Supplied with kind permission of the ABR Company Ltd, publishers of Tug&OSV

International Tug&OSV

INCORPORATING SALVAGE NEWS

July/August 2020

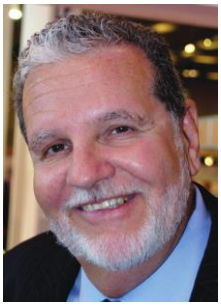
Svitzer's new global CEO looks beyond Covid-19

Capt Arie Nygh looks into a strange phenomenon when towing

Stefan Sedersten looks to the future as Berg eyes the tug market

25
1995 - 2020
INFLUENTIAL YEARS

Strange effect of tug's manoeuvre



► Capt Arie Nygh

Capt Arie Nygh, managing director of SeaWays Consultants, investigates the unusual phenomenon of water flow generated by a tug causing a tow to turn counter-intuitively

In September 2017 while engaged in centre lead forward (CLF) training on an ASD escort tug utilising a 50m towline, the pilot ordered the tug to come out to the 10 o'clock position and lift-off at three-quarter power (60 tonnes). This was for training purposes to assist the outbound laden Capesize ship in rounding a bend in the channel. Instead of assisting the ship's turn to port it actually induced a turn to starboard.

The pilot ordered the tug to stop and subsequently informed me he had to apply 20 degrees port helm on to counter the tug's effect on the ship, which was to turn the ship to starboard.

After consultation I agreed with the pilot to trial this again when rounding the next bend in the channel, which again was to port. At this turn the tug came to 4 points out to port of the ship's bow pulling at three-quarter power. The ship required 25 degrees port helm to counter the induced turn to starboard. Again, counter-intuitive.

Given this phenomenon was new to me, I reached out via my international network only to find it was also new to other colleagues. Admittedly, some in good faith and in positive support offered theories such as:

- A force generated from the tug's propeller wash acts on the ship's hull forward of the pivot point pushing the ship's bow away and in so doing overpowering the tug's towline pulling force. *In the scenario as I have described it can clearly be seen the tug's wash is hitting the ship's hull aft of amidships. Consequently, I do not believe this theory is correct in this circumstance.*
- The tug creating a 'donkey effect' force to turn the ship away from the lift-off tug. *While this is a known phenomenon I do not believe it is relevant in this scenario. See: http://www.pilotmag.co.uk/wp-content/uploads/2012/01/Pivot-point-web.pdf*

My own theory is, given the wash from the tug's propellers in this position along with a medium length towline, water flow generated by the tug's propellers can clearly be seen hitting the ship's hull aft of amidships. Therefore, due to an increase in water flow velocity, there is likely a low pressure formed on the tug side of the ship's hull near the stern. This in turn pulls the ship's aft part in the direction of the tug and consequently steers the bow away from the tug. Basically, it's along the lines of the Bernoulli's Law.

To explore my theory, I have undertaken a number of trials:

- At 45 degrees (4 points) on a long towline (80m-plus) the tug's propeller wash can be seen to miss the ship's hull. *Result: the tug pulls the ship's bow towards it, as one would expect.*
- On a medium length (plus/minus 50m) towline, positioning the tug square on the ship's beam (3 or 9 o'clock position) so the tug's propeller wash can be seen to miss the ship's hull. *Result: the tug pulls the ship towards it, as one would expect.*
- I have trialled this in a number of ship simulation facilities. *None have created*

the effect, likely due to this type of water flow generally not being modelled into the software of simulators.

- In open water with high under-keel clearance (UKC). *This trial was rushed due to time restraints, so should be considered inconclusive. The outcome seemed to have less effect than when the ship was in a narrow channel with low UKC.*

When opportunity has afforded me, I have been working on this project in an endeavour to solve this phenomenon, while finding more support from notable individuals along the way.

This said, it remains somewhat a mystery that, in my opinion, needs resolution. In the meantime, SeaWays has restricted CLF tugs training between positions:

- 1 to 2 o'clock (30 through to 60 degrees out from right ahead)
- 10 to 11 o'clock.
- NB: To be clear, if a pilot orders the CLF tug to lift-off in these zones the tug master is instructed to comply.

My endeavour to solve the CLF phenomenon led me into discussions with Port Ash's Capt Cliff Beazley. I think it fair to say that Cliff also supports the theory that the CLF tug is creating a Bernoulli Effect acting on the ship's aft body, effectively at the end of the ship's aft turning lever – though again, it's yet to conclusively be proven.

In our discussions, Cliff shared with me a video of a trial he ran utilising the manned models at Port Ash. This involved a manned model 70-tonne bollard pull (BP) ASD tug stationed amidships on a Panamax ship with the tug creating water flow from its propellers forward and aft along the ship's hull.

