5 TOWING TECHNIQUES

Overview

Over 50% of all marine SAR incidents result in a tow being established.

Towing is potentially hazardous to both vessels and all crew involved. Large forces can be involved with resultant high loads. One careless moment is all it takes for injury or damage to be sustained.

Knowledge of safe towing procedures is therefore of key importance for all CRV crew and Skippers. This module is designed to give an introduction to the fundamental issues, including recommended towing techniques, safety precautions and equipment.

Regulations & Policy

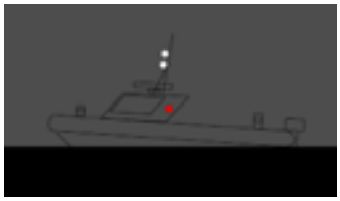
Maritime Regulations

The Maritime Rules provide the steering and sailing rules covered by Rule 22 'Collision Prevention', plus standards for installation, performance and use of lights and sound signals covered by Rule 22.24 'Towing and Pushing'.

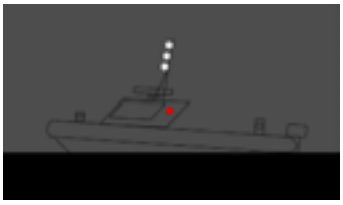
The rules state that a power driven vessel engaged in towing or towing alongside (barging) should exhibit;

Lights

- Two masthead lights in a vertical line.
- When the length of tow exceeds 200 metres (measured from the stern of the towing vessel to the after end of the tow) 3 masthead lights in a vertical line must be carried.
- Side lights.
- Stern light.
- A towing light (yellow) in a vertical line above the stern light.



Port aspect tow <200m



Port aspect tow 200m

Stern aspect

The vessel being towed should exhibit;

Lights

- Side lights.
- Stern light.

Shapes

- When the length of tow exceeds 200 metres, a black diamond shape where it can best be seen on both towing and towed vessel (if practical).

Where from any sufficient cause it is impracticable for a vessel or object being towed to exhibit the lights or shapes prescribed, all possible measures must be taken to illuminate the tow or at least to indicate its presence.

If the towing operation is such that it severely restricts the towing vessel and its tow in their ability to deviate from their course, in addition to the lights and shapes already described the towing vessel may exhibit the lights and shapes for a vessel that is 'Restricted in Ability to Manoeuvre' (RAM).

- Three all-round lights in a vertical line where they can best be seen the highest and lowest being red and the middle one white.
- Three black shapes in a vertical line where they can best be seen the highest and lowest being balls and the middle one a diamond.

If a CRV does not display the prescribed RAM lights and shapes, it remains a power driven vessel. In a crossing situation it remains the give way vessel to a power driven vessel crossing on its starboard side, vessel under sail, vessel engaged in fishing etc. (Refer Maritime Rule 22 & CBES Boatmaster course)

A CRV may display code flag Delta "*Keep clear of me; I am manoeuvring with difficulty*", but this is purely to inform other vessels and does not confer any special status on the CRV and its tow.

Coastguard Policy

The primary (and legal) responsibility of Coastguard personnel during a SAR operation is the preservation of life. Consequently the recovery of a disabled vessel rather than solely the people aboard could be considered not 'search and rescue'. In many instances however it is a more practical and reasonable solution to take the disabled vessel in tow to effect a safe rescue.

In determining whether or not to undertake a tow, the Skipper of the CRV must consider both the existing and forecast weather, together with the possible danger to people on board the disabled vessel. If there is any question regarding the best course of action, all relevant information is passed to the Incident Management Team or Duty Officer who, in consultation with the CRV Skipper, will decide whether to tow the disabled vessel and its crew, or to transfer those people to the CRV.

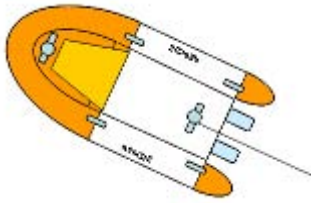
Towing Past the First Point of Safety

A tow operation to remove a vessel and crew from danger is only strictly a SAR operation until reaching the nearest safe haven. To continue the tow beyond this point must be by arrangement, within Unit SOPs, Regional policy, and agreed by the Skippers of both vessels.

Towing Configurations & Line Handling

The most common arrangements for towing fixtures on CRV's are either a single fitting on the centreline (for a straight tow), or cleats on either quarter (for a "y" or bridle tow).

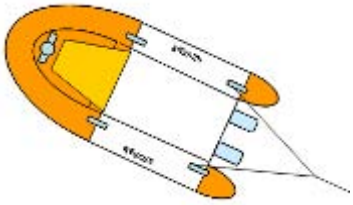
Straight Tow



With a single fitting on the centreline the fitting is often positioned some way forward of the vessels transom, allowing the stern to swing while towing. This will give greater control and manoeuvrability than if the towline is attached directly to the stern.

'Y' or Bridle Tow

Fixed Bridle



With a bridle tow the towline is usually made fast to the vessels quarter cleats. The bridle may be a fixed length which allows no adjustment of the towline – this is the least desirable of all the towing configurations.

Adjustable Bridle

An adjustable bridle which allows the towline length to vary is a more desirable towing configuration, but it comes with the added complexity of dealing with blocks and extra line.

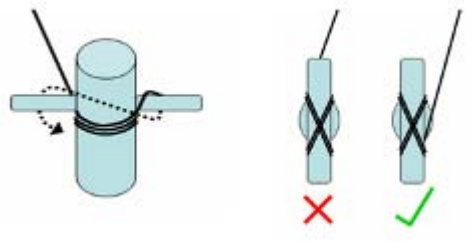
The bridle is made up either of a block permanently attached on the end of the main towline, with the bridle line lead through the block. Or the main towline is lead through the block (or a snatch block is used) to one of the quarter cleats, and the other line from the block which forms the bridle is adjusted to ensure the tow line is centred.

With the first method the main towline is a set length and any adjustments to the towline length are made with the bridle line. The disadvantage is that to lengthen the towline by 5m you may end up paying out almost 10m of bridle line. The advantage is that the strain of the tow will be equally divided between the two quarter cleats.

The second method reduces the amount of line needed on board the CRV for towline adjustment, but the strain imposed by the tow will not be equally divided between the two quarter cleats. The majority of the strain will be on the cleat taking the main towline.

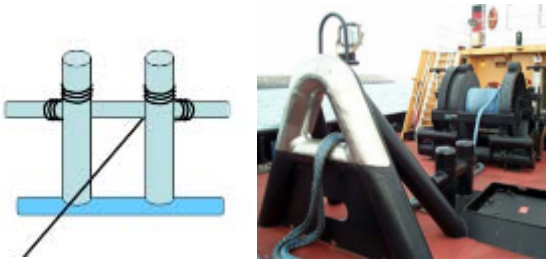
Line Handling

What ever method is used straight tow or bridle, care must be exercised when attaching the towline to the CRV so that the towlines lead is 'fair '. This will reduce the chance of the towline trapping itself on the cleat or post.



Some fittings are specifically designed for towing. The picture below of a commercial tug shows what is sometimes referred to as a "staple." The idea being that no matter what angle the towline takes it will not chafe or foul on any other part of the towline.

The same advantage can be gained from using fittings such as the one illustrated found on some CRV's. The towline is lead through the centre of the fitting and made fast on its forward side, ensuring the towline cannot trap itself.



All CRV crew should be aware of the potential hazard of the towline parting and its subsequent recoil. Great care must be taken to ensure the towline is stowed correctly and is free to run at all times.

- Avoid putting yourself in a position where a parting line and subsequent recoil will put you at risk.
- Do not handle lines under load close up to the fitting; always keep a safe distance between it and your fingers.
- If gloves are to be worn, they should only be close fitting finger-less (sailing type) gloves which will not become trapped by a line.

Towlines

Materials & Construction

There are many different types of rope both in terms of the material and construction used. Outside of the more specialised ropes available the most common materials used are;

- Polyester.
- Polypropylene.
- Nylon.

Materials

Polyester and Polypropylene are the most common materials used for towlines. Nylon isn't generally used by Coastguard as a towline, not because of any issues of strength – in fact Nylon is very strong, and often used in commercial towing. The problem is Nylons capacity for stretch. While a towline needs to be able to stretch to absorb some of the dynamic loading imposed on it, Nylon rope depending on its construction can stretch to an excessive degree (60% + in some cases).

The greater the stretch the greater the recoil when a line parts. The danger is not just from the towline, there is also the risk of a fitting such as a cleat being pulled out but remaining attached to the recoiling line.

Polyester	**Polypropylene**
Stretches approx 25 to 35% of its length.	Stretches approx 25 to 35% of its length.
Does not float.	Lightweight and floats.
Good resistance to UV.	Poor resistance to UV.
High melting point (friction).	Low melting point (friction).

Of the two types of material Polyester is preferable mainly due to its resistance to UV and the fact that it sinks. A line that sinks is far less likely to get caught around rudders or worse propellers when manoeuvring, and a floating line will sink blow the water to allow a catenary in the towline (See Catenary Devices). Another advantage of Polyester is its high melting point. While it is preferable to make any adjustments to a towline when there is no strain on the line this may not always be possible – as in the case of towing a vessel in heavy weather with a following sea. The higher melting point of polyester means it is less likely to suffer damage if surged around a cleat or post while still under load.

