

First class service with escorts

Escort tugs can reduce the risk of tanker accidents in port approaches by 80%. However, such a service is costly and only suitable in particular cases. If the complex operation of escorting tankers is mishandled, more harm than good will come of it

All tugs are workboats but some of the most difficult and demanding tasks fall on those tugs engaged in tanker escort duties.

Escort tugs were introduced to minimise the risks associated with tankers losing power or steering while transiting confined waters. In most cases their use has been mandated either by government or by individual terminals, often in response to a major tanker accident and as an integral part of a larger tanker safety enhancement and pollution prevention programme.

Special breed

Tanker escort tugs are still comparatively rare, not least due to the high costs of such vessels and of providing the service. Their economic viability is enhanced by building the tugs as multipurpose vessels, with the ability to fight fires, respond to oil spills, engage in salvage work and carry out conventional harbour ship handling duties. Most of the pioneering work in developing tanker escort services was carried out in Norway and on the US West Coast, and today these two areas still play host to the greatest concentrations of escort tugs.

However, the tanker escort service net has continued to expand and the UK, Sweden, Finland, Turkey and Canada are amongst other countries where tanker escorts are carried out on a regular basis.

There are still relatively few tugs purpose-built for high-speed tanker escort duties and in possession of escort tug notations from the classification societies. However, a number of modern, powerful, general-purpose harbour tugs with appropriate propulsion systems are capable of providing a ship escort service.

Tanker escort operations fall into two categories. The first involves inner harbour areas where distances are not great and there are often restrictions that prohibit vessel speeds from exceeding 6 knots. The second category covers those operations where the escort tug accompanies the tanker for considerable distances along extended fairways. In the latter case the tanker often proceeds at speeds of 10 knots and above and requires the attendance of a specially designed escort tug of considerable power.

Tug design

Blackouts are still the most common reason why tankers lose power and/or steering, so it is important that the escort tug is able to take immediate remedial action once an emergency occurs. As a first step it is now commonplace for the tug to be tethered to the tanker throughout the escorted passage. Tugs are tethered at the stern of the tanker.

Escort tugs are designed in accordance with the tractor tug concept, with the propellers at one end and the skeg and the towing equipment at the other. The most common type of escort tug propulsion system is the cycloidal, or Voith Schneider, propeller (VSP).

Vessels are provided with two such propulsion units, and the controllable pitch characteristic of the VSP enables full engine power to be utilised as a steering or braking force with immediate effect. Z-drive and azimuthing stern drive (ASD) propellers are also used on escort tugs and also provide high levels of performance flexibility. The redundancy of twin propulsion systems, including main engines, guarantees a vital extra degree of safety.

Direct and indirect

At relatively slow speeds, the direct method of escorting is used. In addition to the tanker's own rudder forces, the thrust of the propellers of the escort tug is utilised for steering and braking the tow. At higher speeds this method can no longer be used, as the side force necessary to keep the tug in position consumes a higher percentage of delivered power and reduces the towrope force. At a certain speed the towrope force drops to zero.

For higher speeds the indirect method of escorting is utilised. The hydrodynamic lift from the tug's hull and skeg generates a large force for transmitting through the rope into the tow. The tug's propellers are effectively the steering gear, forcing the "rudder", i.e. the tug's hull and skeg, into the angle of attack needed to generate the highest lift forces.

Purpose-built escort tugs have completely different bodylines and outfit to those of other tug types. The challenge for the designers of modern escort tugs is to achieve the correct mix of main dimensions, hull lines, skeg design and propulsion system to provide the necessary lift coefficients and proper balance of forces while minimising the power requirements, ensuring adequate tug stability and accommodating the large tow rope forces generated under dynamic ship handling conditions and in different sea states.

Early US days

The earliest tanker escort rules are those implemented in various US West Coast ports. This regime has been tightened over the years, and today escorting is required in Los Angeles/Long Beach, San Francisco, Puget Sound and Valdez, Alaska.

Foss Maritime began providing tug escorts for tankers in Puget Sound in 1975 when the state of Washington implemented a law requiring tug escorts for loaded tankers over 40,000 dwt. The law specified that the horsepower of the escort tug must equal at least 5 per cent of the deadweight of the loaded tanker. Tankers entering Puget Sound are limited to 125,000 dwt loaded.

