Port of Rotterdam maneuvres in SSPA´s simulator lab gives higher accessibility for large tankers

SSPA was contracted by the Port of Rotterdam to improve the maneuverability for large tankers at the Port and to optimize dredging requirements to improve accessibility for large tankers into the Botlek area. The customer put very high demands on model accuracy regarding vessel behavior, operating in very shallow waters and under stressed tidal and multilevel current variations. Effective and flexible simulation tools giving pilots high accessibility was of the utmost importance. The project was a challenge for SSPA’s experts due to the advanced modeling of stratified current patterns to be carried out using the well-established SEAMAN simulation tool. At the same time, it would be the maiden voyage for SSPA´s new and improved simulation lab.

Currents
The current is always a concern when maneuvering a vessel in the Port of Rotterdam and the pilots who work there have extensive knowledge of the current at different times during its 24-hour cycle. In order to improve accessibility and safety for large tankers into the Port of Rotterdam, hypothetical future scenarios had to be analyzed and questions answered: how will dredging change the current situation and how would this affect pilots maneuvering vessels into the area? The Port Authority had developed a very advanced CFD model of the currents in the harbor area. Very high-resolution current patterns in the harbor were presented in four dimensions, time and space.

How much would the proposed dredging increase the maneuverability of vessels entering the port, and what would this mean for accessibility? How many more vessels would be able to enter during a high water period after the dredging?

The key issues were defined and highlighted immediately. Realistic vessel behavior was extremely important for reliable simulation results. Furthermore, due to the huge variation of currents over depth and position at the port area, correct modeling of the currents’ influence on the vessel was another critical issue to achieve that realism. SSPA’s SEAMAN Software and SSPA’s considerable knowledge in modeling shallow water operations could meet the vessel-manoeuvering modeling required. The project plan and number of variations to be simulated demanded high flexibility in layouts and conditions, as well as high accessibility.

Customized lab set up
The tool used for simulations at SSPA is SEAMAN, as described earlier in Highlights. SSPA’s simulation tool has been developed in-house for 30 years, drawing on decades of theoretical and practical research, as well as model scale tests carried out in SSPA's basins. It is used for all types of simulations in different configurations: fast-time, desktop, full mission, or in any other variant that is needed to solve the customer’s problem. It is truly a bespoke simulation tool.

SEAMAN was used to set up two bridges, one full mission bridge with a 300° view, and one designated tug bridge with a 150° view, both located in SSPA’s simulator lab. In addition to the tug-bridge, up to three automatic tugs controlled by the simulator operator were used.

Linus Aldebjer
Project Manager.
He studied Engineering Physics at Chalmers University of Technology. Previously he worked as Software Architect at Saab Underwater Systems, Motala, Sweden. Since he was employed at SSPA in January 2011, he has been leading the work to upgrade SSPA’s simulation tool, SEAMAN. He has also been involved in various research projects developing route optimization and mathematical modeling.

Contact information:
Direct: +46 31 772 90 77
Email: linus.aldebjer@sspa.se
The Botlek area of Rotterdam was built up to provide both visual models to the bridge view and input to SEAMAN’s mathematical models of the influence of banks and depths on the vessels. Modifications were made in SEAMAN to handle the detailed current model provided by the customer. Two sets of typical simulations were carried out – one with the more detailed current model and one without. Comparison of these two results made it clear that the customer had been correct in their first assumption, correct modeling of the complex current patterns in this area significantly improved the accuracy of the simulation. SEAMAN was modified to handle a fourdimensional current model. This was the first real time simulation tool able to handle this that the customer was aware of.

**Simulations**

Two skilled pilots recruited from the “Loodswezen” together with a tugboat captain and port representative, carried out the simulations in close cooperation with SSPA’s maneuvering experts. Models were created and used of four different types of vessel and two different tugboats.

For each simulation, the opinion of the mariners of the outcome of the simulation was compared with SSPA’s margin-based Safety Index calculations. SSPA’s project manager and nautical experts compiled results to answer the Port of Rotterdam’s initial question: How much will accessibility to the harbor increase with the modifications?

**Answering the customer’s question**

After two weeks of successful simulations and analysis, the results were quantified and a “window of opportunity” for docking was created for each port configuration and type of vessel.

This was the answer to the customer’s question. SSPA’s long tradition of simulations, the decades of experience in vessel dynamics, the modifications made to fit this particular project, as well as close cooperation with the customer, all gave credibility to the results. But the ultimate proof was from the professional experts in vessel manoeuvring at the Port of Rotterdam – the pilots operating there. “After the initial calibrations, the behavior of the vessels was very realistic,” said Jose Van Rijsewijk, a pilot at the Port.

This demanding and challenging project showed the capability and flexibility of SSPA’s modern simulation lab and well-established modeling resources, all of which have been set up to provide the customer with reliable answers.

After SSPA presented the final report the Port of Rotterdam was confident they had enough background information to make a decision. It was decided to dredge the “thorn” portion of the investigated area, as this would increase accessibility for large tankers significantly.