Commercial Marine Deck Machinery – 30 Years of Change

By Barry Griffin

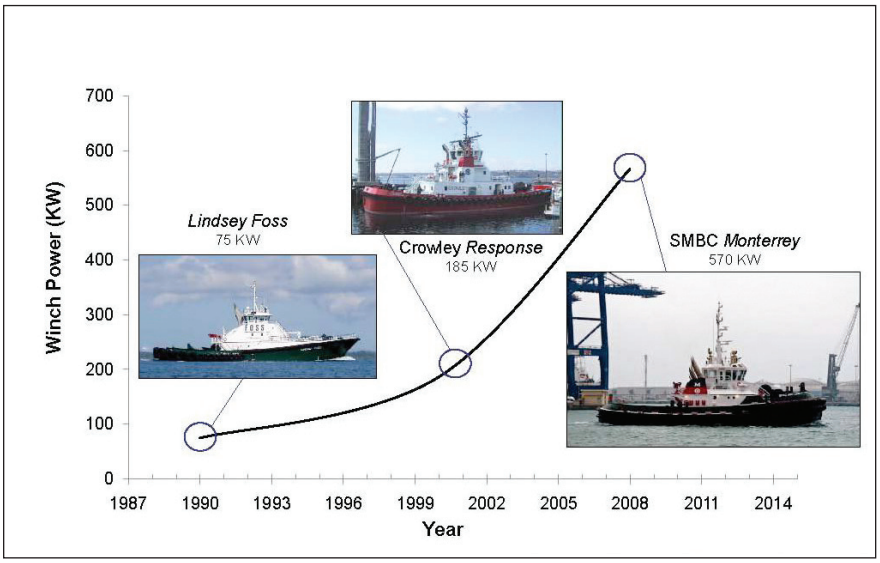
Developments in winches and other deck machinery continue to keep pace with the current trends in shipbuilding and repair worldwide. This is especially true for the so-called High Performance winches and cranes used in a variety of traditional and new ventures. This class of machinery exhibits exceptional operating characteristics often tailored to a vessel or class specific mission. New, more powerful ships and corresponding tugboats require high line speed and winch pull, smooth control of braking and load control, wide operating range, and specialized controls and monitoring features often integrated into other ship systems. The range of applications covers diverse segments of the marine industry including near-shore and open ocean tanker escort and assist tugs, offshore anchoring handling and supply vessels, ATB tugs and barges, scientific research ships, high seas fishing and emergent offshore aquaculture, and other purpose built specialized vessels, small and large. These ships work where the payload is expensive and the cost of failure is high.

The machinery and rope system installed on the recently commissioned Moran and Grupo Boluda tug ***Monterrey***, operated by SMBC at Sempra's Energia Costa Azul LNG terminal near Ensenada, Mexico illustrates many of the following significant changes that have occurred in the past 30 years of evolution of this class of machinery.

Increase in Winch and Machinery Power

Winch power applied to modern escort and assist tugs engaged in open ocean and energetic sea conditions has increased dramatically over the past 20 years. Winch power has multiplied six-fold, and while tug bollard pull has stayed in the 65 to 95 ton range, newer tugs with bollard pulls of 120 tons are planned for ship assist service at future LNG terminals and other offshore oil and gas projects. Winches for these tugs could approach 1,000 HP, even when fitted to future vessels with better seakeeping ability, hull design and active and passive roll damping.

Increases in Winch Power



Winch power has increased dramatically over the past 20 years. Artwork courtesy of Barry Griffin.

Electric Motors Replace Hydraulics

Perhaps the most significant evolution from a marine machinery perspective is the development of electric motor driven machinery. The latest generation of variable frequency electric winch drives (VF) offer performance equal to or greater than many hydraulic systems, and require less maintenance. Hydraulic valves, controls, and motors have continued to improve and still offer very good performance and value in many applications. However, as a good friend of mine says "The main problem with hydraulics is that the minute you turn them on they start wearing themselves out" and therefore maintenance, filters, leaks, and even catastrophic failure can occur, not to mention the far higher costs associated with installing a hydraulic system.

In addition to electric machinery we are now seeing the development of the all-electric workboat. With the exception of cranes, electric driven propulsion and diesel electric and hybrid generation systems appear to be the systems of choice for future offshore and other vessels where positioning, propulsion control, and cargo storage and handling must be optimized.

Much has been written about the legitimate benefits and drawbacks of electric versus hydraulic power for deck machinery, but less has been said about the change to electric that has become the predominant customer preference in many applications.

I have been witness to all the small steps in the progression toward electric machinery in 30 years on the waterfront. The adoption of electric machinery, like most changes in our conservative, price and safety conscious industry, did not occur overnight.

Markey 750 HP multiple motor and double drum electric Ocean Class Asymmetric Render Recover (ARR) hawser winch on ***Monterrey.*** Photo courtesy of Barry Griffin.

Softline Replacing Wire

A second major sea-change is the nearly universal acceptance of HMPE ropes in all marine work, except where potentially severe abrasion can occur, such as ocean towing. Back in 1994, when I first began selling Spectra® and Plasma® tug hawsers and face lines for Puget Sound Ropes I encountered substantial resistance on safety, performance, and price issues. As the next generation of tugs beyond 4,000 hp came on line, the industry began to see the benefit that several of the leading innovators, including Foss Maritime and Bisso Towboat had known. After several additional years of improvements in fiber strength, construction techniques, coatings, and fitting and connection strategies, the tug and commercial marine industry has settled down into a more or less commodity and standard practice mentality. Many hours and hundreds of tug operations were spent observing and documenting what did and didn't work so that improvements could be made in the whole system from Master to port engineer to factory.

