



Is your port ready to receive bigger ships, larger loads and maximise throughput?

By DR TERRY O'BRIEN OAM, executive director, OMC International

Valemaxes. VLCCs. Post-Panamaxes. Maritime news headlines reveal that the race has begun for ports to be ready to dock the new generation of mega ships, expand their capacity and minimise arrival and departure delays.

Some news stories to set the scene: the much publicised widening of the Panama Canal is expected to open a third lane with 15m draught in 2015; Hamburg Port has docked the CMA CGM Marco Polo which is the world's largest container ship, capable of carrying more than 16,000 standard containers; North Queensland Bulk Ports (NQBP) is reportedly projecting a 12 per cent increase in total throughput for this financial year and its transformed Abbot Point coal port aims for 230 mta, a fourfold increase in throughput; Port of Melbourne Corporation (PoMC) has dredged to allow 14m vessels to enter Port Phillip Heads and the Victorian Government is now looking at developing its deep water port at Hastings; the combined Pilbara ports, a massive entity,

forecasts an eventual throughput of 1 billion tpa, and last year 25 per cent of all bulk sailings from these iron ore ports were carried by ships larger than 200,000 dwt with 80 per cent larger than 170,000 dwt.

As bulk cargo and container volumes ramp up, port authorities are increasingly under commercial pressure to facilitate efficient and cost effective navigation. Bigger ships with bigger loads bring bigger demands for deep water shipping channels but an absolute focus on safety must remain a primary goal.

So, how can ports attract the big ships and manage the growth in throughput? While one solution has been to dredge deeper access channels, a more cost effective alternative may be to implement proven UKC management technology which can make optimum use of the high tides and minimise any necessary dredging. This approach will better maximise port capacity without compromising safety.

More efficient use of tides

Bigger ships put increasing pressure on ports to use tides more effectively, whether they are spring tides or neap. Tides plus real-time UKC management technology offer the possibility of wider tidal windows and multiple sailings on a tide, irrespective of tidal range or cycle.

Where there is a wide tidal range, as in the Pilbara ports, the greatest reduction of dredged depth and volumes in approach channels has resulted from the optimal use of tidal assistance. Since OMC implemented its DUKC® system in 1995 at Port Hedland and Dampier, extended safe sailing windows have accounted for most of the 7 per cent of extra cargo loaded. The challenge is to make the most of the highest part of the tide, including the opening and closing shoulders, to send out as many of the bigger ore carriers as possible. What follows focuses on the Pilbara ports and in particular, Port Hedland, the world's largest bulk export port.

Growth of multiple sailings on a single tide

In June 2012 Port Hedland Port Authority (PHPA) sailed six ships on a single tide, a record at that time. PHPA has recently announced that a new tonnage record for the largest departure of iron ore on a single tide was set on January 15 this year. The new record of 1,059,740 tonnes beat the previous record by more than 19,000 tonnes.

OMC has been developing and jointly trialling with PHPA since 2010 a DUKC® Optimiser module that successfully optimises sailing times and draughts of multiple vessels on a single tide and will regularly repeat these records. In the initial release, delivered in 2011, some operational constraints were still entered manually by the schedulers.

DUKC® Optimiser

A second release of Optimiser was launched in October last year as part of the new 'Platinum Package' contract announced for Port Hedland

(see below). This module includes automatic handling of constraints such as tug and pilot availability and booking priorities, and will safely maximise total tide tonnage, increase total throughput and provide ship operators with greater flexibility in the timing of port visits while reducing the workload for schedulers.

After further trialling of this new stage, Optimiser will be extended to include inbound shipping, as well as departing ships. This will help PHPA in their "logistics" task of maximising port capacity safely.

DUKC® Series 5 web-based 'Platinum Package'

During 2012, BHP Billiton decided not to proceed with its proposed \$20 billion outer harbour development at Port Hedland. The reasons stated for this decision were the cost of such development per tonne of additional iron ore output and the belief that opportunities exist to ship considerable additional tonnage from the inner harbour at much less cost. Following this decision by the BHP

