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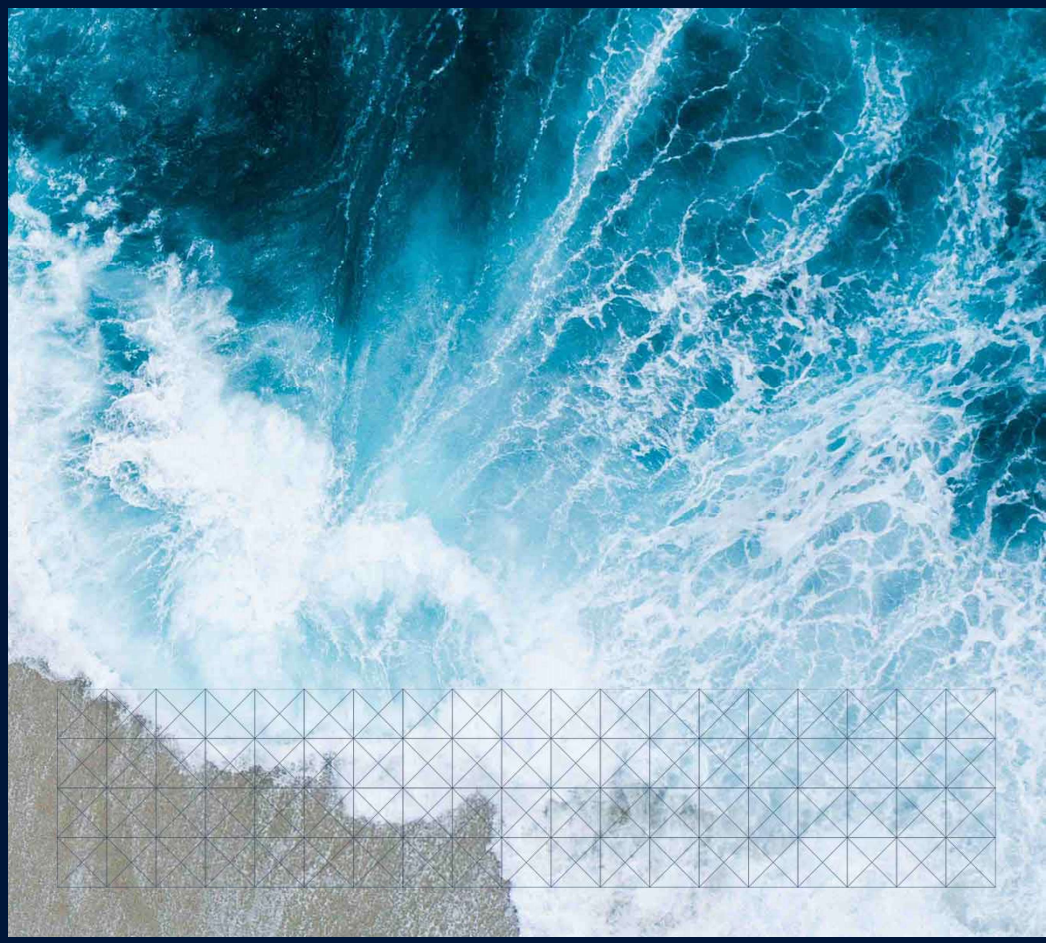
COASTAL ENGINEERING DAY, MARIN
BYGGTEKNIKKDAGEN - 2019

Improving marine operations with real time simulators

29.04.2019

Bård Thingstad



SMS/SMSC History

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1980 STATENS TRENINGSSENTER FOR SKIPSMANØVRERING

- Simulator from Fokker
- Training pilots – Brevikstrømmen
- Ship handling training
- 6 employees

1986 SIMULATOR TRAINING FOR SHUTTLE TANKERS

- Following Statoil requirements
- Inspired by aviation industry

1990 SHIP MANOEUVRING SIMULATOR CENTRE AS

- SMSC privatized

SMSC
SHIP MODELLING & SIMULATION CENTRE

SMS/ SMSC History

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2016 KONGSBERG PURCHASES SMSC

- 100% of shares owned by Kongsberg from 01.01.2016
- New DNV class A simulators purchased
- From 1. juli 2016; Integrated into Kongsberg with new name; «Kongsberg Maritime Training & Advisory, Grilstad»

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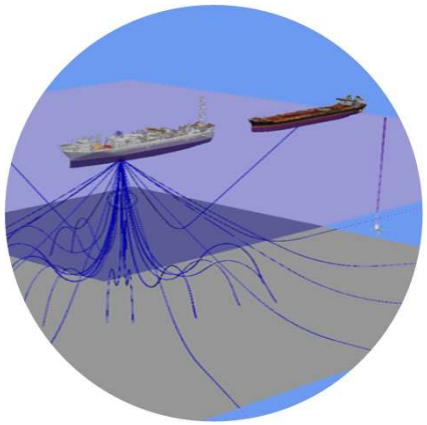
Advisory deliveries

