CANADIAN COAST GUARD AUXILIARY

CENTRAL AND ARCTIC REGION

PHASE 02

- FOREWORD & PURPOSE -

This manual is yours to keep and use for future reference and is to be used with the power point presentations as well. The names listed under the acknowledgements and contributions devoted a tremendous amount of time and commitment to the concept and completion of this manual and the current training program.

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- CHAPTER 1 -
VESSEL CHARACTERISTICS

1.1 DISPLACEMENT HULLS

Displacement hulls typically have a rounded bottom with a tear drop shape running bow to stern. Displacement hulls "displace" or move, an amount of water equal to the weight of the boat. Displacement hulls are very efficient, most long range cruising boats such as trawlers and many sailboats use this type of hull. Because of their design, displacement hulls are restricted in their speed to the square root of their waterline length times 1.34. Therefore, a 64 foot boat can realistically only expect a top end speed of a little over 10 knots.

1.2 PLANING HULLS

1.2.1 PLANING

Planing is sliding or skimming over the surface of the water. Any true displacement vessel, including a planing hull at low speed, is sustained - buoyed up by hydrostatic forces exactly equal to its own weight.

The surrounding water pushes inward and upward with equal force. Therefore, when a boat is launched it automatically settles into the water until the weight of the water it displaces exactly equals its own weight.

Underway, many boats, particularly the planing designs, convert some of the energy of their forward motion into vertical lift by deflecting water downward. A flat stone skipped across a pond obtains lift in the same way, temporarily remaining above the water's surface despite the fact that stones are too dense to float. Unlike the skipped stone, which rebounds from the surface at high speed, a planing boat can never obtain enough dynamic lift from the water to lower its displacement all the way to zero, although fast ones come close. (Of course, with the addition of aerodynamic lift, light racing hydroplanes readily become airborne and, not infrequently, crash as a result).

Speed potential in a displacement vessel is harshly limited by the inherent speed of the wave system it generates as it shoulders water aside. In simple terms, the displacement vessel lacks the power to climb appreciably up the back face of its own bow wave. On the other hand, a boat on a clean plane is perched just behind the crest of the wave it creates

by deflecting water downward, forward and outward. The water shoved down and aside by the passage of the hull, instead of closing in directly behind the boat and forming a distinctive stern or quarter wave, breaks cleanly away at the transom and chines. The faster the boat goes, the longer it takes this water to rebound in the boat's wake. Thus the stern wave of a planing hull, unlike the well-defined quarter-wave of a displacement hull, trails a substantial distance behind the transom. The faster the planing boat goes, the further it lags behind.

1.3 THE ADVANTAGE OF V-BOTTOMED HULLS

V-bottom boats have acquired their overwhelming popularity partly because their extra wetted length along the keel makes them highly resistant to porpoising which is a tendency to pitch and slam. (Two other advantages of v-bottoms, their enhanced ability to negotiate rough water at high speed and bank into turns). For a given speed and load, a v-bottom will create more drag and require more power than a flat bottom. In almost all cases, this trade-off is worthwhile.

1.4 BANKING, HEELING AND STABILITY

Good planing hulls, instead of leaning away from turns like displacement boats or automobiles, bank into them like motorcycles. The explanation for this is rooted in the basic principles of planing. When a boat enters a turn, centrifugal force causes it to skid sideways. In the process of skidding, the boat is actually planing sideways as well as forward. As a result the high lift leading edge area shifts toward the side of the bottom that is on the outside on the turn, raising it and causing the boat to bank.

V-bottom boats bank harder and more reliably in turns than flat bottom boats. As a v-bottom boat skids sideways, the outer side of the hull meets the water at a large trim angle and develops lots of lift, while the inner side contacts the water at a much smaller angle and may easily develop suction.

Good planing boats are more stable at speed than they are at rest. When weight is shifted to one side of a displacement boat, the boat heels, moving the centre of buoyancy laterally until it is again in vertical alignment with the centre of gravity - this time with the boat heeling to some extent. However, when a boat is planing, the same weight shift will also alter the trim angle on one side of the bottom relative to the other, inducing an additional and comparatively large dynamic righting force.

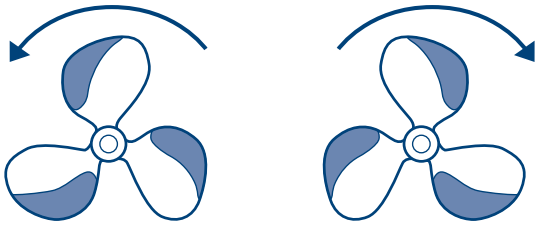
1.5 PROPULSION AND STEERING

Propulsion and steering are considered together here for two reasons. Applying thrust has no use if you can't control the vessel's direction, and often the device providing the propulsion also provides the steering. There are three common methods of transferring power and providing directional control:

- Rotating shaft and propeller with separate rudder
- A movable (steerable) combination, such as an outboard motor or stern drive
- An engine-driven pump mechanism with directional control, called a waterjet

All three arrangements have their advantages and disadvantages from the standpoint of mechanical efficiency, ease of maintenance and vessel control. Using one type of propulsion instead of another is often a matter of vessel design and use of parameters, operating area limitations, lifecycle cost and personal preferences determining the type of propulsion. There is no single "best choice" for all applications. Regardless of which type is used, become familiar with how each operates and how the differences in operation affect vessel movement. The following assumptions will apply to propulsion:

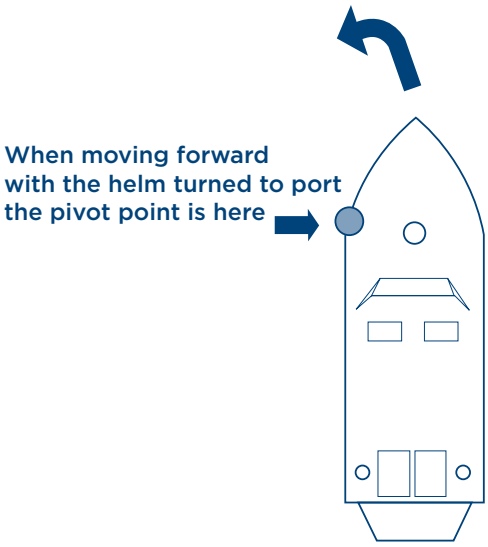
- If a vessel has a single-shaft motor or drive unit, it is mounted on the vessel's centreline
- When applying thrust to go forward, most propellers turn clockwise (the top to the right or a "right-handed" propeller), viewed from astern. When going astern it turns counter clockwise viewed from astern when making thrust to go astern
- If twin propulsion is used, most vessels have counterrotating drives in the following configuration: starboard propeller, when going ahead, operates as above (right-hand turning), while the port unit turns counter clockwise (left-hand turning)



Viewed from astern, turning for propulsion to go ahead (forward). Propeller on right (starboard shaft) turns clockwise and is called a right-handed propeller. When in reverse (backing), the rotation is opposite.

1.5.1 PIVOT POINT

On almost every boat, the propulsion and steering arrangement is designed to operate more efficiently and effectively when going ahead than when going astern. When turning, a vessel will rotate on a specific point, called the pivot point. The fore and aft location of the pivot point varies from boat to boat, but is generally just forward of amidship when the boat is at rest. As a hull moves either ahead or astern, the effective position of the pivot point moves either forward or aft respectively. A sense of the location and behavior of the pivot point is a critical component for boat handling at slow speed.

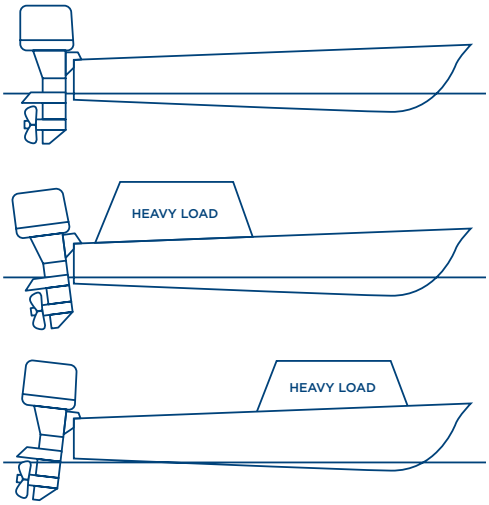


1.5.2 TRIM

Trim is the angle of the hull in reference to the water's surface. There are a few ways to adjust this angle:

- Adjust the angle of propulsion
- Adjust the weight onboard the vessel
- Use trim tabs or fins attached to the hull or engine leg to create lift (stern up) or suction (stern down) from the water travelling along the hull surface

When moving on to a plane, the boat is actually climbing up its own bow wave. Displacement mode describes the vessel at slow speed displacing its weight in the water. During the transition between displacement mode and planing mode, the vessel must overcome its bow wave and ride on the after part of the hull, suspended on a cushion of air and water it develops dynamic lift. In order for the transition to occur smoothly, the boat must be properly trimmed.



Trim to offset loading condition.

1.5.3 ADJUST THE ANGLE OF PROPULSION

The angle of propulsion in reference to the angle of the transom can affect trim. This is most commonly achieved by adjusting the trim ram on a drive mount. Trimming up increases the angle and drives the stern down while lifting the bow up. Trimming down does the opposite. The ideal trim angle vs. power ratio is when the boat is stable, but has a minimum amount of hull surface in the water. As the angle of trim is increased or "trimmed up," more horsepower is required to hold the hull out of the water. If there is a lot of

horsepower and too much of the hull is lifted out, then the boat becomes unstable. There are two indications of being trimmed up too high:

- Porpoising: When the bow bobs up and down, even in calm water
- Chine Hopping: Violently hopping; when the boat sways from one side to the other, with increasing frequency

The boat is not trimmed high enough when the steering is stiff and sluggish and the bow wake is still up at the bow. The boat will be pushing a lot of water along like a snowplow, rather than gliding along.

1.5.4 OPTIMUM TRIM

A good trim angle is characterized by responsive steering, and the feeling that the boat is floating on a cushion of air. At this angle, the boat is using less fuel, is more stable, steers easier, and is going faster.

1.5.5 ADJUSTING THE TRIM WITH WEIGHT

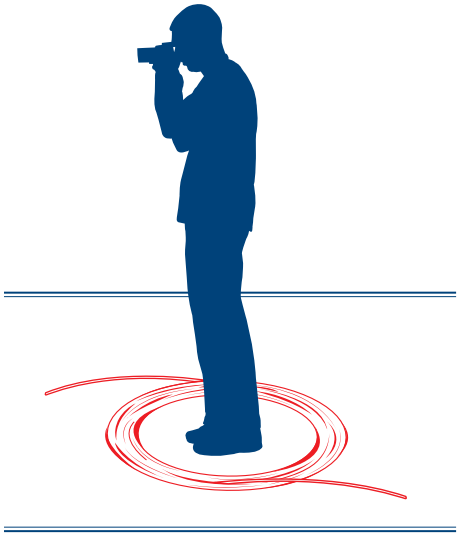
With small boats, portable ballast (people) can be moved around to balance out the boat. When first accelerating, move weight forward to help the bow climb the wake. Once up on a plane, move the weight aft to trim up the bow. If power trim is available, start with the trim down first, and when up on a plane, trim up to the optimum.

- CHAPTER 2 - SEAMANSHIP

2.1 SEAMANSHIP

2.1.1 LINE HANDLER

The line handler and operational positions will vary with the mission requirements but in general this person performs the functional duties required by the mission. The line handler will ready and prepare any lines or tackle required for the securing and mooring of the vessel or securing of gear on the vessel. The line handler will ready and prepare any lines or tackle required in the assistance of another vessel. The operational person will identify hazards on deck or related to the operations (e.g. “don’t stand in the bight!”).



GENERAL DUTIES AND RESPONSIBILITIES OF A LINE HANDLER

- Be responsible for crew and deck safety during line handling operations
- Verify the plan with the captain/coxswain
- Inspect all lines and equipment to be used for wear or damage prior to starting operations
- Secure the decks of all gear and lines for getting underway
- Coil and stow all line hanging or in lockers
- Secure lines
- Check the lead of line to make sure crew are clear of the bight and running gear
- Keep line clear of running gear, especially in the water (stern and propellers)
- Continuously report progress of line handling operations and the tension state of lines and any other dangers
- Ready and toss the heaving line

The only rope on a ship is the one that rings the bell. A rope becomes a line or halyard when it assumes a purpose on a vessel. The care and handling of lines is the primary skill of any mariner.

SUGGESTED COMMANDS AND SIGNALS FOR LINE HANDLER

- **Clear** – all crew are clear of lines, gear and machinery that is about to be engaged
- **Clear Forward Clear Aft** – all mooring lines are off the dock and the vessel is clear to proceed
- **Standby to** - get ready to perform a task
- **Let go** - stern, bow, spring or breast lines – untie the line and get it clear of the dock or vessel
- **Ready Lines** - stern, bow, spring or breast lines – untie and hold line with one wrap/ loop on the rail or cleat and stand by to let go
- **Ready Lines for** - port/starboard tie up – break out mooring lines and fenders and rig them for tying up on a designated side
- **Pass the line** – throw the line or hand it to its destination
- **Make fast** – tie up the line
- **Take a wrap** – to control the line without making it fast, wrap it once under the rail or on a cleat and pay out or take in slowly
- **Slack the line** – loosen the line
- **Pay out / surge the line** – feed more line out in a controlled manner

2.2 KNOTS AND LINES

2.2.1 CONSTRUCTION

NATURAL FIBRES

Natural fibres such as manila, sisal, hemp and cotton will shrink when they get wet and also tend to rot or become brittle. Manila is still used today on large ships and is the best natural fibre for mooring lines, anchor lines and as running rigging. Manila has little stretch and is very strong. However, it has only about one-half the strength of a comparable sized synthetic line.

Natural fibre line should be uncoiled from the inside of a new coil in order to prevent kinks. Always whip the ends of natural fibres to keep them from unraveling. When natural fibre lines have been in salt water you should rinse them in fresh water and allow them to dry thoroughly. They should then be properly coiled and stored on grates above deck in a dry, well-ventilated place to help prevent mildew and rot.

Natural fibre ropes should be maintained in a clean and dry state, as rot and mildew are their main causes of deterioration. They are, however, more resistant to heat than traditional synthetic fibre ropes; they do not burn quickly and their breakdown is slower. These lines are rarely used on rescue vessels.

SYNTHETIC FIBRES

Nylon

This synthetic fibre is stronger, more elastic and more durable than manila. However, when placed under excessive load, nylon will break without warning. It is expensive and does not float. Nylon is the best known and most used of the synthetic fibre used in ropes. It has high breaking strength wet or dry and a strong weather resistance. It is highly elastic and when under load can stretch up to 40%.

Nylon ropes are used for shock absorbing when used as mooring lines and are often used to secure fenders to permit stretch as the vessel moves up and down against the dock. Nylon ropes are light to handle and give the appearance of a smooth slippery surface. They have a high melting point (250°C) and are pliable in normal temperatures.

Polyesters

Initially known as Dacron© and Terylene©, polyesters are not as strong as nylon and have inferior stretch properties. Their abrasion and temperature resistance are similar to nylon. Polyesters are considered to be more resistant to acids, oils and organic solvents than their nylon counterparts. Their strength remains the same in wet or dry conditions. These characteristics make them ideal for most running rigging of sailboats. The disadvantage of polyester is very similar to that of nylon: it will not float. Its use should be kept to a minimum when working about bitts or warping drums. The melting point is between 230°C and 250°C.

Polypropylene

This synthetic line is light, flexible and falls between manila and nylon for strength. It's available in bright colours and will float. Floating line stays away from propellers, making it a good choice for a towline and recovery line. However, polypropylene is susceptible to UV damage and will deteriorate over time.

When you see a wet polypropylene rope steaming under tension, it is getting close to reaching the propropylene's melting point and breaking.

2.2.2 LAY AND WEAVE

Most line is made from three strands twisted together. The 'lay of the line' is the term used to describe the manner in which the line has been twisted. Some of the stronger and more expensive lines are braided together with inner and outer cores. One common line of this type is called Samson Braid.

2.2.3 KNOTS, BENDS AND HITCHES

Knots have many uses in the maritime world. However, not all knots are equal; some knots are better than others. This section lists various knots that meet the three important conditions for all good knots:

- Easy to tie
- Easy to undo
- Safe (if used as and where recommended)

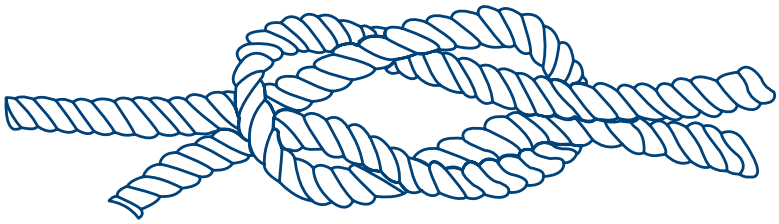
A crew member should understand that any fastening (i.e. knot) reduces the strength of a rope. Knots and bends reduce the rope strength by up to 50%, while hitches reduce it by 25%. Well-executed splices can be used to join ropes while retaining 80% or more of rope strength. Most knots in polyethylene or polypropylene monofilament ropes tend to slip. These knots must be “doubled-up” in order to hold, due to the waxy monofilament surfaces.

REEF KNOT

This knot is good for joining lines of the same thickness together.

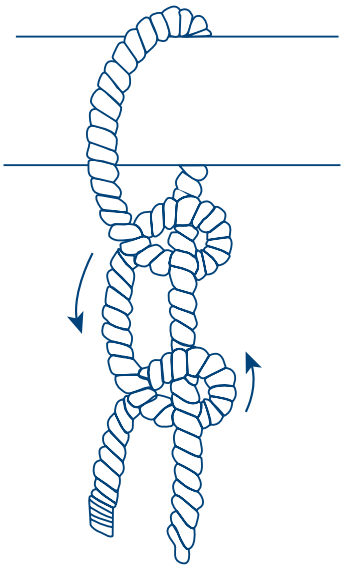
It can be easily undone. The reef knot is used to fasten two lines of equal size when no great load is anticipated. If used to connect lines of different sizes, it will slip and if used to join two towlines, the knot will jam under heavy stress and be extremely difficult to untie. The reef knot needs constant tension on both lines, for a sharp pull on one of the ends may cause the knot to fall into two half hitches and subsequently binding.

Never use the reef knot to join two lines when significant loads are anticipated. Never rely on this knot when life, limb or valuable property is involved. Severe injury or damage could result from misuse of this knot.



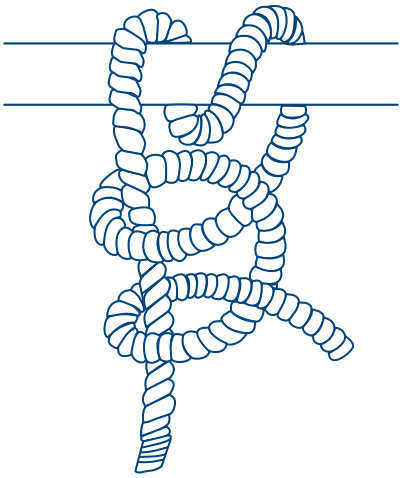
TWO HALF HITCHES

These can be useful to bend the end of a rope to a spar, stanchion, bollard, or ring. To reinforce or strengthen the single half hitch, two half hitches may be used.



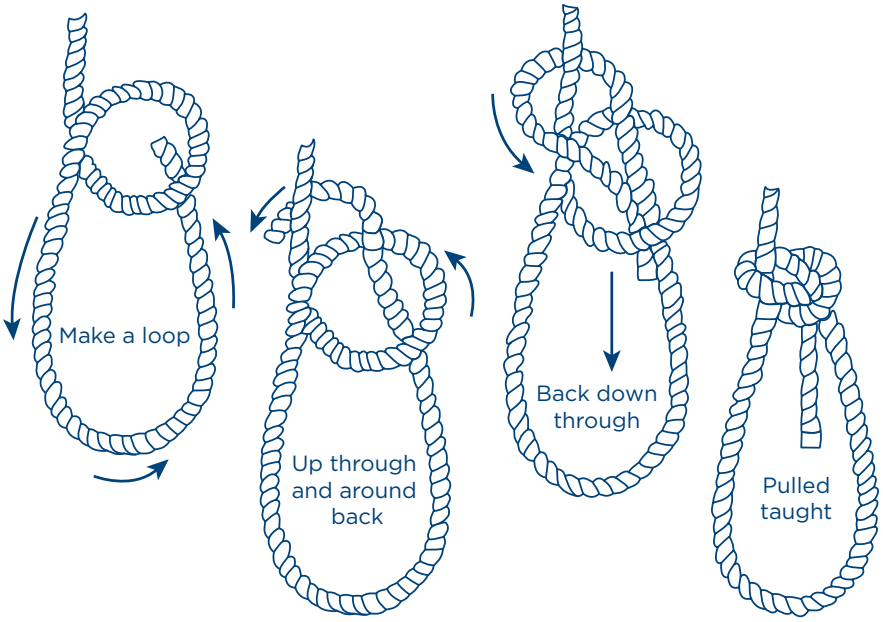
ROUND TURN AND TWO HALF HITCHES

The Round Turn and Two Half Hitches is a hitch used to secure the end of a rope to a fixed object and is often used in boating to permanently tie to a piling, mooring, column or ring.



BOWLINE

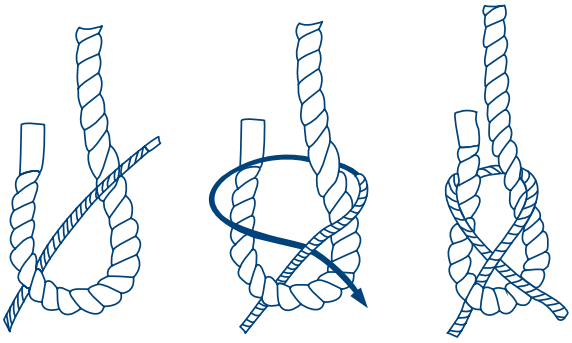
One of the most versatile knots, the bowline is good for forming loops in lines with the loop retaining its size. It is a knot that will never slip and rarely jams. The bowline is one of the most valuable knots for day-to-day use on a boat. It is relatively easy to untie after it has been under load. Two bowlines can safely join two towlines of equal or unequal size.



