

AN OVERVIEW OF TUGMASTER TRAINING SYSTEMS

REASONS FOR TRAINING

Training is part of the learning process of a tug captain or pilot. It is a continuous process which does not stop the moment a pilot or tug captain is appointed. Learning continues during one's whole career.

Training can include practical on the job training, and/or a more theoretical phase. In several ports, tug captain training is still only carried out on the job and the same is true for most ports with respect to training pilots about tugs and tug use.

Training on the job, gathering experience in practice, is essential to become a skilled pilot or tug captain. However, unless there are competent instructors with a structured training program for on the job training, it may become a system of 'trial and error'. In that case there are risks involved because of the 'errors'. It may also become time consuming and can therefore be expensive. Furthermore, tug captains or pilots only pass on to a trainee the experiences they have built up themselves. This will include their shortcomings and accumulated bad habits and may not, therefore, result in the most efficient and safest tug use.



Training 'on the job' of a captain of an ASD tug by a qualified instructor

Providing pilots and tug captains with both theoretical and practical background knowledge of the capabilities and limitations of tugs, and of what can be expected in practice when

tugs render assistance, gives a better understanding of tugs and their performance and results in more efficient and safe ways of building up practical experience during training on the job. This also applies to simulator training, which should not be seen as a substitute for training on the job, but as a way of substantially improving the overall training package.

The importance of a proper training has grown since the appearance of tugs with different propulsion systems, such as Voith Schneider or azimuth propulsion. Several accidents have happened due to the fact that tug masters lacked sufficient experience with the tug under their command. Tugs are a costly investment and should therefore be used in the most efficient way. In addition, port developments do not always keep pace with increased ship size or draft and a minimum number of tugs is often used due to economic pressure. This results in diminishing safety and operational margins and a more essential role for the remaining tugs. This role can also grow due to the increased power of tugs, resulting in the use of fewer tugs per ship.

Tug captains and pilots should therefore possess the ability to use or handle a tug to its fullest capability, which can only be achieved by proper training. Experience can be gained more quickly and the highest level achieved when a tug captain handles only one tug or tug type. When, as is the case in some ports, tug captains shift between different tug types, the need for proper basic training also increases.

In addition to a basic training, focused on the local situation, there can be several reasons for training, such as:

1. A new type of tug to be introduced in the port.
2. Specific situations, conditions or bottle-necks in the port requiring special attention.
3. Port developments, for instance a new harbour basin or berth.
4. Specific, large or deep draught ships expected to call at the port.

It will be clear that training is not limited to new tug captains or pilots. In particular the four training purposes mentioned above are for experienced tug captains and pilots as well.

Depending on port requirements, tug captains and crew are often trained in fire fighting and pollution control. Knowledge of these subjects would be welcome even when not required by a port, since tugs have to handle all kind of ships, some with dangerous cargoes. Emergency tug assistance may be required and the more knowledge about the risks involved the better. However, this article only deals with training in the use of tugs and ship handling with tugs.

DIFFERENT TRAINING OBJECTIVES

As mentioned above, there can be different reasons for training in tugs and tug use apart from the normal training on the job. These different training objectives will all be considered, though it depends entirely on the local situation of a port which of the following training courses is required. In all ports, of course, basic training will always be very useful.

1. Basic theoretical-practical training

Theoretical-practical training cannot be carried out without the knowledge of experienced pilot-instructors and tug captain-instructors. They should have the ability to pass on their knowledge and experience in a clear and understandable way. The reason why the term theoretical-practical training is used is because training should not be purely theoretical but should have a

strong relationship to daily practice.

Basic theoretical-practical training gives tug captains and pilots insight into the most relevant aspects of ship handling with tugs. It takes into account the capabilities and limitations of tug types used, type of ships calling at the port, specific characteristics of the port and environmental conditions, with the objective of achieving efficient and safe tug use. Basic training is intended for both trainee pilots and tug captains, but can also be useful for experienced pilots and tug captains, when they have not had an earlier opportunity to attend such training.

In a large number of ports theoretical-practical training courses in tug assistance are given. Training arrangements and target groups, including the tools used, differ between ports. Without going into detail, the most important aspects of basic training are considered next. For basic training on ship handling with tugs the following main subjects are important:

For a pilot training:

- Ship handling.
- Knowledge of the capabilities and limitations of tugs while they render assistance.