The US Oil Pollution Act of 1990 introduced additional, federal requirements for Puget Sound. Single-hull tankers carrying over 5,000 tons of oil as cargo are required to have a two-tug escort when proceeding in the Sound. Under OPA 90, double-hull tankers are exempt but such ships must still meet state of Washington requirements.

Foss tug fleet

"In 1982 Foss designed and had built six so-called Voith Water Tractors (VWT) fitted with Voith Schneider Propellers (VSP), the first such tugs in North America," explains Tim Brewer, vice president of ship assist services at Foss.

"In 1992 we introduced two, more powerful, purpose-built tugs, Lindsey Foss and Garth Foss, into this service to meet the OPA 90 requirements. Possessing a high power rating - 8,000 hp - the tugs can provide single tug escorts for any tanker entering Puget Sound. For most of the 1990s they were the largest Voith tractor tugs in the world."

In addition to its Puget Sound service, Foss Maritime also operates escort and harbour assistance tugs in Los Angeles/ Long Beach and San Francisco. "We use a mix of VWTs and Z-drive tugs for US West Coast tanker escort activities," points out Tim Brewer. "Our experience has shown that in general VWTs are preferred for emergency response when tanker escorts are underway at speeds above 6 knots, while the Z-drive tractor tug propulsion system is most effective for responding to emergencies when tanker escorts are underway at speeds below 8 knots."

Z-drives

Foss Maritime recently developed a design for a powerful, 6,250 hp Z-drive tractor tug for tanker escort and assist duties, and two tugs built to this design were

delivered in 2001. Marshall Foss operates in Los Angeles/Long Beach harbours while Lynn Marie is in service in the San Francisco Bay area, operating for the Foss sister company AmNav Maritime Services.

"These two tugs are the most powerful harbour tugs operating in the California ports. The Z-drive design is excellent for slow-speed escorts under 8 knots and for docking and undocking manoeuvres," comments Tim Brewer. "Their brute power provides an excellent service capability for tankers and the ever-increasing size of container ships calling at California ports."

Crowley customising

Crowley Marine Services is another tug operator that has provided tanker escort services on the US West Coast, including Alaska, for many years. In 2002, for example, Crowley performed over 500 tanker escorts on behalf of the Alyeska Pipeline Company in Alaska's Prince William Sound.

"In the course of those operations, no oil spills larger than 5 gallons were reported, no tankers were delayed and the Occupational Safety and Health Administration (OSHA) recordable incident rate was zero," says Todd Busch, director of ship assist and escort services with Crowley.

In August 2002 Crowley deployed Response, its latest escort vessel, to assist tankers loading and discharging in the Puget Sound refineries. Built by Marco Shipyard in Seattle, the 40-metre long tug has a bollard pull of 70 tonnes and is designed to escort tankers at speeds over 12 knots.

"Vessel Management Systems Inc, our in-house vessel engineering and construction arm, worked with all the parties involved in Puget Sound tanker escort operations to design this state-of-the-art tug specifically to meet the conditions and requirements of the area," explains Todd Busch.

Norwegian roots

Norway's involvement with escort tugs is also deep-rooted. In contrast to the US, where state and federal regulations mandate the use of tanker escorts on certain waterways and in certain ports along the West Coast, in Norway it is the terminal operator that specifies escort operations. Today, most oil and gas terminals in Norway require tanker escorts.

Buksér og Bjerfving AS took delivery of its first tractor tug designed for the indirect mode of tanker escorting in 1981. The Oslo-based tug operator was the first to have tugs achieve compliance with Det Norske Veritas (DNV) escort class notation, including the steering pull certificate. That honour fell to the "fin-first" of "skeg-first" tractor tugs Bess and Boss built in Norway in 1994. The vessels are rated at 55 tonnes bollard pull (TBP).

"Today, we operate five escort classed tugs - three at the Mongstad terminal for Statoil, one at the Norsk Hydro gas terminal in the Grenland area and one on the spot market," reports John Nielsen, a director at Buksér. "To date our 70 TBP tug Boxer, , has the highest certified tonnes steering pull (TSP) rating in the DNV register, with 148 tonnes at 10 knots. The Boxer design was licensed to Crowley for use in the construction of their tug Response."

