The vision of the International Sales Manager on the world market of thrusters

Mr. Bert Ault of Thrustmaster of Texas Inc.

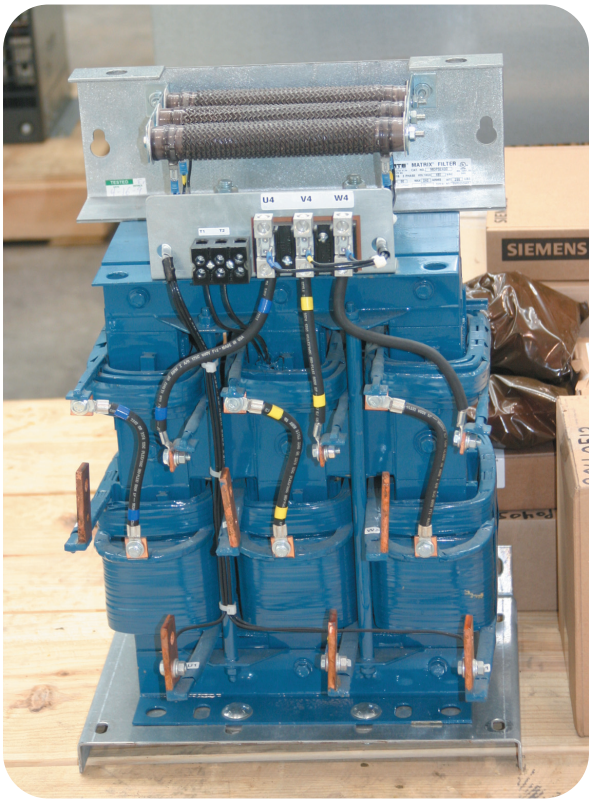
In May of this year, exactly one year after the opening of their new production site Thrustmaster invited Holland Shipbuilding back to Houston for a second visit. This invitation emphasizes the good relationship with the magazine and its editors. The plant is now fully operational and we were treated to a guided tour around the new facilities, followed by an interview with Mr. Bert Ault, International Sales Manager at Thrustmaster. Mr Ault has more than thirty years experience in sales of engineered capital equipment all over the world.

Together with Mr Hans Hoek, who is general manager of the Thrustmaster Office in Schoonhoven, they are also responsible for the Dutch market. Both men are extremely proud of Thrustmasters achievements to date and the future development of the company.
Mr. Ault takes up the story...

Dynamic Positioning

To get a better impression of the product development and as a foundation for understanding Mr. Ault's (read 'Thrustmaster's') vision on the world market of thrusters, he first explains to us the basics and history of Dynamic Positioning (DP).

Mr. Ault starts his fascinating exposition: "The history of DP (Dynamic Positioning) dates way back to 1961 when the drillship *Cuss 1* was fitted with four deck mounted azimuthing thrusters mounted over the side at the four corners of the vessel, in an attempt to drill the first Moho (Moho - Mohorovicic Discontinuity, usually referred to as the Moho, the boundary between the Earth's crust and the liquid mantle) well. The thrusters were directly engine driven and were manually controlled. It was possible to keep the ship in position within a radius of about 180 meters above the well off La Jolla, California, at a depth of 948 meters. Due to the depth of the water, the great length of the drilling stem had enough flexibility to allow such a large operating envelope. *Cuss 1* was also used for other core drilling operations off California and



Mexico in deep water, up to 3,500 meters. Simultaneous manual control of the four thrusters was a difficult task, so the idea was developed to use a computer to control the thrusters.
Whereas the *Cuss 1* was kept in position manually, later in the same year Shell launched the drilling ship *Eureka* that had an analogue control system interfaced with a taut wire, making it the first true DP ship. While the first DP ships had analogue controllers and lacked redundancy, vast improvements have been made since then.
Recently the offshore-industry globally has tended to do exploration and exploitation of oil and gas wells at greater depths; with the accent on 300 to 2400 meters deep water and ultra-deep water of 2400 meters and more.
"This makes anchoring problematic, providing an interesting market for the Thrustmaster DP innovations", Mr. Ault continues "Though our DP systems require a higher initial investment, the advantages are huge and pay-back time is relatively short. One of the major advantages, for example, is the gain in deck space, because of the possibility of omitting a lot of the space consuming deck equipment . . . consider for example the size of the anchor handling winches capable of handling the forces from anchors at 2 or 3 kilometres water depth. Besides that, DP nowadays is not only used in the oil industry, but also on various other types of ships. In addition, DP is not limited to maintaining a fixed position any more. One of the possibilities is sailing an exact track, useful for cable lay, pipe lay, survey and other tasks."

