon as possible.
4. Attempt to isolate the fuel source, if burning material is not attached, throw overboard.
5. Ready the appropriate fire extinguisher and attack the fire from a safe distance.
6. Abandon ship if necessary.

Do not underestimate the dangers of a freshly extinguished fire or fuel source. Overhaul the fire source to eliminate any residual heat sources or exposed fuels, and establish a fire re-flash watch.

Types of Fixed Fire Suppression Systems

Custom engineered systems - originally intended for manned spaces on large vessels, but include scaled-down system configurations suitable for installation in unmanned spaces such as engine compartments on smaller vessels. They include carbon dioxide systems, new clean fire extinguishing agents such as FM200, and halon. **NOTE:** There are no new halon systems being installed, due to environmental concerns halon is no longer manufactured.
Pre-engineered systems - intended to be an "off the shelf" item suitable for installation by either a fire equipment distributor or the vessel's operator. The systems currently approved are simple, consisting of a single agent cylinder with attached valve, and are attached to a bulkhead inside the engine compartment. They are called "pre-engineered" because they are tested by an independent testing lab (UL or FM) to extinguish a fire in a simulated engine compartment of the maximum volume which they are intended to protect.

Alternative - If the machinery space of a small vessel can be protected by the contents of one portable or semi-portable fire extinguisher, such an extinguisher may be used as a fixed gas fire extinguishing system subject to the requirements found in 46 CFR 181.400(b)(5). However, portable and semi-portable extinguishers may not be converted into fixed systems by replacing components such as valves, hoses and nozzles with miscellaneous valves, piping, etc.

Chapter 9 - Marlinespike

Purpose:

To secure equipment and perform mission duties, the operator and crew must be able to tie common nautical knots and care for lines.

Performance Objectives:

By the end of this chapter the participant should be able to:

1. List common materials used to make rope and advantages and disadvantages of each.
2. Determine the proper line for specific tasks onboard a vessel
3. Describe proper care, storage, and handling of boat lines.

Practical Performance Objectives:

1. Given a length of rope, the participant will demonstrate the Bowline, Anchor Bend, Clove Hitch, Square Knot (reef knot), Sheet Bend, Figure 8, Lineman's Loop and Cleat Hitch.
2. Given a length of rope, the participant will demonstrate two methods to coil and stow a line aboard a boat.

Marlinespike

Marlinespike seamanship includes not only knot tying, but also the whole subject of rope and line as used in the seafaring profession. Humans have been tying knots and using ropes since before recorded history.

Rope is "rope" when it is being manufactured and stocked in the store. Sailors refer to "rope" as "line" once it has been acquired for use on a boat. Specifically, a line takes its name from the purpose it will serve (IE. mooring line, bow line, spring line).

Terminology

- Line – a rope on board a vessel
- Standing part – the portion of a line not used in making a knot
- Tag end (bitter end) – the end of the line you are working with.
- Bight – any curved or doubled section of a rope
- Under load – under tension
- Static – not stretchy
- Dynamic – not stretchy & stretchy

Materials

Lines are made from a variety of materials ranging from wire strands to fibers of many kinds. The choice of which to use is dependent on the use it will be put to. Different fibers have different physical characteristics (strength, weight, elasticity, abrasion resistance, U/V resistance, etc.) and it is important to know what they are to determine which is best for

the application you intend to use that line. Obviously wire provides the best strength-to-size ratio, but is difficult to work with. Fiber lines are the most common around boats. Each fiber has different properties that determine their usage.

- Cotton - weak, deteriorates quickly.

- Hemp - relatively strong but deteriorates quickly.

- Polypropylene - strong, cheap, floats, harder to tie, susceptible to sunlight.

- Nylon - very strong, elastic, good for dock and anchor lines.

- Kevlar - very strong (high tensile strength, low shear strength), static, expensive, used in competition sailing.

- High Intensity Fiber (Dacron, Duron, A.C.E.) - very strong, very static, good for running rigging.

Construction

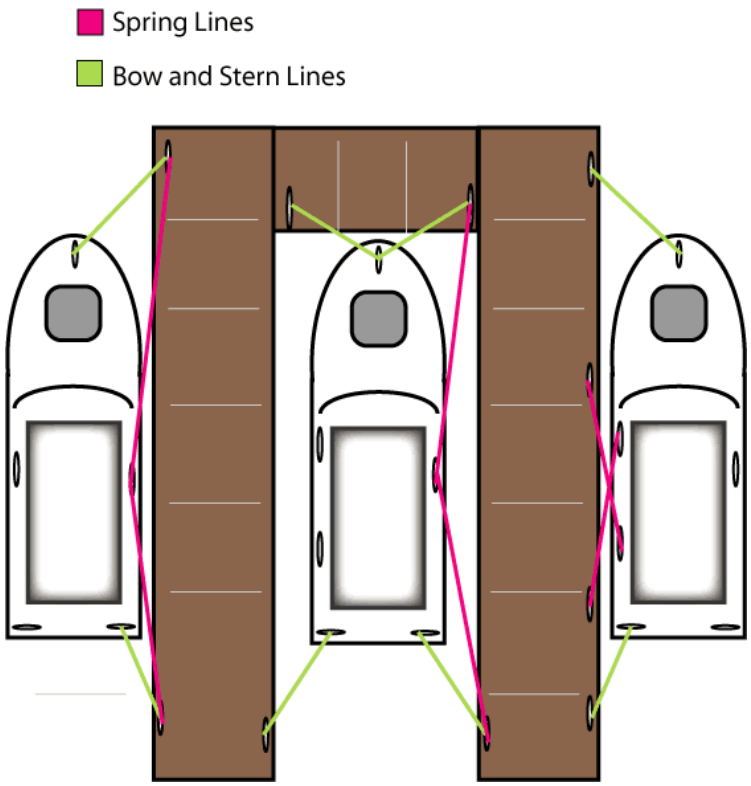
Lines are constructed in different ways, the most common being the three-strand or "laid" rope. It is made by twisting and re-twisting the fibers together. Ultimately the main strands are twisted in a clockwise or "right-hand" lay as seen with the end held away from you. Another common type of line is braided line that is made as the name suggests by braiding fibers together. It can be found as single or double braided, which refers to the presence or absence of a braided core.

Line Selection

The choice of a line type will depend on a combination of factors:

- Intended use of a line
- Diameter of line – line smaller than 3/8 inch is not recommended
- Strength – should be able to hold 5x the expected load
- Weight of line
- Static or dynamic
- Floatation
- Impact resistance
- UV exposure
- Abrasion resistance
- Exposure to corrosives

At least three and preferably four lines should be carried aboard for docking. A bowline to secure the bow; a stern line to secure the stern, and at least one spring line to reduce fore-and-aft movement. The diagram below shows four lines used. Although the stern line will keep the boat from moving forward too much, to be safe a fourth spring line running from the dock cleat forward could be used.



Line Size

<1/4": good for hanging gear up
5/16"-7/16": general use
1/2": general use on boats under 16’
9/16"-5/8": general use on boats 16-40’ and anchor lines for boats up to 40’

Recommended lines for vessels <26':

- Bow line – Double braided nylon (not longer than the distance between the bow eye and propeller/pump)

- Dock lines – Double braided nylon. Four lines: 2 the length of boat; 2~1.5 times the boat length

- Anchor line – 1/2-inch twisted nylon or larger. Length (rode) should be 7 to 10 times the anticipated depth.

- Tow line – 1/2–3/4-inch double braided nylon (75' or greater)

Line Care

- Never put a strain on a kinked line
- Keep lines clean
- Guard against chafe and abrasion
- Never overload lines
- Keep chemicals off lines
- Finish the ends of lines to prevent fraying
- Don't stand on lines
- Store properly

Stowage

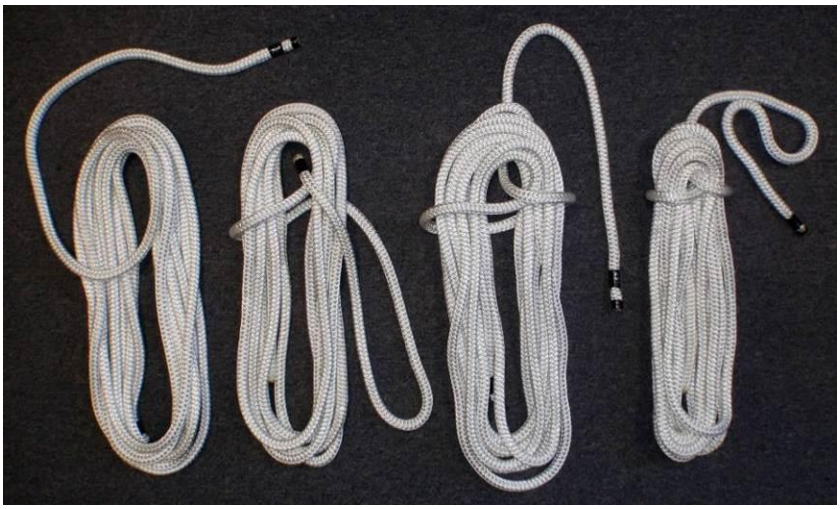
Lines should be rinsed with fresh water to remove salt, dirt, and other corrosive or abrasive material. Do not wash lines in a washing machine or dry in a dryer.

Lines should be stowed by coiling them and hanging them in a well ventilated place. Leaving lines lying loose on deck is a mark of poor seamanship and can be dangerous.

Coiling

Quick Turn - Good for hanging an often-used line on a rail (secured with a quick release knot, e.g., clove-hitch finished with a bight).

Coil up all but the last 1-2 feet of line. Lay the working end across the front of the coils just below your coil-holding hand. Pass the end clockwise (when viewed from the top of the coil) around the coil horizontally. After one complete turn, stick the end through the top of the coil, above the

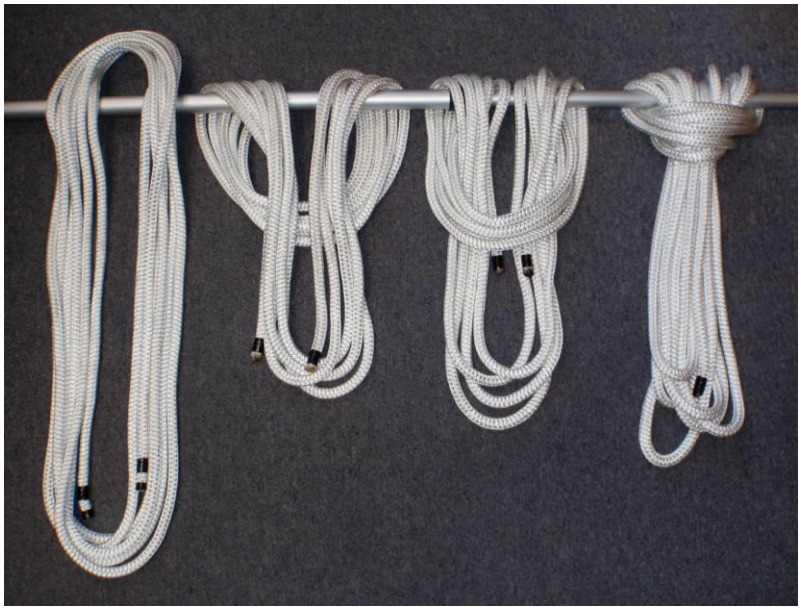


horizontal turn. Pull on the end to draw up.

(Note: The quick turn can result in a loop handy for hanging the coiled line if a bight is put into the line before wrapping around and through the coil, instead of just using the single end of the line).

Larks Head - Good for hanging a less-frequently used line on a rail.

Make large coils. Finish with the line ends even, and hanging down at least 3/4 of the length of the coils. Wrap the top of the coils over the top of the rail (you will have to switch hands to do this). Pass the bottom of the coils through the space between the rail and what was the top of coils. Pull the bottom of the coils downward.



Gasket Hitch - Good for storing a line in a box or side tray.

Coil the line leaving 3-4 times the coil length to work with. Starting about a third of the way down the coils, make about four tight horizontal clockwise (when viewed from the top of the coil) wraps up toward your hand. Put a bight in the line and pass the line through the hole between the horizontal wraps and your hand, without pulling the bight all the way through. Roll the bight over the top of the coils, and flush with the horizontal wraps. Pull the tag end to snug the bight around the coils. A more secure coil can result using more than 4-6 wraps.

Knots

The choice of a knot to use for a given task is dependent on factors such as: strength of the knot; ability to remain tied under load, or when unloaded; size of line; speed in tying; ability to be untied after loading; and others.

The following table lists the properties and uses of the required knots:

Knots and Strength of Lines		
Knots/Bends/Hitches	**% Retained Line Strength**	**Common Uses**
Square Knot	43-47*	Join smaller size lines
Clove Hitch	60	Tie to piling with ½ hitch
Figure 8		Stopper knot won't jam
Bowline	67-75	All purpose, won't jam
Sheet Bend	48-58**	Join different size lines
Anchor Bend	76	Quick fastening; securing to anchor chain ring
Lineman's Loop	75	Attach a loop in the middle of a line
*Both nylon and combination ropes in smaller sizes are liable to slip **Smaller sizes of nylon are likely to slip without breaking		

There are eight basic knots that every boater should know. All knots used by boaters are designed to be easy to tie, take a tremendous amount of strain and then be easy to untie. The eight knots are as follows, and you should practice until you can tie them without thinking about it.

Bowline - Also called the "king" of knots, the bowline is very versatile. It is used to form a temporary loop in a line that may then be put over a piling or cleat. It can also be used to attach a line to an eye. This knot won't slip or jam.

Start by making an overhand loop that looks like a six (see first figure). With the end of the line, come up through the hole in the six, around the back of the line you're holding and back down through the hole in the six. Grab the part of the line that went up through the hole and the part of the line that came back down through the hole in one hand, and the top of the line you were holding in the other, and pull.

Anchor Bend (Round turn with half hitches) - Used to permanently tie to a piling, mooring or ring. Simply take a full turn around the object being tied to. Then tie one half hitch through the turn and then add a second half hitch around the line itself to "lock it".

Cleat Hitch - In order to secure the boat to a dock or secure a line to the boat you will probably use the cleat hitch. Take the line to the ear of the cleat furthest from where the line comes from (the load). Take ¾ wrap around the base of the cleat and then start a figure eight across the top of the opposite ear. Finish with a half hitch turned under so that the line is coming away from the cleat in the opposite direction from which it came in.

Clove Hitch - Used to temporarily tie to a piling this knot can come loose. You may add a couple of half hitches as above to make it more permanent. This knot is simply two loops with an end tucked under. It should not be tied on anything that can turn or spin.

Square knot (reef knot) - Simple to make, the square knot is used for lots of light duty including tying things down. Start with an overhand knot like you were beginning to tie your shoe. Keeping the ends of the lines in your hand on the same side, cross them again and tie another overhand knot. If you don't keep them on the same side you'll end up with a granny knot that will jam.

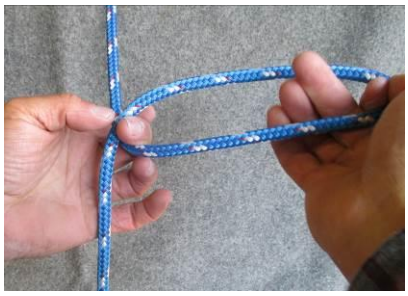
Sheet Bend – Quick and easy to tie, the Sheet Bend is one of the most commonly used knots for joining two lines. Start by folding the end of a length of line to form a loop. Pass the working end of the second line up through the loop. Next pass the working end of the second line around and behind the loop. Bring the working end to the front passing it over the loop and under the second line where it comes up through the loop.

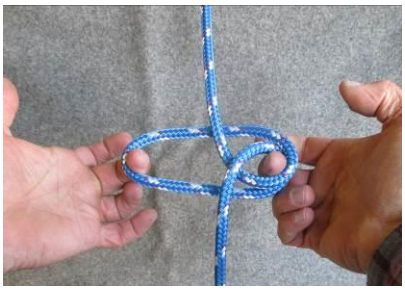
Figure 8 – The most common stopper knot used by boaters. It's easy to untie after being put under load.

Single Figure 8

Double Figure 8
(Optional)

Lineman's Loop – Used to make a perpendicular attachment loop to a line loaded on both ends. It is one of the stronger and more secure loop knots.





Chapter 10 - Trailering

Purpose:

To minimize property damage and prevent accidents while trailering, the operator must maintain the vehicle-trailer-boat combination and practice sound operating skills.

Learning Objectives:

By the end of this unit, the participant will be able to:

1. Identify proper vehicle-boat-trailer combination.
2. Identify trailer equipment and safety features.
3. Maintain trailer equipment
4. Demonstrate safe trailering techniques pulling and backing a trailer around obstacles.
5. Demonstrate safe launch and retrieval of a motorboat

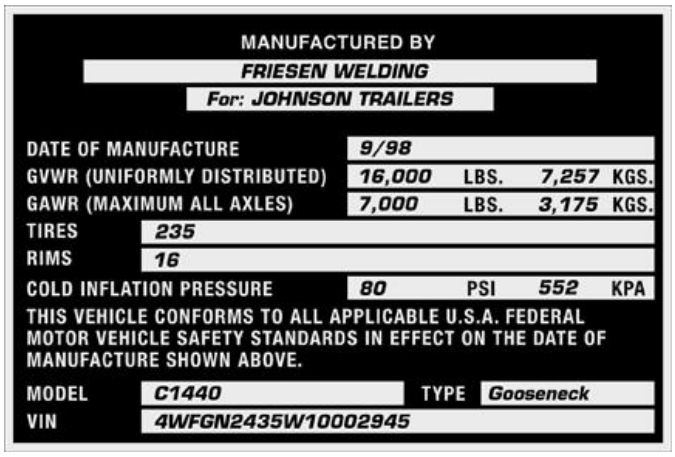
The majority of boats are trailered to and from the water. Your boat trailer is only one part of the entire boating package that includes the boat, trailer, hitch and tow vehicle. Neglecting the trailer's maintenance can result in damage to your boat, tow vehicle or both. The trailer must have a load capacity adequate to carry the boat, motor, fuel and all equipment.

Gross Vehicle Weight Rating (GVWR) - Maximum allowable weight of tow vehicle or trailer when loaded, including weight of vehicle or trailer itself, passengers and gear. It's highly suggested not to exceed 85% of the trailers GVWR.

Gross Axle Weight Rating (GAWR) -
Maximum weight an axle is designed to carry, including weight of vehicle or trailer and gear.

Capacity Plate

The GVWR, GAWR and trailer identification numbers are located on the trailer's capacity plate.


MANUFACTURED BY
FRIESEN WELDING
For: JOHNSON TRAILERS

DATE OF MANUFACTURE	9/98			
GVWR (UNIFORMLY DISTRIBUTED)	16,000	LBS.	7,257	KGS.
GAWR (MAXIMUM ALL AXLES)	7,000	LBS.	3,175	KGS.
TIRES	235			
RIMS	16			
COLD INFLATION PRESSURE	80	PSI	552	KPA

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.A. FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

MODEL	C1440	TYPE	Gooseneck
VIN	4WFGN2435W10002945		

Trailer Bed Types

Rollers and/or Bunks (pads) are used to support the boat on the trailer. There should be sufficient support so as not to allow the boat to warp. You should make sure that all support surfaces are in contact with the boat at all times.

Rollers - support the boat on a system of rollers, which allows for easier launch.

Bunks (pads) – provide better support than rollers, but launching and retrieval require that the boat is floated on and off the trailer.

Trailer Selection

- Load Rating – Boat, fuel, motor, gear etc. Check Manufacturers Specs.
- Load Height – Center of gravity when loaded, visibility/mirrors.
- Length – Support stern area and transom without overhang.
- Support – Good rollers, pads or combination.
- Brakes – Electric or hydraulic on trailers hauling >1500 lbs gross weight.
- Winch – Appropriate nylon strap or steel cable for weight.

- Lights – Waterproof, mounted high if possible.
- Motor Support – Transom saver.
- Safety Chains – Must be strong enough to support GVWR of trailer, and long enough to allow for turning, yet not drag on ground.
- Spare Tire – Purchase spare tire with trailer or obtain one matched to trailer GVWR. Confirm wheel/lug design matches existing setup. Mount on trailer.

Tow Vehicle Selection

The tow vehicle also must meet certain performance standards such as engine power, engine and transmission cooling, wiring, brakes, battery, suspension, alternator, axle ratio, tires, and wheels in order to tow the boat and trailer. You should consult your dealer for advice. Each tow vehicle also has a maximum weight that it may pull by law. Again, it is suggested that you not pull more than 85% of the vehicle's limit.

- Load Rating- Manufacturers load rating.

- Add-ons- Stabilizers, transmission cooler, oil cooler, mirrors.

- Hitch- Manufacturers suggested type, properly sized to match vehicle and trailer/load.

- Ensure ball matches hitch and load. Equalizing type recommended >2000 lbs gross weight.

- Tires- Manufacturers suggested type.

- Transmission- Manufacturer's recommendation (many suggest automatic transmission).

Hitch/Coupler/Ball Selection

The trailer is attached to the towing vehicle by a trailer hitch. A socket on the front of the trailer drops over a ball on the back of the hitch and then locks down. These two parts must match in size. The ball size is determined by the class of trailer. The hitch should be permanently attached to the towing vehicle and should handle the load you are attempting to pull. Bumper hitches (attached to bumper only) are illegal in some states and not recommended.

- Hitch Class- There are four classes and dependent upon the GVWR of your trailer. If you're at or near the GVWR for a hitch class, move to the next higher rated hitch. Another rule of thumb is to buy the hitch that's strong enough to match the maximum rating of your tow vehicle.

Class 1 – Trailer GVWR to 2000 lbs. (suggest 1700 lbs.)
Class 2 – Trailer GVWR to 3500 lbs. (suggest 2975 lbs.)
Class 3 – Trailer GVWR to 5000 lbs. (suggest 4250 lbs.)
Class 4 – Trailer GVWR to 12000 lbs. (suggest 85%)

- Attachment- Attach hitch to frame of vehicle by bolting or welding. Do Not Use bumper hitches!

- Equalizing Hitches- Recommended for loads over 2,000 pounds and most over 3,500 pounds. See tow vehicle owner's manual.

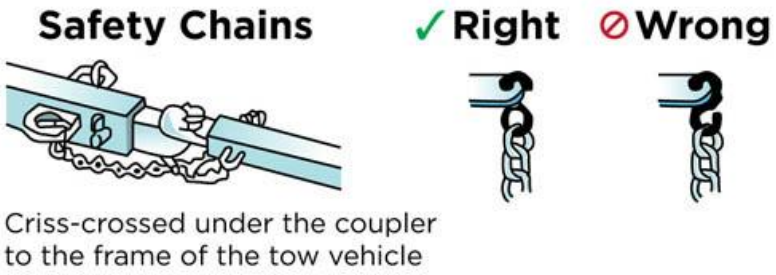
- Ball and Coupler- Select according to GVWR of trailer or maximum rating of tow vehicle. Solid steel balls recommended.

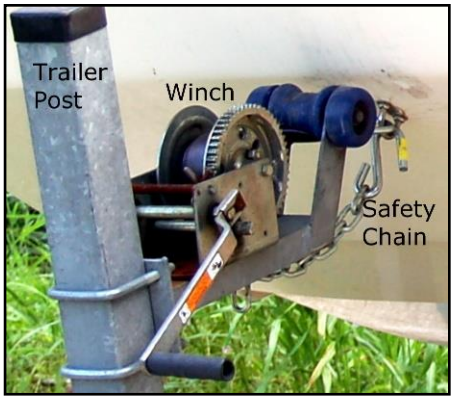
    - Be aware that balls come trailer balls come in 1 7/8", 2" and 2 5/16"

- Receiver Hitch- These have removable ball mount platforms. They are ideal for height adjustment, and for security of ball when not in use. Select by GVWR or maximum rating or tow vehicle.

