Dynamic solution for vertically challenged ports

Ports in shallow, tidally restricted waters constantly face the threat of grounded vessels, but real-time under-keel clearance technology can help them manage the risks – all via the VTS centre. ***Stephen Cousins*** reports

When a steering malfunction forced the large bulk carrier *Iron King* to run aground in the navigation channel of Australia's Port of Hedland in mid-2008, it was a priority to remove the obstruction as fast as possible. To avoid further disruption to shipping traffic and associated product losses of up to US$40M per tide cycle, the port opted to refloat the vessel and move it to deep water outside the standard sailing windows.

This tricky operation was made possible thanks to the use of Dynamic Under Keel Clearance (DUKC) technology produced by Australian company OMC International. It's an under-keel clearance prediction system that harnesses real-time data on a ship's motion and response, together with the wave and tide climate and other major environmental factors to ensure safe navigation in shallow waters.

Using DUKC information, eight tugs took just three hours to sail the *Iron King* safely back into deep water, and Australia's largest port (by tonnage) was able to resume normal operations. The system's ability to determine accurately the critical vertical component of a ship's navigation – what can't be seen under the water – offers many benefits to ports in tidally restricted areas, and not just in an emergency response situation.

By sending dynamic, real-time data to a port's vessel traffic services (VTS) centre, DUKC helps ports manage risk by preventing ship groundings and increasing safety margins for vessels transiting the port. It also allows deeper-draught ships to visit with larger cargoes, boosting a port's productivity without the need for capital dredging, OMC maintains. And

greater keel clearance means a wider tidal window, allowing more ships to visit at more flexible times.

The system has undergone several incarnations and earlier this year the new Series 5, web-based version was introduced, allowing access by authorised users anywhere in the world. Significantly, from early 2011 the Australian Maritime Safety Authority will make this version compulsory for all 8m-plus draught vessels transiting the shallow and environmentally sensitive Torres Strait, which separates the northern tip of Australia's Cape York Peninsula from the southwestern area of Papua New Guinea.

But any port could benefit from the system believes Captain Eric Atkinson, retired harbor master at Australia's Port of Freemantle, which monitors some 340 vessels a year using DUKC: "When we started to use the system it was intended just to benefit shipping customers by helping them increase cargo loads, but we soon realised that it took the risk away from handling deep-draught ships in the port. The system allowed us to predict the under-keel clearance of every vessel and then check that prediction against the actual clearance shown on the ship's recording. Pretty soon we were using it as a risk management tool."

The brains behind DUKC is its numerical ship motion model software, which calculates and forecasts the interaction of waves, tides, currents and vessel dynamics based on constantly updated data feeds taken from sources within the port including wave-rider buoys and tide recorders etc. This equipment should be regularly re-calibrated to maintain a level of information given by the DUKC that is said to be accurate for all vessel classes and environmental conditions. Information is then displayed on a screen in the port's VTS suite, allowing staff to complete the long-term planning of maximum safe draught, plus earliest and latest sailing times. The results are gradually refined from 36 hours ahead of transit time right up to the time of sailing and beyond.

OMC claims the technology is so accurate that under extreme weather conditions it will allow a 250,000dwt carrier to negotiate a channel within 1m clearance of the seabed.

Using dynamic data is a far more reliable form of risk management compared with conventional methods, explained Peter O'Brien, chief executive of OMC. "Relying on pilots to manage the risk of grounding in severe events by applying discretion without the assistance of modern analysis tools cannot be considered an adequate risk management technique," he said, adding that planning sailing times in tidally restricted waterways based on a static rule for under-keel clearance, "does not allow for risk to be adequately quantified or managed". This advice has been taken on board by the Port of Melbourne, which last year licensed DUKC technology to ensure the safety of large vessels entering Port Phillip Heads, one of the world's most treacherous waters for ship navigation.

The port's risk assessment concluded that vessels operating under DUKC advice would be significantly safer than vessels operating under the existing static rules. "Safe navigation is our highest priority, and the system's principal benefit to us is that is reduces the risk profile of deep-draught vessels transiting the port waters," a spokesman told *P&H*.

Photo: OMC International

The pilot's version of DUKC is already used in Melbourne with Torres Strait to follow this year

Significantly, at Melbourne (and this year in the Torres Strait) risk has been further reduced by integrating DUKC software into portable pilot units (PPU), including laptops, which allow pilots to monitor predicted under-keel clearance on board vessels in real time. The PPUs enable pilots to optimise safe vessel speed as well as receive advice from the port's VTS on unexpected circumstances, such as a vessel breakdown.

DUKC comes with certain installation and training requirements. The system must be configured specifically for each port to connect the various data feeds – including data from hydrographic instruments, vessel manoeuvre information and environmental data, plus other historic data – back into a server. Typically, OMC carries this out and tests it over a period of about six months.

The results are displayed on a standalone display in the VTS centre. Monitoring and interpreting the information requires initial and ongoing operator training, which OMC provides, and will probably involve some expansion of the VTS and harbor control operator's role, said O'Brien. OMC provides 24-hours-a-day on-call support via its staff of engineers, naval architects and IT personnel, and all data is stored and archived for future analysis.

DUKC technology is typically known among shippers for its commercial benefits, but is gradually being taken seriously as a risk management tool for ports. New Zealand's Maritime Safety Authority recently recommended the system to a local port where two tankers touched bottom when entering in rough conditions. Industry bodies PIANC and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) are developing guidelines and new standards for real-time UKC management based on input from O'Brien and others in the field.

"It's my belief that one day DUKC will become a standard requirement for all ports, just as all ports are now adopting AIS and vessel traffic control systems," concluded Freemantle's Captain Atkinson. PH

Photo: Port of Hedland Authority

Port of Hedland, where *Iron King* ran aground