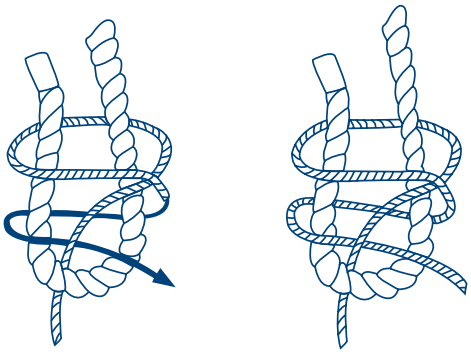
SHEET BEND

A single sheet bend, also known as a becket bend, is used to join lines of unequal thickness. The double sheet bend gives a more secure connection when unequal-sized lines are used, particularly when one line is considerably thicker than the other. This knot is ideal for joining lines together, even if they are of different sizes.

SHEET BEND

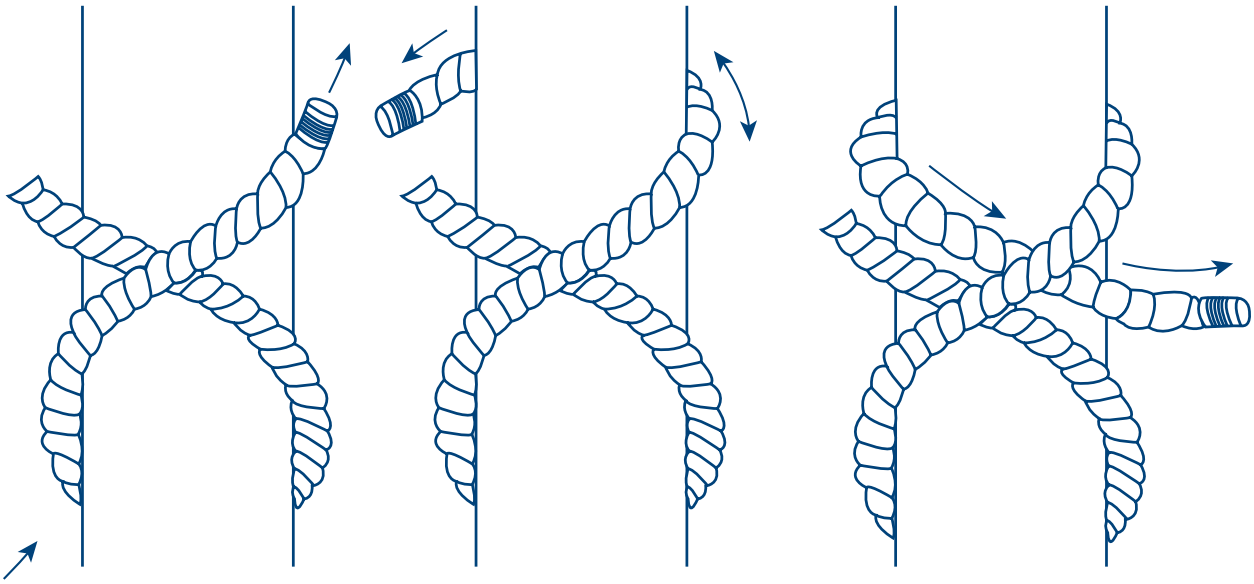


DOUBLE SHEET BEND



CLOVE HITCH

This knot is good for making a line fast to a spar or a smaller line fast to a larger rope. It will not slip because the second half hitch rides over the standing part of the rope. The clove hitch is a good choice to use when temporarily securing a line to another rope, a railing, a spar or similar object. It can work loose and should not be left unattended. Under heavy load, it can jam tightly. It can be made more secure with half hitches.



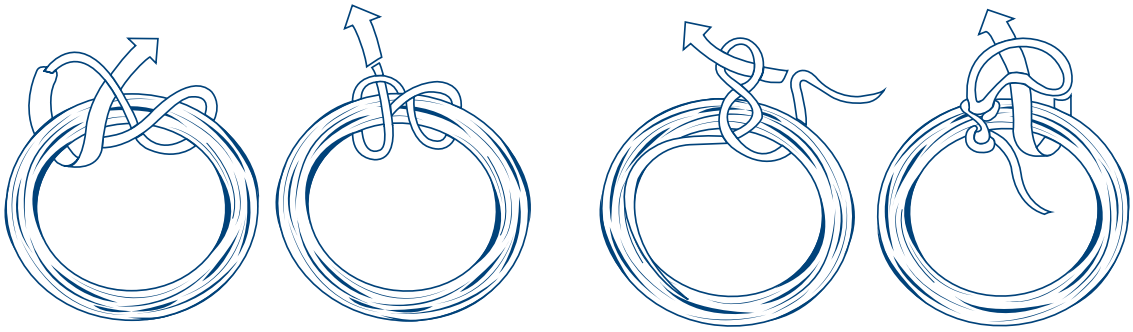
2.3 COILING AND STOWING

Lines can become a pile of spaghetti very easily, unless time is taken to handle them correctly. To avoid kinks, twisted ropes should be coiled in a clockwise direction (or in the direction of the lay of the rope) and uncoiled in a counter-clockwise direction. Another method is to flake out the line figure-eight fashion. This method avoids putting twists in the line in either direction and minimizes the risk of kinking. Braided ropes have no inherent twists and are thus far more resistant to kinking. Even if kinks develop, they cannot develop into knuckles. The best way to prepare braided ropes for deck stowage is with the figure eight method. The rope can be flaked either flat on the deck or figure-eight style, vertically around bulkhead cleats. Hand coiling should be avoided since it will put turns in the rope that are likely to develop into kinks during paying out.

TO COIL A 3 STRAND LINE FROM A SECURED END:

- Start at the cleat, with the line in your left hand
- Make smooth, even sweeps with your right hand, and lay the coils (approximately 2 ft. / 0.61 m in diameter) one at a time, into your left hand
- If the line is twisted or crossed, spin the line with your thumb to twist the kinks out of it

- Always start from the secured end, or it will end up with twists and kinks
- When stowing lines, make sure the space is flat and even
- When line is coiled, there are two methods used to secure them, see diagrams*



2.4 GENERAL PRECAUTIONS FOR WORKING WITH LINES

- All rope should be kept dry and clean and away from chemicals, acids, alkali, drying oil, and paint to avoid damage and strength reductions
- Never overload a rope
- A frozen rope should be allowed to thaw and dry before re-use
- A rope should never be dragged over the ground or over sharp objects
- Avoid abrupt bends if possible, as they weaken rope strength considerably. Pad all sharp corners
- Synthetic ropes can be slippery when wet or new
- Store lines in a dry cool place with good ventilation
- Hang them in loose coils well above the floor or deck
- Dry and clean wet lines before storing. Allow them to dry naturally, as too much heat will make the fibres brittle
- Keep lines away from all sources of heat
- Lines should be kept out of direct sunlight, when not in use
- Be sure to seal any tail ends of strands by whipping
- Artificial fibre ropes can have the cut ends melted, and a heat shrink sleeve shrunk on to the end. Do not use tape for that purpose

2.5 LINE INSPECTION

Lines should be checked regularly. The main points to check are external wear and cutting, internal wear between the strands and deterioration of the fibres:

- Check the entire length of the line for breaks on the outside fibres, cuts, burns, signs of abrasion, unlaying and reduction in diameter; each represents a loss of strength
- Untwist the strands carefully to observe internal condition of the line. It should be bright and clean. Excessive wear of interior fibres is often indicated by the accumulation of a powder-like dust
- Pull out a couple of long fibres from the end of the line and try to break them. If they break easily, replace the line
- If a line is found unfit for use, it should be destroyed or cut into short lengths
- If there is any doubt as to whether or not a line is fit for use, replace it immediately

2.6 DECK SAFETY AND LINES UNDER LOAD

Lines and wires are of paramount importance in SAR operations. No matter what kind of rescue, in the vast majority of cases lines will be used at some point in the process. When a line is bearing weight (or is tight), it is said to be “under load”. When handled carelessly, loaded lines can kill in the blink of an eye.

Lines or wires that part (break) under strain can kill or injure crew members nearby. Especially with artificial fibre ropes, as the line parts, the line will immediately return to its unstretched length, causing it to lash back at high speed. Anyone caught in the path may not survive the experience.

2.6.1 KNOW THE SIGNS OF OVERLOAD

When a line or wire is overloaded it will give off warning signs such as:

- Groaning, creaking and popping sounds
- Rotating and stretching
- Shrinking in diameter
- Losing its natural shape
- Strands breaking and peeling
- A steel wire may bleed out the lubrication from the hemp core
- Steam rising from rope

If a line is suspected of being overloaded then immediate action should be taken. Take the load off of the line by communicating with the helmsman to ease the throttle or manoeuvre the vessel to relieve strain, slacking or surging the line.

Do not wear gloves or mitts when working with lines. When undoing a line under load, keep your fingers clear of the cleat. When the line comes free it can run quickly, pulling a hand into the cleat or guide. Never stand directly behind a line under load. If it breaks it will whip back and could injure anyone standing in the opposite direction of the load.

If a line is showing more than one of the sign of trouble, shout a warning and get clear.

DO NOT try to approach the line to slacken it yourself.

2.6.2 NEVER STAND IN THE BIGHT

The bight is the loop of a line lying on the deck. If a foot is in the loop when the line tightens, the foot could easily be cut off or you could be pulled over the side. A bight may not be apparent where the working area is large and where the line may quickly straighten in the event of a cleat, guide or block breaking.

2.6.3 WATCH YOUR HEAD

Never stand under a load, or in areas where overhead equipment may swing and cause serious injury.

Always wear a hard-hat, steel toed boots and a PFD when working with overhead loads on board a vessel or at dockside.

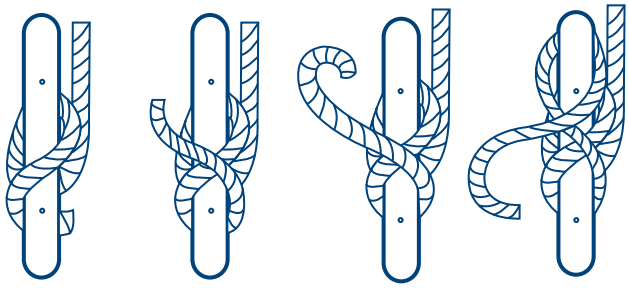
2.7 MOORING AND SECURING THE VESSEL

A small boat can have as few as two and as many as eight mooring lines, depending on the weight of the vessel, weather conditions, location and length of stay. If the vessel has a permanent mooring, the lines may be left on the dock to be picked up when returning.

The order by which the boat's lines are to be secured or let go will depend on the preference of the helmsman. He/she may want to use the forward spring to swing the stern out, or the after spring to swing the bow out. The bow line is generally the first on and last off. When tying up at someone else's dock, use slip lines on the bow and stern for ease of control. There are many variations to mooring a small boat. The method will depend on the moorings at the dock or facility.

2.7.1 CLEAT

The cleat is the most common fitting found on recreational craft. Take a complete round turn around the base of the cleat and lead the line around the horn to form a figure eight. Avoid locking tucks when turning up a cleat, as if it comes under load it will be difficult to undo in a hurry.



THROWING A LINE

Preparing it:

1. Split the lines into two coils: a throwing coil and a following coil.
2. The throwing coil should be a small, light coil approximately the diameter of a basketball. The throwing end should hang about 15-25 cm below the coil.

Throwing it:

1. With the line in front of you, place the throwing coil in your hand and the following coil in the other hand.
2. Wait until everyone is ready.
3. Check behind you to see if you have enough space to swing.
4. Keep your eyes on your target and throw directly at it.
5. Swing your throwing arm around (outstretched, like a discus thrower) and let the following coil fly out of your other hand.

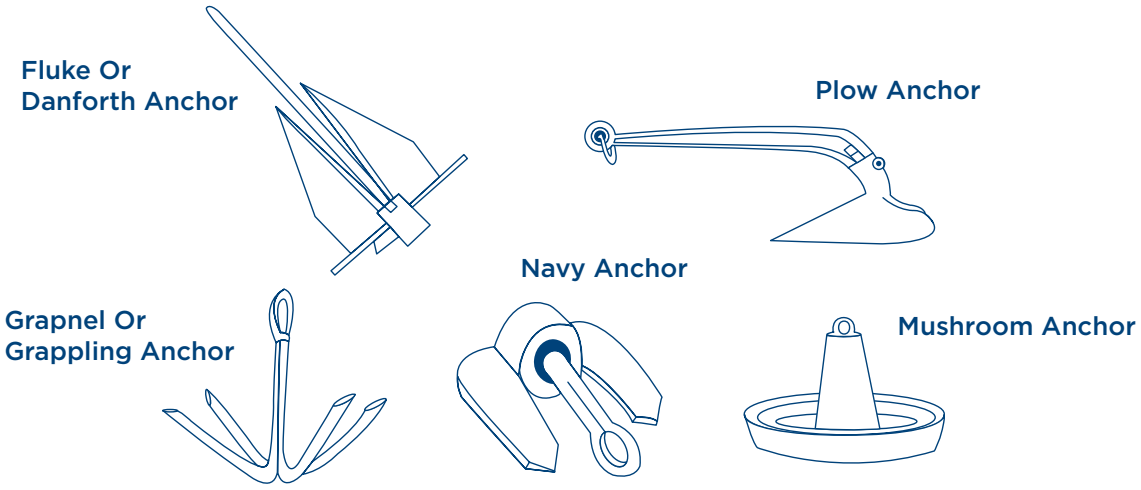
2.8 ANCHORING

Small open boats usually use their anchors for a short rest, or to wait out weather or fog. If severe weather threatens, or if you lose power and find yourself drifting into danger, you'll want an anchor that will do the job – grab the bottom and hold on. Many people believe that anchors can hold by their weight alone. Anchors actually hold by digging into the bottom, and therefore the type of anchor used will depend on the type of bottom.

2.8.1 TYPES OF ANCHORS

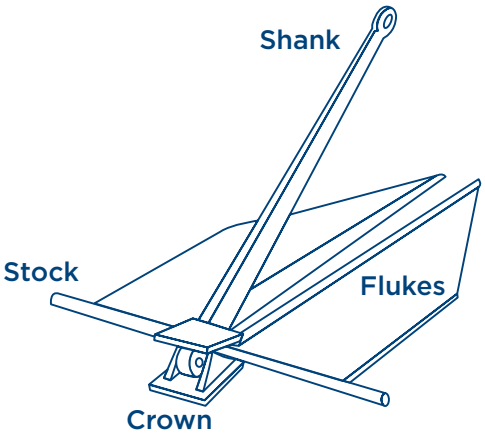
There are different types of anchors with specific advantages for each type. The type of anchor and size (weight) of anchor a boat uses depends upon the size of the boat. It is advisable for each boat to carry at least two anchors. The rope or chain that attaches the anchor to the vessel is called the anchor rode.

- Fluke or Danforth – this type of anchor has excellent holding power, and it takes up little storage space
- Plow – plow anchors have excellent holding power, plowing deeper under heavy strain. They're a favorite yacht anchor
- Grapnel or grappling – capable of holding onto rocks where standard anchors drag. It's also useful for retrieving objects lost overboard
- Navy anchor- strong and dependable, although it's heavier at a given holding power than a Danforth
- Mushroom anchor- low in price and adequate for small boats. Not for anchoring out in strong winds and waves



2.8.2 MAIN PARTS OF A TYPICAL ANCHOR

1. **Shank:** Aids in setting and weighing the anchor. Attachment point for the anchor line.
2. **Flukes:** Dig in the bottom and bury the anchor, providing holding power.
3. **Crown:** Lifts the rear of the flukes, and forces the flukes into the bottom.
4. **Stock:** Prevents the anchor from rolling or rotating.



2.8.3 ANCHOR FITTINGS

There are various methods for securing the rode to the anchor ring. With fibre line, the preferred practice is to work an eye splice around a thimble and use a shackle to join the thimble and ring.

1. Screw Pin Shackle – Bends the length of chafing chain to the shank of the anchor.
2. Swivel – Attaches the chafing chain to the detachable link. Allows the line to spin freely.
3. Thimble – Protects the anchor line from chafing at the connection point. Use synthetic line thimbles for lines 7 cm in circumference (2 cm diameter) and larger. The Eye Splice is used around a thimble to connect it to a ring on the anchor by a shackle.
4. Chafing Chain – Tends to lower the angle of pull of the anchor and assists in preventing chafing of the anchor line on the bottom. The minimum recommended length of chain should be equal to the boat length.

2.8.4 SETTING THE ANCHOR

Choose your anchorage carefully. Consider the shelter that your location offers, whether it's a well-holding bottom, and the proximity of other boats. Remember that boats of different sizes may swing to a different scope than yours, so it's important to give other boats as wide a berth as possible.

STEPS FOR ANCHORING

1. Fasten the inboard end of the anchor line to a secure point on the vessel, and securely fasten the outboard end of the anchor line to the anchor.
2. Approach the selected spot slowly, and put the vessel in reverse when over the desired location.
3. When the boat begins to gather sternway, lower the anchor to the bottom, and gradually pay out the rode.
4. Take a turn around the bit, snugging up the line, causing the anchor to "bite", then pay out the rest of the rode to the appropriate scope. If there is any doubt, prove the anchor's holding by backing against the rode using reverse power.
5. Finally, check the set of the anchor by choosing 2 objects abeam, which form a range. Periodically check your position in relation to them. Any change in their bearings means that you should try again.

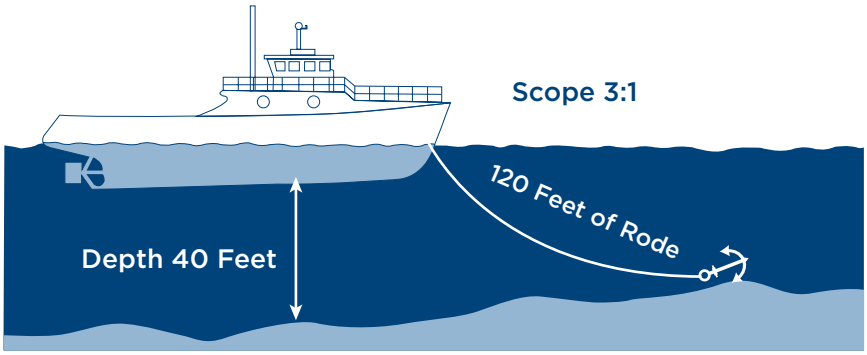
2.8.5 SCOPE

Scope length is the length of rode required for anchoring, which depends on the depth of the water.

The ratio of the length of rode to the vertical distance from the chock to the bottom is called the scope.

Scope length depends on the type of rode you are using, the weather, and bottom conditions. A scope of 7:1 is ideal in most conditions. For temporary fairweather anchoring a 3:1 ratio will suffice.

To ensure an effective hold, the angle of pull should be kept as close to horizontal as possible. Heavy weather will demand greater scope.



2.8.6 WEIGHING ANCHOR

When ready to weigh anchor and get underway under power, the vessel goes slowly ahead while the anchor rode is taken in to prevent fouling the propellers. Have the person on the bow lifting the anchor indicate to the helmsman which direction the rode is leading, so the helmsman can steer in that direction and take the weight off the rode. When the boat approaches the spot directly over the anchor, and the rode is tending straight up and down, the anchor will usually free itself from the bottom.

2.8.7 CLEARING A FOULED ANCHOR

If the anchor refuses to break free, snub the anchor line around the forward bitt or cleat and advance the boat a few feet. Sometimes even this will not free the anchor, and the operator should run in a wide circle, slowly, to change the angle of pull. Take extreme care to ensure the anchor line does not tangle in the propellers during this operation.

Another way to break out an anchor is with a “trip line,” if one was rigged during anchoring. A “trip line” is a line strong enough to stand the pull of a snagged anchor. Attach the “trip line” to the crown of the anchor (some anchors have a hole for this purpose). The “trip line” should be long enough to reach the surface in normal anchoring waters, with allowance for tidal changes. Pass the “trip line” through a float and end the line in a small eye-splice that can be caught with a boat hook. If the anchor doesn’t trip in the normal manner, pick up the trip line and haul the anchor up crown first.

ON WATER & PRACTICAL COMPETENCIES

SEAMANSHIP – LINES & SAFETY AROUND LINES			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the knowledge and demonstrate safe working skills around lines. All skills must be demonstrated at minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Identify the lines on board the vessel and the strengths and weaknesses of each		
	Demonstrate the inspection of the lines for excessive wear and signs of damage		
	Identify and demonstrate the inspection line devices on the vessel IE: Bridle, Sampson Post, Tow Hook, Cleats, Etc		
	Demonstrate proper line care, coiling and stowage of all lines		
	Demonstrate the coiling of lines		
	Demonstrate continual safety around lines		

SEAMANSHIP - KNOTS

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the following knots a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Bowline		
	Round Turn two half hitches		
	Clove Hitch		
	Reef knot		
	Sheet Bend		
	Figure Eight		

SEAMANSHIP – HEAVING LINE/THROWING LINE/THROW BAG

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully prepare and throw a leaving line and attach a heaving line onto a larger line using the appropriate knot a minimum of once and throw a throw bag successfully **three** times.	The student must accomplish the following tasks a minimum of once and successfully throw a throw bag **three** times: Prepare a heaving line		
	Throw a heaving line		
	Attach a heaving line to a larger line using the appropriate knot (Sheet Bend)		

SEAMANSHIP - MOORING

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully identify and demonstrate the proper mooring of a vessel to a dock or floating dock a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Identify the following lines: bow line, stern line, forward spring line, breast line, after spring line		
	Demonstrate the mooring of a vessel using a: bow line, stern line, forward spring line, breast line, after spring line		
	Demonstrate the proper use of a deck/dock cleat and deck/dock ring to secure the vessel (if applicable)		
	Demonstrate the proper use of a bollard to secure the vessel (if applicable)		

SEAMANSHIP - ANCHORING

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate anchoring the vessel in the listed roles a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Demonstrate setting up the anchor		
	Setting anchor in the water and secure it		
	Manoeuvring the vessel		
	Retrieving the anchor		
	Stowing the anchor		

- CHAPTER 3 -
STABILITY

3.1 STABILITY

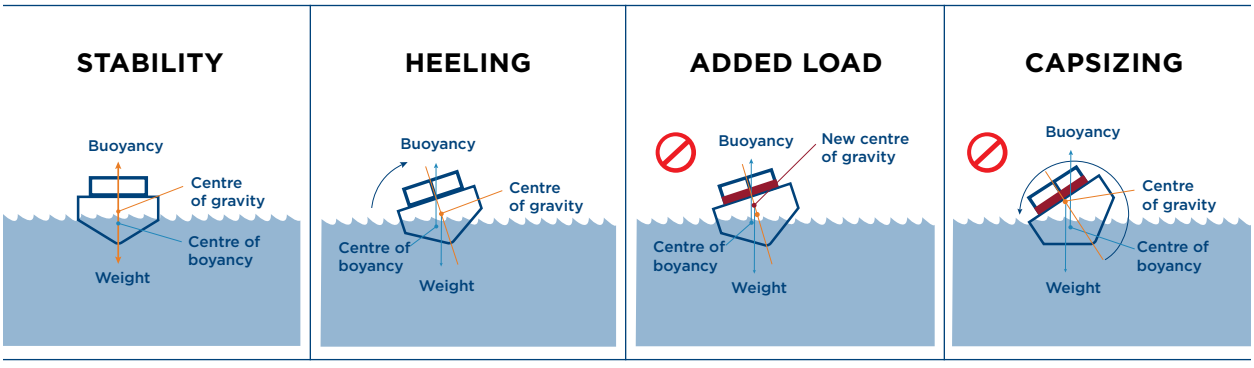
Stability refers to a vessel's ability to resist capsizing by returning to an upright position after being heeled over (tilted to one side due to wind or sea conditions). Many forces affect vessel stability and each type of vessel reacts differently to heeling forces. The owner is responsible for ensuring that the vessel has adequate stability to safely carry out its intended operations. As a result, each vessel operator needs to know how the vessel with its load interacts with outside forces of nature and what affects its stability. For example, open boats and vessels with large well decks may tend to ship water and/or downflood (when water enters the hull from above deck or over the gunwale), making them less stable.