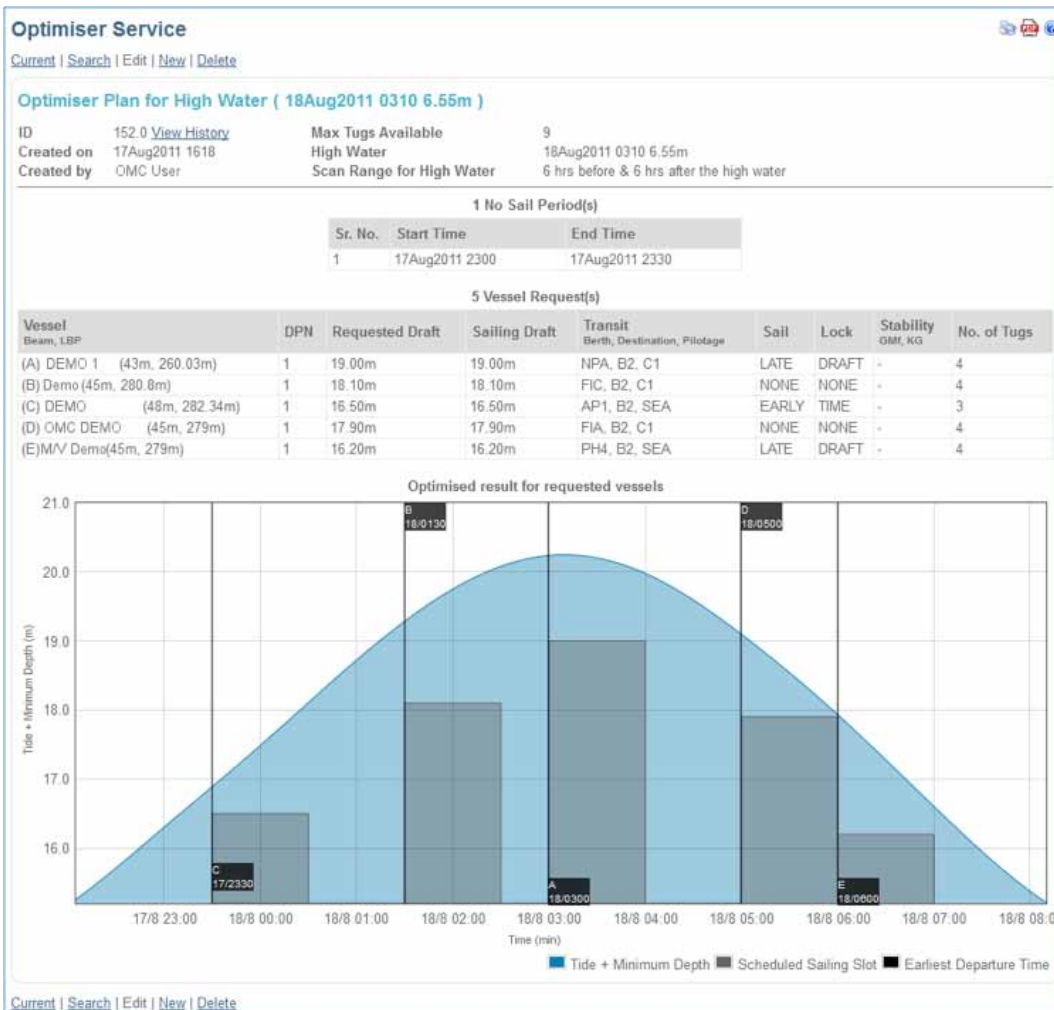
Board, PHPA commissioned OMC to implement its DUKC® Series 5 Platinum Package as one major cost-effective step to achieve this goal. In a recent article on this new OMC contract, author John McIlwraith reported BHP's Chief Executive Marius Kloppers as saying that more iron ore could be delivered to Port Hedland than its export allocation allowed (350mta rather than the existing allocation of 250mta).

"I think that what we are saying is that our supply chain will deliver the tonnes and what we will do is maximize the throughput through the inner harbour to the maximum we can squeeze out of it". (Refer to 'Perfectly Managed', Australia's Mining Monthly January 2013 page 87 <http://www.omc-international.com/images/stories/media/2013-AMM-Perfectly%20Managed.pdf>)

PHPA is OMC's first client to be licensed to use the full 'Platinum Package'. Two components, DUKC® Optimiser and DUKC® Chart Overlay, are presently being trialled and will be integrated into their

web-based Series 5 system this year by OMC's maritime and software engineers. The final extension to this package will be OMC's Dynamic Capacity Modelling which will highlight all areas and options where port throughput from the inner harbour can be increased to allow the maximum tonnage of iron ore "to be squeezed out of it". This module should ultimately be a most significant contribution to the complexity of UKC management and navigation in Australia's large bulk ports.

