Intuitive operation and pilot training when using marine azimuthing control devices

AZIPILOT

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AZIPILOT WORKSHOP - ROTTERDAM 24TH FEBRUARY 2011

This workshop brings together Representatives from the Ports, Training Providers, Ships Masters and Pilots and provides us with an excellent opportunity to discuss best operational practice and how to incorporate this into training requirements for personnel operating ACD's.

This presentation will give a brief outline of the work we have completed to date and hopefully give us all some thing to think about over lunch as to what we would like to see in the future so that we can have a useful discussion this afternoon.

As we are approaching the final phase of this three year Project having completed the Review, Summarise and Assimilation tasks we are now turning our attention to what recommendations we can make to improve Operational Practice that can be incorporated into future Training programmes.

We are very much aware of the potential for damage to various components of the pods, particularly the bearings when there is a loss of oil film if they are incorrectly operated, and also the possibility for damage to the Port infrastructure and the ship itself. It is hoped that any improvement in training that comes from this Project will greatly reduce those risks.

Slide 2

M1015 refers to training for Masters and Chief Officers on ships with unusual handling characteristics, it recommends they should have adequate relevant experience and training before taking up their duties. Should vessels fitted with ACD's be considered as having unusual handling characteristics and if so should it be a recommendation or even a requirement for senior officers to attend an ACD training course.

We have also determined that there is little or no training offered to Pilots by those responsible for the provision of Pilotage Services and the training offered to ships officers is somewhat varied in its extent and content ranging from a prolonged handover period between Masters to attendance of full simulator training courses.

This Work Package so far has looked at the current recommendations and criteria for the operation of ACD's, with particular regard to IMO manoeuvring criteria and its relevance to podded vessels.

Slide 3 & 4

We have collected a number of Pilot Cards ranging from the standard IMO layout to more elaborate layouts and would welcome input on whether there should be a different and much more informative layout for podded vessels and if so what level of information would we think is necessary.

We have looked at existing operational practice, this was achieved by interviewing ships Masters who had considerable experience with ACD's and Ships Masters who have little experience with pods. We have been able to examine Guidelines issued to Ships Officers by both the Manufacturers and Ship Operators.

It became apparent to us during that particular phase of the project that there is a large gulf between the Ship masters who had little experience of operating pods and had no formal training and as a consequence they tended to use the pod only as a stern thruster inb what we know as the T Bone configuration and the experienced Master who had been on appropriate training courses and used the pods with confidence and to their full potential by altering the angle and the thrust to achieved the desired result.

Slide 5

The Manufacturers guidelines are aimed at advising the ship handler. The general recommendation being to operate and control the pods as gently as possible in order to avoid high acceleration rates that may lead to a high use of power (thrust) to stop the vessel. High levels of thrust can cause large vibrations that may reduce the life of the mechanical components and increase fuel consumption. Large angles of the pods at high speed

Slide 6

The information we received through interview with Ships Masters involved some discussions about guidelines issued by the ship operator, here again we see

recommendations on how to operate the pods, or what to try and avoid doing. The questions we perhaps need to address is should these recommendations be embraced as become an integral part of any training programme or are they impractical to achieve during the manoeuvring of the vessel.

Slide 7

With regard to the transfer of control and the way in which the control consoles are designed and operated we took the following photographs during our gathering of information. The first one shows how the control handle has been marked to show which way to turn it to achieve the desired result, perhaps indicating the counter intuitive nature of the pod, this slide also shows how one Master had the control adapted so that the he turns the controller in the direction he wants the bow to go. You can see here how the pod is pointing in the opposite direction to the handle. This could be very confusing for the Pilot.

Slide 8 & 9

The next slide, taken on the same vessel shows the difference between the central console and the bridge wing consol. One being the conventional control handle while the bridge wing is a joystick. This resulted in the situation where the Master remained at the centre consol during maneuvering and relied on information, such as distances, from his Chief Officer.

Slide 10

We have reviewed accident and incident reports involving ACD equipped vessels. This was achieved by searching through accident reports from Government Agencies charged with investigating marine casualties.

The number of incidents investigated is minor when compared to the total number of incidents available for inspection. It was expected that more incidents would have occurred due to an expected lack of appreciation by personnel of the special characteristics of pods and inadequate onboard procedures. We concluded that while no one fault exists in all the incidents there is some commonalty in that maneuvering error and transfer of control issues are relevant in 60% of the incidents. However in reaching this conclusion we are very much aware that not all incidents are investigated and minor damage to a vessel through misuse of the pods may only be the subject of an internal investigation and will never reach the public domain.