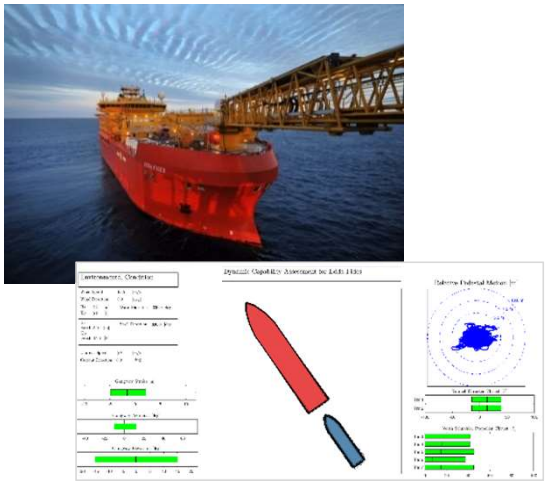
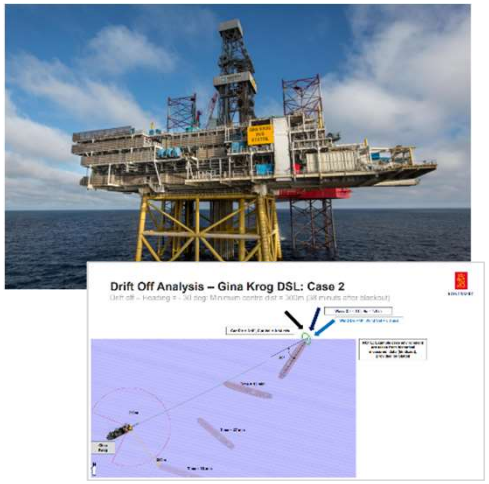
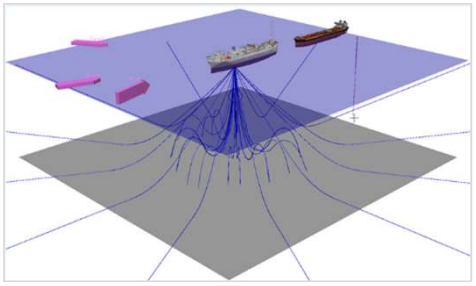


Engineering simulations

Operational simulations

Operational support

Engineering simulation examples

Follow target, Edda Fides	Drift-off analysis, Gina Krog DSL	Hawser-less offloading operation
		
Calculation of operational limits for follow target operation with accommodation vessel	Calculation of heading restriction: (+-30°) Drift-off time to safety zone: (+ 30 min)	Calculation of operational limits for hawser-less offloading operation

How can we improve marine operations with real time simulators?

Challenges:

- Complex projects with a lot of companies/ departments involved
- Difficult to have «complete picture» of marine operations
- Lots of systems active together – lots of interfaces
- End user often not involved in Engineering phase
- Different «language» amongst end users, engineers etc.

How can we improve marine operations with real time simulators?

- Engineers, contractors, oil companies and end users **meets to discuss on neutral grounds**
- Visualization of complex operations ensures **everybody talks the same lang**uage
- Visualization and testing makes it **easier to see and test solutions** on complex issues
- Enables **testing** of system setup and new features (software and infrastructure)
- Tests **interface** between different systems operating together
- **Combined with engineering simulations**, Hazid, Hazops, Risk analysis etc.
- End user **trained in vessel specific operations**

Why is vessel specific training important?

- 80 % of all accidents are (still) caused by human factors.
  - Systematic and relevant training will reduce the risk of fatal mistakes and errors on board.
- Continuously increasing complexity of modern vessel systems – few vessels are an exact copy
  - Increasingly important to train on your own ship
- No room for relevant manoeuvring training during normal operations – failure no alternative
  - Only Captains/ Chief officers are allowed to handle the ship
- Poor knowledge on manoeuvring characteristics of own ship
- Poor knowledge on the limitations of own ship (weather limitations)
- Simulator training makes you able to test ship capacities in new areas/ narrow waters
- Simulator training makes you able to test new features