Construction

The two common types of rope construction used are 3 strand or plait construction. The braid construction more commonly see on yachts is generally not used. This type of construction usually results in a rope with very little stretch and hence very little chance of absorbing any dynamic or 'snatch' loads.

3 Strand

Plait

Braid

Of the two main types of rope construction in use – 3 Strand and Plait each has its own advantages and disadvantages

3 Strand	**Plait**
Easy to splice.	More complex to splice.
Prone to kink.	Does not kink (it has no inherent lay).
Needs more space to stow.	Needs far less space to stow.

Towline Ends

Towlines should have an eye spliced in the end rather than a knot tied in it such as a bowline. ***Any knot bend or hitch will always create a hard point and weaken the rope. The bowline typically reduces the strength of a rope by approx 40%. A properly constructed eye splice typically retains 90 - 100% of the original strength.***

The problem often encountered is that the size / diameter of the towline is such that there can be difficulty attaching it to the fittings on the towed vessel. Many fixtures and fittings on small vessels are barely suitable for there own mooring purposes never mind accepting a towline.

One solution to this problem can be borrowed from a common practice in commercial tug & towing operations. Instead of the main towline being attached to the towed vessel, a shorter length of smaller diameter, high strength line is bent onto the main towline, and it is this line that is used to secure the tow.

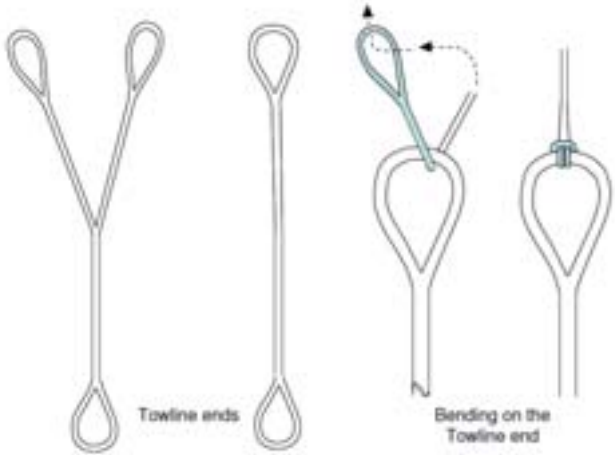
Typically these lines are Spectra / Dyneema or Kevlar rope. The advantage is that these more ‘exotic’ types of rope are typically far smaller in diameter and weight than the main towline therefore much easier to handle and ultimately secure to the other vessel. Although such lines have very little stretch, the stretch necessary to absorb any shock loading is still present in the main towline.

A comparison taken from a leading rope manufacturer shows a Polyester rope of 20mm having a breaking load of 6300kgs, while a Dyneema rope of just 8mm has a breaking load of 6700kgs. The diagram opposite shows the relative diameters of the two different types of rope.

These towline ends make securing the tow not just easier, but because of their reduced diameter make fitting chafe gear (a protective covering to prevent damage to the tow line) much more practical.

The towline ends are essentially sacrificial. While more expensive per meter than the main tow line, replacing a short end of Dyneema rope is generally more acceptable than having to shorten the main tow line due to chafe damage.

The towline ends can be of different configurations to suit different vessels; these would generally be one with a bridle arrangement of two spliced eyes and one with a single eye. The towline end is bent to the main towline either by a suitable rated shackle (with chafe gear such as leather fitted on both eyes), or by forming a cow hitch on the eye of the main towline.



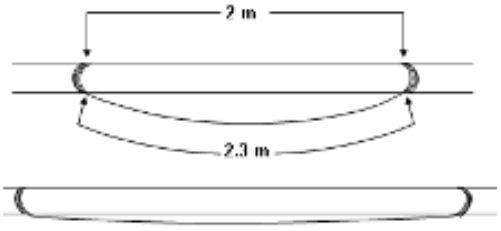
Towline Loading

One of the major concerns during a towing operation is how much load is being put on the towline and the fittings used to secure it. There is a way of approximately calculating this – and it will at least give an indication of when the tow line is getting close to or has reached its safe working load.

Maximum safe working load is usually taken to be 50% of the rated strength of the rope. The rated strength or break load being the load at which the line will probably part. Any rope manufacturer or supplier should be able to give not just the rated strength of a rope, but also its 'elongation at break' or 'stretch at breaking'.

For example
Polyester 3 strand 20 mm Diameter - break load 6300kgs - elongation at break 30%. Using the above example a cheap & easy 'eyeball' method of gauging loads on the towline can be set up.

- If the elongation at break is 30%, then the elongation at the ropes max safe working load (50%) will be approx 15%.
- A preset length is measured and marked on the towline – in the illustrated example 2m. 15% of 2m is 300mm so the when the rope is at its max safe working load those two marks on the towline will no longer be 2m apart but 2.3m apart.
- To give a visual indication of what is going on, a light easily seen line is attached (usually by stitching & whipping) to the towline at the marks. The light line should be attached such that there is 2.3m of it between the marks.
- With no load on the towline the light line will hang loose, as the load and hence stretch increases, the light line will become tighter. At max safe working load the light line will be stretched tight.



The light line should be small enough that if it were to catch on any fittings during the towing operation it will not snag but simply snap – this also ensures that a broken line will be a clear indicator if the max safe working load is exceeded.

If that happens slow down and / or reduce any snatch loadings on the towline.

Chafe Gear

Any towline in use can be subject to high loading and consequently suffer damage from chafe on the towed vessels fairleads or stem fitting. One of the most cost effective and robust types of chafe gear is simple flexible plastic hosing. The hosing can be already on the towline when it is passed and subsequently held in position with a simple clove hitch or preferably a rolling hitch.

Or in the case of the crew of the towed vessel not being familiar with either of these two hitches any form of lashing that keeps it in place.

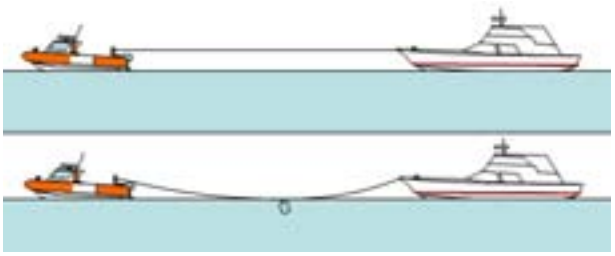
If hosing or similar is not available, any suitable chafe gear should be considered – old towels or clothing. It can take only a few minutes to seriously damage a line exposed to chafe.

Catenary Devices

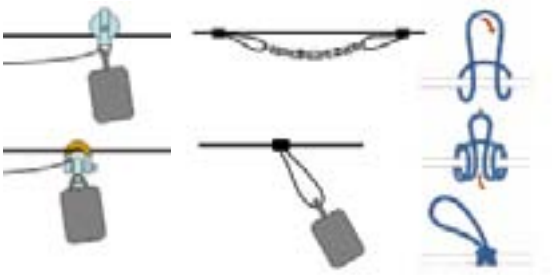
A catenary is the curve or dip in a line caused either by the lines own weight or by weight attached to the line. If a towline is stretched taught between two vessels any shock loading is transmitted directly through to both vessels.

Its shock loading that is the greatest cause of towlines parting or pulling out fittings.

Having a catenary in the line means that part of any dynamic loading is absorbed by having to first lift and stretch out the towline - the longer the towline the more catenary. In large commercial towing operations the length of the towline may be several hundred meters long. The sheer length of the towline will ensure a catenary. The space available on board many CRV's means that the length of towline alone may not be enough to induce the desired catenary, so additional weight may need to be added to the towline.



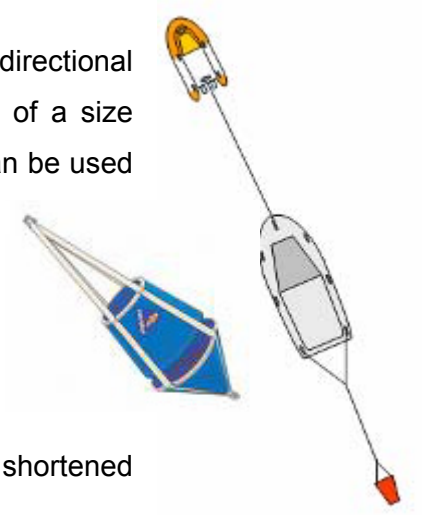
This weight or catenary device may be a permanent feature, such as a length(s) of chain in the towline, or a weight that can be added to the towline as required.



The greatest cause of shock loading to the towline and fixtures is when the vessels are out of step with each other. This is when the towing vessel and the vessel being towed do not ride up or down the waves at the same time. Being out of step can also cause further problems detailed later in this text. (See Towing Hazards)

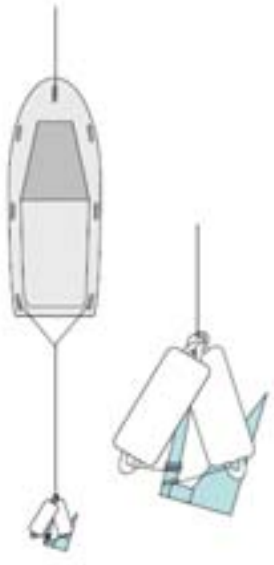
Drogues

A drogue slows a vessel down and produces greater directional stability. Drogues come in various designs and should be of a size suitable for the vessel. There are adjustable drogues that can be used for a range of different sized vessels. Deployed from the towed vessel's stern a drogue will help to prevent the towed vessel surfing down the face of a wave or sheering from side to side.



