EUROPEAN TUGOWNERS ASSOCIATION

GUIDELINES FOR SAFE HARBOUR TOWAGE OPERATIONS

1st Edition - February 2015

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1. PREAMBLE

This document is intended to portray tug's operational safety issues for the attention of all those concerned, mainly Pilots, Masters of vessels being assisted, their bridge teams and mooring parties.

In February 2011, the European Tug owners' Association (ETA) and the European Maritime Pilot's Association (EMPA) jointly issued a document mainly on the subject of bitts, bollards and chocks. This document was intended to raise awareness of ship owners, naval architects, new-building superintendents, classification societies, shipyards and insurers about the concerns of the towage industry.

Structural issues are, however, not the only liability for safe tug operations.

Other types of risk that tug crews are imperilled by without having any control whatsoever of them are brought about by certain practices of pilots, ship's command and mooring parties of the vessels being assisted.

ETA has identified a need for a set of general guidelines, widely applicable to all types of vessels and ports. These general guidelines have been kept as concise as possible and presented as a list of "DO NOT" and "DO" when making use of harbour towage services.

The list of "Do" and Do not" has been presented in bullet form for ease of reference and can be found in the last 3 pages of this document. The background to all the relevant points is presented in the first part of this document and ETA strongly recommends all concerned to read through them carefully in order to get a better understanding of the tugs' crews concerns.

2. DIFFERENT TYPES OF TUGS

Ship's crews may sometimes wonder why two (2) seemingly similar tugs are being employed and made fast differently.

Fig. 1 Tugs operating "bow to bow" and "stern to bow"

The reason for this is:

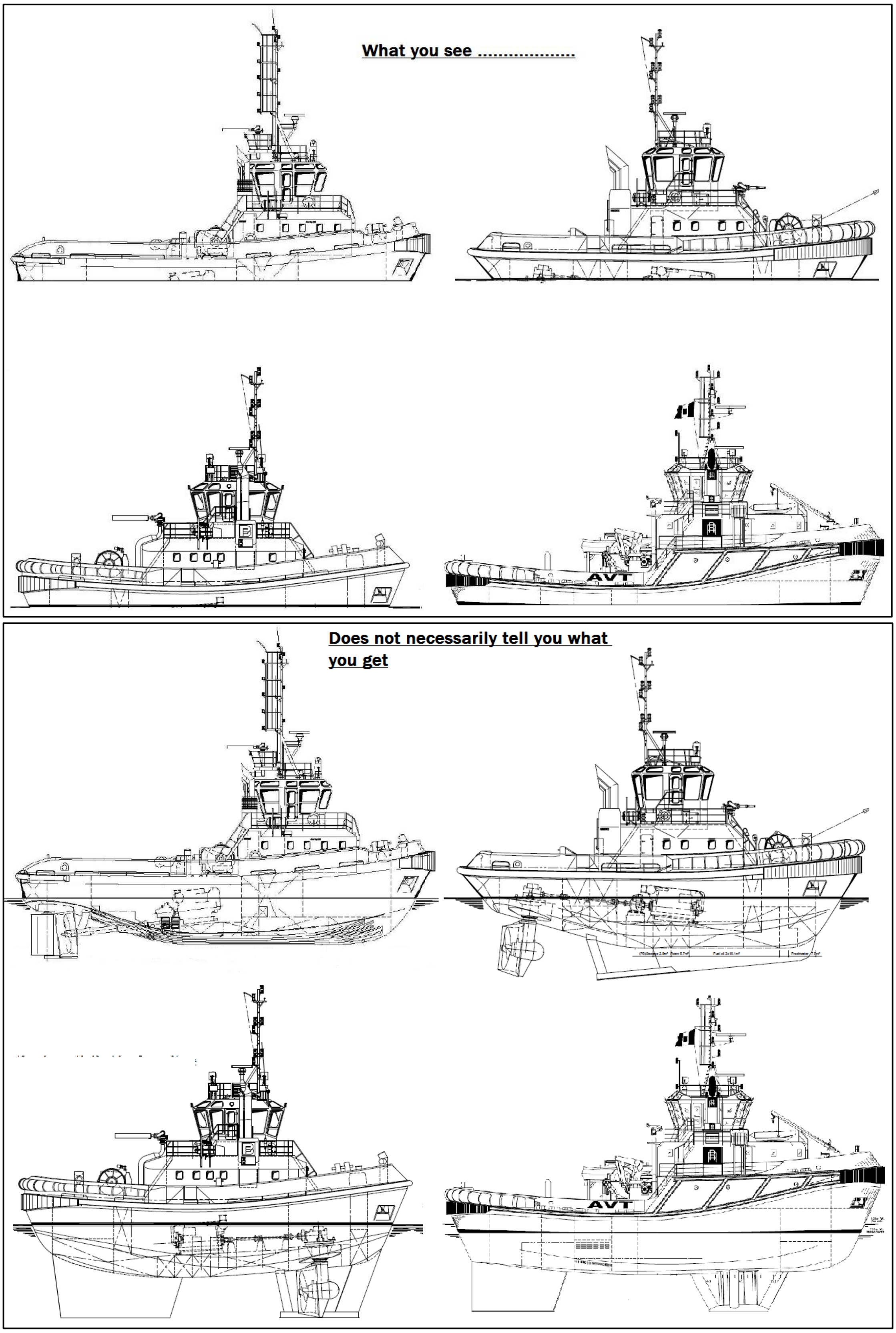

Fig. 2 Different types of hull design and propulsion

As can be noted from the above illustrations, it is not always easy to deduce the type of propulsion system of a tug without looking at the underwater section. There are various types of propulsion system arrangements but the four (4) most common are:

- Conventional propulsion system.
- Azimuth Stern Drive (ASD).
- Tractor tug with Rudder Propellers.
- Voith Water Tractor.

Apart from the four most common propulsion arrangement systems described above, we also mention the "Rotor" tug, which can be considered as a further development of the Tractor tug having, apart from the two forward mounted azimuth thrusters, a third azimuth thruster unit mounted at the stern replacing the skeg.

Another type of tug is the "Combi tug", a modified single screw tug with an additional azimuth thruster at the bow, in line with the main propulsion aft. It nearly operates as a Tractor tug.

Conventional tugs are fitted with a standard propulsion system. There are variances of these types of tugs mainly being single or twin screw, with fixed nozzle and steerable rudder or steerable nozzle and with fixed pitch or variable pitch propeller.

Conventional tugs connected at the stern of the vessel being assisted will have to work in the traditional way (see fig. 3). This requires a lot of skill and experience from the tug Master and is considered to be the most inherently dangerous towing method for such a tug, due to the high risk of being pulled over sideways, which is called "girting".

