TRAINING BULLETIN

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PROS & CONS TOWING SHIP VIA CLF OR RUDDER/PUSH ON THE TRANSOM

Preamble
This training bulletin pertains to pros and cons of tugs towing via a ship's Centre Lead Forward (CLF) or pushing on ship's transoms and quarters during towage operations, both when assisting the ship up to steerage speed and when engaged in Active Escort duties.

Overview - Dynamic Assist & Harbour Towage Operations
Large ships with low under keel clearance (UKC) can be assisted up to steerage speed by a tug:

- Towing the ship ahead when its towline is connect through the ship's CLF to a set of bitts,
- Towing the ship ahead when its towline is connect through the ship's shoulder Fairlead to a set of bitts,
- Pushing the ship ahead when the tug is bow on to the ship's transom.
- NB: This could be a combination of two tugs towing and pushing at the same time.

Overview - Escort Towage Operations
Ships when experiencing a steerage or engine failure can be assist by an escort tug:

- Bow Ops:
  - Towing the ship ahead via it the tug's towline being connect through the ship's CLF to a set of bitts,
  - Steering the ship by increasing or decreasing the relationship of the tug's towline to the ship's centreline.
  - The ship can be propelled and steered by a combination of bow operations.
- Rudder/Push:
  - Pushing the ship ahead with the tug's bow on to the ship's transom,
  - Steering the ship when the tug's bow is on the ship's transom by increasing or decreasing the relationship of the tug's centreline to the ship's centreline.
  - The ship can be propelled and steered by a combination of Rudder Push tug operations.
- NB: This could be a combination of two tugs towing and pushing at the same time.

Pros Bow Operations

- The CLF tug can lead a ship into port and its berth then become a lift off tug during the berthing phase of the operation. This is beneficial when:
  - The ship has large flares in the bow,
  - The ship has cargo extending beyond the ship's side, such as a heavy lift ship,
  - The ship has low freeboard, such as a small product tanker or a submarine,
  - Where due to the ship's size the tug has to use long turning levers on the ship to achieve maximum 'effective' bollard pull.

- When a ship is sailing the CLF tug can readily be a holdup tug, then a left-off tug and if required assist in towing the ship up to speed and or becoming an active escort tow without having to disconnect and connect its towline.

- In the case of the ship having an engine or steerage failure the bow tug can:
  - Tow the ship to clear open water,
  - To some degree, steer the ship to clear open water.

Cons Bow Operations

- There are additional operational safety risks associated in connecting and disconnecting to the ship's CLF when the ship is underway.

- The tug has to be of an appropriate design to effectively and safely undertake bow operations.

- The training required for the tugmaster and crew is of a high competency level.

- The ship's crew need to be knowledgeable and have appropriately weighted heaving lines available to be deployed to the tug.

- The ship has to be at a safe connection speed *through the water* for the tug to be able to safely connect its towline. This may be difficult for a pilot to achieve if the ship is steaming into a strong tide or current, whereby the pilot has to maintain a certain speed *over ground* to clear a channel or have sufficient steerage speed.

- Where the tug has to back into a large swell or sea there can be issues with snatching into the towline. Snatch loadings in turn increase the risk of the towline parting or ship's deck fittings failing.
  - NB: When a tug's towline goes slack and then comes tight due to tug movement effectively what is happening is the tug moving at meters per second creates kinetic energy. Given the weight of the tug this can represent huge forces that can be beyond the capacity of the towline or ship's deck fittings to absorb.

- Due to the ship's pivot point moving forward as the ship gains speed the ship's forward turning lever is about 1/3 the length when compared to the aft turning lever. This makes it considerably harder for a tug made fast CLF to steer the ship than a tug pushing on the transom.

- The tug when towing in the bow looses a high percentage of its pulling force due to a combination of:
  - The tug transom's lateral resistance to the force field of water,
  - Hull friction as the water flows down and around the tug's hull,
  - Lost of effective bollard pull due to the water flow from the tug's propellers hitting the ship's bow and shoulders.
  - At 8 knots transit speed a RAstar85 looses about 30tbp, therefore only produces 55t towing effect on the ship.