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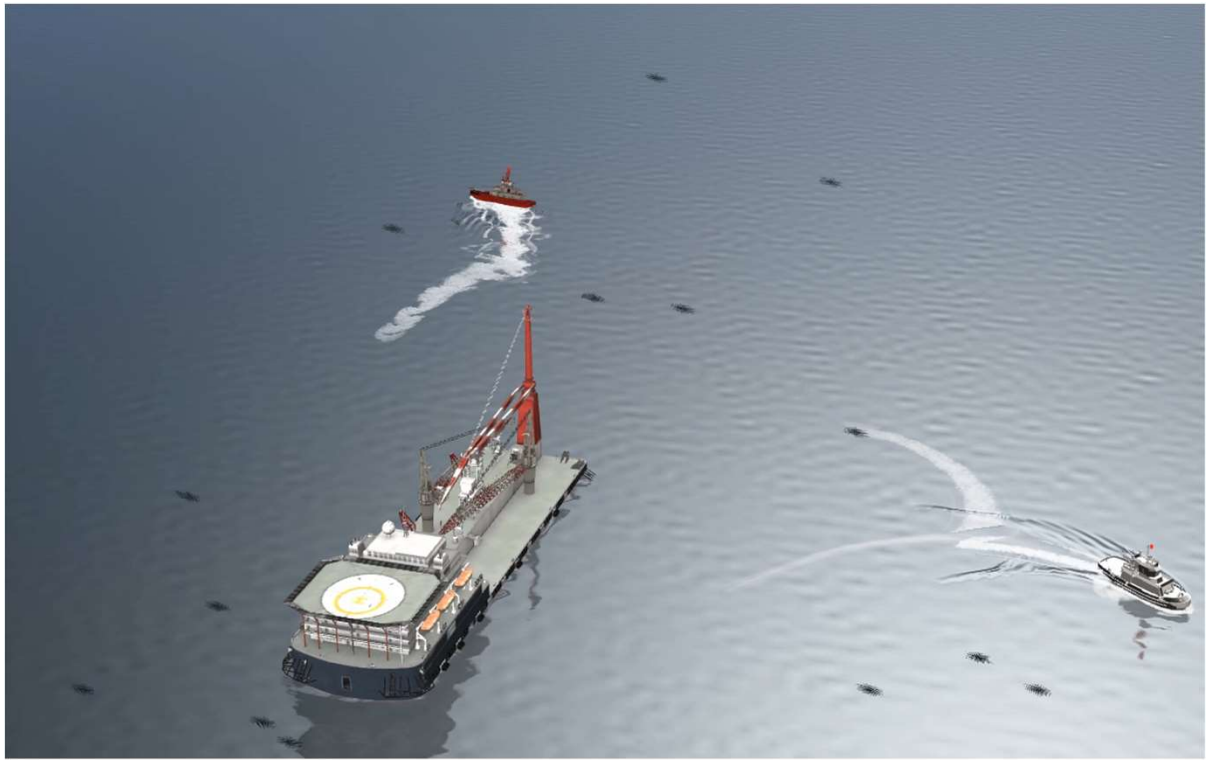
- Propeller + Hydrodynamics + Wind + Wave+ Rope
- Simple models for simple error
- All possible scenarios should be dynamically stable. Try to avoid vessels going bananas.



Special Things to Consider:

- Ship To ship Interaction
- Shallow water effects
- Different draft.
- High speed Effects
- Tugging