Conventional tugs deliver the highest bollard pull in the forward direction and will mostly be used as a bow tug on a hawser. When connected at the stern of the vessel being assisted, they will effectively be working in the "conventional" mode, also referred to as "stern to stern". The "towing point" will be moved further aft from the towing hook by using a Gob-line and a "stopper" block. The use of the Gob-line is very important in order to avoid girting of the tug.

Fig. 3 Conventional tugs connected at the stern of the vessel being assisted.

Fig. 4 Conventional tug - Twin screw in fixed nozzles and steerable rudders

Azimuth Stern Drive (ASD) tugs are fitted with two (2) thrusters at the stern. The thrusters can be rotated independently through 360^0 (hence "azimuth") thus the propeller thrust can be directed in any direction. Azimuth thrusters can have either fixed pitch propellers or variable pitch propellers with the latter providing for reversing of the propeller thrust. Azimuth stern drive tugs are fitted with a harbour towing winch which is located on the foredeck and a towing staple which is fitted forward of the winch for assisting at the stern ("bow to stern") or at the bow ("bow to bow") and/or a stern winch for assisting "stern to bow" in the conventional mode.

This type of propulsion system provides for high manoeuvrability particularly during transit sailing, however it does have some limitations when combining thrust and direction resulting in a lower bollard pull. This will be explained later.

Fig. 5 Azimuth thrusters mounted at stern

Azimuth Tractor Drive tugs are fitted with two (2) azimuthing thrusters at the bow (forward of midship) which have basically the same characteristics as the azimuth thrusters fitted on azimuth stern drive tugs. These tugs are fitted with a harbour towing winch which is located on the aft deck and a towing staple which is fitted aft of the winch. The stern and/or bow area is normally also heavily fendered, designed for push/pull operations.

Fig. 6 Azimuth thrusters mounted at bow – water tractor

VOITH water tractor tugs are fitted with two (2) cycloid propellers located at the bow (forward of midship). The Voith units are basically composed of a circular plate, rotating around a vertical axis and a circular array of vertical blades (normally 5 of a hydrofoil cross section) protruding out of the bottom of the tug. Each blade can rotate itself around a vertical axis. The internal gear changes the angle of attack of the blades in synchronization with the rotation of the plate, so that each blade can provide thrust in any direction, These tugs are fitted with a harbour towing winch which is located on the aft deck and a towing staple which is fitted aft of the winch.

Fig. 7 Voith Water Tractor

ROTOR tugs are primarily tractor tugs with a third 360° propulsion unit under the stern, in order to further enhance manoeuvrability and transverse bollard pull.

Fig. 8 Rotor tug with three rudder-propellers

COMBI tug: The main propulsion unit is located aft, with an azimuth thruster that is mounted at the bow and in line with the main propulsion.

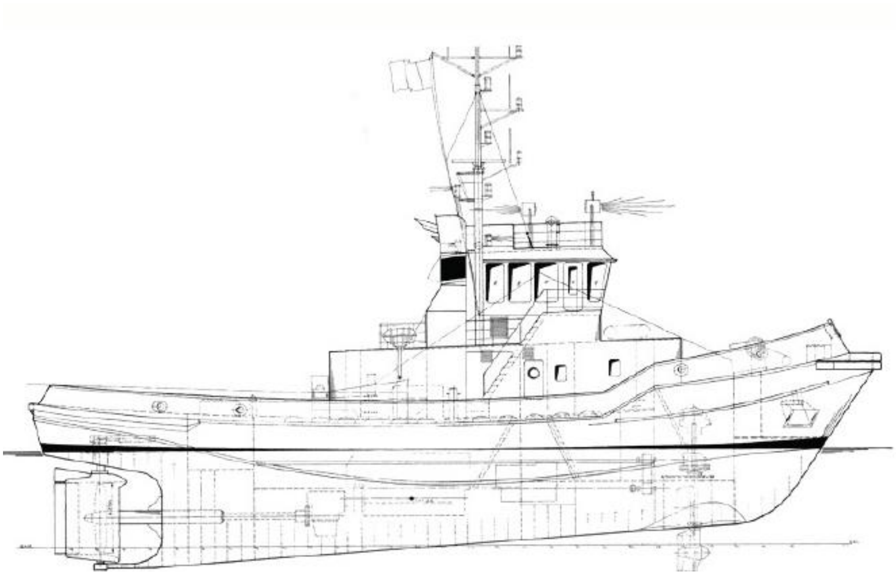

Fig. 9 “Combi” tug with an azimuth thruster under the bow.

Typical bollard pull vector diagrams for the various types of tugs are shown below.

The length of the vectors indicates the "power" that can be provided in the direction of the vector.

Green: Conventional twin screw tug (with or without bow thrusters) – fixed propellers on horizontal shafts.

Red: Tractor tug - their diagram is much more "distributed" in all directions, with some more power delivered ahead and astern.

Blue: Azimuth Stern Drive tug - when moving sideways, the thrust in that direction is reduced considerably.

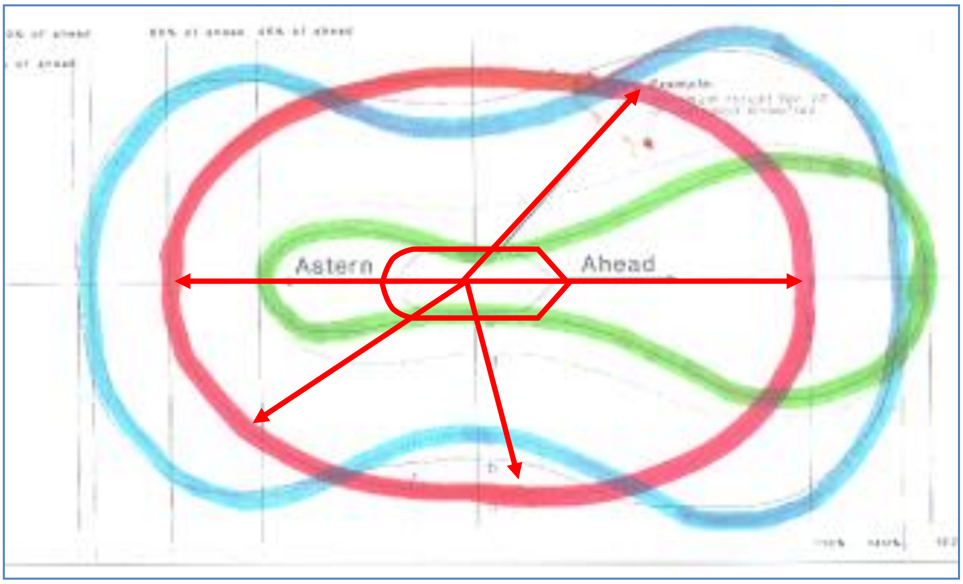

Fig. 10 Bollard pull vector diagram for various types of propulsion

3. LIMITATIONS OF TUGS

The tug's Bollard Pull

STATIC BOLLARD PULL and OPERATIONAL (Dynamic) BOLLARD PULL:

The Bollard pull of a tug only refers to the static force exerted by the tug pulling on a fixed object during a test, in sufficiently deep water. The force on the towline is measured and then used as a standard for the towing capability of a tug, as indicated on the tug's Bollard Pull Certificate.

