TUG DEVELOPMENT

PAST, PRESENT & FUTURE

By Jack Gaston
1830 - First Paddle tug in service

1900 - Screw tugs take precedence over paddle

1900 – 1950 – Tug design concept refined but little fundamental change

1955 - Voith introduce the first water tractor.
- Steam and diesel tugs built in UK
- Kort nozzle gaining popularity

1958 - 7 diesel-electric paddlers for RMAS

1980 – Voith twin unit tractors well established
Azimuth tractor compete with Voith
First ASD tugs introduced in UK
Use of Kort nozzles universal

1996 - Purpose built ASD escort tugs introduced

1999 - First ‘Rotor tug’ in service
First ‘Ship Docking Module’ in service
Voith escort tugs in service

2005 - Voith escort tugs refined
High performance ‘Compact’ ASD tugs gain popularity
Z-TECH tugs in service
The Towage Industry in Great Britain is traceable back to about 1830.

Early tug development slow and underwent a period of consolidation, during which time the screw propeller and iron hulls became widely accepted in shiphandling and seagoing vessels.
From 1900 – Screw tug designs were firmly established and constructed using well tried ‘ship design’ principles.

Many vessels had a working life well in excess of 50 years, including a small number of paddle tugs.
1950 -
• Hull design in shiphandling tugs had changed little in spite of World War II high demand for tugs.
• The introduction of diesel engines, and ‘Kort’ nozzles, available since 1932, had not yet become well established.
• Many single screw steam tugs of approx 1000 ihp were built throughout the 1950s.
Many motor Tugs built in late 1950s early 1960s were designed to replicate deep draft single-screw steam tugs with precise control of propeller revolutions via direct-reversing main engine or higher speed engine and reduction-reverse gearbox.
By the mid 1960s single screw diesel tugs of 2000bhp were typically equipped with steerable Kort nozzles giving a bollard pull of 30 tonnes.

The last single screw tug built for a British owner was the Ganges in 1982, a tug of 2640bhp and 42 tonnes bollard pull. Ganges and the Voith tractor Sun Thames were christened on the same day.
1955 – Stier, the first Voith Schneider tractor tug entered service in Germany starting a quest for alternative propulsion systems for shiphandling tugs that continues to this day. The cycloidal propeller, invented by in 1928 by Ernst Schneider and J M Voith offered the towage industry its first omni-directional propulsion system.
The first single and twin-unit Voith tractors were in service in the UK ports in the mid 1960s.

By 1980 twin-unit Voith tractors were well established in several and many of those tugs are still in use. Lady Elizabeth - 30m in length and 30 tonnes bollard pull.
Tractor tugs with ‘Schottel’ fully steerable azimuthing propulsion units first appeared in Germany in the 1970s. Using the same tractor configuration as Voith, with a skeg aft, this type of vessel provided Voith with stiff competition. Stackgarth 1985, 44 tonnes bollard pull.
The first azimuthing stern drive (ASD) tug introduced to Britain and Europe in 1981 by J P Knight was the Japanese built Kinross. A 34m tug of 3200 bhp, with Niigata engines and Z-Peller azimuthing propulsion units, she had a bollard pull of 48 tonnes. UK and European owners soon adopted the ASD concept in locally built examples.
In 1993 Damen Shipyards entered the ASD tug market with the ASD 3110. A tug of 30.7m and 3980 bhp it had a maximum bollard pull of 50 tonnes. Over 100 tugs of this type were built.

Portgarth is a typical example delivered for use in Bristol in 1995.

In 1996 the first three slightly larger Damen ASD 3211 were introduced. The 32.7m tugs have main engines of 4827 bhp and a max bollard pull of 60 tonnes.

Many variants, fitted for fire fighting, are in use as terminal tugs.
In the mid 1990s escort towing and tanker handling with ASD tugs became a reality in Britain with the ‘Sven Aart’ designed. Cramond, Dalmeny and Hopetoun.

The 43.5m Hopetoun, delivered in 1997 was a vessel of 9700 bhp with a bollard pull of 124 tonnes.

Cramond and Dalmeny, built in 1994, were 34m tugs with 4800 bhp and 62 tonnes bollard pull.
1999 – saw the introduction of two entirely new design concepts, the ‘Rotor Tug’ and the ‘Ship Docking Module’ (SDM). Both are capable of generating their full bollard pull in any direction (360 degrees) around the tug. Neither has yet to be employed in the UK.

The ‘Rotor Tug’, has 3 propulsion units in tractor configuration (2 forward and 1 aft), a concept invented by Ton Kooren – President of KOTUG.

