Seamanship 2

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The technical skills covered by the practical seamanship module are essential for ensuring safety and efficiency at sea

Constructive feedback and suggestions for improvements to the SAR Training Matrix is appreciated. Please email feedback / suggestions to sartrainingfeedback@coastguard.co.nz providing as much detail as possible. Thank you.
Overview
The technical skills covered by the practical seamanship module are essential for ensuring safety and efficiency at sea.

1. Rope Types
The properties of a rope determine how useful it is for a given application. Key properties are strength, weight, weather and chemical resistance, melting point and elasticity. Whether it floats or sinks is also an important consideration. Natural fibre ropes have almost exclusively been replaced by synthetic materials. A hot knife is the preferred method for cutting synthetic rope.

1.1 Laid Ropes
These are twisted and appear like a screw. When used, laid rope is partial to untwisting. This can cause spinning of suspended loads, kinking or stretching. Twisted ropes have a preferred direction for coiling.

1.1 Braided Ropes
These are smaller strands plaited together. They come in single, double, hollow and solid braid. Braided ropes stretch less than laid ropes and they are stronger. Its smoother surface makes it easier to handle, it also bends more easily and does not kink. Braided polyamide (nylon) over a braided core gives a high strength.
2. Rope Properties

The strengths in the table below are examples as a guide only. Many 3 strand polyethylene ropes are used in commercial fishing, these are not as strong as similar polypropylene ropes but have better abrasion and UV resistance. Polyethylene in a different construction gives Dyneema or Spectra rope which is stronger than 1x19 stainless wire.

Characteristics of Synthetic fibres used in rope construction

<table>
<thead>
<tr>
<th></th>
<th>Nylon (Polyamide)</th>
<th>Polypropylene</th>
<th>Polyester</th>
<th>Polyethylene</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Texture</strong></td>
<td>Very smooth and glossy. Has an oily texture when new</td>
<td>A waxy texture. Less slippery than other synthetics.</td>
<td>Softer and easier to handle than nylon</td>
<td>A shiny plastic texture. More slippery than other synthetics</td>
</tr>
<tr>
<td><strong>Stretch</strong></td>
<td>46%</td>
<td>35%</td>
<td>25%</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Buoyancy</strong></td>
<td>Sinks</td>
<td>Floats</td>
<td>Sinks</td>
<td>Floats</td>
</tr>
<tr>
<td><strong>Water Absorption</strong></td>
<td>4%</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td><strong>Melting temperature</strong></td>
<td>250°C</td>
<td>165°C</td>
<td>265°C</td>
<td>125°C</td>
</tr>
<tr>
<td><strong>Resistance to UV and chafe</strong></td>
<td>Moderate</td>
<td>Poor</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td><strong>Breaking Strain (10mm line)</strong></td>
<td>2080kg</td>
<td>1425kg</td>
<td>1590kg</td>
<td>930kg</td>
</tr>
</tbody>
</table>

Source:

Activity: Analysing Ropes

- Form teams and provide each team a length of each of the different rope types.
- Each team is required to identify which type of fibre each rope is made of by evaluating the look, feel, buoyancy and burning characteristics.

Provide each team with:
- Several short lengths (20cm) of each of the types of line
- A copy of ‘Safety in Small Craft’
- Bucket of water
- A lighter
3. Rope Usage

3.1 Mooring Lines
A typical vessel will have one bow line, one stern line and two spring lines for berthing purposes. A large vessel may also have breast lines. It should have two lines slightly more than length of vessel and two lines slightly more than twice length of vessel. This gives the ability to double all the lines and have full length doubled springs for springing in and out of berths. Polyamide (nylon) is the preferred choice for mooring lines for larger vessels because of its stretch, which causes less damage to vessel's cleats & fittings. Coastguard CRV’s often use polyester which is suitable for mooring small craft.

3.2 Towing Rope
Polyester and polypropylene are the most common materials used for towlines. Polyester is the recommended first choice in keeping with commercial towing where the minimum stretch in a towline is needed. Polyester is also preferred because it sinks which makes it less likely to get caught around rudders or propellers, it is also UV resistant. It needs to stretch to absorb some of the loading, but not stretch too much. Polypropylene has a low melting point making it prone to damage when surging round fittings under load.

3.3 Anchor Rope
An anchor rope needs to sink and be very strong. It must also be weather resistant and stretch without breaking. For these reasons anchor ropes will usually be made of polyamide (nylon).