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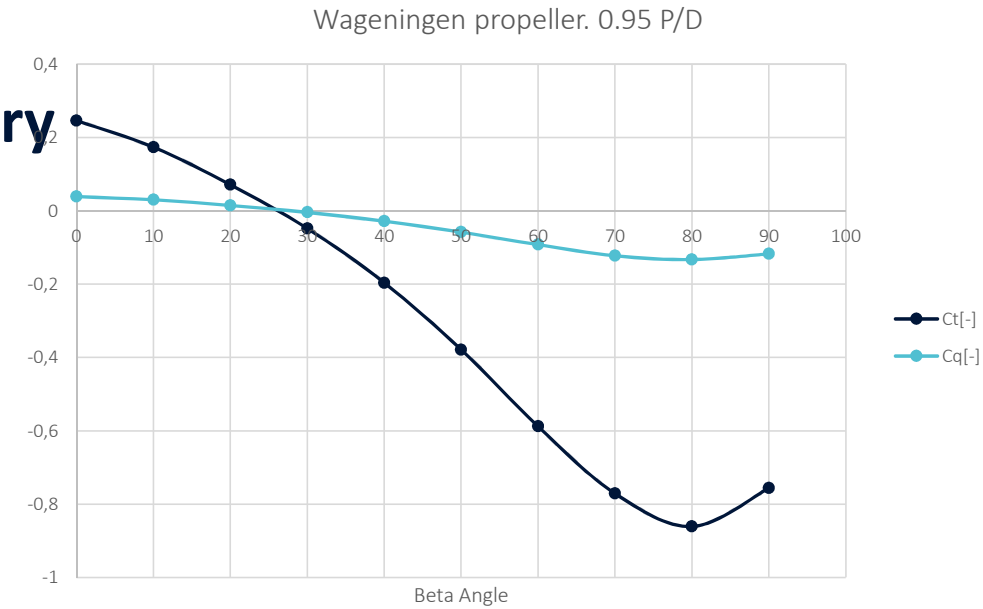
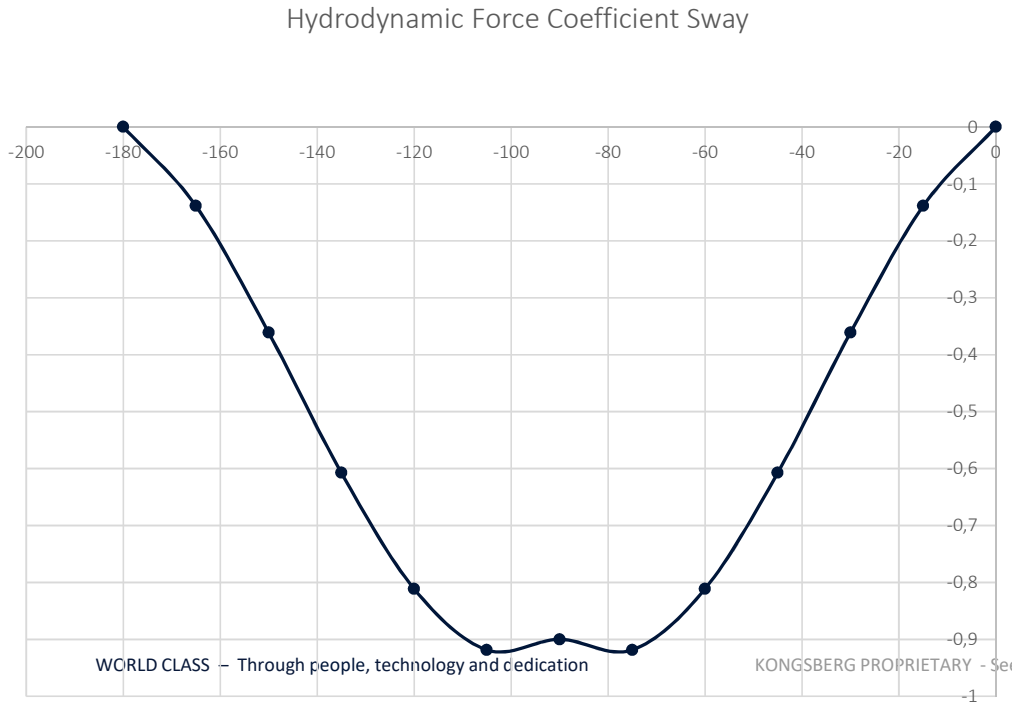
Theory





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Then reality

Turning Circle

Zig Zag

Customer Acceptance tests etc.