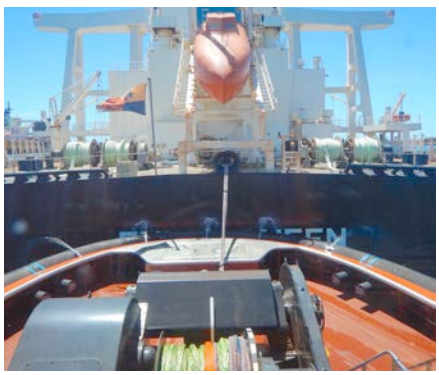
- In live operational trials and also in our simulation facility we have shown that under certain circumstances a tug connected CLF when attempting to steer a ship by pulling ship's bow towards the tug can actually steer the ship in the opposite way……being away from the tug. This phenomena discovered by SeaWays is new to pilotage of ships and we are in the process of researching to gain a thorough understanding of why and when it occurs.

Pros Rudder/Push Operations

- The Centre Lead Aft (CLA) tug can assist a ship into port and its berth, then become a lift off tug during the berthing phase of the operation. This is beneficial when:
  - The ship has large counter in the quarters,
  - The ship has cargo extending beyond the ship's side, such as a heavy lift ship,
  - The ship has low freeboard, such as a small product tanker or a submarine,
  - Where due to the ship's size the tug has to use long turning levers on the ship to achieve maximum 'effective' bollard pull.
- When a ship is sailing the CLA tug can readily be a holdup tug, then a left-off tug and if required assist in pushing the ship up to speed and or becoming an active escort tug without having to disconnect and or connect its towline.
- In the case of the ship having an engine or steerage failure the rudder/push tug can:
  - Push the ship to clear open water,
  - Steer and or propeller the ship to clear open water,
  - Lengthen its towline and steer the ship by Direct, Powered Indirect or Indirect assist,
  - Lengthen its towline and slow or stop the ship by Direct or Transverse Arrest.
- The tug can safely make fast and let go at relatively high transit speeds, generally in the order of 10 knots through the water.
- In some cases the tug can also push on the ship's quarters to enhance the steering effect on the ship.
- A high percentage of the tug's rated bollard pull is effectively applied to drive the ship ahead;
  - NB: A RAstar85 at a transit speed of 8 knots may loose about 20t bollard pull, therefore applying about 65t pushing force onto the ship.

Cons Rudder/Push Operations

- The tug has to be of an appropriate design to effectively and safely undertake rudder/push operations. The main feature being the tug must have a large rounded bow section and sausage fender with no tire fenders fitted. This is so the forces created by the tug are proportioned over a large hull plate area and a number of internal frames.
- The training required for the tugmaster and pilot to ensure high competencies and correct commands.
- The ship's transom and the tug's bow must marry up correctly. Hence being a Rudder/Push tug is not always possible.
- The prevailing sail state has to be such that the tug will not range up and down the ship's hull plating or come off the hull plate due to swell action and then ram back onto the hull plating.
- If the tug is an older design and or has tire fenders fitted then there is a possibility that a pressure point can be created on to the ship's hull plating.
- Damage can be done to the ship's hull plating, internal frames or paintwork if the Rudder/Push tug has:
  - An old design bow shape more in keeping with a conventional vessel, being relatively narrow shoulders tapering into a more pointed bow section,
  - Tire fender fitted into the stem of the bow section, which creates a pressure point onto the ship,
  - Fender retaining chains and or steel coat-hangers holding fenders in place, this leads to metal to metal situations and in turn damages a ship's paint work.



Effective Bollard Pull Test

SeaWays have undertaken a test at our simulation training facility in the UK on two identical 312m 274,000dwt large loaded Capesize ships:

- With an 18.9m draft and 0.6m UKC.
- The ships were both steaming at 6.2 knots into a 2m long period swell.
- One had a RAstar85 ASD tug made fast CLF on an 88m towline.
- The other had a RAstar85 ASD tug made fast CLA with its bow on the ship's transom as a Rudder/Push tug.
- Both ship's engines were stopped at the same time with only the tugs to continue the ship's transit.

Tug Centre Lead Forward 88m towline				Tug Rudder/Push tug Centre Lead Aft			
Time	**Speed Knots**	**Towline Tonnes**	**Time Run Minutes**	**Time**	**Speed Knots**	**Towline Tonnes**	**Time Run Minutes**
1206	6.2	55	0	1203	6.2	n/a	0
1221	4.2	55-35	15	1218	4.8	n/a	15
1236	3.9	60-45	30	1233	4.6	n/a	30
1251	3.7	69-50	45	1248	4.6	n/a	45
1306	3.3	74-56	60	1303	4.6	n/a	60

Test Results

From the trial it can be seen the tug pushing on the ship's transom was able to exert more driving force onto the ship than the tug made fast CLF could exert in pulling the ship.