3.4 Life Ring Rope
A flotation device or life ring will usually have a polypropylene rope attached. This type of rope is used because it usually comes in bright colours, and it floats.
Laid ropes should always be coiled in the same direction as the lay, this will minimise twists in the rope and make the rope less prone to tangling when next used. Braided ropes also have a memory and therefore benefit from being coiled the same way every time. Holding the rope in the left hand and coiling with the right is the best technique irrespective of whether the person coiling is left or right handed. Rope should never be coiled around the elbow. Doing so temporarily renders the rope and one arm useless. This is not a safe or practical state to be in on a vessel.

Ropes are affected by heat, abrasion, chemicals and sunlight. Avoid leaving in direct sunlight or near a source of heat. Avoid contact with chemicals and sources of ignition. Ensure the ends are protected against unravelling by using heat to melt the ends.

Regularly examine ropes for abrasion, chafing, cuts, kinks, chemical damage, flat or soft spots, stiffness or other damage, and replace when worn. Also check the ends, splices and whippings. Some ropes get used and worn at one end, by changing the end that is used the rope will not need to be replaced as quickly. If a rope has been stretched allow it time to recover before reeling up or storing.

Rope should be cleaned occasionally by hand in fresh water with pure soap and then hung to dry. Do not use hard brushes or abrasive cleaners. When the rope is not in use store it in a dark area where air can flow around it.

5. Basic Knots

It is important to select the correct knot for the job, tighten the knot, and allow sufficient free rope as a tail, so that the knot does not pull undone. A good rule is to leave at least 10 times the width of the rope as a tail. All knots reduce the overall strength of the rope some by up to 40%. Several knots in a rope will cumulatively reduce its strength.

“Inspecting your rope should be a continuous process of observation before, during and after each use. In synthetic fibre ropes the amount of strength loss due to abrasion and/or flexing is directly related to the amount of broken fibre in the rope’s cross section.”

5.1 Round Turn and Two Half Hitches

This combination of knots can be used to attach a rope to a ring or pole. It can also be used to attach a vessel to the buoy shackle of a mooring buoy. This knot tightens its grip as the pressure increases but is relatively easy to undo. The two turns around the pole take the strain while you complete the knot. This is why it is useful while mooring. If you are handling a heavy load you can add extra turns to take the strain while you tie the knot.
5.2 Bowline
This knot is used to create a loop at the end of a rope. The loop can be tied around or looped over an object. The knot is easy to untie, however it cannot be undone while it is under tension. It is typically used for mooring lines and attaching anchors. (Anchors should be attached by a round turn & 2 half hitches followed by a bowline.)

It is possible to tie this knot with one hand, which is useful if you are using the other hand to hold on. The knot is known to slip if not tightened correctly and may come undone once the load is off. Adding a half hitch using the end can stop it from slipping.
5.3 Clove Hitch
This is used to temporarily attach a rope to a pole, rail, spar, post or similar fitting. It will slip along the object if subjected to a sideways pull. A clove hitch is used to lash spars or similar, with strain taken on both ends to secure the object. It is sometimes used to tie on fenders.
5.4 Double Sheet Bend

This is used to secure the end of a rope to an eye and is easily untied; this is more secure than a single sheet bend. It is important that if there is a smaller diameter line, it is used for the round turn. The strength of the bend is reduced if both tails are on the same side.
5.5 Rolling Hitch

A rolling hitch will enable a line to be tied onto another line, spar or similar, and pull exerted on that line in one particular direction. This can be useful to increase the tension on a line or take the weight off the line while adjustments are made. There are many slight variations on how to tie a rolling hitch, and the pictures below show just one particular version.

The bitter end is looped twice around the line / object working back towards the final direction of pull (pictures 1 & 2).

The bitter end is then crossed over the initial turns and secured with a half hitch (pictures 3, 4, 5). The completed rolling hitch (picture 6).
Sometimes a single rolling hitch is not sufficient for the load. In which case a second (and possibly third) rolling hitch can be tied. The method is the same as described above only this time there must be sufficient length of line in the bitter end to tie a second rolling hitch above the first one. The completed double rolling hitch (picture 7).

6. Ropes on Deck

This section covers some of the practical aspects of using ropes on deck.

6.1 Berthing and Leaving Berth

The diagram below shows a vessel secured to a berth using six lines. Smaller vessels may not need breast lines and can be secured with just four lines.

Bow and Stern Lines

The purpose of the bow and the stern lines is to prevent the vessel from surging backwards and forwards along the berth, and keep the bow and stern close to berth. To be effective at preventing surging these lines should be led out from the bow and stern and secured at points well forward and well aft of the vessel. If secured short and close they will not be effective in preventing surging and damage the vessel. They should also be long enough to take into account the rise and fall of the tide.
**Bow Spring and Stern Spring Lines**

These are used to assist the bow line and stern line to prevent the vessel surging along the wharf and in conjunction with the bow & stern lines to ensure the vessel keeps parallel to berth.