For a tug captain training:

- Handling a free sailing tug.
- Knowledge of capabilities and limitations of ships and of tugs while rendering assistance.

It is assumed that pilots have already gained experience in and knowledge of ship handling and tug captains of at least handling a free sailing tug (see page 7 for on-the-job training). Other aspects have specifically to do with ship handling with tugs and will be discussed below in more detail.

What knowledge of tugs and tug use is required for a pilot?

The following knowledge is required to gain insight into the performance of tugs:

- Knowledge of what tug types are available in the port.
- Understanding various tug types and their propulsion and steering system functions.
- The bollard pull of tugs, ahead as well as astern.
- Knowledge of how the different tug types operate when rendering assistance, including the use of towlines and towing equipment.
- Knowledge of the capabilities and limitations of tug types when rendering assistance and how the tugs can be used in the most advantageous way. This applies to situations when the ship is stopped in the water as well as when the ship is making headway or going astern.
- Understanding of the interaction effects between tug and ship and insight into how interaction may affect tug performance and safety and how these influences can be minimised.
- Apart from interaction effects, knowledge of the relationship between:
 - a) Ship's engine and rudder manoeuvres and speed.
 - b) Tug performance and safety.

It is not only necessary to have knowledge of the different tug types in use in a port in general, but also of each tug in particular. That is necessary because within a certain type the

design of various units may show marked differences not only in appearance but also in performance and capabilities.

In addition to the training subjects mentioned above, a pilot should be trained to be able to:

- Establish the required bollard pull for ships, taking into account factors such as ship particulars, underkeel clearance, environmental conditions, particulars of the passage to the berth and of the berth and berth location.
- Determine the most effective positions of the available tugs and tug types, taking account of when, where and how tug assistance is required during passage towards the berth, at the berth or when departing.

Furthermore, a pilot should have knowledge of:

- Port regulations with respect to tug use.

The knowledge gained above contributes to effective and safe tug use.

What is useful for a tug captain to know about ships?

For optimal ship handling a pilot should have a good insight into what a tug can do, including its limitations. For the same reasons it is useful to provide tug captains with knowledge about the manoeuvring capabilities of ships they assist. The following are recommended:

- Basic knowledge of manoeuvring characteristics of ships, especially for medium and low speed manoeuvring, including the influence of wind, current, shallow water and banks on a ship's behaviour.
- Basic knowledge of the working of the different ship propulsion and rudder types and their effect on tug assistance.
- Performance of bow and stern thrusters.
- Relationship between a tug's position and ship's response to the forces exerted by a tug.
- Basic understanding of the interaction effects between tug and ship and insight into how interaction can affect tug performance and safety and how these influences can be minimised.
- Apart from the interaction effects, knowledge of the relationship between:
 - a) Ship's engine and rudder manoeuvres and speed.
 - b) Tug performance and safety.

This knowledge will give a tug captain a basic general insight into a ship's manoeuvring behaviour and capabilities. Taking into account different ships and the situations and circumstances in a port, the knowledge gained may contribute to improved anticipation of a ship's behaviour and a pilot's intentions.

A tug captain should acquire knowledge of the following:

- The capabilities and limitations of tug types while rendering assistance and in particular of the tug he has under his command, which includes the capabilities, limitations and efficient use of the propulsion and steering control systems of the tug, and how to respond to propulsion and steering control system failures.
- How to make use of the capabilities of his tug in the safest and most advantageous way when passing or releasing towlines, when coming alongside or departing from a ship's

side and when rendering assistance, taking into account all the risks involved related to tug or tug type.

- Proper towing winch and towline handling and the use of appropriate towline lengths.
- The most effective positions for various tug types, taking into account when, where and how tug assistance is required such as for compensating for the influences of wind or current, and with respect to the specific passage towards a berth and berth location.
- Safety regulations and measures, for instance the need to maintain watertight integrity when a tug is rendering assistance.
- Port regulations with respect to tug use.

As with the pilots, the knowledge gained contributes to safe and efficient tug use. Some towing companies have good training manuals, which include several of the aspects mentioned above. It should be noted that theoretical-practical training gives a basic insight, but the required experience can only be acquired on the job.