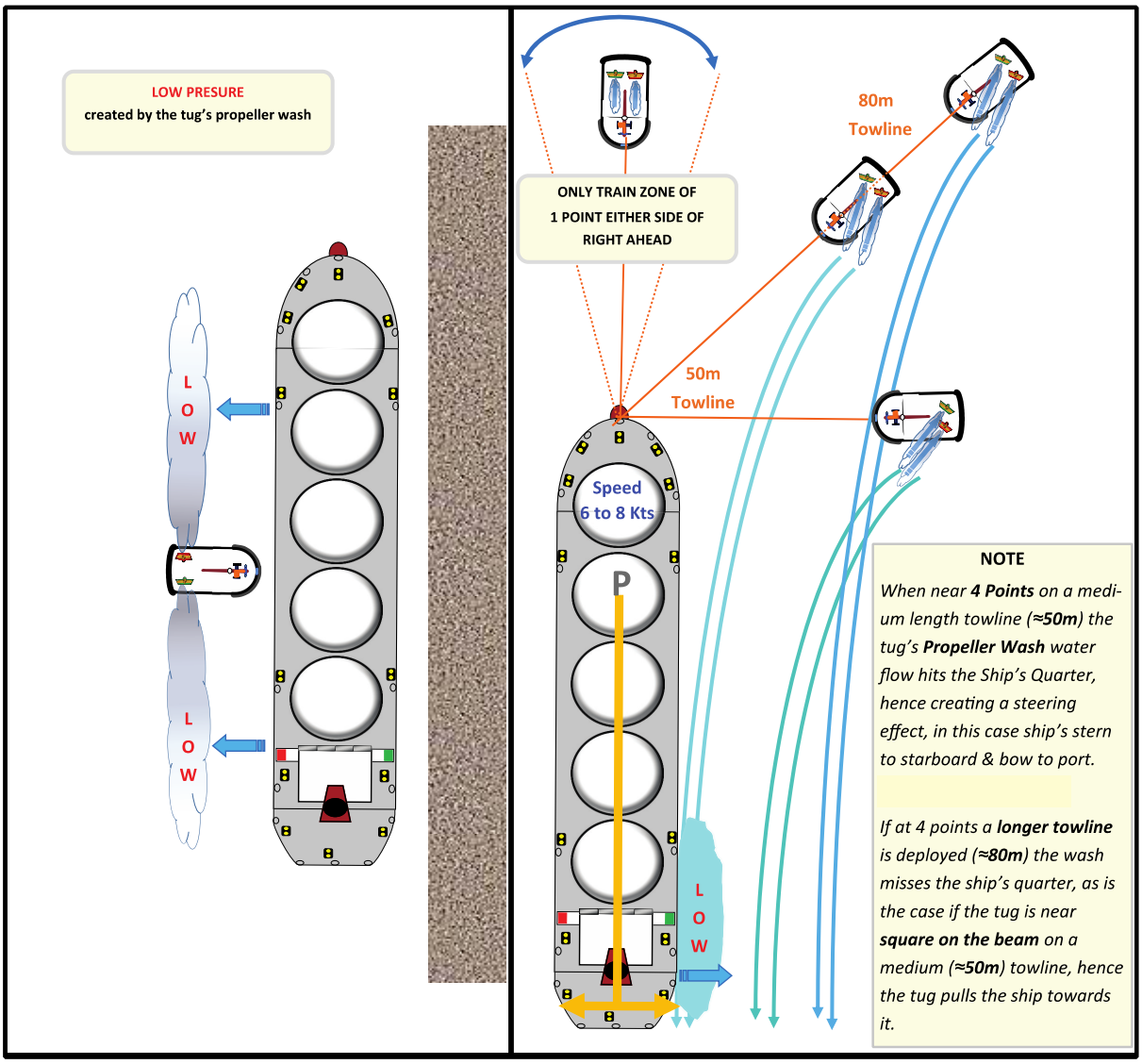
The outcome being, the water flow in turn creates a low-pressure area (Bernoulli's principle in fluid dynamics) that draws the ship away (off) from the berth without the tug actually touching the ship's hull and with no towline attached.

In March 2020 an opportunity presented while I was training in New Zealand to live trial this phenomenon of sailing a ship with no towline connected by creating low pressures down the ship's side purely from the tug's propeller wash.

This took place initially with a small LPG tanker and a 24m ATD 60 tonnes BP tug, with the ATD's stern 1m off the ship – hence its azimuth propellers were about 22m off the ship's side. NB: If an ASD, then the bow would have been 1m off the ship's hull.

Afterwards, I videoed the footage recorded on the pilot's PPU and have taken start and finish screen shots *(see over page)*.

The start and finish time is on the left-hand side of the screen. One can see it took less than two minutes to move the ship in a controlled manner 8m to 10m sideways off the berth – remembering this was our first haphazard attempt at it. Having proved the concept to ourselves we later that day sailed a laden tanker berthed on the opposite side of the wharf (*see images below and over*).