According to Mr. Ault, DP nowadays can be defined as: "A system which automatically controls a vessel's position and heading, exclusively by means of active thrust." Further, as a small explanation of the theory behind the DP-formulae is required to get a full comprehension: Any vessel (or other object) has six freedoms of movement; three rotations and three translations. In a vessel they can be illustrated as roll, pitch, yaw, surge, sway and heave. Dynamic positioning is concerned with the automatic control of surge, sway and yaw. Surge and sway, of course, comprise the position of the vessel, while yaw is defined by the vessel heading. Both of these are controlled about a desired or "set point" values input by the operator, i.e. position set point and heading set point. Position and heading must be measured in order to obtain the error from the required value. Position is measured by one or more of a range of position references, while heading information is provided from one or more gyrocompasses. The difference between the set point and the feedback is the error or offset and the DP system operates to correct these errors. Whilst accuracy is at the forefront of development it is important to note that the performance of a DP systems hinges very much on the integrity of the data being fed into it. A DP system properly designed will hold a vessel in position within 1m .

Sales achievements and expectations

The major projects in the order book at Thrustmaster consist of 60% international projects and 40% U.S. projects. All sales divisions have a high success rate, especially in the markets of FPSO units (Floating Production Storage and Offloading), PSV's (Platform Supply Vessels), OSV's (Offshore Supply Vessels), Cable & Pipe Lay vessels, Construction Barges and Accommodation Vessels.
Thrustmaster has a patent on 'Portable DP', with more than 50 systems sold worldwide. There still is a general growth in the demand for DP systems, caused by a growing demand for oil on one hand and a considerable growth of 'Developing Countries' on the other.
Approximately 85% of the DP systems supplied for Anchor Handling Vessels, Accommodation Barges, Construction Barges and Pipe & Cable Lay Vessels are classed DP 2 or 3.
Almost all self propelled barges have DP 1 or 2.
The sales departments, captained by Mr. Bert Ault, are now working on tenders for almost all the major oil companies in the world, impressive names can be considered as a valued relation to Thrustmaster, like: BP, Chevron, Exxon Mobile, Gazprom, Gulf Oil, Petrobras, Shell, Sonangol, Stratoil, Texaco & Total. At this moment a lot of orders come from upgrading 'well stimulation vessels' and tankers to DP 2 shuttle tankers.
A number of Thrustmaster's portable DP-systems are dedicated to simply bringing barges to a drill location; these barges will sink down onto a well (of course after removal of the portable propulsion systems) and will be cemented in at a depth of approximately 1,500 meters. These cemented in barges will function as base stations to which DP shuttle tanker can be connected.

Growth markets - Products

Three of the most interesting growth markets at this moment are Support Vessels for Wind Mill Plants, Cable Lay Vessels, Construction/Foundation & Maintenance Vessels.

The demand for Support Vessels for Wind Turbine Plants was already highlighted in the Maritime Innovations' Special our previous issue. It is interesting to note that Europe is one of the highest rated continents concerning the use of wind turbines. The plants generate more electricity for Europe as an alternative source of energy than the United States. According to statistics, 40% of the world's wind farms over the next eight years will be controlled by Europe. As 13 of the 20 largest wind power markets are already located in Europe. Wind turbine power is essentially the same for creating electricity in Europe as it is in the United States; however Europe uses this alternative energy resource more. Already a number of barges for building and supporting Wind Mill Plants have been provided with Thrustmaster DP-systems.

The reason for Cable Lay Vessels being such a popular issue, is nature itself. In addition to the market of renewing existing cables and laying new cables, there is a lot of work flow from the results of the recent Tsunami's, which washed out a lot of cables. Thrustmaster DP-systems are used on vessels for relaying these cables. In this case tracking in combination with DP is also an important issue, as the vessel ploughs a 5 to 6 meter deep trench with a jet-system. Needless to say the required precision for laying according to a specified grid and the higher demands to make it Tsunami-proof make the task that much more challenging.

