ESCORT TOWAGE

By Brendan Smoker & Andy Read

When some readers think of escort towage, they may recall those well-known images of tugs heeled over to extreme angles, decks immersed, wondering if at some point the tug will capsize. Towage industry leaders would like to think things have come a long way since then, namely in the improved capability of modern escort tugs along with training and competence of those they employ on the controls.

What constitutes an escort tug is often misunderstood. In many cases, people assume that any tug connected to a moving ship is escorting, but this is not the case. In situations where the tug is not imparting any force on the ship and the speed of the connected vessels is less than 6 knots, this situation is properly defined as a ship-assist mode. To be truly considered escort- capable, a tug must be able to safely and effectively provide steering or braking forces via a towline to the ship at speeds greater than 6 knots. This is typically done in an indirect towing mode, utilising a combination of hydrodynamic lift and drag from the hull and skeg providing towline tension and thrust from the drives to maintain position.

The justification for escort towage has always been a 'sensitive' control measure for harbour authorities, weighing the balance between protecting the local environment, port interests and operational necessity against the commercial sensitivities of ever-rising port costs to shipping lines.

When assessing the requirement and parameters for escort towage, harbour authorities should engage with their towage providers (and tug masters) and ask, "What is it we want the tugs to do and what is the added margin of safety that they will provide?" Clarify expectations, limitations and suitability of assets available for the task.

With a clear understanding of escorting speeds, rates of turn and localised requirements from the trials team (pilots) to support this process, effective research and development through simulation, modelling and trials have proven a critical process when validating performance data.

The design of an escort tug is a balancing act between various competing features. The most appropriate tugs result from clearly defined operational requirements, such as, the maximum-rated escort speed (typically 8 or 10 knots), and the maximum steering and braking performance. It is also worth defining if the tug is to operate in calm or heavy weather and if it will be a dual-purpose tug used for both ship-assist and escort duties.

The starting point is typically a proven escort tug 'platform', but with hull dimensions adjusted to provide the stability needed to counteract the expected escort forces. With the centerline skeg being so critical in the generation of escort forces, its shape, size and location are carefully analyzed in CFD or scale model testing. The working deck is carefully laid out so that the escort towline staple is positioned optimally, and is visible to the tug captain.

The longitudinal position of the staple needs to be carefully studied. Too far forward and the tug will not generate the full escort capability of the hull and too far aft and the tug may not be 'fail safe' in the event of a propulsion failure.

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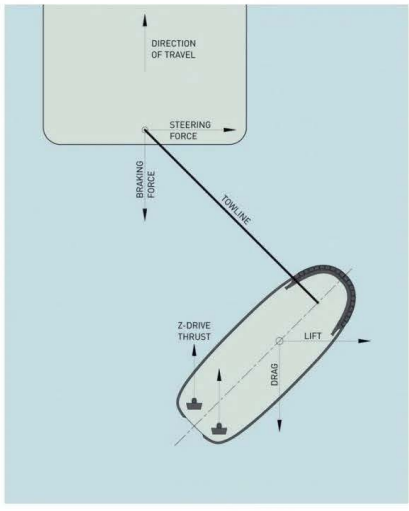

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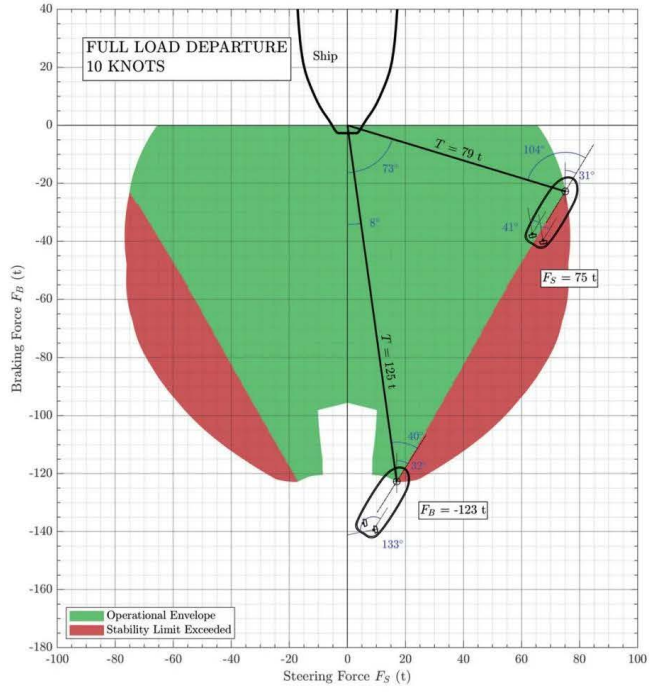
Towage operators have made significant investments in fleet renewals to provide high-quality (and appropriate) assets within the ports where they operate. With the significant variety in escort tug requirements, naturally there is also a wide range of escort tug capabilities. Therefore, it is critical for both the tug master and ship pilot to understand the escort performance and limitations of each escort tug on the job.

