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# Jack-up operations
# improving efficiency and reducing risk

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## Abstract

Manoeuvring simulators are widely used within the maritime sector for evaluation of port lay-outs, risk analysis, general planning of operations and training of navigators.
The concept is gradually being adopted by the offshore sector to train and evaluate the feasibility of ship-to-ship operations, single point moorings, and not least installation of offshore wind turbines using jack-ups or similar.
Especially the latter use requires that the simulators are able to accurately simulate the critical operations of jack-up installation and maintenance vessels.

## Objectives

The ability to simulate the entire operation i.e. from when the jack-up arrives at the position and to the more critical elevation and pre-loading stage reduces risks and uncertainties considerable as operations may be planned, rehearsed and procedures adapted based on the experience gained. Further this adds to defining the performance envelope relative to the conditions at a given site thereby quantifying the risk associated with each stage and consolidating the decision support data.

## Methods

A jack-up simulator module has been developed which includes the effects of wind, current and waves on the legs as well as thruster-leg interaction as the legs are lowered and retrieved.

Typical simulation scenarios have emphasis on the critical phases during soft pinning where the spud cans make the first contact with the seabed and when the spud can penetrate the seabed until sufficient bearing capacity has been achieved.

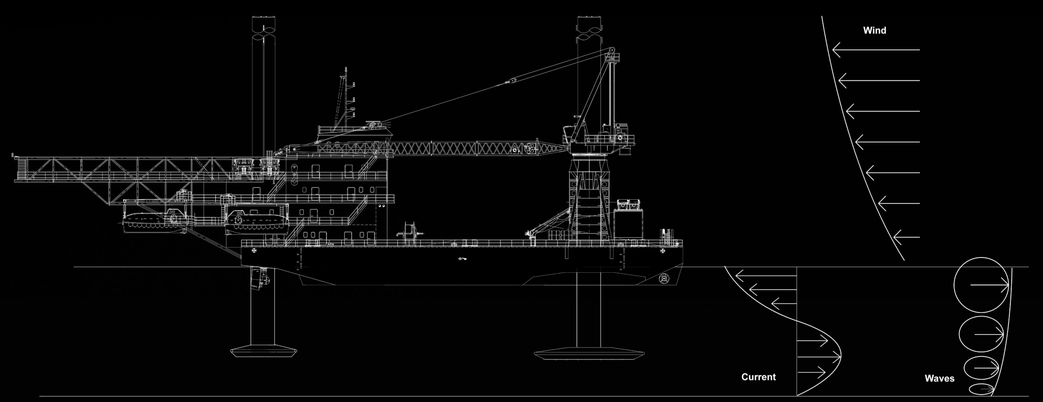
The soil bearing capacities are modelled as a function of depth and associated with the individual spud can.

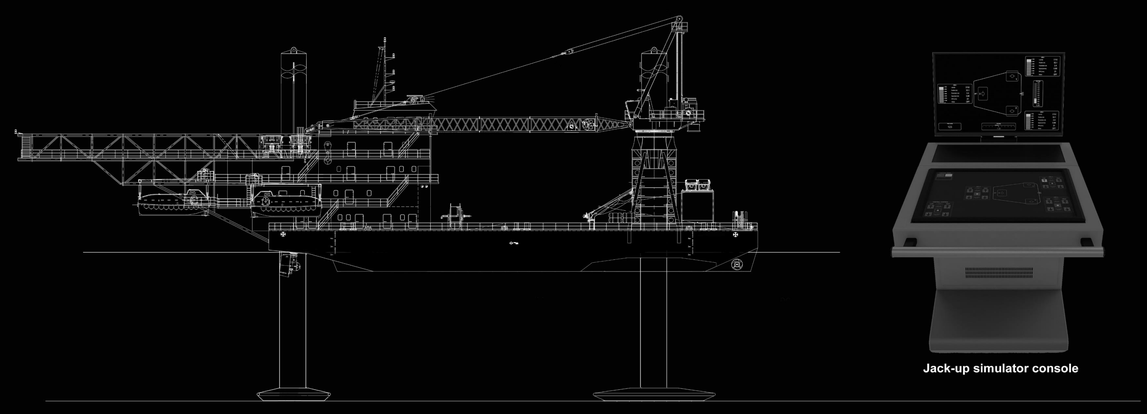
## Results

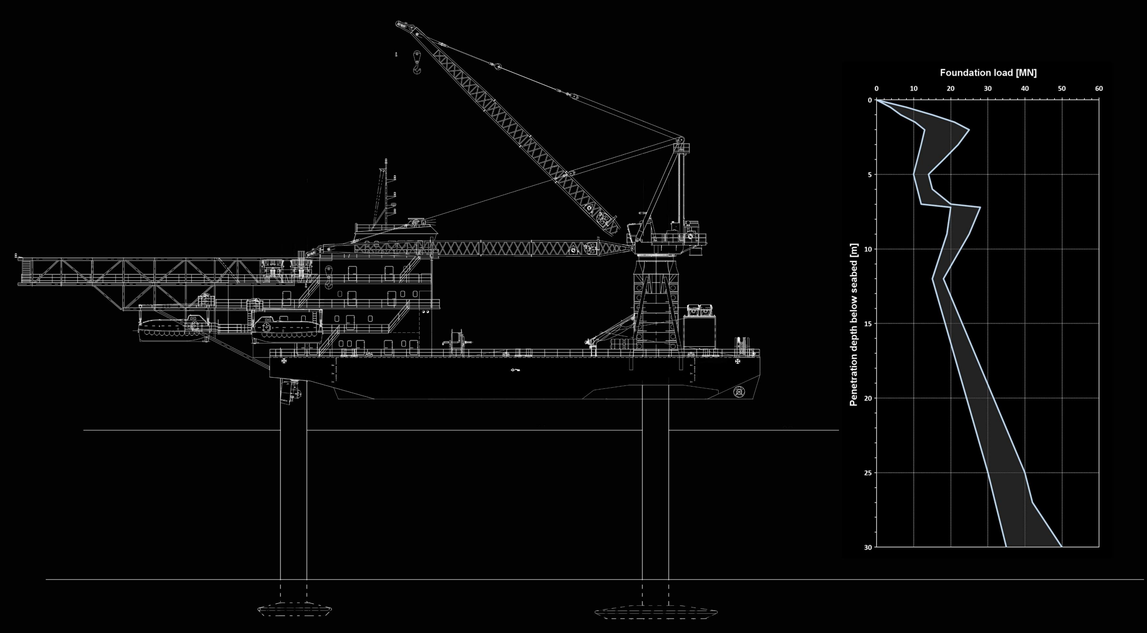
The new jack-up modules will have a significant impact on safety and efficiency as it will enable operators to undertake a mission with navigators and jacking engineers well trained and with a preconception of what to expect and how to react.

## Conclusions

A relatively simple model for the elevation mechanism is found to be adequate, while the forces - due to vessel movements, current, waves, wind and thruster interaction - acting on the moving legs are calculated using the Morison equation giving the drag forces and the inertia forces. The bearing capacity curves for the actual site in question are used to calculate the vertical forces which results in the vessel being lifted out of the water and critical events like e.g. the effect of unexpected punch through can be simulated.
Further the paper demonstrates how the jack up functionality has been integrated with a full mission simulator environment complete with generic instruments including jacking monitoring and control panels and an operator control system which makes it possible to alter the conditions and introduce events, e.g. an unexpected punch through as well as monitor and record the operation for debriefing sessions.

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