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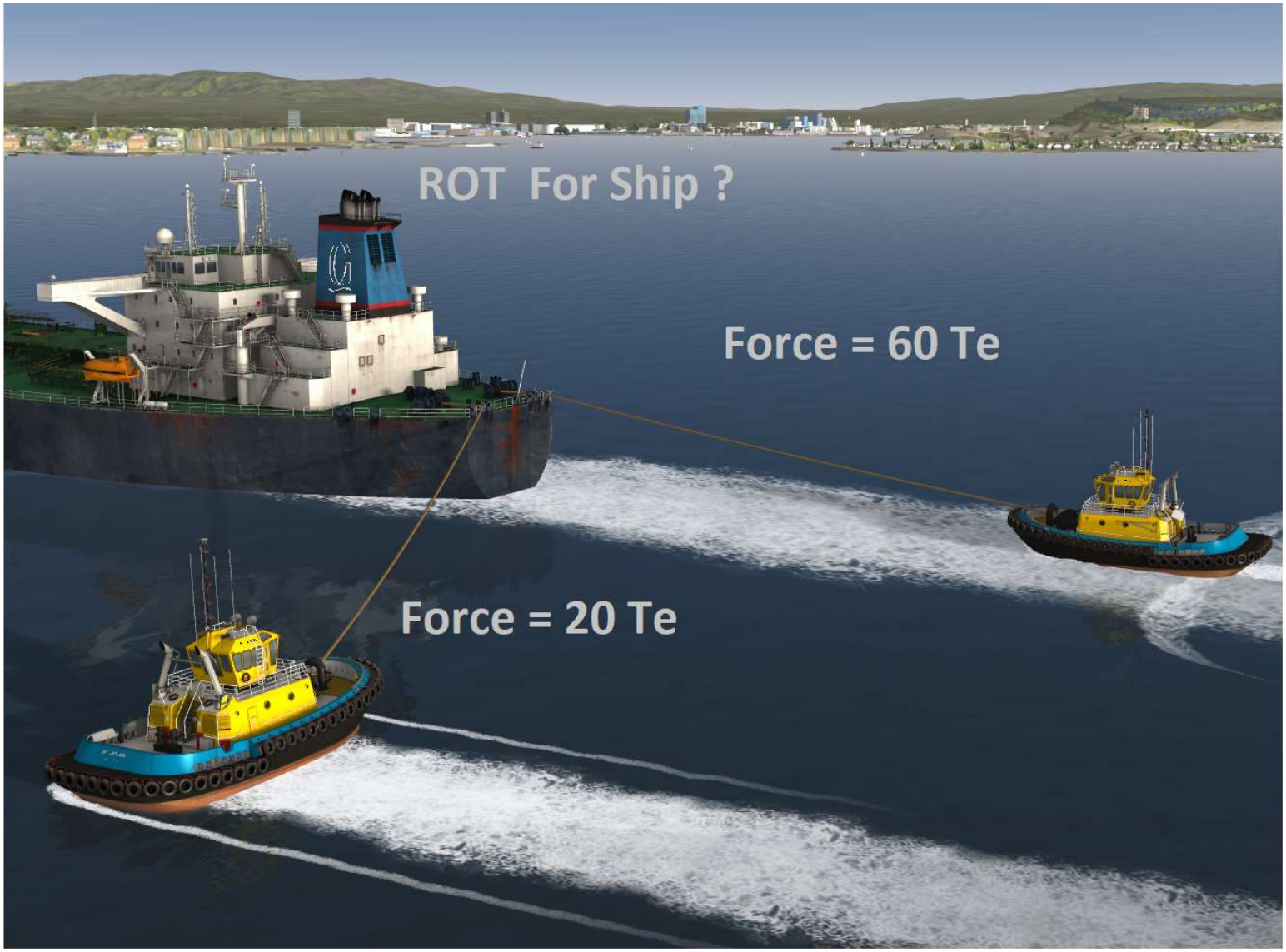

Projects - Offloading

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Direct offloading
from moored FPSO's

Alternative offloading
concepts

Joint workshops with
FPSO, ships and cranes
in same environment

Projects – Crane Studies

Platform/FPSO Crane;
Blind zone studies

Subsea Crane;
Lifting operations

Platform/FPSO Crane; Lifting -operations

Joint scenario set-up;

Vessel, crane, DP, ROV…

Projects – Fairway and Harbour dev.

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Confined waters

Harbor development

Projects – Arctic waters

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Marine operations in arctic waters
with
SMSC Ice Model

Alaska LNG;
6 knots current
12 m tide
Drifting ice

Joint Ice Management scenario set-up

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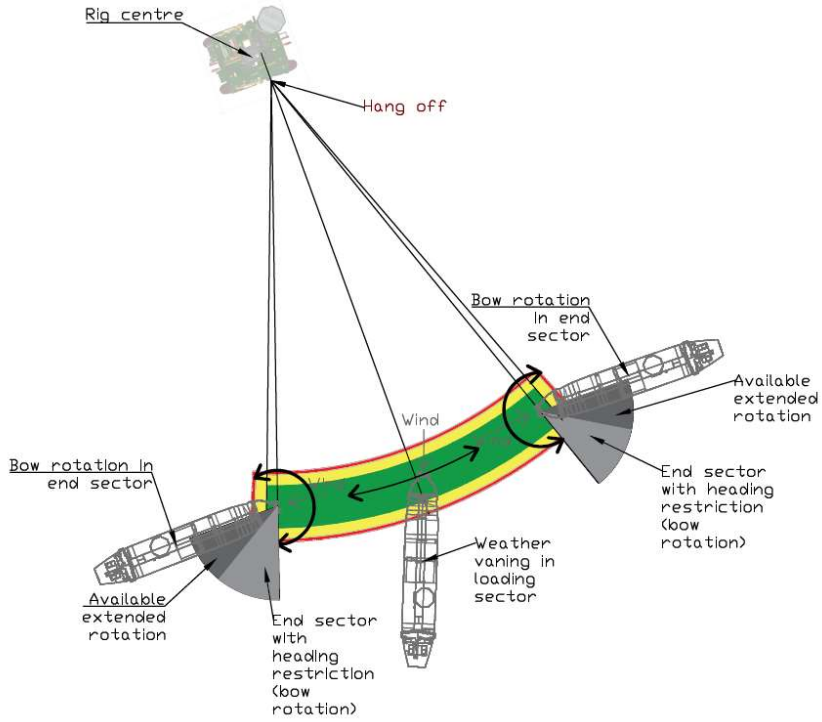
Example projects: Offloading