**Breast Lines**

Generally used for larger vessels, breast lines are lines which run to the shore perpendicular to the vessel’s centre line and are used to limit how far away the vessel can get from the wharf. They are not usually needed unless the vessel is being blown off the berth so that getting on and off is becoming difficult. They should not be used if the vessel is left unattended and there will be a large rise or fall in the tide.

**Surging**

Surging is usually caused through tidal movement such as swells. The effect of this is to cause the vessel to move or surge. The surging can be forward and back or up and down.

Surging hazards are common when berthing alongside another vessel at sea or alongside a wharf, pontoon or jetty. This could cause damage to the vessel’s bulkheads or hull. Damage can be avoided by using fenders between the two boats or the boat and the wharf.

Spring lines will limit the effects of surge. In a heavy surge it is detrimental to have tight mooring lines as the stretch and rebound may increase over time resulting in lines parting or fittings pulling out.

**Letting Go Lines**

This is the term used to release lines from the shore, cleats, bollards or the vessel. It is usually used when leaving a berth, whether that be a wharf or from alongside another vessel.

When leaving dock it is necessary to cast off the lines securing the CRV. These lines must be cast off in the correct order; otherwise the vessel can be put in danger. The sequence of letting go lines will depend on the berthing situation. For example, how the vessel is berthed in relation to the prevailing wind and tide, how much room is available and whether to let go the bow first or the stern first will be decided by the skipper at the time based on these facts. Good communication between the skipper, the helm and the deck crew are essential before letting go. The skipper should brief the crew as to the plan for letting go, and the words and signals that are to be used.

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Depending on the size of the CRV there may be four lines attached to bollards on the wharf. Note that removing the lines is typically done in the reverse order to attaching them when berthing. However if there is a change in the wind or tide, or a need to spring off, this means they are often not done in reverse order to coming alongside. Assumptions should not be made as to what or when to let go. Clear closed loop communication should always be used.

If there will be no assistant on land to remove the headline from the bollard, it will be necessary to first set up a rope looped around the bollard and back to the vessel in its place. This is so that the lines can be released from the vessel. Once lines are released crew should confirm to the skipper when lines are clear of the berth and the water.

### 6.2 Securing Lines

This simply means to fix a line or rope to a bollard, cleat or similar object such as a handrail. For example you may be asked to secure a throwing line to the vessel's cleat or handrail. You may also be asked to secure a bow line or berthing line to the shore. Securing a line to a cleat or double bollard will involve taking at least three turns in a figure eight pattern. Alternatively use a bowline or a round turn and 2 half hitches on a single bollard.

#### Making Fast

Making fast is to secure a line or rope to a fixed secure point such as a cleat or bollard. It may also be securing a general purpose line or heaving line to a hand rail or similar fixture.

Making fast should be done in such a way as to secure the line effectively, but allow it to be undone easily in due course. Crew should clearly communicate to the helm and skipper when a line is made fast.

#### Cleats

Cleats are used for securing ropes and lines and are generally found around the vessel’s decks and may appear on some bulkheads (walls). An example of their use would be to secure a heaving line or berthing line. The Coastguard method is;

- Take one full turn around the base of the cleat.
- Make a figure of 8 on the cleat
- Finally add a second full turn.
- Do not make locking knots which may jam.

This is method is known as OXO within Coastguard.
Securing to a cleat

1

2

3

4

Bollards

Bollards are also used to secure berthing lines from the boat to the shore. They can appear similar in shape to a cleat (double bollard), although are generally made of cast metal or hard steel and are much larger, which makes them ideal for berthing. They may be single bollards which would require a bowline / round turn & 2 half hitches.

- Take 3 full turns on the bollard to create enough friction to hold.
- Making figure 8’s on the pins is just to tie it off. The pins are not made to take the weight.
- Do not make locking knots which may jam.

Securing to a bollard

1

2
Dipping Eyes
Two separate ropes are looped over a bollard in such a way that they can be removed in any order. For example the first rope to be looped over the bollard may also need to be the first one to be removed. This is achieved with a technique called dipping eyes, where the loop of the second rope is ‘dipped’ through the inside of the loop of the first rope. This is a good seamanship technique to utilise when securing to a bollard to which another vessel is already secured.

Creating dipping eyes

Removing dipping eyes
7. Messenger Lines

A messenger line is simply a length of light line attached to the towline that can be thrown, propelled or floated to a vessel or person. These are often used to assist with getting people out of the water.