Additional training aspects

Training for pilots and of tug captains have been dealt with separately up till now, but as they should work as a team, training should include more time together. A very important objective of a training should be the creation of good understanding and cooperation between pilots and tug captains, and also amongst tug captains, because they have to coordinate their manoeuvres in such a way that the most effective tug forces are delivered to the ship. When, for instance, two tugs are assisting a ship and one makes a mistake, the effect of the other tug may also be disrupted. To achieve good cooperation it is essential to include the following elements in all training courses:

- Effective communication between pilot and tug captain.
- Optimum information exchange between pilot and tug captain and between the tug captain and his crew regarding tug placement, destination, intended manoeuvres, propeller use, towline use, etc.

How can a basic theoretical-practical training be given?

The knowledge of experienced pilot-instructors and tug captain-instructors is a requirement for successful basic training, which can be given as follows:

1. By a classical course, making use of overhead sheets, slides and/or videos.
2. By a classical course and the use of simulations. Simulators can be used to give participants insight into various aspects of ship handling with tugs. For some training objectives, desktop simulation programs may be appropriate, or in some cases remote controlled models, whether or not in combination with manned ship models, may suffice. Otherwise full mission bridge simulators or compact simulators (see Simulator page).
3. For junior pilots a part of their training should be undertaken on board of tugs, while trainee tug captains should accompany pilots on board ships for different jobs involving tug use.

Several of the training subjects for pilots and tug masters are similar. Combined training is therefore very effective, in particular when a part of the training is given on a full mission simulator. However, the contents of basic training may differ between ports because of the differences in level and background of pilots and tug masters. The background of pilots may also be such that they have already gained considerable experience in tug assistance, especially in ports where pilots are recruited from the ranks of local tug captains. Whether completely or partly

combined training should be given for pilots and tug captains, therefore, should be considered locally.

In addition to basic training, regularly meetings between pilots and tug captains (common practice in a large number of ports) are very useful to discuss the problems encountered daily and suggest ways of solving them.

2. Training for specific situations and conditions

This kind of training is sometimes required for problematic areas in the port or port approaches or for difficult environmental conditions such as strong currents or fog. Restrictions in force for certain port areas, harbour basins or berths with respect to tidal currents or wind are sometimes considered too stringent, especially from an economical point of view, so relaxed regulations are issued. For pilots and tug masters the situation then becomes more difficult due to the greater influence of wind and/or current, but proper training will familiarise them with the new and more severe conditions and the smaller safety margins. In most cases such a training follows a feasibility study, often carried out on a ship manoeuvring simulator in close cooperation with pilots.

Training is aimed at a specific situation, and so attention is focused on a specific location in the port, the particulars of that location, the environmental conditions, certain classes and types of ships and the tug assistance required. Training is then given in the right ship and tug manoeuvring procedures involving the required bollard pull and tug placement with the objective of being able to handle ships safely in the given situation. Bollard pull and tug placement may be varied during the course, in an effort to establish the optimal method of tug assistance.

3. Training for a new planned port, harbour basin or berth

In most cases the training for this kind of situations is based on the findings of a feasibility study of the particular port or port area. It includes the range of environmental conditions, the planned water depths, the type and size of ships and tug assistance. For a planned new port the type of tugs may still be unknown. This type of training does not differ much from the one above, but is aimed at a totally new situation.

Such training provides the possibility at an early stage to familiarise pilots and tug captains with the new situation. Again, the right ship and tug manoeuvring procedures, the required tug bollard pull and optimum tug placement are subjects to included in the training.

4. Training for specific ships coming to the port

Training for specific ships normally concerns ships of such size, windage or draft, that they are marginal regarding port dimensions, water depths and/or environmental conditions. Training may follow a previous study which determined the maximum environmental conditions and required bollard pull. The aim of the training is to familiarise pilots and tug masters with handling the specific ships in the port, and arriving and/or departing procedures under maximum allowable conditions. Thus ship and tug manoeuvres are practised with the required bollard pull and the correct tug placement.