Safety Chains

All trailers should be equipped with safety chains. The safety chains attached from the trailer to tow vehicle should be criss-crossed under the coupler and strong enough to absorb the shock of a trailer hitch failure. Another safety chain should be attached from the trailer to the bow eye of the boat in case of winch strap/cable failure.

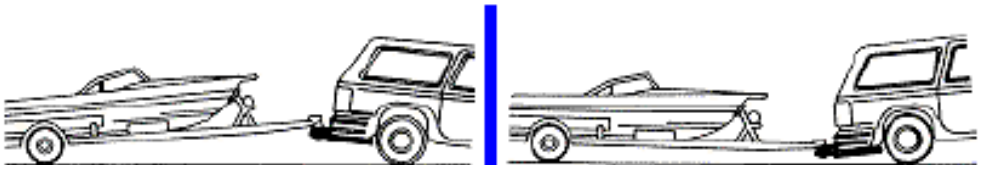




***NOTE: Some states require the use of "closed link" connectors instead of an "S" hook. It is the operator's responsibility to determine if their trailering equipment meets these specific requirements.**

Tongue Weight

In addition to the trailer's capacity weight you must also consider "tongue weight." The weight of the trailer tongue that attaches to the towing vehicle should be between 5 to 15% of the combined total weight of the boat and trailer. In other words, 60% of the trailer load should be forward of the trailer wheels.



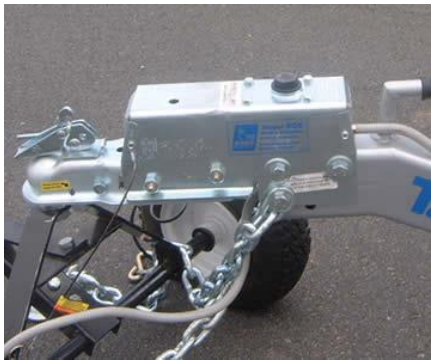
(1) (2)

(1) Too much weight on the rear of the trailer will cause the trailer to fishtail and may reduce traction or lift the rear wheels of the tow vehicle off the ground. You will need to adjust the tongue weight forward by moving the balance point of the trailer.
(2) Too much weight on the hitch will cause the rear wheels of the tow vehicle to drag and may make steering more difficult. You will need to adjust the tongue weight back by moving the balance point of the trailer.

Electrical Connections

Most trailers are equipped with either a flat four-prong connector or a circular 7-pin connector for light hookup. Associated with the connector there is a standard for wiring color and use (green wire – right turn signal; yellow wire– left turn signal; brown wire– tail lights, rear markers rear side lights and white wire– ground). Tow vehicles will come equipped with various electrical hookups thus an adapter may be needed between trailer and tow vehicle.

Braking System



The most common types of brakes found on trailers are surge brakes. Surge brakes are hydraulically operated and activated by a pressure-sensitive master cylinder in the coupler which is mounted on the trailer tongue. When the tow vehicle slows, the brakes are activated as the trailer moves forward. As the tow vehicle moves forward the brakes come off.

Preventative Trailer Maintenance

- Inspect winch strap/cable along with tie-downs for tears and fraying.
- Check trailer frame for wear or cracks.
- Check tire tread and inflation.
- Proper greasing of hubs.
- Check wiring for cuts and abrasions.
- Check rollers and bunks for deficiencies.

Preparing to Tow Safely

- Drain accumulated water from the boat's bilge by removing plug.
- Trailer weight properly distributed, between 5-15% on tongue.
- All gear secure.
- Lower the tongue socket onto the ball on the trailer hitch and lock together securely.
- Connect trailer lights to towing vehicle and check all lights are working.
- Attach safety chains from trailer to tow vehicle securely in a criss-cross fashion to form an "X".
- Trailer jack stand up and locked in a safe position.
- Winch ratchet locked.
- Check that all tie-down straps, winch strap/cable and bow safety chain/fastener are secure.
- Check that motor or drive unit is tilted and secured (if necessary). Use transom saver if recommended by manufacturer.
- Make sure wheel bearings run free and are properly lubricated.
- Check tire pressure including spare, lug nuts and test brakes.
- Make sure to stow drain plug in the boat so any remaining water can drain and it is there when you get to the ramp.
- Adjust mirrors and seat.
- Don't forget the boat keys along with field gear.

NEVER CARRY GASOLINE TANKS IN THE TRUNK OF THE TOW VEHICLE.

Road Handling

The weight that you are trailering will make your towing vehicle less responsive in many respects. Speeding up, slowing down and all maneuvers will require more time to accomplish. Allow more distance for braking and maintain safe distance from vehicle in front.

Make sure your side view mirrors are large enough to provide an unobstructed rear view on both sides of the vehicle.

Remember that the turning radius is much greater. Curbs and barriers must be given a wide berth when turning corners. Backing a trailer can be somewhat tricky but with practice you should be able to accomplish the task in a minimum amount of time. When backing the trailer, it will turn in the opposite direction of the tow vehicle; take it slowly and try to avoid over-steering. Prior to operating on the open road; practice turning, backing up, etc. on a level, empty parking lot.

Trailer Backing Tips

- Put steering hand on the bottom of the wheel. Move your hand in the direction you want the boat stern to go
- Learn how to use side mirrors rather than looking over your shoulder so you can back up a wide variety of vehicles (e.g., vans, utility vehicles).
- Don't put the tailgate down on pickups.
- Look before backing to be 100% sure there is nothing behind you.
- Remove your seatbelt when backing a boat down a ramp.
- Open windows and turn off the radio.
- Use of a spotter is highly recommended.

- When setting up for backing up, if possible, make the inside of the arc on the driver side.
- Stay close to a guidance feature (e.g., edge of ramp, seam in concrete). It will help keep you in line.
- Make your own guidance feature (e.g., spray paint, place rocks).

Launching

1. Initial launch preparations done away from the ramp so as not to impede launching for others.
2. Raise the outdrive or motor, remove the support bracket and install the drain plug.
3. Disconnect the trailer wiring. Remove tie down straps. **NOTE: Do not disconnect the winch strap or safety chain at this point!**
4. Load the boat with equipment.
5. Connect the fuel tank (if necessary), check fluid levels.
6. Recheck that drain plug is installed.
7. Drive to the ramp and back the boat and trailer down the ramp, preferably to where the trailer tires, but not the bearings are in the water.
8. Set the emergency brake, shift into Park, and block the wheels.
9. Someone should get aboard the boat, turn on the blower, lower the motor, look for water entering the boat, sniff the bilge and start the motor.
10. Make sure you have attached a bowline to the boat, unhook the safety chain, then release the winch and disconnect the winch line.
11. You should be able to launch the boat with a slight shove or by backing the boat off the trailer under power.
12. Return the towing vehicle to the parking lot as soon as the boat is launched so the next person in line may proceed.
13. Move the boat to an area away from the ramp to load additional equipment and passengers.

Retrieval

The steps for retrieving the boat are essentially the reverse of launching and you should keep in mind being courteous of others launching and retrieving.

1. Unload the boat away from the ramp if possible.
2. Back the trailer into the water, again preferably keeping the bearings of the trailer above the water.
3. Maneuver the boat carefully onto the submerged trailer, attach a bowline and shut off the engine prior to raising it.
4. Attach winch strap/cable and winch the boat onto the trailer. Make sure winch is locked.
5. Attach the trailer safety chain to the bow eye of boat.
6. Drive the trailer and boat out of the ramp for cleanup, reloading, securing equipment and safety check.
7. Attach all tie downs and reattach wiring for lights.
8. Remove the drain plug to allow water to drain from the bilge.

Chapter 11 – Boat Handling

Purpose

Getting underway for the first time can be a stressful experience. However, with adequate preplanning, passenger orientation and preparation, stress can be kept at a minimum and a safe voyage can be expected.

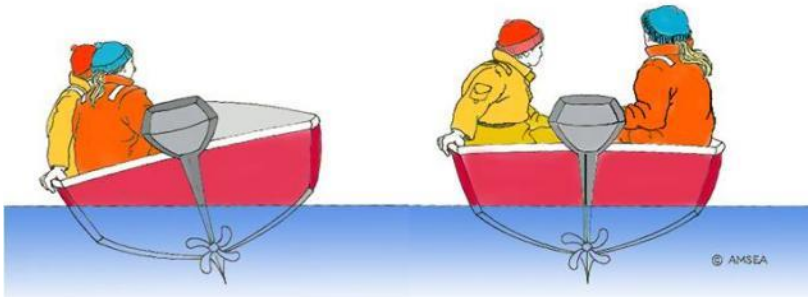
Learning Objectives:

By the end of this unit the participant should be able to:

1. Demonstrate boarding and loading of boats
2. Demonstrate trimming of boats to ensure handling.
3. Describe reaction of the boat to changes of helm and throttle controls.
4. Describe how environmental factors affect boat handling

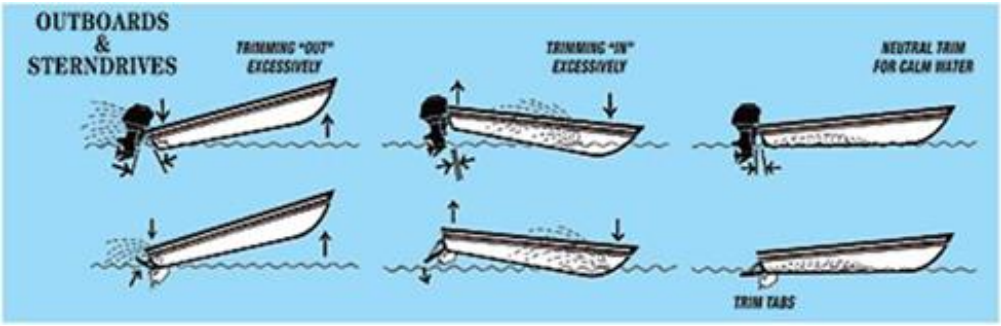
Boarding- Stability is a safety issue; wearing a PFD is critical.

- Maintain constant communication with the crew
- Secure boat.
- Keep body low.
- Keep weight centered.
- Load items into boat one at a time, handing items to person already in boat (avoid throwing).
- Secure load.



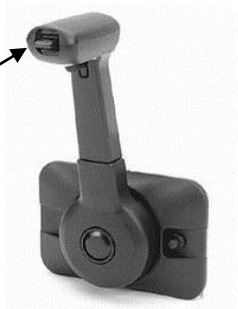
Boat trim- This is the way a boat floats, and is vital in a small boat. It is influenced primarily by weight distribution, and secondarily by trim controls on boats that have them, either in the form of trim tabs or outboard/inboard/outdrive motors.

- Distribute the weight in the boat (keep the bow light).
- Avoid sudden sharp turns.
- Never exceed boat's capacity.



Ensure that you understand where the trim adjustment is located and how to use it prior to departing

Trim Control



Getting Underway

Once the boat has been checked out, passengers and equipment are aboard, and the engine has been started and has been allowed to run until it has come to operating temperature, you are ready to cast off. But before casting off let's take a look at how to tie and untie the boat properly.

Undocking Plan

Prior to getting underway, you should implement an undocking plan with the help of your passengers. You should consider the traffic in the area, the direction of wind and current and the depth of the water.

Do not assume that everyone onboard has the same boating experience that you have or that they can read your mind. Be specific and give direction if you ask for their help. Telling a passenger to attach a spring line means nothing if that person doesn't know the meaning of the term, which line to use and where (and how) to tie it.

Make sure that your engines have run for a few minutes and that they are warmed up before casting off lines. (Long idle periods are not recommended.) Also, check the oil pressure and other items on your pre-departure checklist prior to leaving the dock.

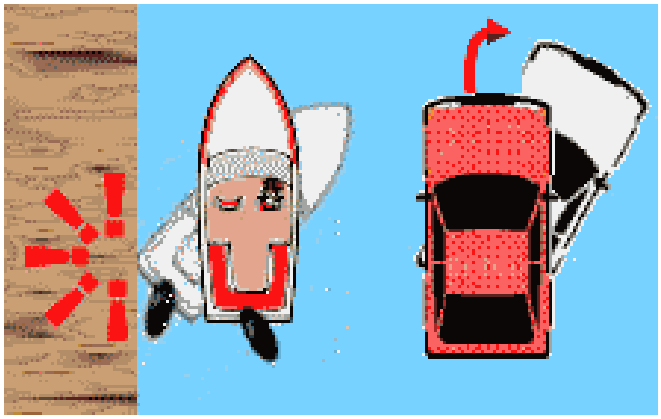
When the wind or current is pushing your boat away from the dock the procedure is simple.

1. Cast off lines and pull in fenders as the wind blows you away.

2. When clear and safely away from the dock and other boats, shift to forward and depart at idle speed.

3. Be careful to make sure you have been pushed safely away and that the stern will not hit the dock as you motor forward and turn.

Remember: A boat does not steer like a car; it pivots on its axis at a point approximately one-third to one-fourth back from the bow when moving forward.



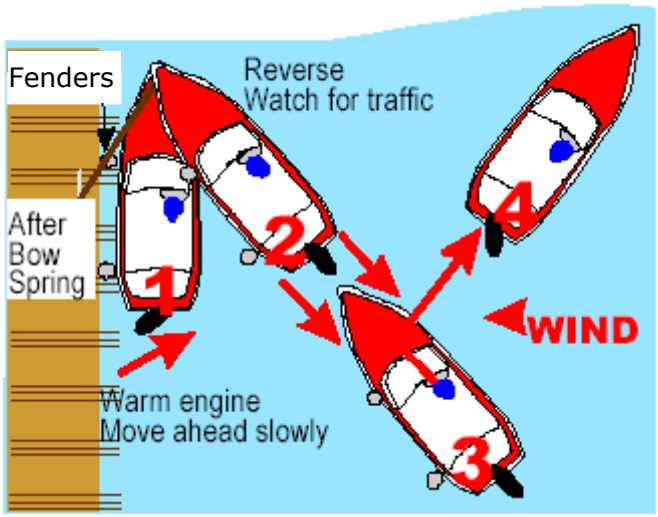
If the wind or current is pushing your boat toward the dock you will have to do some extra planning.

1. Cast off all lines except an after bow spring line. This line will keep you from moving forward and allow the stern to pivot away from the dock. (see illustration)

2. You may want to use a fender forward to cushion the bow of the boat against the dock.

3. Turn the motor or rudder to the direction necessary to push the stern away from the dock.

4. Shift into forward at idle speed. Slowly, very slowly.



5. The stern will swing away from the dock. When it is clear of all obstacles and traffic, cast off the spring line and back away from the dock.

6. When you are safely away, shift to forward and idle away from the dock.

Once you are clear of the dock, stow lines and fenders so they will not be in the way or pose a tripping hazard. Be sure to control speed when leaving the dock and check for other boats, swimmers or other obstacles.

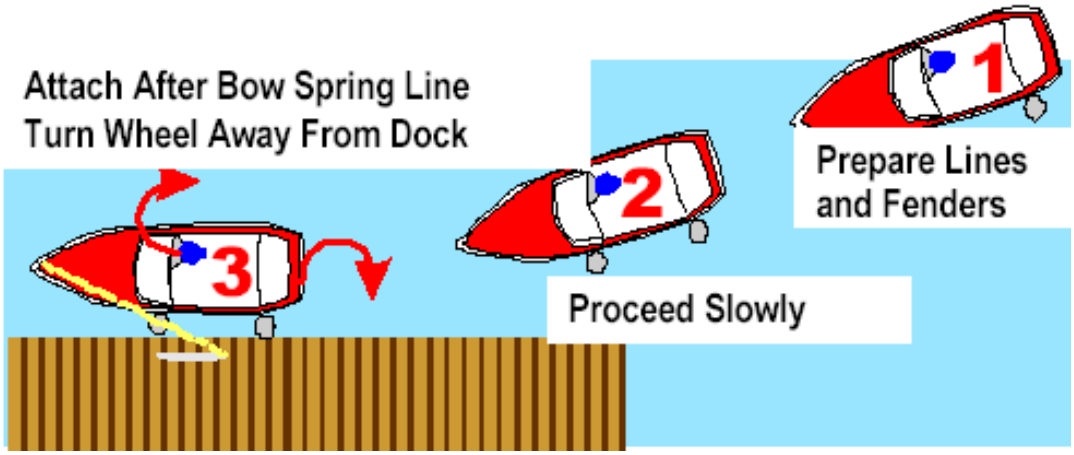
Docking Plan

Before approaching the dock, one end of the docking lines should be secured onboard; fenders readied and speed reduced.

If the wind is onshore (blowing toward the dock), the boat is brought to a position parallel to the dock and about two feet off. The wind will blow the boat in. It can then be secured by bow, stern and spring lines.

If the wind is offshore (blowing away from the dock), you should approach the dock at a 20 to 30 degree angle. A bowline is passed ashore and secured. In boats with an outboard, or inboard/outboard engine, the engine is turned towards the dock and put in reverse. This will bring the stern into the dock. The boat can then be secured with the stern line.

The procedure is different for boats with inboard engines. The rudder will be used to bring the stern in. To push the stern in using the rudder, attach an after bow spring to keep the boat from moving forward. With the engine idling forward, turn the wheel away from the dock as illustrated below. Since the boat cannot move forward and the rudder is pushing the stern in, the boat will pin itself against the dock while you secure the other lines. All maneuvers are more easily accomplished if the boat has twin engines, rather than a single engine. (This will also work for outboards and I/Os.)



Fuel Management

Practice the "one third rule"

- Use one third of fuel going out
- Use one third of fuel to get back
- Keep one third of fuel in reserve

Maneuvering Underway

Once underway your duties as a skipper do not stop. You are still responsible for the safety of all on board, your boat and damage to other boats and personal property caused by collision or damage from your wake. As skipper you should:

- Be familiar with the safe handling characteristics of your boat. Know its cruising speed, idle speed, how it turns left and right and its stopping distance.
- Always choose a safe course. Do not take any risks that might endanger yourself or your passengers or crew.
- Know where you are at all times. Check around you and use landmarks, aides to navigation, charts or any other means possible to pinpoint as accurately as possible your location. If you have an emergency and have to call for help, the first question you will be asked is "where are you?"
- Keep an eye on the wind, current and weather. Will any changes affect you and the course to your destination?
- Follow the rules of the road and obey them. In specially marked or crowded areas control your speed.
- You should always render assistance to other boaters in danger or distress. This could be anything from a stalled engine to a life-threatening event.

Specific Local Hazards

You should be aware of, and plan for, any specific local hazards in the area in which you will be boating. You should have charts onboard for all areas you boat in. If you are boating in an area for the first time, seek assistance from other boaters or marinas with local knowledge who can inform you of additional safety precautions which must be considered.

You should be aware of any and all of the following:

- Hazardous Inlets
- Shoaling areas
- Whitewater areas
- Dams
- Locks
- Abnormal tides or currents

Make sure you check with state and/or local officials for requirements and specific conditions that may apply to a body of water on which you intend to boat. For an example, some lakes prohibit any motorized vessels.

Boat handling

All boats handle differently and inexperienced operators require hands- on practice with an instructor/experienced boater. This can apply to experienced operators with a new boat as well.

- A motorboat is most easily maneuvered going against the current or wind;
- When moving with the wind or current, you must go faster than the current to maintain control of the boat.
- If you need to quickly reduce speed, put motor in reverse and apply power.

- Keep in mind the old saying "a kick ahead is better than a kick astern"...you have more control over forward motion than stern motion due to the design of rudders and/or propulsion systems.

Factors affecting handling

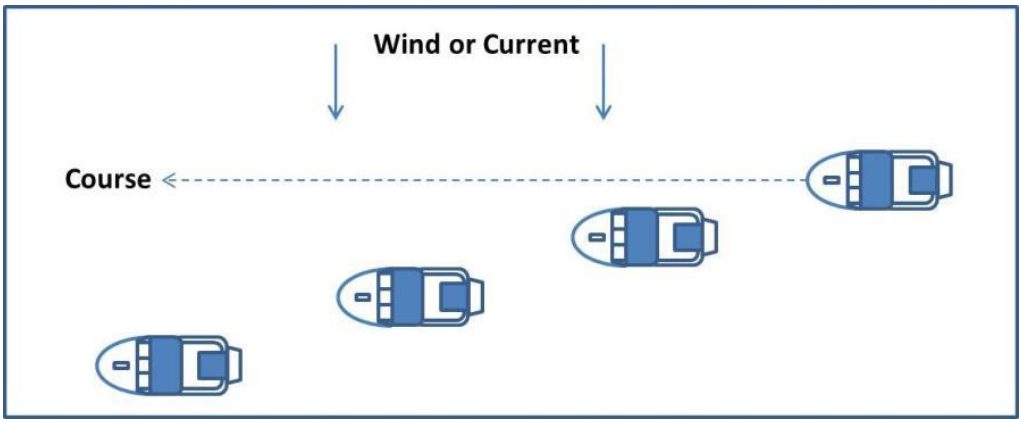
Every boat handles differently and the conditions of operation affect how it responds. It is essential to review the basic characteristics with each new boat, and under the various environmental conditions you can expect to operate in.

- Boat Characteristics
  - Hull Type- planing vs. displacement.
  - Propeller type/number- prop walk (stern walks to right with right hand screw in forward gear, to the left in reverse), which is more pronounced at high speed with blades near surface or slow speed in reverse.
  - Rudder response- loss of control at slower, through-the-water, speed.
  - Propeller thrust- can be used to obtain more control if used in short bursts when turning.

- Environmental Conditions
  - Wind- Has greater effect on boats with larger surface area above waterline.
  - Current- Has greater effect on boats with larger underwater profile.
  - Tide- high, low, slack, ebbing or incoming.
  - Wave action- use trim, heading and speed adjustment to deal with wave action (more advanced techniques such as sea anchors can be used in very rough conditions).
  - Land Influences
  - Obstructions- shoals

Leeway

Wind or current pushing your boat off course causes leeway. Boats with a large amount of surface area above the waterline (freeboard) will be affected by the wind to a greater degree than low profile boats. Additionally, boats with a large keel or underwater profile will be affected by current to a greater degree than planing boats with less structure under the water. You should compensate for leeway by steering into the wind or current in order to proceed on a straight course to your destination.
You can visualize leeway by looking back at your wake while on a steady compass heading. If your wake is not following directly behind you, but being set to one side or the other, you are experiencing leeway and should correct.



Chapter 12 – Anchoring and Beaching

Purpose:

To minimize the risk of damage to the boat and motor, or injury to personnel, operators must be able to use sound anchoring or beaching procedures.

Learning Objectives:

By the end of this chapter the participant should be able to:

1. Choose the anchor for the bottom conditions and the type and size of boat.
2. Describe the lines and gear that make up the rode and ground tackle.
3. Calculate scope, given water depth, under both calm and heavy conditions.
4. Describe anchoring procedures.
5. Describe beaching procedures.
6. Describe methods for making fast/holding position while beached.

Anchoring

Depending upon the mission requirements, environmental conditions and special circumstances it will eventually become necessary to anchor or beach a vessel. The art of "staying put" requires an understanding of ground tackle, and how to properly use it, as well as the bottom conditions where you are operating.