Basically the exerted force is generated by the tug's propeller thrust only. However, in day-to-day operations the circumstances are dynamic rather than static and the actual pull exerted by the tug can thus vary considerably from the bollard pull test value as stated in the tug's Bollard Pull Certificate. Due to the dynamics of speed and current the force on the line can, at peaks, easily be much higher than the static bollard pull.

The negative effect of the tug propeller wash impinging on the ship's hull, which increases with a small under keel clearance (UKC) and /or a short towline, is to be noted. Tugs are built to produce higher forces than the bollard pull by creating an optimal underwater form of the tug's hull, which can generate pull forces as a result of the hydrodynamic forces working on the tug's hull.

The tug's hull does not play an important role when pulling on a ship stopped in the water or when pulling straight ahead as bow tug or straight astern as stern tug on a ship making headway. When a ship has no speed through the water, the maximum pull exerted by the tug is approximately the same as the bollard pull. When a ship has headway, the thrust of the bow tug pulling straight ahead is less because the tug has to propel itself through the water, thus reducing the effective pull on the towline.

Thus, for a bow tug, the exerted pull generally decreases with increasing speed through the water.

The opposite is true for stern tugs. Its propellers are working astern in a negative water flow and a towline force higher than the one mentioned on the BP Certificate can thus be developed when combining the tug's propeller thrust with the forces caused by the tug's hull resistance through the water. A few examples:

- A stern tug operating in the indirect mode can generate high pulling forces, which increase with the ship's speed (and at a speed of 10 knots can be as high as twice the static bollard pull); while the propeller thrust is used to keep the tug at an optimal angle with the ship's heading to achieve the highest possible pulling forces.
- A tug braking a ship's speed and working under a small angle with the ship's heading can generate high braking forces caused by the propeller thrust and tug resistance through the water.
- A conventional tug can also create high towline forces, generated by the hydrodynamic forces working on the tug hull when towing under an angle to a ship's heading on a ship having headway.
- Tugs handling ships in locks or dry-docks often operate with a short steep towline. Pulling at full power will cause higher forces in the towline than the pull exerted by the tug, due to the vertical towline angle and the weight of the tug itself. Due to water dynamics (waves and/or swell) the peak load on the towline may even become so high that the towline may part.

The above is intended to show that the exerted pull can be much higher than the bollard pull of the tug's certificate and (even) that the peak load on the line does not always have a direct relation to the certified bollard pull. <u>Therefore these exerted forces should not be referred to as 'bollard pull' but instead as 'Towline Force' which should be considered when deciding which bollard to be used on board the assisted vessel.</u>

Tug operational limitations.

It is obvious that when a tug has to move sideways rather than longitudinally the resistance created by her hull being dragged sideways through the water will increase substantially and she will need to use more of her available propulsion power for this motion, leaving less pull available for the assisted vessel. Apart from that, being dragged sideways is generally a very dangerous situation for any tug not equipped with a dynamically rotating towing point that shifts the tow load to the side of the tug under sideways pull, like for instance a DOT-system or a Carrousel Towing System. Tugs that are equipped with such systems have the advantage that girting under a tow load is impossible and that thus their sideways hull resistance can effectively be used to increase towline force.

ASD tugs

This type of tug has excellent manoeuvrability, including moving sideways, but the disadvantage is that these tugs have their propulsion units at the stern. When moving sideways, the rudder-propellers are turned in an almost opposite position, so as to create sufficient power at the stern to drag the hull sideways through the water.

This somewhat complicated manoeuvre, commonly referred to as "side stepping", will significantly reduce the towline force. In the picture below; the pull astern is reduced because the tug needs to side-step at a relatively high speed (2-3 knots) to keep up with the vessel, which is still moving dead slow ahead , while approaching the turning basin. In this case, the intention is to swing the vessel, not to provide steering assistance at speed. The manoeuvre shown below must not be confused with "indirect steering mode".

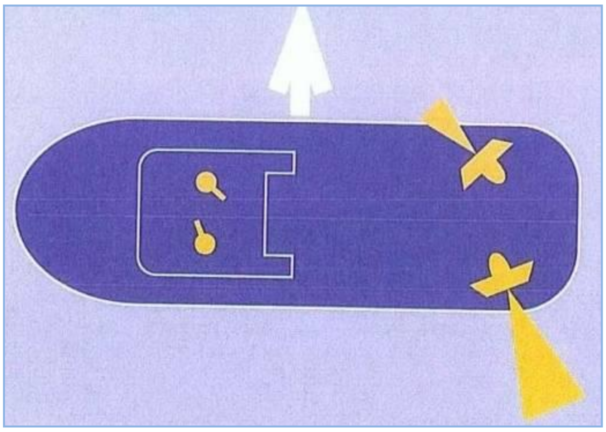

Fig. 11 Position of thrusters for side stepping **Fig. 12 ASD tug side steps to a position for assisting swinging**

This dissemination of power may also play an important role when the vessel is (to be) moored in a strong current: The vessel may be stationary in position off the berth, ground speed zero, being pulled in on the mooring ropes, while at the same time the tug needs to use part of her power to keep herself in position against the current while also keeping the towline tight to control the motion of the vessel.

Tractor tugs

This section applies to both Voith Schneider tractor tugs as well as to Tractor tugs with rudder propellers.

Both have their propulsion units in a position forward of mid-ship. Thus, when they have to move sideways, the force can be applied much more directly in the direction needed; the turning lever on which the propulsion power also acts, is much smaller than in an ASD tug where the propellers are located entirely at the stern and as far away from the tug's turning point as possible.

However, also in this case, the resulting bollard pull will be reduced because of the higher sideways drag of the hull through the water and the power needed to overcome this.

ASD tugs can be used in the "reverse tractor" mode, but not always as efficiently as real tractor tugs. The new modern shorter and wider ASD tugs will however preferably be used as such and will manoeuvre as efficiently as normal tractor tugs. Shorter and wider however also means more drag in the longitudinal direction, which in turn negatively affects the fuel efficiency and free running speed of the tug.