5. Training for a new type of tug to be used in the port

A new type of tug has consequences for tug captains as well as for pilots. Tug captains should be trained to handle the new type of tug, in particular when the tug's propulsion and control system differs from the ones they were familiar with. Voith, the manufacturer of the cycloidal propulsion system, sometimes employs an instructor, but this is not always the case with azimuth propulsion suppliers, although at least one tug yard does provide an instructor. It takes time before a tug captain gets used to the new propulsion system and its controls. After

sufficient experience is gained when free sailing, the tug captain can start assisting ships. It also takes time to become fully familiar with tug capabilities and limitations when rendering assistance. According to a spokesman of a port that bought azimuth tractor tugs, it took approximately one month under the supervision of a capable instructor to convert an experienced tug master on conventional tugs to be fully competent in omni-directional propulsion.

A new type of tug performs differently. When the previous tug has, for instance, been a conventional tug and the new one is a tractor tug, the capabilities of the new tug are much greater larger and limitations fewer. This influences tug assistance dramatically. The method of tug assistance changes, in particular when the tug is used to its full advantage. As a consequence, a new type of tug will influence the way ships are manoeuvred in the port, thus affecting pilots as well.

Training for a new tug type should therefore not only be training in tug handling. At a certain stage, pilots should be involved together with the tug captains. Training should then comprise the total procedure of ship handling based on the new type of tug and its capabilities and limitations, taking into account the port characteristics, ships calling at the port and environmental conditions. This may include training for escort purposes.

Training may also follow a simulator study, to determine the effect of a new tug type on the accessibility of the port. This type of training also applies to escort tug operations.

6. Specific tug training for escorting and anchor handling support tugs

In addition to training already described, escorting of tankers and/or LNG carriers might be a requirement for a port. Escorting requires a specific training in tug handling and the relevant rules, regulations and procedures. For escorting purpose-built tugs are often used. In general, care must be taken that tugs providing escort services are suitable tugs, because the forces generated during escorting may be extreme, so the tug must have sufficient stability, freeboard and a very strong towing equipment.

Captains of escort tugs have to work in close cooperation with pilots. Therefore, apart from the training in tug handling for escort services, training is needed in cooperation with the pilots.

The number and size of anchor handling support tugs is growing rapidly. Training of tug masters and mates has become a necessity, as has been proven by some accidents during anchor handling activities.

How the specific training courses can be delivered

On the job training for new tug types and escorting

With respect to the training of tug masters, in spite of all the modern training systems, training on the job is still the best training system for tug handling, provided there are capable instructors available. For a large part of the basic theoretical-practical training, as mentioned earlier, a simulator can be used. Simulators can train tug captains in tug handling capabilities, but only to a certain degree. They cannot replace on the job training. On the job training takes much longer, but is more effective with respect to learning the daily practice of tug, ship and tow line handling and the risks involved.

A well-known instructor is Captain Arie Nijgh who trains tug captains on tugs with omni-directional propulsion units, in particular ASD (azimuth stern drive) and ATD (azimuth tractor drive) tugs, with a strict and structured program in a rather short time. His training program is efficient and effective.



ITA President Arie Nijgh training P&O Maritime Services tugmasters on ASD tugs in Port Jebel Ali, Dubai

