

## Achieving perfection in an imperfect world

**If terminals were operated in a perfect world, simple scheduling tools to monitor both loading and unloading of vessels would be sufficient. In addition, vessels would arrive at the exact second they are scheduled and waiting times would never occur. World Port Development explains...**

**T**here is only one problem with the above statement and that is we don't live in a perfect world. Vessels can arrive early or they might be delayed due to a number of factors. If this is taken into account, a whole new world is opened up that consists of waiting times, congestion, lack of tugs, crane capacity and berths. Fortunately, terminals have options to use current infrastructure to its full potential by changing the cargo flow, adding a (dedicated) berth for loading or unloading operations and improving handling capacity or use advanced scheduling systems to cope with the variability in arrivals.

### Simulation

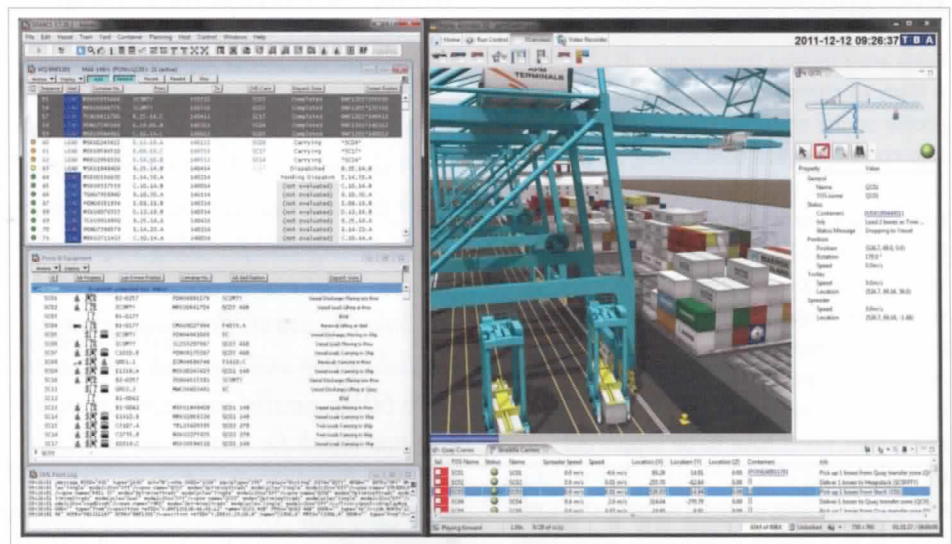
But before approval is given for example for the construction of a new berth, operators might consider the use of simulation before making such a financial investment. Simulation will be a cheaper option to give the operator an insight into their current operations and how their investment – in new berths, cranes, tugs, etc - will affect their future operations. Systems Navigator - an independent consultancy company based in the Netherlands specialises in the design and creation of decision support solutions based on operations research technology. Their specific expertise is in using a combination of discrete event simulation

and optimisation for decision support models that can predict system performance as well as operational decisions by means of planning and/or scheduling. Simulation can provide clients with a global rollout of a strategic decision support system capable of performing in-depth studies, such as berth occupancy analysis in various terminal configurations and weather patterns. For one particular client over 20 terminals were simulated in Argentina, Belgium, Brazil, China, Dubai, India, Indonesia, Malta, the Netherlands, Oman, Panama, Singapore and USA. To maximise their results Systems Navigator employees supported simulation workshops and terminal operation analysis to the client. The simulation project gave the client an insight in their tank terminal network through acquisitions, new constructions and

upgrades for existing facilities. Simulation can also reflect potential bottlenecks in infrastructure when converting for example a re-gasification terminal into a combined re-gasification and bunkering terminal. A combination of simulation modeling and scenario Navigator interface software can be used to analyse over 75 scenarios. The result of this research can be the basis for advice given to management on the minimum investment needed to facilitate the number of desired yearly vessel arrivals.

### On terminal

Once the terminal or port has sorted their infrastructure the next step would be to look at their operations. In particular, the loading and unloading operations of a terminal once the ship has moored. Netherlands-based TBA is an international provider of decision support and operations optimisation services. Its product lines are concentrated around simulation, emulation and vehicle control. TBA's simulation software (TimesSquare and Trafalgar) enables container terminal operators to analyse short - and long term needs, quantify requirements and make the best informed decisions on the design of new or extended terminals. The software can assist in questions, such as, what handling system provides the best solution for a new green-field terminal, how much equipment is required to achieve the desired productivities, what is the impact of enhanced stacking strategies, what is the impact of particular layouts, routing patterns, etc and what is the energy peak from all electrical equipment and how long does it last? "What we have experienced is that the range of questions that can be answered has increased

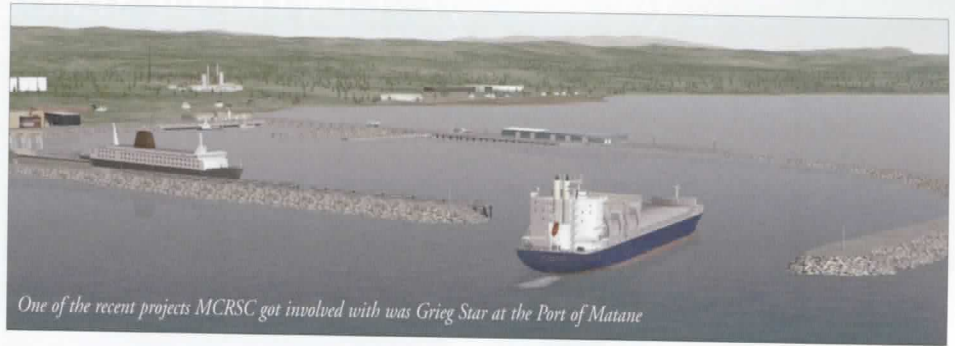


CONTROLS in operation. Left the TOS (SPARCS 3.7) and right, a screenshot from the execution of the moves that the TOS sends as well as the status of the equipment executing the moves