Vessels built or converted to non-pleasure use on or after April 1, 2005, must comply with the stability requirements of section 717 of the Small Vessel Regulations. For information on how to assess the stability of a vessel built or converted to non-pleasure use before April 1, 2005, refer to Ship Safety Bulletin 07/2006: Guidance for Assessing Intact Stability and Buoyancy of Existing Small Non-pleasure Vessels.

A properly designed and loaded vessel should resist heeling forces when operated within its design limitations.

Adding weight above a boat's centre of gravity will raise the centre of gravity and decrease stability. As the centre of gravity is raised, less heel is required to capsize the vessel. Removing weight from below the centre of gravity may also make the vessel less stable.

The best way to prevent a boat from capsizing is to operate a well designed, maintained and loaded vessel with an experienced crew. Preventing unstable vessel conditions and being able to recognize the warning signs when such conditions do occur can save lives. Be on constant watch for loss of stability. Consult a marine professional to determine the impact on stability of modifications you are thinking of doing before you go ahead.



3.1.1 PRECAUTIONS

Of all accident types, founders and capsizes caused by a loss of stability are the most likely to lead to death on the water. Many of these accidents can be avoided.

A well-designed vessel will resist capsizing or foundering in severe conditions if it is operated properly. Keep these rules in mind:

- Be aware of outside forces: wind, waves and water depth. Always check the weather forecast before setting out and avoid rough weather conditions
- Don't overload your vessel. Be aware of the amount of weight added to your vessel and available freeboard. Place people and cargo evenly
- Make sure that all cargo, tools and equipment are well secured during the entire voyage. It is a lot safer and simpler to remove well-prepared lashings after a successful voyage, than to try to add lashings in poor weather while a vessel is rolling and pitching. Store cargo below deck if you can
- Reduce both the amount of liquids/cargo that are able to move and the area in which they can slosh back and forth by using smaller tanks and by subdividing cargo holds, because partly-filled water and fuel tanks and cargo holds can make your vessel unstable
- Prevent water from getting into your vessel by keeping hatches, doors and windows closed, as much as you can, when underway. Regular maintenance of seals and fastening devices will help to ensure watertightness
- Remove water as quickly as possible. Scuppers and drains must meet design standards and be kept in good working order
- Do not perform operations such as lifting or towing unless the stability of your vessel has been assessed under these conditions
- Adjust course, speed, or both if you can, to reduce the vessel's rolling motion
- Avoid sharp turns or turns at high speed
- Consult a marine professional before making changes, because modifications to your vessel may affect its stability. Have the stability information revised to reflect any changes you make to the vessel

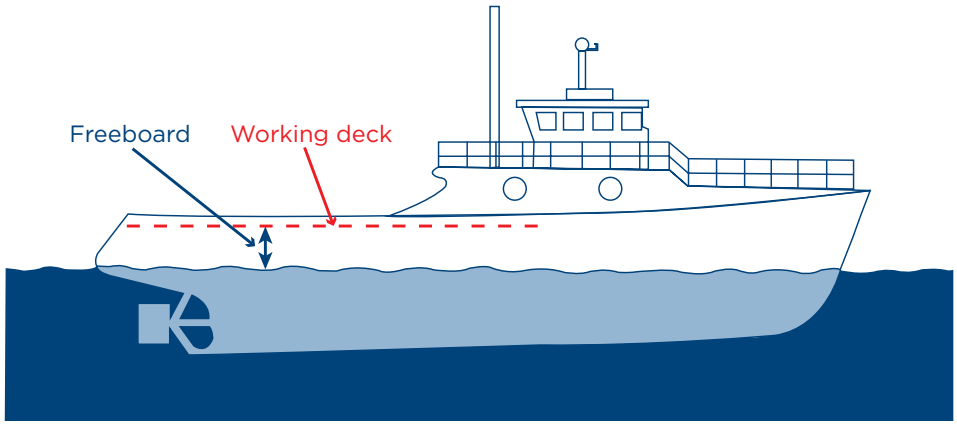
3.1.2 WARNING SIGNS OF INSTABILITY

- The vessel's handling changes. For example, it seems sluggish, rolls more or rolls more slowly
- The vessel is listing to port or starboard or is trimmed more than usual by the bow or stern
- There is less freeboard than would be expected normally. If so, check tanks and holds for flooding or cargo shift
- The bilge pumps are working more frequently than usual. If this happens, check the bilges for water and that bilge pumps and alarms are working properly
- The bilge alarm is sounding

3.2 FREEBOARD

Freeboard is the distance between the water and the watertight deck of your vessel, or the gunwale (upper edge of the hull) if it's an open boat without scuppers. If the deck edge goes under water when the vessel heels, its stability will decrease rapidly and the danger of capsizing will increase. If the gunwale of an open boat is going under water, there is an imminent risk of capsizing. An overloaded vessel's freeboard will be smaller and the deck edge or gunwale may go under water with even a slight heel.

You need a safe freeboard height, so take care not to overload your vessel.



3.3 FREE SURFACE EFFECT

When a vessel with a full tank heels over, the tank's centre of gravity does not change, so the vessel's stability is not affected. Water on deck, liquids in holds and partly filled tanks and bilge water, however, will shift with the movement of the boat. When this happens, the centre of gravity will also shift, making the vessel less stable. This "free surface effect" reduces stability and increases the danger of capsizing.

To test the "free surface effect" in your own home, fill a glass of water and walk across the kitchen. You should have no trouble doing so without spilling any water. Next, pour the same amount of water into a cookie sheet and carry it across the kitchen. It's harder to keep the water in or on the cookie sheet. That's because the large free surface allows the water to slosh over a greater surface.

It is good practice to reduce free surface effect by dividing tanks with baffles and fluid cargo holds with bulkheads and by having as few partly filled tanks and holds as you can.

FRESH WATER ALLOWANCE

Salt water is denser than fresh water.

When leaving the sea and entering fresh water, freeboard will be reduced and draft will increase. Ensure to allow for enough freeboard when making this type of transition from water type to another.

3.4 VESSEL LOADING

When loading a small boat with cargo and/or passengers, it is important to follow some simple rules, and trim the boat properly, using the weight on board or a power trim system.

VESSEL LOADING CHECKLIST

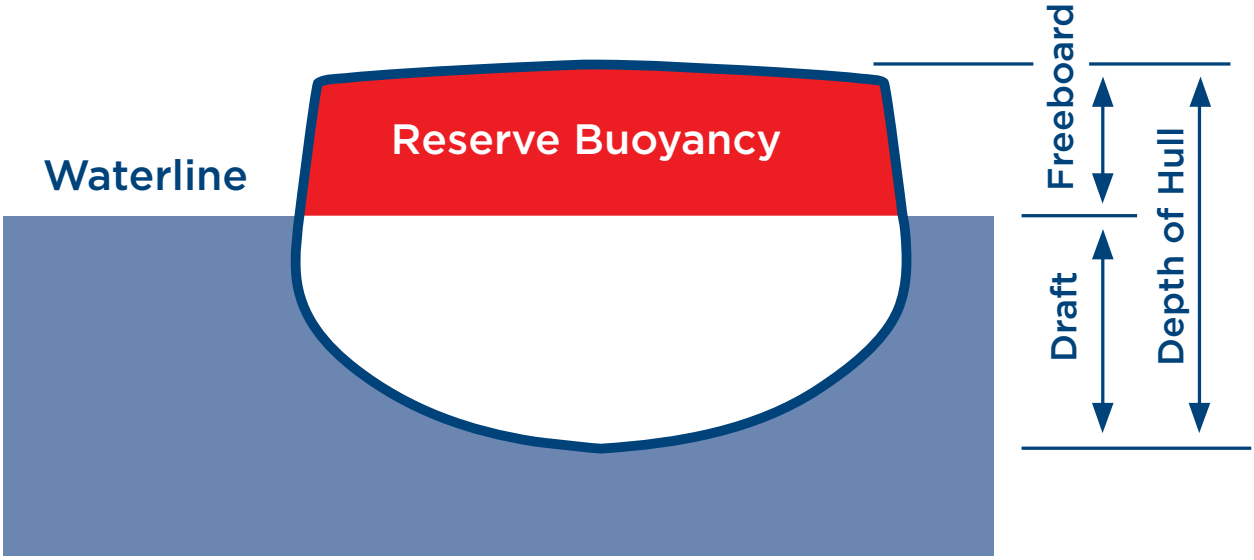
1. Do not exceed the maximum number of people or the recommended gross weight that appears on the capacity plate.
2. Position the people and gear to enable the even distribution of the weight forward and aft.
3. Load from the middle and work out evenly (first one side and then the other) Keep load as low as possible.
4. Lash or stow the gear in lockers to prevent its uncontrolled movement.

RESERVE BUOYANCY

The volume of air trapped in a watertight space above the waterline.

The term reserve buoyancy is used to describe the unused buoyancy in a vessel. This is the buoyancy that will rescue a vessel in the event of circumstances that would, without reserve buoyancy, result in either in capsize or sinking.

It is essential to the seaworthiness of a vessel to retain a substantial amount of reserve buoyancy. Some vessels can take more than their own weight in flooding water aboard without sinking due to reserve buoyancy.



ON WATER & PRACTICAL COMPETENCIES

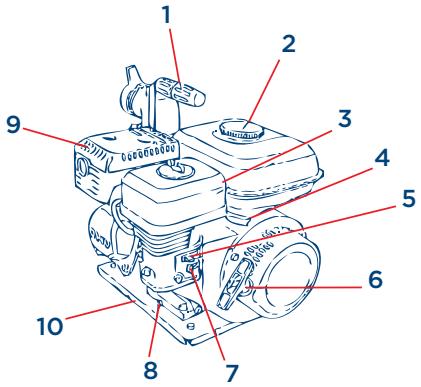
SEAMANSHIP - VESSEL WATERTIGHT INTEGRITY AND STABILITY			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the knowledge and tasks related to vessel integrity, stability and watertight integrity a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Identify the bilge pump or dewatering system on the vessel and operate if required.		
	Demonstrate the inspection of all hatches and doors that are required for watertight integrity of the vessel		
	Identify and demonstrate proper stowage of equipment on the vessel and secure all equipment as necessary on the vessel		
	Identify the need for proper placement of equipment on the vessel and the need to maintain proper weight distribution and how this relates to load distribution and trim		
	Demonstrate the proper loading and unloading of equipment, passengers, cargo on the vessel		
	Understand the hazards of loose water or equipment on the deck of the vessel		
	Understand the importance and hazards during icing conditions (if applicable)		

- CHAPTER 4 - DEWATERING

4.1 USING A DEWATERING PUMP

The dewatering pump is important equipment when it comes to SAR vessels. The pump is not as readily available or as quickly deployed as the fire extinguisher but this pump may save your vessel and many other vessels if practiced at using it.

The vessel master must assess a fire situation on the SRU relative to the crew's ability to cope with it.



1. Carrying Handle
2. Fuel Tank Cap
3. Air Cleaner
4. Throttle Lever
5. Choke Lever
6. Starter Cord (Handle)
7. Fuel Valve
8. Oil Drain Plug
9. Muffler
10. Base Plate

NOTE: WE DO NOT FIGHT FIRES; THE PUMP MAY BE USED TO EVACUATE PERSONS FROM A VESSEL ON FIRE. FIRE FIGHTING IS NOT A FUNCTION OF THE CCGA.

4.1.1 WATER

Water is always in plentiful supply in the marine environment. While water is found in portable extinguishers, it is more likely to be applied from buckets or pumps. Water is most effective when used under pressure, in the form of fog. Water applied by bucket or by hose can be used effectively to extinguish burning wood, upholstery, bedding and other combustible solids, excluding fibreglass.

4.1.2 WHEN USING WATER TO EXTINGUISH A FIRE ABOARD A VESSEL, YOU MUST KEEP THE FOLLOWING IN MIND:

- Sporadic dousing by bucket will not be effective against major fires
- Water directed in stream at fuel fires can splash the burning fuel to areas that are not on fire yet
- Water will turn into steam when placed on a fire, thus further hampering visibility already obscured by smoke
- Large quantities of water used to fight a fire may affect the stability of the vessel, and thus dictate limited use

4.2 STEPS FOR USING A DEWATERING PUMP

Maintain and test the pump regularly. It will then start and run when needed the most.

Set up

- Place in a spot where the exhaust is clear of flammables
- Get suction hose and fire hose ready
- Check fuel

Start

- Turn on power
- Adjust choke
- Open fuel line
- Set throttle to 3/4
- Open chamber lid
- If not a self-priming pump, prime chamber (pour water into chamber or fill hose)
- Attach suction hose
- Put suction hose over the side
- Ready output end (control hose nozzle)
- Pull start cable

Operating

- Surge the suction hose to help with prime
- Ease choke until pump runs smoothly
- Adjust throttle to full
- Monitor suction
- Check that exhaust is clear from objects
- Control water flow with nozzle

ON WATER & PRACTICAL COMPETENCIES

CARE & INSPECTION OF DEWATERING PUMP			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand the importance of the dewatering pump, demonstrate the care and inspection of the dewatering pump, and setup the dewatering pump. The students must accomplish the tasks a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Inspection of dewatering pump – oil Reservoir/gauge		
	Inspection of fuel system and turn fuel “on”		
	Inspection of hoses (intake and output)		
	Inspection of couplers on hoses – connect hoses to pump		
	Prime pump (If applicable)		
	Start dewatering pump with use of “choke” and throttle		
	Shut down the pump and stow in safe location with fuel turned “off”		
	Knowledge of the operating manual for the dewatering pump onboard the vessel		

- CHAPTER 5 -
BASIC NAVIGATION

5.1 BASIC NAVIGATION

Charts are the boater's equivalent of a road map. They provide much more information and are more vital to a boater's safety than a road map is to a motorist.

5.1.1 THE MAGNETIC COMPASS

The magnetic compass is used to conduct a boat's direction. Since a compass is very useful when it comes to navigating with charts, it is normal that we begin with this topic. The boater should know its principles of operation and always remember that it seeks Magnetic North, not True North.

A magnetic compass has primary magnets that are located on the underside of the compass card. These serve to assist the compass in seeking Magnetic North.

Secondary magnets are sometimes located in the base of the binnacle of large vessels with a steering station. These can be sometimes adjusted and serve to reduce error between magnetic heading and compass heading. Fluid is used in the compass bowl to dampen vibration and oscillation of the card and expansion bellows are located in the lower section of the fluid container to allow for changes in the volume of fluid due to expansion and contraction as the temperature changes.

5.1.2 DEVIATION

Ferrous materials or electronic gear aboard a boat can set up magnetic fields that will affect the magnetic compass. The effect is to deflect the compass from Magnetic North. The error so produced is known as deviation and is the angle, in degrees, between Magnetic North and Compass North. The error is always either east or west and will change with the boat's heading.

FINDING DEVIATION

There are a number of ways to find deviation. One of the simplest is to use a fixed navigational range and a pelorus. A pelorus is a fixed compass card on which bearings relative to a ship's heading are taken. First, determine the magnetic direction of the range. Then run across this range with the boat on compass headings 15° apart. Each time the range is crossed note the compass bearing of the range by sighting with the pelorus. The difference, in degrees, between the compass bearing of the range as observed by the pelorus and the magnetic bearing of the range from the chart is the deviation for that compass heading of the boat. Remember that deviation will vary with the heading of the boat.

5.1.3 ANATOMY OF A CHART

Much information is given in the Title Block and elsewhere around the border of a chart. The Title Block will name the country, the province and the area covered by the chart. You will also be able to find out if a chart is metric or not, by looking at the Title Block.

The edition number and date appear in the margin of the chart in the lower left-hand corner. Immediately following these figures will be the date of the latest revised printing.

A nautical chart can convey much or little to its user, depending on the user's ability to read the chart. A great amount of information must be shown on a chart for safe navigation. In many areas there is little room on the chart to get it all in. Thus, extensive use is made of symbols and abbreviations.

Elsewhere on the chart, wherever space is available, information will be found such as the meanings of special abbreviations used only on that chart; special notes of caution regarding dangers; references to anchorage areas; and other useful bits of information. All notes on a chart should be read until well understood as they may cover important information that cannot be illustrated graphically.

To make chart reading easier, quicker and more accurate, the various Canadian agencies that produce nautical charts have adopted a standardized system of abbreviations and symbols. It is essential that boat coxswains and crew members have the ability to read and understand their charts rapidly and accurately. Knowledge of the symbols and abbreviations is a must in order to develop this ability. The meaning of all these symbols is given in the Chart No. l (a document published by the Canadian Hydrographic Service that can be found where charts are sold).

SCALE

The scale of charts is commonly stated as a ratio, e.g., 1:100,000 or 1:25,000. A scale stated as 1:100,000 means that one unit of length on the chart represents 100,000 units of length on the surface of the earth. Ratios can be thought of as fractions. That is 1:100,000 can be thought of a 1 over 100,000 or one hundred thousandth. It is easy to see then that 1:100,000 is a smaller scale than 1:25,000.

The smaller the scale of the chart the greater the geographic area that can be shown on a given size chart paper. It is common to use a small scale for charts of large areas showing only major features with little detail. As the scale becomes larger the area covered on the same sheet must decrease but the detail shown can increase. Therefore, charts where much detail is desired such as charts of harbor approaches and facilities will commonly be to scales such as 1:25,000 or 1:12,000 or larger.

PROJECTION

A chart is a pictorial representation of a portion of the surface of the earth. As the earth is a sphere, some distortion occurs when the curved surface is applied to the flat surface of a chart. Various methods of projecting the curved surface on to the flat have been developed in order to minimize distortion of scale. Canadian pleasure boaters will mostly encounter charts produced on the Mercator Projection. Canadian policy now requires that nautical charts be produced using the Mercator Projection in the Metric System.

DATUM

Datum is a reference level from which depths and heights shown on a chart are measured. In coastal waters where there are tides, two datum references will be given. As an example, chart T3450, which covers the Strait of Georgia (between Vancouver Island and the main-land of British Columbia) shows datum for soundings reduced to lowest normal tides and datum for heights based on higher high water and large tides.

On inland waters, where there is no tide, one datum level is used for both soundings and heights. On Lake Ontario charts the Title Block states that datum is when the gauging station at Kingston, Ontario, reads 74.0 m (242.8 ft.).

The Title Block shows whether depths are measured in fathoms, feet or metres and heights in feet or metres. A scale bar at the bottom of the chart is provided to facilitate conversion of the different units.

COMPASS ROSE

Every chart has at least one compass rose overprinted on it. The outer ring of the rose shows true direction. The inner ring of the rose shows magnetic direction. The angle, in degrees, between the True North and the Magnetic North is known as variation and is noted on the rose with its annual rate of change.

VARIATION

Variation is the error in compass reading due to the geographic and magnetic poles not being in the same place. This error is the angle between True North and Magnetic North as shown on the compass rose on the chart. Variation is dependent upon geographic location and is stated as being either east or west. Since the magnetic pole is constantly shifting, variation in any locality will change over time. The rate of change is shown on the compass rose and variation should be corrected for the current year before being applied to any navigational plot. Variation is independent of the boat's heading.

LATITUDE AND LONGITUDE

On a chart, locations are usually determined through the use of a grid system using latitude and longitude. Latitude is measured along the right and left (corresponding to east and west) margins of the chart. Longitude is measured along the top and bottom (corresponding to north and south) margins of the chart.