An anchor will need to be readily accessible and properly secured to the vessel. Anchoring may be needed if bad weather is blowing you ashore or if your engine has quit and the wind and current are pushing you into shore or other boats. **Anchoring from the stern can be hazardous because of the possibility of swamping (transom is lower than the bow) and anchor line fouling in the propeller.**

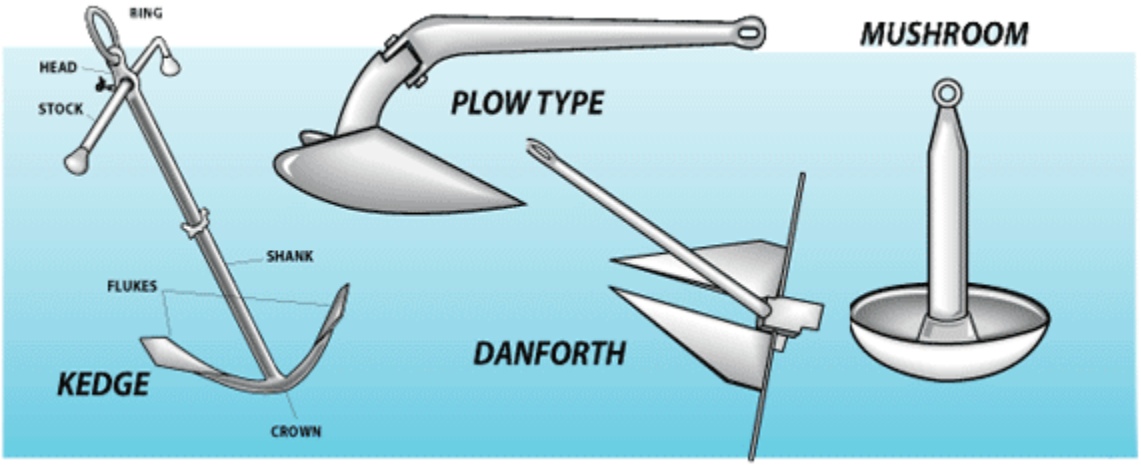
The first step in anchoring is to select the proper anchor. In spite of claims to the contrary there is no single anchor design that is best in all conditions. On most pleasure boats the three anchors you will find most are the fluke or danforth type, the plow and the mushroom anchor.

Anchoring considerations

- Type and weight of boat determines: anchor size; anchor chain/anchor line diameter, mooring bit or cleat size/strength.
- Character of bottom determines anchor type.

Types of anchors

- **Kedge** - for rocks and heavy grasses.
- **Burying** - buries into bottom for clay, sand and mud (Plow, Danforth, Bruce).
- **Mushroom** - sinks into bottom; for permanent moorings, for mud bottoms.



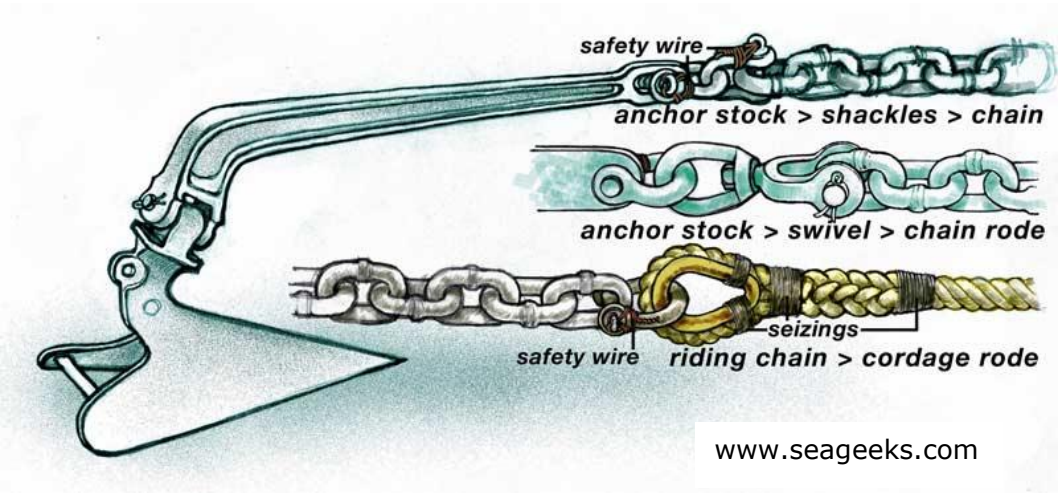
NOTE: Boats should carry at least two anchors with appropriate gear or tackle, a smaller, lighter anchor for calm weather, and a larger one for bad weather conditions or when anchoring overnight. Anchors can become stuck, making a backup necessary since the only solution may be cutting the anchor line and abandoning the anchor.

Ground Tackle - Anchors must have something to attach them to the boat. This is called the anchor rode and may consist of line, chain or a combination of both. The whole system of gear including anchor, rode, shackles etc. is called ground tackle.

Anchor Line (rode)- Nylon works best due to its ability to stretch, thereby absorbing surges in heavy seas. A typical rode consists of nylon line with a length of chain between the line and anchor. The chain will aid in lowering the angle of pull on the anchor and prevents chafing of the line when the anchor gets buried. Proper chain length depends on a

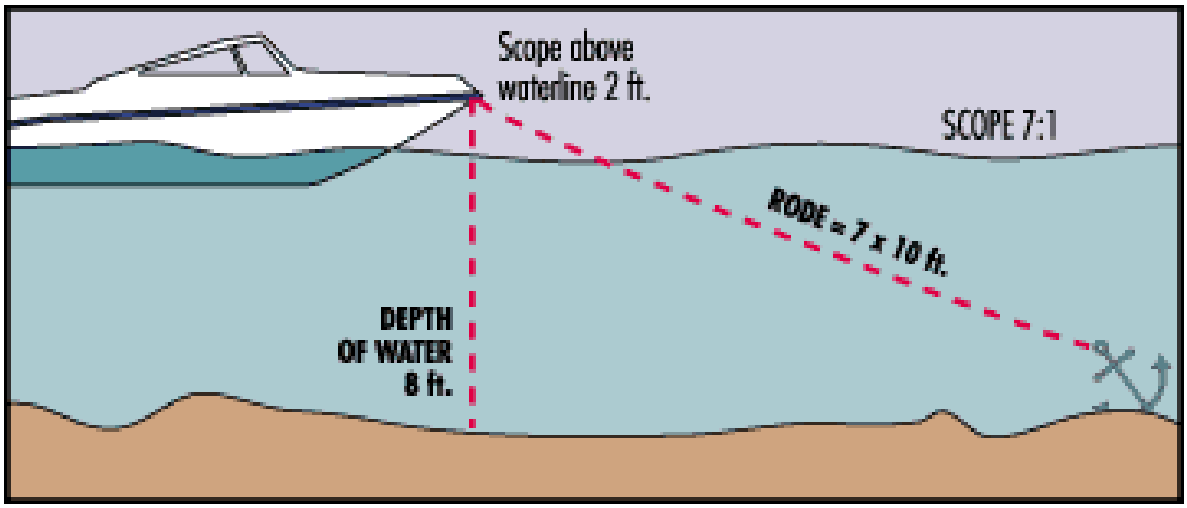
variety of factors (e.g. boat length, weight, bottom conditions and more). As a minimum, 1/2' per foot of boat length is recommended. Chains must be connected to anchors with properly sized swivels.

- Three-strand nylon
- Double braided nylon
- Diameter of anchor line - too small or too large is bad.



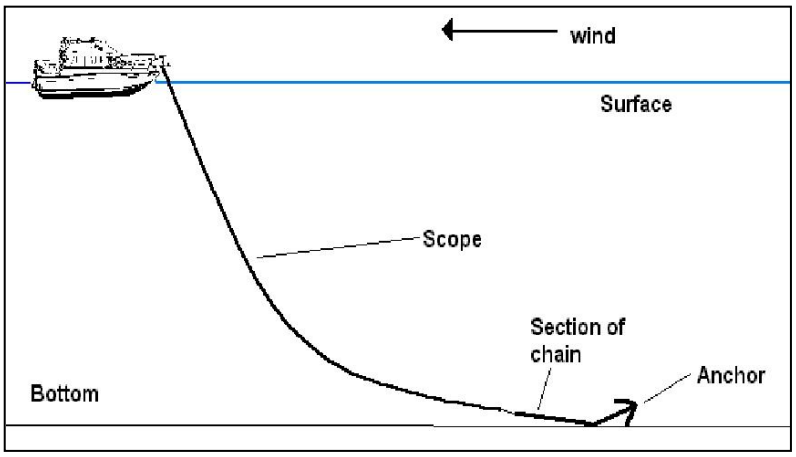
Anchor Scope- This refers to the length of anchor line needed when anchoring. The amount of rode that you have out (scope) when at anchor depends generally on water depth and weather conditions.

- Average depth of water determines anchor scope.
- Ideal scope is 7:1 (ratio of the amount of rode to depth of water).
- Strength of the wind and/or current affects scope, may increase to 10:1 ratio in heavy weather.



Selecting an Anchorage

- Select site protected from wind, seas, strong currents and other boat traffic.
- Check chart for water depth (be mindful of tides) and bottom type (avoid rocky, and steeply sloping bottoms).
- Verify water depth at anchorage and within radius of swing (tidal flow may affect swing); ensure clearance above shallowest point.
- Ensure clearance from other boats or obstructions in radius of swing.



Anchoring Proceedure

- Prepare and inspect gear; lay out or flake line needed for scope.
- Head your boat into the wind or current.
- Lower anchor with line under bow rail; make sure you are not standing on any part of the line or loop as it goes over the side; be sure the end of the anchor line is secured to the boat.
- Reverse the engine to stop headway. Leave in reverse at idle speed.
- When the boat starts to make a slight sternway through the water, lower the anchor from the bow. Pay it out as needed, preferably with a turn of line around the bit or cleat
- When the full rode is out, snub the line quickly to set the anchor.
- Back up slowly to help anchor dig in.
- After anchoring, check position by sighting on some shore landmarks to make certain that the anchor is not dragging; reset anchor if necessary.

Remember: Avoid anchoring from the stern, especially in small boats.

Getting Underway

- Run up to the anchor slowly under power, hauling in line as you go. Let the boat do the work.
- When anchor line is straight up and down, attempt to break anchor free. If it doesn't come free, tie off to bitt/cleat and allow wave action to break it free. If this doesn't work, move ahead under power a few feet. If this doesn't work, run slowly in a wide circle around the taut line.
- Once freed, haul the anchor line in, shaking it up and down to free it of weeds or grass.

- Clean the anchor and chain of sediment by swinging it back and forth near the surface.
- Carefully haul anchor and chain on board avoiding it striking the hull, and passing it under the railing if there is one.
- Stow anchor and rode immediately, ready for next use.

Beaching

Beaching a boat is a common practice, but one that requires care to avoid damage to the hull, rudder/s, propeller/s and any other gear attached or projecting below the bottom. The operator must know where all such gear is located on the hull and the amount it projects from the hull.

Common considerations

- Depth of water
- Type of bottom/beach
- Slope of bottom/beach
- Draft of boat
- Draft of boat at points that will make contact with shore/bottom.
- Wave action
- Current
- Tide

NOTE: Do not allow anything but the hull to be load bearing on the shore/bottom.

Beach Selection

- Sandy, clay, mud or gravel bottoms are best.
- Medium to steeply sloped bottoms.
- No obstructions at or below surface, or immediately downriver.
- Area protected from wave/wake action.

Approach

- Scout area slowly. If in a twin engine, outboard/IO boat; turn off and raise one engine, raise other as high as possible yet still operate efficiently at slow speed. In a single engine, outboard/IO boat, raise engine as high as possible yet still operate efficiently at slow speed.
- Verify condition of bottom and determine drift if any.
- Make approach so as to touch bottom with bow first. In moving water, use heading and engine speed necessary to hold position relative to landing point.
- Maintain slowest speed possible to beach
- Have crewperson go ashore and make boat fast.
- Switch engine off when boat is secured.

NOTE: If any personnel or gear is removed from boat, it will be necessary to reposition boat further up onto the beach due to change in draft.

Making Fast/Holding position

- Tie bowline or anchor line to solid object (tree, large rock etc.).
- Set anchor on beach (bury it).
- If you don't have an anchor, make a sand anchor by tying bow line or anchor line to small log, or similar object and burying it at 90-degree angle to pull of line.
- Hold position with engine thrust (short term, requires operator to remain on board).
- Hold position by posting crewperson on beach, holding bowline. Operator should remain on board in event crew cannot hold boat.
- Small boats with no hull projections may be carried up onto beach, well away from waterline.

Getting Underway

- While holding the bow line, push boat to a nearly free-floating position before loading crew and gear
- Lower the engine to minimum working depth, start it, and allow it to warm up
- Load gear and crew
- Position should be held with engine in forward at minimum speed
- Bring bow line and remaining crew on board
- Back down slowly to break bow free from beach

Chapter 13 – Rendering Assistance and Towing

Purpose:

To prevent property damage and injury to personnel while rendering assistance, the operator must follow policy directives and standard towing principles and procedures.

Performance Objectives:

By the end of this chapter the participant should be able to:

1. Determine level of assistance to be rendered.
2. Describe the equipment needed to safely tow a boat.
3. Describe the types of towing approaches relative to conditions.
4. Describe the types of tows and advantages and disadvantages of each.
5. Describe key safety procedures for towing.

Introduction: Safety is always the most important concern when towing. Every towing activity is potentially dangerous. The safety of the crew and the crew of the towed vessel is more important than property, and the primary responsibility in any towing situation is to maintain safety of life. Towing is a complex evolution. A safe and successful outcome hinges on crew professionalism, skill competencies and vessel capabilities, communication and teamwork.

Risk Assessment

Every boat crewmember is responsible for identifying and managing risks. Towing mishaps can be prevented by honestly evaluating risks involved in every step of any towing evolution. Communicating with the towed vessels' crew is a priority; they may have important information that is essential and necessary to complete a successful towing mission.

WARNING: ***Do not let a perceived need to engage in a towing mission override a complete, honest risk assessment process that emphasizes personnel safety. (Use the GAR Model)***

Situational Awareness

The dynamics of a towing situation continuously change from the time pre-towing preparations begin until mooring at the conclusion of the mission. All crewmembers must stay fully aware of the constantly changing situation at any given time during a towing evolution. It is important that each crewmember knows what goes on in the surrounding environment and how things change.

Crew awareness should be reinforced through communication: commenting on what is believed to be happening, and involving the towed vessel's crew. The "outside" view could provide information about things not visible from the towing vessel. When clues indicate that situational awareness is being lost, a decision must be made whether or not to continue with the towing evolution. A decision takes the form of action/reaction and communication. Everyone in the crew has a responsibility in the decision-making process.

Risk Management Planning

Realistic towing training based on standardized techniques, critical analysis, and mission briefing and debriefing will contribute to over-all risk management and the development of a towing risk management plan specific to the towing vessel. All crewmembers must contribute to the risk management planning for maximum safety and efficiency.

Responsibility

Maritime practice and tradition has maintained that all vessels will render assistance to any vessel or persons in distress so long that it is safe for the assisting vessel and personnel. In today's litigious world, law has bolstered this tradition under the Good Samaritan Act. The following laws apply to most situations where assistance can safely be rendered:

Duties related to marine casualty assistance and information (46 U.S.C. 2303)-

- "(a) The master or individual in charge of a vessel involved in a marine casualty shall- (1) render necessary assistance to each individual affected to save that affected individual from danger caused by the marine casualty, so far as the master or individual in charge can do so without serious danger to the master's or individual's vessel or to individuals on board...".
- "b) An individual violating this section or a regulation prescribed under this section shall be fined not more than $1,000 or imprisoned for not more than two years. The vessel is also liable to the United States Government for the fine."
- "(c) An individual complying with subsection (a) of this section or gratuitously and in good faith rendering assistance at the scene of a marine casualty without objection by an individual assisted, is not liable for damages as a result of rendering assistance or for an act or omission in providing or arranging salvage, towage, medical

treatment, or other assistance when the individual acts as an ordinary, reasonable, and prudent individual would have acted under the circumstances..."

Duty to provide assistance at sea (46 U.S.C. 2304)-

- (a)(1) A master or individual in charge of a vessel shall render assistance to any individual found at sea in danger of being lost, so far as the master or individual in charge can do so without serious danger to the master's or individual's vessel or individuals on board.
- (2) Paragraph (1) does not apply to a vessel of war or a vessel owned by the United States Government appropriated only to a public service.
- (b) A master or individual violating this section shall be fined not more than $1,000, imprisoned for not more than 2 years, or both.

Policy

Individual policy requirements may further spell out parameters where and when such actions can take place or if types of assistance may be limited to specific actions or circumstances. **It is important that all operators and crew understand and comply with specific bureau and station policy on towing**

Protections

As a bureau representative in a government boat the "Good Samaritan" rule (46 U.S.C. 2303 (C)) may not apply to your actions (i.e. those with a "duty to act"), however Courts may recognize the following of established policy/procedures as a sign of competency and good faith effort.

Law & Private Enterprise

Bureau representatives operating a “Public Vessel” shall also be aware that they must allow commercial tow and salvage operations an opportunity to provide assistance and shall not interfere with a commercial enterprise operating within the scope of its’ profession. If assistance from a commercial entity is so declined by the vessel in distress, the “Public Vessel” may offer forms of assistance within the policy parameters prescribed

Obligation

If the bureau vessel cannot tow, operators are required to render a form of assistance in the situations mentioned above so long as it is safe. When undertaking a tow, it is only expected that the tow will be to the nearest safe anchorage, harbor, marina, etc..

Rescue Priorities: (Self/Crew/Victim)

1. Protect life first
2. Protect property second
3. PFD's for ALL-Hands

Potential Tow situations:

- If a potential threat to life and property exists with no other options for assistance.
- If the equipment, crew skill level, and environmental conditions warrant that a safe tow can be made.

<u>Do Not</u> Tow Situations:

- If the disabled vessel is sinking, on fire, damaged and/or presents a danger to your vessel or other vessels.
    - *Rescue personnel, disregard the vessel*
- If there is <u>any doubt</u> about safety; equipment, weather, or skill level of the crew.
    - *Advise Rescue personnel*
    - *Request assistance from a capable resource*
- If the tow is only for personal convenience and there is no danger to the disabled vessel.
- If a competent and willing towing service (commercial or volunteer) is available in the area.
- If the occupants of the disabled vessel appear under the influence of drugs or alcohol.

***Note:* Other forms of assistance may be the preferred option - cell phone, radio, fuel, food, stand-by on scene until tow service arrives.**

Other Options

- Rescue passengers if situation is life threatening.
- Try and obtain competent assistance capable of handling the situation.

Protect life first, property second

Towing Equipment

When towing a boat or other maritime craft, always use the proper equipment for the task. Using the proper equipment minimizes accidents and possible injuries. This section discusses the design, use, and limits of towing equipment.

Common equipment used to tow include the towline or lines, connecting hardware, pre-constructed bridles and pendants, reinforced deck fittings, drogues, fenders, and additional lines.

Towlines are usually 2-in-1 (double-braided) nylon, not less than ½" diameter and preferably ¾" or greater. Length should not be less than 75' for calm inland water tows, and can be up to 900 feet depending on the vessels and anticipated conditions.

Double-braided nylon is not required for towing and the specific line should be chosen based upon the specific use and the variety of types and sizes of vessels to be towed.

The towing vessel's construction, power, size, and fittings determine towline size and diameter. The proper towline will allow a vessel to tow up to its design limits. The towline will part before damage occurs to a vessel's fittings, structure or hull.

Towlines will usually have an eye spliced into the tow end. Towline length and size will vary on other vessels due to design limits and available space.

Offshore or in heavy weather, a towing vessel may need 500 feet or more of towline to keep a towed vessel in step and to minimize the effect of shock-loading.

NOTE: Nylon instead of other synthetic fiber cordage is preferable and should be used for a good combination of strength and stretch (elongation and elasticity).

CAUTION! Do not tow beyond the vessel's design limits by simply increasing towline size. If the towline's breaking strength exceeds the limits designed into the vessel's fittings and structure, damage and structural failure may result.

Connecting Hardware

Connecting hardware for use in towing includes shackles, snap hooks, carbiners, swivels, and other items, that should have the following characteristics:

- These items must be made of strong, low-maintenance materials.
- They must be easy to connect and disconnect or open and close by all crewmembers.
- All hardware should resist distortion.
- Shackles need a large enough throat to easily cross an eye or thimble.
- Captive-pin (safety) shackles should be used wherever possible. The pin should be attached to the shackle with a lanyard to prevent pin loss.

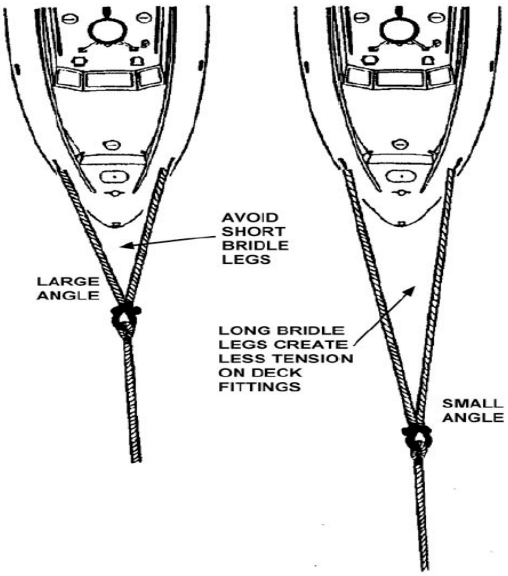
NOTE: When using general hardware, crewmembers should be sure to:

- Keep all hardware clean and lubricated.
- Inspect hardware after each use.
- Be particularly cautious of hardware that has been shock-loaded.
- Immediately replace any hardware that is distorted, spreading, excessively worn, or stripped.

Towing Pendants and Bridles

It is not always possible, appropriate, or safe to attach a towline from a single point on the stern of a towing vessel, or to a single point on the bow of a distressed vessel. A bridle can also be used by towing vessels without centerline towing capability or with transom obstructions (outboard motors or rigging). The bridle is attached to fittings in a manner to clear the obstructions.

In these cases, a pendant or bridle should be rigged. The pendant or bridle forms part of the tow rig, leading from the eye or thimble of a towline to the appropriate location(s) or deck fitting(s) on the towed vessel.



Towing pendants and bridles are made of double-braided nylon, Kevlar or wire rope. (Wire rope should be used for large vessels or steel hulls.) The two most common rigs are a pendant and a bridle.

CAUTION: The pendants and bridles should have a breaking strength equal to or greater than the towline, to reduce the possibility of snap-back.

NOTE: If the towed vessel's fittings (chocks or cleats) limit bridle or pendant size, "doubling-up" (two bridles or pendants) should be considered. When expected towing force threatens safe working load of the individual bridle legs, if doubling-up, all lengths must be exactly the same so each part shares an equal load.

Pendants are used to reduce wear and chafing at the towline end (particularly the eye and its splice). A pendant must be long enough so the towline connection is clear of obstructions on the towed vessel.

Bridles are used to exert an equal pull on the hull of a distressed vessel, or to exert an equal amount of drag from the towing vessels athwart ship fittings, they are preferred for heavy weather towing. Rather than using a fixed point for a Y-Bridle, the towline can be attached to a single length of line with a ring or clip that slides along the bridle during a turn, allowing the vessel being towed to readily turn with the towing vessel.

NOTE: Bridle leg lengths must be equal to share the strain of the tow. A "Y" bridle provides the best results when towed vessel deck fittings (chocks and cleats or bitts) are not right at the towed vessel's bow, or where obstructions (bulwark or rigging) on the bow prevent a pendant or towline from making a direct lead back to the towing vessel.