Building on experience

All Buksér escort tugs are designed in-house by the company's naval architects, and the latest project is a newbuilding, now under construction, which will be the world's strongest and fastest escort tug. The vessel will have a continuous bollard pull of 95 tonnes, a certified steering pull of 160 tonnes at 10 knots and a free running speed of 16 knots. The tug is earmarked for duties at Mongstad, beginning at the end of the year.

"Successful tug escort operations need purpose-built, properly tested vessels and well-trained crews," points out John Nielsen. "A good tug escort service has been shown to reduce the risk of tanker accidents in port approaches by 80 per cent. "However, if the operation is not carried out correctly, tanker escorting may be dangerous to both the tug crew and the assisted vessel. The customer needs to know how to specify and verify the tug escort service. Accordingly, for the future an independent third party verification of escort tug performance is of paramount importance. DNV has led the way in this field, but today most classification societies can offer this service."

Training ways

Escort tug design and equipment is one thing. However, to ensure an effective escort and safeguard the lives of those involved, it is necessary for all responsible parties to be appropriately trained and, through proper communications, fully aware of the actions being taken along the chain of command at all times.

In an emergency an escort tug operating in the indirect mode will be subject to high loads very quickly as it seeks to bring the tanker under control. It is therefore critical that everyone, from the tug master to the pilot and the tanker officer of the watch, knows precisely what to do when the moment of truth arrives.

Training is essential to ensure that personnel on the tug and the tanker take appropriate measures at the right time. "Our training programme takes in not only real-time training on our two escort tugs," states Capt Jarkko Toivola of Fortum Oil & Gas Shipping, "but also simulator training. We have found that simulators, where dealing with worst-case scenarios can be practised at will, help ensure the shortest possible reaction times; the use of appropriate corrective measures; proper communications; and effective cooperation between tanker and tug personnel under tight time constraints and very stressful conditions.

"In addition to the use of the "playback" and "what if" options, simulator training also enables us to further develop operational procedures, guidelines and rules based on lessons learned from the high number of optional escort scenarios we consider.," adds Capt Toivola.

"With simulators we can practice with situations that it would be unsafe to consider in a real-life situation during a tethered escort up a narrow waterway to one of our refineries. Simulators are also extremely useful when considering the viability of a possible new tanker escort operation."

Future for escorts

Tanker escorts are often not the optimum solution for improving the safety of tanker operations in nearshore waters. Experience has also shown that in relatively few cases is the use of escort tugs justified from a cost-benefit point of view.

However, the escort tug concept continues to spread and the body of industry knowledge about the design and operation of vessels able to provide an effective escort service is growing. In parallel, tug service companies providing tanker escorts are building an impressive safety record.

Maritime traffic continues to grow and, at the same time, public tolerance of oil spills and ship accidents, especially in harbour and coastal waters, is decreasing.

Improvements in tanker safety mean that over 50 per cent of major ship oil spills now involve bunker fuel and that tanker cargo spills are in the minority.

Against this background, it is entirely possible that governments will not only continue to demand oil and gas tanker escorts in more of their ports but also, for the first time, escort tugs to accompany ships other than tankers.

Share the knowledge

"The "science" of escort towing is still in its infancy, and it is important that the industry shares the knowledge accumulated to date to ensure that escort towage

develops as safely as possible and the option is given due consideration in those applications where it has a potential role to play," believes Robert Allan, president of naval architects Robert Allan Ltd in Vancouver.

"Often, ports pay lip service to the idea of tanker escorts but, in reality, they are unaware of the large forces required to control a large, disabled vessel; how best to bring these forces to bear; and the importance of providing large reserves of buoyancy, stability and power to enable the tug to handle the forces.

"Similarly, it is critical that tug operators and crews have a good understanding of the forces involved and the safe operating limits of their particular vessel. It is also incumbent upon researchers and designers such as ourselves to inform the international towing and tanker-owning communities of the extensive work done in this field.

"The industry has made good progress to date. We need to work together to build upon what we have achieved," concludes Robert Allan.