In one of the Reports we looked at involving a collision between a tug and the vessel it was assisting there was criticism by the Investigating Authority of the informal training regime followed by the tug community whereby one officer trains another. This criticism was based on the assumption that any faults or bad habits would be passed on rather than be corrected by a more formal training programme.

Slide 11

Using a podded model at the Manned Model Training Centre at Port Revel in France a series of trials were conducted using the Normandie, which is a scale model of a 260metre vessel equipped with two Mermaid pods, the trials were conducted to identify best operational practice in both normal and emergency situations

When conducting a series of crash stops from an initial speed of 13½ knots trials showed the quickest way to stop the vessel is by turning the pods through 180º inboard maintaining full positive rpm. In the trials this showed that the vessel could be brought to stop in 2.1 ship lengths. Turning the pods through 180º outboard is less efficient and the ship was brought to a stop in 2.3 ship lengths. The transverse arrest, often used by Tug masters where the pods are turned 90º inboard while maintaining full positive thrust brought the vessel to a stop in 2.5 ships lengths.

By using full negative thrust, i.e. full astern, on the pods brought the vessel to a stop in 3.0 ships lengths.

With regard to turning circles the Normandie was reverted to her original single right handed propeller to make a comparison between conventional propulsion and podded.

With a speed of 10 knts a conventional turn to starboard with 40º of helm gave a turning circle of 3.4 ships lengths. Using two pods at 20º gave a turning circle of 3.2 ships lengths. This provides us with a 1 in 2 angle ratio between pod and rudder angle for comparable turning circles.

When using only one pod the tightest turn was achieved using the ‘outboard’ pod. A starboard turn using the starboard pod gave a turning circle of 3.9 ships lengths while a starboard turn using the port pod gave a turning circle of 3.2 ships lengths.

Slide 12

During the course of our information gathering we came across different terminology for the modes of operation that are used onboard ACD vessels.

Modes of Operation will depend upon the installation. During the course of the Project to date we have encountered different modes of operation, given different names by different Operators. Do we think there is a case here for having standard terminology?

The Open Sea Mode, or the Cruise Mode allows full power, possibly as much as 17 mega watts, both pods and rpm settings are syncronised and the angle to which the pods can be turned may be limited to typically 10º but may be 35º

The Manoeuvering Mode or manoeuvring direct mode in which the power available is reduced, 12/13 mega watts, again both pods and rpm are synchronised but the angle at which the pods can be turned is increased typically to 35º

In the azimuth manoeuvring mode or fast mode or aziman mode the power available is again reduced, typically to 10mega watts but the pod angle and rpm can be operated independently through 360º

Slide 13

It is perhaps important to determine where the propeller is situated. When situated at the front of the pod it has clean water flowing into it and the water is accelerated over the main body . If the main body is designed to act as a control surface then this fast flow will increase the steering force generated which can result in a significant speed loss when course keeping.

Slide 14

To overcome this loss of speed when course keeping can be overcome to a degree by the inclusion of flaps that are used to steer the vessel when at speed

Slide 15

The pusher type has the propeller at the back of the strut, they do not benefit from the accelerated water flow and consequently these units are less likely to be designed to act as a rudder.

ACD vessels do tend to be less course stable, not only for the reasons mentioned above but also due to the lack of skeg and bulb that are often removed to make way for the pods. Sea trials are carried out in deep water and we know that manoeuvring characteristic change when in shallow water and tend to move vessels to the more course stable end of the spectrum.

Slide 16

We know from Project interviews and from our own experiences that many Ports have a requirement for vessels over a pre determined size to take a tug regardless of the vessels manoeuvring characteristics so should any training programme include exercises that involve towage.

Many of the ports, particularly within the EU have ageing infrastructure and as such may not only require the vessel to take a tug but may also put limits on the usage of such powerful pods, even when in the manoeuvring mode and at reduced power the thrust of water has a potential to cause damage to ageing and crumbling quay walls.

Conclusion

In concluding this session I hope we can give more thought over the lunch period into how we can incorporate some of the Operational difficulties we have come across into a comprehensive programme of training ships officers and pilots in how to operate ACD's to achieve the maximum potential they have to offer while protecting the mechanics under a wide range of conditions.