Drogue

A drogue is a cone-shaped device (similar to a wind sock) that is attached to the stern of the vessel being towed to increase resistance, thus keeping the vessels in line

NOTE: Recommend carrying a pre-rigged tow bag containing needed equipment.

Towing Safety

- Start tows gently.
- Steady pull at reasonable speed (below planing speed) when underway.
- Stay "in step", with both boats on crest of waves at same time.
- Allow a "catenary" or dip in the towline, this will act as a spring, preventing sudden jerks on the line and attachment points.
- Do not stand in line with towline. The line and/or attachment hardware may break and snap back at you.
- Do not fend off with hands/feet while rigging tow- risk of injury exists.
- Consider length of tow when making turns.
- Don't let the disabled boat "rear-end" you.
- Shorten line for more maneuverability if needed, particularly in harbor area. Consider use of "alongside" tow.
- Be ready to cast off or cut towline (emergency breakaway) if disabled vessel starts to sink or endangers you.
- Mark towline along its length with Velcro flags or plastic surveyor ribbon for visibility.
- Move passengers of towed boat to yours only if it can be done safely, and not overload your boat.

Tow Operational Plan

- Survey scene and evaluate conditions.
    - Anchors out, or other hazards in area?
    - Has the operator asked for assistance?
    - Boat to be towed appears in good condition and is structurally sound.

- Talk to Operator.
    - Evaluate Skipper.
    - Are they sober?
    - Do they appear to be in control?

- Where do they wish to be towed?

- Prepare tow system and assign tasks to crew on towing vessel.

- Give special Instructions to crew of towed boat.
    - All people wearing PFD.
    - All passengers seated in proper area and boat trimmed.
    - Have them de-water their boat as much as possible before initiating tow.
    - Instruct operator to steer with you; or rig outboard motor, or rudder amidships.
    - Have rigged anchor ready to use should towline break.

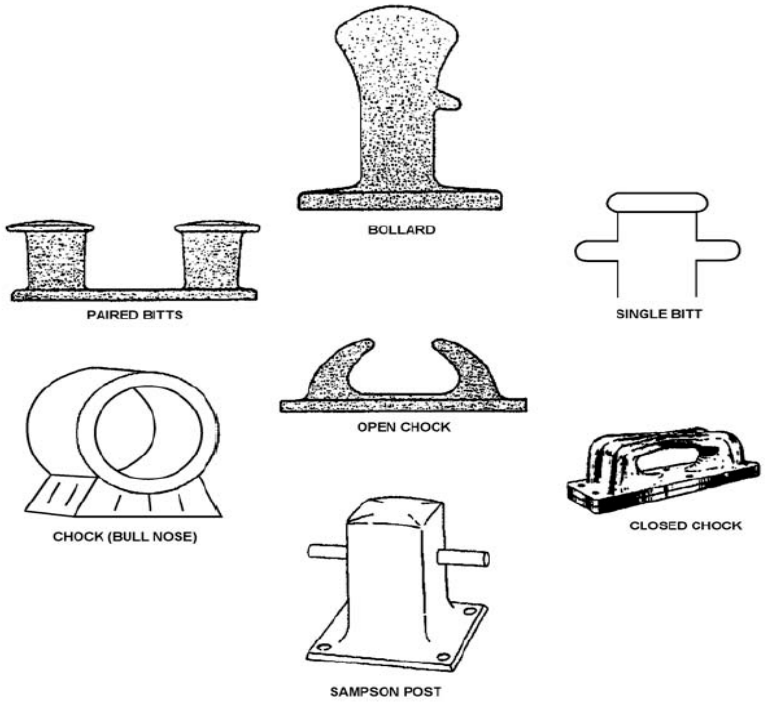
- Communication between boats.
    - Hand signals.
    - Radio (VHF or CB).

Towing Points (towed vessel)

- Bow eye best choice if it is in good shape.
- Can use Sampson post.
- On sailboats, can use foremost mast unless it is a "stepped" (removable) mast. Lead towline through chocks or some form of fairlead, then back to the mast. Secure to stanchions or winches to tie off.
- As last resort, use bow cleats, but be careful - most recreational boats are not equipped with adequately reinforced cleats. Requires special rigging.

Towing Points (towing vessel)

- Transom eyebolts (also called "lifting eyes") – must be well built and reinforced if used (verify to be sure).
- Stern cleats - must be heavy duty, mounted through the deck with reinforced backing. (If in doubt, check with manufacturer.) Standard equipment on some commercial grade vessels.
- Towing bit - best, but not available on most boats.



Securing line to towing points

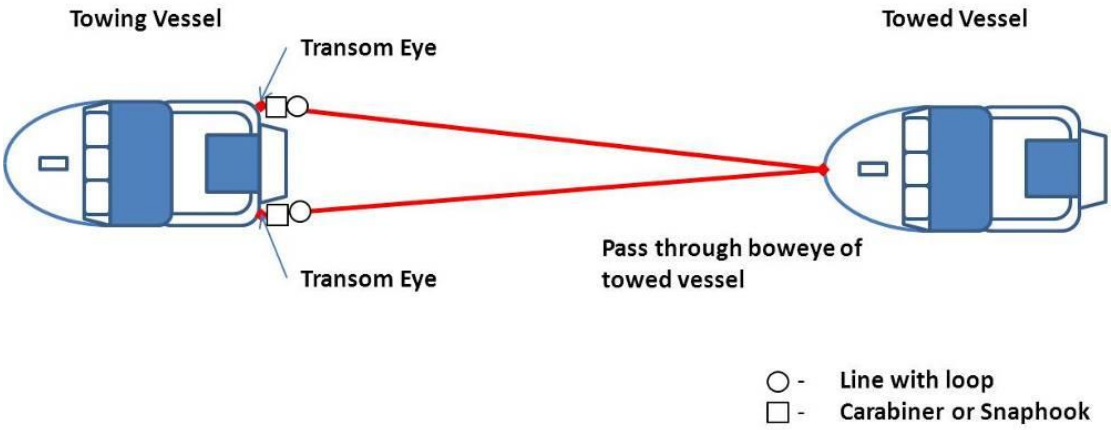
- When securing to a bow eye or transom eye, use a loop in combination with a carabineer or snap-hook, loops can be tied using a bowline or figure eight on a bight.
- When securing to reinforced cleats, use a loop or standard cleat wrap.

Types of Tows

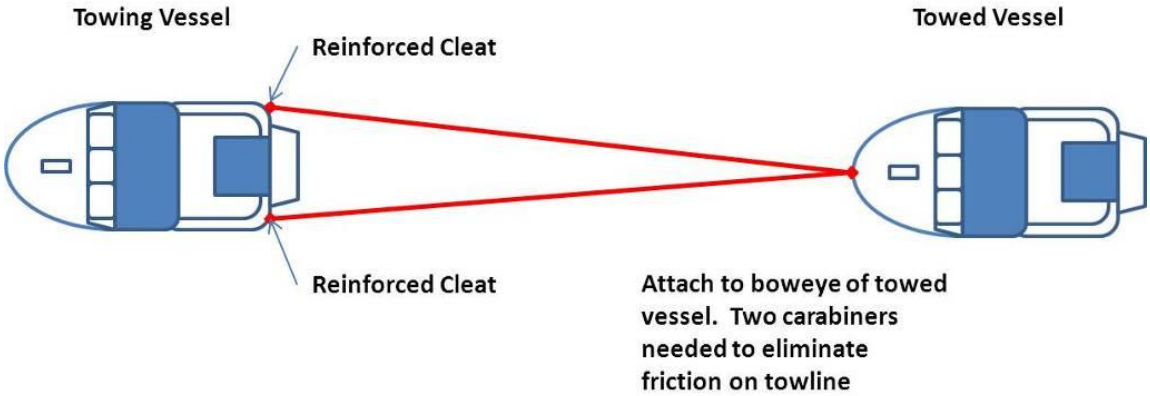
- Single Point Tow

  - Works best on boats equipped with towing bit (other attachments result in unbalanced pull and/or interference with motor on outboards).
  - Need very strong attachment point or towing bit.
  - Easy to rig.
  - Good for long, off shore towing.
  - Good shock absorbency.
  - Length of rope can be changed from towboat.

- Off Stern with "V" Bridle (Option 1)

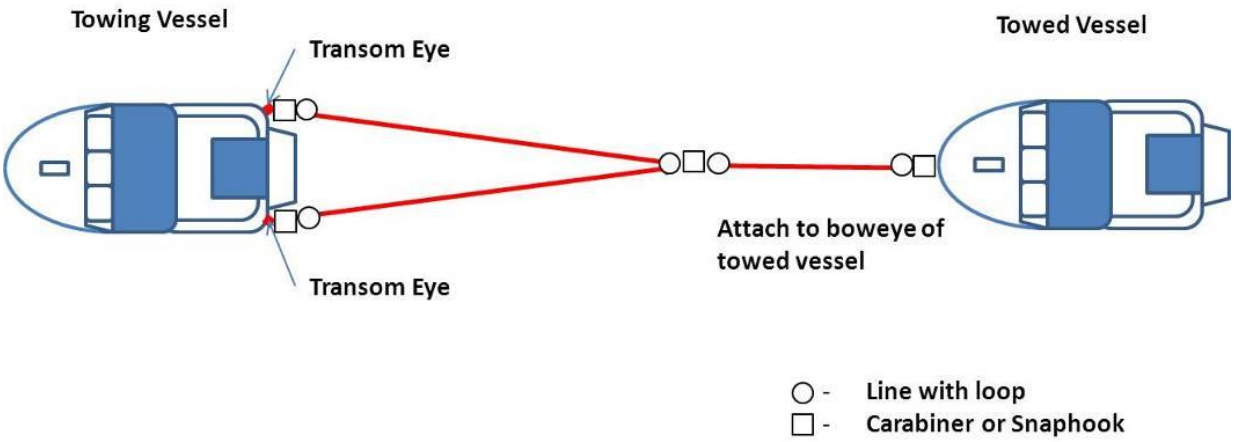


- Off Stern with "V" Bridle (Option 2)

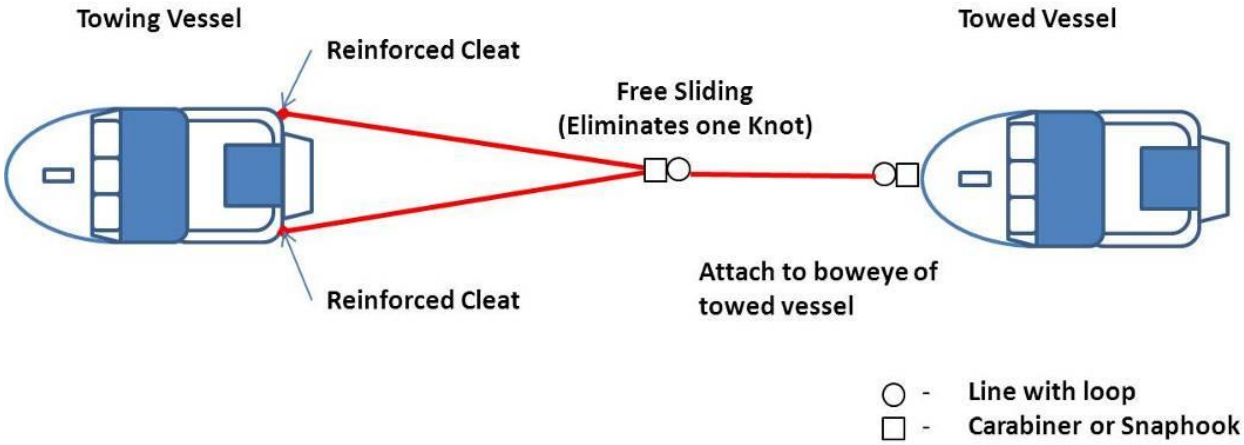


- Used on Inboard, Outboard, or I/O.
- Good control in confined waters.
- Length can be easily changed from towboat.
- Distribution of load is good.
- Not suited for tows requiring long towline.
- Best control when bridle is lead forward of propeller/rudder.

- Off Stern with "Y" bridle (Option 1)

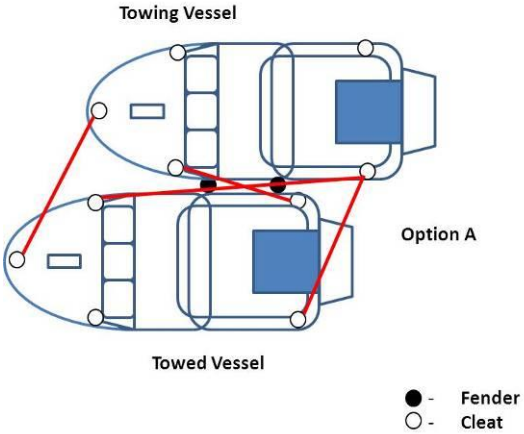


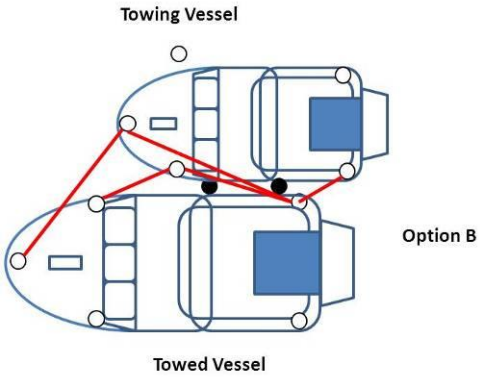
- Off Stern with "Y" bridle (Option 2)



- Used on Inboard, Outboard, or I/O.
- Good for long off shore towing.
- Length can be changed, but with difficulty.
- Good shock absorbency.
- Bridle must be very strong (best if pre-made).
- Need very strong attachment points.
- Best control when bridle is lead forward of propeller/rudder.

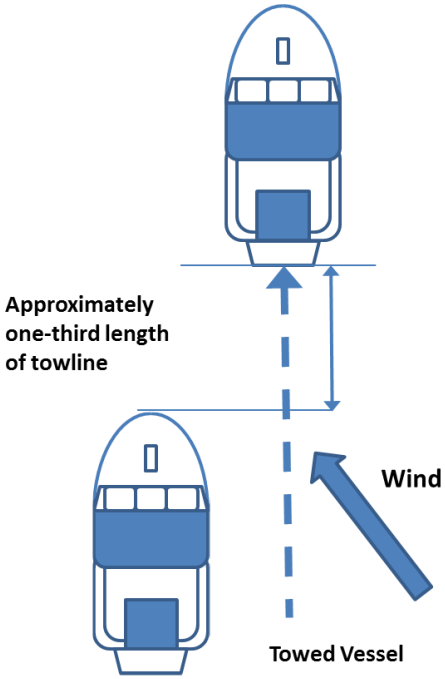
- Alongside Tow (pusher)
    - Excellent control in confined waters.
    - Should be set up with towed boat on port side of towing vessel so as to not obscure visibility in your boats danger zone.
    - Works well even with only one person for both boats.
    - Works well when other boat cannot be steered.
    - Must have fenders to avoid damage.
    - Does not work well in other than smooth waters.
    - Visibility is impaired.



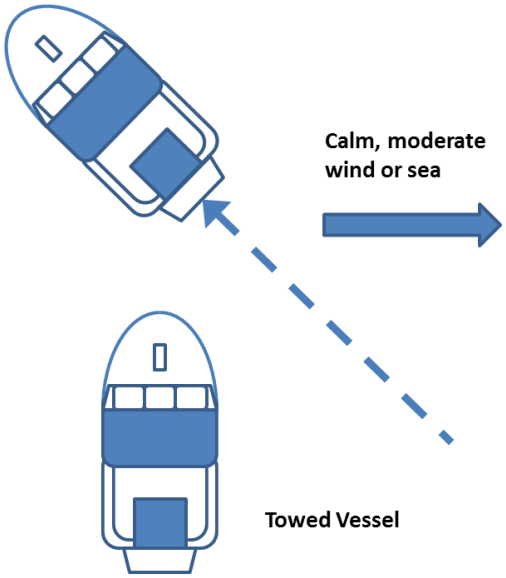


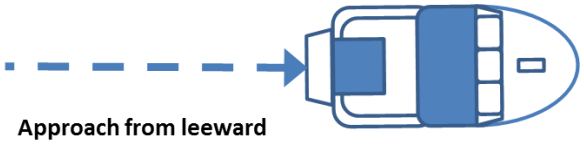
Towing Approaches- Selection based on conditions.

- Parallel approach (limits maneuverability).

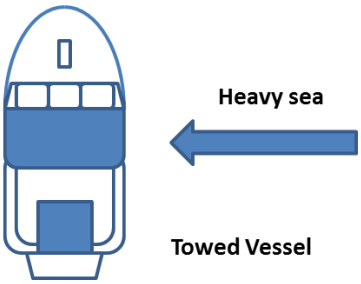


- 45-degree approach (quickest and best in most cases).

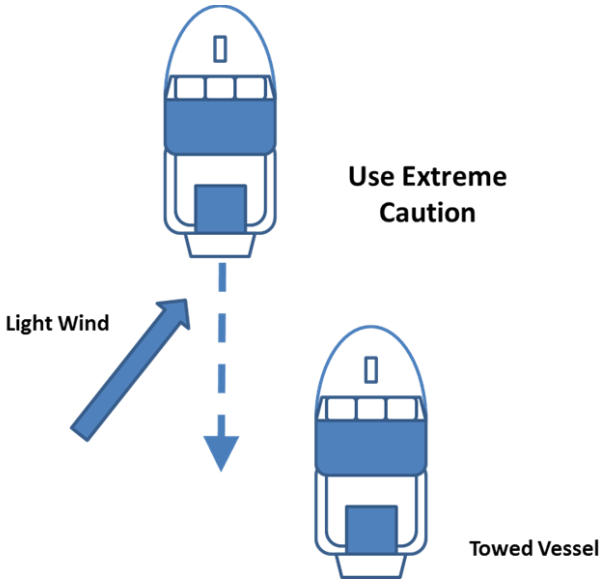




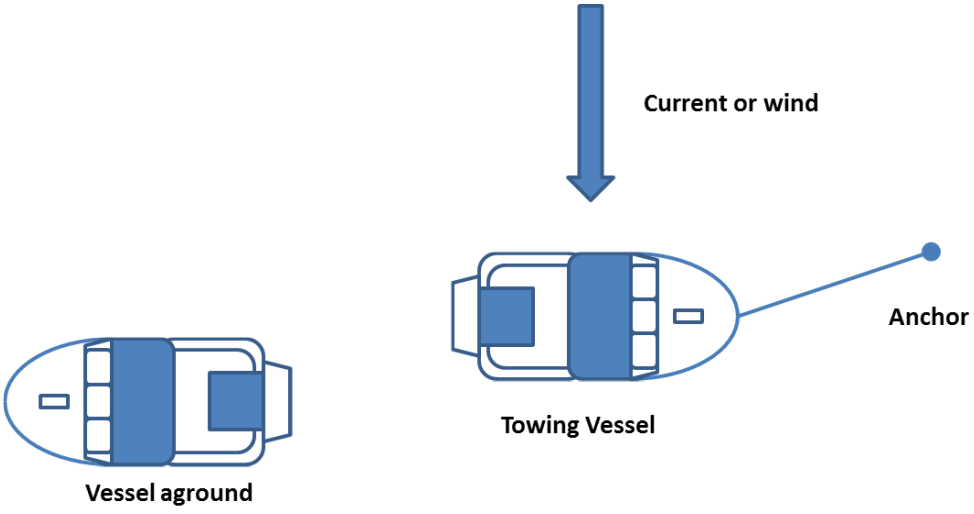
- Crossing the T approach (works well in moderate to heavy seas).



- Back down approach (easy to foul prop).



- Drift approach, use kedge anchor and drift down to boat (usually done if towed boat is aground). Anchor prevents the towing vessel from being carried into shore.



Hooking up

- If bow eye is easily accessible, pass or throw the towline to the disabled operator and have them hook in the carabineer.
- If bow eye is hard to reach, instruct your crewmember to hook up being careful to avoid being "pinched" under the disabled vessel's bow.
- Can use a "kicker hook" to make the job safer and easier.
- If bow eye is not available, may need to put crewmember on board to set up a special rigging using bow cleats. Be careful of weak cleats!

Disconnecting the Towline

The towline should already be shortened up to some extent already. The towed vessel should be turned into the prevailing conditions for better control, making towline recovery easier and safer. It also allows the towing vessel to maintain control of a tow a little longer.

Procedures:

1. The towing vessel should instruct the towed vessel to pre-establish any post-tow actions and have their deck rigged accordingly, ie. Mooring lines, fenders, anchor, or be ready to switch to another tow vessel.
2. With the tow barely moving, allow the towline to slacken, the operator signals for the towed vessel crew to disconnect the rig and let it go into the water.
3. The towing vessel crew then hauls the tow rig aboard.
4. Once the tow rig is clear the towed vessel can begin the next evolution.

Emergency Disconnect or Sinking Tows

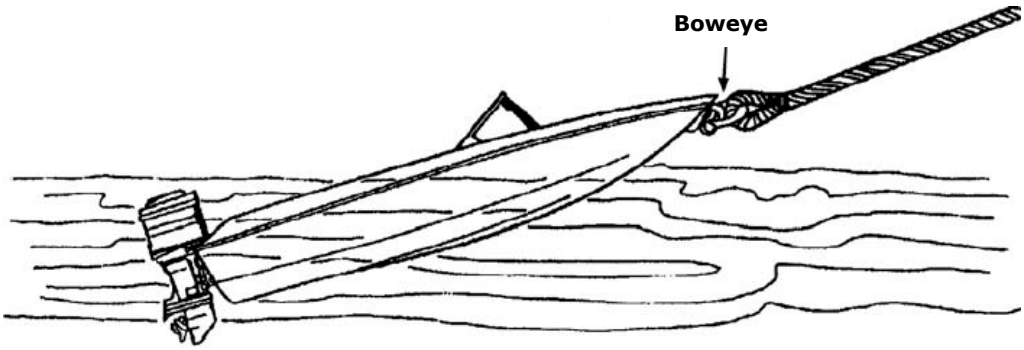
If it becomes evident that a tow is about to sink, the situation should be very quickly assessed. Quick decisive action to minimize loss of life is the first priority. Once abandon ship procedures are initiated, radio communications will likely be lost. The primary action is to break the tow and rescue the people, either from the deck of the towed vessel or from the water.

A sinking tow can pull the stern of the towing vessel under unless all crewmembers pay close attention to the immediate situation. There might not be enough time to disconnect the towline from the towed vessel once it begins to sink. If a tow begins to sink, all towing vessel headway is stopped. The force exerted through the towline increases the danger of the towed vessel yawing and capsizing. Every attempt should be made to have the towed vessel's crew disconnect the towline if possible and await rescue.

Always have a knife or cutting tool readily accessible when conducting a tow

Emergency Disconnect Procedures:

1. Reduce towing vessel headway to "all stop."
2. The operator instructs the crewmembers to break the bit and allow the line to slip.
3. Instruct the towed vessel crew to disconnect the tow rig and release it over the side.
4. If steps 2 & 3 above are not possible the towed vessel crew must cut the towline, cut the towline as close to the bitt as possible to avoid snapback.
5. Once free of the tow, make preparations to rescue people from the towed vessel.
6. Note the vessel's position by GPS, radar fix or geographical range and bearing.



CAUTION! Recovering people from a sinking tow presents dangerous challenges, use extreme caution to prevent fouling the towing vessels rudders and propellers in the rigging and debris from the towed vessel; this could place both crews in extreme danger!

Chapter 14 – Weather

Purpose:

To ensure mission success an operator must be able to forecast weather patterns, changes in environmental conditions and use environmental indicators to identify the onset of heavy weather.