The 'Platinum Package' is available to all ports and waterways and the modular form allows the regulators, particularly in smaller regional ports, to select only those modules relevant to their port's needs.



DUKC Optimiser software user interface



Iron ore carrier off Port Hedland

There is obvious potential for these new DUKC® applications to bring significant benefits not only to other Australian ports, such as Dampier, Cape Lambert and Hay Point, but also to major bulk ports overseas, such as Vale's iron ore export ports in Brazil.

DUKC® Chart Overlay

As well as the Optimiser, OMC has also developed DUKC® Chart Overlay, another new product included in Series 5 which increases pilot safety by forecasting and showing very clear "go" or "no go" areas as part of an electronic charting package on the Portable Pilot Units (PPUs) pilots carry on board to monitor the transit in real time. Based on dynamic UKC calculations and predictions, this Chart Overlay is a world-first for pilots.

DUKC® Chart Overlay displays UKC information geospatially on top of electronic nautical charts. This cutting-edge development lowers the risk of channel blockage by providing pilots and incident controllers with a significant risk control measure. DUKC® Chart Overlay will bring DUKC® advice to pilots and VTSOs at Port Hedland when most needed – when the unexpected happens, such as the engine breakdown and grounding of the 'Iron King' in July 2008.

Smarter Dredging

Dredging optimisation technology offers a major cost effective means of increasing the capacity of Port Hedland's existing channel and inner harbour to compensate partly for the "loss" of the outer harbour

throughput.

Over the years, DUKC®'s methodology has been successfully used to design the vertical dimensions of a new channel, or to deepen an existing channel, so as to minimise channel dredging quantities and associated environmental effects. When this technology is already installed in the port, it can be used conjunctively with dredging to create the channel depth profile which matches the UKC requirements throughout the transit so that the amount of material dredged is matched to the depths required for the ships transiting. Every tonne of dredged material reduced provides a saving generally in the order of \$50 to \$100. Maintenance dredging costs can also be minimised and it can even be a useful first step in a new port where a UKC system is not installed. For example, at the Port of Hastings Victoria, historical wave and tide data input can be used with the DUKC® channel design software to indicate the likely areas of focus for further hydro-meteo or environmental studies. Again it may facilitate potential capital cost savings.

Channel deepening will continue coming under scrutiny because the often lengthy environmental and other studies on the impact of dredging have been costly and contribute to major delays in project completion. Smarter dredging can reduce these effects, and in some cases, eliminate the need to dredge altogether by "going deeper on a computer screen!" (refer Kevin Chinnery: Optimisation, BRW July-Sept 2008 <http://www.omc-international.com/images/stories/media/20080731%20BRW-LC-O%27Brien.pdf>)

Channel design also includes the horizontal dimension and, as the only Australian member of PIANC's Working Group (WG) 49, I have had the privilege of being involved in updating the well-known PIANC guidelines on channel design (WG 30 report) to take into account the increase in ship size since publication of the 1997 edition.

OMC iHeave® prompted by 'Graveyard of the Pacific' study

Last year, a team of in-house engineers unveiled our new ship motion measurement instrument OMC iHeave®. This safety tool, which is about the size of a shoebox, was developed in the course of carrying out a desktop study now finalised for North America's 'Graveyard of the Pacific' and was described in my Autumn 2012 contribution to Shipping Australia. This North American project was the original prompt for OMC's engineers to develop, and then commercialise, OMC iHeave® which gives results of similar accuracy to a full DGPS set-up. Accessing the bow and transferring DGPS equipment by helicopter during winter at the Columbia River Bar was regarded as too dangerous and would have prevented us from measuring the very ship motions the pilots were most concerned about.

This tool also increases the safety of lives at sea by enabling a ship's vital wave response data to be collected in severe weather conditions where it could otherwise be potentially unsafe to do so. In one year the death of 40 seamen was caused when a cargo of fine metals liquefied and caused the ship to capsize. This lightweight unit can be safely mounted by pilots within minutes and it can continuously monitor ship movements during an entire transit, directly measuring all six degrees of ship motions in waves – in all weather conditions – from just one internal location on the ship's bridge.