Heaving Line

A heaving line is a light line with a ‘monkey’s fist’, sand pouch, or similar weight at the throwing end.

The other end of the heaving line is secured to the towline. Securing the heaving line approximately one meter from the towline eye will enable the eye to be placed directly onto the bollard / post or cleat on the disabled vessel without trapping the heaving line. It also can make it easier to pull the towline under the pulpit or stanchions of the disabled vessel.

Throwing a Heaving Line

- The weighted end plus several small coils should be held in the throwing hand, with the remaining coils held loosely in the other hand.
- Stand with toes in line with the desired target.
- To cast the heaving line a short distance an underhand movement can be used.
- Aim higher and further than the target to cast the heaving line so that it settles over the deck of the vessel.

A heaving line can be cast a considerable distance and with reasonable accuracy, but it does take practice! Never aim directly at the other vessel or its crew.

Float Line

A floating line (polypropylene), used with a life ring, fender or lifejacket, may be floated from upstream / upwind, so that the current or wind carries the line to the disabled vessel. This can be slow and difficult to achieve so is usually only attempted in exceptional circumstances.
Rescue Throw Bags
A standard ‘throw bag’ can also be used as a messenger line. Throw bags are not as ‘user friendly’ as a dedicated heaving line, because the towline is attached to the throw bag right next to the crew’s ‘throwing hand’. They are however made from polypropylene, and can be used as a floating messenger line. Hold one end of a rescue throw bag in your hand and throw the bag. The bag can be filled with water for extra weight.

Line Throwing Device
A rocket line thrower or shoulder line-firing gun may be used to pass a towline when conditions are such that your vessel cannot get close enough to the disabled craft to use a heaving line. They are predominantly used when forced to throw into strong wind. Similar to a heaving line aim high to allow the line to land over the deck.

8. Anchoring

The anchor should be attached to the chain and warp and the end of the anchor rode should always be securely fastened to the vessel to assist in rapid emergency deployment. Before the need arises, the helmsman should brief the crewmembers on procedures for anchoring.

Anchoring involves good communication between the helmsman and the crew. With noise from the engine(s) and the wind, it is difficult to hear voice communication. The Skipper should ensure a pre-arranged set of hand signals that the crew understands. Keep the signals as simple as possible.

Having selected a suitable spot, the helmsman should run in slowly, preferably on some range ashore selected from marks identified on the chart, or referring the vessel’s position to radar ranges or GPS data to aid in locating the chosen spot. Use of two ranges will give the most precise positioning. Later these aids will be helpful in determining whether the anchor is holding or dragging. The vessel should approach the selected spot head to the prevailing wind or tide. The CRV should be moving very slowly astern when the anchor is deployed. As the anchor is lowered into the water, it is important to know how much rode is paid out when the anchor hits the bottom. At least one round turn should be taken on the forward bitt or cleat to maintain control of the rode. The anchor rode should not be held with hands alone.
8.1 Deploying the Anchor
- Station two persons on the forward deck if available.
- The anchor should be released just prior to deploying so as to avoid it bouncing around on deck in adverse weather.
- Never step in coils of anchor warp and never heave the anchor away from vessel.
- On the helmsman’s command, lower the anchor over the side.
- Once the anchor is on the bottom, take a working turn on the forward bitt to control how fast and how much anchor rode is released.
- The angle and direction of the rode should be communicated regularly back to the helm.
- Once the desired length is paid out (4 - 6 times the depth of water), make up the anchor rode to the forward bitt.
- Check anchor is holding by observing the angle of the warp, the attitude of the CRV relative to the wind and tide and by using visual transits or a hand bearing compass. GPS and Radar may also be used to set up ranges, guard zones or anchor alarms.

8.2 Weighing the Anchor
- The helmsman should go forward slowly and the anchor rode should be recovered to avoid fouling the propellers.
- Flake the line into the locker as it comes onboard. If being recovered by hand, a second crewmember can assist with ensuring there is a working turn on the forward bitt at all times.
- 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.
- Communicate to the helm when the anchor is off the bottom.
- Securely stow all ground tackle as soon as possible.

8.3 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.
- Extreme care should be taken to ensure the anchor line does not tangle in the propellers during this operation.

Activity: Anchoring
- Look at the unit SOP for deploying and weighing the anchor.
- If there is no SOP then get into groups and write one.
- If there is, then is it accurate? Does it reflect practice?
- Have you identified the hazards during the process of deploying and weighing anchor?
- How are these minimised?