Drogues can be of particular use when a towline has been shortened up in preparation to enter harbour, when running a bar, or when towing in a following sea.

If a suitable patented drogue is not available, other equipment may be used in its place but it needs to be robust enough to withstand the forces involved. Warps streamed in a single line or in a bight, with objects attached such as kedge anchors, water containers, fenders (weighted down) have all been used as drogues.



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.

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 approx 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 coils should be held in the throwing hand, with the remaining coils held loosely in the other hand.
- To cast the heaving line a short distance an underhand movement can be used. To cast it further an overhand straight arm throw (similar to a discus thrower) will be needed.
- Aim 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!

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 crews 'throwing hand' (which can make throwing it a little awkward). They are however made from polypropylene, and can be used as a floating messenger line.

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.

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.

Never aim directly at the other vessel or its crew.

Kicker Hook

One item of equipment that can be extremely useful in attaching a towline is a kicker hook. A kicker hook is a device which can be used to fasten a towline to the 'trailer eye' (an eyebolt on the waterline under the bow) of a trailer boat (a difficult and potentially dangerous operation at sea).

Many trailer boats do not have deck fittings of sufficient size or strength to rely on for towing, with the exception of the trailer eye, and towing from the trailer eye is the preferred method as it helps to lift the bow of the towed vessel.

Any towline attached to the bow of a vessel will depress or pull down the bow (referred to as a vessel trimmed by the head / bow). The smaller the vessel the more pronounced this effect can be.

Any vessel trimmed by the head will be harder to control and will have a greater tendency to yaw (swerve from side to side). Whenever possible trailer boats should be towed from the "trailer eye" to prevent this happening.

A kicker hook can be purchased from some chandlery shops but it isn't always an 'off the shelf' item. Kicker hooks can be manufactured quite easily. It consists primarily of a suitable sized hook or carabineer with a spring gate.

The tow line (or more usually a towline end of 4 - 5m made specifically for the job) is attached to the eye of the hook. The hook is held in place on a pole / boat hook in such a way that when the hook is snapped onto the trailer eye, the pole can be pulled away from the kicker hook.

There are several different methods for attaching the kicker hook to the pole, but the simplest consist of;

- A steel tube welded to the hook so that it slots over the end of the pole. It should fit snugly but not so tight as to be difficult to release.
- Another version uses a slot cut in an aluminium pole or boat hook that fits the main body of the hook.

The kicker hook is held in place with the towline running between the palm of the hand and the pole thus keeping a little tension on the towline.

Towing Equipment Maintenance

- All equipment used in towing should be checked regularly.
- Any damaged or worn equipment should be replaced at the first opportunity.
- Any rope used should be from a reputable manufacturer / supplier and have known ratings for strength and stretch.
- Any hardware used such as shackles should be from a reputable manufacturer / supplier and have known ratings for strength.
- Any hardware used should be inspected regularly for signs of corrosion or fractures.

Towing Hazards

Most accidents that do occur during towing operations can be traced back to insufficient preparation, inappropriate set up, or inadequate monitoring of equipment and crew during the tow.

The following are abridged extracts from the MNZ report on the sinking of the tug Nautilus in Auckland harbour:

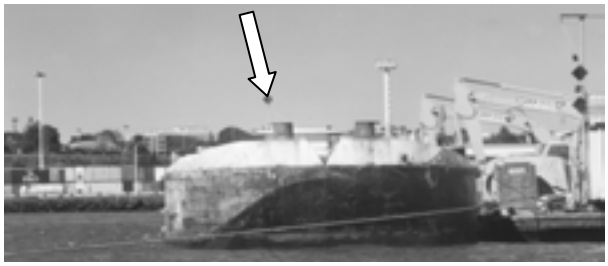
Accident report –tug Nautilus III

On Friday 9 March 2001, at about 0725, the tug Nautilus III was towing the laden hopper barge H7 in Auckland Harbour when the barge took a sheer to starboard. The tug skipper manoeuvred the tug in an attempt to arrest the sheer but the tug was girted, capsized, and sank. *Girted – when a tug is heeled by the direction of pull on a towline and is in danger of capsizing.*

The weather at the time of the accident was an easterly wind of about 5 knots, rippled sea, overcast with good visibility.

The towline they used was a 20 m length of 60 mm diameter multiplait rope with a soft eye spliced in each end. One eye of the towline was looped over the H post on the tug, the other eye over the starboard bollard on the bow of H7 (See picture below).

The skipper manoeuvred H7 off the wharf, and once H7 was about 80m off and parallel to the wharf the skipper increased to full power. When the barge was about 100m from the end of the wharf he turned the tow to starboard to head down the harbour.



As the tow proceeded down the harbour the skipper noticed that H7 was yawing up to about 40 degrees either way so he reduced the engine power to just over half - estimated to be about 4 knots through the water. H7 was still yawing but due to the reduction in speed the period of the yaw cycle had increased.
Shortly after, H7 yawed to starboard about 60 degrees, the skipper of Nautilus III applied power in an attempt to arrest the yaw. H7 continued yawing to starboard, and had begun to overtake the tug which altered the direction of pull on the towline more towards the beam of the tug, causing it to heel to starboard. Nautilus III was girted with the towline leading close to abeam on the starboard side. The heel of the tug increased until the sill of the watertight door to the accommodation, which was open and hooked back to the bulkhead, was submerged and down flooding commenced

As the tug rolled onto its starboard side the towline went slack and floated clear of the H post on the tug. The skipper swam clear, pulled himself along the towline and climbed onto the barge. The Nautilus III sank quickly, coming to rest on the seabed on its starboard side.

Analysis

The intent of Maritime Rule Part 40C, as described by the MSA, allowed the use of an axe as a "positive means of quick release that could be relied on to function correctly under load and for all directions of applied load and expected heel angles". It is debatable whether a deckhand wielding an axe to a towline under load from the deck of a tug over on its side could be described as reliable; nevertheless, this has been accepted in the industry for a long time.

When loaded with dredgings H7 usually trimmed by the head, and had a reputation as being awkward to tow for this reason. Being down by the head would create a natural tendency for the barge to yaw under tow. Lengthening the towline can reduce the yaw and its effect on the progress of the tow, but the skipper was unable to do so because the towline was fixed at each end. The barge was reportedly yawing 40 degrees either side of the intended track. This was an indication of poor tow geometry.

Findings

The sinking of the Nautilus III was caused primarily by lack of planning and communication as well as non-compliance with safety precautions and basic towing techniques. This accident is a prime example of how accidents can occur just as readily during a short harbour tow as they can on an ocean towing operation, arguably more readily so.

The use of a fixed eye at each end of the towline and the inability to slack, release or sever it in an emergency significantly reduced the options available to the crew when the emergency developed, and did not comply with Rule Part 40C.

This incident illustrates what can happen even in sheltered waters in good conditions and with a vessel specifically designed for towing.

Summary of Accident Report

The factors that resulted in the sinking of Nautilus III;

- Towed vessel trimmed by the head (bow down) – increasing the chance of yawing.
- Towline not made fast on centreline of towed vessel - increasing the chance of yawing.
- Towline was far too short - increasing the chance of yawing.
- Towline was fixed length – unable to lengthen, and hence reduce the effect of yawing.
- Towline unable to be released quickly.

Towing Hazards cont

To appreciate the inherent dangers in towing an understanding of the forces acting upon both the towed and towing vessels is essential.

Yawing

Yawing is when the towed vessel swerves off course, and as was highlighted in the previous accident report can endanger both the towed vessel and CRV.

To prevent or reduce a towed vessel yawing:

- Make sure the tow line is pulling the towed vessel from a point on its centreline.
- If towed vessel starts to yaw – decrease speed.
- If towed vessel starts to yaw - lengthen the towline.
- Ensure that both CRV and towed vessel are in step with each other.
- If possible trim the towed vessel down by the stern. Lower out boards for example on smaller vessels, or move weight(s) to the stern.
- Whenever possible tow trailer boats from the towing eye.
- Deploy a drogue or similar from the stern of the towed vessel.

Burying the Bow

The CRV can cause the towed vessel to bury its bow by getting the tow out of step with the wave pattern, or by towing at too high a speed. This problem is common in steep waves and can happen while travelling at any angle into or before the sea. In a head sea burying the bow of the towed vessel can create huge loadings on the tow line and the risk of swamping the towed vessel. In a following sea there is the danger of the towed vessel broaching. Broaching is where a vessel looses control and turns beam on to the waves.

The chances of burying the bow are increased when the point of attachment to the towed vessel is well above the waterline, as the pull and weight of the towline will tend to drag the vessels bow down.

Tows being undertaken at above planing speeds induce this problem much more readily than tows carried out at displacement speeds. Remember - If possible always attach the towline to the towing eye of trailer boats to help lift the bow.

