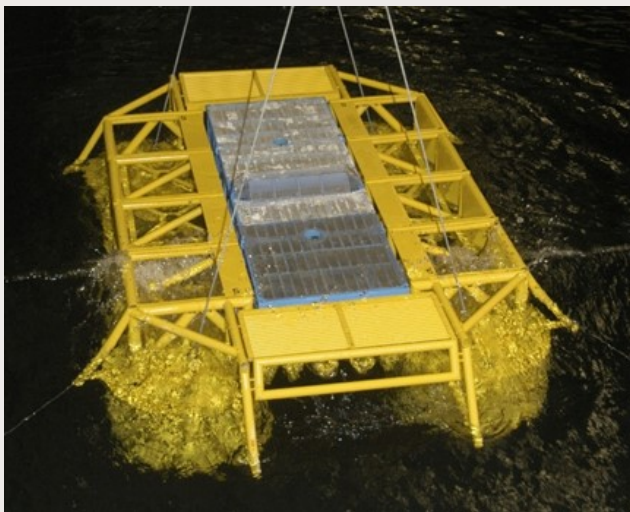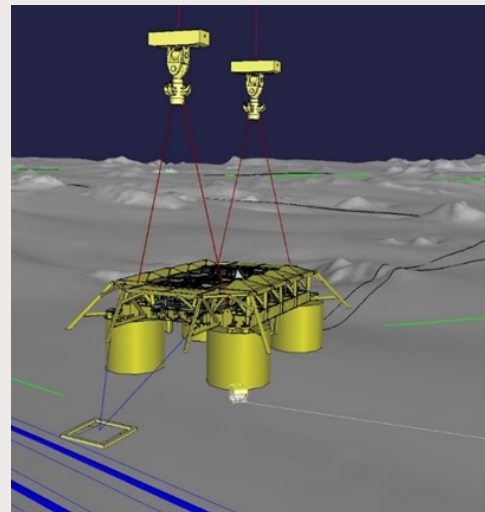# Marine Operations

Crane and lifting operations offshore involve a series of weather sensitive activities. To ensure safety and efficiency in the operations, numerical simulations and model tests are used both for feasibility studies of new concepts and to determine the limiting sea states for a particular operation.

Model testing to obtain hydrodynamic coefficients for use in the numerical model of the installation operation.

Simulation of landing at a target on seabed.
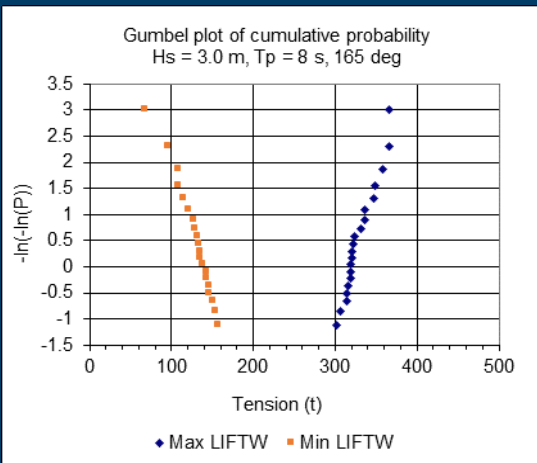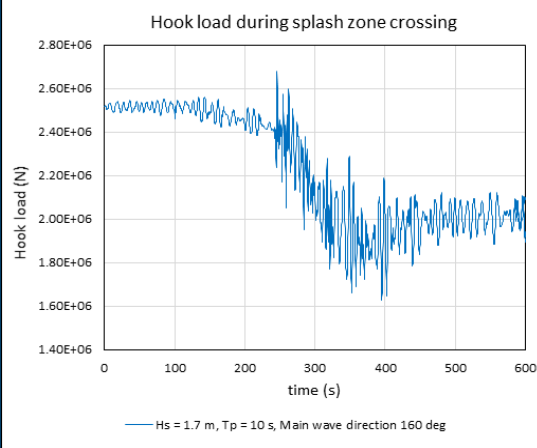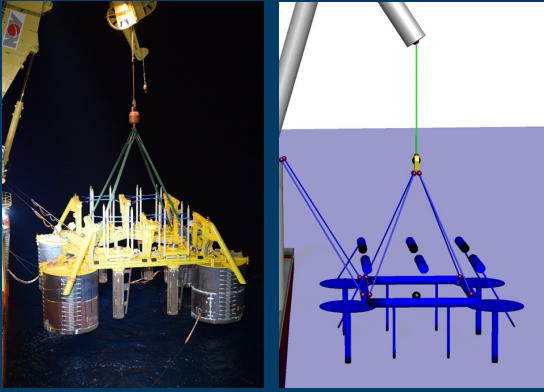
OUR EXPERTISE AND SERVICES

SINTEF provides solutions to analyze different marine operation scenarios. The solutions can be provided by two means: model tests and numerical simulation.

The SINTEF developed tool **SIMA** offers possibilities for numerical modelling of hydrodynamic response of slender marine structures and large volume floating structures by use of the time domain simulation codes **SIMO** and **RI-FLEX**. Coupling wires for towing and lifting, winches, tugger wires, cranes, fender/bumper/docking cone contact and ballast system can be modeled. Combination of the tools provide solution for numerical simulation of the different marine operations with body motions, line tension and contact forces reported. SIMA includes a work-bench with modelling environment, post-processor and workflow environment. 3D visualization of the simulation is available.

The **Ocean Basin Laboratory** is used for basic and applied research on marine structures and operations. A total environmental simulation including wind, waves and current offers a unique possibility for testing of models in realistic conditions. Smaller test tanks are also available for feasibility studies and establishment of hydrodynamic coefficients of subsea structures.

INSTALLATION AND SIMULATION

Hook load during splash zone crossing

— Hs = 1.7 m, Tp = 10 s, Main wave direction 160 deg

Gumbel plot of cumulative probability
Hs = 3.0 m, Tp = 8 s, 165 deg

♦ Max LIFTW ■ Min LIFTW

Installation of an Integrated Template Structure (ITS) modelled and simulated by use of SIMA. Depth dependent hydrodynamic coefficients are used on the ITS model to ensure realistic wave forces on the structure during splash zone crossing. A series of simulations of the lowering through the spash zone are performed and minimum and maximum forces extracted to determine limiting seastate for the operation.

EXAMPLES OF MARINE OPERATIONS ARE

- Crane operations with lift off from vessel deck or barge
- Lift and handling of heavy loads in air
- Installation of sub-sea structures with lowering through the splash zone and landing at target on seabead
- Retreaval of subsea equipment
- Lifting operations from vessel to platform
- Subsea and surface towing
- Float-over mating
- Decomissioning and removal of platforms
- Transport and installation of offshore wind turbine foundations
- Installation and maintenance of offshore wind turbines

PROJECTS / RESEARCH FIELDS

- Numerical modelling and simulation of crane operations including lift off from deck, splash zone crossing and landing on sea-bed
- Numerical analysis of new concepts for installation of subsea equipment
- Model testing and numerical analysis to obtain hydrodynamic co-efficients for structures to be installed
- Numerical analysis and model tests of concepts for decommissioning and removal of oil and gas topsides and platforms
- Transfer of personnel between vessels/platforms (walk-to-work)
- Participation in HAZID/SJA meetings, based on simulation results

USEFUL LINKS

- SIMA - www.sintef.no/en/software/sima
- Ocean Laboratory - www.sintef.no/en/all-laboratories/ocean-laboratory
- SFI MOVE - www.ntnu.edu/web/move/move-marine-operations-center

SINTEF

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