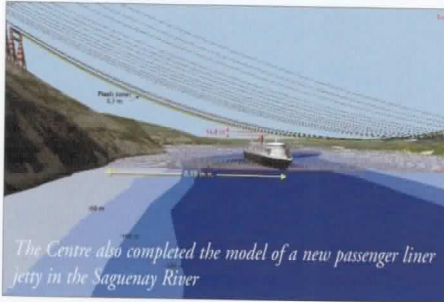
over the years, while we expand our models," said Yvo Saanen, Managing Director/COO at TBA. "Also, new types of equipment are being tested. Think of shuttle carriers that can carry two 40' containers next to each other (2006), the lift AGV (2006 and onwards), the cassette AGV (2007), the automated shuttle carrier (2008), the cross-over triple RMG (as realised at Burchardkai), the stacking crane that carries two 40' containers and all kinds of quay crane concepts including APMT's FASTNET crane." Next to simulation software, TBA's emulation software (Control) enables customers to test and tune their Terminal Operating System (TOS) in realistic circumstances, thus allowing for enhanced implementation efficiency and optimised terminal performance. TBA's Control software has meanwhile been applied in more than 40 terminals world-wide, assisting in performance testing of new TOS releases, or new TOS modules. It has been linked to 7 different TOS systems, ranging from Navis' Spars to TSB's Catos and RBS' Topx. Nearly all (semi-) automated terminals have used or are using Control software to ensure that the performance of their TOS under complex circumstances can be reached. "For a few years now, Control is also used for training the users of TOS under what we call 'near to live' circumstances. Vessel planning, yard planning, equipment deployment, and real-time control, are all being executed through TOS against the emulation model of the terminal. As such, all trainees work against a terminal that behaves exactly the same, and thus the quality of their plans and control can be measured objectively. DP World has already developed an entire training programme around the emulation, which is well-received world-wide," Saanen added. The objectives for the coming years range from automated optimisation of parameters, to plan validation (check of vessel plans before executing them) to parallel simulation to the operation with a short look ahead to warn for upcoming problems, such as quay crane clashes, yard clashes, or other sources of productivity loss.

## Tug boats

There is one 'issue' that remains and that is the continued training of operators of tugs, pilots and vessels. As we have seen from the other simulation article in this issue the need to enhance the skills of operators can be done through simulation. One company that provides such a service and has a reputation for its excellent facilities is the Maritime Simulation and Resource Centre (MSRC) in Quebec, Canada. In 2005, spurred on by the desire to offer the best possible training for



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its members, the Corporation of Lower St Lawrence Pilots (CLSLP) acquired a USD3 million state-of-the-art marine multi-disciplinary navigation simulator from Kongsberg Maritime. The popularity of the simulator, and the increased demand for its use (the lower St Lawrence, which runs between Les Escoumins and the Port of Québec, is known for its large tides, fierce currents, and fragile ecosystem, and requires consummate skill and knowledge to navigate), necessitated the development of MSRC. Today, the MSRC provides leading-edge training by pilots for pilots from across the country, and is one of the most respected and unique simulation centres in the world. The centre boasts some of the world's most modern and up-to-date equipment with four navigation simulators recreating geographical areas and offer users a wide variety of vessels equipped with the most up-to-date navigational instruments. For pilots, the need for training never stops and in addition to the dedicated training of the CLSLP members, the Centre has opened its doors to anyone seeking skill improvement techniques, the design of appropriate ship handling techniques for pilots, as well as for masters and officers, highly realistic tug escort and tug assisted berthing and un-berthing operations with large vessels, and to run the necessary simulation exercises in order to validate each individual project. "Every year, the safe navigation of thousands of vessels in the Lower St Lawrence pilotage district depends on our expertise," said Simon Pelletier, a CLSLP board member. "Every year, we sail on a growing number of increasingly sophisticated ships. These new classes of tankers, cargo and cruise ships are faster,

larger and rely on more advanced propulsion control systems with integrated, sophisticated electronic navigation technology. This means our pilots must constantly apply their extensive knowledge of local conditions to the varying performance characteristics of a large variety of ship categories." One of the recent projects MSRC got involved in was with Grieg Star, an integrated shipping company, which used the services of the centre to determine safe and appropriate procedures for approaching, berthing and un-berthing manoeuvres at the port of Matane, for their K-class general cargo bulk carrier. CLSLP pilots used the DNV Class "A" 330 degrees Full Mission Simulator to conduct a series of simulations with different weather conditions in order to establish the operational limits or approaching, berthing and un-berthing manoeuvres without tug assistance. The MSRC developed three different ship models of the K-class, the Port of Matane geographic database and integrated the currents used for the simulations. Other projects the Centre already completed or which are in progress include LNG terminals at Lévis and Gros Cacouna - a special project cargo carrier, the St Lawrence Seaway database development for emergency procedure training, model of a new passenger liner jetty in the Saguenay River and a dredging project in Cacouna harbour. It also participated in a simulation project to assess the feasibility of a new terminal in the port of Quebec. Pilots, port management and ship management came together to observe how the simulated vessels could safely dock and berth at the virtual terminal. The big advantage of the simulator for the Quebec project, for example, was that promoters wanted to build a new dock but they couldn't quite say what the impact on the other stakeholders in the area would be, and how it would be feasible for vessels to safely berth and leave in different conditions. So instead of building without knowing, MSRC integrated the dock facility that they planned to build into the database and did a whole range of simulations. The simulation exercises potentially saved millions of dollars not to mention innumerable headaches. ■