Verification of offloading at Alta field

- **Field:** Alta EWT
- **Field operator:** Lundin
- **Type:** Moored RIG with direct loading from loading riser
- **Rig and operator:** Leiv Eirikson – OR Operations Norge Inc (Ocean Rig)
- **Shuttle Tanker and operator:** Amundsen Spirit - Teekay
- **FSV and operator:** Bourbon Arctic - Bourbon Offshore

Challenges

- Limited operation: 60 days
  Extended well testing in summer time
- Complex operation
- No exact same operations done before
- Sensitive area



Scope of work

- Workshop/ verifications:
  - Connections/ Disconnection
  - Marginal weather conditions
  - DP software/ safety barriers
  - Procedures
  - Identification/ verification of training contents
  - Information exchange between involved parties
  - Emergency scenarios
  - Know the roles of other parts of operation; procedures, limits and restrictions

Scope of work

- Joint training of crew on Rig, Shuttle tanker and Anchor handler:
  - Get a good understanding of the operation, introduction to procedure and manuals
  - Know the roles of other parts of operation; procedures, limits and restrictions
  - Perform a safe and good operation in cooperation with each other
  - But also for the different parties to get to know each other better

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Example projects: Crane-and lifting operations

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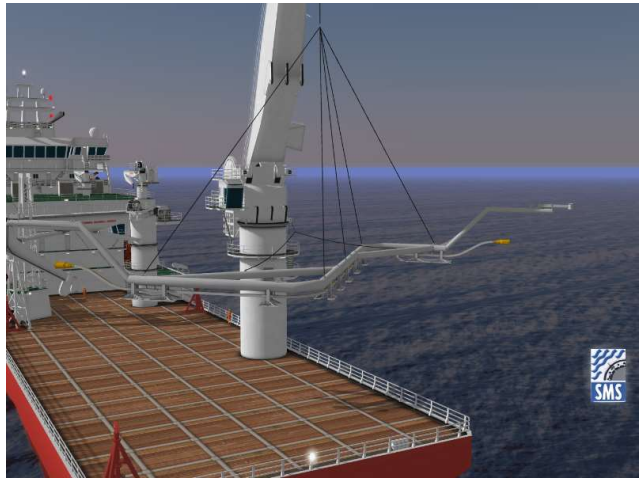
SUBSEA CRANE



OFFSHORE CRANE

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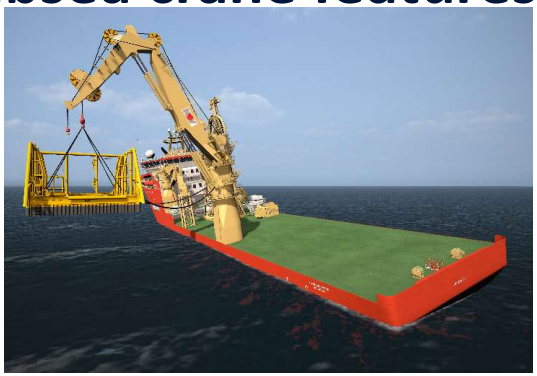
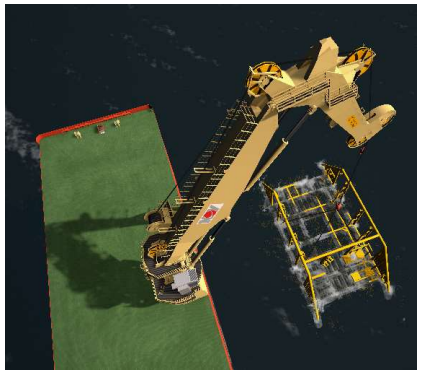
Subsea crane features

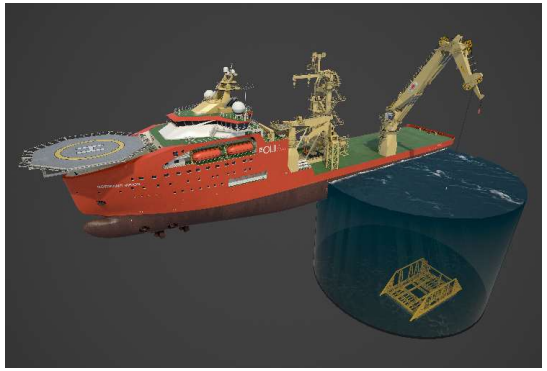
LIFT OVER-BOARD



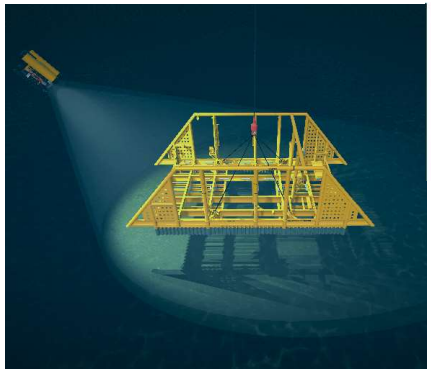
ANTI HEELING



SPLASH ZONE



LANDING/PICK-UP



HEAVE COMPENSATION

OBS ROV

GUIDE WIRE/
TUGGER WINCH

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Ekofisk HPS/SPS Installation with Skandi Arctic (Technip)