Performance Objectives:

By the end of this chapter the participant should be able to:

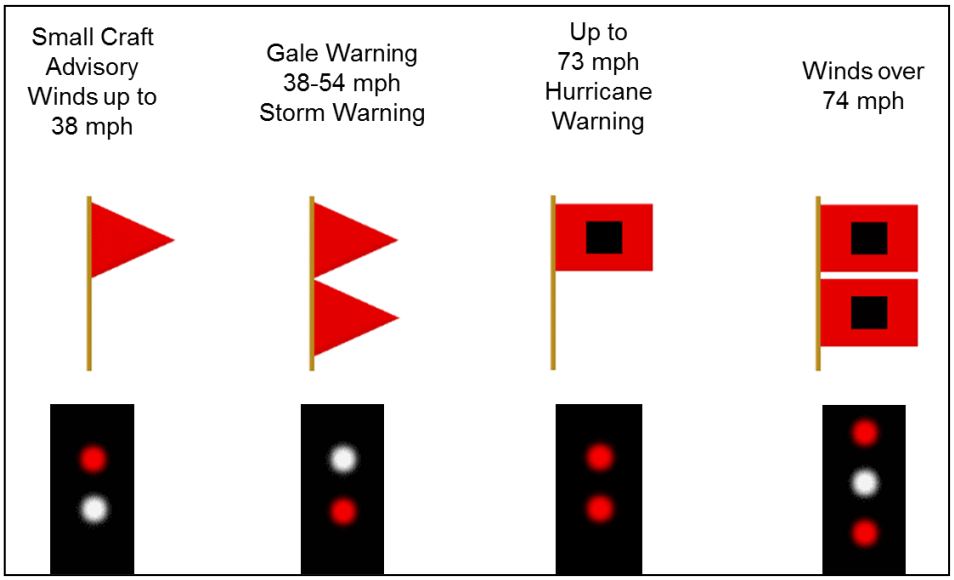
1. Identify three tools to aid in predicting weather and environmental conditions.
2. List the factors that can cause changes in water conditions.
3. Predict the high and low tide in your area as applicable.
4. Describe the use of clouds to predict changing weather.

It is the responsibility of the boat operator to check and monitor the weather.

Weather Forecasts

- Local news
- Websites
- VHF Radio
- Harbor Master

National Weather Service Storm Advisories



Weather Hazards to Boating

A combination of any of these factors can increase the danger to the boat exponentially.

Wind – High wind can affect stability of the boat. Large wind-driven waves can wash over the side of a small craft and fill it with water. In addition, if a large wave hits a vessel at just the right angle, it could capsize a small boat. Swimmers are also vulnerable to the effects of winds and large waves. Inexperienced swimmers can tire very quickly while trying to swim in large waves.

Surf – Waves that move into shallow water. Most dangerous place, boats are surf avoidance vessels.

Rain and Fog – Causes restricted visibility. Rain squalls can result in increased winds. Onset can be rapid.

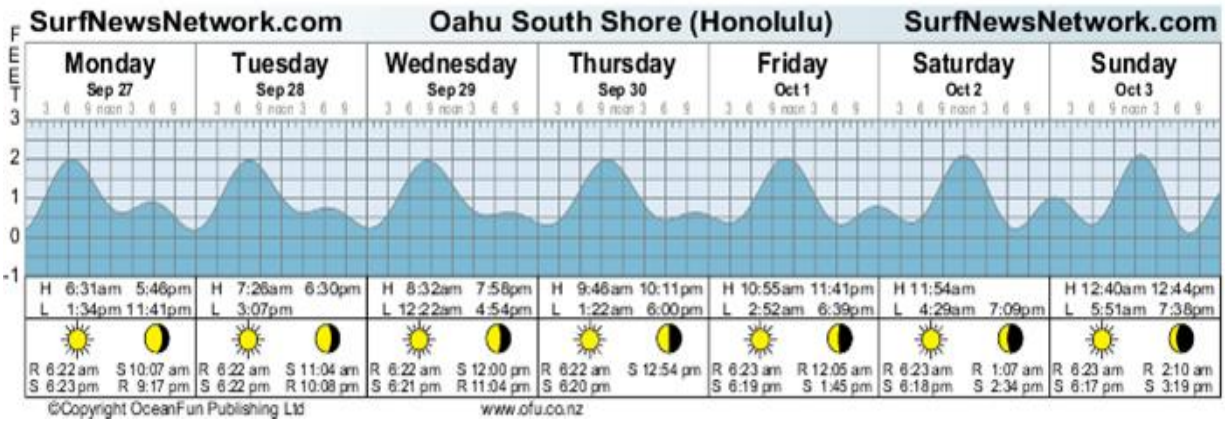
Current – Tidal currents can affect navigation. Hull type will determine how a boat reacts in currents. Currents will be stronger near shore and restricted inlets.

Tides – Rise and fall of the water's surface. Tidal fluctuations differ by area and may cause strong currents, shallow areas, dangerous surface conditions, i.e. standing waves, choppy surface, etc.

Tide tables are available at most coastal stores and marinas:

- Based on a tide gauge in your region
- Correct for your location

- May also provide additional information, i.e. moon and sun rise/set, moon phases, etc.

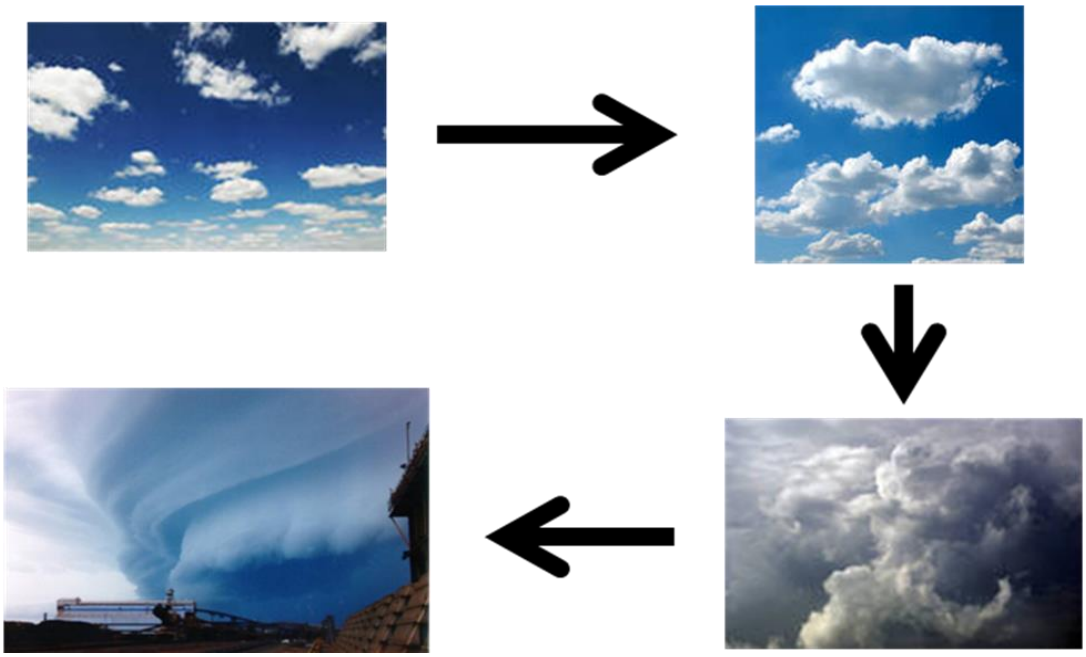


Lightning – All thunderstorms are dangerous to boaters because they contain lightning. Boaters are especially at risk from being struck by lightning because they are often the tallest object in a large open space. A direct lightning hit can damage or destroy vessels, overload navigational and electronic equipment, and electrocute passengers. **For more detailed information on lightning please refer to the "Boating-Lightning Protection" handout.**

Clouds

Clouds are a good indicator of changing weather, as well as wind direction.

Increasing Clouds = Increasing Weather



How to Avoid Being Caught In Foul Weather:

- Tune a portable radio to a local station that gives weather updates.
- Be alert to the weather you can see. Developing clouds, shifting winds and graying skies all may be indications of danger.
- Listen for distant thunder.
- Track changes in barometer readings. A rising barometer indicates fair weather. A falling barometer indicates foul weather.
- Watch for wind direction shifts which usually indicate a weather change.
- Watch for lightning and rough water. Remember that boats, particularly sailboats, are vulnerable to lightning if not grounded.
- Watch the weather to the west, the direction from which most bad weather arrives. However, be observant of weather from all directions.

If you are caught in foul weather:

- STAY CALM
- Tune your VHF to weather for updates
- Close all hatches, windows, etc. to reduce the chance of swamping.
- Distribute the weight evenly on your boat and secure loose items
- Keep bilges free of water. Be prepared to remove water by bailing if needed
- Stay low as you can towards the middle of the boat
- Set a lookout. Watch for other boats and floating debris. If there is fog, sound your fog horn.
- Ready anchors in case engines fail
- Inform shore contacts of the situation
- Reduce speed and slowly work your way to shore but keep enough power to maintain headway and steering.
- Head for the nearest shore that is safe to approach. If already caught in a storm, it may be best to ride out the storm in open water rather than trying to approach the shore in heavy wind and waves.
- Avoid running broadside to the waves. Head bow into the waves at a 45 degree angle.

UNIVERSITY OF FLORIDA
Florida Cooperative Extension Service

SGEB-7
October 1992

Boating-Lightning Protection[1]

William J. Becker[2]

"One minute the fisherman was sitting atop his elevated seat aboard his boat. The next minute he was dead--the victim of a lightning bolt."

This was the lead paragraph in a recent Florida newspaper article. These accidents can and do happen--and yet they need not.

Florida has more thunderstorms--and thus, more lightning strikes--than any other state (see Figure 1). Only three states have a higher death rate from lightning than Florida, and no state has more deaths or injuries.

Florida averages more than ten deaths and thirty injuries from lightning per year. Approximately fifty percent of the deaths and injuries occur to individuals involved in recreational activities, and nearly forty percent of those are water-related: boating, swimming, surfing, and others.

Those who enjoy Florida's waters certainly should understand the phenomena of thunderstorms--lightning and the precautions to take in order to keep these activities pleasurable--and how to prevent tragedy.

LIGHTNING PHENOMENA

Most lightning strikes occur in the afternoon--70 percent between noon and 6:00 p.m. As the air temperatures warm, evaporation increases. This warm, moisture-laden air rises and evaporates, forming fluffy cumulus clouds. As more moisture accumulates, the clouds darken and change into cumulus nimbus clouds--thunderstorm clouds--frequently, with a flattened top or anvil shape, reaching to 40,000 feet or more (see Figure 2).

The upper portion of the cloud develops a positive electrical charge, the lower level a negative electrical charge. The air, because it is a poor conductor of electricity, restricts the regular flow of electricity between these, attracting electrical charges.

While this phenomenon is occurring in the clouds, a similar phenomenon is occurring on the surface.

1. This document, SGEB-7, was published May 1985 and last reviewed October 1992 by the Florida Cooperative Extension Service. For more information contact your county Cooperative Extension Service office.

2. Professor and Extension Safety Specialist, Agricultural Engineering Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida, Gainesville, FL 32611.

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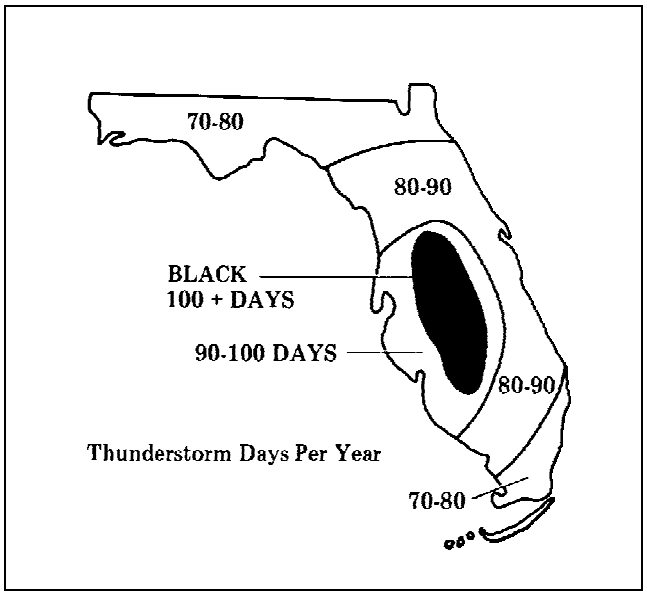


Figure 1. Thunderstorm days. Florida has more thunderstorm days than any other state. Lightning is what makes it a thunderstorm

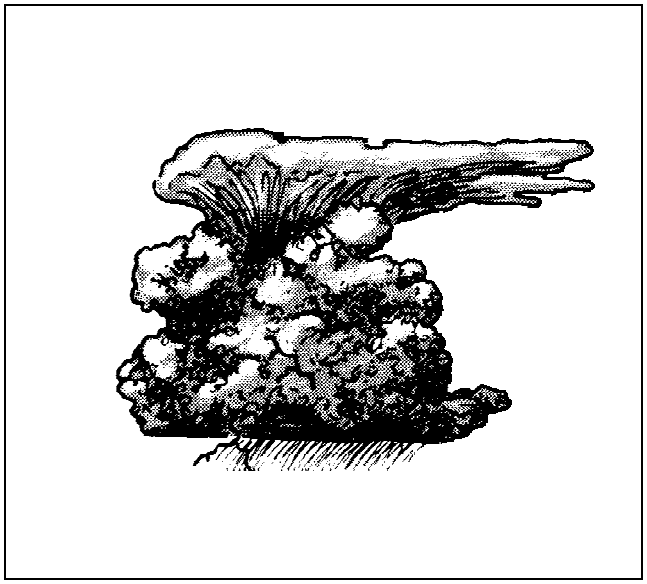


Figure 2. Thundercloud. High, dark clouds, particularly those with flattened, anvil shaped clouds indicate danger.

Negative charges repel negative charges and attract positive charges. So, as a thunder cloud passes overhead, a concentration of positive charges accumulates in and on all objects below the cloud. Since these positive charges are attempting to reach the negative charge of the cloud, they tend to accumulate at the top of the highest object around. On a boat that may be the radio antenna, the mast, a fishing rod, or even you! The better the contact an object has with the water, the more easily these positive charges can enter the object and race upward toward the negative charge in the bottom of the cloud.

Lightning occurs when the difference between the positive and negative charges, the electrical potential, becomes great enough to overcome the resistance of the insulating air and to overcome the resistance of the insulating air and to force a conductive path between the positive and negative charges. This potential may be as much as 100 million volts. To help you understand the magnitude of this voltage, the voltage needed in an automobile to cause a spark plug to fire is only 15 to 200 volts! And the spark plug gap is but a fraction of an inch!

Lightning strikes represent a flow of current from negative to positive, in most cases, and may move from the bottom to the top of a cloud, from cloud to cloud, or most-feared, from cloud to ground (see Figure 3). And when the lightning does strike, it will most often strike the highest object in the immediate area. On a body of water, that highest object is a boat. Once it strikes the boat, the electrical charge is going to take the most direct route to the water where the electrical charge will dissipate in all directions.

Let's consider a few possibilities. Lightning strikes the ungrounded radio antenna on your boat. The metal antenna carries the electrical charge to the radio, which does not have a good conductor to the water. Your hand is on the radio, or on metal connected to the radio. Your feet are on a wet surface, which is in contact with metal which extends through the hull of the boat to the water. Your body may then become the best conductor for the electrical charge.

A second example is a sailboat. Lightning strikes the mast. The electrical current follows the mast or wire rope to your hands, through your body to the wet surface, and then through the hull to the water.

Or, while operating a motor boat, the lightning strikes you, passes through your body to the motor, and then to the water.

Or, sitting in your aluminum or fiberglass rowboat, you are holding a graphite (a good electrical conductor) fishing rod. The rod is struck by lightning. The electrical charge passes through the rod, your body, then to the boat to the water.

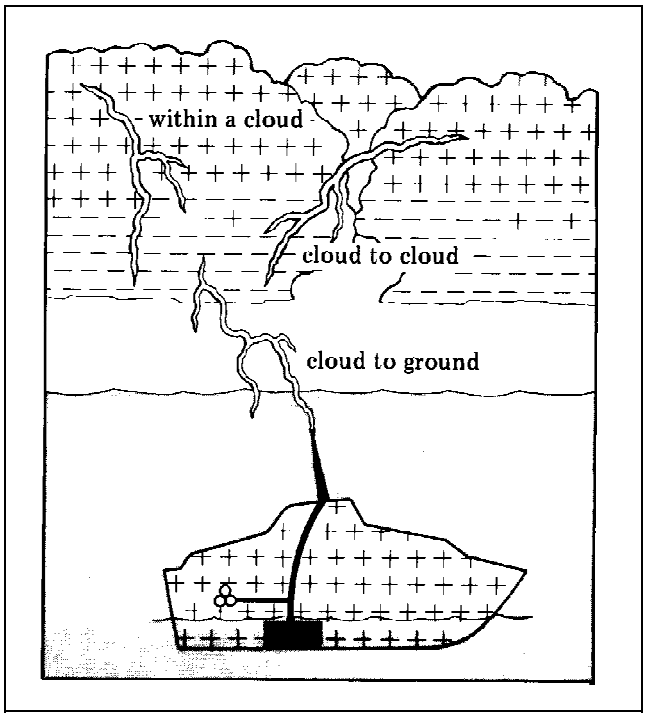


Figure 3. When the electrical potential becomes great enough, lightning can occur within a cloud, from cloud to cloud, or from cloud to ground

In all four examples you could be seriously injured. You could be dead.

You need not even be in contact with the components of the boat struck by lightning. Unless the components of the boat which could conduct electricity are bonded together and are adequately grounded, there could be side flashes. A side flash occurs when the electrical charge jumps from one component to another seeking a better path to ground. You might be that "better path."

MINIMIZE LIGHTNING STRIKE DAMAGE

Do not become a lightning target. Preferably stay off, and definitely get off, the water whenever weather conditions are threatening. Check the weather. The National Weather Service (NWS) provides a continuously updated weather forecast for Florida and its coastline via the VHF/FM channels WX1 (162.550 MHz), WX2 (162.400 MHz), WX3 (162.475 MHz). Never go boating without listening to this service. Their short-term forecasts are quite accurate, but small localized storms might not be reported. Therefore, it is important that boaters learn to read the weather.

Watch for the development of large well-defined rising cumulus clouds. Once they reach 30,000 feet the thunderstorm is generally developing. Now is the time to head for shore. As the clouds become darker and more anvil-shaped, the thunderstorm is already in progress.

Watch for distant lighting. Listen for distant thunder. You may hear the thunder before you can see the lightning on a bright day. Seldom will you hear thunder more than five miles from its source. That thunder was caused by lightning 25 seconds earlier. The sound of thunder travels at one mile per five seconds (see Figure 4).

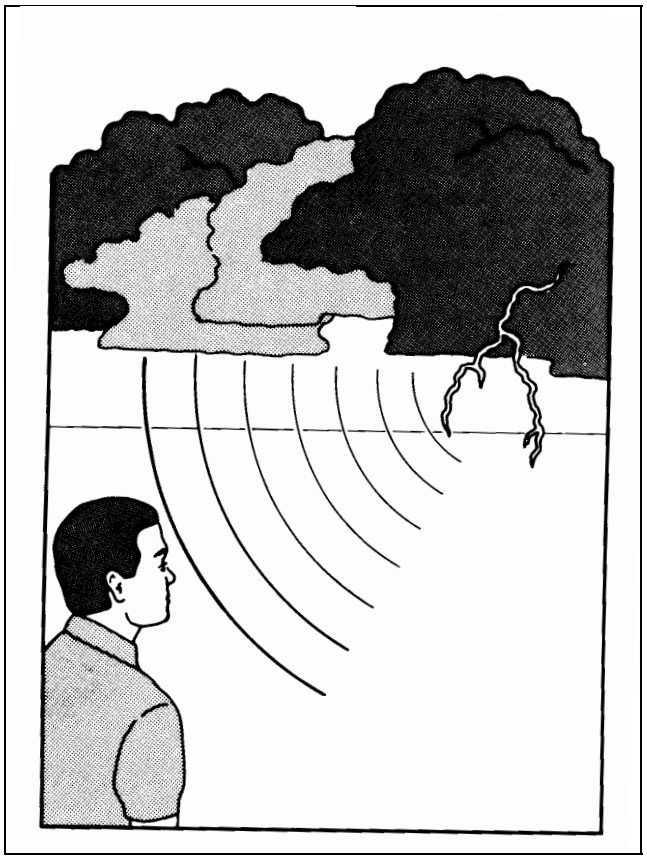


Figure 4. Sound of thunder. The sound of thunder travels at a speed of one mile per five seconds.

You are two miles from shore. The thunderstorm which is now five miles away is traveling in your direction at 20 miles per hour, which means it could be overhead within 15 minutes. Can you reach shore--two miles away--and seek shelter within that time? You better move!

LIGHTNING-PROTECTED BOATS

There is no such thing as lightning-proof boats, only lightning-protected boats. All-metal ships are rarely damaged, and injuries or deaths are uncommon. These ships are frequently struck, but the high conductivity of the large quantities of metal, with hundreds of square yards of hull in direct contact with the water, causes rapid dissipation of the electrical charge.

But small boats are seldom made of metal. Their wood and fiberglass construction do not provide the automatic grounding protection offered by metal-hulled craft. Therefore, when lightning strikes a small boat, the electrical current is searching any route to ground and the human body is an excellent conductor of electricity!

Today's fiberglass-constructed small boats, especially sailboats, are particularly vulnerable to lightning strikes since any projection above the flat surface of the water acts as a potential lightning rod. In many cases, the small boat operator or casual weekend sailor is not aware of this vulnerability to the hazards of lightning. These boats can be protected from lightning strikes by properly designed and connected systems of lightning protection. However, the majority of these boats are not so equipped.

Lightning protection systems do not prevent lightning strikes. They may, in fact, increase the possibilities of the boat being struck. The purpose of lightning protection is to reduce the damage to the boat and the possibility of injuries or death to the passengers from a lightning strike.

If you are considering the purchase of a new or used boat, determine if it is equipped with a properly designed and installed lightning protection system. Such a system is generally more effective and less costly than a system installed on a boat after it has been constructed.

LIGHTNING PROTECTION SYSTEM

The major components of a lightning protection system for a boat are an air terminal, main conductor, and a ground plate. Secondary components are secondary conductors, lightning arrestors, lightning protective gaps, and connectors (see Figure 5).

The mast, if constructed of conductive material, a conductor securely fastened to the mast and extending six inches above the mast and terminating in a receiving point, or a radio antenna can serve as the air terminal.

The main conductor carries the electrical current to the ground. Flexible, insulated compact-stranded, concentric-lay-stranded or solid copper ribbon (20- gauge minimum) should be used as the main conductor.

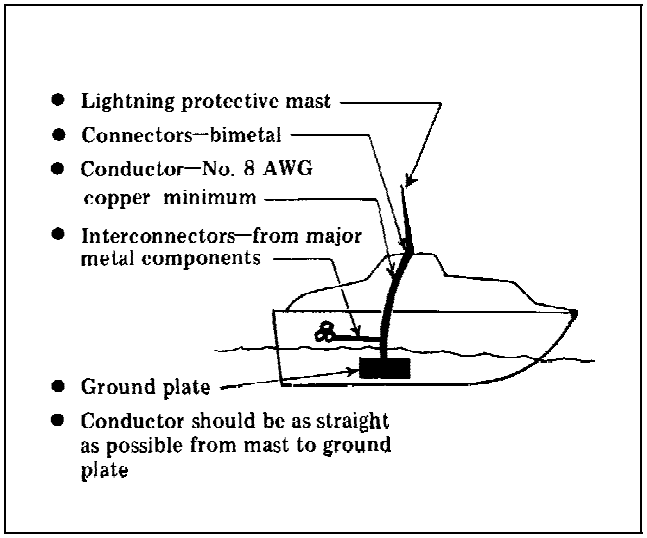


Figure 5. Components of a Lightning Protection System.