The scale used may appear in degrees (°), minutes (‘), and seconds (“); written as 43° 36’ 18”

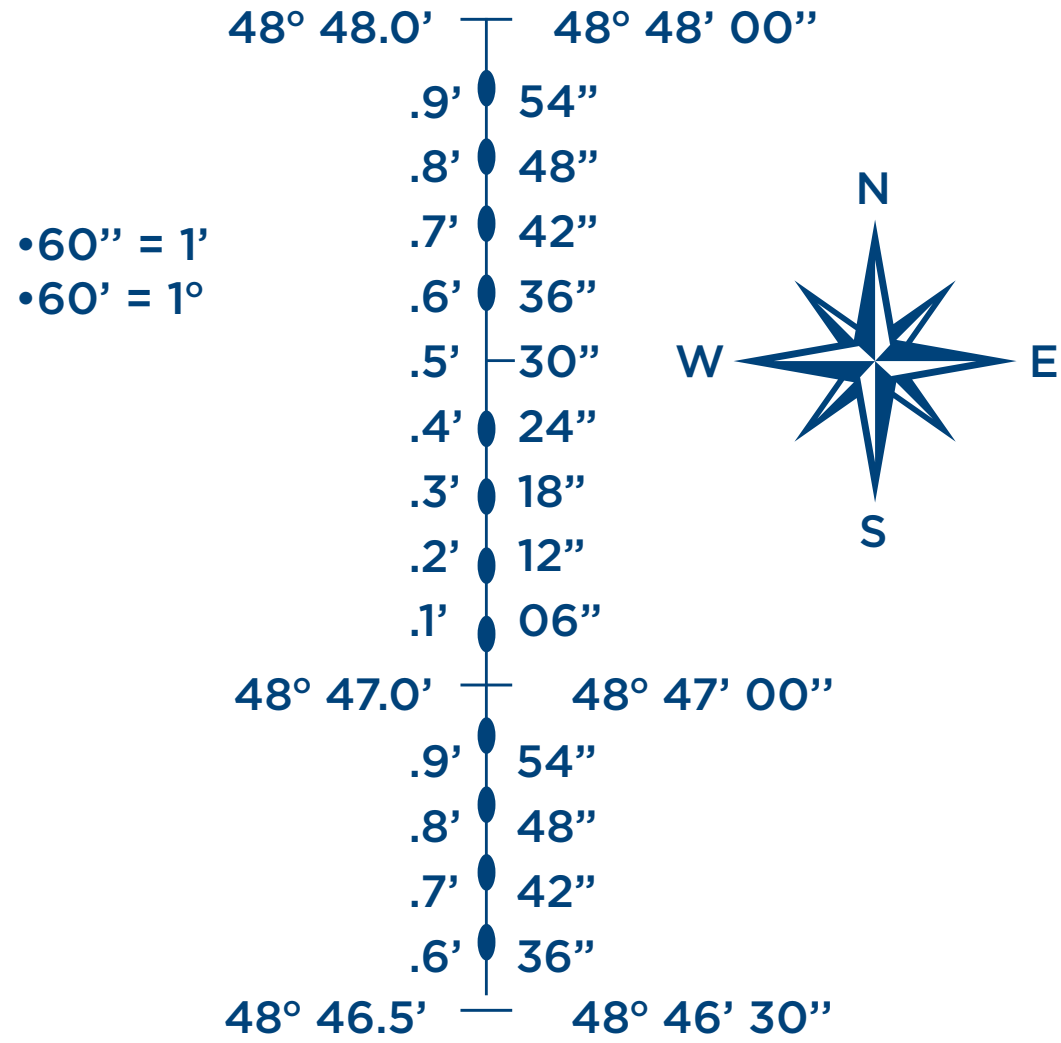
(43 degrees, 36 minutes and 18 seconds), OR in degrees and decimal minutes written as 43° 36.3” (43 degrees, 36 decimal 3 minutes).

Latitude is measured from 00 at the equator to 90° at either the North or South Pole. Therefore, latitude is referred to as being North or South to indicate in which hemisphere the navigator is working. Longitude is measured from 00 at Greenwich, England, East and West to 180°.

Conversion of Seconds to Decimal Minutes is done by dividing the number of seconds by 60. For instance 36” becomes (36 ÷ 60) 0.6’.

Another example 44” would become (44 ÷ 60) 0.7’. Note that we are rounding off to the nearest 1/10 or 0.1 in our computations. Conversely, to change decimal minutes to seconds, one would multiply the decimal part of the minutes by 60. Certain small discrepancies creep into our work doing these conversions but these are of little consequence in piloting a small craft.

DECIMALS AND SECONDS



5.1.4 WORKING WITH CHARTS

In the following paragraphs, will be found detailed explanations on how to work with charts, plot position, plan routes, use bearings and compass.

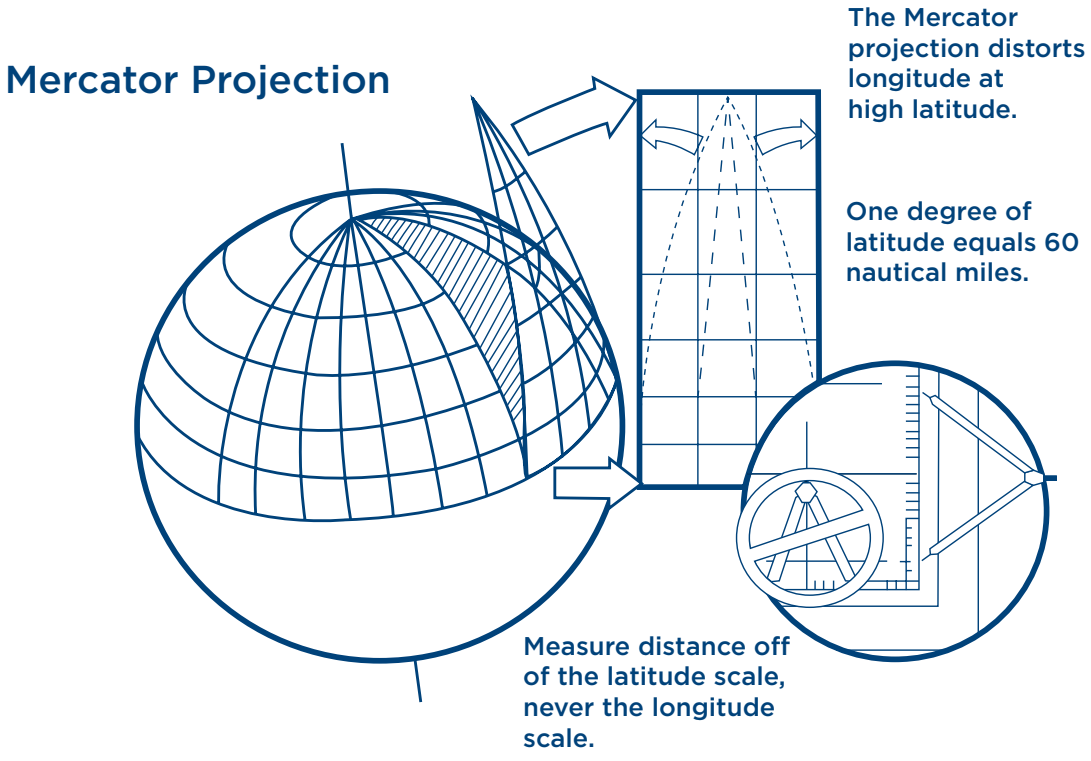
TOOLS

Several tools are needed to work properly with charts. The most commonly used tools are compass divider and parallel ruler.

MEASURING DISTANCE

Distance is always measured on the latitude scale (side margins). Due to distortion of scale in producing the chart projection, scale is true and reliable within a narrow band of latitudes. Therefore, when scaling distances on a chart always use the latitude scale immediately to the east or west of the area in which you are plotting.

One minute of latitude equals one nautical mile. Use dividers as illustrated to measure distances. Long distances are stepped off. For instance, 27 miles could be stepped off in 5 steps of 5 miles plus I step of 2 miles.



PLOTTING BEARINGS AND COURSES

Bearings and courses are plotted as true on the chart. Therefore, the outer circle of the compass rose is used.

To lay off a course line, set the parallel rule on the compass rose so that one edge of the rule is aligned through the centre of the rose and the desired course on the outer circle. Then “walk” the parallel rule to the part of the chart where you want to draw the course line.

To determine a bearing, say between two objects, set the parallel rule so that one edge passes through both objects. Then, “walk” the parallel rule to the compass rose so that one edge of the rule passes through the centre of the rose. Read the bearing from the outer circle. When reading a bearing from the compass rose, be careful to know the sense of the bearing. That is, is the bearing from A to B or from B to A?

DEVIATION AND VARIATION

When plotting a course on the chart, that course must be converted to a compass reading by which to steer the boat. Uncorrecting is the process of converting True bearings to Magnetic or Compass bearings. This routine is the opposite of the correcting routine. The elements are listed as:

TRUE

VARIATION

MAGNETIC

DEVIATION

COMPASS

For example, let’s convert a True course of 215° to a compass course.

T 215°

V 10°W

M 225°

D 10°E

C 215°

First add the Westerly variation to the True heading to get the Magnetic heading and then subtract the Easterly deviation to get the Compass heading.

DISTANCE, SPEED AND TIME

The formula used to solve for distance, speed or time when any two of the variables are known is: 60 D = S T where:

D = the distance in nautical miles,
S = the speed in knots
T = the time in minutes

60 is a multiplier to allow us to use minutes rather than decimal hours.

For these calculations, the distance should be expressed to the nearest 0.1 nautical mile; the time should be determined to the nearest minute and the speed should be expressed to the nearest 0.1 knot.

CONVERSION OF SECONDS TO DECIMALS AND BACK

Seconds to Decimals = Seconds

Decimals to Seconds = Decimal X 60

For example, a boat is running at speed of 14 knots. How far will it travel in 40 minutes?

Solution:	60 D	S T
	60xD	14÷40
	D	(14 x 40) ÷ 60
	D	9.3 nautical miles

If it takes a boat 34 minutes to travel 12 miles what is its speed?

Solution:	60 D	S T
	60x 12	S x 34
	S	(60 x I2) ÷ 34
	S	21.2 knots

If it is 9.5 miles to base and the boat will cruise at 11 knots, how long will it take to run to the base?

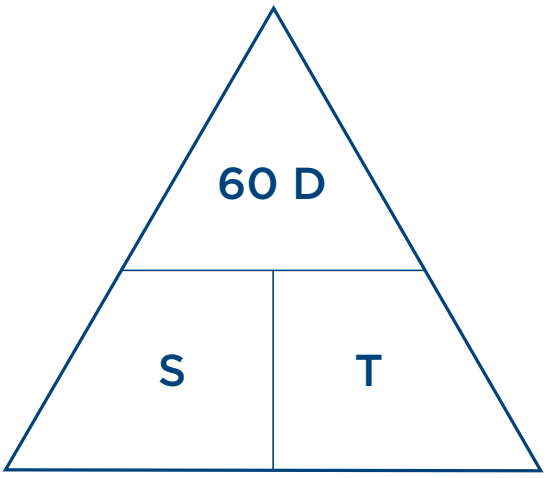
Solution:	60D	ST
	60 x 9.5	11÷T
	T	(60 x 9.5) ÷ 11
	T	52 minutes

The last example can be used to calculate an E.T.A. The problem is that it involves some mental calculations and it may not be so helpful in stressful situations. Another quick method can be used. All you need is a chart and a pair of navigational dividers. Let's say you are tasked somewhere and the rescue coordination centre wants to know your E.T.A. You know that your top speed is 40 knots. Just divide 40 knots by 10. This will tell you how many nautical miles you can travel in 6 minutes (since one knot is one nautical mile per 60 minutes). It thus gives you 4 nautical miles per 6 min. Measure 4 nautical miles on the latitude scale with the dividers. Then, simply use the dividers to find how many minutes you will need to reach your destination. If you need 4 times the length measured with the dividers, you know that you will need 4 x 6 = 24 minutes to reach your destination. As you can see, this method can be really quick and it does not involve extensive mental calculations.

Another easy way to remember how to calculate time speed and distances is to use the "distance/speed/time triangle."

To use this aid, simply cover the value required. The triangle will provide the correct answer.

TIME, SPEED & DISTANCE



$$\text{Speed (KTs)} = \frac{60 \times \text{Distance}}{\text{Time}}$$

$$\text{Distance (NM)} = \frac{\text{Speed} \times \text{Time}}{60}$$

$$\text{Time (MIN)} = \frac{60 \times \text{Distance}}{\text{Speed}}$$

RELATIVE BEARINGS

A relative bearing is measured from 000° at the boat's head in a clockwise direction to the target. Radar commonly gives relative bearings to targets. These bearings must be changed to True before being plotted on a chart. To do so, the True heading of your boat must be known.

For example, you are running on a True heading of 047° when a bearing is taken on a distant landmark. The bearing was 062 ° Relative. To find the True bearing of the target landmark, you just need to add your bearing to the relative bearing. This gives you (047° + 062°) 109°.

If the result you get by adding the two bearings is more than 360°, just subtract that 360°. For example, if your boat is running on a True heading of 302 ° and the bearing to a target is 321° Relative, the true bearing of the target will be (302° + 321°) 623°. This result is more than 360°, so, to get a more intuitive result, we will remove the extra 360°. The final bearing is thus (623° - 360°) 263°.

5.1.5 NAVIGATING WITH CHARTS IN A SMALL SAR UNIT

While you were reading the previous paragraph, it probably occurred to you that most of the techniques presented are time consuming. Also, nautical charts have a tendency to be fairly large. Working with such large charts requires space and protection from the elements. These are two things that many SAR units don't have. Trying to plot a course while already "en route" will usually be a difficult thing to accomplish on most SRU. Charts, even if the traditional way to work with them does not always apply, can still be very useful to SRU. Let's now see what is the best way to use nautical charts when you are involved in SAR.

KNOW YOUR CHART

Everybody in a SAR team should spend some time to study the charts that cover their territories. You must learn the distinctive features of the area you are covering. Pay attention to the location of special aids to navigation such as cardinal buoy and lighthouses. Learn where the various channels are and how to get to them. Memorize the number of important buoys. Usually, all buoys from the same channel have a similar number (AE32, AE33, AE34, etc.). Buoys in main channel are usually designated by a letter and a number (H33, H35, etc.) while buoys in secondary channels are designated by two letters and a number (HDIS, HDI9, etc.). Knowing the letter designation of buoys is especially useful when someone gives its position by telling you the number of the closest buoy. It might also be a good idea to get a general idea of the depth at the various areas covered by your charts. Shallow areas that may be hazardous to navigation should be known.

VISUALIZE

By simply looking at your chart, you should be able to visualize the area you are looking at. In other words, you should be able to translate symbols and shore contour into real landscape. This is a skill that requires practice. The best way to improve your visualization skill is to spend some time on the water. Explore your territories and always monitor your

progress on the chart. Look at lights in daytime and try to imagine how they will look at night. Once you master this skill, you will be able to know exactly where you are on a chart by simply looking around.

ALWAYS KNOW WHERE YOU ARE AND WHERE YOU WILL BE

As a SAR crew, you must always be aware of your position on the chart. This means that you should never have to get a fix to know where you are. Electronics (RADAR, GPS and electronic charts) are quite handy to keep track of your position. However, you should be able to know where you are without using these devices. There is always a risk of malfunction with electronics and that's why you have to know how to find your position manually. In addition, all these electronic devices are telling you where you were a few seconds ago. They can never tell where you are now exactly or where you will be in the next minutes.

FIND GOOD ROUTES TO NAVIGATE THROUGH YOUR TERRITORY

Routes should be used but not exactly in the way that was given previously. A good SAR crew will plan a few routes before going on the water. Routes are useful for hazardous areas (shallow water, narrow channels, etc.). When you plan routes, try to use what is called "landmark navigation" which is using the distinctive features of the landscape as reference point (these are easier to remember than compass courses). Take local anomalies (tides, currents, shallow areas, etc.) into consideration when you plan your routes. It may also be a good idea to prepare a sheet of paper on which you have all the courses to steer to get to various places (and the corresponding ETAs). On that sheet, you could also place the name, addresses and coordinates (lat., long.) of all the marinas in your territory. Once you have planned a few routes, you should be able to reach any area of your territory quickly and safely. Do not wait to be called somewhere to plan a safe route to go there.

5.2 ELECTRONIC NAVIGATION

5.2.1 RADAR

GENERAL

Radar is an aid in navigation. It is not the primary means of navigation. Boat navigation using radar in limited visibility depends on the coxswain's experience with radar operation. It also depends on the coxswain's knowledge of the local operating area and is not a substitute for an alert visual lookout.

BASIC PRINCIPLE

Radar radiates radio waves from its antenna to create an image that can give direction and distance to an object. Nearby objects (contacts) reflect the radio waves back and appear on the radar indicator as images (echoes). On many marine radars, the indicator is called the plan position indicator (PPI).

ADVANTAGES

Advantages of radar include:

- Use at night and low visibility conditions
- Obtain a fix by distance ranges to two or more charted objects. An estimated position can be obtained from a range and a bearing to a single charted object
- Rapid fixes
- Fixes may be available at greater distances from land than by visual bearings
- Assistance in preventing collisions

DISADVANTAGES

The disadvantages of radar include:

- Mechanical and electrical failure
- Minimum and maximum range limitations

MINIMUM RANGE

The minimum range is primarily established by the radio wave pulse length and recovery time. It depends on several factors such as excessive sea return, moisture in the air, other obstructions and the limiting features of the equipment itself. The minimum range varies but is usually 18 to 45 m from the boat.

MAXIMUM RANGE

Maximum range is determined by transmitter power and receiver sensitivity. However, these radio waves are line of sight (travel in a straight line) and do not follow the curvature of the earth. Therefore, anything below the horizon will usually not be detected.

OPERATIONAL RANGE

The useful operational range of a radar on a boat is limited mainly by the height of the antenna above the water.

READING THE RADAR INDICATOR

Interpreting the information presented on the indicator takes training and practice. The radar indicator should be viewed in total darkness, if possible, for accurate viewing of all echoes. Also, charts do not always give information necessary for identification of radar echoes, and distance ranges require distinct features.

It may be difficult to detect smaller objects (e.g., boats and buoys) in conditions such as:

- Heavy seas
- Near the shore
- If the object is made of nonmetallic materials

OPERATING CONTROLS

Different radar sets have different locations of their controls, but they are basically standardized on what function is to be controlled. The boat crew should become familiar with the operation of the radar by studying its operating manual and through the unit training program.

READING AND INTERPRETING RADAR IMAGES

The plan position indicator (PPI) is the face or screen of the CRT (Cathode Ray Tube) which displays a bright straight radial line (tracer sweep) extending outward from the centre of a radar screen. It represents the radar beam rotating with the antenna. It reflects images on the screen as patches of light (echoes).

In viewing any radar indicator, the direction in which the boat's heading flasher is pointing can be described as up the indicator. The reciprocal of it is a direction opposite to the heading flasher, or down the indicator. A contact moving at right angles to the heading flasher anywhere on the indicator would be across the indicator.

The centre of the radar screen represents the position of your boat. The indicator provides relative bearings of a target and presents a map-like representation of the area around the boat. The direction of a target is represented by the direction of its echo from the centre, and the target's range is represented by its distance from the centre. The cursor is a movable reference and is controlled by the radar cursor control. The cursor is used to obtain the relative bearings of a target on the indicator.

Radar bearings

Radar bearings are measured relative the same as you would in visual bearings with 0000 relative being dead ahead. In viewing any radar indicator, the dot in the centre indicates your boat's position. The line from the centre dot to the outer edge of the indicator is called the heading flasher and indicates the direction your boat is heading.

To obtain target relative bearings, adjust cursor control until the cursor line crosses the target. The radar bearing is read from where the cursor line crosses the bearing ring.

NOTE: LIKE VISUAL OBSERVATIONS, RELATIVE BEARINGS MEASURED BY RADAR MUST BE CONVERTED TO TRUE BEARING PRIOR TO PLOTTING THEM ON THE CHART.

Target range

Many radars have a variable range marker. You dial the marker out to the inner edge of the contact on the screen and read the range directly.

Other radars may have distance rings. If the contact is not on a ring, you would estimate (interpolate) the distance by its position between the rings.

Example:

The radar is on the range scale of 2 nautical miles, and has 4 range rings. Range information is desired for a target appearing halfway between the third and fourth rings.

- Range rings on the two mile scale are 1/2 mile apart (4 rings for 2 miles means each ring equals 1/4 of the total range of 2 miles)

RADAR CONTACTS

Even with considerable training you may not always find it easy to interpret a radar echo properly. Only through frequent use and experience will you be able to become proficient in the interpretation of images on the radar screen.

Knowledge of the radar picture in your area is obtained by using the radar during good visibility and will eliminate most doubts when radar navigating at night and during adverse weather. Images on a radar screen differ from what is seen visually by the naked eye. This is because some contacts reflect radio waves (radar beams) better than others.

Common Radar Contacts:

A list of common radar contacts and reflection quality follows

Contact	Integrity
Reefs, shoals, and wrecks	May be detected at short to moderate ranges, if breakers are present and are high enough to return echoes. These echoes usually appear as cluttered blips.
Sandy spits, mud flats and sandy beaches	Return the poorest and weakest echoes. The reflection, in most cases, will come from a higher point of land from the true shoreline such as bluffs or cliffs in back of the low beach. False shorelines may appear because of a pier, several boats in the area, or heavy surf over a shoal.
Isolated rocks or islands off shore	Usually return clear and sharp echoes providing excellent position information.
Large buoys	May be detected at medium range with a strong echo; small buoys sometimes give the appearance of surf echoes. Buoys equipped with radar reflectors will appear out of proportion to their actual size.
Piers, bridges and jetties	Provide strong echoes at shorter ranges.
Rain showers, hail and snow	Will also be detected by radar and can warn you of foul weather moving into your area. Bad weather appears on the screen as random streaks known as “clutter.”

RADAR FIXES

Radar navigation provides a means for establishing position during periods of low visibility when other methods may not be available. A single prominent object can provide a radar bearing and range for a fix, or a combination of radar bearings and ranges may be used. Whenever possible more than one object should be used. Radar fixes are plotted in the same manner as visual fixes.

NOTE: IF A VISUAL BEARING IS AVAILABLE, IT IS MORE RELIABLE THAN ONE OBTAINED BY RADAR.

Example:

On a compass heading of 300°, you observe a radar contact (image) bearing 150° relative. Deviation, from the deviation table, for the boat's compass heading (300° C) is 3° E. Obtain the magnetic bearing of the contact.

Procedure

- Correct your compass heading of 300° to magnetic heading. Write down the correction formula in a vertical line

  C = 300°
  D = 3° E (+E, - W when correcting)
  M = 303°M
  V = not applicable in this problem
  T = not applicable in this problem

- Compute information you have opposite appropriate letter in previous step. Add the easterly error 3° E deviation to the compass heading (300· C) to obtain the magnetic course of 303° M

- Add the radar relative bearing (ISO degrees relative) to the magnetic heading (303° M) to obtain magnetic bearing of the radar contact (093° M). 303° + 150° = 453° degrees (greater than 360°) 453° - 360° = 093· M bearing of contact

Range Rings

Radar range rings show up as circles of light on the screen to assist in rings estimating distance. Major range scales are indicated in miles and are then subdivided into range rings. Typical range scales for a boat radar are 1/2, 1, 2, 4, 8, and 16 nautical miles (NM). Typical number of range rings for a particular range scale are shown in the table below.