OMC iHeave® was designed specifically for use by pilots to allow them to gather hard data on ship motions under the conditions that are of concern to them. OMC is now offering this vessel measurement and analysis service to other clients. In November last year, OMC iHeave® won the 2012 IJB (International Bulk Journal) Awards 'Innovative Technology' (Marine) category.

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In further developments, OMC has now also delivered a demonstration DUKC® system (the first in North America) to the Columbia River Bar Pilots who are using the OMC iHeave® unit to again measure the severe ship motions of the winter seas.

Mooring Technology

The mooring analysis and design work developed during my years in academia led to the development of a real-time and predictive Berth Warning System (BWS), installed at the Kurnell offshore mooring facility at Botany Bay and also at Hay Point in the late 1990s.

The BWS, which includes the core SPMS ship motion modelling technology, is a scientific tool for reducing the probability of an incident resulting from excessive motions of the moored ship. It allows terminal operators to decide whether to remove a berthed vessel, delay berthing, increase loading rates or simply operate as scheduled. By predicting the loads placed by the ship on mooring lines and fenders, and forecasting wind and waves out to 48 hours, the BWS helps support terminal operators to make decisions about the safe operation of berthed ships. As well as improving operating safety, the BWS also increases port efficiency by reducing the risk that operations will be suspended unnecessarily.

The BWS can also be used as a planning tool. When a number of ships are waiting for the same berth, it allows operators to model several ships over a 48-hour period to ensure operating safety and continuity by selecting the optimum order to load the ships. Vessels of different sizes and stability parameters can experience significantly different motions in the same wave and wind conditions.

Like DUKC® Series 5, the BWS is also available to port users through the internet via a web browser.

It is interesting that, after a decade of no growth in demand for such systems, five new BWS systems have been ordered in the past six months! This must surely be a reflection on the increasing commercial pressure for efficient and safe maritime operations.

The future

The arrival of the mega ships and the rapidly increasing throughput, especially in our hub ports, is



Photo by Captain Robert Johnson, Columbia River Bar Pilots

bringing increased complexity and many changes and challenges to our shipping industry. Port authorities must manage growing commercial demands but also pressure from varying sources such as politics, legislation, regulations, amalgamations, expansions and privatisations. Add in volatile markets, recessions and expansions and there is much uncertainty. As an engineer, certainty is always paramount and I am grateful that the focus of our specialised maritime firm is on providing proven, scientific-based technology which has been safely operating for more than 20 years!

OMC and regulators are fully aligned in their endeavour to support safe and efficient navigation through their ports or waterways and our innovative and award-winning technology is “promoted” in this article in the spirit of communicating the safety and efficiency benefits which it can offer to the maritime industry. Looking ahead, my hope is that OMC will continue for many years yet to innovate and further develop tools which can assist ports to receive big ships and to maximise their throughputs safely.

DUKC® turns 20

This year marks the 20th anniversary of the first DUKC® installation at Queensland’s Hay Point coal terminal in March 1993, made possible by the strong support of our ‘pioneer’ client North Queensland Bulk Ports Corporation (formerly Ports Corporation of Queensland).

DUKC® was introduced into Western Australia (Fremantle Port) in April 1994,

with strong support from Fremantle’s Captain Eric Atkinson, Australia’s longest serving Harbour Master and now President of the International Harbour Masters Association (IHMA). BHP commissioned a DUKC® system at Port Hedland in 1995, and other customised systems were installed at Rio Tinto’s Dampier Port in 1995 and, more recently, in Rio’s Cape Lambert port in 2010. Our systems are successfully operating in most major Australian ports, in NZ and in Europe.

The latest web-based DUKC® Series 5 was first commissioned as operational in 2011 by the Australian Maritime Safety Authority (AMSA) to ensure shipping safety in Torres Strait. In June 2012 the DUKC® Series 5 system was announced 1st Runner-Up in the prestigious 2012 IHS Safety at Sea Awards for Engineering Excellence.

OMC’s technology not only maximises port capacity but also improves pilot safety, equips port authorities with essential risk mitigation tools, minimises dredging and saves billions of dollars in shipping costs of transporting cargo and container goods around the world. It has a 20-year incident-free safety record.

That’s worth celebrating!

* In June 2010, in the Queen’s Birthday Honours List, OMC founder and executive director Dr Terry O’Brien, who is a Melbourne engineer and former academic, was awarded a Medal of the Order of Australia (OAM) for services to the maritime transport industry. ▲