This test was commissioned after a real life event in the Port Hedland shipping channel whereby:

- A Capesize ship was steaming at 8 knots in the channel into a 2m long period swell and had an engine slowdown event.
- The pilot ordered the:
  - Forward passive escort RAstar85 ASD tug to make fast CLF, this took about >10 minutes to achieve,
  - CLA RAstar85 ASD tug to shorten up its towline and push full on the ship's transom, this took about <1 minutes to achieve.
- The CLF bow tug ran out 100m of towline, which could several more minutes to achieve.
- The CLF tug when lifting full was experiencing snatch towline forces ranging from 0t to 90t, due to the effect the 2m+ swell was having on the tug.
- Although the CLF tug tried a combination of none were successful in managing the snatch loadings:
  - Varying power settings,
  - Render Recover - Gear 1,
  - Render Recover - Gear 2,
  - Render only,
  - Manual control.
  - NB: Subsequently we have undertaken a test whereby on a RAstar85 tug we ran out 180m of towline when made fast CLA and then engaged the Render Recover winch in Gear 2 on full render recover. By doing this we decreased the diameter of the towline on the winch drum, which in turn meant the line pull in render recover mode increased to 60t whilst the line speed decrease but was still faster than if the winch was in Gear 1. The next test will be to trial this when bow-to-bow in a swell.
- After consultation with the pilot and to avoid doing damage to the tug's towline or the ship's deck fittings the tug recovered its towline and took up a passive escort on the port shoulder of the ship.
- Meanwhile the CLA tug had pushed without issue at full power on the ship's transom throughout.
- Note:
  - At half power the tug started to come off the ship's hull somewhat. So the tugmaster after consultation with the pilot increased to full power and the tug then remained pinned.
  - There was no ranging up and down the hull plate when pushing full.
  - The tug had its fender lubricating spray on throughout.

Training

SeaWays training philosophy and methodology is not to instruct a tugmaster how to do a specific towage tasking. In fact you will not find anywhere in our training manuals where we actually tell a tugmaster how to do a specific tasking.

Rather we endeavour through our ClassNK accredited training to:

- ⚓ Develop a set of competency skills via structured competency based training to a defined standard, which we refer to as *'tools in the tool box*',

- ⚓ Educate tugmasters to have a thorough theoretical towage knowledge by a combination of:
  - Online eLearning lessons that are assessed via a question & answer multi choice process,
  - Direct live lecturing by an accredited Training Master,
  - NB: For Module 1, 2 and 3 there are a total of 46 eLearning theory lessons.

- ⚓ Develop a high level of confidence so the Tugmaster can make informed decisions in a dynamic environment, while under challenging circumstances and often when tired.

Given this approach a tugmaster can weigh up all the prevailing considerations and requirements pertaining to each element of an operation and then engage in outcomes that are best suited to:

- ✓ The circumstance at hand,
- ✓ The tug they are driving,
- ✓ The ship they are servicing,
- ✓ The pilot's requirements,
- ✓ The prevailing environmental issues and
- ✓ Most importantly that it is safe to do.

Training program for RivTow RAstar85 tugmasters

- ⚓ Module 1: ASD Tug Handling
- ⚓ Module 2: Undertaking Harbour Towage
- ⚓ Module 3: Active Escort & Dynamic Assist
- ⚓ Markey Render Recover winch training
- ⚓ The training and accrediting of five RivTow RAstar85 Training Masters
- ⚓ Online eLearning covering 46 lessons on Towage Theory
- ⚓ All tugmasters completing SeaWays' Verification of Competency Task Book, which formally captures via 35 pages of dot points the learning outcomes a tugmaster requires to be master of a RAstar85 tug.
  FYI: the actual tug driving competencies are captured in 5 only pages of the VoC Task Book.

So as to best manage the risk associated with live on board training the first stage for each of the Module 1, 2 & 3 tugmaster training is undertaken in a DNV accredited TugSim running advanced Transas software.

The live on board training Modules are then redelivered to the tugmasters by a combination of SeaWays consultant trainers and SeaWays trained and accredited RivTow training masters.

When all the tugmasters have been trained there is a process whereby SeaWays undertakes an independent Competency Assessment (training audit) to ensure all tugmasters and their crews are operating at the required standard.