The ground plate, and that portion of the conductor in contact with the water, should be copper, monel or navel bronze. Other metals are too corrosive. The secondary conductors ground major metal components of the boat to the main conductor. However, the engine should be grounded directly to the ground plate.

Lightning arrestors and lightning protective gaps are used to protect radios and other electronic equipment which are subject to electrical surges.

The connectors must be able to carry as much electrical current as other components of the system. Further, the connections must be secure and noncorrosive.

On a large power boat or sailboat, a properly designed and grounded antenna could provide a cone of protection. Presently, however, the vast majority of the radio antenna is totally unsuitable for lightning protection. This is also true of the wires feeding the antenna. If the antenna is not properly grounded, it may result in injury or death and cause considerable property damage.

Sailboats with portable masts, or those with the mast mounted on the cabin roof, are particularly vulnerable as they are usually the least protected as far as grounding or bonding is concerned.

Ideally, an effective ground plate should be installed on the outside of all boats when the hulls are constructed. Unfortunately, this is not often done. Such a ground plate would help manufacturers design safer lightning protection systems for the boats.

LIGHTNING PROTECTION CODE

The National Fire Protection Association, Lightning Protection Code, suggests a number of ways in which the boater can protect his boat and minimize damage if the boat is struck or is in the vicinity of a lightning strike. These suggestions are summarized below:

- A lightning protective mast will generally divert a direct lightning strike within a cone-shaped radius two times the height of the mast. Therefore, the mast must be of sufficient height to place all parts of the boat within this cone-shaped zone of protection (see Figure 6).

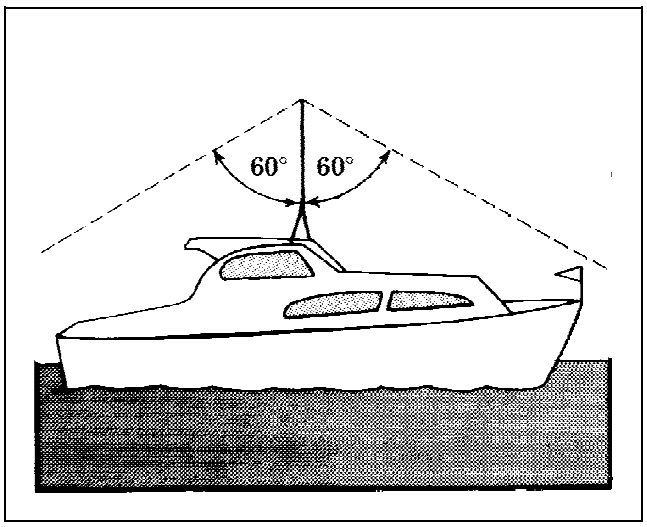


Figure 6. Cone of protection. A line drawn at a 60-degree angle from the top of the lightning protection mast should pass over all portions of the boat, including standing passengers.

- The path from the top of the mast to the "water" ground should be essentially straight. Any bends in the conductor should have a minimum radius of eight inches (see Figure 7).

- To provide adequate protection, the entire circuit from the top of the mast to the "water" ground should have a minimum conductivity equivalent to a No. 8 AWG copper conductor. If a copper cable is used, the individual strands should be no less than No. 17 AWG. Copper metal or strips should be a minimum of No. 20 AWG.

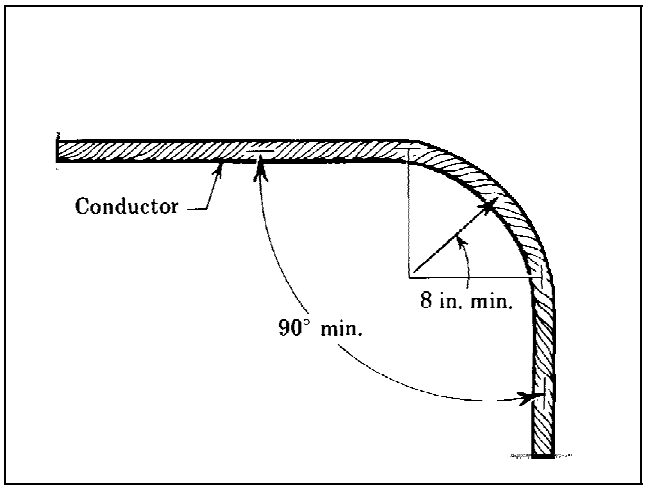


Figure 7. Ground Cable. The ground cable should take as direct and straight a line as possible from the mast top to the water ground. No bends exceeding 90 degrees with an 8 inch minimum radius should be used.

- Major metal components aboard the boat, within six feet of the lightning conductor, should be interconnected with the lightning protective system with a conductor at least equal to No. 8 AWG copper. It is preferable to ground the engine directly to the ground plate rather than to an intermediate point in the lightning protection system.

- If the boat's mast is not of a lightning protective design, the associated lightning or grounding connector should be essentially straight, securely fastened to the mast, extended at least 6 inches above the mast and terminate in a sharp receiving point.

- The radio antenna may serve as a lightning protective mast, provided it and all the grounding conductors have a conductivity equivalent to No. 8 AWG copper and is equipped with lightning arrestors, lightning protective gaps, or means for grounding during electrical storms. Most antennas do not meet these requirements. The height of the antenna must be sufficient to provide the cone-shaped zone of protection.

- Antennas with loading coils are considered to end at a point immediately below the loading coil unless this coil is provided with a protective device for by-passing the lightning current. Nonconducting antenna masts with spirally wrapped conductors are not suitable for lightning protection purposes. Never tie down a whip-type antenna during a storm if it is a part of the lightning protection system. However, antennas and other protruding devices, not part of

the lightning protection system, should be tied down or removed during a storm.

- All materials used in a lightning protective system should be corrosion-resistant. Copper, either compact-stranded, concentric-lay-stranded or ribbon, is resistant to corrosion.

- The "water" ground connection may be any submerged metal surface with an area of at least one square foot. Metallic propellers, rudders or hull will be adequate.

- On sailboats, all masts, shrouds, stays, preventors, sail tracks and continuous metallic tracks on the mast or boom should be interconnected (bonded) and grounded.

- Small boats can be protected with a portable lightning protection system. This would consist of a mast of sufficient height to provide the cone of protection connected by a flexible copper cable to a submerged ground plate of at least one square foot. When lightning conditions are observed in the distance, the mast is mounted near the bow and the ground plate dropped overboard. The connecting copper cable should be fully extended and as straight as possible. The boaters should stay low in the middle or aft portion of the boat.

WHEN CAUGHT IN A STORM

Thunderstorms in Florida and over its coastal waters are frequently unpredictable. Even with the best weather reports, along with constant and accurate observations of climatic conditions, boaters can still be caught in open waters in a thunderstorm. Then, with or without a lightning protective system, it is critical to take additional safety precautions to protect the boat's personnel. These precautions during a thunderstorm are:

- Stay in the center of the cabin if the boat is so designed. If no enclosure (cabin) is available, stay low in the boat. Don't be a "stand-up human" lightning mast!

- Keep arms and legs in the boat. Do not dangle them in the water.

- Discontinue fishing, water skiing, scuba diving, swimming or other water activities when there is lightning or even when weather conditions look threatening. The first lightning strike can be a mile or more in front of an approaching thunderstorm cloud.

- Disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.

- Lower, remove or tie down the radio antenna and other protruding devices if they are not part of the lightning protection system.

- To the degree possible, avoid making contact with any portion of the boat connected to the lightning protection system. Never be in contact with two components connected to the system at the same time. Example: The gear levers and spotlight handle are both connected to the system. Should you have a hand on both when lightning strikes, the possibility of electrical current passing through your body from hand to hand is great. The path of the electrical current would be directly through your heart--a very deadly path!

- It would be desirable to have individuals aboard who are competent in cardiopulmonary resuscitation (CPR) and first aid. Many individuals struck by lightning or exposed to excessive electrical current can be saved with prompt and proper artificial respiration and/or CPR. There is no danger in touching persons after they have been struck by lightning.

- If a boat has been, or is suspected of having been, struck by lightning, check out the electrical system and the compasses to insure that no damage has occurred.

SUMMARY

Boating in Florida's waters is an enjoyable activity for many people. Keep it that way!

Listen to the weather reports! Learn to read the weather conditions. Heed these reports and the conditions. Stay off or get off the water when weather conditions are threatening.

Install and/or maintain an adequate lightning protection system. Have it inspected regularly. Follow all safety precautions should you ever be caught in a thunderstorm. By using good judgement, it is less likely that first aid or CPR will be needed while boating.

REFERENCES

National Fire Codes. Lightning Protection Code--NFPA 78; Fire Protection Standard for Motor Craft--NFPA 302, 14. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Standards and Recommended Practices for Small Craft. Standard E-4, Lightning Protection. American Boat and Yacht Council, P.O. Box 806, Amityville, NY 11701.

Sitarz, Walter A. Boating Safety--Thunderstorms (MAP-5), Florida Sea Grant College Program, University of Florida, Gainesville, FL 32605.

ACKNOWLEDGEMENT

This publication, "Boating/Lightning Protection" (SGEB-7) replaces "Boating Safety/Thunderstorms" (MAP-5), a Florida Sea Grant bulletin published December 1978 and is acknowledged as a source of information for this bulletin.

Chapter 15 – Special Items

Purpose:

To ensure compliance with laws and regulations an operator must follow proper procedures for area specific boating.

Learning Objectives:

By the end of this unit, the participant will be able to:

1. Understand the role of the National Association of State Boating Laws Administrators (NASBLA) and state contacts for specific state regulations that may pertain to them
2. Identify and take the appropriate steps to reduce the spread of aquatic nuisance species by boat
3. Recognize the hazards and special circumstances they may encounter when navigating in and around locks, dams and bridges
4. State the purpose of the Vessel Traffic Service
5. Comply with law enforcement boat boardings

National Association of State Boating Law Administrators (NASBLA)

NASBLA is a professional association that represents recreational boating authorities in the United States and its territories. Their mission is to reduce death, injury and property damage associated with recreational boating and making it a safe enjoyable boating environment.

NASBLA's goals for achieving its mission:

- Provide national leadership and advocacy to focus policies and resources on reducing risks in recreational boating and in waterway security.
- Provide models and standards that foster best practices and uniformity among the states and territories.
- Provide professional development opportunities and other products and services that benefit members.
- Identify and employ the highest professional standards and best practices in governing, administering and measuring the performance of the association.

Further information on NASBLA may be found at: www.NASBLA.org

Along with Federal regulations, when operating a boat, the operator must be aware of state and local regulations.

For a Boating Law Administrator Directory with State Contacts visit the NASBLA homepage.

Aquatic Nuisance Species

Invasive species are infiltrators that invade ecosystems beyond their historic range. Their invasion threatens native ecosystems and commercial, agricultural, or recreational activities dependent on these ecosystems. They may even harm the health of humans.

Humans have assisted with this invasion for centuries with both intentional and unintentional introductions. Intentional introductions involve the deliberate transfer of invasive species into native ecosystems. An example of this would be someone who disposes the contents of their home aquarium into a waterway. Unintentional introductions occur when invasives are transferred through accidental means. For instance, one of the ways that zebra mussels have spread is through ship ballast water, which is used to keep ships stable in the water.

Invasives are transferred through numerous vectors including ships, boats, barges, aquaculture, agriculture, nurseries, or connected waterways. Through these and other vectors, thousands of invasive species have been introduced into this country, causing significant environmental damage and costing the economy billions annually.

Who are These Invaders and What Damage Can They Do?

They cover a wide variety of species ranging from microscopic plankton to 8-foot tall **purple loosestrife**. Other examples include the **zebra mussels, Asian carp, Northern snakehead, European green** and **mitten crabs**, **hydrilla**, **Eurasian water milfoil**, **water lettuce**, **nutria**, **sea lamprey**, **big head carp**, **salt cedar**, and **New Zealand mud snail**. Some of these organisms seem to have little impact on native ecosystems and human activities while others have devastating effects. The following provides a few examples of these unwanted guests.

Zebra mussels have inflicted tremendous damage to native ecosystems and to facilities using surface water. A direct correlation exists between an increase of zebra mussel populations and a decrease in native mussels. Millions of dollars have been spent by surface water users, like power plant and municipal water suppliers, to control and eradicate zebra mussels.

The **European green crab** invaded eastern North America in the early 1800s. It was discovered in California between 1989 and 1990. It probably entered the east by boats and the west in packing material of bait shipments to California. Females can produce 200,000 eggs annually. The European green crab has damaged New England's soft shell clam industry. New England snails have made evolutionary changes to their shells due to predation by the crab. Because they eat mussels, clams, snails, worms, barnacles, algae, isopods and other crustaceans, they could damage commercially important Dungeness crab, oyster, and clam fisheries on the west coast.

Eurasian water milfoil is from Europe, Asia, and northern Africa. In 1942, it was found in a pond in Washington, D.C., and has spread throughout much of the U.S. by the aquarium trade, fishermen, and boaters. Eurasian milfoil out competes native vegetation in lakes, ponds, and reservoirs, thus providing a less nutritious diet for waterfowl. Eurasian water milfoil also supports fewer invertebrates that fish eat. Its dense growth impedes water flow and clogs water intakes.

The Response

The National Invasive Species Act (NISA) was passed in 1996 amending the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The 1990 Act established the Aquatic Nuisance Species (ANS) Task Force to direct ANS activities annually. The Task Force is co-chaired by the U.S. Fish and Wildlife Service (Service) and the National Oceanic and Atmospheric Administration. Other members include the National Marine Fisheries Service, Environmental Protection Agency, Department of Agriculture, the U.S. Coast Guard, the U.S. State Department, and the Army Corps of Engineers. NISA furthered ANS activities by calling for ballast water regulations, the development of State management plans and regional panels to combat the spread of ANS, and additional ANS research.

In 1999, President Clinton signed the Executive Order on Invasive Species. This Order established the Invasive Species Council, which will oversee activities of existing organizations that address invasive species. However, even though many current activities combat the invasive species, their negative impact on this country's resources has been recognized for years.

The Lacey Act was passed in 1900 and has since been amended to restrict importation, acquisition, and possession of wildlife deemed injurious. Wildlife are considered injurious if their importation could impact negatively on agriculture, horticulture, forestry, the health and welfare of humans, and the welfare and survival of wildlife and wildlife resources in the U.S.

The Service's Fisheries Program, through its Division of Fish and Wildlife Management Assistance, supports the implementation of these Acts and the Executive Order through its Invasive Species Program (Program). This program provides national leadership preventing, eradicating, and controlling invasive species.

The Program provides funding for ANS Task Force personnel and numerous Task Force activities. It also funds seven FWS regional coordinators and their respective invasive species activities. These coordinators work closely with the public and private sector to develop and implement invasive species activities. Many of the Service's fishery resources offices also provide support for invasive species activities.

The priorities of the Program are as follows:

1. Increase public awareness of invasive species issues through education and outreach programs.
2. Coordinate aquatic nuisance species (ANS) management activities with other Federal and State agencies and private entities.
3. Provide technical assistance for controlling ANS on Federal lands.
4. Coordinate and conduct research activities.
5. Through the regulatory process, prevent the importation of nonindigenous nuisance species.

Increase public awareness of nonindigenous nuisance species issues through education and outreach programs.

This is perhaps the most important priority. If the spread of nonindigenous nuisance species is prevented by an informed public, then efforts to control or eradicate ANS will require fewer resources.

The ANS coordinators conduct numerous workshops and meetings as a means to educate and inform the public about ANS. Workshops target important issues such as State ANS plan development preventing spread of ANS through the New York Canal System, and mitten crab impact on the West Coast. Assistance is provided for national and international meetings.

Coordinators author articles and provide interviews for national publications and news programs.

They also attend boating and sportfishing shows, informing thousands of participants about the definition, biology, and impacts of ANS and what they can do to help prevent their spread.

Coordinate ANS management activities with other Federal and State agencies and private entities.

Zebra Mussel Sightings

One of the premier activities that numerous ANS coordinators have worked on with public and private entities is the 100th Meridian Initiative. The coordinators have worked with the Canadians and other partners to develop and implement the 100th Meridian Initiative, which will help prevent the westward spread of zebra mussels and other ANS by boats and personal watercraft. Boat inspections and surveys are conducted in 100th Meridian jurisdictions, including North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Through inspections and boaters surveys, partners can determine the impact that transporting boats and personal watercraft has on the spread of zebra mussels and other ANS and whether boats traveling west have been in zebra mussel-infested waters.

The ANS coordinators organize cooperative sampling efforts with other Federal, State, and municipal governments, universities, and public interest groups to track the distribution of ANS such as round gobies in waters near Chicago. They also assist with integrated pest management and weed issues, which involves public outreach and biological control risk assessment.

The Division provides funds to the National Nonindigenous Aquatic Species Information System in Gainesville, FL. Data in this system are used as a clearinghouse for ANS information such as maps of sightings, impacts of ANS, and verification of ANS samples. These data are easily accessible to the public.

Provide technical assistance for controlling ANS on Federal lands.

The Service is the steward of approximately 93 million acres of national wildlife refuge land. Many nonindigenous nuisance species have made their home on these refuges. The Fisheries Program support Fishery Resources Offices that monitor these species on refuges.

The Department of Defense is required to develop and implement integrated natural resource management plans for the 25 million acres that it controls. These plans address prevention and control of nonindigenous nuisance species. The Fishery Resources Offices review and assist with the implementation of these plans.

Coordinate research activities

Ruffe and round goby, originally from Eurasia, have invaded the Great Lakes. Fishery Resources Offices in the Great Lakes continuously work with States and universities to monitor their populations defining their range of invasion. Sampling equipment used for monitoring is developed, tested, and refined. The diets of round gobys are also being studied. For instance, preliminary analysis indicates that they eat zebra mussels, insect larvae, and small fish.

Zebra mussel impacts on native mussels have been studied by fishery resources offices over the past few years. Zebra mussels are removed from native mussels before the natives are returned to their habitats. Zebra mussel populations are monitored.

Sea lamprey, which are native to the North Atlantic, are established in the Great Lakes. They have decimated lake trout populations through their feeding method, in which they attach to fish and extract their body fluid. As participants in the Great Lakes Fisheries Commission, the Fishery Resources Offices assist with controlling sea lampreys. These control methods include testing and applying lampricide, developing and installing lamprey traps, and stocking strains of lake trout that may adapt to surviving a sea lamprey attack. Through these efforts, the battle against sea lamprey is being won.

Prevent the importation of invasive species.

Many invasive species are imported into this country for various reasons such as for pets or for the fur trade. These species may escape or when they are no longer wanted, their owners sometimes release them into the wild, which can negatively impact native plants and animals. The Division identifies and researches imports that could potentially injure native wildlife and wildlife resources, human health and welfare, agriculture, aquaculture, horticulture, or forestry. If an import is deemed injurious, its importation will be denied through the regulatory process.

Steps you can take:

- Inspect your vessel and trailer, removing any nuisance species (zebra mussels and eurasian watermilfoil) you see before leaving the waterway.
- Drain your motor, live well, and bilge on land before leaving the waterway.
- Empty your bait bucket on land. Never release live bait into a waterway or release aquatic animals from one waterway into another.
- Rinse your vessel, trailer and equipment.
- Air dry your vessel and equipment for as long as possible.
- Kill attached zebra mussels by pulling boats out of the water to dry for a minimum of 10-14 days.

- Flush the engine's cooling system with hot water.
- Apply antifouling materials such as paint and films to vessel hulls, trim tabs, water ports, transducers and swimming platforms to discourage zebra mussel attachment.

The Future

More attention is being given to invasive species issues. Through the Division's programs and the assistance of other Federal and State agencies and the private sector, invasions of these species can be reduced and their impact can be minimized. Public knowledge and participation are key effectively combating these invaders.

For More Information:

U.S. Department of Interior, The Aquatic Nuisance Species Task Force (an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species) http://anstaskforce.gov/

U.S. Fish and Wildlife Service, National Wildlife Refuge System. Invasive Species Program- http://invasives.fws.gov/

Locks

When traversing connected navigational areas with considerable difference in water levels you may encounter locks. These are used to move boats up or down from one level to another.

Locks operate on a simple premise. You drive your boat into a chamber with gates at each end. To raise the boat, water is let into the chamber until it is the level of the water to be entered. When the water reaches that level the gates on the new elevation side are opened and you drive out.

To go to a lower level, you enter the chamber and the gates are closed and water is let out until you are even with the lower level. The gates on that side are opened and again you drive away.

The lockmasters are responsible for the safety of vessels going through the locks. Their instructions should be followed precisely. You normally will call the locks on your VHF radio and make arrangements to enter the lock. (The VHF channel changes in different parts of the country but 13 is a good place to start if you do not already know the channel or it is not indicated on a sign at the entrance to the lock.)

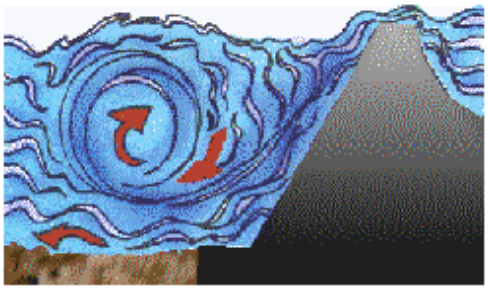
You may, however, give two long and two short blasts from your horn and follow the light signals that are displayed at each entrance to the lock. Generally, they work similarly to a traffic light. A red light means stop, you cannot enter the lock and you must stay clear of any traffic about to exit the lock. A yellow light sometimes displayed means the lock is preparing for your entrance but still stay cautiously clear. A green light means the boat may enter the lock with caution and follow the instructions of the lockmaster. (Sound and light signals may be different in different parts of the country. Investigate beforehand.)

Prior to entering the lock you should have fenders rigged on both sides of the vessel. You should have crew in PFDs ready to handle lines and loop, not tie, them to the posts, bollards or lock wall ladder rungs on the side of the lock the lockmaster has indicated. Keep hands and feet clear of the boat and wall. Use a boat hook or paddle to fend off if necessary. Your crew handling the lines will have to adjust them as the water level rises or falls. Your lines should be at least twice the depth of the lock. Once secure in the lock shut off your engine.

As soon as the water in the lock reaches the proper level, the gates are open and the lockmaster has indicated that you should do so, you should cast off lines and exit with caution.

Dams

Dams are built to back up water in a reservoir for a variety of reasons. This wall-like structure pools the water as it flows over the crest and drops to the lower level. This drop creates a hydraulic, which is a backwash that traps and re-circulates anything that floats. Boats and people have been caught in this backwash. A person caught in the backwash of a low-head dam will be carried to the face of the dam, where the water pouring over it will wash him down under to a point downstream called the boil. The boil is that position where the water from below surfaces and moves either downstream or back toward the dam. A person who is caught in a low head dam struggles to the surface, where the backwash once again carries him to the face of the dam, thus continuing the cycle.



To complicate matters, these dams are usually loaded with debris, such as tires and logs on the surface and rocks and steel bars just below, posing additional problems should a person get trapped in this dangerous structure.