Conventional tugs

Conventional (single or twin propeller) tugs require the most skills when it comes to manoeuvrability, i.e. the ability to turn around on its own axis quickly, which means that the tug master must anticipate the dynamics of an operation.

The fixed propellers have great efficiency in the forward mode, but the directional power must be supplied by rudders and, in the case of twin screw tugs, also by the propellers operating in opposite directions.

Such tugs may be equipped with a bow thruster, but the efficiency of the thruster is reduced at speeds above 4 to 5 knots (unless it is an azimuting thruster).

Examples of directional limitations.

When a vessel is proceeding at a considerable speed and the tug is requested to pull the bow in a particular direction, the situation can quickly become quite critical for almost all tug types.

A vessel will always turn around its pivot point. When the vessel is stationery the pivot point will generally be close to the mid-ship of the vessel where the centre of the hull's lateral resistance is usually located. However, when moving ahead or astern the pivot point will move either forward or aft respectively, in relation to the speed and direction of the vessel through the water. This means that once the vessel makes headway, the bow tug will have to exert more power to swing a vessel around, and the aft tug can do with less power. The situation reverses when the vessel is moving astern. One must keep in mind that the higher the speed (forward) of the vessel being assisted, the more towline force the forward tug(s) must generate to change the assisted vessel's heading.

When the bow tug is ordered to pull the bow sideways at speeds above 4 knots, her directional force on the towline will be significantly reduced because the moment on the pivot point is very much diminished and any effort of the forward tug to turn the vessel will be almost futile. **For this particular reason, the pilot should always use the aft tug to change the heading of the assisted vessel until the speed of that vessel is reduced to less than 4 knots.**

In general the situation will become quite dangerous for all type of tugs at the bow, when speed increases and the tug at the bow is expected to control the movement of the vessel's bow.

The screenshot below was taken during a simulator exercise. During this particular run, with the vessel moving at 6 knots and the tug's towline at almost 90° to the assisted vessel, the tug did not have any reserve power to avoid being pulled over by the vessel (girting). At this point, the tug master could not do anything to move away from this dangerous situation. A few seconds later the software indicated that the tug had indeed effectively capsized.

Fig. 13 Screenshot taken during simulator run showing the tug in a girting situation

In order to avoid such precarious situations, the Tug Masters should always inform the Pilot when reaching 75% of the tug's propulsive power. The remaining 25% should be kept as reserve power to always be able to turn the tug's heading back in line with the towline force.

DAVID AGAINST GOLIATH

Large ships in particular need water flowing across the rudder in order to be able to steer. For this particular reason, Pilots prefer to keep the vessel's engine engaged ahead, thus accelerating the water just in front of the rudder, and instruct the aft tug(s) to keep check of the vessel's speed by acting as brake.

One must keep in mind that the slow ahead speed of a vessel propelled by means of a 100,000 Horse Power engine could be significantly too high for the tugs to maintain control.

The vessel's propeller wash will hamper them enormously and will make it difficult for the tug to keep position behind the vessel, especially when the towline is short. Sometimes this will lead to "fishtailing". In order to avoid this situation, tugs will generally try to use the longest line possible, however it is always important that the pilot advise the tug master(s) whether he intends to keep the vessel's engine engaged or not.

The tug's bollard pull will be significantly affected, as soon as the vessel's speed starts to increase. The ship's propeller wash will increase the water velocity flowing through the tug's propellers, this making it necessary for the tug to use more power to manoeuvre and station keeping.

When the tug moves into such a position that the vessel's propeller wash may act directly onto tug's beam, there is a good chance that the towline will part or, in the worst case, the tug may even capsize!

Fig. 14 Tug being girted by propeller wash and towline force

Bow Operations

At the bow of the vessel, the pressures in the water vary considerably. There will be a positive pressure in front of the vessel where the water is pushed away and eventually a reduction in pressure where the water starts to flow away alongside the ship as the speed of the water increases. Pressure decreases when the water speed increases.

When two different pressure fields are acting at different points on the tug's hull, it may cause the tug to veer immediately in front of the vessel which may result in the tug being overrun by the vessel.

The higher the speed of the vessel, the larger the pressure differences acting around the vessel's bow.

Another factor that contributes to pressure differences is the tug's propulsion. The water flowing through the tug's propeller(s) will cause an additional increase in water flow between the tug and the assisted vessel, and may thus cause or increase the interaction between the two hulls.

The conclusion of all this is that speed should always be kept within a "safe window", in general between 2 knots and 6 knots through the water. There may be circumstances which may justify a higher operational speed, however, when a Pilot asks for more speed than 6 knots, the Tug Master should not hesitate to question the reason behind such a request whilst informing the Pilot that at such elevated speed the forward tug will generally be of limited use.

Fig. 15 Can YOU imagine doing this at high speed?

The practice shown below is, in ETA's opinion, **outright insanity!**

Fig. 16 Picture found on the internet, unknown origin

SPEED IS THE MOST COMMON CAUSE OF TUG ACCIDENTS!

For bow operations, the tractor tug has the added advantage that the tug's propellers are furthest away from the pressure fields around the vessel's bow, thereby reducing considerably the risk of interaction between the vessel and the tug's propulsion.

Azimuth stern drive tugs will therefore often be employed in the "bow to bow" mode and thus will effectively act as tractor tug. This mode of operation is often referred to as "reverse tractor mode".

This particular operational mode has the added advantage of bringing the tow point further up front (at the towing staple), so that in the event that something happens to the tug's propulsion system, or in the event that the tug master makes an error during manoeuvring the tug or even if the assisted vessel for some reason veers away from her intended course, the tug will not be at risk of being pulled over but will be swung around ending up alongside the vessel.

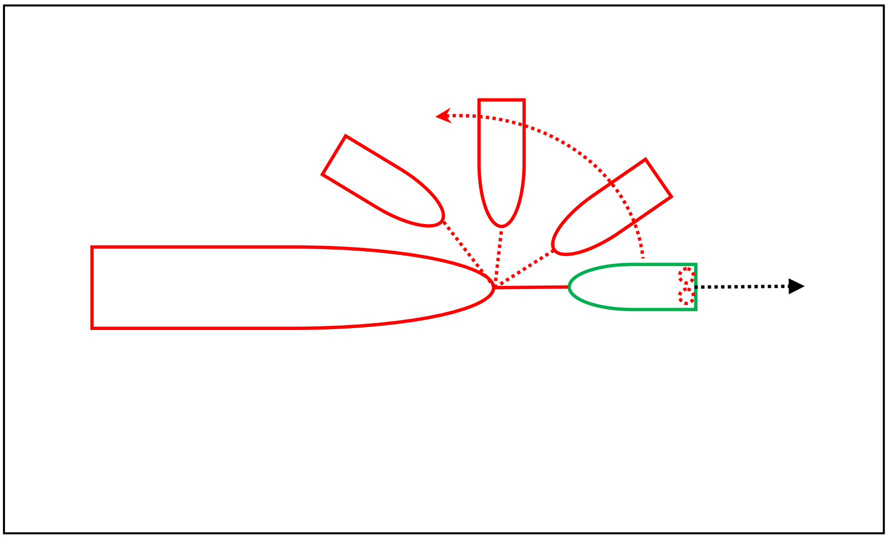

Fig. 17 In case of an event, the tug will swing on the towline

This however does not mean that the tug cannot be severely damaged or that serious injury to crew cannot occur, the consequences will however definitely be much less than can be expected when the tug is girted and/or run over by the assisted vessel.