Stopping and Swamping

The towed vessel can cause the CRV to both stop and then to be swamped by following seas. This problem occurs when the towed vessel has got out of step with the sea state when towing in a quartering or following sea. The towed vessel falls behind one wave while the CRV is in front of the same, or another wave. If the towed vessel is induced to bury its bow, its reserve buoyancy is enough to dramatically slow down or stop its progress through the water. This in turn affects the CRV and which can be overrun by waves as its stern is held down by the weight of its tow.

Being Overtaken by the Tow

This occurs when the CRV and the towed vessel get out of step. The CRV either slows down / stops, or the casualty accelerates down or across a wave (with the possibility of broaching) and overtakes (with the possibility of being girted as in the previous accident report) or collides with the CRV. The same thing can happen if the CRV slows down too quickly, and does not allow for a natural rate of deceleration for the towed vessel. The heavier the vessel, and higher the initial speed, the more momentum it will have.

All of the previously listed towing hazards are likely to occur if the CRV and casualty are out of step with each other, and they will all increase the risk of the towline parting or pulling out fittings. The general rule for towing astern in open water is to use as long a tow line as possible, and always ensure the vessels are in step with each other.

Sinking Tow

If time allows the vessel can be towed out of any shipping channels and possibly beached. (See Module Emergency Repairs) In shallow water and if safety permits payout the towline and buoy off its end so that it is visible on the surface. Note the sunken vessels position and report the situation.

Any vessel that sinks becomes the responsibility of the Local / Regional Harbour Master or MNZ depending on its location. Units must be aware of their local procedures & protocols as regards to sunken vessels (See Module Legal Considerations).

If forced to cut the tow line; cut it on or as close to the fitting as possible to avoid injury from the ropes recoil.

Sea & Swell

The table below describes open water swell. As can be seen an average swell can be up to 200m in length. In conditions such as these the CRV's tow line alone may not be of sufficient length.

Description	Length	Period	Height
Low swell of short or average length	0 - 200m	Less than 11 sec	0-2m
Long, low swell	+ 200m	More than 11 sec	0-2m
Short swell of moderate height	0-100m	Less than 8 sec	2-4m
Average swell of moderate height	100 - 200m	Between 8 and 11 sec	2-4m
Long swell of moderate height	+ 200m	More than 11 sec	2-4m
Short heavy swell	0-100m	Less than 8 sec	+ 4m
Average length heavy swell	100 - 200m	Between 8 and 11 sec	+ 4m
Long heavy swell	+ 200m	More than 11 sec	+4m

It is accepted practice that only the CRV's towline is used, because its age, condition, and strength is known to the CRV's crew. There may be times however where it is necessary to use lines from the other vessel to lengthen the tow.

If no suitable lines are available, then using the other vessels anchor and rode may provide a solution. The tow line is attached to the anchor or shackled to its chain nearby. The weight of anchor and any chain provides a good catenary device.

If the other vessel has nylon rope as part of its anchor rode then great care must be taken to ensure that no one is exposed to the risk of the line recoiling if it should break. Using nylon rope as part of the tow line is not ideal – but it may be the only way to avoid the huge loading imposed on both towline and fittings by towing out of step, and the occurrence of the towing hazards listed previously.

Towing Speed

Displacement vessels should never be towed at or above their hull speed. (See Module Boat Handling & Heavy Weather for definition of displacement vessel)

At such a speed, fuel consumption rises considerably, and enormous strain is put on the towline and fittings as the towline tries to literally drag the vessel up and through its own bow wave. Not only does the risk of pulling out a fitting or snapping the towline increase, there have also been numerous instances of small vessels swamped and sunk while under tow purely because it was towed at excessive speed.

The table opposite gives approx safe towing speeds for different lengths of displacement vessel. Often the easiest guide to a safe max speed is to simply ask the Skipper of the towed vessel what their 'cruising speed' is and base the speed of the tow on that figure.

This table shows the approx max safe speed for displacement vessels, but all towing operations should be carried out at speeds suitable for the conditions.

- Approx Max towing speed = Sq root of waterline length in feet x 1.34.
- Safe towing speed = 90% of approx Max speed.

Waterline Length		Safe Speed
Meters	Feet	
3.0	10	3.5 kts
3.5	12	4.0 kts
4.0	14	4.5 kts
5.5	18	5.0 kts
6.0	20	5.5 kts
7.5	25	6.0 kts
9.0	30	6.5 kts
10.5	35	6.5 kts
12.0	40	7.5 kts
13.5	45	8.0 kts
15.0	50	8.5 kts
18.0	60	9.0 kts
21.0	70	10.0 kts

Towing at planing speed

A sufficiently powered CRV is able to tow most disabled vessels at displacement speed, but it requires significantly more power to be able to get a disabled planning vessel over the "hump" and onto the plane. Once on the plane the drag of the disabled craft is greatly reduced.

Any loss of support to the towed vessel while planing, e.g., wave effects, turning, change in weight distribution or change in speed may well cause a rapid drop off the plane and a potential hazard from the effects of rapid deceleration and / or yawing. Towing a vessel at planing speed should only be attempted in relatively calm conditions.

Imagine you are on the helm of your CRV, on the plane at approx 20 kts. How confident would you feel taking your hands off the wheel and throttle controls and putting them in your pockets? That's the position the towed vessel is in – and the only thing controlling the vessel is the constant tension on the towline.

Summary of Standard Towing Practice

Standard practice that should be adopted when towing;

- Operate with an extended tow line in open water, generally the longer the better.
- Always try to keep the towed vessel and CRV 'in step'.
- As necessary deploy a drogue from the towed vessel to reduce its potential to yaw.
- Trim the towed vessel down by the stern if possible.
- As necessary employ a catenary device in the tow line to minimise snatch loading.
- Tow at a safe speed – For a displacement vessel with consideration for its max hull speed, and for all vessels at all times a speed suitable for the conditions.

Preparation for Towing

Visual Assessment - SAP – Stop Assess Plan (See Module Victim Recovery)

- Assess the vessel's drift and motion before deciding on an approach.
- How is the vessel trimmed fore and aft and athwart ships?
- Are there any fittings on the vessel that could damage the CRV if you come alongside? (You may end up 'barging' the vessel)
- Are there any ropes / lines in the water?
- What attachment points are there for the towline?

Questions to Ask / Information to Obtain

- How many people are on-board?
- Does anyone have injuries or need medical assistance?
- What is the nature of the problem?
- Has the vessel sustained any damage?
- Is the vessel taking on any water?
- Is everything on board stowed and secure?
- For a displacement vessel, work out its safe towing speed.
- Can the vessel monitor VHF channel.....?
- Does the vessel have working Navigation lights, searchlight or torch?
- Is the steering impaired in any way?
- What kind of securing points are available – are they strong enough?
- Are they able to receive and secure a towline? Always remember that the entire operation may be easier if (with the owner's permission) you put a crew member on board the other vessel.

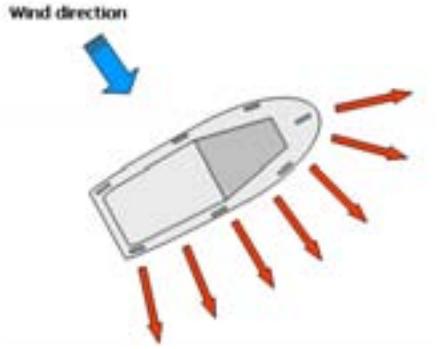
Before Commencing the Tow

- Ensure that you have agreement as to where you are towing the vessel.
- If appropriate request that everyone wears a lifejacket.
- Ensure that communication with the vessel have been established, i.e. VHF, hand signals and / or light signals if the tow will be conducted at night.
- Have the vessel turn on its navigation lights (port, starboard & stern).
- Have the vessel secure the rudder amidships ***or*** instruct they steer for CRV's stern.
- Hoist code flag Delta / turn on the CRV's navigation and towing lights.

Approach and Passing the Tow Line

How you approach a disabled and drifting vessel will primarily depend on the prevailing weather conditions and on the vessels motion.

A disabled vessel will normally drift more or less beam on to the wind and waves. Depending on the hull configuration, weight distribution and superstructure they may drift with the bow slightly upwind or downwind. The leeward side of the disabled vessel should always be considered as potentially hazardous to the CRV.



The area extends not just directly downwind of the vessel but also in front of and to leeward of its bow. ***As the vessel is pushed down wind by wave action it can also accelerate forwards*** – this is especially prone to occur in vessels that are drifting in a bow down attitude to the wind in the first place.

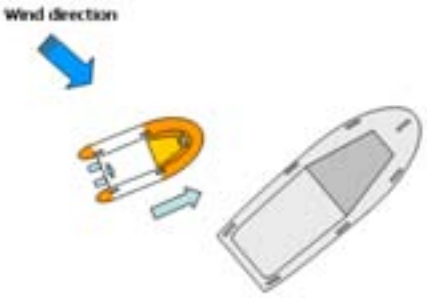
Approach

Generally there are 4 different methods of approach depending on the sea conditions;

- Parallel Approach calm to slight seas.
- 45°Approach slight to moderate seas.
- Crossing the Bow moderate to rough seas.
- Crossing the Stern moderate to rough seas.