We are now beginning to see possible limitations in the ropes' ability to dissipate the heat generated from contact friction and internal stresses caused by running back and forth over sheaves in new dynamic applications on the open ocean. The major rope companies are improving their products' ability to reduce the ill effects of heat, and this will certainly be an area of intense effort for the future in order to handle heavier payloads in higher sea states.

Computers, Controls, and Remote Internet Connections

Most notable to our customers and service personnel is the ability to remotely access operational and diagnostic data over the Internet via cell or Sat phone to vessels and machinery at sea. For example, during a recent conference in Europe I demonstrated on my laptop the ability to show winch, rope and electric drive information on a Markey equipped tug in near-real time while it was engaged in a ship job in the US 5,000 miles away. This ability can increase the response speed and accuracy of service, improve crew training, and provide long term and remote monitoring of rope use and residual strength to the homeport and rope supplier.

Beyond our small world of machinery, we see the ubiquitous use of relatively inexpensive computers, to which many advances in naval architecture, marine engineering, simulation and modeling of vessels motions and operations, computer aided design and manufacturing of equipment and ships can be attributed.

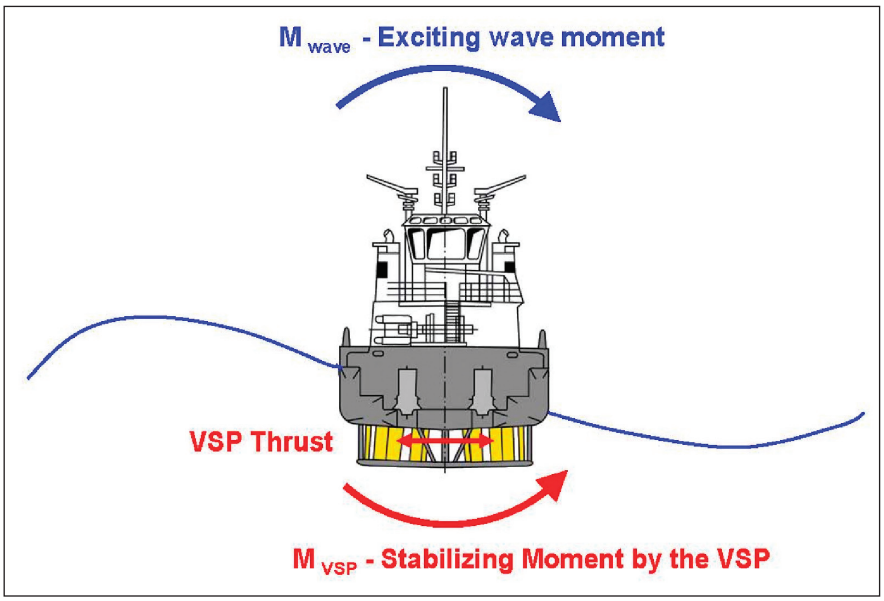
Vessel Stability and Propulsion System Integration

The separate improvements in each area of marine engineering now allow even greater synergies of safety, operational window, and economy when combined though an electronic interface. Dynamic positioning (DP) is one example where GPS and other location data are used to control supply boat propulsion in order to lay safely near offshore oil rigs when handling cargo. This system continues to advance in redundancy and accuracy.

Voith Turbo Marine Systems has provided recent offshore supply vessels with Voith Cycloidal propellers with roll stabilization capable of significantly reducing vessel motion when laying to and also when underway.

Another system was recently introduced by Markey Machinery and Griffin Associates. The Dynamic Vector® (DV) system integrates winch tension and length control with tug and ship propulsion, allowing single lever control of the total tug force applied to ship assist and escort hawsers. Initially intended for long duration open ocean operations, the complete system will allow the tug to perform the high pull portion of the Markey winch render-recover function. This will in turn allow the hawser and tug to apply higher loads in open ocean conditions by lessening hawser motion, friction, and heat buildup. Systems such as this are also believed to reduce operator fatigue during extended maneuvers.

Higher levels of integration are possible when combining the DV force and position vectors from several tugs using the AIS or VHF system into a real-time display of data for use by ship Masters and pilots. In the future the operational data from such systems will be used by simulation facilities to improve and validate their original operational projections.



Voith Rollcontrol System on Edison Chouest Platform Assist Vessel. Artwork courtesy of Barry Griffin.

Water Cooling of the hawser on ***Monterrey.*** Photo courtesy of Barry Griffin.

Global Cooperation and Innovation

Globalization and communication in markets and technology along with the growth of specialized marine societies have allowed unprecedented cooperation and partnerships to evolve among international owners, tug designers, shipyards, equipments suppliers, and vessel operators. Small innovative companies can now more easily collaborate with each other and with large multinationals. Technology has drawn us closer together, and at sea, can continue to provide greater efficiency, safety, and opportunity. PMM

Barry Griffin is the VP of Sales of BA Griffin Associates and manufacturers representative for Markey Machinery Company, Puget Sound Ropes, Voith Turbo Marine, Hochang Machinery Industries Co, Ltd., Westec International., Ltd, OceanSpar Technology LLC and Net Systems, Inc and distributes products for WW Patterson Co. and Thern Incorporated. He appreciates the contribution of Moran Towing and Grupo Boluda, Markey Machinery Company, Puget Sound Ropes, Voith Turbo Systems, Foss Maritime, Gary Nishimura, and Capt. Greg Brooks for help with this article.