4. SECURING TUGS

Passing on heaving lines

Due to the dangers arising from interaction between the tug and the vessel, conventional tugs and azimuth stern drive tugs employed at the bow in conventional mode usually insist on having the heaving line passed on from the ship's (lee) shoulder rather than letting it down from the centreline chock as illustrated below.

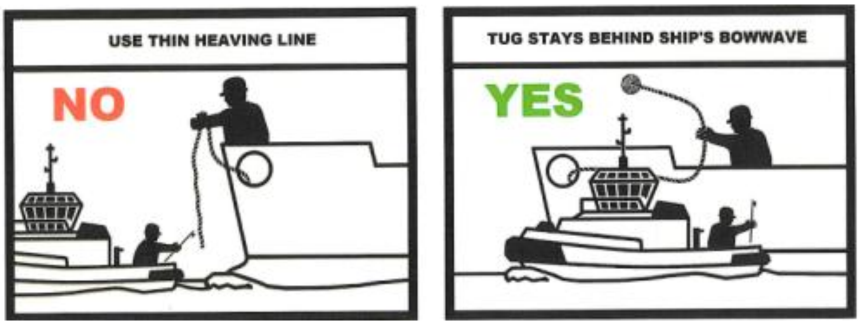

Fig. 18 Pass the heaving line from the ship's shoulder

ETA however does recognize that on some ships, due to their construction, it would be very difficult to arrange for a heaving line to be passed through the centre chock and handed further aft so that it may be handed over to the tug from the ship's shoulder as shown in the right hand side illustration above. Some improvisation might be needed from the ship's crew.

Fig. 19 Try to pass the heaving line to the ship's shoulder attached to a closed loop of line running back to the centre line chock inside the closed foc'sle

A workable solution could be an endless loop made from a small diameter line (heaving line size) passed beforehand through the centre chock around the bow structure to the side "window", by which the heaving line to be used can be pulled from the centreline chock to the ship's shoulder. Nevertheless, we strongly advise crews to make efforts to solve this type of situation for the sake of SAFETY.

Secure the stern tug first.

It is highly recommended to secure the stern tug first so that the tug can be immediately employed to "brake" the vessel's speed and steer the vessel as necessary. Normally, connecting the stern tug is much easier and thus quicker than connecting the bow tug. By making fast the stern tug first the Pilot can depend on the stern tug to provide immediate assistance in the event that the vessel's propulsion system or steering gear fails. Moreover, as already explained, once the vessel is making headway through the water, the vessel's pivot point shifts forward from mid-ship and will continue to move forward as the speed increases. Thus~~,~~ assistance from the stern tug will undoubtedly be more effective than any assistance that can be rendered by the bow tug particularly at speed in the region of 4 - 6 knots or above through the water, thus further enhancing the argument in favour of connecting the stern tug first.

Do not alter course or start turning the vessel whilst securing the bow tug.

Tug Masters, particularly those employed on the bow tug, cannot always see the side of the ship and therefore could be taken off guard if the vessels starts altering course unexpectedly. Pilots should always advise the tug of any significant course changes.

Fig. 20 Conventional tug secured as bow tug

Always inform the stern tug before putting the engines astern.

When the engines are put on astern and /or the vessel starts to move astern, the stern tug will be drawn in towards the vessel. It is therefore imperative that the Tug Master is fully aware that vessel has engaged its engines astern so that he may take evasive actions if necessary.

5. HEAVING LINES CAN BE LETHAL WEAPONS

Beware of the incorrect use and particularly incorrect construction of heaving lines! The use of a weight at the end of a heaving line is considered to be extremely dangerous and could cause serious injury to those below and damage the tug.

While tug crews understand that it may not be easy to get a heaving line across in heavy wind conditions, they still don't like to see heavy items coming down on their decks with the possibility of these weighted heaving lines hitting them on the head or against an arm, shoulder or leg. One may not believe that the items shown in the picture below were actually removed from heaving lines. The items shown actually form part of a collection of inappropriate weights connected to heaving lines that came down from vessels over the period of two years at a particular major Western European port. They were cut off and removed by the tugs' crews.

Fig. 21 Heaving lines can become murder weapons!

One would be surprised to note that the heaviest object weighed 1.28 kg. One can image the damage or type of injury such a weighty object can cause particularly when dropped or thrown from a considerable height. Nuts and bolts stuffed inside Monkey Fists are just as deadly. Even weights made from hatch cover packing can cause fatal injuries.

Ideally heaving line weights should be made from soft (leather) bag filled with a small amount of sand, about 0.2 kg maximum.

6. COMMUNICATION PILOT-TUG

During towage operations it is very important that Pilots communicate unambiguously, clearly and easy to understand about all their intentions and requests/instructions to the assigned tugs.

In most ports Pilots will instruct the tugs by requesting a percentage of tug power (i.e. Full – 50% - 25%- Stop) and direction of pull (i.e. Ahead, Astern, Starboard, Port). Others prefer to use of the "Clock" system where the heading of the assisted vessel is 12 o' clock and stern is 6 o' clock, to indicate the direction of pull.

Pilots should only refer to the tug's name when conveying instructions to the tug and refrain from using the Tug Master's name. This will also assist the vessel's bridge team to understand what is going on.

7. DISCONNECTING TUGS

Release the bow tug first

For the same reasons as described above, particularly during sailing, the bow tug should be released first. If this is delayed, the speed may start to build up and this can rapidly bring the tug into the dangerous zone of varying pressures around the vessel's bow. **Bow tugs should always be released prior to speed exceeding 4-6 knots through the water!**

Different procedures for releasing bow and stern tug!

One must understand that there is an important difference in procedure when disconnecting the bow or the stern tug. The bow tug will be ahead of the vessel and can easily manoeuvre clear from the vessel. Therefore the bow tug towline should be released and let go rapidly as there is very little risk that the towline will end=up in the tug's propellers.