Project challenges

Size and weight of HPS

- Wider than vessel
- Lifting height close to crane capacity

Objectives

- Verification of procedures
- Familiarization
- Training
  - Crane & Tugger winch operations

Crane capacity and lifting height

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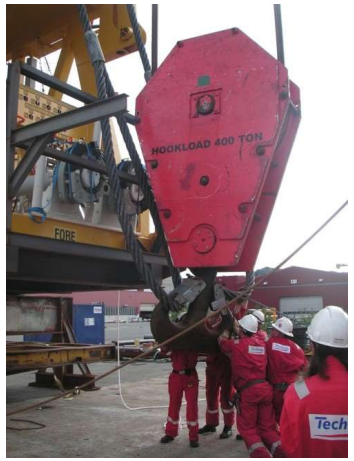
CRANE CAPACITY

- Minimum required radius for overboarding: 24.0 [m]
- Static weight of HPS close to crane capacity

RIGGING DESIGN

- 10Te crane block landed on deck
- Lifting height at R = 24.0m – length of slings
- Plan: remove 2 hatches and lower through roof of HPS
- Solution: remove 4 hatches to increase weather criterion to $Hs_{,ops}$ = 2.0m



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Material handling and lifting simulation for Goliat cranes

Project objective & delivery

OBJECTIVE

Uncover hazardous aspects during lifting operations, including:

- Sea lifts and internal lifts, bulk hose handling and lifting routes.
- Laydown areas and blind zones.
- Safety distance for supply vessel.
- Operational limitations.

DELIVERY

Simulation report, containing:

- Crane operational feasibility and improvements to platform layout.
- Verification of specific lifting operations.
- Identification of blind zones.
- Verification of laydown areas and lifting corridors.

Conclusionns

TERJE WALLE

Area Team Leader,
Development & Technology,
Eni Norge AS

«The projects have uncovered blind zones and challenging lifts at a very early stage, enabling us to make necessary changes to the layout.»

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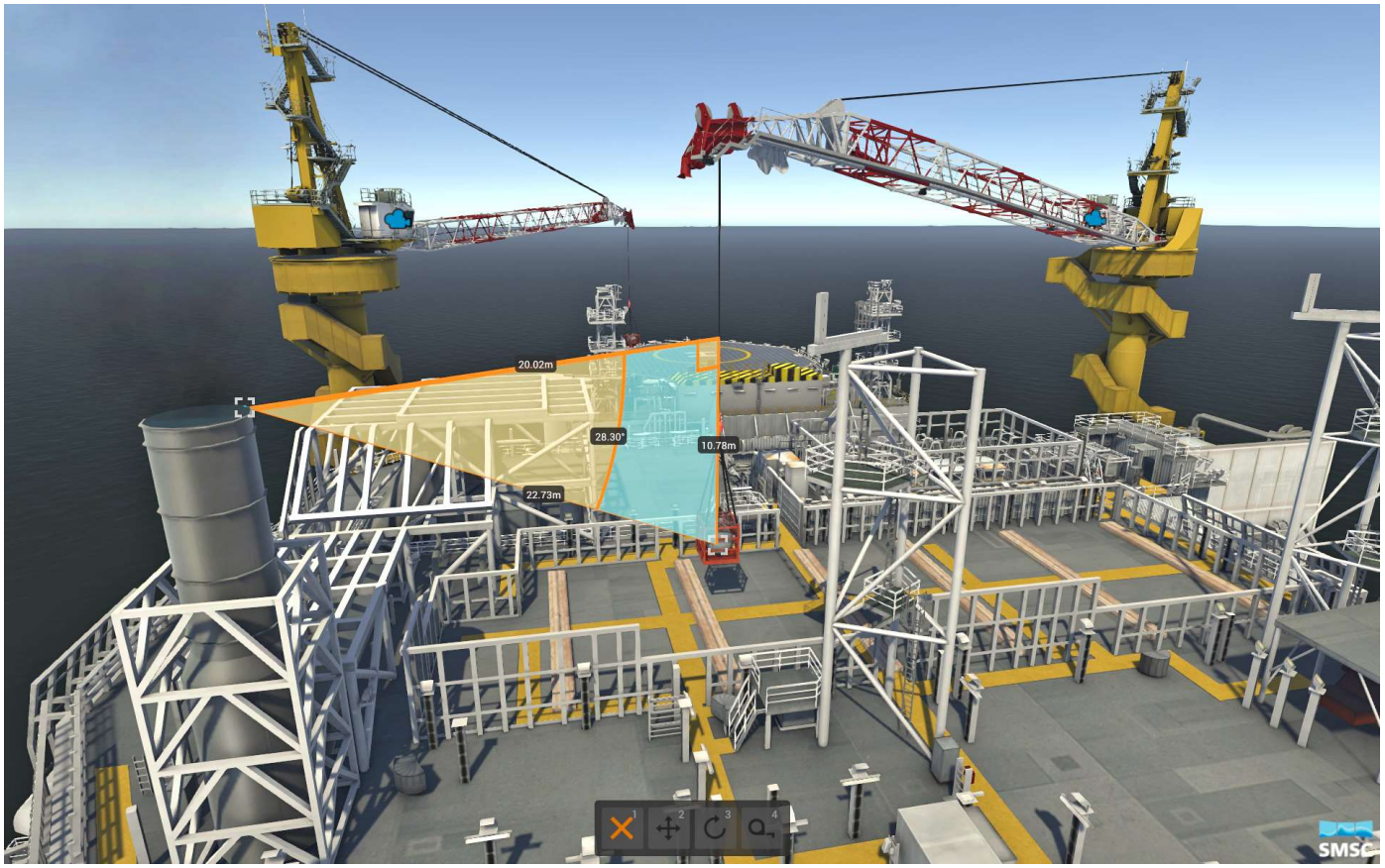