Dams do not need to have a deep drop to create a dangerous backwash. During periods of high water and heavy rains, the backwash current problems get worse, and the reach of the backwash current is extended downstream.

Small low-head dams that may have provided a refreshing wading spot at low water can become a brutal death trap when river levels are up. Simply put, it is not the drop of the dam which is the lethal danger, but the backwash current. This backwash current is governed by volume of water and flow.

From downstream, you may not realize the danger until it’s too late. From upstream, low-head dams are difficult to detect. In most instances, a low-head dam does not look

dangerous, yet can create a life-threatening situation. You should always pay attention to warning signs, markers or buoys and keep well clear of low-head dams.

Bridges

When approaching a bridge in a boat, slow down and familiarize yourself to the surroundings before proceeding forward. Bridges obstruct visibility and are often a popular fishing location. Know the height and width of your boat and make sure you have clearance to make it through and if returning back through the same bridge, know the tide table. Debris may also accumulate around bridges, and can cause damage to your boat. If approaching a draw bridge, contact the bridge operator in order to pass safely.

Vessel Traffic Service

The Vessel Traffic Service (VTS) is a marine monitoring program established by harbor or port authorities similar to air traffic control. VTS systems utilize various technology (i.e. radar, closed circuit tv and VHF) to track vessel movements and provide navigational assistance in areas of safety concerns.

Law Enforcement Boardings

If a coast guard vessel or state law enforcement vessel flashes their blue lights, hails you on either their VHF or bullhorn you must stop your boat immediately. Once stopped the law enforcement boat will approach your boat and announce their intentions. The law enforcement officer will be in uniform and armed. If they board your boat, they will want to see the boats registration or documentation and then proceed to inspect the boat. The scope of the inspection, during most boardings, is to determine boats use and checking for compliance with state and federal laws applicable to the size of your boat. After inspection you should receive a copy of the boarding report that notes any discrepancies in compliance with regulations.

NOAA Guidelines for Viewing Marine Mammals

- Remain at least 100yds. away
- Ensure your actions do not cause a change in behavior of the marine mammals
- Do not trap mammals with your boat, always leave them an escape route
- If approached by marine mammals, slow down and shift to neutral
- Do not crowd other viewing vessels, keep viewing time to less than ½ hour
- Do not cross paths of marine mammals, parallel their routes
- Avoid excessive or sudden changes in speed in the vicinity of marine mammals
- If sitting silent with engine off, occasionally tap motor to make noise to avoid marine mammals surfacing into the boat

Report incidents of harassment of marine mammals to the National Marine Fisheries Service 24 hour HOTLINE 1-800-853-1964, state or local enforcement agency, harbor patrol, or your local Coast Guard office.

Appendix A
Department of Interior Watercraft Safety Policy
485 DM 22

August 29, 2011

Department of the Interior
Departmental Manual

Effective Date: August 29, 2011
Series: Safety Management
Part 485: Safety and Occupational Health Program
Chapter 22: Watercraft Safety

Originating Office: Office of Occupational Safety and Health

485 DM 22

22.1 **Purpose**. This chapter establishes the minimum requirements for the safe operation of Department of the Interior (DOI) watercraft and for the training of Departmental watercraft operators.

22.2 **Scope**.

A. The policy in this chapter applies to watercraft for which the DOI is responsible (e.g., watercraft the DOI owns, borrows, rents, or leases), anyone on board watercraft for which the DOI is responsible, and DOI personnel conducting official duties on watercraft regardless of ownership. Employees performing official duties on commercially licensed watercraft (ferries, tour boats, commercial vessels, etc.) will abide by established maritime standards for those vessels, orders issued by the captain of the vessel and in accordance with all relevant safety standards and authorities noted in this chapter.

B. Seaplanes are not within the scope of this chapter.

C. Contractors are not within the scope of this chapter but must comply with the safety and health clauses in their contract agreement and with Federal, State, and local watercraft requirements.

22.3 **Authorities**.

A. Public Law 91-596, Sec. 19, Federal Agency Safety and Health Program Responsibilities.

B. Executive Order 12196, Occupational Safety and Health Programs for Federal Employees.

C. Occupational Safety and Health Administration (OSHA) General Industry Standards, 29 CFR 1910; Shipyard Standards, 29 CFR 1915; Marine Terminals, 29 CFR 1917; Longshoring Standards, 29 CFR 1918.

D. 46 USC 2109 - Public vessels.

E. 33 CFR, Navigation and Navigable Waters, Subchapter S, Boating Safety.

F. 46 CFR 25, Shipping, U.S. Coast Guard (USCG), Department of Transportation, Requirements, Subpart 25.25.

22.4 **References**.

A. 410 DM - Department of the Interior Property Management Regulations.

B. American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA) 107-2004, High Visibility Safety Apparel and Headwear.

C. U.S. Coast Guard, Navigational Rules, International-Inland.

D. U.S. Coast Guard, 46 CFR Part 160, Inflatable Personal Flotation Devices.

22.5 **Definitions**.

A. Crew. Personnel other than the operator essential to the operation of the watercraft.

B. Motorboat. Any motorized watercraft 65 feet or less in length and does not require a USCG license or certification to operate.

C. Operator. The individual in physical control of the watercraft.

D. Personal Flotation Device (PFD). Commonly known as a life jacket. Various types of PFDs are available. The type of PFD selected depends on user activity, weather conditions, and user preference. See section 22.7C of this chapter.

E. Watercraft. Boats and ships, collectively, that are propelled manually, by wind, or machinery (i.e. airboats, sailboats, inflatable rafts and other vessels), excluding seaplanes.

22.6 **Responsibilities**.

A. Heads of bureaus and offices. Responsible for implementing a watercraft safety program within their bureau or office in compliance with this chapter.

B. DOI Office of Occupational Health and Safety.

(1) Coordinating with the DOI Safety and Health Council, developing and maintaining standards for watercraft safety training such as the Motorboat Operator Certification Course (MOCC), Motorboat Operator Instructor Certification Course (MOICC), Refresher training, and MOCC modules (e.g., Airboat Module, Open-Water Module, and River Module).

(2) Coordinating with the DOI Safety and Health Council to develop and provide training materials.

C. DOI Safety and Health Council. Sponsoring the DOI Watercraft Safety Work Group by providing guidance and assistance.

D. Bureau Safety Managers.

(1) Ensuring the appointment of a bureau watercraft safety coordinator.

(2) Accomplishing the following or delegating authority to the bureau watercraft safety coordinator:

(a) Reviewing requests for deviations to Personal Floatation Device (PFD) requirements as described in section 22.7C of this chapter. This responsibility may be delegated to regional safety managers.

(b) Reviewing requests for MOCC and MOICC substitutions, and approving or denying each request based on the requirements in the MOCC Instructor Manual.

(c) Identifying Internet or other courses that are approved for use in completing the refresher training educational module.

E. DOI Watercraft Safety Work Group.

(1) Recommending to the DOI Safety and Health Council, program and policy changes to this chapter.

(2) Meeting as necessary, but at least annually, for peer group discussions and exchange of best business practices.

(3) Working cooperatively with other agencies and organizations (e.g. USCG, National Oceanic and Atmospheric Administration, Scientific Boating Safety Association, National Safe Boating Council, etc.) to increase the watercraft training opportunities available to DOI personnel (e.g., through the development of training modules, and expanding the numbers of courses that have reciprocity with the DOI-MOCC).

F. Watercraft Safety Coordinators.

(1) Serving as the watercraft safety program point of contact for their respective bureau or office and helping coordinate watercraft safety activities and operator training.

(2) Successfully completing MOCC and MOICC training.

(3) Serving as the bureau or office representative on the DOI Watercraft Safety Work Group.

G. Supervisors.

(1) Establishing protocols to ensure that all DOI personnel and volunteers:

(a) Conduct watercraft operations in a safe manner and in compliance with established bureau and office policies and procedures.

(b) Maintain equipment in compliance with existing policies and procedures.

(c) Ensure that operators have the skills needed for the conditions in which they are reasonably expected to operate watercraft.

(2) Ensuring that all DOI personnel who operate and work in watercraft on official duty have training in watercraft operations appropriate for:

(a) Type and size of watercraft used;

(b) Geographic, climatic, and physical nature of the operations; and

(c) Operational tasks being performed.

(3) Providing safety and survival equipment that the watercraft operator identifies as necessary.

H. Watercraft Operators.

(1) Successfully completing the training requirements outlined in this chapter.

(2) Safety of personnel on board regardless of position and grade, and operating the watercraft in compliance with existing policies, guidelines, and training.

(3) Conduct of watercraft operations while in control of the vessel.

I. Watercraft occupants other than the operator.

(1) Obeying the instructions of the watercraft operator.

(2) Adhering to all safety regulations.

(3) Conducting themselves in a reasonable and prudent manner at all times.

22.7 **Requirements**. Bureaus engaged in watercraft operations will establish a watercraft safety program that includes the following minimum requirements:

A. Safe Watercraft Operation.

(1) Departmental watercraft will be operated in a safe and prudent manner and in accordance with Federal standards in addition to the requirements in this chapter.

(2) Departmental watercraft will meet or exceed applicable USCG design and equipment requirements.

(3) In addition to basic safety devices required by Federal regulations, Departmental watercraft will be outfitted, based on expected conditions, with other equipment necessary for safe operation. This may include communications gear, navigation aids, and satellite navigation. Special consideration should be given for the use of up-to-date commercially available tracking systems.

(4) Departmental personnel will be trained prior to operating watercraft. See sections 22.7E of this chapter.

(5) DOI personnel operating watercraft normally subject to USCG licensing regulations will be licensed in accordance with the requirements in 46 CFR 25. Departmental watercraft will meet the applicable USCG inspection and certification requirements.

(6) Periodic inspection and maintenance programs will be established for all Departmental watercraft, as required by 410 DM - Department of the Interior Property Management Regulations. Records of inspections and maintenance will also be kept in accordance with 410 DM.

B. Float Plans.

(1) Prior to using a watercraft, the operator must provide verbal or written notification to a reliable contact with at least the following information:

(a) Description of watercraft

(b) List of occupants

(c) Emergency equipment on board

(d) Point of departure

(e) Planned route

(f) Estimated time of departure

(g) Estimated time of return

(h) Means of contact (e.g., VHF radio, mobile phone), and contact schedule

(i) Purpose of the trip

(j) Description of vehicle(s) left at launch site(s)

(k) Recommended plan of action if overdue

(2) Deviation from these requirements is permitted if special mission situations prevent the conveyance of this information.

C. Personal Flotation Devices.

(1) All personnel are required to wear a PFD in open areas of watercraft less than 65 feet in length. An operator can require occupants to wear a PFD in any area of the watercraft regardless of the length of the watercraft. A manually-inflatable PFD is recommended for use in enclosed areas of watercraft to reduce the risk of entrapment in the event of capsizing.

(2) PFDs must be USCG-approved and appropriately rated for the type of watercraft, and designed for operational applications, durability and mission requirements. The outer shell of PFDs will be international orange unless a different high-visibility color is required for special uses (e.g., ANSI 107-2004 approved fluorescent yellow-green). In accordance with 46 CFR 25.25-15, each PFD is required to have at least 200 sq. cm. (31 sq. in.) of retroreflective material attached to its front side, at least 200 sq. cm. of material on its back side, and, if the item is reversible, at least 200 sq. cm. of material on each of its reversible sides. The material attached on each side of the item must be divided equally between the upper quadrants of the side, and the material in each quadrant must be attached as closely as possible to the shoulder area of the item. In accordance with 46 CFR 25.25-13, each PFD is to be equipped with a light securely attached to the front shoulder when on board watercraft being operated in coastal waters, the ocean, sea, or large lake. PFD requirements for non-motorized watercraft use and operation will be determined at the discretion of the individual bureaus, however PFD colors and reflectivity must provide for enhanced visibility and search and rescue purposes.

(3) Deviation from the high-visibility color requirements in Section 22.7C(2) in this chapter may be permitted if special mission requirements, such as those involved in law enforcement, cannot be otherwise satisfied. Deviations must be requested in writing by the supervisor of the organizational unit conducting the operation prior to the conduct of the activity. The written request will identify alternate safety measures to be taken. Deviations will be authorized on a case-by-case basis by the individual bureau or office safety manager for a period not to exceed one year.

(4) All PFDs must be inspected and maintained in accordance with the manufacturer's instructions. PFDs should be stored in a cool, dry place out of direct sunlight. A "dry" area is considered any suitable area where water will not condense on a PFD. All PFDs should be kept away from oil, paint, and greasy substances.

D. Cold weather personal protective equipment (PPE). Cold weather PPE (e.g., USCG-

approved exposure suit) will be worn when the sum of air and water temperatures is less than 100 degrees Fahrenheit. An exception to this requirement may be made if the operator determines that risks associated with wearing cold weather PPE (e.g. crew performance degradation, thermal stress) are offset by the benefits of not wearing cold weather PPE. Prior to use, personnel will be trained in the use of this equipment.

E. Training.

(1) DOI personnel must complete the MOCC before operating motorboats while conducting official duties, and the MOCC must be completed by anyone operating motorboats for which the DOI is responsible (e.g., watercraft the DOI owns, borrows, rents, or leases).

(2) Motorboat operator certification will be valid for 5 years. To be recertified, operators will successfully complete the refresher training outlined in the MOCC Instructor Manual.

(3) Successful completion of the MOCC does not imply that personnel are competent to operate any motorboat in all conditions that they may encounter. Supervisors must ensure that watercraft operators receive safety and operations training on the watercraft, in the environmental conditions, and in the areas, they will be operating. MOCC modules, developed by the DOI to help meet some specialized training needs, are outlined in the MOCC Instructor Manual.

(4) Operators of non-motorized watercraft are exempt from the requirement to complete the MOCC, but must be provided practical operator safety training pertinent to the watercraft and environmental conditions in which the watercraft is operated. Examples of how this need might be met include completion of the non-motorized version of the MOCC River Module, or one of the American Canoe Association (http://www.americancanoe.org) Water Safety and Rescue Courses.

(5) In preparation for taking the MOCC or an MOCC module, DOI personnel may practice elementary operating skills under the on-board supervision of an experienced operator who has completed the corresponding training.

(6) The MOCC and MOCC modules will be conducted in accordance with the objectives outlined in the MOCC Instructor Manual.

(7) DOI personnel successfully completing the MOICC will be qualified to teach the MOCC as outlined in the MOCC Instructor Manual.

(8) Other watercraft training may be substituted for the Departmental MOCC and MOICC. Requests for substitutions must be submitted to the bureau or office safety manager or, at his or her discretion, the bureau or office watercraft safety coordinator. Any training that is substituted must be comparable to MOCC or MOICC objectives.

Appendix B
US Fish and Wildlife Service
Watercraft Safety Policy
241 FW 1

September 17, 2014

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1.1 What is the purpose of this chapter? This chapter:

A. Describes responsibilities for implementing the Department of the Interior (Department)-mandated watercraft safety program, and

B. Establishes minimum requirements for the U.S. Fish and Wildlife Service's (Service) safe operation of motorboats and other watercraft.

1.2 What is the scope of this chapter?

A. This policy applies to:

(1) Watercraft for which the Service is responsible (e.g., watercraft the Service owns, borrows, rents, or leases),

(2) Anyone on board watercraft for which the Service is responsible, and

(3) Service personnel conducting official duties on watercraft, regardless of ownership. Employees performing official duties on commercially licensed watercraft (ferries, tour boats, commercial vessels, etc.) must abide by established maritime standards for those vessels, any orders the captain of the vessel issues, and all relevant safety standards and authorities in this chapter.

B. The policy does not apply to:

(1) Operators of watercraft larger than 65 feet in length. Those operators must have a U.S. Coast Guard (USCG) license and follow USCG operator requirements;

(2) Seaplanes; and

(3) Contractors. Contractors must comply with the safety and health clauses in their contract agreements and with Federal, State, and local watercraft requirements.

1.3 What are the authorities for the watercraft safety program?

A. Federal Agency Safety Programs and Responsibilities (Public Law 91-596, Sec 19).

B. Executive Order 12196, Occupational Safety and Health Programs for Federal Employees.

C. Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters (29 CFR 1960).

D. Navigation and Navigable Waters (33 CFR Parts 1-199).

E. Shipping, USCG, Department of Homeland Security, Uninspected Vessels (46 CFR Part 25, Subchapter C), and Lifesaving Equipment (46 CFR Part 160).

F. 485 DM 22, Watercraft Safety.

1.4 What is the Service policy for operation of watercraft? We must operate all watercraft in a safe and prudent manner in accordance with local and State laws, USCG and Departmental regulations, and this chapter.

1.5 What terms do you need to know to understand this chapter? See Table 1-1.

Table 1-1: Watercraft Safety Program Terminology

Term	Definition
A. Anti-exposure clothing	Apparel designed to protect the wearer from exposure to particular elements, which includes the following or its functional equivalent: **(1)** USCG-approved Type V immersion suit. **(2)** USCG-approved Type V worksuit. **(3)** USCG-approved Type III float coat in combination with flotation bib coveralls or comparable clothing, such as a USCG-approved Type III float coat in combination with chest waders. The chest waders may be made of neoprene, or, if you wear adequate thermal protection under the waders, non-insulating material. **(4)** A dry suit and a USCG-approved personal flotation device. The dry suit must be worn with the proper under gear (i.e., the layer against the skin should be synthetic and the second layer should be fleece thermal).
B. Immersion Suit	A USCG-approved Type V personal flotation device that is generally stowed on board, is put on if there's an emergency, and provides greater hypothermia protection than anti-exposure clothing.
C. Kill Switch	A device designed to shut off the engine if the operator is thrown overboard or away from the controls.

Table 1-1: Watercraft Safety Program Terminology	
Term	**Definition**
D. Motorboat	Any motorized watercraft 65 feet or less in length that does not require the operator to hold a USCG license or certification.
E. Motorboat Operator Certification Course (MOCC)	The 24-hour training course that Service-authorized personnel who operate motorboats must successfully complete.
F. Motorboat Operator Instructor Certification Course (MOICC)	The training course required in order to teach the MOCC.
G. Operator	The person in physical control of the watercraft.
H. Personal Flotation Device (PFD)	A Department and USCG-approved device designed to keep the user afloat while in the water.
I. Watercraft	Boats and ships collectively that are propelled by hand, wind, or machinery (i.e., motorboats, airboats, sailboats, inflatable rafts, kayaks, and all other vessels).

1.6 Who is responsible for the watercraft safety program? See Table 1-2.

Table 1-2: Responsibilities for the Watercraft Safety Program	
This official…	**Is responsible for…**
A. The Director	**(1)** Ensuring sufficient support and resources to effectively implement watercraft safety program requirements, and **(2)** Appointing the Service Watercraft Safety Coordinator.
B. The Assistant Director - Business Management and Operations	**(1)** Nominating the Service Watercraft Safety Coordinator to the Director, with assistance from the Chief, Division of Safety and Health; and **(2)** Providing sufficient support and resources to the Chief, Division of Safety and Health, to ensure that the Chief can effectively accomplish his/her watercraft safety program responsibilities (see section 1.6D).
C. Regional Directors	**(1)** Ensuring there are sufficient resources and support to implement this policy within their areas of responsibility, and **(2)** Appointing a qualified Regional Watercraft Safety Coordinator.
D. The Chief, Division of Safety and Health	**(1)** Facilitating, administering, and supporting the Service Watercraft Safety Working Group; **(2)** Working with the Service Watercraft Safety Working Group to update and revise this policy; **(3)** Working closely with the Service Watercraft Safety Coordinator to ensure that he/she actively participates on the Departmental Watercraft Safety Working Group; **(4)** Conveying pertinent watercraft safety issues to the Departmental Safety

Table 1-2: Responsibilities for the Watercraft Safety Program	
This official…	**Is responsible for…**
	Council; and **(5)** Interpreting the requirements in this chapter and resolving Servicewide issues and questions about the policy.
E. Service Watercraft Safety Coordinator	**(1)** Successfully completing MOCC and MOICC training. If the Service Watercraft Safety Coordinator has not taken these two courses prior to appointment, he/she must have a minimum of 5 years of boating experience and must complete the two courses within 1 year of appointment; **(2)** Serving as the watercraft safety program point of contact with other bureaus and the Department; **(3)** Serving as the chairperson of the Service Watercraft Safety Working Group; **(4)** Serving as our representative on the Departmental Watercraft Safety Working Group; and **(5)** Reviewing requests for MOCC course substitutions and approving or denying each request based on the requirements in section 1.7A.
F. Service Watercraft Safety Working Group	**(1)** Meeting as necessary, but at least annually, for peer group discussions and exchange of best practices; **(2)** Assessing training needs and discussing standardized approaches and best business practices for conducting the MOCC, MOCC refresher training, the MOICC, and any additional specialized watercraft training modules; **(3)** Ensuring watercraft safety training meets the operational needs of our workforce; **(4)** Evaluating the adequacy of the requirements in this chapter and proposing policy and procedural additions or changes, as appropriate; and **(5)** Working cooperatively with other agencies and organizations (e.g., USCG, National Oceanic and Atmospheric Administration (NOAA), Scientific Boating Safety Association, National Safe Boating Council, etc.) to increase the watercraft training opportunities available to Departmental personnel. The group does this by developing training modules and reviewing the courses that all agencies/organizations offer to see if they meet the same requirements as the MOCC.
G. Regional Watercraft Safety Coordinators	**(1)** Successfully completing MOCC and MOICC training. If a Regional Watercraft Safety Coordinator has not taken these two courses prior to appointment, he/she must have a minimum of 5 years of boating experience and must complete the two courses within 1 year of appointment; **(2)** Coordinating and overseeing the Regional MOCC program, which includes approving all Service MOCCs taught in the Region and their lead

Table 1-2: Responsibilities for the Watercraft Safety Program	
This official…	**Is responsible for…**
	instructors; **(3)** Coordinating Regional compliance with policies and procedures governing the training, maintenance, and safety of watercraft operations; **(4)** Actively participating on the Service Watercraft Safety Working Group; **(5)** In conjunction with the Regional Safety Manager, reviewing requests for exemptions to use auto-inflating PFDs as described in Exhibit 1, Safety and Survival Equipment Requirements; **(6)** Determining when a motorboat operator must use a kill switch (see section 1.9); **(7)** Sending requests for MOCC substitutions to the Service Watercraft Safety Coordinator; and **(8)** Working cooperatively with other agencies and organizations (e.g. USCG, NOAA, Scientific Boating Safety Association, National Safe Boating Council, etc.) to increase the watercraft training opportunities available to Departmental personnel.
H. Regional Safety Managers	**(1)** Working with the Regional Watercraft Safety Coordinator to provide technical support, and **(2)** Reviewing requests for authorizations to use auto-inflating PFDs as described in Exhibit 1.
I. Project Leaders/ Supervisors	**(1)** Establishing protocols to ensure that all employees, volunteers, and others: **(a)** Conduct watercraft operations in a safe manner and in compliance with established Departmental and Service policies and procedures, and **(b)** Maintain equipment in compliance with policies and procedures, such as the Service's Maintenance Management System (372 FW 1 and 2); **(2)** Ensuring that employees, volunteers, and others who operate and work in watercraft on official duty are trained and have the skills in watercraft operations appropriate to the (also see section 1.7D): **(a)** Type and size of watercraft used; **(b)** Geographic, climatic, and physical nature of the operations; and **(c)** Operational task(s) being performed; **(3)** Entering information into the Department's Learning Management

Table 1-2: Responsibilities for the Watercraft Safety Program	
This official…	**Is responsible for…**
	System (i.e., DOI Learn) to document when employees, volunteers, and other participants complete initial watercraft training and refresher training. If the system will not allow them to enter this training, the Project Leader/supervisor must maintain and track safety and health training by a documentable and producible means; **(4)** Reviewing and sending requests for authorization to use auto-inflating PFDs to the Regional Watercraft Coordinator as described in Exhibit 1, Safety and Survival Equipment Requirements; **(5)** Providing the safety and survival equipment that the watercraft operator identifies as necessary and as described in Exhibit 1, Safety and Survival Equipment Requirements; and **(6)** Completing an accident report within 6 days of being notified about an accident using the Department's Safety Management Information System (SMIS), regardless of whether or not injuries occurred and regardless of the cost of the associated property damage.
J. Watercraft Operators	**(1)** Successfully completing the MOCC and maintaining certification; **(2)** Successfully completing training courses and requirements in specialized subjects (e.g., airboat operations, shallow-drive watercraft, jet boats, moving water operations, open water operations) as necessary to meet mission and environmental operating conditions; **(3)** Ensuring the safety of all personnel on board; **(4)** Operating the watercraft in compliance with existing policies, guidelines, and training; **(5)** Before beginning any boat trip: **(a)** Determining what safety and survival equipment is needed and ensuring that the required equipment is on board and maintained in good, serviceable condition, **(b)** Showing others on board where emergency equipment is located and providing any other information that is essential for an emergency, **(c)** Completing an operational risk assessment evaluation before starting operations and as conditions change throughout the day (the protocol is in the MOCC Student Manual located on NCTC's Web site), and **(d)** Providing a written or verbal float plan to a responsible individual outlining pertinent details (e.g., when departing and returning, etc.) of the trip. FWS Form 3-2227, Float Plan, lists float plan requirements. It may be necessary to deviate from these requirements for certain operations (see section 1.11);

Table 1-2: Responsibilities for the Watercraft Safety Program	
This official…	**Is responsible for…**
	(6) Using a kill switch when required (see section 1.9); and **(7)** Immediately reporting to their Project Leader or supervisor any accident, regardless of whether or not injuries occurred or the cost of any associated property damage.
K. Other personnel on board any watercraft	**(1)** Obeying the watercraft operator's orders, **(2)** Adhering to all safety regulations and this policy, and **(3)** At all times conducting themselves in a reasonable and prudent manner.