However, at the stern, the towline should be lowered down slowly as instructed by the tug's crew. If the towline is released and immediately dropped down in the water the vessel's propeller wash will push the towline towards the tug with the possibility of it fouling with the tug's propellers. Therefore it is imperative that the towline is lowered down slowly as requested and indicated by the tug crew's. At no time should the line be dropped down into the water before a clear sign from the tug to do so is received.

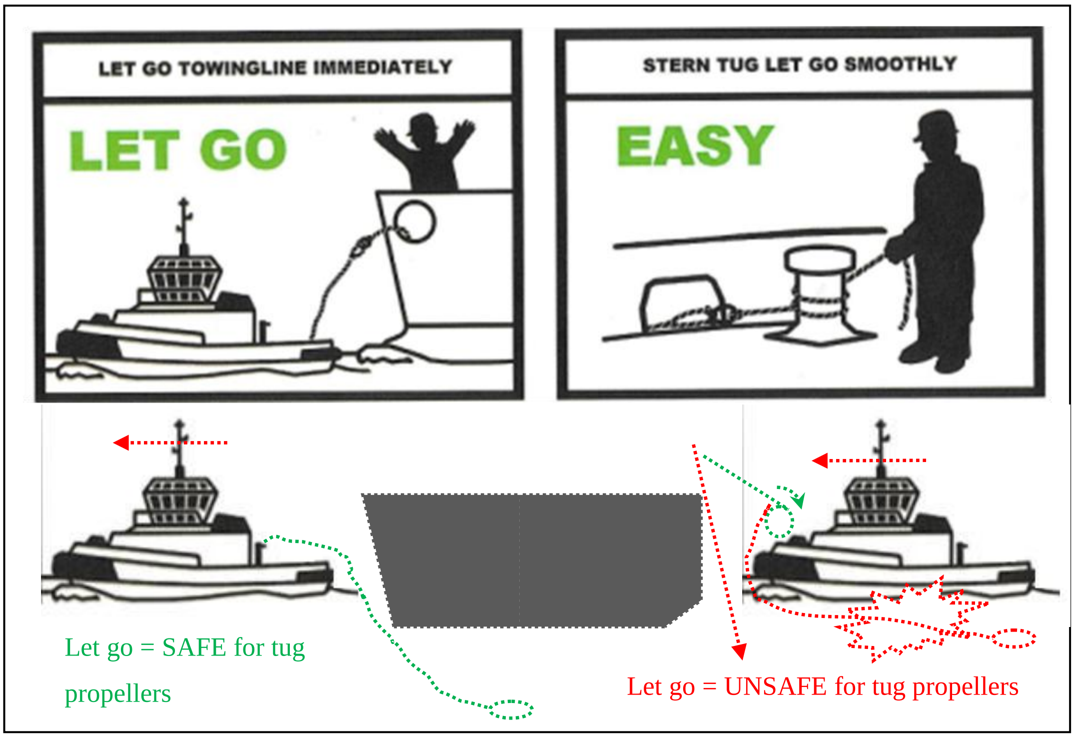

Fig. 22 Releasing tugs - different procedure for bow and stern tug

8. TOWING OPERATIONS IN FOG AND SEVERE WEATHER CONDITIONS

8.1 Towing operations in restricted visibility

Darkness causes restricted visibility and thus the tug master can often hardly see the vessel he is towing. Especially for the bow tug, this could lead to dangerous circumstances.

Just to illustrate:

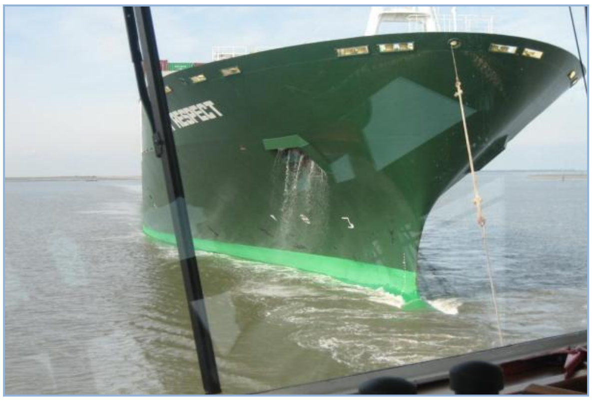

Fig. 23 In bright daylight

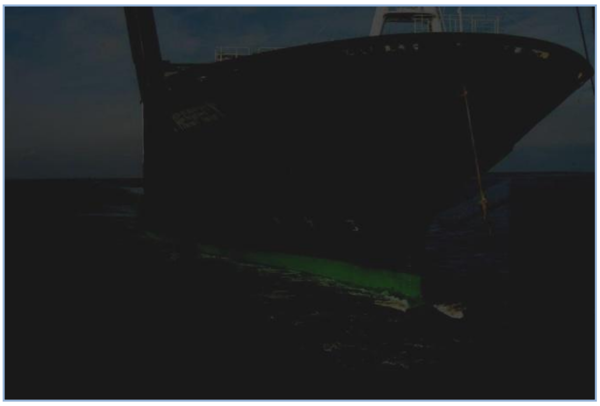

Fig. 24 At night

Another major issue are blinding floodlights.

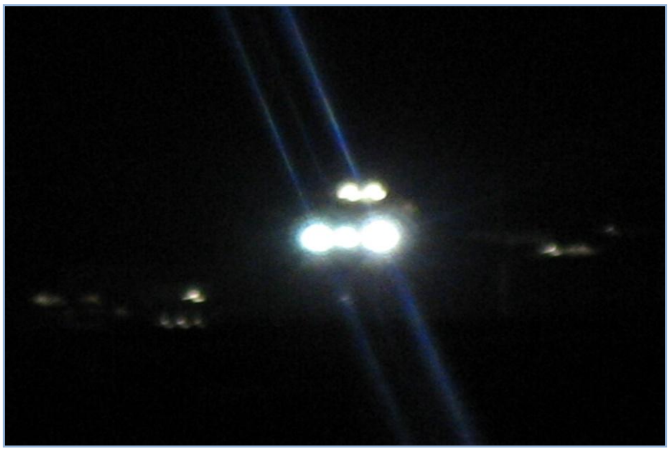

Fig. 25 Floodlights can impair the tug master's night vision

Such strong glares can impair the Tug Master's vision at night, which could eventually result in an inherently extremely dangerous situation. Therefore it is important that floodlights are switched off as soon as the tug is secured, or even better, if possible position the floodlights in such a way that they do not affect the tugs. In reality, this precautionary measure should have come out whilst conducting the vessel's risk assessments for securing tugs during harbour towage operations. These risk assessments have now become mandatory under the amended ISM code.