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Example projects: Confined waters

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Viking Star

Viking Cruises Training course

Scope of work

- Develop shiphandling course for Viking Star in full-scale ship simulator
- For simulator training: Viking Star modelled in accordance with technical specifications and information from sea trials; Model implemented in simulator.
- One captain Viking Star assisted and assessed the Customer Acceptance Test (CAT) before implantation of the model in the simulator.
- A 5-days Ship handling training course adapted to Viking Star was developed.
- All necessary information available: Wheelhouse poster, Pilot card etc.

Viking Cruises Project

Scope of work

- Assist WSM/Viking Ocean Cruises to verify MV Viking Star's ability to perform safe navigation/maneuvering upon arriving/departing the Port of Cienfuegos in Cuba.
- MV Viking Star and its sister ships Viking Sun, Viking Sea and Viking Sky are maximum size set by the local Maritime authorities for passing the narrow waters.
- A reliable mathematical and visual model of MV Viking Star was used in arrival and departure simulations in various wind and tidal current conditions.

Overall objective: Increase theoretical and practical knowledge on how to master your own ship in narrow waters with marginal weather conditions.

Viking Star

Conclusions

- WSM and Viking Ocean Cruises expressed satisfaction with the simulation trials and the final results.
- They are on the basis of the report from KM Training negotiating with Cuban Maritime Authorities for passage and are confident that they will be allowed to enter the port with their cruise vessels.

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Rollingstone to Rekefjord

Challenge

Tideway Rollingstone

The facts:

main data	length o.a.	139.00 m
	width	32.00 m
	draught loaded	6.60 m
	loading capacity	12,000 ton
	main propellors	2 x 3,125 kW
	azimuth thrusters (new per 01-04-2004)	2 x 1,100 kW (retractable)
	bow thruster (new per 01-04-2004)	2 x 750 kW (tunnel)
	cruising speed	12 kts
dynamic positioning	simrad albatross, ADP 702 dynamic positioning system with auto track, auto heading and follow ROV mode	
ERN	95.91.65	
fall pipe	steel pipe sections (8 m) with internal rubber lining deployed through moonpool	
	diameter	1,000 / 500 mm
	depth up to	1,000 m
ROV	active heave compensated on wires, controlling lower fall pipe end. equipped with cameras, profilers, pipe tracker and other sensors as required	
	power	300 kW
classification	ABS - A1E - A.M.S. - A.C.C.U. - DPS-2 (Class II)	
	special service stone dumping vessel	
	IMO / ISM-Code	

Scope of Work

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- Modelling the area
- Modelling the vessel
- Implementing the DP model
- Workshop/ training in simulator
- Report and video

Tideway Rollingstone to Rekefjord

Tideway Rollingstone to Rekefjord

The end result…

Video kystverket

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Bård Thingstad
Project Manager
Global Customer Support & Services – Training & Advisory
Kongsberg Maritime AS
Mobile +47 45888566
bard.helge.thingstad@km.kongsberg.com
www.km.kongsberg.com