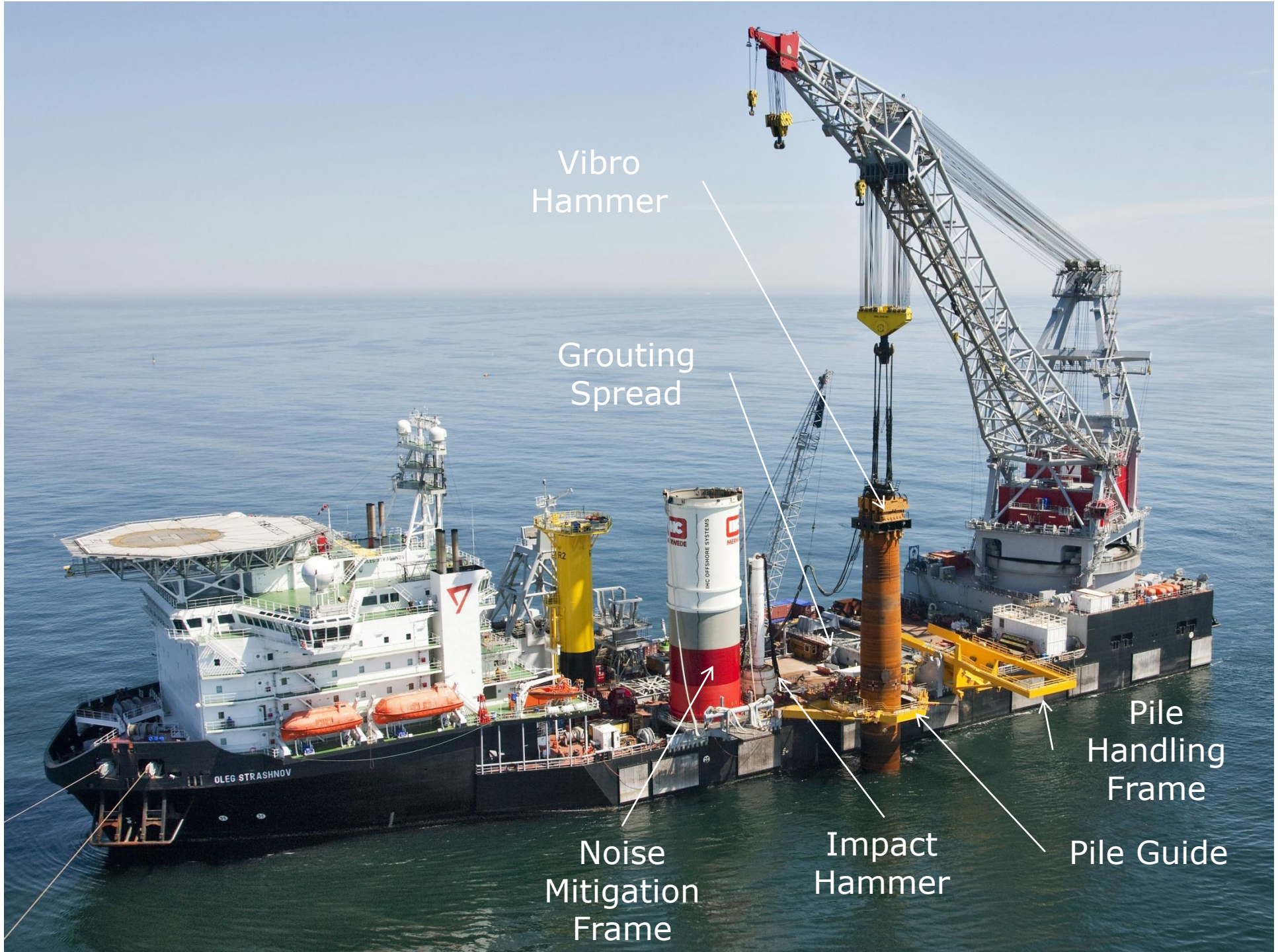
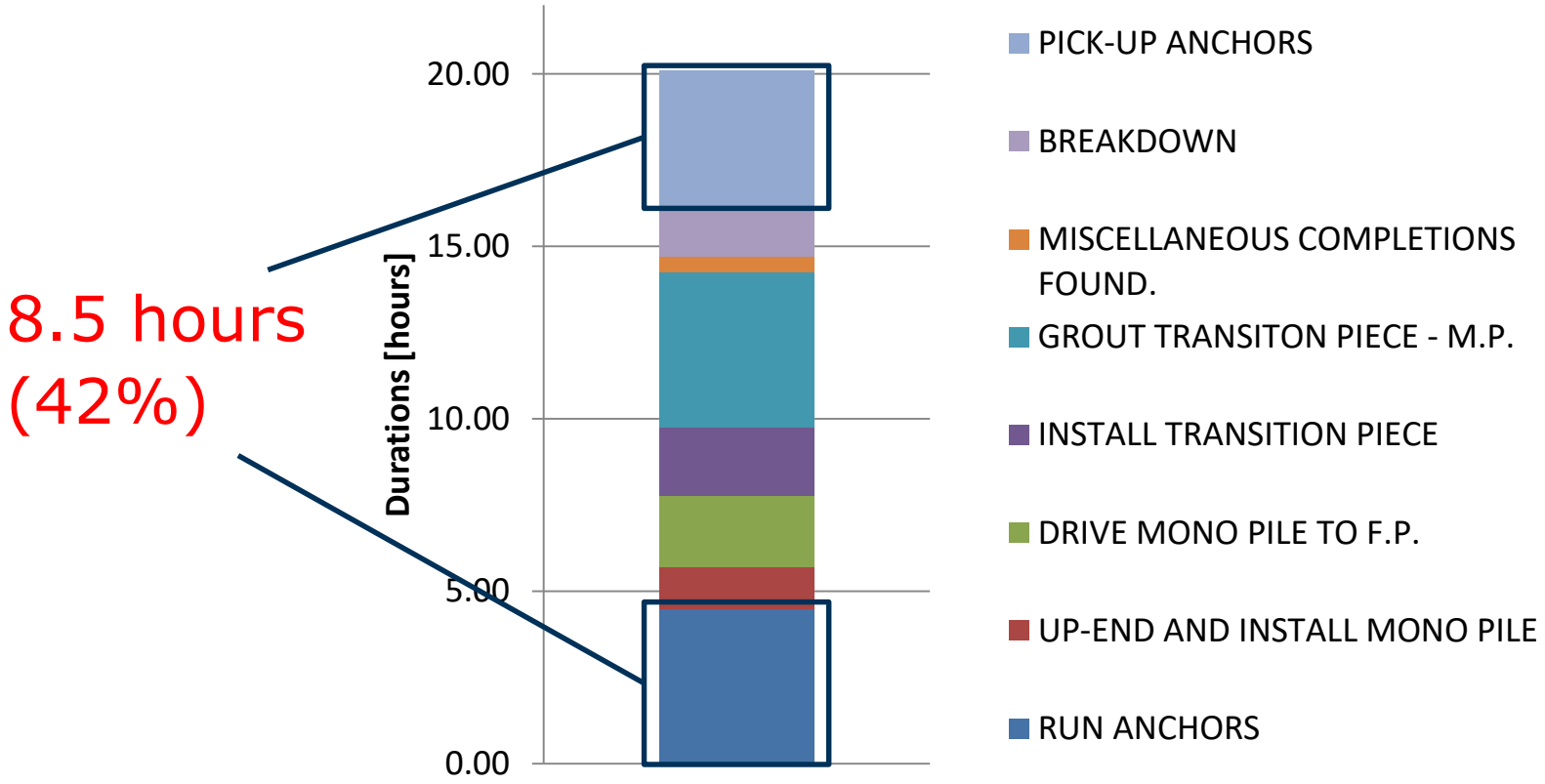
Monopile Installation on DP