SCALE/MILES	RINGS	NM PER RING
1/2	1	1/2
1	2	1/2
2	4	1/2
4	4	1
8	4	2
16	4	4

Lines of Position

Radar lines of position (LOP's) may be combined to obtain fixes. Typical combinations include two or more bearings, bearings with distance range measurement to the same or another object (two or more distance ranges). Radar LOP's may also be combined with visual LOP's.

Care should be exercised when using radar bearing information only, since radar bearings are not as precise as visual bearings. A fix obtained by any radar bearing or by distance measurement is plotted on the chart with a dot enclosed by a circle to indicate the fix and label with time followed by "RAD FIX," such as 1015 RAD FIX.

Distance measurements example:

At 0215, you are on a course of 303° (303° M). Your radar range scale is on 16 miles. You observe two radar contacts (land or charted landmark). The first has a bearing of 330° relative at 12 NM. This target is on the third range circle. The second target is bearing 035° relative at 8 NM. This target is on the second range circle. Obtain a distance measurement fix.

NOTE: RADAR RANGES ARE USUALLY MEASURED FROM PROMINENT LAND FEATURES SUCH AS CLIFFS OR ROCKS. HOWEVER, LANDMARKS SUCH AS LIGHTHOUSES AND TOWERS OFTEN SHOW - AT DISTANCE WHEN LOWLAND FEATURES DO NOT.

Procedure:

- Locate the objects on the chart
- Spread the span of your drawing compass to a distance of 12 NM (distance of first target), using the latitude or nautical mile scale on the chart
- Without changing the span of the drawing compass, place the point on the exact position of the object and strike an arc towards your DR (Dead Reckoning) track, plotting the distance
- Repeat the above steps for the second object (distance of 8 NM). Where the arcs intersect is your fix (position). Label the fix with time and "RAD FIX" (0215 RAD FIX)

A DR plot typically includes many types of LOPs and fixes

USE OF RADAR FOR COLLISION AVOIDANCE

Assistance in preventing collisions. A risk of collision can be ascertained by careful watching the bearing on a radar screen of an approaching vessel. You should then act in accordance with the Regulations for Preventing Collisions at Sea.

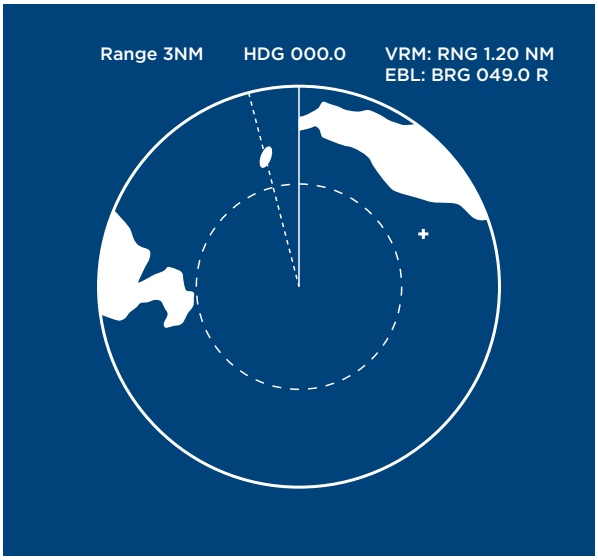
RULE 7

Risk of Collision

> (b) Proper use shall be made of radar equipment if fitted and operational, including long range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

Collision Regulations C.R.C., c 1416 / June 10, 2012

This image shows how a vessel can be pointing in a direction away from you, yet still presents a risk of collision. The radar will help you determine this.



Small vessels are particularly susceptible to blind spots because of lower energy radars and low height antennae.

5.2.2 FACTORS THAT DEGRADE A GPS SIGNAL

Ionosphere & Troposphere Delays. The satellite signal slows as it passes through the atmosphere. The GPS system uses a model that calculate an average amount of delay to correct for this error.

Signal Multipath. The GPS signal is reflected off objects, such as large rock surfaces or buildings, before it reaches the receiver. This increases the travel time of the signal, causing errors.

Receiver Clock Errors. The receiver's built-in clock is not as accurate as the atomic clocks used on the GPS satellites. Slight timing errors may occur.

Orbital Errors. Ephemeris errors, inaccuracies of the satellites' reported position.

Number of Satellites Visible. The more satellites the receiver can "see" the better the accuracy. Electronic interference (terrain and buildings) can all block signal reception, causing position errors or possibly no "fix" at all.

Satellite Geometry. This refers to the relative position of the satellites at a given time. Ideally, the satellites are located at wide angles to each other, poor geometry exist when the satellites are located in a line or tight grouping. Horizontal Dilution of Position (HDOP).

Intentional Degradation of the Satellite Signal. SA, an international degradation of the signal once imposed by the USDOD, was intended to prevent military adversaries from using the highly accurate GPS signal. SA was turned off in May 2000, which has resulted in improved accuracy for civilian users.

5.2.3 GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) is a radionavigation system of 24 satellites operated by the United States Department of Defense (DoD). It is available 24 hours per day, world-wide, in all weather conditions. Each GPS satellite transmits its precise location, meaning position and elevation. In a process called "ranging," a GPS receiver on the boat uses the signal to determine the distance between it and the satellite. Once the receiver has computed the range for at least four satellites, it processes a three dimensional position that is accurate to about 10 m.

STANDARD POSITIONING SERVICE (SPS)

The SPS is available on a continuous basis to any user worldwide. It is accurate to a radius within 10 metres of the position shown on the receiver about 99% of the time.

EQUIPMENT FEATURES

GPS receivers are small, with small antennas and need little electrical features power. Hand-held units are available. Positional information is shown on a liquid crystal display (LCD) screen as geographical coordinates (latitude and longitude readings). These receivers are designed to be interfaced with other devices such as autopilots, EPIRBs and other distress alerting devices, to automatically provide position information. Navigational features available in the typical GPS:

- Entry of waypoints and routes in advance
- Display of course and speed made good
- Display of cross-track error
- Availability of highly accurate time information

DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)

Differential Global Positioning System (DGPS) was developed to improve upon SPS signals of GPS. It uses a local reference receiver to correct errors in the standard GPS signals. These corrections are then broadcast and can be received by any user with a DGPS receiver. The corrections are applied within the user's receiver, providing mariners with a position that is accurate within 10 metres, with 99.7% probability. While DGPS is accurate to within 10 m, improvements to receivers will make DGPS accurate to within a centimetre, noise-free and able to provide real-time updates.

ON WATER & PRACTICAL COMPETENCIES

NAVIGATION – RADAR USE

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand and demonstrate the basic principles of the radar and its functions.	Startup procedure		
	Function and main commands		
	Interpretation of the radar image		
	Ability to use radar for positioning		
	Identification of radar marks useful for navigation		
	Distance measurement by radar		
	Understand and demonstrate the use of radar for collision avoidance		

NAVIGATION – GPS AND DEPTH SOUNDER USE

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand and demonstrate the use of the GPS and Depth Sounder.	Start up procedure for the GPS		
	Startup procedure for the depth sounder		
	Correct use of data supplied by the instrument (GPS)		
	Recognize possible errors, Verify and double check the GPS for accuracy		
	Determine depth from depth sounder and relay the information as required		

NAVIGATION – CHART USE AND CHART WORK			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand and demonstrate the use of navigational chart and navigation tools to read a chart, plot a course and calculate distance between two given points a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: Given a set of co-ordinates plot that position on the chart		
	Given a set of co-ordinates find that position on the chart		
	Demonstrate basic nautical chart reading, course and position plotting		
	Take a course from the chart compass rose and transfer that course to the navigable area on the chart		
	Take a course line and transfer that to the compass rose to determine its true and relative bearing		
	Plot 2 separate points on the chart		
	Measure a distance between two points and calculate the ETA at a given speed for that distance		
	Use the latitude scale to measure distances		

SEARCH PATTERNS

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully navigate an expanding square or a sector search to the satisfaction of the instructor. The student will steer an expanding square or a sector search to the satisfaction of the instructor.	The student must participate in the following tasks a minimum of **once:** Demonstrate effective navigation, course information and tracking of search legs (May use a parallel or creeping line search)		
	Demonstrate effective track legs and beam sighting		
	Demonstrate proper lookout and searching techniques		

NAVIGATIONAL SAFETY

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the listed applications of the collision regulations and navigational safety throughout the course.	Maintain a lookout and advise the operator or navigator as appropriate		
	Determine if risk of collision exists		
	Take appropriate action to avoid collision		
	Demonstrate proper changeover duties ie: Communication, safety, etc.		
	Use the Radar, GPS and or chart plotter plus all available means to establish a safe course and steer the vessel on that course		
	Understand the requirement to carry nautical charts on board the vessel		
	Demonstrate the use of nautical publications in charting a course (List of lights, Chart 1)		

- CHAPTER 6 -
TOWING

6.1 TOWING PROCEDURES

SAR units may provide towing assistance in accordance with the National SAR Objective, provided it can be done without imperiling the assisting vessel, the towed vessel or the persons on board.

6.1.1 TOWING POLICY

If in the judgment of the JRCC or the Coxswain on-scene, the conditions for a distress or potential distress are not present, and if suitable commercial assistance is readily available, then the provisions of tow by the SRU will be denied.

It must be understood, that the SRU are not in the business of salvage nor are they in competition with commercial salvage or tugs.

In many instances, towing a disabled vessel may be the most expeditious or safe means of saving life. The following factors should be considered in determining if a tow should be executed:

WHEN-TO-TOW

- If sea conditions render it hazardous to transfer persons on board
- Vessel is rolling beam on to heavy seas in danger of damage by waves or capsize
- Vessel is drifting towards danger
- Non-transferable injuries or medical problems
- No commercial tug immediately available, or estimated time of arrival would cause unacceptably long wait
- To leave adrift may cause unnecessary discomfort or hardship
- For humanitarian reasons or public goodwill when tow can be safely executed without interfering with higher priorities
- No response from M.A.R.B.
- The JRCC authorizes

A vessel is to be taken in tow only when authorized by JRCC.

Most recreational type craft will have great difficulty in towing a vessel more than 1 1/2 times her own displacement.

WAIVER OF CLAIMS

When the decision is to tow, first obtain a waiver of claims. This can be done by either a written signature or by verbal agreement. If it is to be done by signature, ensure that the master of the distress vessel signs a standard waiver form.

If the waiver is to be agreed to verbally, it can be done on VHF or simply by voice. If VHF is used request that the MCTS monitor the exchange. A simple hail can be made after ensuring rescue crew members are ready to listen and prepared to later attest to wording (see example). In this situation, log the exchange of verbal communication, both question and reply, then have the crew members sign the log book entry as witnesses to its accuracy.

If answers are negative, do not attempt to tow, but stand by and call JRCC for instructions.

If only a verbal waiver has been obtained at commencement, then a signed waiver form should be sought from the master of the disabled vessel once rescue is accomplished. This will confirm the verbal answer.

EXAMPLE OF VERBAL WAIVER:

VERBAL WAIVER OF CLAIMS AND IDEMNIFICATION - To be used when hailing or by radio:

Do you want us to tow?

If we agree to do so, will you hold us harmless and waive all claims for any death, injury or damage which may result, or which may result from the need to abandon or transfer the tow?

(print and place on board near radio telephone to be read to distress vessel's master)

It is customary for the rescuer to set the towing procedure, however, the master of the disabled vessel has the authority to overrule the rescuer's decision. In case of an impasse, the rescuer's duty is to stand by in safety and refer the situation to JRCC.

Each Search and Rescue Unit will have its own method of conducting a tow, depending on the characteristics of the rescue. It is strongly recommended that the towing boat use its own lines for towing as the strength, length and condition are known.

Verbal Towing Assistance Instructions

Name of Master / Owner / Operator or person in charge of disabled vessel: _____

Name of Vessel: _____

Official / Registration or license number: _____

Port of Registry or Home Port: _____

- **Do you understand** that the towing assistance provided by the Canadian Coast Guard Auxiliary (Central & Arctic) will be to the nearest place of refuge or to a rendezvous position where the tow can be safely transferred?
- **Do you understand** that upon arrival at the place of refuge, we will release the towline and it is your responsibility to secure your own vessel?
- **Do you understand** that the towline may be released anytime during the operation and the towing operation could therefore be ended?
- **Do you understand** that if private or commercial assistance arrives on-scene, this Search And Rescue Unit may hand over the tow and you will be liable for any charges from that assistance?
- **Finally**, **do you understand** that the Government of Canada, the Canadian Coast Guard Auxiliary (Central & Arctic) and any of their employees are not liable for damages suffered by your vessel, its crew or passengers, at any time during the towing operation or if the towing operation has to be abandoned or if the damages occurred despite due diligence and competent work of the master and crew of the Search And Rescue Unit?

Signature: _____

Date: _____

Witness: _____

A = name of organization providing assistance i.e: Canadian Coast Guard, Canadian Coast Guard Auxiliary, etc.

Towing Assistance Instructions

I, the undersigned _____ declare being the owner / operator of the _____, registered under the official number or registration or license number _____ do hereby request that the Canadian Coast Guard Ship (or other vessel) _____ provide my disabled vessel with towing assistance. In doing so, I declare being of sound body and mind and perfectly aware of the dangers and risks of a towing operation, for myself, for all persons on board the vessel, and the vessel and its equipment.

I also fully understand the following:

- The towing operation will be to the nearest place of refuge, or to a rendezvous position where the tow can be safely transferred.
- Upon arrival at the nearest place of refuge, the Search And Rescue Unit will release the towline and depart and it will be my responsibility to secure my own vessel.
- If there is a more serious situation elsewhere, the towline will be released or transferred and the towing operation will be ended immediately.
- The Search And Rescue Unit may release the towline and end the towing operation is such operation poses risks to safety of the resource.
- If adequate commercial assistance arrive on-scene, the Search And Rescue Unit may hand over the tow. I will be liable to any charges from that commercial resource.
- The Canadian Coast Guard or Canadian Coast Guard Auxiliary, the Department of Fisheries and Oceans Canada, the Government of Canada, Her Majesty the Queen in right of Canada and any of their employees are not liable for damages suffered by the vessel, any of its equipment, its owner, master, operator, persons in charge, crew or passengers, if the towing operation has to be abandoned, or if the damages occurred despite due diligence and competent work of the master and crew of the Search And Rescue Unit.

Name: _____

Signature: _____

Date: _____

Witness (if any): _____

6.1.2 WHEN-NOT-TO-TOW

- When suitable commercial assistance is available
- It is dangerous to life or limb
- The Distress Vessel is hard aground and to attempt to tow may cause further damage in the course of re-floating
- It is beyond the capability of the Rescue Vessel, due to weather, sea, or size of disabled craft, fuel limitations, etc.
- A higher priority for saving life is presented at another location
- Notify The JRCC

When the decision is not to tow, the rescuer's duty is to:

- Stand by as long as circumstances or conditions permit
- Remove people on board if practicable; and Notify JRCC

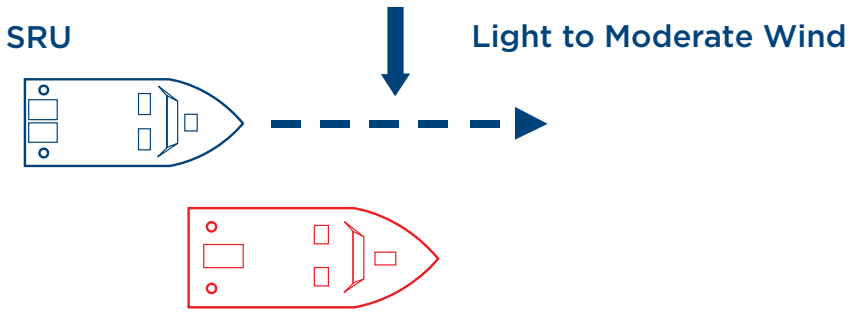
6.2 APPROACHING A DISABLED VESSEL

6.2.1 SAFETY PROCEDURES

- Ensure everyone onboard the vessel being towed is wearing a PFD
- The SRU should circle the disabled vessel to look for hazards
- Lookouts should be watching the lines at all times during the tow
- Constant communication should be kept with the master of the vessel being towed

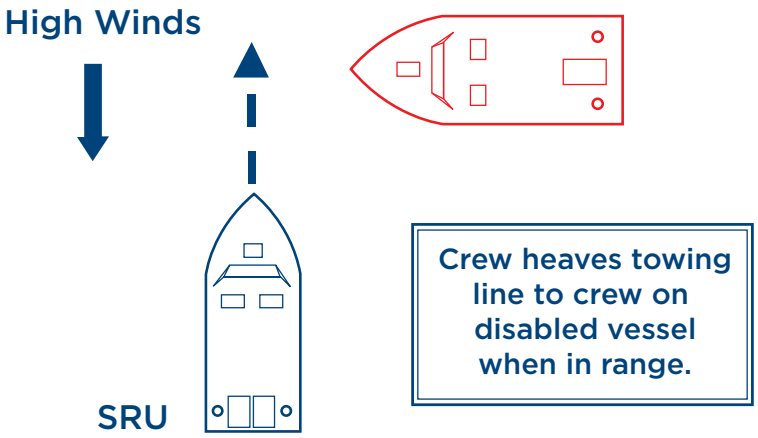
6.2.2 ALONGSIDE APPROACH

In light to moderate seas, the SRU may approach a disabled vessel fairly safely. The helmsman should approach with the other vessel on the starboard side. This offers better depth of vision and reduces the risk of a broadside collision.



6.2.3 CROSS THE "T"

In heavy weather, when an alongside approach is too dangerous, and the SRU crew want to take the disabled vessel in tow, a "Cross the 'T'" approach is often the best choice. As illustrated below, the helmsman is best advised to keep the disabled vessel on his/her starboard side.



6.3 SECURING A TOWLINE

To a vessel in need of assistance: many recreational type power vessels have inadequate means of securing a towline on their fore deck. The small cleats that are lightly secured to the deck are usually inadequate for towing. A towline should be attached to the strongest point available. On trailored recreational power and sailing vessels, the strongest point may be the "C" bow ring.

Caution: Attaching a line to the "C" bow ring should not be attempted in rough water as this is dangerous with the bow of the distress vessel pitching (kicker hook below will help). In calm water this may be carried out by passing the bight through the ring and leading both ends back to the rescue vessel. The tow can then be easily slipped by releasing one end of the line. This method also avoids using both hands while endeavoring to tie a knot at the ring.

To the towing/rescue vessel: light fittings will not stand the strain of towing. Auxiliary rescue craft may expect to carry out more towing than most other non-purpose built vessels. Consequently, they should plan in advance by examining and selecting the strongest securing points or specially strengthening selected cleats. Without a towing post, the next best option is to set up a towing bridle and attach the two ends of this bridle to two cleats on opposite sides of the stern of the vessel.

The best arrangement is a towing post with cruciform, situated well forward on the centre line secured through the deck to the keel. With this rig, it is necessary to keep the post as low as possible whilst clearing any obstructions abaft the post. The following illustrate the two methods of securing a towline on the towing vessel.

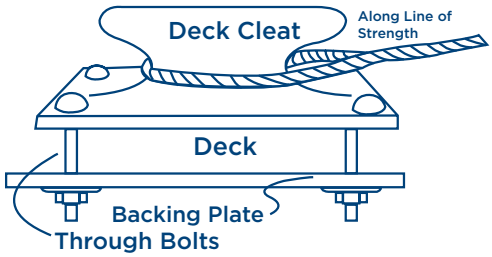
NOTE: TOWLINES, IN NORMAL CIRCUMSTANCES, MUST BE MADE OF A FLOATING MATERIAL, SUCH AS POLYPROPYLENE.

KICKER HOOK ATTACHED TO BOAT HOOK.

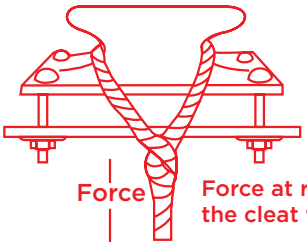
CLASP CLOSED AND RELEASED.

SECURING A TOWLINE TO A CLEAT

CORRECT

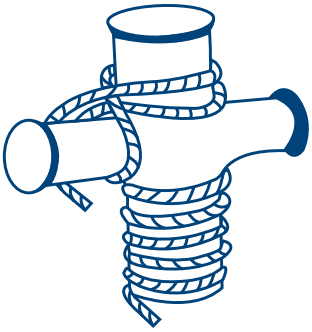


INCORRECT

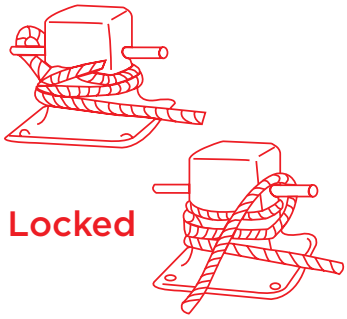


SECURING A TOWLINE TO A BIT

ACCEPTABLE



NOT ACCEPTABLE

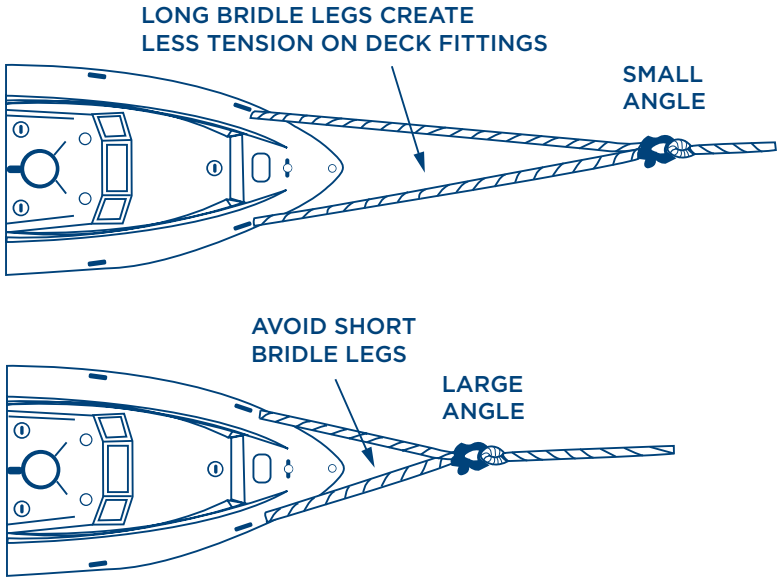


6.4 METHODS OF TOWING

SAMPSON POST

BRIDLE

TOWLINE CONNECTION SHOWING BRIDLE ANGLE



DIAMETER	NYLON	DACRON	POLYPROPYLENE	MANILA
13mm	7100	6100	5300	2650
25mm	24 500	20 000	16 500	9 000
38mm	55 000	36 000	31 500	18 500

NOMINAL STRENGTH OF TYPES OF LINE IN POUNDS

6.5 SAFE TOWING SPEEDS

Damage, sinking and loss of life have occurred as a direct result of towing too fast. Maximum safe towing speed is based on the vessel's waterline length and hull shape, but wind and sea conditions could dictate a much slower speed.