The last new and interesting growth market is the construction of (large) bridges. One of the bridges in Seattle is a good example of sound Dutch input; this bridge was built with the assistance of Dockwise who used a barge to lift bridge sections, of a few hundred tons each, in place. The barge was fitted with a Thrustmaster DP-system for maintaining an accurate position, which is a first requirement for these kind of jobs. In addition Thrustmaster are equipping the vessel used in the construction of the Qatar Bahrain Friendship Bridge.

The Sales Managers are also in the 'race' for providing propulsion systems for the Sea Trucks Group or STG. STG is an international offshore construction vessel operator , they have just formed a joint venture with Wellstream, called Seastream, and they are supporting the new SURF installation in NW Australia (SURF - Subsea Umbilicals Risers and Flowlines). DP will have to be used extensively on the vessels involved in this venture.

Growth markets - Regions

Quoting Mr. Ault: "In the next 5 to 6 years the Australian/Pacific market is expected to experience the largest growth in building accommodation barges. It now already has an annual growth of about 15%". A lot of accommodation (and construction) barges are converted into or built with DP2, which is the minimal requirement, while more and more are being provided with DP3."

Due to the increased need for mineral resources, offshore companies need to explore new regions more and more, often in deeper waters and even under ice caps. Building big thrusters with ice class is the next strong possibility, after DP, for discovering yet untouched areas. Thrustmaster is now very active in converting existing vessels to DP, with the use of retractable/tunnel thrusters, for this market. Recently one of the engineers in the Dutch branch has developed a brand new ice-class design thruster, which at this moment he is presenting to the Management in Houston. Mr. Ault's expectation for the next (5 to) 10 years, Thrustmaster will spend about 20% of the production hours on upgrading vessels to ice-class DP. For the market for ice-class thruster they now have a range available up to 4Megawatts, but for near future the intention is to develop higher powers of 5,5 / 6 Megawatts.

Thrustmaster, at this moment, also has some interesting clients in North Russia where they have a project to design the propulsion train in vessels that going to be used to do offshore work in the area of the Caspian, Black and Aral Sea.

Product development and reliability

Thrustmaster products are being developed in close cooperation with naval architects and owners. A good example in this case is the above mentioned Russian project.

Depending on the demand, Thrustmaster products are subjected to a continuous evolutionary process; inventing innovative solutions to anticipate the changing and increasing demand. The Dutch facility, managed by Mr. Hans Hoek, plays an important role in those innovations as already mentioned.

Thrustmaster also has a broad based range of hybrid propulsion products available on the market, ranging from 50kW until 8MW. Nowadays, having collaboration with Siemens, Thrustmaster is also able to provide the complete thruster package including power group on board. The package includes an electrically driven system with e-motor/generator, power management, DP-system and thruster complete. This opens up new market as a lot of clients prefer a single source supply: a 'one-stop shop' for the complete system.

However, whilst Thrustmaster has an affinity with many Dutch partners given its Dutch owner and branch in The Netherlands.

Some customers though, like Texas drilling contractors prefer an all American (read Texan) manufactured product. In these applications, caterpillar power units will be used. In offshore projects especially reliability is of the utmost importance, this is not difficult to understand when daily rates can be anything from 100,000 to 750,000 dollars US. Down time in this climate can have severe financial consequences. Given that Texas generally, and Houston in particular, is one of the major centres of the drilling and offshore industry, a locally based supply/sub-contractor company with additional bases and offices around the world offers distinct advantages.

Special Product/Market combinations

Some of the Product/Market combinations form an interesting field in themselves: for that reason Mr. Ault spent some time explaining to us three special issues. Each one of them has already been mentioned in the previous text, but now we will deal with them individually in more depth.

Deep sea mining

Deep sea mining is a relatively new mineral retrieval process taking place on the ocean floor. Ocean mining sites are usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1,400 - 3,700 meters below the ocean's surface. The vents create sulphide deposits, which contain precious metals such as silver, gold, copper, manganese, cobalt and zinc. These raw materials are found in various forms on the sea floor, usually in higher concentrations than terrestrial mines and more than 300 locations are waiting to be worked. The deposits are mined using either high pressure hydraulic pumps or bucket systems that take ore to the surface to be processed.