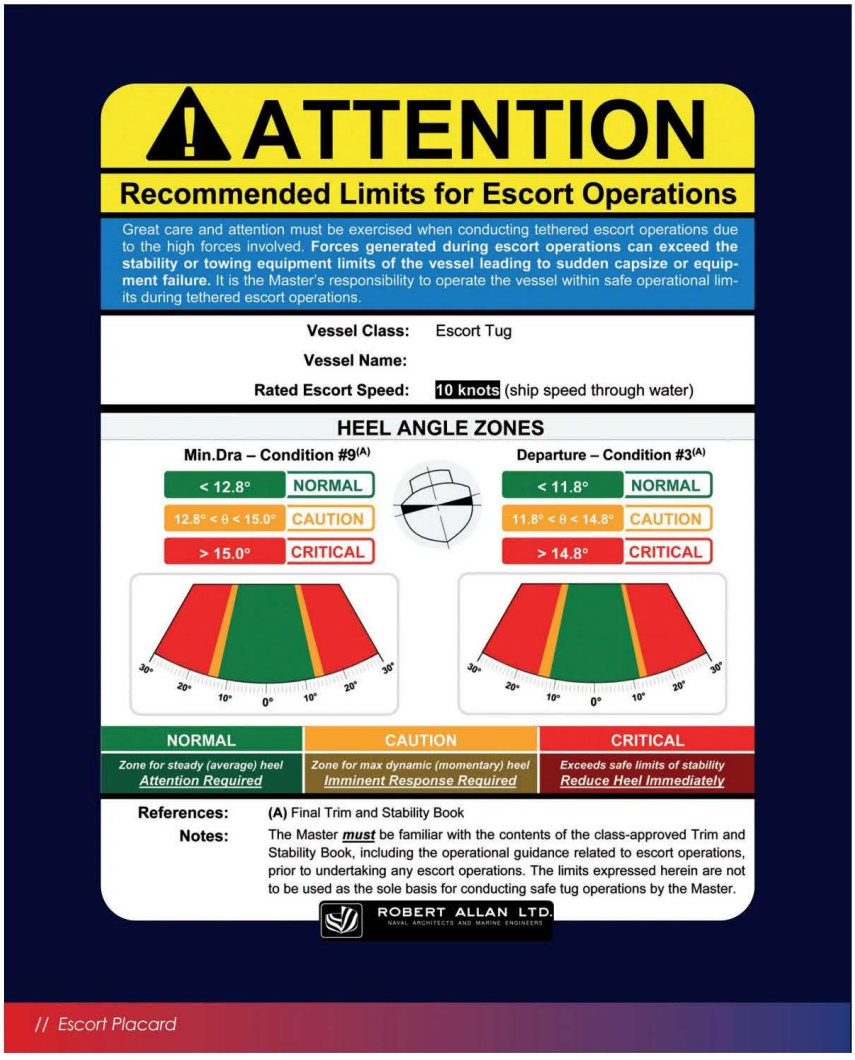
The four key characteristics of an escort tug are:

- The rated escort speed (typically 8 or 10 knots)
- The maximum steering and braking performance (typically shown in an escort performance butterfly diagram)
- The maximum allowable heel angle while conducting indirect escort
- The Towing System Load Rating (TSLR) that dictates the maximum towline tensions for each wrap angle zone

The escort butterfly diagram below shows the performance envelope of the particular tug when tethered in the center lead aft position at the indicated speed and loading condition. The green region indicates the steering and braking forces the tug can achieve at heel angles equal or less than the class heel angle limit. The red region, if shown, indicates forces the tug can generate but at a heel angle greater than allowable by class.

It is the job of the tug master to adjust position throughout the escort operation to maximise potential and thus effectiveness of the tug during the assist phase.