Never tow a hull faster than the hull design speed.

Above hull speed, the vessel will try to ride up on its bow wave, becoming unstable and, in extreme cases, could capsize. Also, wave drag (even one large wake) could slow the hull to displacement speed and cause a severe shock-load in the tow rig as the towing force tries to pull the towed vessel back on plane. In response to this shock-load, the towed vessel could plough its bow into another wave and swamp or capsize.

Moderately powerful SRU's could easily tow smaller open runabouts (5-6 m) on plane. This practice would be considered as unsafe operation of a vessel. Should the tow suddenly "dig in" at speed, disaster would surely follow.

Generally, a tug with a tow should not tow faster than 6 – 8 knots.

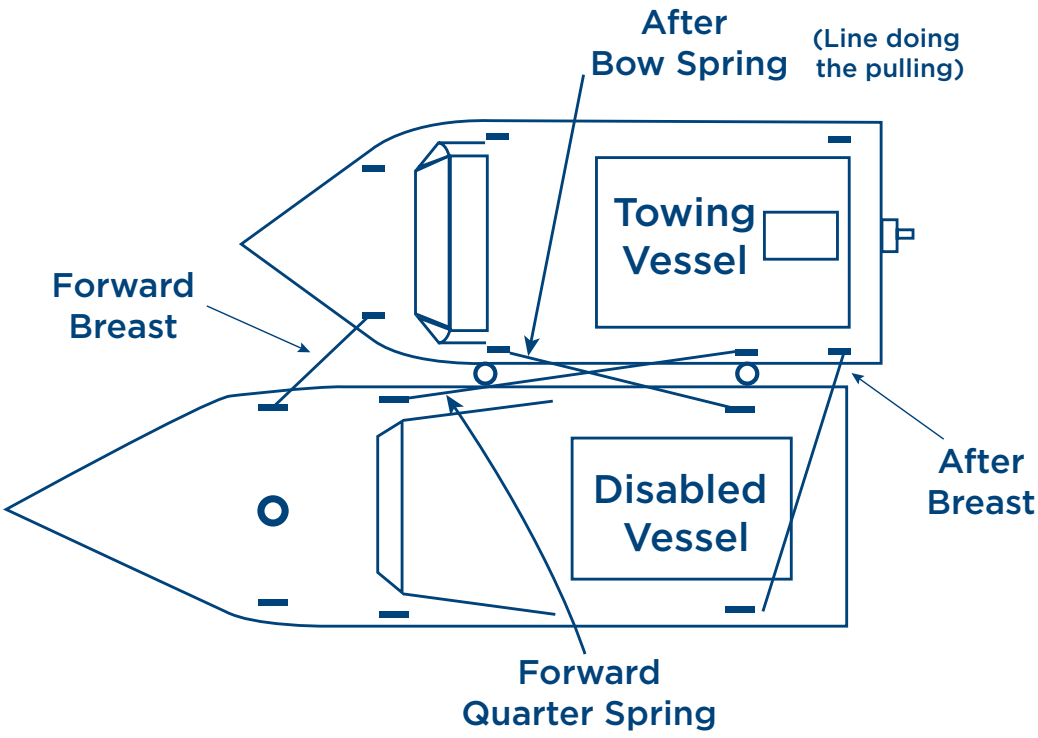
A catenary is the curve formed by a flexible cable of uniform density hanging from two points under its own weight. Other common examples include power lines and an anchor rode. The catenary acts as a damping curve and is a desirable feature when towing.

6.6 TOWING ALONGSIDE

Towing alongside should be avoided in rough water, on long open water tows or by inexperienced Coxswains. It is very important to remember when towing alongside that the rescue vessel's rudder must be well astern of the towed craft. Otherwise the rescue vessel will be unable to turn.

Towing alongside may be advantageous when:

- The tow has lost her rudder or rudder is jammed in a turn
- The tow is taking on water and requires tug's pumps to assist
- Very close quarters manoeuvring is required, such as in a Harbour, or when entering or leaving a slip or a lock (see section, Termination of Tow)



6.7 DURATION OF TOW

Tow to the NEAREST SAFE HAVEN. A safe haven is a harbour sheltered from the weather where shore facilities or medical attention can be obtained if required. NEAREST is defined as the closest harbour which can be safely reached in prevailing conditions of weather, geography and least diversion of the rescue vessel's voyage. The rescue craft should refrain from extending the tow solely to serve the convenience of a vessel owner and/or the Search and Rescue Vessel.

6.8 TERMINATION OF TOW

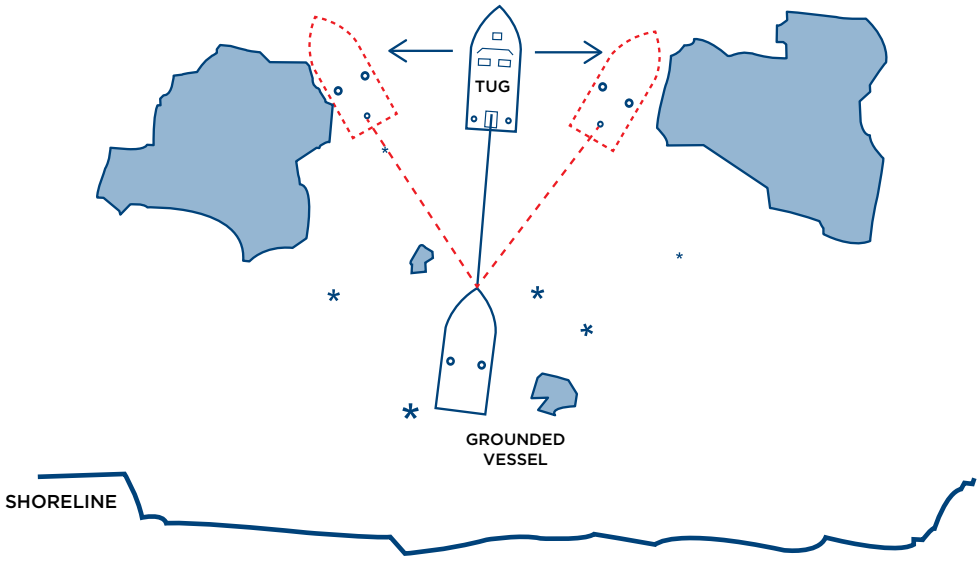
When entering a fairway or harbour with a vessel in tow, the tug should broadcast a "Securite" call. Although the Collision Regulations do not give the tug the right of way, the advice does provide other mariners with an awareness of unusual conditions.

Manoeuvring a small craft to a dock when under tow is difficult and can be hazardous to both tug and tow. The alongside tow method is probably most suited in this instance. When this is not possible, the tug should approach the dock as slowly as possible. Remember that displacement hulls (sailboats) tend to have momentum and do not stop as quickly as planing hulls.

Pendulum effect: When towing a grounded vessel off, the SRU must be very cautious of the pendulum effect of wind or current upon the tug lest she be helplessly swept upon the same shoal.

If possible, the towing vessel should set its ground tackle to limit pendulum effect.

PENDULUM EFFECT



6.9 DRAW DOWN OR SQUATTING

This possibly unexpected action takes place in a situation similar to that described above. When power is applied to dislodge a grounded vessel, the stern of the tug will tend to squat down (or dig in), significantly increasing the vessel's draft.

In shallow waters this could result in serious propeller damage.

Vessel operators should exercise added caution when first initiating a tow under these circumstances.

6.10 TOWING IN FOG

Sound signal

- 1 long blast & 2 short blasts every 2 minutes (CSA – 35C)

The vessel in tow responds immediately with

- 1 long blast and 3 short blasts (CSA – 35E)

6.11 TOWING AT NIGHT

- Ensure towline is illuminated
- Maintain proper lookout
- If possible ensure proper navigation lights are displayed

6.12 TOWING HAZARDS

- Backlash from a breaking tow line
- Tow line fouling propeller
- Inappropriate knots
- Approaching dock too fast
- Physical condition of tow (dry rot / deck fixtures)
- Pendulum effect
- Vessels attempting to pass between tug and tow

NOTE: GLOVES ARE NOT TO BE WORN WHILE SECURING, WORKING WITH, AND TENDING A TOWLINE.

ON WATER & PRACTICAL COMPETENCIES

TOWING ASSESSMENT AND TOWING COMMUNICATIONS			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the ability to conduct a pre-towing interview a minimum of **once**. The use of a checklist is acceptable.	The student must accomplish the following tasks a minimum of **once**: Assessment of towed vessel i.e: Lines in water, position in waves and wind, depth		
	Establish communications with vessel (VHF, Cell) and maintain communications throughout tow		
	Communicate with towed vessel all actions		
	Medical Emergencies and People on Board		
	Nature of problem and taking on any water		
	PFDS or lifejackets on all passengers		
	Verbal and written waiver obtained		
	Steering Instructions – wheel amidships		

TOWING SETUP AND TOWING GEAR			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand and demonstrate the setup of a tow and understand the gear and equipment used in successful towing operations. The following actions must be demonstrated a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: SAPP, vocalized and demonstrated on approach		
	Setup the towline to be passed off to another vessel		
	Pass off towline to another vessel		
	Pass of a towline to another vessel using a heaving line		
	Setup up all appropriate towing gear		
	Setup & placement of fenders (if applicable)		
	Maintain control of vessel while on the helm		
	Identify the following: Heaving Line, Tow Line, Axe or Knife, Tow assist hook, Towing post, Bridle (if applicable)		

TOWING ASTERN			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student will make a controlled approach and stop the vessel close enough to the vessel that the towline can be passed without the use of a heaving line. The student will maintain control of vessel, such that the line may be paid out and secured smoothly without endangering crew.	The student must accomplish the following tasks a minimum of **once**: SAPP, vocalized and demonstrated on approach		
	Keep speed slow and under control		
	Appropriate hand position on wheel at all times		
	Identify danger zones		
	Secure towline effectively and have towed vessel under control		
	Compensate for wind and waves		
	Take strain gradually		
	Ensure proper cantinary and tow step		
	Ensure tow speed is accurate and safe		
	Assign towline watch and lookout duties		
	Act in a safe and controlled manner at all times		

TOWING ALONGSIDE AND DOCKING TOWED VESSEL			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully bring the towed vessel alongside the SRU and successfully dock both vessels to the instructors satisfaction. This must be accomplished in such a manner that is safe and such that it can be secured without damage a minimum of **once**.	The student must accomplish the following tasks a minimum of **once**: SAPP, vocalized and demonstrated on moving vessel from astern tow to alongside tow		
	Setup and placement of fenders - both vessels (if applicable)		
	Secure towed vessel to SRU in correct location (far enough forward of drives/engines)		
	Secure lines in correct positions (Bow, Stern, Spring Lines, Breast line - if applicable)		
	Issue Sécurité		
	Keep speed **slow** to steerage		
	Proper hand positions at all times		
	Post lookout on bow of stricken vessel (if applicable)		
	Use reverse to pull bow out and to change momentum		
	Make gradual throttle changes		
	Compensate for wind and current as required		
	Use pivot points and turning levers effectively		
	Utilize momentum to successfully drift to the dock without either sliding along or bouncing		

- CHAPTER 7 -
NIGHT OPERATIONS / AIR RESCUE

7.1 NIGHT OPERATIONS

7.1.1 PERSONAL SAFETY

Personal safety is critical at night. Crew members should be equipped with:

- PFD's / lifejackets equipped with reflective tape
- An emergency (white) strobe light should be attached to PFD's / lifejackets or the mesh SAR vest using a lanyard
- An approved whistle
- Pyrotechnic flares, laser flares or glow sticks

Consideration should be given to the carriage of bomber style flotation jackets, float coats or full flotation suits due to the usually cooler temperatures found on the water at night.

A change of clothes may also be useful to have on board. A hot day on the water can quickly become a cool evening. Pants, a sweat shirt and / or windbreaker / jacket might be appropriate. Spare clothing should be one step warmer than what you're wearing.

At night, insects and other bugs become an operational hazard, particularly at higher operational speeds. Depending on the vessel design, safety glasses for each crew member on board could be a good investment towards crew comfort. Waterfowl and seagulls are also dangerous obstacles and have been known to fly up and crash into oncoming vessels.

The usual Man Overboard procedures apply at night but objects deployed into the water need to be equipped with reflective markings or lights to increase the chance of detection. Ideally a life ring fitted with a strobe light could be deployed to mark the spot and so the person. In an emergency a white strobe light could be affixed to a PFD or lifejacket.

7.1.2 PRIOR TO DEPARTURE

It is also wise to ensure that the gear which is expected to be required on the tasking / patrol be made readily available, but safely secured. This gear could involve spotlights, tow lines, first aid kit, etc.

The navigator and / or coxswain may also wish to plot the necessary courses, determine times to run the course and check equipment such as radar, GPS, depth sounders, navigational lights, etc. for correct operation prior to departure. The safety and success of a night voyage may depend more heavily on this equipment than would a daytime operation.

- Brief crew on nature of incident and possibly what to expect in the search area
- At night SITREPS are often scheduled at shorter time intervals to provide extra security for the SRU crew

7.1.3 NAVIGATION

At night, there is a greater need to pay attention to your navigation (location) on the water. Aids to navigation, landmarks and local knowledge should all be used to ensure that you are fully aware of your position at all times. Failure to maintain a proper watch on all available navigational equipment can quickly lead to grounding. This is especially so if the channel is narrow and there is a crosswind and no lighted aids to navigation. Failure to maintain situational awareness may result in finding yourself aground before you realize you are out of the channel.

If in doubt, the vessel should be brought to a full stop and an exact position determined using electronic and / or visual observations to ensure the vessel's position is confirmed before moving again. This action includes, if need be, the requirement to 'maintain station' until a proper position is determined.

7.1.4 OPERATIONAL SPEED

Operating a vessel at night includes the need to operate at a slower speed. Objects in the water (deadheads, shoals, unlit buoys, etc) will not likely be as visible. It is not at all surprising to detect other vessels operating without lights. There is also the possibility, during SAR operations, of a person in the water (PIW).

Ensure that you are able to stop your vessel in a minimum of half the distance which you can see. Operating a vessel at night should be considered as operating a vessel in restricted visibility or fog conditions.

STOP AND LISTEN

It is also very beneficial to occasionally reduce speed and idle the engine(s), or even turn it (them) off if conditions permit. Take a good listen for noises coming across the water such as voices, whistles, the slapping of waves on the shore, etc. This stop and listen technique has resulted in people being rescued from the water or vessel operators realizing they are closer to shore or other dangers to navigation than they had previously realized.

ELECTRONIC EARS

Built in loud hailers with an external weatherproof speaker also have a listening mode. As situations warrant, this type of equipment, although fairly directional, could be used to advantage. Similarly, some VHF radios are equipped with a hailer function and if an external speaker is connected it can work well. However, in the hail mode, the radio mode is neutralized. To avoid missing VHF calls, a second radio should be available

7.1.5 VISUAL PERCEPTION

- Depth perception and the ability to see objects in the dark are reduced
- Objects may look different and difficult to see at night
- It is common for navigation lights of a vessel underway to disappear into the back ground lights
- Objects will often appear to be closer after dark than they would appear during the daytime, especially lighted objects
- Objects that one may not see on shore during the day, a radio tower as an example, if lit, may be quite prominent at night
- It is a good idea to conduct familiarity sub patrols with cruises in your operational areas during both daytime and night time operating conditions. Annotate your chart with local information pertaining to landmarks, etc. so that you and your crew will be very familiar with the operational area of your unit
- When possible, it is advisable to search away from the moon (or other illumination) as objects may become more visible from the backlighting. This is also true when using night vision goggles

7.1.6 NIGHT VISION

As mentioned in Phase 01 section 8.5.2 Spotter Duties, look slightly above or below the horizon and the same principle applies here with using night vision. To take advantage of night vision sweep your eyes from side to side. The eye is better at picking up dim objects in motion. This sweeping motion also helps you to spot non-moving objects such as buoys.

Averted vision:

At night, you will see an object better if you are not looking directly at it. You quite likely will see an “object out of the corner of your eye” with peripheral vision. This is known as averted vision.

Dark Adaptation:

Dark adaptation is a heightened sensitivity to light when the eye is subjected to darkness for an extended period. Chemical changes take place in the retina, mostly in the first 20 minutes in darkness, but continuing for up to two hours. This greatly improves the observer’s ability to see faint objects. However, they can be cancelled quickly by a sudden exposure to light.

**NOTE BLUE FLASHING LIGHTS IMPAIR NIGHT VISION.

7.1.7 LIGHTING

It is incumbent upon the operator of an Auxiliary vessel to ensure that the navigation lights of his vessel are operating properly and are not obscured in any manner so that all approaching vessels are able to observe the required navigation lights.

All on-board lighting should be red or blue to minimize loss of night vision. When going to or from a cabin to the deck or wheelhouse ensure cabin lighting is off prior to opening hatches (doors) between the piloting station and decks. Note that it can take 15 to 30 minutes or more to gain adequate night vision.

7.1.8 SEARCH LIGHTS

- A bow mounted remote controlled search light is more suitable for locating targets within 45° of the bow
- Portable search lights are more suitable for use aft of the SRU's mid-ship position
- A search light paired with good binoculars can effectively search a dark shoreline

7.1.9 NIGHT VISION EQUIPMENT

If night vision equipment is available, it may be used to scan for items in and on the water including search targets and aids to navigation, both lit and unlit. Through experience night vision equipment is sometimes more beneficial in some geographical areas than in others.

Night vision equipment may not be suitable for use when searching towards an illuminated background such as lights on shore. It also has to be remembered that night vision equipment detects lit objects many miles away. A novice operator risks becoming confused with the numerous targets which may be seen. Local knowledge and area familiarity become essential. Night vision equipment should not be used when illuminating flares have been deployed.

JRCC should be advised when night vision equipment is being used or is available.

7.1.10 TOWING

As most CCGA SRU undertake towing, there are a couple of factors which may be slightly different at night than during the day. It will be necessary to maintain situational awareness. This means that the crew must focus on what is taking place, on board and in the area surrounding the vessel. Where are other vessels? Is the tow handling well? Is the SRU on course? Are winds and currents affecting the tow? Are any vessels about to cross between the SRU and the vessel being towed? Some of these situations can be alleviated somewhat by maintaining a watch on the towed vessel, by maintaining communications

with the towed vessel, illuminating the tow line and by utilizing the 'flashing blue light' if the CCGA SRU is so equipped.

7.2 AIR RESCUE SUPPORT

7.2.1 PREPARING FOR A HELO OPERATION

- Maintain VHF radio watch on Ch. 16 / 82 Radio traffic when helicopter is overhead is difficult - use earphones if available
- You may be asked to provide a VHF direction finding signal
- Select and clear the most suitable hoist area (preferably aft)
- Secure all loose gear
- Remove or lower obstructions such as flag staffs and antennae
- Wear rain gear or floater coats. Spray from prop wash is significant and is most powerful when the aircraft is on approach to your vessel. Electronic equipment, if not totally waterproof, should be protected
- Secure headgear
- Normally, the helmsman will be asked to steer into the wind and maintain a speed of approximately 5 knots
- On exercises, the pilot may wish to practice approaching your vessel "dead in the water". On smaller and medium sized vessels, expect the prop wash to push your boat some distance until the aircraft is directly overhead
- The helmsman must concentrate on steering and not watch the helicopter
- Severe static electricity may be present on the hoist line. HANDS OFF!
- Do not assist the SAR Tech on his descent

7.2.2 HELICOPTER EVACUATION

- A helicopter evacuation is a hazardous operation to the patient, the flight crew and the SAR vessel crew and should only be attempted in a matter of life and death
- The need for an evacuation is based on the information provided by the SAR vessel crew. Accurate information must be provided so that an evaluation can be made concerning the need for evacuation
- If the hoist is to take place at night, light the pickup area of your vessel as well as possible
- Do not point searchlights at the helicopter. However, a searchlight may be used to assist the aircraft in locating your position

- Provide accurate position, time, speed, course, weather and sea conditions
- One or two SAR Techs may be hoisted on to your vessel to assess the condition of the patient

7.2.3 NIGHT ILLUMINATION

Night searches are frequently enhanced with the use of illuminating flares dropped by fixed wing aircraft. The flares are launched from a few thousand feet and drop by parachute, extinguishing before reaching the ground or water. Their use provides a significant enhancement to lookout visibility.

7.2.4 SAR AIRCRAFT COMMUNICATIONS

CASARA aircraft may partake in a SAR response. The aircraft in this group are permitted to carry a Marine VHF but whether they do or not is left to the discretion of the unit. Vessel based crew should be familiar with the signals used by an aircraft when overhead.

Follow Me - The aircraft will circle the rescue vessel one to three times and then cross the bow, opening and closing the throttles or changing the pitch on the propellers. The SAR vessel master should then advise the JRCC via the SAR communications line that it is following an airplane.

Discontinue Following - The aircraft will circle the rescue vessel one to three times and then cross the stern or wake of the SAR vessel opening and closing the throttles or changing the pitch on the propellers. This will indicate the aircraft no longer requires the services of the rescue craft. At this point the vessel master should contact the JRCC to ensure the situation has been terminated. In many cases, the aircraft will know the particulars of a case before the rescue vessel due to its height and radio reception.