In dense fog, the situation may be even worse because in such a situation even the background is obscured and the Tug Master loses all reference points. He now has to concentrate on multiple items particularly in keeping the tug's towline in check whilst continuously monitoring the radar or ECDIS in order to verify the tug's position.

Fig. 26 Visibility in dense fog situations

In dense fog it is ultimately the Tug Master who will decide whether it is safe to manoeuvre the tug in position to secure the line to the vessel or not. After all, he is the person responsible for handling the tug. It goes without saying that this has to be discussed with the pilot well in advance.

Sometimes, the situation may deteriorate unexpectedly and the Tug Master may be concerned with securing the tug at the bow when it is already practically too late to turn the ship around.

When such a situation arises, the following alternatives could be considered:

- Consider stopping the assisted vessel entirely and let the tugs come to the vessel.
- Make fast on forward shoulder and work in push-pull mode.
- If decided to secure at the bow, consider letting the tug tow the vessel rather than using the assisted vessel's engine for propulsion. Such an option should be very clearly agreed between the Tug Master(s) and the vessel's Master and Pilot prior to operation.

In the event that it is decided to let the tug actually tow, rather than assist, course corrections with the ship's rudder and engines may only be carried out in close consultation with and with prior notification to the Tug Master.

8.2 Towing operations in severe weather conditions

In certain areas, harbour towage operations may commence from outside the port entrance. In particular situations, apart from escorting (passively) the vessel whilst transiting through the port entrance, tugs may also be required to secure outside the breakwaters. In such cases, in severe weather conditions there is a considerable chance that the towline will part when the tug falls into a wave trough.

During such operations, the crew (tug's and vessel's) should be advised to stand well clear (as always of course…) of the towline and have a heaving line ready at hand in case needed.

Fig. 27 Tug heaving and pitching on towline

Stern tugs in particular would more likely run the risk of parting the towline because they will usually be on an even shorter towline than the bow tug due to the lower poop deck, and thus the towline would be running at a considerably steeper angle subjecting the towline to additional undue stresses.

Needless to say that in such situations, the tugs will try to work on as long as possible towlines.

9. TRAINING / EDUCATION of PILOTS

ETA strongly recommends that Pilots should periodically attend on board tugs during harbour towing operations and ideally should find time to attend on both the bow tug and the stern tug.

Pilots may have done so during their initial training period, but as they progress further through their career whilst qualifying to handle larger vessels, they may tend to forget how it feels to be at the other end. Therefore by attending periodically on board a tug during a live harbour towing operation and, if opportunity exists, by attending simulator sessions ideally together with the tug masters, they will constantly keep in mind the tug masters' concerns and the tug masters can gain insight in the pilot's concerns. This will eventually work to the benefit of the tugs' crews and the crews of the assisted vessels because it will undoubtedly have an effect on the safety of all parties concerned.

10. TOWING LINES

Tugs equipped with towing hooks may use the lines of the assisted vessel. In this case, it is extremely important to use a line of sufficient strength and in good condition. Always inspect the lines **externally and internally**, if they are to be used for tug assistance.

All types of towing lines are subject to wear and tear, even steel wires, but it is quite understandable that synthetic lines are much more vulnerable. It is important to verify that the chocks or leads through which towing lines will be led have a really smooth surface.

When a heavy steel towing wire is used by the tug, it will be provided with a "messenger" line for heaving it on board. This will typically be of 24 mm diameter which will be connected to the vessel's heaving line. The messenger line will be of sufficient length so that it will reach on board the vessel before the wire is effectively being pulled on board.
It is important that the wire eye crimp is not allowed to rest within the chock or lead (or bollard) during the towing operations as this will result in undue stress on the wire at the crimp. This will almost certainly cause the wire to break.

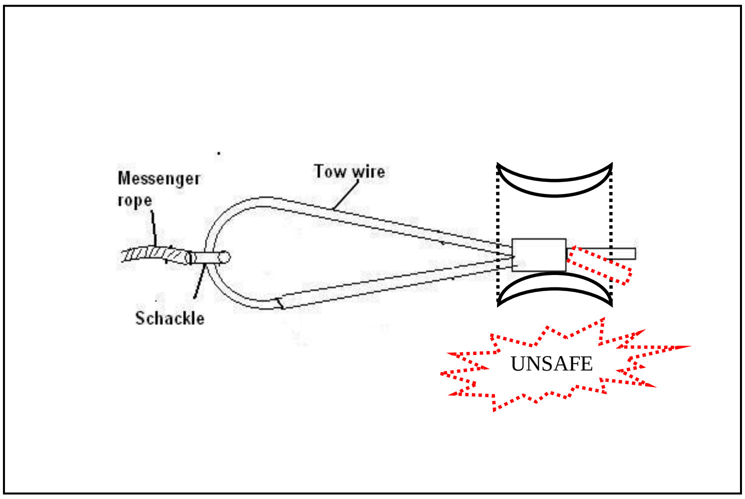

Fig. 28 Risk of towline parting when clamp rests against fairlead

11. TOWING WINCHES VERSUS TOWING HOOKS

Towing hooks on tugs are gradually being replaced by towing winches, the latter having significant advantages over towing hooks.

Towing winches come in various designs. Some winches have the capacity to shorten the towline whilst pulling at full power, others need to be made tension-free for hauling in the towline.

When using towing hooks, the length of the towline cannot be adjusted, whereas where winches are provided, the length of the towline can be adjusted as best suited to meet the requirements of the harbour towing operation.

Further, in the unfortunate event of a towline parting, the tug can rapidly recover the parted towline and reconnect with a second line. In some cases, tugs are fitted with winches have a split drum or even better a double drum. This will make it easier for a second line to be passed onto the vessel in the event that the towline parts.

12. EXAMPLES OF TUG ACCIDENTS

Although the companies involved are not eager to see pictures of their tugs involved in an accident published widely, they nevertheless recognise the fact that lessons can and must be learned from these accidents and therefore these pictures are here made available to those interested.

- "Fairplay 22" capsized during securing at the bow of ferry in high winds and at high speed, with tragic loss of 3 lives

Excerpt of the official investigation report:

Conclusion
During both attempts the speed through the water exceeded the 7 knots that had been agreed.

- The tug "St Annastrand" was perched on the bulbous bow of a container vessel with the bulb between her rudder-propellers and was lifted out of the water. Fortunately she did not capsize, but one of her thrusters broke off.

- The “Flying Phantom” was girted in dense fog while working as bow tug, with tragic loss of life. (see chapter 8, §1 above)

Excerpt from the official investigation report

visibility. Unfortunately, the poor positioning of the controls and equipment around the bridge on the "Flying Phantom" coupled with the poor visibility aft from the bridge hindered the master and chief officer in their task. As the fog was encountered the master and chief officer discussed the possibility that they could tow the "Red Jasmine" rather than being an assist bow tug, therefore reducing the risk of an incident such as the one that did occur. However, this was not discussed with the pilot on the "Red Jasmine", as no clear and concise procedures existed for the conduct of towing in restricted visibility. Instead this was left to pilots and tug masters to determine the best course of action on a case by case basis.