The tanker was 59,000dwt, 183m LOA, 11m draft with low UKC (2m). We sucked the ship 6m off the wharf in less than three minutes and the ship registered a speed of 0.4 knots sideways. Once the tug stopped, the tanker continued to drift out to 10m off the wharf, remaining parallel the whole time; the pilot then simply steamed away.

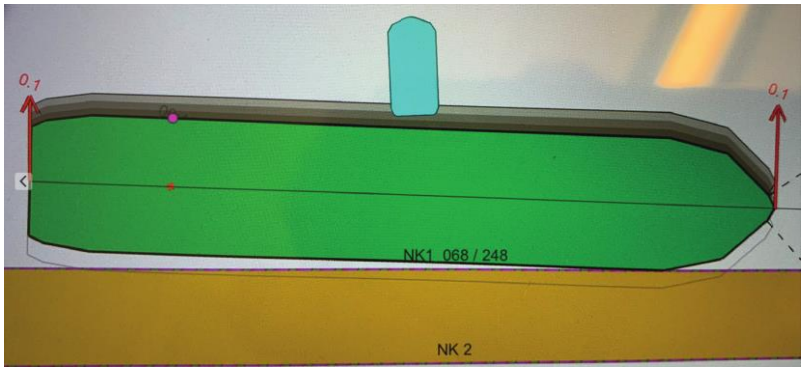
These trials proved water flow generated by a tug along a ship's hull can indeed cause significant effect on a ship and goes some way towards supporting my thoughts of effects caused by a CLF tug's propeller wash on a ship's heading, though this remains yet to be fully substantiated. Interestingly, some work was done in this area at AMC by Dr Paul Brandner in the mid-1990s and in the early 2000s by Prof Martin Renilson, so the issue – though not well known – has been around a long time.

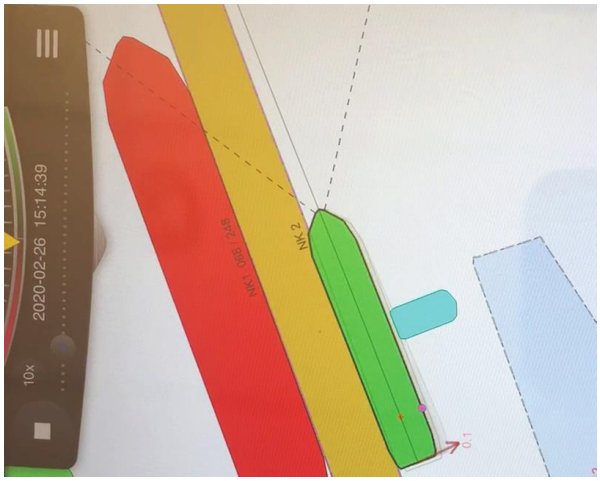
While I believe drawing a ship sideways by tug wash alone is now conclusively proven, the CLF phenomenon is still somewhat open to debate. We know it can under certain circumstances happen, though a definite 'why' currently eludes us. It is important to note with regards to the sailing of a ship as described above, SeaWays is not promoting this as an option.

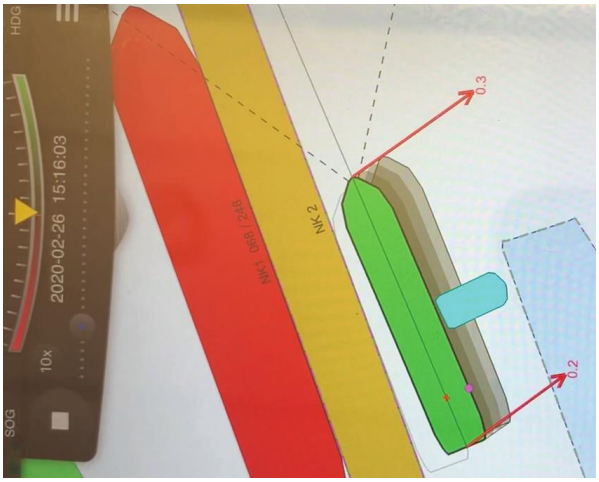
Rather, this phenomenon should be understood by pilots and tug masters so as to better ensure safe and effective operations. As with most things, there will be positives and negatives to grasp from gaining knowledge and understanding:

Yin: If a tug lost its winch or towline at a critical point, a possible option may be to utilise the tug's propeller wash to draw the ship away from a wharf? Yang: An omni-directional tug standing by square near the ship's hull whereby its propeller wash flows down the sides of the ship could be inadvertently drawing the ship off the berth?

At the end of the day, I am neither a pilot nor an expert in fluid hydrodynamics, rather a tuggie who seeks knowledge. Consequently, I am very open to comment, feedback and input.







◄ *A screen shot from the pilot's PPU during the live on-water trial with a 59,000dwt tanker shows how the tug had drawn the laden tanker off the berth while, below left, the tug stops holding the ship alongside and backs off 1m and, right, the tug propeller wash draws ship off berth*