- CHAPTER 8 -
MARINE WEATHER

8.1 APPLIED KNOWLEDGE

These explanations represent a very limited portion of weather science. While they may not transform you into an expert, they should help to understand how to predict major meteorological events a few minutes in advance.

The following paragraphs will describe what to expect from what is observed. This knowledge may help you to be ready for the worst instead of being caught by surprise.

Expect cloudy skies and uncertain weather when:

- Barometric pressure decreases
- Night temperature is higher than usual
- Clouds are moving in different directions at different altitudes
- Small hair-like clouds are present high up in the sky
- In summertime, clouds turn dark in the afternoon

Expect showers when cumuli (small cotton wool-like clouds) form rapidly in early afternoon (spring or summertime).

Expect good weather when:

- Barometric pressure rises
- Temperature decreases rapidly during the afternoon

Expect prolonged good weather when:

- The setting sun is like a fire ball and you can look at it directly
- Barometric pressure remains constant or rises slowly
- Morning fog dissipates within two hours of sunrise
- The sun turns red when it sets

8.1.1 SPECIAL WEATHER CONDITIONS

THUNDERSTORMS

The strongest winds in a thunderstorm usually precede the storm centre itself, in a zone up to three miles long. Gusts up to 50 knots can be expected in this zone. The winds blow downwards from the cloud, and they are especially dangerous for small vessels.

The heaviest rain occurs directly under the thunder cloud, leading to poor visibility. Heavy rain lasts from five to 15 minutes. Thunderstorms normally last less than one hour.

Waterspouts may occur during a thunderstorm. A waterspout is a funnel of cloud reaching from the base of the thunderstorm cloud to the water, which may suck up water into the air. It usually lasts less than I5 minutes. Although immature waterspouts may be very small, they can become extremely violent without warning.

FOG AND SNOW

Fog is a common problem at sea. The major hazard is reduced visibility. Vessels should proceed with caution. Monitor radar carefully if possible.

Snow also reduces visibility, and can be especially hazardous if it falls as melting snow. Melting snow not only reduces visibility, but interferes with radar signals, making radar less effective. This usually occurs during arctic air outbreaks, and is a serious problem in mainland inlets.

ICING

Accumulations of ice on a vessel may lead to serious stability problems. Substantial icing can occur when temperatures are between -3 and -8°C with winds of 16-30 knots. The danger increases with colder temperatures or stronger winds.

Freezing sea spray is the most common and the most hazardous form of icing. Spray blown by winds can cause heavy icing on a vessel, producing a heavy list. Freezing spray usually occurs when the air temperature is less than -2°C, and the water is less than 5°. Freezing spray warnings are included in maritime weather forecasts.

With freezing rain, a film of ice forms over the deck railings and stairways. This form of icing is the least likely to cause stability problems, but it can be a serious hazard for the crew moving on deck.

A similar glaze of ice can be caused by sea smoke. Sea smoke forms when very cold air moves over warmer water, and it can freeze on contact with the vessel. It is not usually a severe problem, but if the sea smoke is very dense, substantial ice may accumulate.

8.1.2 MARITIME WEATHER INFORMATION

MARITIME WEATHER FORECASTS

Maritime weather forecasts are available on:

- VHF Channel 21B, 25B and 83B (Atlantic Coast and Great Lakes)
- VHF Channel 21B and WX1, WX2, WX3 (Pacific Coast)
- Environment Canada Weatheradio VHF broadcasts in Vancouver, Toronto, Montreal and Atlantic Canada
- Regular AM and FM radio weather forecasts

- The Maritime Weather Services Bulletin, obtained by calling the nearest Environment Canada weather office
- MAFOR Code on the Great Lakes and St. Lawrence River

A receiver for continuous weather forecasts is available on the market through maritime supply outlets.

WEATHER WARNINGS

Maritime weather forecasts include four types of severe weather warnings: small craft, gale, storm, and hurricane force winds. The meanings of these warnings are:

- Small Craft Warning: winds 20-33 knots and wave heights 2-3 m (7-10 ft.)
- Gale Warning: winds 34-47 knots and wave heights 6-9 m (20-30 ft.)
- Storm Warning: winds 48-63 knots and wave heights 9-16 m (30-52 ft.)
- Hurricane Force Warning: winds 64 knots and over; wave heights over 16 m (52 ft.)

BEAUFORT WEATHER SCALE

Thanks to the British Admiral Francis Beaufort (1774-1857), the world has a uniform scale that we can use when observing weather and sea states. This present-day version is a modification of the nineteenth century original. Some mariners use this scale to describe the wind and waves.

BEAUFORT WEATHER SCALE

BEAUFORT NUMBER	WIND SPEED (KNOTS)	DESCRIPTION	WAVE HEIGHT (FEET)	DETAILS
0	0-1	Calm	-	**Flat calm; mirror smooth.**
1	1-3	Light Airs	.25	**Small wavelets, no crests.**
2	4-6	Light Breeze	.50	**Small wavelets, crests glassy, but do not break.** No cause for concern, but you should stay on the lookout for a darkening horizon, or a build-up of large, anvil-shaped (cumulonimbus) storm cloud.
3	7-10	Gentle Breeze	2	**Large wavelets, crests begin to break.** Still no cause for concern for a small boat, provided shelter is not too far away and located up-wind. Skippers should be alert to the added motion of the boat and a more persistent breeze.
4	11-16	Moderate Breeze	3.5	**Small waves, becoming longer, crests break frequently.** Small open boats should be heading for shelter.
5	17-21	Fresh Breeze	6	**Moderate waves, longer breaking crests.** Skippers of small open boats, especially craft with little or no built-in buoyancy and small capacity engines, should return to shelter immediately, practicing extreme caution. Everyone on board should be wearing PFDs. Small sailing vessels operating in open waters should have already returned to shelter.

6	22-27	Strong Breeze (Small Craft Warning)	9.5	**Large waves forming, white foam crests break more frequently, spray is flying.** It is now imperative that small craft seek refuge. If the wind is onshore, the conditions will be hazardous at river bar entrances and boat launch ramps, therefore alternative shelter should be sought. Everyone on board yachts should be wearing PFDs, and gear stowage should be checked for security.
7	28-33	Strong Wind (Small Craft Warning)	13.5	**Large waves, foam blowing in streaks along the direction of the wind.** Ocean cruising yachts and deep-sea power cruisers should be secured and rigged for heavy weather. Equal consideration should be given to enabling the vessel to endure the weather system while still trying to reach suitable shelter. Crew on deck and in the cockpits of yachts should be wearing PFDs and have their safety harnesses clipped on at all times. Galley crew should guard against scalds from spillage.
8	34-40	Near Gale (Gale Warning)	18	**High waves of increasing length, crests form spindrift (sea spray) which is blown in wellmarked streaks in the direction of the wind.** All smaller craft should have been in shelter long ago.
9	41-47	Strong Gale (Gale Warning)	23	**High waves, dense streaks of foam, crests roll over.** Slight structural damage will be experienced on shore; shingles may blow away.
10	48-55	Storm (Storm Warning)	29	**Very high waves, long overhanging crests; surface of sea white with foam.** Trees are uprooted and considerable structural damage occurs on shore.
11	56-65	Violent Storm (Storm Warning)	37	**Exceptionally high waves, sea completely covered with foam.** Widespread damage is experienced on shore.
12	Over 65	Hurricane (Hurricane Force Warning)	42 or over	**The air is filled with spray and visibility is seriously affected.** Widespread damage occurs on shore.

MAFOR FORECAST

MAFOR, an abbreviation of MArine FORecast, is a North American code used in the transmission of marine weather forecasts to compress a volume of meteorological and marine information into shorter code for convenience during radio broadcasting. The MAFOR forecast usually supplies the period of validity for the forecast, future wind speed and direction, weather, visibility and 'state of sea.'

Issue Times (EDT/EST): 3:00 a.m.; 10:30 a.m.; 6:30 p.m.

Format

A MAFOR code begins with a date and time group, followed by the name of the area to which the forecast applies, followed by one or more groups of five figures, which may be followed by another optional group.

Group 1

YYG1G1/

YY is the day of the month

G1G1 is the time of the beginning of the valid period of the forecasts in Coordinated Universal Time (UTC).

"/" is the last digit of this group is not used.

Group 2

0AAAam

The maritime area to which the whole forecast or set of forecasts refers. If the geographical name for the forecast region is used instead of the indicator AAAam, it shall be inserted at the place of this group.

AM CODE	PORTION OF THE MARITIME AREA	AM CODE	PORTION OF THE MARITIME AREA
0	Whole of the area AAA	5	Southwest quadrant of the area AAA
1	Northeast quadrant of the area AAA	6	Western half of the area AAA
2	Eastern half of the area AAA	7	Northwest quadrant of the area AAA
3	Southeast quadrant of the area AAA	8	Northern half of the area AAA
4	Southern half of the area AAA	9	Rest of the area AAA

Group 3

1GDFmWm

1: is an identifying number required by international practice. Each code group following the name of the lake will begin with 1.

G: is the code figure for the period of time covered by the forecast given in the group.

D: is the code figure for the forecast direction of the wind.

Fm: is the code figure for the forecast speed of the wind

Wm: is the code figure for forecast weather.

G	FORECAST PERIOD	D	WIND	FM	WIND	WM	FORECAST WEATHER
CODE	DESCRIPTIVE	CODE	DIRECTION	CODE	KNOTS	CODE	
0	Beginning of period	0	Calm	0	0 - 10	0	Moderate to good visibility (greater than 5 km)
1	Valid for 3 hrs	1	Northeast	1	11- 16	1	Risk of accumulation of ice on superstructures
2	Valid for 6 hrs	2	East	2	17 - 21	2	Strong risk of accumulation of ice on superstructure
3	Valid for 9 hrs	3	Southeast	3	22 - 27	3	Mist (visibility 1 – 5 km)
4	Valid for 12 hrs	4	South	4	28 - 33	4	Fog (visibility < 1 km)
5	Valid for 18 hrs	5	Southwest	5	34 - 40	5	Drizzle
6	Valid for 24 hrs	6	West	6	41 - 47	6	Rain
7	Valid for 48 hrs	7	Northwest	7	48 - 55	7	Snow, or rain and snow
8	Valid for 72 hrs	8	North	8	56 - 63	8	Squally weather with or without showers
9	Occasionally	9	Variable	9	64 +	9	Thunderstorms

Group 4

2VSTxTn

2: identifies the group as a supplementary group. The 2 group is valid for the same period as the group that immediately precedes it.

V: is the code figure for the forecast visibility.

Tx: is the code figure for the maximum air temperature.

Tn: is the code figure for the minimum air temperature.

V	VISIBILITY	S	STATE OF THE SEA		TX,TN	TEMPERATURE
CODE		CODE	DESCRIPTIVE	HEIGHT (METER)	CODE	IN DEGREES CELSIUS
0	Less than 50m	0	Calm	0	0	Less than -10
1	50 – 200m	1	Calm	0 – 0.1	1	-10 to -5
2	200 – 500m	2	Smooth	0.1 – 0.5	2	-5 to -1
3	500 – 1000m	3	Slight	0.5 – 1.25	3	About 0
4	1 – 2km	4	Moderate	1.25 – 2.5	4	1 to 5
5	2 – 4km	5	Rough	2.5 – 4.5	5	5 to 10
6	4 – 10km	6	Very rough	4 – 6	6	10 to 20
7	10 – 20km	7	High	6 – 9	7	20 to 30
8	20 – 50km	8	Very high	9 – 14	8	Greater than 30
9	50km +	9	Phenomenal	> 14	9	Not forecast

Group 5

3DkPwHwHw

Dk: is the direction from which swell is moving

Pw: is the period of waves

HwHw: is the height of forecast waves, in units of 0.5 metres

DK	DIRECTION FROM WHICH THE SWELL IS MOVING	PW	PERIOD OF WAVES
CODE		CODE	IN SECONDS
0	Calm	0	10
1	Northeast	1	11
2	East	2	12
3	Southeast	3	13
4	South	4	14 or more
5	Southwest	5	5 or less
6	West	6	6
7	Northwest	7	7
8	North	8	8
9	Variable	9	9
		/	Calm or not determined

NOTE: MAFOR GROUPS 4 AND 5 ARE NOT INCLUDED IN THE CANADIAN MAFOR BULLETINS ISSUED BY THE METEOROLOGICAL SERVICE OF CANADA AND ARE BEING PROVIDED FOR REFERENCE PURPOSES ONLY. THIS IS CONSISTENT WITH THE WORLD METEOROLOGICAL ORGANIZATION'S CODING REGULATIONS FOR THE MAFOR BULLETINS.

Example of a Marine Forecast

MAFOR 0403/ - Superior 12646 14755 245H 12720 - Ontario 15820 12804

Referring to the codes above, this may be decoded as follows: MAFOR 0403/: Marine forecast valid from 03 Coordinated Universal Time of the fourth day of the current month.

Lake Superior: first 6 hours of the forecast period -wind west at 28 - 33 knots, with rain. Next 12 hours of forecast period - wind northwest 34 - 40 knots, with drizzle. During the same period - visibility 1/2 - 1 nautical mile, with rough seas, wave heights of 2.5 - 4 m. Final 6 hours of the forecast period -wind northwest at 17 - 21 knots, visibility greater than 3 nautical miles.

Lake Ontario: First 18 hours of forecast period -wind north 17 - 21 knots, visibility greater than 3 nautical miles, final 6 hours of forecast period - wind north at 10 knots or less, with fog reducing visibility to less than 1/2 nautical mile.

THE COOLING EFFECT OF WIND

Another effect of wind is cooling. The greater the wind, the greater the cooling effect. Vessels engaged in SAR should remember that when a vessel is going at speed, hot days may become considerably cooler. The following chart expresses the cooling effect of the wind with an equivalent temperature.

ESTIMATED WIND SPEED (KNOTS)	ACTUAL THERMOMETER READING (°C/°F)									
	50/10	40/4	30/-1	20/-7	10/-12	0/-18	-10/-23	-20/-28	-30/-34	-40/-30
	EQUIVALENT CHILL TEMPERATURE (°F/°C									
Calm	50/10	40/4	30/-1	20/-7	10/-12	0/-18	-10/-23	-20/-28	-30/-34	-40/-40
0-5	48/9	37/3	27/-3	16/-9	6/-14	-5/-21	-15/-26	-26/-32	-36/-38	-47/-44
5-10	40/4	28/-2	16/-9	4/-16	-9/-23	-24/-31	-33/-36	-46/-43	-58/-50	-70/-57
10-15	36/2	22/-6	9/-13	-5/-20	-18/-28	-32/-36	-45/-43	-58/-50	-72/-58	-85/-65
15-20	32/0	18/-8	4/-16	-10/-23	-25/-31	-39/-39	-53/-47	-67/-55	-82/-63	-96/-71
20-25	30/-1	16/-9	0/-18	-15/-26	-29/-34	-44/-42	-59/-51	-74/-59	-88/-67	-104/-76
25-30	28/-2	13/-11	-2/-19	-18/-27	-33/-36	-48/-44	-63/-53	-79/-62	-94/-70	-109/-78
30-35	27/-3	11/-12	-4/-20	-21/-29	-35/-37	-51/-46	-66/-54	-82/-63	-98/-72	-113/-81
35-40	26/-3	10/-12	-6/-21	-21/29	-37/-38	-53/-47	-69/-56	-85/-65	-100/-73	-116/-82
Wind speeds greater than 40 knots will have little additional effect	Little danger of frostbite. Moderate danger for hypothermia after prolonged exposure.				Moderate danger of frostbite. Exposed flesh may freeze within I minute.			Extreme danger. Flesh may freeze within 30 seconds.		

8.2 HEAVY WEATHER OPERATIONS

8.2.1 FATIGUE

If exposed to adverse conditions for extended periods of time, coxswain and crew will suffer fatigue. This is a serious concern because it affects the ability of the operator to safely handle the boat. Any experienced crew member knows that the ride gets rougher when the driver gets tired. Prolonged exposure to adverse conditions will take its toll on the coxswain's ability to react and deliver a smooth ride. Judgment may also be affected by exposure.

As the rescue vessel advances at speed through stormy seas, many factors such as weather, temperature, sea state, wind chill, noise level and the constant pounding over the waves will increase fatigue.

HEAVY WEATHER CHECKLIST

- All loose equipment stowed in its proper place and secured
- Crew are wearing appropriate protective gear, safety lines and PFD's
- Ensure there is adequate fuel, 1/3 out, 1/3 to return and 1/3 in reserve
- Prepare navigation requirements prior to departure (check charts)
- Determine if any special equipment is required
- Ensure the Crew is briefed of any special considerations or local hazards particular to the mission as well as any conditions that may be encountered
- Make sure that all overboard drains that are designed to be open at sea and freeing ports are open and clear
- Close and secure all door, hatches and other openings
- Extinguish all open flames
- Ensure all bilge pumps are operational
- Turn on your navigation lights
- Reduce speed to match sea condition
- Maintain enough power to allow steering
- Direct the bow into the waves at about a 45-degree angle, if possible
- Run out a sea anchor on a line from the bow to keep the boat headed into the waves if your engine fails
- Notify JRCC via MCTS of current weather conditions

8.2.2 SAFE BOAT HANDLING TIPS

STOPPING

When stopping in heavy weather, the vessel is safest with the bow headed into the seas (stemming the sea). If the vessel is laying broadside to the seas, care must be taken to avoid capsizing in large seas.

CHOOSING YOUR PATH

A good boat handler knows how to read oncoming waves. He or she is always looking for indications that point to the safest path to follow and what to avoid. Choosing your path can be easy once you understand the basics.

The main things to avoid are large steep parts of a wave that are cresting or look like they may crest soon. Each wave can be hundreds of feet long and across its span there will be high spots (peaks) and low spots (windows). The skilled boat driver carefully avoids the high peaks by outrunning them, or ducking through a window spot, before the peak.

If the driver is caught by a cresting wave, he/she must make sure that the boat is not broadside to the face of the wave. The bow must be brought up into the breaking wave. A wave that is about to break has a marked colour change. The colour in the face of the wave will change from dark green or blue to a lighter shade of green or blue just before it breaks. Try to avoid such waves. When running through heavy seas, the driver should always reserve 25% of the power for emergencies. It's very hard to accelerate away from a cresting wave if you're already going full speed.

USE OF THROTTLES

Manipulating power is a vital part of keeping control of the boat in adverse conditions. It is imperative that throttles be used in addition to steering for a smooth ride. The use of throttles provides approximately 60% of the control necessary to navigate comfortably in rough weather. When heading into the seas, there is very little time and space to use the steering wheel to alter course or change trim for every wave. In this case, throttles make up about 80% of the control. Quick and precise control of the throttles can only be accomplished when the driver is in a stable posture.

AIR TIME

When advancing through a heavy sea state at speed, it is inevitable that the propellers will leave the water occasionally. Airtime should be avoided. Being completely airborne leaves the driver without control. Part of the skilled use of throttles includes trying to keep the boat in the water. This makes for a more comfortable ride and less wear on equipment and crew.

POSTURE

Sitting or standing, the driver must be balanced and not relying on the wheel or the throttles for support. The driver's weight should be evenly distributed over his/her feet. If the driver is not balanced, he/she can be thrown and injured. Some drivers stand while navigating through heavy seas. Standing offers better all-around visibility, but can be very tiring after extended periods. The main drawback to sitting is the shock absorbed directly by the spine when pounding through extremely steep seas. If the force is strong enough, the seat cushion can compress and bottom out, allowing a direct impact to the lower spine.

Standing or sitting, the knees should be bent slightly to absorb most of the shock in the legs, and the back should be straight so that the remaining shock is distributed evenly throughout the whole spinal column. If you're sitting, don't rely on the seat to absorb all of the shock. Use your legs to support part of your weight. The body must be in line with the direction of travel.

8.2.3 HEAD SEAS

HANDLING IN HEAD SEAS

The basic concept to follow when navigating into head seas is to keep the boat as level as possible. By using the throttles constantly, one can avoid most of the problems presented in head seas. The best course of action depends on many variables:

- The distance between the wave and the boat
- The speed and amount of throttle applied
- The type and size of the boat

On occasion, a steep wave may present itself and either a quick wheel turn or a reduction in throttle can help avoid the crest. Excessive steering only causes discomfort and needless zigzagging.

When climbing the face of a wave, too much power and being trimmed up, can shoot the boat into a vertical bow-up position only to land this way in the trough. To prevent this, trim down the engines.

Heading into the seas can be reasonably comfortable in a large rolling swell if the driver uses the correct amount of power at the right time. You shouldn't have too much speed on when approaching the wave, and as the boat begins to climb the face of a steep wave, the driver should ease off the throttle. When the bow tips over the peak of the wave and begins to drop, add power to maintain the boat's bow-up position. Airtime should be avoided, but if the props do leave the water, the driver should throttle back, then add power again when the propellers re-enter the water to facilitate a smooth landing. The boat should always re-enter with the props touching down first, followed by the after three feet of the hull. This slight bow up attitude makes for the softest landing.

Heading 45 Degrees Off the Sea

Transiting from wave to wave without slamming or rolling requires skill and dexterity. But if done well, heading off the sea provides a much more comfortable ride than heading directly into the seas.

DANGERS

The most uncomfortable situation occurs when the boat launches off the top of the wave, pitches or heels to one side, and lands on a flat surface of the hull. Not all boats are evenly balanced, and the transverse thrust from the propellers can roll the vessel – with the boat landing unevenly, one side slamming first. This creates a snap roll effect that may toss the crew off balance. If the boat is dipping to the starboard when going over, a slight turn to port will make it level and vice versa. Turn the wheel to the high side. Remember to use your legs to balance and support yourself during lateral impacts.

HANDLING WHILE HEADING BEAM TO THE SEA

Most of the throttle work and steering is directed towards avoiding crests and peaks. It is important to always keep an eye to the oncoming seas. Anticipate the crests and steer a course around them. To avoid dangerous crests or seas, remember to:

- Reduce speed and allow the crest to pass forward
- Steer to leeward and allow the crest to pass upwind
- Accelerate forward to allow the crest to pass aft
- Turn the vessel into the crest and take it on the bow

If the window is before a crest, throttle back and duck through, turning into the wave. If the crest is close, or immediately behind the boat, use power to accelerate away from the wave, running along the trough until a window is found. When crossing the top of the wave, use the wheel and throttles to keep level and prepare for the next wave. Always keep 25% of your power in reserve to be able to out-run crests that you are not prepared for. Keep your eyes windward and cross over the shallow spots. Pay attention to your navigation, since you are being set to leeward. Use landmarks whenever they are available.