Parallel Approach

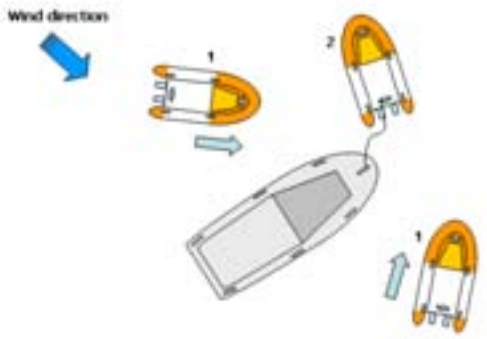
As the name suggests the approach is made parallel to vessel and hence generally beam on to the prevailing wind and waves. The tow line is generally passed across when the CRV is in line with the foredeck of the other vessel.



45°Approach

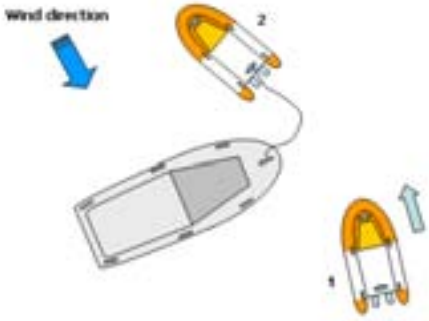
When conditions are such that a slow speed approach beam on to the waves would produce an uncomfortable and possibly hazardous motion on the CRV – then angling its approach to the wind & waves may be a better method.

The approach could me made from either the windward or leeward side of the disabled vessel, (although passing the towline via a messenger line will obviously be easier from a windward position), and then rounding up into the wind to hold station near by the vessel until the tow line is attached. The actual angle of approach need not be at exactly 45°, merely the angle that will best suit the sea conditions.



Crossing the Bow

In moderate or rough conditions then the safety of the CRV and its crew may become the factor uppermost in the Skippers mind when assessing which method of approach to use. Approaching the disabled vessel into the wind may be the only safe and sensible approach.



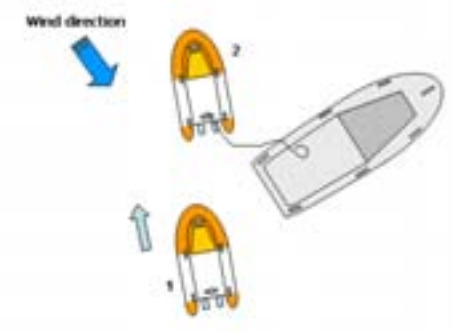
Once clear of the bow the CRV can be turned through the wind to crab across the vessels windward side, and the towline passed to the foredeck when it is directly downwind.

Care should be taken not to cross the bow so close as to endanger the CRV.

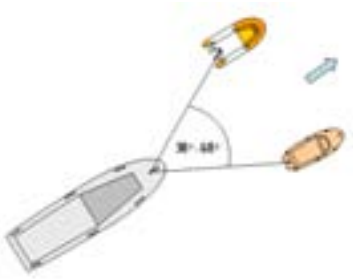
Crossing the Stern

The approach is made towards the stern, and the towline passed either to the vessels windward quarter, and then taken by its crew to the bow, or once the CRV is clear of the windward quarter by crabbing across the wind to pass the towline to the vessels bow.

This approach is the safest for the CRV in heavy weather – but due consideration must be made for the crew of the other vessel. Transferring the line to the bow of the vessel on a cabin cruiser with narrows side decks or negotiating the rigging and shrouds on a yacht may be difficult or downright dangerous.



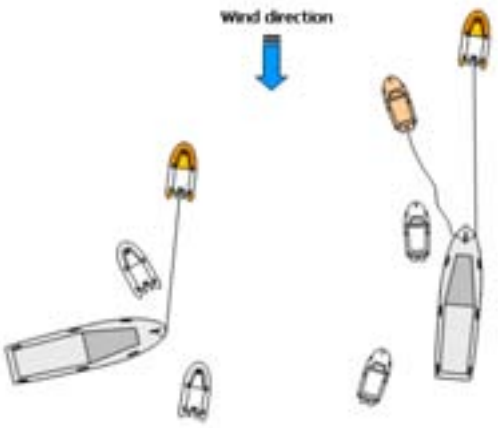
Twin Towing



Usually only adopted when attempting to tow a significantly larger or perhaps flooded vessel. The two vessels towing maintain a parallel course with an angle between tow lines of approx 30° to 60°. More than 60° and too much of the pull is exerted sideways not forward. Less than approx 30° and the towing vessels may be too close to each other for safety. The actual distance between the two towing vessels will be dependent on both the angle and length of tow lines.

The first vessel pays out its towline to a suitable length, and commences to tow at slow speed – just enough to swing the disabled vessel head to wind or slightly across the wind and maintain station. The second vessel then approaches from either side to pass its tow line.

Many vessels fairleads, cleats and bollards will not be large enough to take two tow ropes, and the towlines may need to be lead from either bow. If that is the case then to avoid crossing the towlines the other vessel must be informed as to which CRV's towline is going to be on which side of their bow.



Care must be exercised when first taking the strain on the tow, as unequal load on the towlines may induce the tow towed vessel to yaw. Both vessels then proceed ahead at low speed until they have let out a similar length of towline. Once tension is on the towlines both vessels accelerate slowly to a safe towing speed.

Towing off a Vessel Aground

Before attempting to tow off a grounded vessel, the skipper of the CRV must answer the question - is it necessary? Coastguard's primary role is saving lives not property.

For a vessel that has run aground on a falling tide, then often by the time a CRV arrives on scene, towing the vessel off is no longer possible. The best that can be done is to secure its position with a kedge anchor(s) or shoring if necessary and await the next flood tide.

For a vessel aground on an incoming tide, all that may be needed is again to secure the vessel in position and wait for the tide to do the rest.

Before assisting a vessel aground, the CRV crew must make a thorough analysis of the situation. The following are some key points to consider;

- Was anyone injured in the grounding?
- Are all crew accounted for?
- If appropriate advise vessels crew to don life jackets (could definitely be classed as a time of heightened risk)
- Is the vessel damaged in any way, or taking on water?
- Is the vessel leaking any fuel /oil?
- What time did the vessel go aground?
- What is the vessels draft?

No immediate attempt should be made to pull off a vessel that has been or is suspected to have been seriously damaged. If there is any doubt as to the vessel's ability to remain afloat, no attempt to refloat the vessel should be made by the CRV.

Any vessel aground becomes the responsibility of the Local / Regional Harbour Master or MNZ depending on its location. ***Coastguard Units must be aware of their local procedures & protocols as regards to grounded vessels.***
(See Module Legal Considerations)

If the assessment reveals that the vessel will remain afloat, carefully determine the refloating procedures to use. When preparing to tow free a grounded vessel the Skipper and crew of the CRV must always assess the possible hazards to their own vessel. There are too many cases of one vessel attempting to help another, then subsequently running aground or suffering damage to their own vessel in the process.

- What are the sea conditions?
- What is the present and forecasted weather?
- Is shoring required to support the vessel while awaiting the tide?
- Sound around the vessel and the general area to establish actual depth of water.
- Ascertain the vessels underwater hull shape - many vessels have rudders and propellers protruding below the keel. Severe damage and possible flooding may result from dragging the vessel over the sea bed.
- What is the state of the tide?
- What was the state of tide on grounding?
- Unless weight is removed from the grounded vessel, or its trim altered in such a way as to reduce its draft, pulling the vessel to deeper water should only be considered with great caution.

A 35 ft vessel could easily have a tonnes per cm immersion of 0.2. Meaning that to reduce its draft by 1cm / 10mm you would need to unload 0.2 tonnes from the vessel.

Taken another way if a CRV were to attempt to drag the vessel over the sea bed when it was still 100mm away from floating free, it would effectively be trying to drag 2 Tonnes over the seabed.

Knowing the state of the tide and being able to predict with reasonable accuracy the times and heights of tides is essential - not just for high and low water but for intermediate times and heights. At the end of this section there is information on different methods that can be used to find intermediate tidal times and heights.

In calm sea state conditions with no swell, a wrenching (Side to side pull) will help free the vessel from any suction in the sand or mud.

If there is a sea running then a straight pull can be used to take advantage of the roll and lift effect of the waves.

Heeling a Vessel Aground

For any vessel with a deep keel, heeling it over to one side will effectively reduce the draft. This is a method most commonly employed with yachts. Lead a halyard from the mast to another vessel or a fixed object such as a kedge anchor.

The longer the line from the yachts masthead the greater the leverage

Care should be taken that the halyard used will not foul and hence put undue strain on the yachts rig when she is towed off. The spreaders or crosstrees on a yacht rig are designed to take compression loading from the standing rigging. They are not designed to take large loads in a fore and aft direction.

Refloating the casualty will probably not be considered a success if you dismast it in the process!

The spinnaker halyard is usually preferred because it is normally led through a swivel block at the masthead allowing a wide range of pull without chafing the line.

Pull on the line to induce the vessel to heel. Sometimes the vessel will drift off on its own when heeled by the mast. If not then the vessel itself will need to be towed off. When the vessel is free, release the line used to heel it over as soon as there is sufficient depth of water.

There may be times where running a line from the yachts masthead is not feasible. In which case the use of its boom to hang weights from, may be sufficient to heel the vessel.