Combined training

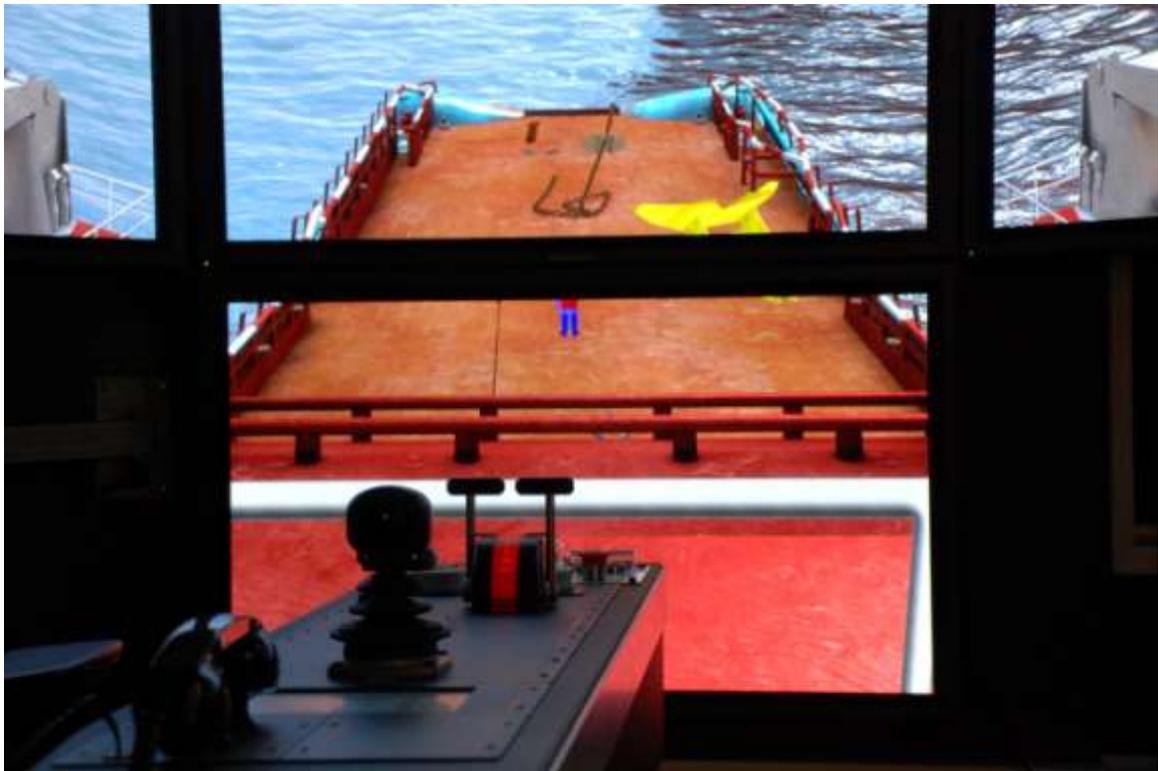
Apart from the training for new tugs and for anchor handling support tugs, training conditions and situations mentioned above always concern optimal ship handling with tugs, often under severe conditions and/or with small safety margins. In practice pilots and tug captains have to work as a team and both have to become familiar with the specific situations, conditions and ships involved. It is best, therefore, that both pilots and tug captains, who have to work in the area concerned or have to handle the specific ships, participate in such training courses together. They will learn from each other through discussions during the course, which contributes to the training objectives.

The same applies to training in the specific ship handling capabilities of a new tug type. A new tug type concerns both pilots and tug captains. Such training may include pilots becoming familiar with the new tug itself, which can be achieved by spending time on board. An important part of the training for escorting can also best be carried out by the combined training of tug masters and pilots. Whether combined training of pilots and tug captains can be arranged depends on the local situation.

The best tool for a combined training is a ship bridge simulator for the ship to be handled by a pilot in combination with one or more tug simulators handled by tug masters.



*Courtesy: Captain Gregory Brooks, USA
Reverse-tractor tug 'Lynn Marie' applying steering forces by using the 'Powered Indirect Escort Manoeuvre'.
Combined training of pilots and tug masters for escort purposes can be carried out on ship bridge simulators*



*Photo Courtesy of Kongsberg
Anchor Handling Simulator of Kongsberg*

The use of ship manoeuvring simulators

Training for ship handling with a new tug can, to some extent, be carried out classically, making use of overhead sheets, slides and videos, showing the performance of the new tug. A compact simulator, which is a smaller version of a full mission ship bridge simulator, is a better training tool, if customised for the specific tug.

In most cases a full mission ship bridge simulator is most suitable, providing the tug simulator is appropriate for the new type of tug and the method of tug assistance, including training for escorting if appropriate.

Although rather expensive, a ship manoeuvring simulator in combination with one or more tug simulators is a very effective training tool for the combined training of pilots and tug captains and therefore most suitable also for the other training objectives, including escort training, and is used for those training purposes in a growing number of ports.

For training of mates and masters of anchor handling support tugs, specific simulator have become available.

For information about simulators, the reader is kindly referred to the Simulator page.

For further information, please see:

“Tug Use in Port. A Practical Guide” 2nd ed. Capt. Henk Hensen FNI. The Nautical Institute, London, UK. 2003.

“Ship Bridge Simulators. A Practical Handbook” Capt. Henk Hensen FNI. The Nautical Institute, London, UK. 1999.

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