8.2.4 FOLLOWING SEAS

When running with the seas, wind is no longer a fatigue factor. This is generally the most comfortable heading as far as ride is concerned. Following seas can make for a speedy and comfortable passage if you handle your boat properly.

DANGERS

The number one concern when running before the sea is sliding too fast down the face of a wave and slamming bow first into a deep trough. This is known as “stuffing the bow”, and when this occurs, the boat is stopped dead. One can imagine the problems that arise when the boat and crew go from twenty-five knots to zero in less than a second.

Another danger is when a large cycloidal wave overtakes the vessel and causes it to surf beyond its power capabilities. When this happens, the vessel’s stern tries to pass the bow, taking the vessel broadside to the sea, resulting in a capsize.

HANDLING IN FOLLOWING SEAS

Throttles are as important as steering in following seas. Having too much power on at the wrong time will result in stuffing the bow. Not having enough power may result in a large cresting wave catching up with the boat. In following seas, the first step is to trim up the engines. If they begin to cavitate, they are trimmed up too high. Once trimmed, accelerate up the backside of the wave. As soon as the bow begins to tip over the peak, back off on the throttles. The driver must then decide whether the next trough is shallow or deep and take the appropriate action. The back of a wave is generally a safe place to sit when deciding a path. If the trough is deep and the wave particularly high, the bow may still be stuffed, even though the boat is properly trimmed. To avoid this, steer out of the hole by turning the bow slightly so that it hits at an angle rather than straight on. The best

avoidance of a deep trough is to not overtake the crest until you have determined what is on the other side. When you determine that it is hazardous to proceed, then throttle back more and turn off to one side or the other.

If the trough is not deep, proceed straight and add power only after the bow has pushed through the bottom of the trough. Lots of power can be safely used while climbing up the back of the next wave, but the 25% reserve rule still applies. Try to manoeuvre through the shallow spots when approaching the back of a high wave, steering around the peak to where the wave is shallower and climbing it there.

8.2.5 QUARTERING SEAS

When running diagonally across following seas, it is important, as it is with all headings, to keep an eye out for large peaks and crests and for shallow spots to pass through. Proper assessment is the key to keeping the vessel in the safest places. As a rule, the back of a wave is a very comfortable place to be. Here it is possible for you to carefully choose a path or just slow down and ride that wave. Again, throttles and steering are equally vital for safe navigation.

DANGERS

If the boat is caught running beam on to the face of a large cresting wave, a capsize can result. If caught from behind by a large wave, steer down the face of the wave into the trough and then accelerate along the trough away from the advancing crest.

HANDLING IN QUARTER SEAS

On this heading, the likelihood of stuffing the bow is not as great as for following seas. Therefore, the engines do not need to be trimmed as high. The boat will handle effectively if the engines are trimmed up slightly, thus keeping the bow up. Watch the oncoming seas very carefully in order to avoid being caught by a surprise crest. As the boat runs along the trough, look ahead of the boat at the back of the next wave, scanning to find windows to cross over in. When climbing the backside of a wave at an angle, one can use additional power safely. When the bow tips over the peak and the boat begins to slide down the face, keep enough throttle on to maintain steerageway and head down into the trough.

Try and avoid finding yourself beam on the face of the wave. In this position, the boat is most vulnerable to capsizing. Once the bow has hit the bottom of the trough, add power and run along the trough until you find another shallow spot in the back of the next wave.

Be familiar with the limitations of both the boat and your own skill. Every vessel and every driver has limitations, and as the driver, you should know them well.

ON WATER & PRACTICAL COMPETENCIES

PPE – INSPECTION/SIZING			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand the knowledge and demonstrate correct sizing of PPE and inspection of PPE. The following must be done at all times.	The student must accomplish the following tasks at all times: Identify the appropriate floatation gear for the weather of the day		
	Size the flotation gear appropriately (not too tight and not too loose)		
	Inspect flotation gear (zipper, buckles, etc.)		

PERSONAL SAFETY			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully identify and demonstrate the following **continually** throughout the course.	Student will wear the minimum flotation Gear required by CCGA at all times as required ("Zip & Clip")		
	Demonstrate the ability to choose and wear the appropriate protective gear for the weather, mission and or training demands		
	Student will explain the need for head protection (If Applicable)		
	Student will explain the need for eye protection (If Applicable)		
	Student will wear eye protection if required on vessel (open cabin vessel & if applicable)		
	Student will wear Head protection (If applicable)		
	Describe difference between PFD & life jacket		
	Know and understand the hazards of working in a marine environment		
	Understand the necessity for keeping the vessel "Ship Shape"		

DAILY INSPECTION OF VESSEL

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand the importance of a daily inspection of the vessel and demonstrate the ability to conduct a daily inspection of the Vessel. The use of a checklist is acceptable.	The student must accomplish the following tasks a minimum of **once:** Identify the items on a daily inspection checklist		
	Demonstrate the inspection of those checklist items		
	Identify defects or discrepancies on the vessel		
	Identify those items that are critical for vessel safety and operation		

DAILY INSPECTION OF EQUIPMENT

STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand the importance of a daily inspection of equipment and demonstrate the ability to conduct an inspection of all emergency equipment on the vessel. Ex: First Aid, Blankets, Backboard, Etc. The use of a checklist is acceptable.	The student must accomplish the following tasks a minimum of **once:** Identify the emergency equipment items located on the vessel		
	Demonstrate the inspection of those emergency items located on the vessel		
	Identify defects or discrepancies of items on the vessel		
	If found defective, indicate how to remedy the equipment and gain a replacement if required		

DAILY INSPECTION OF VESSEL NAVIGATION EQUIPMENT/LIGHTS			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand the importance of a daily inspection of the vessels navigation equipment and lights and demonstrate the ability to conduct a daily inspection of the Vessels navigation equipment and navigation lights. The use of a checklist is acceptable.	The student must accomplish the following tasks a minimum of **once:** Identify the vessels navigation equipment. Ex: GPS, radar, chart plotter, charts, spreaders and dividers		
	Demonstrate the inspection of the navigation equipment		
	Identify the navigation lights on the vessel		
	Demonstrate the inspection of the navigation lights on the vessel		

PRE DEPARTURE BRIEFING			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully understand and provide a Pre departure briefing. the pre departure briefing must be demonstrated a minimum of **once.**	The student must accomplish the following tasks a minimum of **once:** Where to find emergency exits		
	Ensure guests and crew are wearing an appropriately sized PFD or life jacket		
	Ensure guests and crew are familiar with the location of the Fire Safety System (fire extinguishers, etc)		
	Location of the life raft and how to use the life raft		
	How to reduce the effect of movement on vessel so as to affect the stability of the vessel		
	Location of the first aid kit		
	Location of flares and other signaling devices		
	Location of life saving devices (life rings, throw bags, etc)		
	Muster location (if applicable)		
	Ensure guests and crew are familiar with hazards on board the vessel (slippery and wet deck, ropes & lines, pinch points)		
	Proper clothing for weather and appropriate footwear (crew and guests)		

SRU COMMUNICATIONS & USE OF VHF RADIO			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the ability to use the VHF Radio and communicate a status report and a sit rep.	The student must accomplish the following tasks a minimum of **once:** Recognize the distress signals		
	Demonstrate acknowledging a radio call and communicate effectively on an appropriate channel		
	Demonstrate the ability to operate the radios functions IE: Power, Squelch, Channel Select, Scan, Hi/Low Weather, Transmit button.		
	Send a formatted Status report		
	Send a formatted Sit Rep		
	Understand and keep a radio log/record of all relevant information during the course/ on water evaluations		

OPERATIONAL SAFETY			
STANDARD	CRITICAL ACTIONS	INSTRUCTOR INITIALS	SIGN OFF DATE
The student must successfully demonstrate the following practices and safe habits throughout the entire course.	Maintain proper hand positions at all times when on the helm and making way		
	Post lookouts as appropriate		
	Act in a responsible manner and make collision avoidances as required		
	Activate navigation lights at appropriate and required times		
	Remains cognizant of the personal safety of others, including reduction and control of wake where appropriate		
	Demonstrates due care and attention by operating vessels in a safe and controlled manner, including the maintaining of reserve power		
	Demonstrates due care and attention when maintaining vessels by conducting thorough daily Inspections and making minor repairs where appropriate		
	Effective communication skills at all times		
	Wears/carries appropriate personal equipment		
	Understand the need for accurate and complete “ships logs”		

ACRONYMS

AOR	Area of Responsibility
C	Coverage Factor
CASARA	Civil Air Search and Rescue Association
CCG	Canadian Coast Guard
CCGA	Canadian Coast Guard Auxiliary
CCGC	Canadian Coast Guard Cutter
CFB	Canadian Forces Base
CGRS	Coast Guard Radio Station (also known as MCTS)
CHS	Canadian Hydrographic Service
CMCC	Canadian Mission Control Centre
CO2	Carbon Dioxide Gas
CO	Carbon Monoxide Gas
CRP	Casualty Reception Point
CSA	Canada Shipping Act
CSP	Commence Search Point
CSS	Coordinator Surface Search
DFO	Department of Fisheries & Oceans
DMB	Datum Marker Buoy
DND	Department of National Defense
DOT	Department of Transport
DR	Dead Reckoning
DSC	Digital Selective Calling
DTG	Date Time Group
ELT	Electronic Locator Transmitter (used by aircraft)
EPIRB	Emergency Position Indicating Radio Beacon
ETA	Estimated Time of Arrival
FSE	Free Surface Effect
GEOSAR	Geostationary Search & Rescue Satellite
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GPIRB	Global Position Indicating Radio Beacon
HF	High Frequency
ICAO	International Civil Aviation Organization
ICS	Incident Command Structure
IMO	International Maritime Organization
IAMSAR	International Aeronautical and Maritime Search & Rescue
IRB	Inshore Rescue Boats
JRCC	Joint Rescue Coordination Centre
KTS	Knots
LF	Low Frequency
LKP	Last Known Position

LOP	Line of Position
MARB	Marine Assistance Request Broadcast
MAJAID	Major Air Disaster
MCTS	Marine Communications and Traffic Services
MED	Marine Emergency Duties
MF	Medium Frequency
MMSI#	Maritime Mobile Service Identity Number (DSC)
NM	Nautical Miles
NSP	National SAR Program
NVG	Night Vision Glasses/Goggles
NWPA	Navigable Waters Protection Act
OSC	On-scene Coordinator
PCOC	Pleasure Craft Operator Card
PFD	Personal Floatation Device
PIW	Person in Water
PLB	Personal Locator Beacon (used by persons on land)
POB	People on Board
PPE	Personal Protective Equipment
RHIB	Rigid Hull Inflatable Boat
RHIOT	Rigid Hull Inflatable Operator Training
RTB	Return to Base
S	Track Spacing
SAPP	Stop, Assess, Plan, and Proceed
SAC	Send, Acknowledge, Confirm (closed loop communication)
SAR	Search and Rescue
SAREX	Search and Rescue Exercise
SART	Search & Rescue Transponder
SITREP	Situation Report
SKAD	Survival Kit Air Droppable
SLDMB	Self Locating Datum Marker Buoy
SOG	Speed Over Ground
SOLAS	International Convention for Safety of Life at Sea
SOPP	Standard Operating Policies and Procedure
SOS	International Morse Code Distress Signal (...---...)
SRR	Search & Rescue Region
SRU	Search and Rescue Unit
SVOP	Small Vessel Operator Proficiency
SVR	Small Vessel Regulations
TC	Transport Canada
UTC	Coordinated Universal Time
VHF	Very High Frequency
W	Corrected Sweep Width
WIG	Wing In Ground
Wu	Uncorrected Sweep Width

GENERAL GLOSSARY

AERONAUTICAL INCIDENT
All SAR incidents involving aircraft.

AERONAUTICAL COORDINATOR
A person at JRCC responsible for planning, coordinating and controlling the response to aeronautical incidents.

AIDS TO NAVIGATION
A device or object, external to the vessel, located to assist in safe navigation. It may be natural or a man-made structure or object.

APPARENT WIND
The direction of the wind as it appears on board. It differs from the true wind direction and speed, due to the vessel's motion.

BEACON
A distinctive artificial structure erected as an aid to navigation.

RELATIVE BEARING
The direction in which an object lies with respect to the reference direction of a given vessel.

BIFURCATION BUOY
A buoy that marks a point where a channel divides and may be passed on either side.

BUOYANT HEAVING LINE
A floating rope thrown toward a person in the water for them to hold on to while pulled alongside. It can be packed into a rescue throw bag to keep it from getting knotted and makes it easy to throw.

CARDINAL BUOY
A buoy that indicates the direction to safe water for example, a north cardinal buoy indicates that the safest water exists to the north.

CARDINAL POINTS
The four main points of the compass; North, South, East, West.

CASUALTY RECEPTION POINT (CRP)
An intermediate forward location where a large number of survivors can be treated prior to evacuation to appropriate medical facilities.

CHART
A nautical chart not only represents a geographical area of the earth's surface, but it provides the navigator with the location of navigation hazards, aids to navigation, plus other information to assist in safe planning and navigation.

COMMERCIAL VESSEL
A vessel that is not a pleasure craft or used for commercial fishing. A small commercial vessel is no larger than 15 gross tonnage and if used to carry passengers carries no more than 12.

COORDINATED SAR SYSTEM
The facilities, equipment and procedures established in each SRR to coordinate the response to SAR incidents.

COORDINATOR SURFACE SEARCH
When more than one vessel or aircraft has been tasked to an incident JRCC may designate one unit to coordinate the on scene operation.

COXSWAIN
The master of a vessel.

DATUM
1. The most probable location of a search object or person, corrected for total drift at a specific time.

2. A reference level from which depths and heights are measured.

DEAD RECKONING
The process of determining a vessel's position using only knowledge of a departure, vessel's speed, elapsed time and course steered.

DEVIATION
The angular difference between Compass North and Magnetic North.

DISABLED
A term describing a craft that has lost all means of propulsion or steering for any reason, and which is in need of assistance.

DISPLACEMENT HULL
A boat that displaces a weight of water equal to its own weight; underway it constantly displaces or shoves aside the water in its path, while water from either side closes in behind it.

DISTRESS
A SAR incident wherein there is a reasonable certainty that one or more individuals are threatened by grave and imminent danger and require immediate assistance.

DITCHING
The forced landing of an aircraft on water

ELECTRONIC EMERGENCY LOCATOR TRANSMITTER (ELT)
An emergency radio beacon designated for use by aircraft.

EMERGENCY POSITION INDICATING RADIO BEACON (EPIRB)
An emergency radio beacon designated for use by vessels.

FETCH
The distance over which the wind has blown uninterrupted.

FISHING VESSEL
A vessel used for commercially catching, harvesting or transporting fish or other living resources.

FIX
A position determined without reference to any former position.

FREEBOARD
The distance between the water and watertight deck of your vessel, or the gunwale.

GLOBAL POSITION INDICATING RADIO BEACON (GPIRB)
An emergency radio beacon designated for use by vessels which transmits its actual location.

HUMANITARIAN ASSISTANCE
An incident not directly related to an air or marine incident which requires the provision of assistance by SAR resources to save life or relieve human suffering, including the provision of a medevac, transportation of human organs, relief or medical supplies.

HYPERTHERMIA
The condition of having a body temperature greatly above normal.

HYPOTHERMIA
The condition of having an abnormal low body temperature, typically one that is dangerously low.

JOINT RESCUE COORDINATION CENTRE (Also known as JRCC)
A unit responsible for providing efficient organization of search and rescue resources for coordinating the conduct of search and rescue operations within a SAR region.

LEEWAY
Away from the wind.

LIFEBUOY
A lifesaving ring that must be at least 600 mm in diameter and be made of inherently buoyant material; and should have a buoyant line of good quality that does not kink and at least 9.5 mm in diameter and 15 metres long (TC requirements) . The name of the vessel should be marked on the buoy.

LIFEJACKET
A lifesaving appliance designed to keep a person's head above the water and to help them remain in a proper breathing position. Transport Canada states that an approved lifejacket of the right size to fit each person you have on board must be present on the vessel.

MAJOR AIR DISASTER (MAJAID)
An aircraft accident occurring in Canada which because of the size of the accident requires augmentation of established SAR resources.

MAJOR MARITIME DISASTER
A marine incident which because of the number of people involved requires augmentation of established SAR resources.

MARITIME COORDINATOR
A person at JRCC responsible for planning, coordinating and controlling the response to maritime incidents.

MAYDAY
A radio distress signal indicating a person or vessel is threatened by grave and imminent danger and requests immediate help.

MEDEVAC
The evacuation of injured or stranded persons from isolated areas or the recovery of sick or critically injured persons from vessels at sea.

MOORING
A permanently anchored buoy to which a vessel can secure without using her anchors.

OFFICE OF BOATING SAFETY (OBS)
A group of CCG employees responsible for providing SAR prevention logistics and organization.

ON SCENE COMMANDER (OSC)
When more than one vessel or aircraft has been tasked to an incident JRCC may designate one unit to coordinate the on scene operation. If the unit is a primary or secondary SAR vessel or aircraft it is known as the on scene commander. If it is a vessel other than a primary or secondary SAR vessel or aircraft it is known as the Coordinator Surface Search.

OPERATOR
The person in command and charge of the vessel and also known as the Master. Terms can be used interchangeably.

OTHER SAR RESOURCES
Resources other than primary or secondary which from time to time participate in SAR activities when required. This includes municipal and provincial resources, civil volunteers and partially funded federal government resources such as the CCGA or CASARA.

PAN PAN
A radio signal indicating a safety problem that does not require immediate assistance.

PASSENGER
Anyone on a vessel except for the master, a member of the crew or a person employed or engaged in any capacity on board the vessel on the business of that vessel, or a guest on board a pleasure craft. A fare does not have to be paid for a person to be considered a passenger.

PLANING HULL
A hull of such a shape as to be capable of skidding or skimming over the water.

PLEASURE CRAFT
A vessel that is used for pleasure and does not carry passengers. If the vessel is used for the daily living needs of the operator ,eg. transportation or subsistence fishing/hunting, it is still considered a pleasure craft.

PLOT
To draw lines on a chart indicating bearings, courses and positions.

PRIMARY SAR RESOURCES
Aircraft, vessels or formations established and equipped specifically for SAR and staffed with trained SAR crews. Primary SAR resources are under the direct operational control of the SRR commander for SAR tasking.

PRE-DEPARTURE BRIEFINGS
A safety briefing before the voyage begins to show and tell your passengers how to react in an emergency. This is a legal requirement.

PUMPING OR BAILING SYSTEM
Bilge pumps and systems that detect water levels are important safety features, especially for small vessels where water in the bilges can quickly lead to capsizing or sinking. SRU crew must have a way to pump or bail each watertight compartment in any operating condition.

PYROTECHNIC DISTRESS SIGNALS (FLARES)
Emergency devices used to help others know that the vessel needs immediate help. All flares must be clearly marked as being Transport Canada approved and must not have been expired. The size of the vessel will determine the number required to meet regulatory requirements.

RELATIVE WIND
The direction and velocity of the wind as observed from a moving vessel.

RESCUE COORDINATION
The integration of efforts of SAR facilities and resources to achieve concerted and harmonized resolution of SAR incidents in an effective and efficient manner.

RESCUE SPECIALIST
Specially trained rescue personnel who are a key part of a primary SAR vessel. The military equivalent carried on board SAR aircraft are known as SAR TECH's.

SAIL PLAN
A plan that includes the travel route and basic details about the vessel that is filed at the local marina or with an Canadian Coast Guard Marine Communications and Traffic Services (MCTS) Centre by telephone, radio or in person before heading out.

SEARCH AND RESCUE REGION (SRR)
A specified geographical area in which SAR operations are coordinated and controlled by a designated Rescue Coordination Centre.

SAR INCIDENT
A reported air or maritime incident which requires a response by the SAR system.

SAR MISSION
The task assigned to a SAR resource by JRCC in response to a SAR incident. A SAR mission starts with formal tasking by JRCC and is normally defined in scope and time.

SAR OPERATIONS
When the response to a distress incident requires the utilization of more than one resource and/or numerous SAR missions are anticipated during the resolution of the incident.

SAR RESOURCE
A resource capable of responding to a search and rescue incident.

SAR UNIT
A unit specializing in the provision of search and rescue services.

SAR VEST(Survival vest)
Safety vest that allows a CCGA member to carry required safety items; worn over other gear.

SCOPE
The ratio of the length of anchor rode to the depth of water.

SEARCH INITIATOR BUOY (SIB)
A maritime EPIRB designed to float free from a sinking vessel while remaining attached to it by a reel-out cable. If the depth of the water is greater than the length of the cable, the SIB will break free, and float to the surface.

SECONDARY SAR RESOURCES
Aircraft or vessels established and equipped for other than SAR, but which can be expected to respond (when available) to SAR tasking. They include multi-tasked government resources.

SELF LOCATING DATUM MARKER BUOY
A datum marker buoy launched by either an aircraft or SRU vessel and used to measure rate of drift; PIW of either a POB or a life-raft. The buoy transmits a signal to a satellite, which in turn transmits the data to the appropriate JRCC.

SRR COMMANDER / RESCUE COORDINATOR
The military commander designated by NDHQ as being responsible for SAR operations within a search and rescue region.

SPOTTERS
Personnel aboard a SAR aircraft or vessel to assist in the conduct of a visual search.

STABILITY
The characteristic of a vessel that helps it stay upright; and is able to return to an upright position after being heeled over.

STAND / STOOD DOWN
The order originating from the master of the vessel in distress or JRCC which releases the resource from the incident.

STAND ON
1. To maintain course and speed.

2. Stand-on; right-of-way

STARBOARD
The right hand side of the vessel when facing forward.

TRUE NORTH
The direction of the geographical pole.

VARIATION
The angular difference between Magnetic North and True North.

WAKE
The disturbed column of water around and behind a moving watercraft which is set into motion by the passage of a watercraft.

WINDWARD
Towards the wind.

NOTES

CANADIAN COAST GUARD AUXILIARY

CENTRAL AND ARCTIC REGION