- Once the weights are attached under the boom, a line is taken from the aft end of the boom to the yachts bow or any suitable fitting forward of the mast.
- The boom is hauled outboard using the line to the bow.
- Once the boom has been swung as far outboard as possible, both the line to the bow and the mainsheet are used to secure the boom in position.

Tidal Times & Heights

The NZ almanac or other local publications such as those produced by the local / regional council or local boating clubs will have HW and LW times and heights. What is relevant however in the case of a grounded vessel is intermediate times and heights of tide.

For example: a vessel runs aground on a falling tide. Your CRV responds to its call for assistance and you establish that the vessel ran aground 1hr 45mins after high water – it is now 2 hrs 20 mins after high water.

The question is how much will the tide drop from now until low water, and will the next high water be sufficient to refloat the vessel?

In grounding the vessel may have 'run up' a sand bank or rock and will need more height of tide to refloat it than there was at the time it ran aground. This can only be properly ascertained by sounding around the vessel.

In the case (for example) of the next high water being lower than the previous one, and the vessel having run up as it grounded, it may be necessary to immediately make preparations to lighten and / or heel the vessel to ensure it can refloat at the next high water.

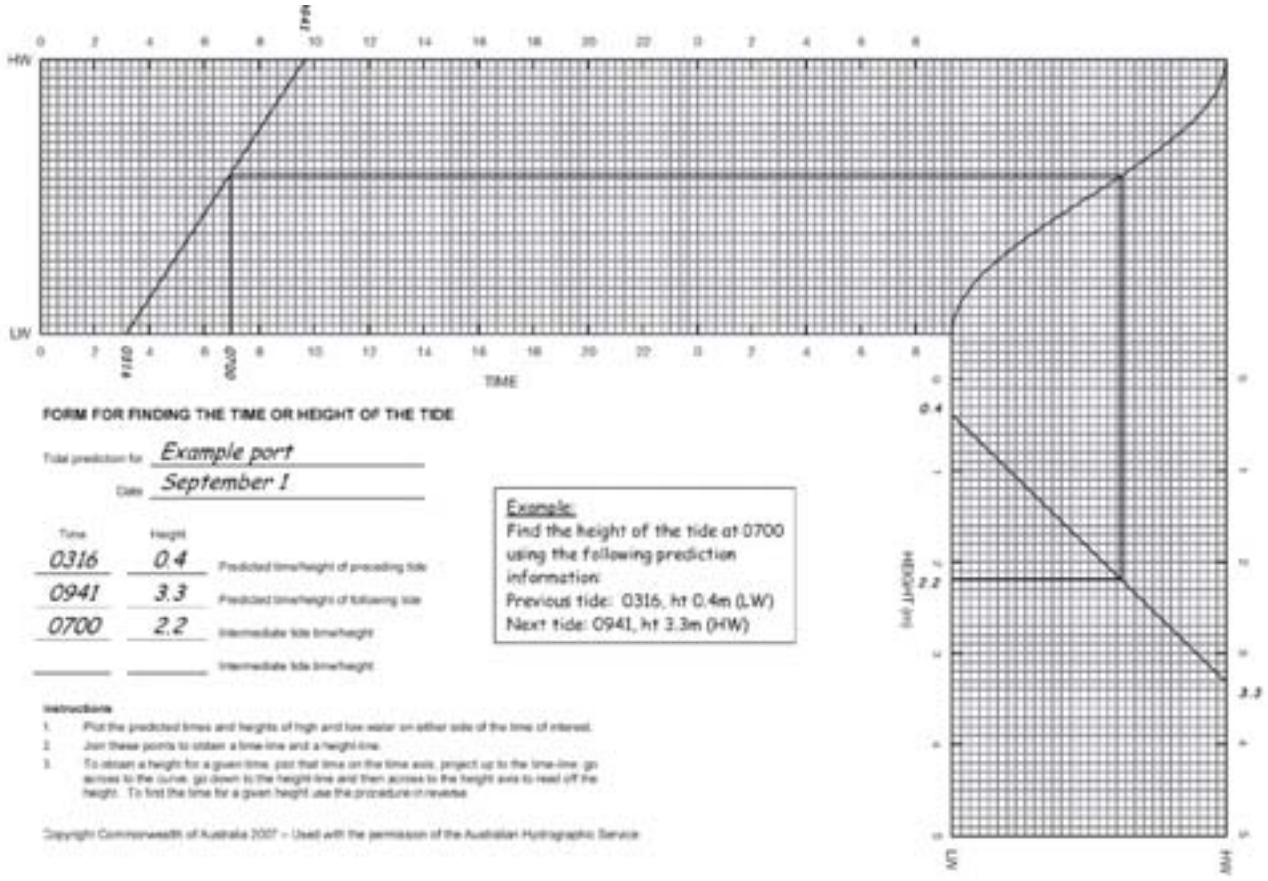
Sources of Tidal Information

Some chart plotters have the facility to give local tidal predictions for any given time between high and low water.

The NZ Almanac contains tidal information for standard ports that can be plotted on a graph to find intermediate times and heights. The NZ Almanac also contains information on secondary ports, but this information cannot be plotted on to the graph without some calculations. These can be time consuming and you probably will need a calculator.

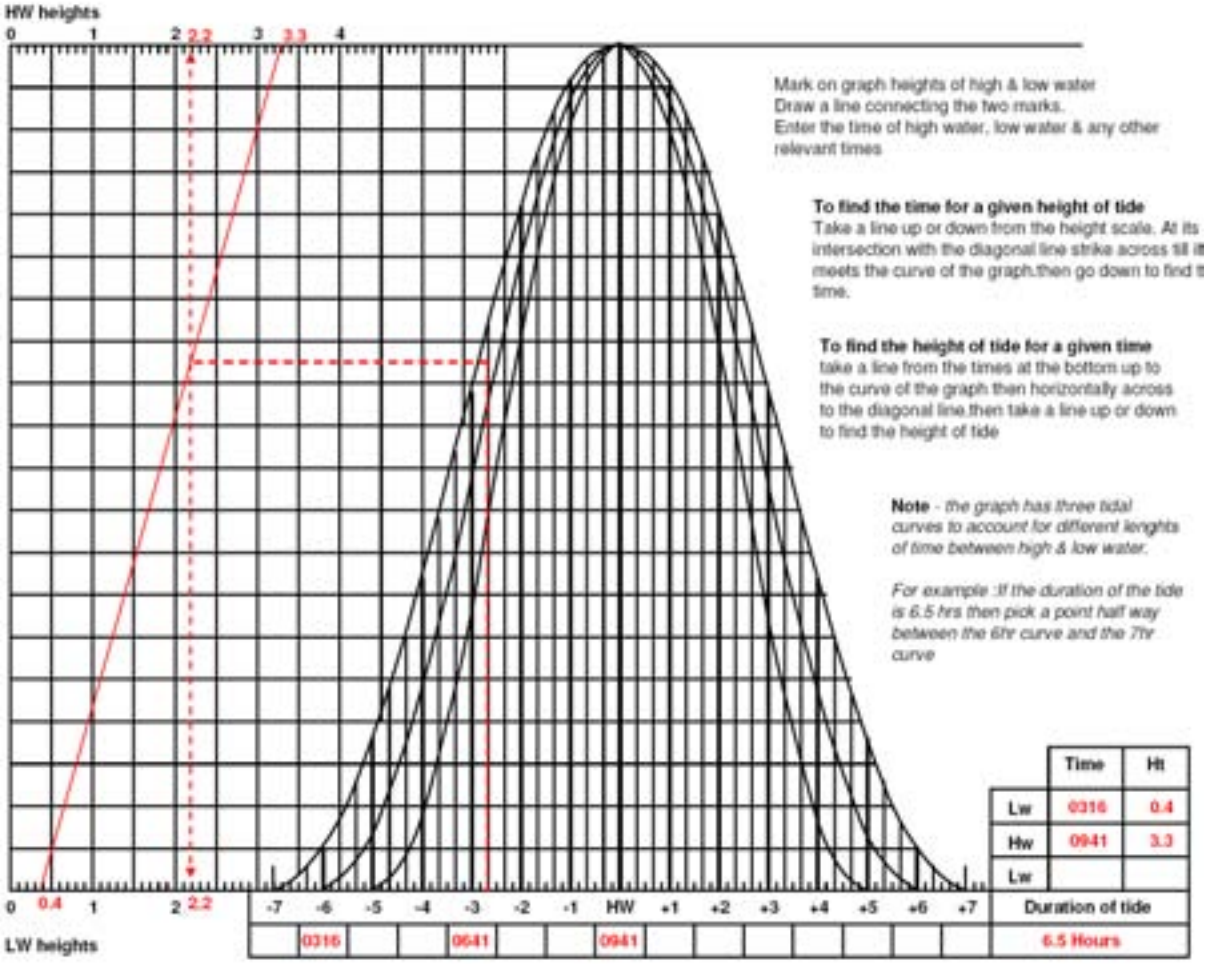
Alternatively if you can find your local times and heights of tide from another publication, you can plot this information directly onto the graph in the Almanac.

NZ Almanac Graph



Generic Tidal Graph

Below is a tidal graph that works in just the same way as the one in the NZ Almanac, just a little easier to use and read.