1.7 What are the training requirements for watercraft operators?

A. Motorboat Operator Certification Course (MOCC) & Refresher Training.

(1) Service-authorized operators of motorboats must, at a minimum, successfully complete the Department's MOCC or an approved substitute course.

(2) Before taking the MOCC, personnel may practice motorboat operation under the supervision of a MOCC-trained operator on board the watercraft. Personnel who have not taken the MOCC may only operate motorboats to gain experience.

(3) Contact the Regional Watercraft Safety Coordinator to register for the MOCC or to request approval for a substitute course. Substitute training must meet the MOCC objectives, including on-water proficiency.

(4) Operators must complete MOCC refresher training every 5 years to maintain certification. Details about the MOCC and MOCC refresher are in the MOCC minimum standards on NCTC's Web site.

B. Motorboat Operator Instructor Certification Course (MOICC). Individuals who have successfully completed the MOICC instruct MOCC courses. Details regarding the MOICC are found in the minimum standards on NCTC's Web site.

C. Airboat Training.

(1) Before operating an airboat independently, airboat operators must:

(a) Take the "Airboat Module" in addition to the MOCC, and

(b) Have 40 hours of documented driving time. The driving time:

(i) May occur before or after completing the Airboat Module and only under the supervision of a qualified airboat operator, and

(ii) Must be documented on FWS Form 3-2238, which the operator and the Project Leader/supervisor sign.

(2) If an operator doesn't drive an airboat frequently enough to maintain proficiency, the operator must retake the "Airboat Module" at least every 5 years.

D. Additional Training. Project Leaders and supervisors must ensure that watercraft operators have received adequate training (personal qualifications) to safely operate their motorized or non-motorized watercraft within the type of water and environmental conditions they encounter. Successful completion of the MOCC does not mean that someone is competent enough to operate a watercraft in all conditions that they may encounter.

(1) Training courses in special subjects, such as airboat operations, river operations, and open water operations are available.

(2) Operators of non-motorized watercraft (e.g., kayak, canoe, pirogue) must take a non-motorized watercraft operators course, demonstrate their competence, or receive on-the-job training to become competent before they may operate the watercraft.

(3) Lack of course availability for training operators does not alleviate the Project Leader or supervisor of the responsibility of ensuring that the operator is properly trained. Contact the Regional Watercraft Safety Coordinator for information.

1.8 What safety and survival equipment are required for watercraft?

A. Each watercraft must meet or exceed applicable USCG, Departmental, and Service design and equipment requirements and be outfitted based on expected conditions with equipment necessary for safe operation. Personnel must maintain all USCG-required personal safety equipment as mandated by USCG regulations and State and local laws.

B. For detailed information on the requirements for PFDs, fire protection equipment, anti-exposure clothing, immersion suits, communications equipment, navigation aids, and auxiliary power, see Exhibit 1, Safety and Survival Equipment Requirements.

1.9 When must operators use a kill switch?

A. Use requirement: Operators must use a kill switch when there is a risk that they could be thrown overboard or away from the controls, except in rare instances when doing so increases the risk to personnel. For example, it might be riskier to use a kill switch when operating upstream from a significant hazard, operating in extremely rough water, performing a rescue, or performing nonhazardous work tasks within the boat. When the use of a kill switch during a specific mission is determined to pose a greater hazard than not using a kill switch, the Project Leader or supervisor or his/her designee must write a Job Hazard Assessment (JHA) to identify measures to prevent injuries associated with the operation (see 240 FW 1).

B. Watercraft without kill switches: We will install kill switches if there is a risk the operator could be thrown from the controls.

C. Outboard with tiller: When operating an outboard with a tiller, the operator must attach the kill switch before shifting out of neutral.

D. Airboats: Airboat operators must use kill switches at all times except in those rare instances when doing so increases the risk to personnel. For example, it might be riskier to use a kill switch when operating in deep water in narrow channels where suddenly stopping the engine could swamp the airboat.

1.10 What are the minimum maintenance documentation requirements?

A. Project Leaders/supervisors must ensure that all watercraft are maintained in good, serviceable condition as required by the manufacturer and this chapter. They may use FWS Form 3-2226, which is a preventative maintenance checklist.

B. The watercraft operator must:

(1) Inspect the watercraft for seaworthiness and proper equipment before taking it out, and

(2) Keep a maintenance log for each watercraft, motor, and trailer. Logs for each item can be maintained in separate notebooks or all in one notebook. The logs must contain the results of inspections, maintenance performed, fueling operations, trip information, total hours, and trailer maintenance information. Operators should keep maintenance logs on board when space allows.

1.11 What are the requirements for a float plan? Before using a watercraft, the operator must notify a reliable contact either verbally or in writing (you may use FWS Form 3-2227, Float Plan) about the plans for the trip. The form describes what information to provide about the trip.

1.12 What are the requirements for surf landings? Landing a watercraft under high surf conditions is dangerous and requires special skills. Only trained personnel with supervisor approval may attempt these landings. A second vessel should be standing by to render assistance.

1.13 What are the requirements for accident reporting and investigations? Operators must report all accidents and near accidents to their Project Leader or supervisor. The Project Leader or supervisor is responsible for completing an accident report using the Department's Safety Management Information System (SMIS), regardless of whether or not injuries occurred or the cost of any associated property damage.

A. We must investigate and report serious accidents (loss of life, three or more people hospitalized, or Service property loss of $250,000 or more) in accordance with Service policy in 240 FW 7, *Accident Investigation and Reporting*. The investigation team, appointed by the Assistant Director - Business Management and Operations, must include at least one member of the Service Watercraft Safety Working Group. Investigators cannot be from the Region where the accident occurred.

B. The operator must also complete a Boating Accident Report (USCG Form 3865) whenever an accident involving a Service watercraft (including watercraft under contract) occurs in U.S. waters or in U.S. territory waters, and:

(1) It results in more than $2,000 in property damage,

(2) The boat is destroyed,

(3) A person is injured and requires medical treatment beyond first aid,

(4) A person disappears from the vessel under circumstances that indicate death or injury, or

(5) A person dies.

You can find more information about boating casualty investigations on the USCG Web site.

C. If required by State law, the operator must also report the accident to local authorities. State

requirements for reporting boating accidents may be more stringent than Federal (e.g., some States require that all boating accidents be reported immediately). Check with your Regional Watercraft Safety Coordinator for reporting procedures.

1.14 How are explosives transported on watercraft? See 244 FW 1, Explosives Safety.

1.15 How long can an operator drive or operate a vehicle/equipment (including watercraft) in one day?

A. When possible, supervisors planning work must not require more than 8 hours of operating vehicles, watercraft, and/or equipment in one duty shift.

(1) Supervisors must consider factors such as work environment, number of consecutive days performing work (fatigue), and medical conditions that may affect an employee's ability to operate a vehicle, watercraft, and equipment safely. Supervisors must adjust maximum operating time to address fatigue or other conditions as applicable.

(2) Operators are always responsible for safe vehicle, watercraft, and equipment operation. If at any time an operator feels like he/she cannot operate a vehicle, watercraft, or equipment safely due to fatigue or any other reason, he/she has an obligation to safely stop the vehicle, watercraft, or equipment. This may mean staying overnight to rest and continue the trip the next duty shift.

B. Employees must not exceed 10 hours operating time (control of vehicle/equipment/watercraft, including rest stops) during a 16-hour duty period. However, if an operator cannot complete a run within 10 hours, he/she may drive up to 2 additional hours to complete the run or reach a place offering safety for the vehicle occupants and security for the vehicle and its cargo.

(1) Trip planning must allow for at least 8 consecutive hours off duty prior to each duty period this section covers.

(2) We allow an exception when exceeding these times is essential to addressing immediate and critical law enforcement issues.

(3) When an operator must exceed a 16-hour work shift, the operator's supervisor must document the mitigation measures used to reduce fatigue.

/sgd/ Rowan W. Gould
DEPUTY DIRECTOR

Date: September 17, 2014

Safety and Survival Equipment Requirements

Personal Flotation Devices (PFDs)

Types/Specifications	Requirement(s)
(1) Motorized watercraft	In watercraft less than 65 feet in length, all personnel must wear a U.S. Coast Guard (USCG)-approved PFD in open areas. An operator may require occupants to wear a PFD in any area of the watercraft regardless of the length of the watercraft. Personnel must wear conventional (inherently buoyant) PFDs in accordance with 485 DM 22.
(2) Non-motorized watercraft	Personnel must wear a USCG-approved Type I, II, III, or V PFD at all times.
(3) Manual-only inflatable PFDs	Personnel must use USCG-approved manually inflatable PFDs when working in enclosed areas of watercraft where there is a risk of entrapment if the watercraft capsizes.
(4) Auto-inflating PFDs	Personnel may only use auto-inflating PFDs in special circumstances, where there is evidence that it is riskier to use a conventional PFD than it would be to use an auto-inflating PFD. • **Request for authorization to use auto-inflating PFDs:** The supervisor of the operational unit must send a written request to use auto-inflating PFDs to the Regional Watercraft Safety Coordinator before the activity begins. If the Regional Watercraft Coordinator concurs with the request, he/she sends it to the Regional Safety Manager for review. Both officials must concur with the request before authorizing use. The authorization is valid for 1 year and only for the particular task for which it is approved. -The Project Leader or supervisor may authorize, in writing, use of auto-inflating PFDs for law enforcement operations. -When an auto-inflating PFD is authorized, the Project Leader or supervisor must write a Job Hazard Assessment (JHA) to identify measures to prevent injuries associated with the operation (see 240 FW 1). • **Training and maintenance for auto-inflating PFDs:** Personnel must successfully complete training that is approved by the Regional Watercraft Safety Coordinator before using auto-inflating PFDs. The request for authorization must include a detailed plan for additional training and establish a maintenance program with which personnel must comply. -The training should be specific to the type and model of auto-inflating PFD. Personnel must test the PFD in the water during the training. The training should also cover maintenance and inspection requirements and repacking procedures. -Users must also perform maintenance in accordance with the manufacturer's recommendations. At a minimum, personnel must inspect the auto-inflating PFD after each immersion or every 6 months, if not used. Also every 6 months, personnel must inspect the bladder, arming device, carbon dioxide canister, and seal.
(5) PFD color and reflective	PFDs must be international orange in color and equipped with retroreflective tape in accordance with 485 DM 22.

Safety and Survival Equipment Requirements		
material	Project Leaders/supervisors may allow personnel to use PFDs of equal visibility (e.g., yellow or red) or greater visibility (e.g., high-visibility green) if they are the safest for the job. Personnel may use a PFD that deviates from the high-visibility color requirement if special mission requirements, such as those involved in law enforcement, cannot otherwise be satisfied.	
Fire Protection Equipment		
	Requirement(s)	**Authorizations/exceptions/other special issues**
	There must be one or more USCG-approved Type B fire extinguishers with a 2.5 lb. charge installed at a location that is readily accessible on all motorboats, depending on size, as follows: • Less than 26 feet in length – 1 extinguisher • From 26 feet to 40 feet in length – 2 extinguishers • From 40 feet to 65 feet – 3 extinguishers	Follow USCG guidelines for fixed systems on watercraft larger than 65 feet.
Anti-Exposure Clothing		
	Requirement(s)	**Authorizations/exceptions/other special issues**
	Personnel must wear anti-exposure clothing when air temperature and water temperature combined fall below 100 degrees Fahrenheit. Anti-exposure clothing is particularly important when watercraft operate: • Alone, off shore, or in a remote location, and when rescue may be delayed or is unlikely; and • In conditions when immersion in the water will likely disable the victim regardless of the proximity to shore or rescue. Personnel must be trained on using this clothing.	The operator of the watercraft may make an exception to this requirement if, using the risk assessment protocol found in the MOCC student manual, he/she determines that risks associated with wearing anti-exposure clothing (e.g., personnel performance degradation, thermal stress) are offset by the benefits of not wearing it.
Immersion Suits		
	• Immersion suits provide greater hypothermia protection than anti-exposure gear, and the supervisor of the operating unit or policy may require them based on the hazards of the operation. • All watercraft personnel must wear USCG-approved immersion suits when working in coastal waters, the ocean,	

Safety and Survival Equipment Requirements	
	and seas that exhibit cold or harsh conditions, and in large lakes that exhibit those same conditions. • The operator must assign each person on the watercraft the suit they must use in an emergency, show them how to use it, and give them the opportunity to practice using it. • Supervisors must ensure personnel inspect immersion suits when purchased, when retrieved from storage, after every use, and at least every 6 months if not used frequently. Personnel must maintain immersion suits as recommended by the manufacturer.
Communications Equipment	
	• We provide communications equipment (e.g., marine radio, cell phones, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELTs), etc.) capable of requesting emergency assistance and maintaining radio schedules to operators of all watercraft, except in those instances where the operator has determined that the equipment is not necessary due to the nonhazardous nature of the operating environment. • As with all safety and survival equipment in this table, the Project Leader or supervisor must provide the equipment that the operator identifies as needed (see 241 FW 1).
Navigation Aids	
	Navigation aids suitable to the mission must be on board the watercraft. The aids may include a compass, radar, GPS, depth finder, etc.
Auxiliary Power	
	• We recommend auxiliary power (e.g., an extra outboard motor) for motorboats operated in areas where it's not easy to get assistance in case there is a primary engine failure. • We require auxiliary power for motorboats operated in areas where assistance is unavailable. • In cases where auxiliary power is not practical (e.g., airboat operation), the operator must identify in a written float plan methods to obtain assistance during engine failures.

Appendix C
Accident Reporting

SMIS

Offline Accident Reporting Worksheet

(Preparation for reporting online via WWW.SMIS.DOI.GOV)

Factual Information about the Accident

Date / /	**Reporter's/Supervisor's Name**	**Last-4**
Time : AM PM	**Place/Location of Accident**	
Zip Code	**Narrative**	
Result ☐ Injury ☐ Illness ☐ Injury w/Prop Damage ☐ Property Damage Only ☐ Incident Only		

Contributing Factors

Unsafe Act	**Unsafe Condition**	**Management Factor**

Personal Data

Name	Last		First		MI
Attributes	SSN	DOB / /	Sex	Occ Code	Grade/Step
Address	Street			State	Zip Code
Organization	Bureau Code	Sub-Bureau Code		Organization Code	
Empl Status	☐ Perm ☐ Temp ☐ Emer ☐ Contr ☐ Concess ☐ Public ☐ Volunteer ☐ Firefighter ☐ BIA Other				

Injury Information

Body Part	**Date Work Stopped** / /
Severity	**Date Pay Stopped** / /
Nature	**Date Terminated** / /
Type	**Date Returned** / /
Activity	**45 Days Comp Began** / /
Cause	**Days Restricted Duty**
Source	**Days Lost Time**

Property Damage Information

Prop Type	
Description	
Prop Owner	
Cause of Damage	
Source of Damage	
Cost/Loss	
Respon for Prop	SSN Name (use personal data block above or another form)

Additional Notes and Bureau Specific Data

Appendix D
Float Plans

FLOAT PLAN

1. Name of Operator and Telephone Number _____

2. Description of Boat: Type _____ Color_____
Trim Color _____ Number_____
Make _____ Name_____

3. Type of Vehicle Used _____

4. Purpose of Trip

5. Persons On Board: Names, Ages, Address

6. Radio Equipment and Frequencies

7. Communication Schedule _____

8. Departure Date and Time _____

From_____To _____
Routes and Stops

Expected Return (Date and Time)_____

9. Time of Weather Briefing _____

10. If not Returned by (Date and Time)_____ Call the Coast Guard or Notify the Following Numbers

11. Notes

Boating Safety Float Plan

Date(s):_____ **Departure Time:**_____ **Return Time:**_____

Vessel(s):_____

(Name / State #'s or Documentation #'s / Length and Type / Color Description)

Departing From:_____ **Launch/Recovery Site:**_____

Transit Area:_____ **Vehicle(s) Description:** _____

_____

Mooring Location:_____ **Vehicle(s) License #:** _____

_____

Area(s) of Research:_____

(Latitude & Longitude and /or Name with Physical Description)

If operator has not returned or made contact as arranged please call the following emergency number:

_____

(List the local USCG or Rescue Authority for your area of research)

Operator and Crew Information

1) **Operator:**_____ **Phone #:**_____

Additional Persons On Board:

(Name / Affiliation / Phone#)

2)_____

3)_____

4)_____

5)_____

Weather Conditions & Forecast

○ **Inland** ○ **Offshore**

What are the forecasted conditions?

Water Surface:_____

Water Current:_____

Wind: _____ / _____

(velocity) **(direction)**

○ **Day** ○ **Night**

(Nav Lights & Rescue Lights Required)

Visibility:_____

(Distance NM) **(Clear / Fog / Haze / Rain)**

Sunrise:_____ **Sunset:**_____

High Tides	Low Tides
Height _____Time_____	Height _____Time_____
Height _____Time_____	Height _____ Time_____

Mission Description

Specific Type of Operations:

_____

_____

_____

_____

Checklist

- ○ #_____**PFD's**
- ○ **VDS- Flares & Non- Pyro**
- ○ **Radio**
- ○ **E.P.I.R.B.**
- ○ **Cell #**_____
- ○ **Anchor**
- ○ **Bilge, Oil, antifreeze, fuel**
- ○ **Maintenance log**
- ○ **First Aid Kit**
- ○ **O2 Kit if Scuba**
- ○ **Flash Light**
- ○ **Food**
- ○ **Water**
- ○ **Paddles**
- ○ _____
- ○ _____

FLOAT PLAN- FILE WITH RESPONSIBLE CONTACT

Crew Leader & Crew Member Names	Crew: Radio Channel &/or Cell Contact #'s	Responsible Contact: Radio &/or Phone #'s	Departure		Expected time of Return		Ditch Bag #	GAR Score	Vehicle/Boat Description/ #'s/Plates	Travel Route/Boat Landing(s) used/water body and specific area of ops.
			Date	Time	Date	Time				
									Truck: Boat:	
									Truck: Boat:	
									Truck: Boat:	
									Truck: Boat:	
									Truck: Boat:	

Crew Leader Actions: Disposition of Completed Float Plan-(1 copy to Responsible Contact), (1 copy secured with Crew), (post 1 copy at crew station). Responsible Contact **may be a supervisor, co-worker, LE Dispatcher, or other competent person(s). Initiate communication check/verification with responsible contact prior to deployment. Plan a back-up mode of communication with contact if possible (i.e. cell phones to back-up radios). File completed float plans at station for 1 year min.**

***Crew Leader: File a completed float plan with a responsible contact. Follow "risk assessment" protocol prior to launch and until completion of mission. Notify responsible contact when the mission is completed. Communicate delays or changes concerning estimated time of return to your contact as soon as possible. In the event of problems or an emergency, notify contact immediately! Notify responsible contact and supervisor ASAP when a GAR score change impacts mission status.**

***Responsible Contact: Provide crew leader with your contact information for the duration of the float plan. Expect and be prepared to receive crew communication as well as initiate call/welfare check with crew if no contact is received by the expected time of return. (Duration of the float plan may exceed normal office hours, making after-hours phone contact numbers Necessary.)**

Updated 03/2014

USFWS Float Plan Example (vR1 2015-10-05)

Scheduled trip dates/times from boat launch	**Depart From:**		**Return To:**	
	Date:	**Time:**	**Date:**	**Time:**
Planning (e.g. when/where to meet, tides/flows, sunrise/set, weather)				
Trip purpose				
Planned route				
Boat Operator and Crew Information	**Name** / **Role** / **Agency** / **Phone** / **Email** / **Emergency Contact** / **Phone**			
	[ ]			
	[ ]			
	[ ]			
	[ ]			
	[ ]			
	[ ]			
Boat Description	(Length, Registration, Make/Model, Color, Distinguishing characteristics)			
Towing vehicle	(License-plate numbers, and vehicle make, model, color)			
Means of on-water contact and contact schedule				
Float-Plan Contact	(The person responsible for initiating emergency action if the vessel is overdue):			
What will be done by the Float-Plan Contact if the boat is overdue	The Float-Plan Contact will consider the boat overdue if no check-in by:			
	If a boat is overdue, the Float Plan Contact will (list actions and identify Emergency-Response contacts including phone numbers):			
What will be done by the boat operator if the trip is changed or delayed				
Emergency Equipment on board				
Notes				

Appendix E
MOCC Material Revision Request Form

MOCC Material Revision Request Form

Date of Request:	
Name:	
Address:	
City, State, Zip:	
Phone:	
E-mail:	

Gary Schetrompf
National Conservation Training Center
698 Conservation Way
Shepherdstown, WV
25443
Phone: 304-876-7255
Fax: 304-876-7262
www.nctc.fws.gov

MOCC Chapter to be revised	

Instructor Material to be Revised (Check all that apply)	Comments (A brief Description of the Suggested Revision)
☐ PowerPoint Presentation	
☐ Lesson Plan	
☐ Participant Manual	
☐ Training Aid	
☐ Handouts	
☐ Other	

Comments (Please provide detailed information such as page number, slide number, and any supporting information):

Please return this form and any pertinent files and supporting materials to NCTC by one of the three methods listed to the right. (Select appropriate method)

- ◯ Mail: Gary Schetrompf
  National Conservation Training Center
  698 Conservation Way
  Shepherdstown, WV 25443
- ◯ Email: gary_schetrompf@fws.gov
- ◯ Fax: 304-876-7262