Alan MacLeay, Engineering Director

1 October 2019

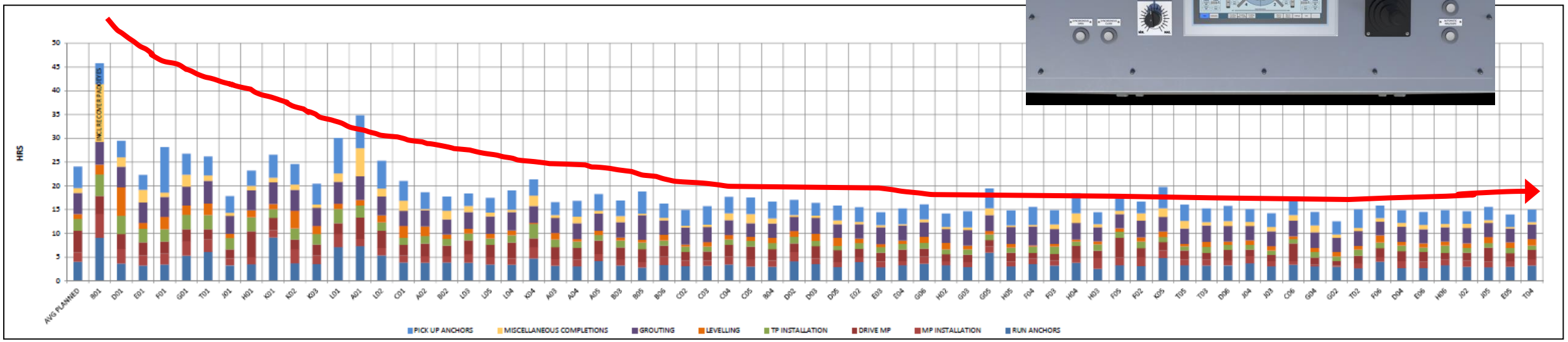


Why MP Installation on DP?



