

Melbourne improves safety of ships at Port Phillip heads

Port Phillip heads poses one of the most challenging waters for ship navigation to be found anywhere on earth. The history of shipwrecks since settlement began at Melbourne in 1835 attests to this reality. Huge, long swells up to 5 metres significant wave height, combined with currents up to 6 knots on the ebb (which occurs at low water), cause even ships in excess of 250 metres in length to plunge several metres downward in extreme conditions.

The recent decision by the Port of Melbourne Corporation to licence OMC's world-leading DUKC® navigation technology will significantly increase the safety of large vessels passing through the treacherous entrance to Port Phillip Bay.

The Port of Melbourne is Australasia's largest and one of the world's top 50 container ports and from 1 June 2009 it will be compulsory for all deep draft vessels transiting port waters to use OMC's Dynamic Under Keel Clearance system. This decision followed an extensive trial and validation process which confirmed that the system is capable of delivering improved safety and efficiency benefits to port users in comparison to existing static rules.

All 35 Port Phillip sea pilots will access the system on their PPU's (Portable Pilot Units) while in transit through the heads, along Port Phillip Bay's long approach channels and up the Yarra River. Pilots will be provided with live data for all variables which affect the under-keel clearance of their vessel. They will be able to

continuously monitor it and adjust speed as required to safely optimise clearance and manoeuvrability.

OMC has undertaken very extensive pilot training during the past few months to prepare for the roll-out of the system (DUKC® Desktop and DUKC® PPU) to all pilots.

"This is the first time anywhere in the world where a port has made our system operational for an entire pilotage group," OMC founder, executive director and former Melbourne University academic Dr Terry O'Brien said.

The system will also be integrated into Melbourne's two Vessel Traffic Services (VTS) Centres to provide a VTS operator with the same under-keel predictions and grounding warnings as the ship's pilot receives on the PPU. The operator will be able to transmit this information to the pilot by radio in the case of a communications failure (or pilot laptop failure or damage/loss while boarding).

In summary, the technology will be available to shippers for planning vessel sailing drafts and windows, to VTS operators for monitoring safe under keel clearance during transit of all deep-draft ships and to ship pilots and masters to control vessel speed such that adequate clearance is maintained throughout the transit from berth to the deep water outside the heads.

In 2001, the then Victorian Channels Authority invited tenders for a desk study to investigate the suitability of a real-time under-keel clearance management system for installation in

Dr Terry O'Brien, chairman and executive director OMC International



port waters. OMC was awarded the tender after open competition.

Following completion of the desk study in 2002, an initial trial of OMC's system was developed and full-scale ship motion validation measurements commenced.

During 2003/04 unpredictable wave "spikes" were discovered in measurements undertaken by the Port of Melbourne Corporation at Port Phillip heads. This issue delayed the system's implementation because it was perceived that such phenomena made it impossible to reliably predict wave conditions at the heads, and therefore model vessel under-keel clearance.

In 2006/07, PoMC positioned additional latest state-of-the-art instrumentation at critical locations to provide high quality wave data. It also asked that OMC analyse and investigate these new data with the objective to prove the reliability of wave predictions through these complex waters. Hydrodynamicists from OMC subsequently proved that the "wave spikes" were in fact instrument error and did not exist in nature, and further that waves could be accurately and reliably predicted through the heads.

With this issue resolved, OMC was then able to develop accurate and validated algorithms to model the transformation of wave height, period and direction through the heads at all stages of the tide. This was integrated within the system to provide accurate determination of the subsequent dynamic effects on vertical ship motions for any specified ship and loading condition, including the strong wave-current interaction effects at the heads.

In 2007/08 a further series of full-scale ship motion and under keel clearance measurements were undertaken by PoMC for 12 vessels transiting the Port of Melbourne channels. OMC's system was run "blind" for each ship

and the results were provided to the port for independent validation of the accuracy of OMC's ship motion predictions. Comparisons of the DUKC® predictions against the precise DGPS measurements confirmed that the system accurately predicted squat and turning heel in the Yarra River and South Channel and vessel wave response in Port Phillip heads under a wide range of wave/tidal current conditions and vessel types and sizes.

Furthermore, PoMC contracted two independent experts to undertake risk assessments of the system specifically for the Port of Melbourne:

- The first study examined the touch bottom probability of typical vessels operating under the advice of the system compared to the existing static rule for both the then-existing and deepened channels. In both scenarios, the independent expert concluded that typical vessels operating under the advice of the system would be considerably safer than vessels operating under the existing static rules.
- The second study involved a risk assessment of both the existing UKC practices in operation at the port and those which would operate with OMC's system. The primary conclusion from this risk assessment study was that the implementation of OMC's system for the Port of Melbourne would reduce existing clearance risk in the port waters to very low levels, consistent with a port policy to maintain risk as low as reasonably practicable.

