



# SIMULATORS SUPPORT SAFE PORT NAVIGATION



**HR Wallingford**  
Working with water

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Ship simulators have become much more realistic, accurate and quick over the last three decades, underpinned by the steady growth in the processing power of computers. It is of little surprise, therefore, that they are playing an ever greater role in contributing to port safety through, for example: pilot and tug master training, and their continual professional development; supporting changes in the design of ships, ports and terminals, and helping pilots and tug masters to become familiar with those alterations; and investigating incidents and near misses in ports.

## **EVALUATION, MODELLING AND ASSESSMENT**

Simulation has been used by hydraulic organisations (including HR Wallingford) for over 30 years to evaluate the impact of new ships in ports or terminals, in terms of manoeuvrability, environmental limits and towage requirements. This process

continues to improve thanks to higher quality modelling and higher definition images. For new ships or for changes in areas such as engine performance, it is invaluable to know in advance that the vessels will be able to manoeuvre safely in port. Ship simulation teams, such as ours, therefore build hydrodynamic models of the ship before it is constructed (or during construction), along with a model of the port in question. This includes hydrodynamic modelling of current and flows to create realistic navigation scenarios.

Once these models have been created and installed in the simulators (typically functioning ship and/or tug bridges surrounded by a 360-degree simulated environment), pilots and tug masters can use them to assess the situation or develop the best methods to handle the ship. This assists in determining the limiting conditions in which it can enter and leave the port safely. A simulator can

help a pilot understand, quantify, and use the hydrodynamic forces acting on vessels to their advantage, which can be many hundreds of tonnes on the largest ships. Simulations can also help contribute to feasibility studies and risk assessments for the owner and ship operators/owners.

## **PORT AND TERMINAL DESIGN**

In cases where ports or terminal operators wish to investigate possible alterations in layout if needed to accommodate new ships, simulators can make an important contribution to the design process. Accurate modelling of a new layout can show the impact on navigation of alterations. Subsequently, pilots, tug masters and vessel traffic service operators can all train together in on linked simulators to familiarise themselves as a team with the new layout. At HR Wallingford, for example we have enough simulators to represent a whole manoeuvring team at either of

our Ship Simulation Centres in the UK and Australia.

**LINKED-UP BENEFITS**

As well as linking the machines to examine the impact of new vessels or layouts, a joined-up approach is also ideal for team training. There are many scenarios where team training can contribute to port safety by, for example, practicing emergency response or investigating new manoeuvring strategies. Systems can be set up to be extremely flexible. For example, all HR Wallingford simulators (five in the UK, six in Australia) can be easily configured to simulate different types of vessels, as required.

**TRAINING AT ALL LEVELS**

Simulators can, of course, also be used individually, and they are now widely employed in pilot and tug master training for learning certain manoeuvring techniques, moving up class and refresher courses. Pilots can use simulators to practice high risk manoeuvres in complex areas, such as navigating to a difficult berth, to gain confidence and reduce the risk of accidents. Simulators can also create weather conditions, such as squalls, which otherwise may not occur regularly, yet require specific expertise.

It is essential in training that pilots and tug masters learn on realistic, high quality models of their actual port. The quality of simulation combined with the bespoke facilities that are specifically designed for the simulation of pilotage have been key to its success as a training tool. If marine pilots and tug masters are operating in a port that they know well, their confidence is boosted by seeing that the simulator correctly replicates existing navigation conditions and the layout of the port.

**NEAR MISSES**

Another important role in port safety that simulators can play is in scrutinising near misses or incidents in port. By being able to recreate an incident on a simulator, port or terminal operators may identify a modification that would reduce the likelihood of it recurring, for example in the layout, procedures, or manoeuvring strategies. Taking such actions also demonstrates that issues are being investigated thoroughly.

**FLEXIBILITY**

When examining port and terminal designs, it is important that the simulation models can be altered easily and quickly to allow potential changes to the layout to be modelled and assessed efficiently. Inbuilt flexibility also makes it possible to tailor scenarios to the specific training needs



of the pilots and tug masters. In our Ship Simulation Centres, we have personnel available to discuss and make modifications of all aspects on the spot, as needed.

**PEOPLE POWER**

While hydraulic modelling capabilities and ship handling models are of course essential to ship simulation work, the support of people on the ground makes a real difference. In our Ship Simulation Centres, for example, we draw on an expert team of experienced maritime engineers, master mariners, pilots, tug masters, naval architects, scientists and software modelling

experts, and these are underpinned by HR Wallingford's broader maritime and coastal engineering capabilities.

**THE NEXT STEPS**

Given that processing power is very likely to continue to grow, ship and tug manoeuvring models will no doubt become even more sophisticated. It will also be possible to make even more advances in the detail of visual scenes, and models will be able to handle more complex data even more quickly. Every step forward in simulation will contribute to ensuring that navigation in ports becomes safer.

**ABOUT THE AUTHOR**

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 Dr Mark McBride has more than 30 years' experience in port and maritime design related work. He is responsible for all HR Wallingford's studies relating to ship motion and offshore applications, including vessel manoeuvring, ship mooring and port/terminal operations. He has a degree in naval architecture and a doctorate in port operations simulation, and has managed a wide range of ship and offshore related projects. He regularly chairs and participates in PIANC, SIGTTO and British Standard Working Groups.

**ABOUT THE ORGANIZATION**

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 HR Wallingford is an independent engineering and environmental hydraulics

organisation. We deliver practical solutions to complex water-related challenges faced by our international clients. We own and run ship simulation centres in the UK and Australia. Our unique mix of know-how, assets and facilities also includes state of the art physical modelling laboratories, a full range of numerical modelling tools and, enthusiastic people with world-renowned skills and expertise. A dynamic research programme underpins all that we do.

**ENQUIRIES**

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