// Escort Placard

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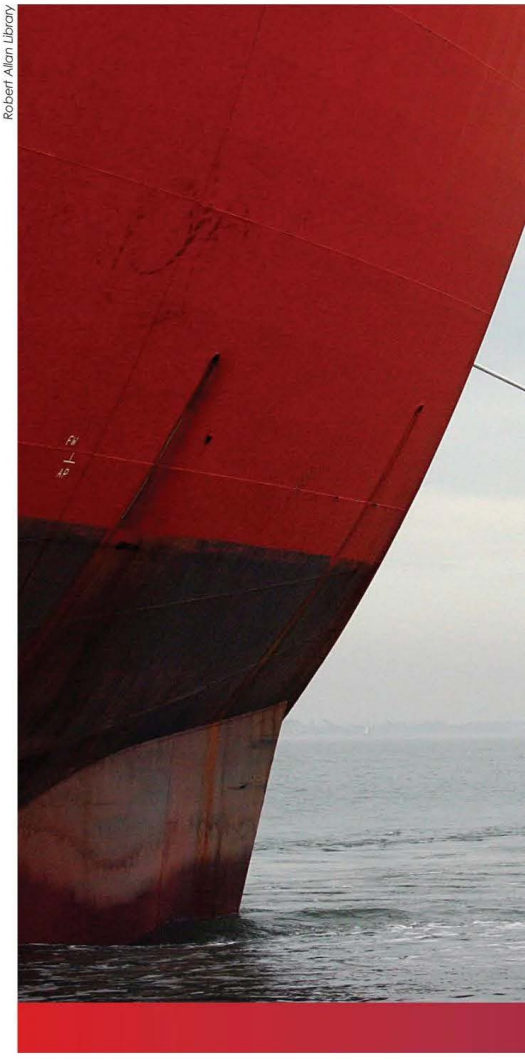
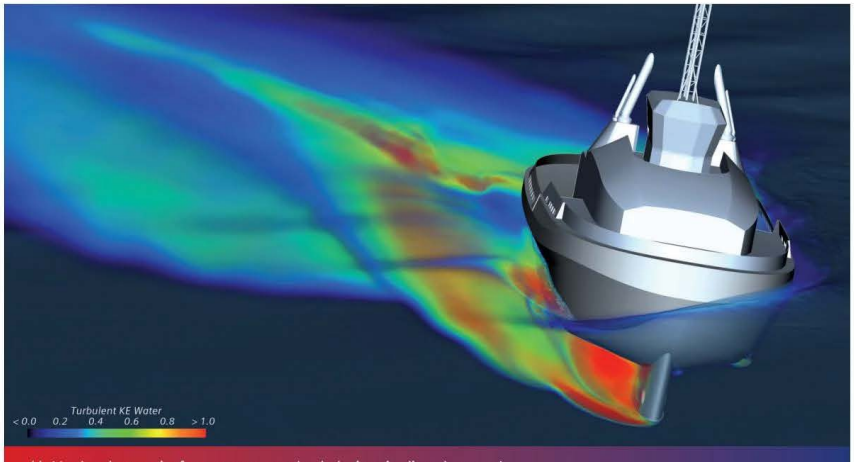


The rated escort speed, maximum allowable heel angle and TSLR are defined in the Escort Placard, included in the official tug stability book. The placard is meant to be posted in the wheelhouse to ensure the master is aware of the tug stability and towing equipment strength limits while escorting. The size and position of the skeg, coupled with the hydrodynamic characteristics of the hull, have a significant effect on the amount of steering and braking force that the tug can generate. It must also have sufficient propulsive thrust to enable proper positioning at all required speeds. With regard to safety, there are several aspects to consider: primarily stability and towing equipment.

The tug must have enough reserve stability in this dynamic situation to properly counteract the extremely high heeling moment that is generated in extreme escort situations. Additionally, all the towing equipment – winch, line and staple, etc – must be engineered for the intended service. For winches, this may include an active payout and retrieval system to prevent slack lines and shock loads that may occur as the tug manoeuvres or moves in heavy seas.



// Hydrodynamic forces generated during indirect escort

// Tenax, Southampton Pilots

With all towage operations, the exchange between pilot and tug master is a fundamental process to ensure the safe execution of the act. Control of speed throughout the passage is critical to ensuring the safety of the operation. Escort tugs running at their upper escort speed of 10 knots only have limited power reserves to keep pace with the assisted vessel and to manoeuvre into an assist position. It is vital (but sometimes forgotten) to consider the high lateral speeds generated aft as a large vessel rounds a turn. To maintain optimal position, balancing the yaw angle due to the ahead and athwartship speed components can be a challenge for even the most experienced tug master.

Because of the high forces involved, selecting appropriately rated deck fittings is important and the additional loading forces that can be caused by the angle of the towline towards the lead need to be considered. For example, a tug towing on a towline with an angle up to 45° to the vessel, can generate 140% of its bollard pull force on the deck fitting. Pilots should be aware of and communicate any limitations or restrictions these fittings may pose to the escort operation.

The final, and among the most critical aspects of escort tug design and operation, is training. The most successful escort operations around the world involve frequent simulator and live training, with both tug masters and pilots working together. The best escort tug in the world is only as good as the training of the Master and pilot.

CREDENTIALS

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- *Prior to career in pilotage, 10 years' experience in towage industry.*
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