HOW SIMULATION IMPROVES PORT OPERATIONS



PREPARATION AND TRAINING FOR SAFE LARGE VESSEL TRANSITS

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As the mega ship era continues to unfold, the margin for error when large vessels approach and depart ports is nil. Improvements in port infrastructure, such as the widening and deepening of channels, along with upgrades to piers and cargo handling equipment is necessary for ports to capitalise on new economic opportunities.

In addition, the collaboration of humans and technology is necessary to make vessel berthing as safe as possible. In order to assess if ever-larger ships can safely navigate waterways, both ports and pilot organisations have turned to navigation simulators to verify and validate the most appropriate procedures. However, despite using these best practices, pilots are also being challenged by some waterways where port infrastructure has not yet been adapted for the large vessels, so they must adapt as best they can until improvements are made.

NEW VESSELS, NEW TECHNOLOGY

Vessel sizes have increased exponentially due in part to the new Panama Canal. But even before it opened, the pressure was there for larger ships. In the 70s, we saw large tankers, VLCCs and ULCCs appeared at our sea buoys. Now we see new Panamax and Post-Panamax container vessels, Quantum cruise ships, large gas carriers and capsize bulk carriers requesting berths, tugs and pilots.

In the past, the work of a trained pilot was performed with a keen eye. Now, thanks to advances in technology, pilots can add a new level of expertise to their local knowledge and shiphandling skills that makes their job much more efficient.

PORTABLE PILOT UNITS (PPUS)

While pilots are well-versed in the latest onboard systems on various ships, it has now become practically mainstream for them to use PPUs, adapted to the local area, to help with maneuvering large ships in evermore confined areas. Why? Because the sheer size of these vessels makes it difficult to judge speed and rate of turn. For example, in the 1970s, VLCCs were mostly confined to outer harbours or even mooring buoys. Today, large vessels are being sailed to terminals up rivers and canals that were not designed for their sizes and drafts.

A PPU provides pilots with additional geographical data above what's available onboard, to help with navigation. For example, multiple and accurate tide meters, high-density datum, accurate traffic information through traffic management systems and AIS information is easily provided with a quick touch or click. This information is crucial to pilots as it provides more real-time situational awareness than ever before. PPUs can also be used during simulation training.



View of one of the four Navigation Bridges at the Maritime Simulation and Resource Centre (330° Full Mission Class "A", DNV approved). Ship models and Geographic Database developed in-house by MSRC. (credit: MSRC).

HOW SIMULATION BRINGS STAKEHOLDERS TOGETHER

With ever-larger ships calling, ports see opportunities in growth and competitiveness. But before the pilots agree to accommodate longer, wider, higher and deeper vessels, a meticulous process needs to take place.

The pilots, together with the various local government, industries, environmental and even citizen committees, must evaluate the feasibility of these requests and ensure that the safety of navigation and the protection of the local environment will remain a priority.

The goals of using navigation simulators are three-fold.

- Study and evaluate the feasibility of a new project or procedures.
- Determine the most efficient procedures and set the safety parameters and limits.
- Train the professionals involved in the new procedures and inform them on the limits and safety parameters.

CUSTOMISED PILOTAGE DATABASE AND SHIP MODEL

Any development study must start with building the database of the local pilotage area including bottom, current, high-density bathymetry, navigation aids and berth. Technicians will create a model identical to the ship and the maneuverability data will be refined until approved by the pilots (pilot's grade). The pilots will evaluate the maneuvering characteristics of the new vessels as expected as per SOLAS international standards.

The model will then be reevaluated in the database to ensure that it reacts properly with the local environment such as banks, currents and other vessels. The experience and expertise of the pilots are crucial at this phase of the evaluation. Being part of the approval of the model and database will give the pilots confidence in the validation of the whole process. It will be key to their approval of the conclusions of the study and acceptance of the upcoming training that will follow. The ship model and database quality are of great importance, especially current data. Having more realism will help the pilot use his references and give him confidence.

TRIAL MANEUVERS

The study can then begin with trial runs in preselected areas. These areas are selected for their sensitivity to risk such as, for example, shallow waters, bends, meeting areas, speed restrictions or even suction effects on moored vessels. Transit speed in relation to under-keel clearance, air draft, impact on existing traffic, tide windows, can all be evaluated. These are some of the elements that can be used to assess if the project is feasible.

Another advantage of using a ship simulator is that it is possible to adapt the database by modifying the depth of the channel, the shapes of the bends and thus minimise the dredging work necessary. At this stage, it is also possible to alter the position of the berth to be built in order to reflect the safest and most efficient practice experienced during the trial runs.

SETTING SAFETY PARAMETERS FOR STAKEHOLDERS

Once the feasibility has been proven, the next step is to set the windows of safe operations. The wind speed limit is the first obvious limit to be set. State and height of the tide for the approach and departure is another. By doing so at this point, all parties involved set out with the same set of rules. Each one has been informed and can see first-hand why the limits are set at a certain



Post-Panamax Containership model used for training Houston Pilots for approach of large vessels on the Houston Channel (credit: MSRC) the Corporation of

level. This eliminates further arguments on when operations can and cannot be undertaken. It sets the number and also, in certain cases, which type of tugs (propulsion type and power) need to be used.

This aspect that simulator studies have brought cannot be underestimated; the port authorities are confident that their infrastructure will be safe. Tug operators have a clear understanding of the assets that will be required. For pilots, it gives a clear indication of the limits of operations. For the terminal and the ship itself, it gives them clear information on operations, for example, the possibility to adjust the arrival or departure time and draft of the vessel. Having clear procedures and safety guidelines greatly improves efficiency for all parties.

TRAINING FRONT LINE PROFESSIONALS

With the new berth being built or the new, larger vessel's arrival deadline coming near, it becomes essential to train the front lines professionals. The procedures that have been deemed safe and efficient in the evaluation of the project now need to be shared with all involved in the practical operations. The ship model and the database which were built for the evaluation are now available for training.

From the study's recommendations, practical exercises can be elaborated so that those who will be on the front lines can understand and experience the new challenges ahead. This kind of hands-on training is highly valuable. It gives confidence. It sets normalised procedures which in turn increases safety and efficiency.

Simulators now have the capacity to train several students at once, for example pilots can train alongside tug captains. Participants can exchange their point of view and agree on set procedures. Exercises can be taken to the limit without any danger to ship or shore infrastructure.

Here, it is vitally important that all key players, from management to captains and crews of the large vessels, tugs, port personnel and traffic managers, etc., communicate effectively during both the planning phases as well as during real-time operations.

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ABOUT THE ORGANISATION

Based in Quebec City, Canada, the Maritime Simulation and Resource Centre (MSRC) is a purpose-built total turnkey port procedural development centre, and one of the few facilities in the world offering a full range of simulation options spanning from standalone desktop simulation to fully interactive, manned tug and large vessel simulations. MSRC also builds customised pilotage databases and ship models that allow pilots to train in their own real-world conditions. MSRC is a division of the Corporation of Lower St. Lawrence Pilots.

ENQUIRIES

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