Caution - Tidal predictions do not take into account the influence of weather - namely atmospheric pressure and prevailing wind direction and strength. These factors can have a marked affect on predicted tidal heights.

Average air pressure is usually taken to be around 1013. With a higher than average air pressure the water levels will be lower than predicted, and with lower than average air pressure there will be higher water levels than predicted.

Variations in air pressure alone usually only account for a maximum of around 0.3 m difference in predicted tidal heights. Wind direction and strength can make a much larger difference to tidal heights.

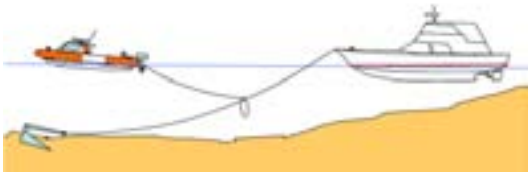
The typical conditions that lead to flooding in coastal areas, would be a low air pressure, and strong sustained onshore winds (which would effectively push or back up water into estuaries) Heavy rainfall leading to higher volumes of river water meeting the incoming flood tide would increase water levels even more.

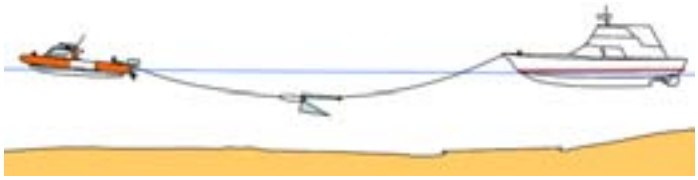
Vessel at Anchor

A disabled vessel will often have put down its anchor. If there is sufficient sea room then, the anchor can be raised and the vessel allowed to drift before setting up the towline. This at least allows a clear foredeck prior to accepting the tow. If the vessel is close to a lee shore then the towline may need to be attached prior to raising the anchor.

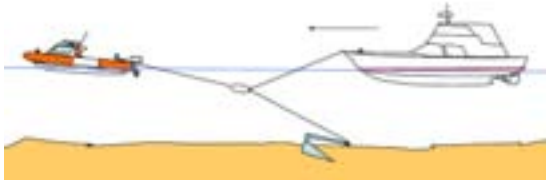
One problem that can occur is when a vessel is unable to raise its anchor. The anchor may need to be 'tripped 'by the CRV.

A bight of line or preferably a short length of chain is passed around the anchor rode and pulled slowly and gently along the rode until it comes in contact with the anchor. The anchor is then pulled out by the CRV.

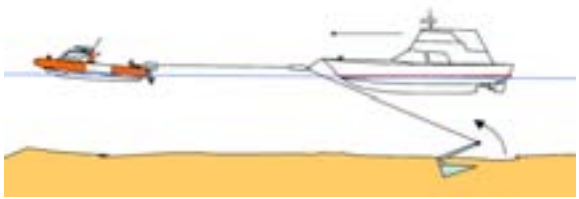




The tripping line should be allowed to sink to the sea bed and the pull from the CRV should be as horizontal as possible. If the tripping line from the CRV is pulled too hard, or the anchor rode from the anchored vessel has very little weight / pressure on it then there is the chance the tripping line will snag on the rode before it has reached the anchor (diagram right).



If the tripping line does snag on the anchor rode, it will tend to pull the anchored vessel towards the tripping line. This will eventually exert a pull on the anchor, but it risks damage to the anchored vessels bow (due to contact with the tripping line chain / anchor rode), and tripping the anchor in this way is not as effective as pulling directly with the tripping line.



If for whatever reason the anchor cannot be tripped, or the CRV Skipper decides that in the circumstances tripping the anchor is unnecessarily hazardous, then the anchor and rode will need to be left behind. If the anchor is to be let go completely then a GPS position should be taken and the end of the anchor rode buoyed so that it can be retrieved at a later date.

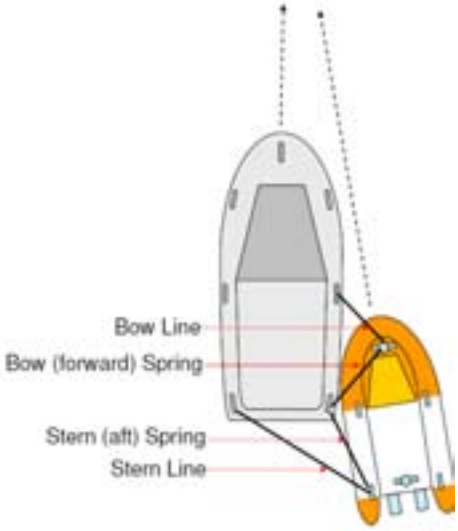
Towing Alongside or Barging

Towing alongside should only be attempted in calm to slight seas, and for a short period of time. The movement of two vessels alongside each other in a sea way can easily damage both vessels.

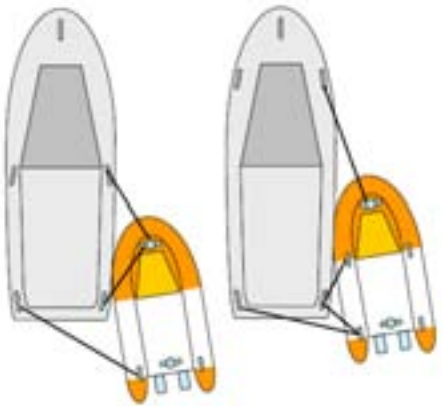
To give the greatest amount of control over the tow the CRV should be tied alongside the vessel as far aft as possible while still remaining secure alongside.

With vessels smaller than the CRV the positioning generally isn't that critical, however with vessels the same size or larger it becomes increasingly important.

The CRV should be made fast using a bow line, stern line, and springs to prevent the vessels surging. All lines should be led so that adjustments can be made on board the CRV. It may be in some cases that a bow line at a suitable angle will double up as an effective spring – , in which case the tow may be adequately secured using just 3 lines. (See diagram below)



Once secured alongside all slack in the lines should be taken up, with the bow of the CRV pointing in towards the other vessel by approx 10-15°. Securing the CRV so that its bow is pointed in slightly ensures that when moving ahead the water pressure created is keeping the vessels together, not trying to force them apart.



There are no hard and fast rules as to exactly how the tow is made fast, each vessel will be different as the position of the cleats or posts available will determine how the tow is finally secured.

Transferring Tow Astern to Tow Alongside

There are 3 common ways in which a tow astern can be transferred to an alongside tow:

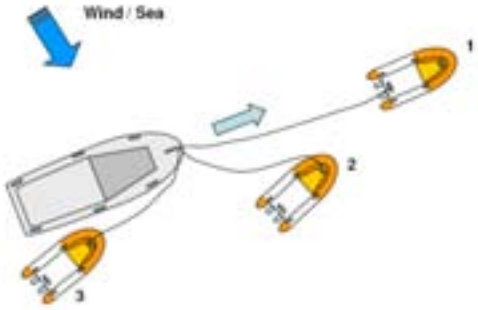
- While Underway.
- While at Anchor.
- While on a Mooring.

Transfer While Under way

Choose which side of the other vessel you wish to go alongside. The choice may well be determined on the ultimate destination of the tow ensuring that as far as possible the approach to the berth will be as near as practical into tide or wind. ***When planning to berth a tow it should always be remembered that the CRV is obliged to secure the towed vessel to a safe berth not necessarily its customary berth.***

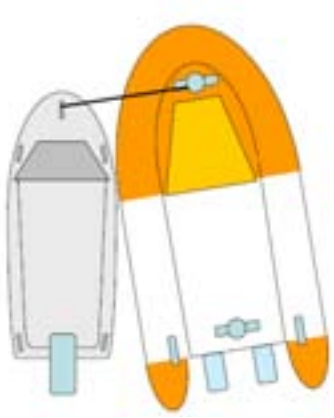
- Brief CRV crew on plan and assign individual tasks.
- Brief crew on towed vessel on plan and if feasible assign tasks.
- Reduce speed and shorten up the towline.
- Reduce speed still further to allow towline to go completely slack.
- If possible keep the towline attached to the disabled vessel until alongside.
- Manoeuvre CRV to the chosen side of the vessel.

You must ensure that you have adequate sea room in which to complete the operation. If not you may find your self drifting down onto a lee shore or other vessels before you have gained control of the tow!



While manoeuvring the CRV gather in any slack or pay out on the tow line accordingly to prevent the tow line catching on any obstructions, and to keep it clear of the CRV props / jet units (jets are particularly prone to 'swallowing' lines in the water). If the attempt to go alongside has to be abandoned for any reason, with the towline still attached control of the tow can be regained and the manoeuvre attempted again.

There are no hard and fast rules as to the order in which lines should be attached when towing alongside, but the sensible approach would be to attach those lines which will enable control (while going ahead) over the tow first. – This almost inevitably means the stern (aft) spring is the last line to be secured.



With vessels smaller than the CRV a bow line can often be used almost immediately to gain control over the tow while going ahead. The bows of both vessels are held approximately in line / next to each other (with a smaller vessel this will automatically ensure the CRVs stern projects behind the other vessels stern). The remaining lines required for the tow can then be secured.

With vessels that are larger than the CRV the position of the CRV relative to the other vessels becomes more important. With larger vessels, as the CRV comes alongside the most important line to secure first is often the bow (forward) spring, followed by the stern line then bow line.