On satisfactory completion of this external validation process, PoMC approved the customisation of a full DUKC® system for Melbourne for both vessel passage planning and for in-transit monitoring and control. The former component will be used by VTSOs at Port Control Centre and the latter will be used by Port Phillip sea pilots on their onboard laptop computers.

The final stage in this long development process was approved by the port's board in February 2009.

How the system works:

The technology works by taking into account all the variables that affect how much under keel clearance a particular ship with a specific cargo on a specific day needs in order to transit depth-restricted waterways without risk of running aground. It is the only system in the world that has proven capacity to manage the vertical (depth) component of navigation in waterways. The system ensures that any potential economic benefits will never compromise a safe passage and it remains the only proven system worldwide which has taken ships deeper than calculated by static rules.

The system, which was first installed in Queensland's Port of Hay Point in 1993, is now in operation at 19 ports around the world (11 in Australia, three in NZ and five in Europe).

The DUKC® PPU was first trialed in Port Hedland waters in 2005. For the past three years OMC has participated in the A\$40 million European Maritime and Navigation Information Services (MarNIS) research project concerned with enhancing safety at sea. The system contributed very substantially to the development of the Port Operations and Approach Decision Support System (POADSS), a "new generation" PPU. The Port of Lisbon was chosen for a live demonstration of this technology during an actual transit from deep water to berth. A senior Lisbon pilot operated the POADSS for the transit and successfully demonstrated the system's capability to display, to centimetre accuracy, the under-keel clearance predicted by OMC's system alongside the actual measured clearance for the full transit.

The DUKC® VTS is shore-based and receives information from the passage planning stage through to in-transit pilot and ship tracking data. The

system can be accessed by operators and safety regulators within the VTS for in-transit risk monitoring.

Implications for the industry

“PoMC’s decision to mandate DUKC® as its operational under-keel clearance system for Melbourne is a crucial one for the international maritime industry because it further validates our technology’s already proven safety record,” Dr O’Brien said. “Even though there have been more than 250 independently validated sailings undertaken around the world since 1993, PoMC has funded further extensive validation of the system in the past two years.

“Worldwide there have been more than 45,000 safe sailings under DUKC® advice in the past 16 years without a single incident. Safety is paramount to ports, and having proven the safety value of our system in Melbourne, we believe that we

can prove its validity anywhere around the world.”

The system’s VTS technology can assist emergency response operations, as was demonstrated at Port Hedland last year when it was used to provide clearance predictions to enable the safe removal to deep water of the *Iron King*, a large bulk carrier which ran aground just after leaving the harbour as a result of a steering malfunction.

Groundings can and do happen. While the *Iron King* incident grabbed newspaper headlines only last year, two oil tankers grounded on a shoal in the approach channel to the port of Marsden Point in New Zealand within three months of each other in 2003. On safety grounds, Maritime Safety NZ required the port to install OMC’s technology following the second of these groundings. Subsequent analyses demonstrated that if the system had been in operation at the time, it would have advised that

these sailings should not take place due to inadequate clearance at the time of channel entry.

Federal Government support

OMC’s expansion and continued development of navigational products has been made partly possible through the strong backing of the Australian Government, with three R&D grants being obtained since 1998 in open competition across all industry sectors. Of relevance here is the second grant (in 2003) for the development of a DUKC® PPU and the third (in 2006) for a Ship Grounding Warning System (GWS), now renamed DUKC® VTS.

“The Federal Government’s strong R&D financial support of OMC helped our company win a major contract in Germany last year. Our unique navigation technology has now been installed in the VTS Centres at Bremerhaven (the 20th largest container port in the world) and Bremen for ports along the Outer and Lower Weser River,” said Dr O’Brien.

Dr O’Brien said that shipping through Torres Strait is a prime potential beneficiary of the system which is now operational for Torres Strait on OMC’s server and is able to monitor the under-keel clearance of any ship transiting through the strait.

“The system is already being used in North Queensland, with a recent commissioning for Rio Tinto Alcan at the port of Weipa. This means that over 30 per cent of all vessels transiting through Torres Straits will have commenced their passage planning under the guidance of DUKC®. It is expected that the technology will deliver significant savings by providing ships with greater certainty of how much cargo they can safely carry,” he said.

Planning is well advanced to roll out the VTS and PPU systems into several more national and international ports and waterways during 2009. ▲



Navigating with the OMC system