The SDM was the brainchild of Erik Hvide Chairman of US Hvide Marine. Two propulsion units are employed, each positioned slightly off the centreline to port and starboard.
The ‘Rotor Tug’ is in service in the Netherlands, Germany, Australia and Spain. Some 31 ‘Rotor Tugs’ in service, or under construction representing 4 designs, including one escort variant.

RT Pioneer one of four sisterships introduced in 1999. All four tugs have three main engines generating a total of 6300 bhp for a bollard pull of 76 tonnes.
Six SDMs of two variants are in service in US ports and two built in Spain for use in Barcelona. The 27.45m long vessel’s are oval in plan-form, shallow draft and powered by two 2000 bhp engines giving them a bollard pull of 55 tonnes in any direction.

SDMs are only suitable for harbour use, normally with a crew of two.
By 1999 – There was an increase in the use of escort tugs worldwide, with Voith Schneider propellers the propulsion system of choice for many operators.

Norwegian tug Boxer carrying out escort trials in the Medway 2006

Boxer entered service in 1999 with Bukser og Bergning, with a bollard pull of 67 tonnes and max steering force 150 tonnes at 10 knots
2005 – Saw important improvements in the performance and stability of Voith escort tugs. The involvement of Robert Allan Ltd led to an innovative hull design and a detailed product refinement project by Voith improved the propeller performance.

The picture shows Phenix one of a series of escort/shiphandling tugs for Solent Towage (Ostensjo) under construction in the Spanish Gondan yard in 2007.

Phenix in the escort role. The 37m tug has main engines of 6530 bhp giving a bollard pull of 68 tonnes. In the escort mode it can generate a steering force of 140 tonnes at 10 knots.
The unique Z-TECH, introduced in 2005 resulted from a joint venture project between, PSA, Robert Allan Ltd and Cheoy Lee shipyards. With true omni-direction performance it incorporates the best handling and operational characteristics of both the Z-drive tractor tug and Azimuthing Stern-Drive (ASD).

Z-TECHs are in use in Singapore, Australia and the USA. 35 built.

Star Opal is 27.4m long with main engines of 5000 bhp and a bollard pull of 60 tonnes.
2005 – saw a rapid growth in ‘Compact’ ASD tug designs of 24–28m from both Robert Allan, Damen and other designers.

Svitzer Harty working bow-to-bow

The Damen ASD 2411 is exceptionally agile, has a bollard pull of up to 70 tonnes and a small crew.

Svitzer Shotley (Adsteam Shotley)
Current ASD terminal tug design

Smit Panther a Damen ASD 3213 ‘Big Cat’ class.  
32m loa 7218 bhp – 95 tonnes BP

Svitzer Kilroom RAL design  
39m loa 8288 bhp  
112 tonnes BP

Both tugs incorporate features derived from the Joint Industry SAFETUG project.
The way ahead – ASD proven design with ‘Hybrid’ propulsion?

Many Proposals but currently only one true hybrid – Foss USA

Compact 24m design 60t BP – smaller diesel main engines + 2 generators + batteries

Seamless operation thro 4 modes of operation via power management system
Smit has chosen the Damen ASD 2810 as their current standard for shiphandling in many ports – 21 vessels in service.

An ASD 2810 has also been used for the Smit-Damen E3 study into a future low emissions variant or ‘Hybrid’.
The Svitzer approach!
The ‘ECO tug’ two prototype diesel-electric ‘Hybrid’ tugs under construction.

Features:-
Well tried ‘M’ class + 3 diesel generators + Exhaust gas treatment + All electric deck machinery
So what happens in the meantime!

Until the technology settles down and new tugs are available most operators are looking at fuel saving measures on the premise that less fuel used = Less pollution!!

Possible options ;-  
- Using shore power when ever possible  
- Study operating patterns  
- Monitor fuel consumption  
- Where possible make adjustments to operating practices and fine tune propulsion systems  
- Train and encourage crews to conserve fuel

Regardless of global warming or any other ecological considerations all of the above reduces operating costs which makes good business sense – Perhaps the industry should have acted earlier!
And what happened to the Carrousel towing system?

It worked well on the prototype!

Mounting a winch was very difficult. Crew safety was an issue.

The two vessels under construction were cancelled due to excessive delays.

This might be worth considering!

The Auto-align winch being tested by Jon-Rie.

Works on the righting arm principle with the winch and staple on the same rotating platform.
JUST HOW GREEN CAN A TUG GET!!

THANKS FOR YOUR PATIENCE!