The bow (forward) spring dictates the position of the CRV alongside the other vessel, and the stern line controls the angle at which the CRV sits alongside the other vessel.

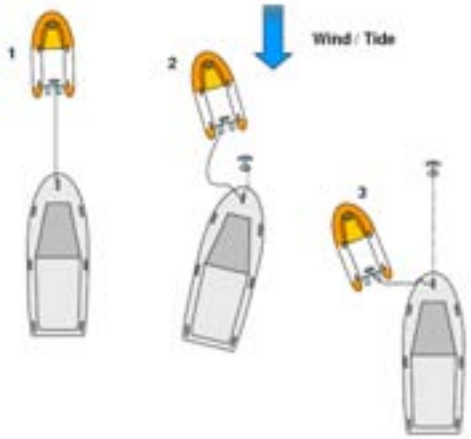
Applying power in ahead will tension the bow spring, and by adjusting the steering on the CRV, and the length of the stern line the desired angle to the towed vessel can be maintained. The remaining bow line and stern spring are then attached and tensioned.

The original tow line may become the new stern (aft) spring, or by transferring it forward on the CRV it may be used as a bow line. Often however the new lead of the original towline will not be fair on larger vessels due to stanchions or rails, risking chafe to the line or damage to the other vessel.

At Anchor

Ensure that the other vessel has sufficient anchor chain / warp for the depth of water. Ensure that it can drop its anchor, and just as importantly recover it – with loss of engine it may not have power to its anchor winch, and not all winches can be manually operated.

- Tow the other vessel to a stop. Slacken the tow line by going astern / easing tow line.
- Beware - the casualty may take some time to stop due to its momentum, so the entire manoeuvre should be carried out at as slow a speed as possible.
- As other vessel gathers sternway it should let go its anchor. Keep the tow line slack until it is confirmed that the anchor is holding.
- If the other vessel cannot let go its anchor with the tow line in place, then remove the tow line from its fitting but ***keep it on board*** until the anchor has been dropped, and it is confirmed that the anchor is holding.

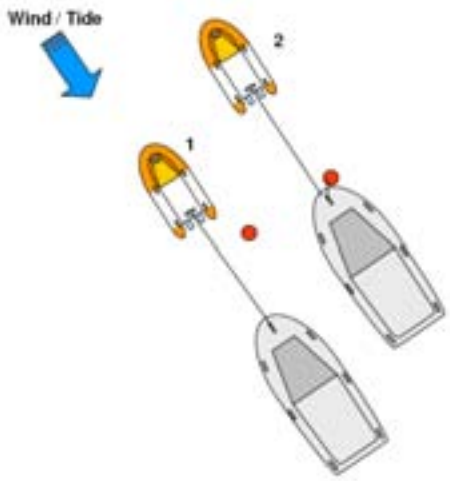


Do not simply cast off the towline – just in case!

On a Mooring

The other vessel can be secured to a mooring prior to transfer of the tow.

- Reduce speed and shorten up the towline to a suitable length.
- Manoeuvre the casualty to pick up the mooring, as with anchoring the tow line should never be cast off until the towed vessel is secure.
- It may be that this entails the mooring being initially secured by the shoulder of the vessel rather than directly at the bow.



Berthing a Tow

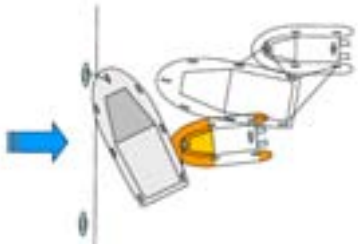
Before committing to any close quarter manoeuvres it is imperative to test manoeuvrability. Performing a figure of eight then coming to a stop will give you an indication of your turning circle and stopping distance.

- With a large vessel alongside visibility will be hampered so a lookout on the other vessel should be posted.
- Approach to the berth should as far as practical be made into the wind or tide (which ever is the greatest influence). Slow down gradually to maintain control of the tow.
- Ensure all crew (CRV& towed vessel) are briefed and if applicable assigned roles / tasks.
- Ensure fenders are in place and all shore lines made ready.

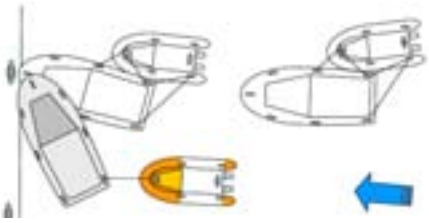
Visibility can be severely reduced by the tow – in many cases with a large vessel alongside the best position for the CRV Skipper may not be on the CRV, but on board the tow – relaying helm and throttle orders by voice, hand signals or hand held VHF.

Sometimes even a 'safe berth' can present difficulties if there is a strong wind or tide. CRV's have more than adequate power and manoeuvrability to berth in adverse conditions, but that may not be the case with another vessel tied alongside. Berthing the tow may well be a manoeuvre best carried out in two or more stages.

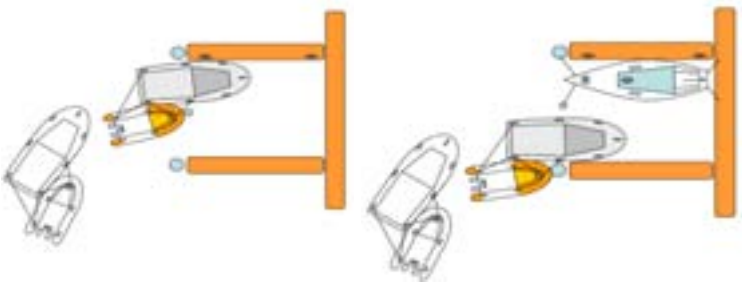
In the case of a strong offshore wind putting the bow of the towed vessel (with adequate fenders) onto the berth first, then rearranging the lines to allow the CRV to push it alongside may be an option (opposite).



With a strong onshore wind the same approach could be taken but this time with the CRV pulling on the towed vessels stern to control the operation (opposite).



Berthing in Marinas often leaves little option but to perform the operation in separate stages as there isn't enough space for two vessels. The towed vessel may have to be held in position by the CRV until it can be pulled into the berth by its shorelines.

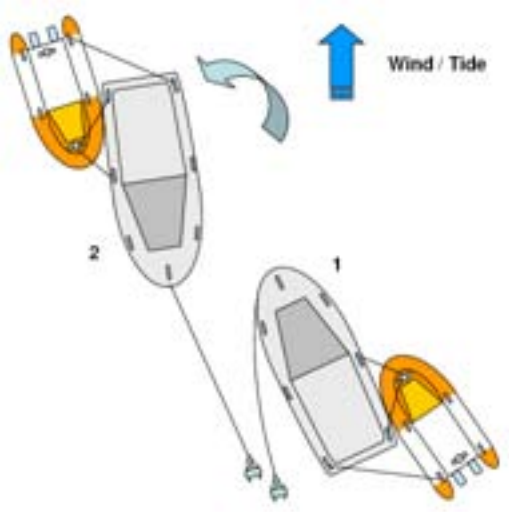


Using an Anchor to Turn

There may be times where just using engines and steering alone will not be able to turn a large tow quickly enough, or in as tight a circle as is needed.

For example: entering a narrow channel on a flood tide or with a strong following wind.
In a case such as this using an anchor to 'short turn around' may be the only option.

- The other vessels anchor is made ready.
- The tow is slowed to bare steerage way.
- The tow is turned slightly (to port in the example diagram) so that that the CRV will be on the outside of the turn. This will ensure there is no chance of the anchor rode fouling on the CRV or towed vessel.
- The anchor is let go, and the tow allowed to swing around on the anchor once it bites – with engine assistance from the CRV if necessary.
- Once the tow has turned to face into the wind / tide, the tow can be slowly motored ahead while the anchor is recovered.



Note – to turn on the anchor it often isn't necessary for the anchor to hold and dig in as you would normally expect when anchoring – just the drag created by the anchor along the sea bed can create a powerful turning effect.

Slewing a Tow

For the vast majority of barging operations the CRV should be able to manoeuvre the tow without too much difficulty, however with vessels considerably larger than the CRV another technique to turn the tow may be needed. This technique is commonly used in commercial tug & barge operations, where the vessel being towed is often many times larger than the tug.

In the example diagram the CRV is driven ahead with port helm onto the bow spring. The stern line is eased (other lines may need to be eased also depending on their lead) thus allowing the CRV's stern to swing out.

This manoeuvre is best affected if the CRV's bow spring is led from as far forward on the CRV as possible, giving the greatest pivoting effect.

With the CRV now as near perpendicular to the other vessel as possible, the CRV pushes the stern of the vessel to port thus slewing the tow to starboard. To return to its original alongside position the helm is reversed (in this case to starboard) allowing the CRV's stern to swing back into the tow, and slack is taken out of the lines previously eased.

To slew the tow the other way the bow line is eased under control to allow the CRV to drive astern on its stern spring. This makes the bow swing away from the tow (again other lines may need to be eased at the same time depending on their lead). As the CRV pivots on its stern spring, slack is taken out of the stern line.

With the CRV in position and its lines secure again the CRV is driven ahead to slew the tow's stern to starboard thus turning the tow to port.

To return to its original alongside position the CRV is driven ahead onto the bow spring helm to port, and the stern line eased.