

Offshore tug simulations in extreme environments



MARIN's tug simulators were recently used to investigate equipment requirements and limitations of tugs working in extreme conditions.

Offloading operations are taking place in more and more challenging environments. And in some of the most challenging locations offloading operations are faced with rapid changing environmental conditions like squalls and solitons (rapidly changing currents). The MARIN study looked at the effect of these events on a moored tanker, assisted by a single pull-back tug, with a particular focus on the safety aspects.

A desk study was performed to define the critical conditions and fast-time simulations were used to narrow down the number of design conditions. Then a series of real-time simulations were carried out using MARIN's tug simulators. A mooring master on the ship's bridge controlled the operation and directed the tug, while the tug master steered the tug. This meant that the exercise was as real as possible and assured that realistic tug strategies were used. During the study different tankers and tug types were tested with different line lengths and towing points. The tug models included realistic

stability characteristics, which also meant that they were able to capsize.

The squall conditions included a sharp increase of the wind velocity in combination with a sudden change in wind direction. Under these conditions the offloading tanker starts to rotate to a new equilibrium heading and position. The pull-back tug was used to keep tension on the hawser and to prevent a collision between the tanker and the offloading buoy. However, if the tanker rotates quickly the tug can be pulled along, which may bring the tug itself into a hazardous situation. MARIN examined parameters like deck edge emersion, heel angles, station keeping capabilities etc. and found large differences depending on the towing configuration.

This fresh insight will be used in the planning of offshore operations in the future. It also helps when decisions need to be made about the choice of equipment for terminals where extreme conditions can be expected. □

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