Diamonds are also mined from the seabed and various companies (including the world renowned famous Dutch company 'De Beers') are planning to mine the offshore waters of Papua New Guinea and New Zealand.

Currently, the best potential site has been found in the waters of Papua New Guinea (at a depth of approximately 1,800 meters), with rich deposits of gold, copper and zinc. Excavation of this area is projected to begin in the next few years.

It is believed that once the gold is extracted from the seabed, the costs for the complete mining process are covered and thus all other extracted products are purely profit for the mining companies.

The link with Thrustmaster is clearly evident; all of these excavations will require DP equipped mining barges. Thrustmaster are fully prepared and equipped to provide all the portable DP systems for the area.

DP conversion of existing vessels

As older offshore production areas become more congested and new exploration moves to deeper waters, the demand for dynamically positioned vessels, barges and platforms increases rapidly. Rather than scrapping older vessels and replacing them with DP-capable replacements, many existing vessels and rigs can now be upgraded for DP at a fraction of the cost of replacement.

A good DP system uses multiple azimuthing thrusters with either, variable speed fixed-pitch propellers or fixed-speed controllable pitch propellers. Either way, the system is complex and comprises many components and subsystems. Proper integration of all parts of the system requires a good understanding of the interdependence of all the critical system components. Acquiring and installing the sub-systems in an existing hull is always challenging and often requires major vessel modifications necessitating extensive design work and lengthy dry-docking.

Quick and relatively inexpensive conversions of existing vessels and barges to DP capability are quite feasible using the PDP Packaged System Approach. In many cases, the total

cost is only half of what a conventional conversion would cost. Almost any vessel or platform can be converted regardless of hull depth or machinery congestion. Since there is just one single equipment supplier involved, project budget and schedule are easily established with a high degree of accuracy. While deck-mounted power units and outboard thrusters may not be very elegant, they avoid major surgery and permit the vessel to remain in its original state. Moreover while outboard thrusters are somewhat exposed to collision damage, repairs can be conducted quickly without the need for dry docking. For DP conversions of existing vessels, the Thrustmaster Packaged System Approach is the better way.

Pipe laying with DP

Pipe laying is one of the most exacting applications for dynamic positioning. Not only are environmental forces acting upon the vessel, but also the weight of the suspended pipe catinery will create additional forces. The vessel must maintain position and accurate heading control. If the vessel loses its heading, the pipe comes under great bending load, which may result in pipe breakage or failure of the pipe handling equipment on deck. This may cause damage and injuries. The need for accuracy becomes increasingly important in shallow water depths where the length of the pipe suspended between the barge and the bottom is short. This short length does not allow much flexing to accommodate for vessel drive-offs or heading changes. Very good slow speed tracking control capability and very accurate control of position and heading is essential in this application.

Today's dynamic positioning systems use software that includes a mathematical model of the vessel. This is developed for each individual vessel and it contains information about vessel wind drag, vessel current drag, center of gravity, center of rotation, location of thrusters, etc. With the help of this mathematical model, the DP controller issues the correct commands to the thrusters on a continuous basis to maintain desired position, heading and speed of the vessel.

The controller gets continuous updates from position reference sensors (such as DGPS), heading references (gyro compass) and the speed and direction of the wind (anemometer). There are two different criteria that prompt the DP controller to take corrective action. The first is position feedback. If the position reference signal indicates that the vessel is off location, the controller takes corrective action by controlling the thrusters in such way as to get the vessel back into its required position.

The second is wind feed forward. As wind direction and speed change, the controller again controls the thrusters to offset the changes and act before the vessel has moved out of position. Using dynamic positioning for pipe lay and pipe repair operations, especially in areas with restricted manoeuvrability and shallow depths, is certainly feasible and will result in more efficient operations. In these conditions a high degree of accuracy is demanded and this requires a high performance DP control system coupled with very responsive thrusters having a wide speed range in both forward and reverse. Thrustmaster of Texas has the experience, the know-how and the right products for this application.

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