- The "Smit Polen" collided with the bulbous bow of a container vessel in stern to bow mode, at high speed. Fortunately she did not capsize.

Excerpt of the official investigation report

The Smit Polen was attempting to establish a port side towage connection with Maersk Nijmegen in order to provide stern-to-bow assistance. The crew took the heaving line and connected the messenger line to it. At the time of establishing the connection the tug was travelling at a ground speed of approximately 7.3 knots. Due to a 1.6 knot ebb current, the tug's speed through the water was approximately 8.9 knots. According to Smit's incident report, Smit Polen had a maximum available speed of 11 knots.

During an interview with Dutch Safety Board investigators, the captain of Smit Polen stated that he moved from the control panel at the rear of the bridge to the control panel at the centre of the bridge. At that moment, the starboard stern of Smit Polen collided with the port side of Maersk Nijmegen's bulbous bow. Smit Polen's starboard side came broadside in front of Maersk Nijmegen. Smit Polen initially heeled over approximately 45 degrees to port and subsequently heeled over to an angle of approximately 80 degrees. As a result of Maersk Nijmegen's forward speed, Smit Polen pivoted on the container ship's bulbous bow. Smit Polen became free from Maersk Nijmegen's bulbous bow and righted itself. During the process, Smit Polen's bridge collided with the bow of Maersk Nijmegen, breaking several bridge windows. Figure 15 shows Smit Polen and the container vessel during the accident.

Ocean going tug "Gudri" girted by tow

- Tug "Adonis" capsized while towing a barge (Australia) (see 5.1 above)

Excerpt from the investigation:

The ATSB found that while the masters of the two tugs were aware of the risk of capsize, neither of them realised that *Adonis* had entered a classic capsize scenario when it moved abaft of the barge's port bow before the barge had begun to slow down. The barge's speed was not reduced in time to allow *Adonis*'s master to regain control of the tug and manoeuvre it back into a safe position ahead of the barge. The tug's crew were not able to release the towline using the towing hook's quick release arrangement before the tug capsized.

-Small tug girted working stern to stern without gobline (Australia)

13. "DO NOT" AND "DO" IN HARBOUR TOWAGE OPERATIONS.

DO NOT Actions of Pilot, ship's Master and mooring parties

- ***Do not*** send the crew to the mooring stations (too) late
- ***Do not*** maintain the speed of the vessel too high whilst securing tugs.
- ***Do not*** use DANGEROUSLY HEAVILY WEIGHTED HEAVING LINES.
- ***Do not*** execute course changes whilst the tugs are securing their towlines.
- ***Do not*** use *tug Master's* name when communicating orders to the tugs.
- ***Do not*** enga*ge the vesse*l's engine/s during manoeuvres without first informing the respective Tug Masters
- ***Do not*** throw the heaving line (at the bow) from the centre line but from the ship's shoulder
- ***Do not*** make rapid and excessive steering changes without informing the tugs.
- ***Do not*** build up speed in excess of 6 knots through the water with the bow tug (still) connected
- ***Do not*** use full engine power particularly on a large vessel when a tug is secured aft.
- ***Do not*** keep floodlights shining into the tug master's eyes; this will impair his night vision and will seriously hamper his ability to estimate distances and to assess the operations.

- ***Do not*** keep floodlights shining towards the tug in case of restricted visibility.
- ***Do not*** make headway on own power in very dense fog with a bow tug secured without prior agreement between tug and pilot. Consider letting the tug(s) tow the vessel rather than using the vessel's propulsive power.
- ***Do not*** build up speed over 6 knots through the water starting from a "dead ship" with a bow tug secured
- ***Do not*** drop the towline at the stern when disconnecting the tug (unless instructed otherwise by the tug.)
- ***Do not*** delay to drop the towline at the bow when disconnecting the tug once instructed to do so by the tug.
- ***Do not*** wait for something to happen to start preparing the heaving line(s) again.

DO **Pilot - Master exchange of information or vice versa**

- Pilot-Master exchange to include info on modus operandi of tugs
    - Tug name(s), type, bollard pull and position for securing
    - Whether tug lines or ship's lines will be used
    - Normal heaving line or heavy messenger line
    - Position for passing heaving line forward (bow / shoulder).
- First make fast the stern tug then the bow tug.
- First let go the bow tug, then the stern tug.
- Pilot to instruct vessel's Master to have his crew at mooring stations in ample time, agree on period of notice needed by ship's crew.
- At night, Pilot to instruct vessel's Master to turn off blinding floodlights
- Inform vessel's Master of Local regulations, if applicable
- To secure the bow tug in very dense fog, it is imperative that the assisted vessel takes off all speed through the water and the tug moves in to make fast.
- It should be discussed and agreed well in advance with the tug master whether once the bow tug is secured the vessel may use her own propulsion power.
- Keep vessel's speed at maximum 6 knots through the water particularly when the bow tug is being connected and whilst the bow tug is still connected
- Pilot to use tug's name when giving orders, so the bridge team can understand

- Pilot to inform the stern tug when engaging the vessel's propeller in order to watch out for the propeller wash.
- Pilot to inform the stern tug about any rudder position changes about to be effected during manoeuvring.
- Tug Master to inform the Pilot whilst reaching 75% of the total engine power of the tug.
- Pilot to be made aware of any "novice" or "trainee" Tug Masters or of any Tug Masters who may not be familiar with the area and who will be participating during the harbour towing operation.
-

DO **Actions of Pilot, ship's Master and mooring parties**

- ***Do*** bring speed down sufficiently before securing a tug, especially the bow tug
- ***Do*** limit use of propeller to the minimum required for steering,
- ***Do*** **drop** the towline **at the bow** when disconnecting the tug, however only when instructed to do so by the tug.
- ***Do*** **slack away** the towline **slowly at the stern** when disconnecting the tug and only let go off the messenger line when instructed to do so by the tug
- ***Do*** use tug's names when conveying orders to the tug and provide clear and concise instructions.
- ***Do*** turn off floodlights as soon as the tug is secured.
- ***Do*** have a spare heaving line ready at hand <u>and a skilful deckhand to handle same.</u>

- ***Do*** use heaving lines with light weights, preferably using soft sand bags.
- ***Do*** inform the stern tug before engaging engines astern.

As may be noticed, items are repeated in both the Do and Do Not section, obviously in the opposite way. This was done intentionally to increase the chances that they will be noted and remembered.