Dudgeon Implementation

- First Implementation of motion compensated outrigger for SHL
- Procedure optimized through project execution



Possible Solutions

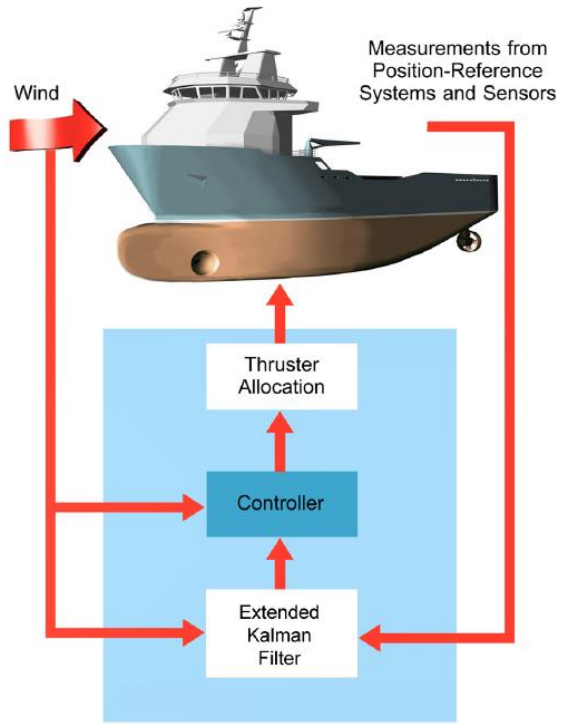
1. Vibrating

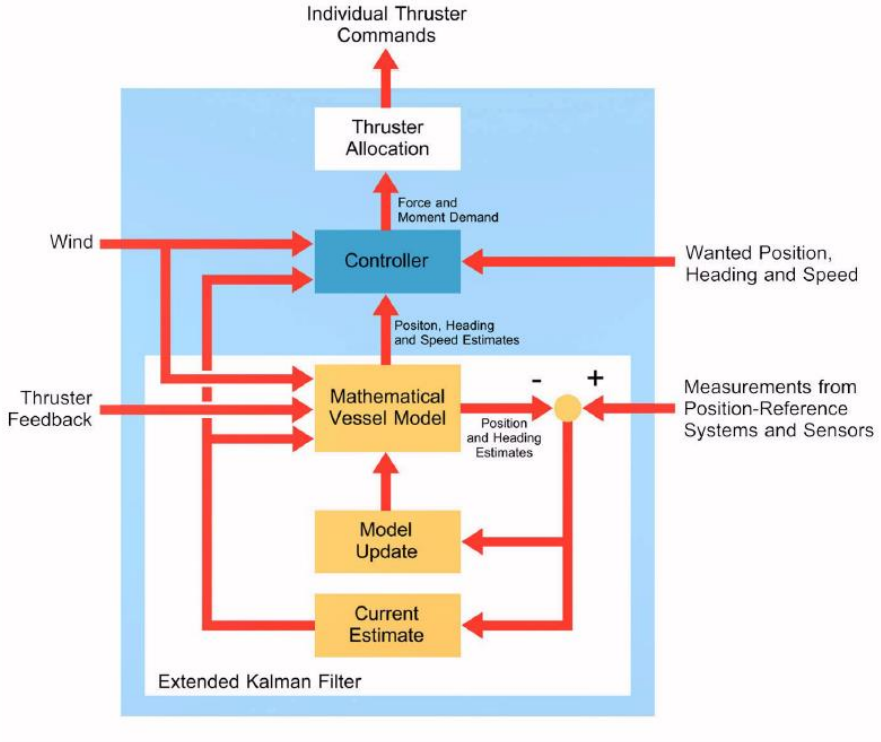
2. Smart Outrigger

3. MIF

What is DP?

"Dynamic Positioning is a method to automatically maintain a vessel on its position and/or heading or a predefined track by use of its thrusters and/or rudders."





External Force to DP System

Unknown force are considered as “false current force”, e.g. wave drift and current force
DP only reacts to low frequency forces, thus not first order wave force
For special operations such as pipelay and plough operations

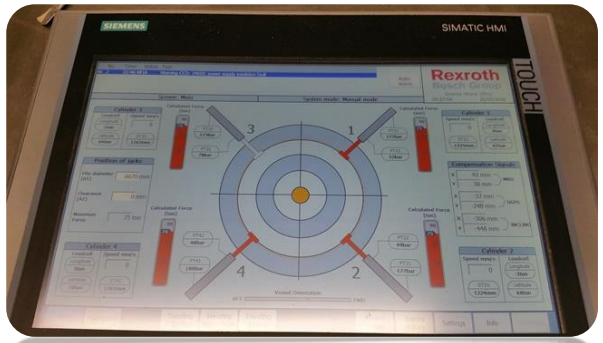
- External force usually in force feed forward

Useful for MP on DP!

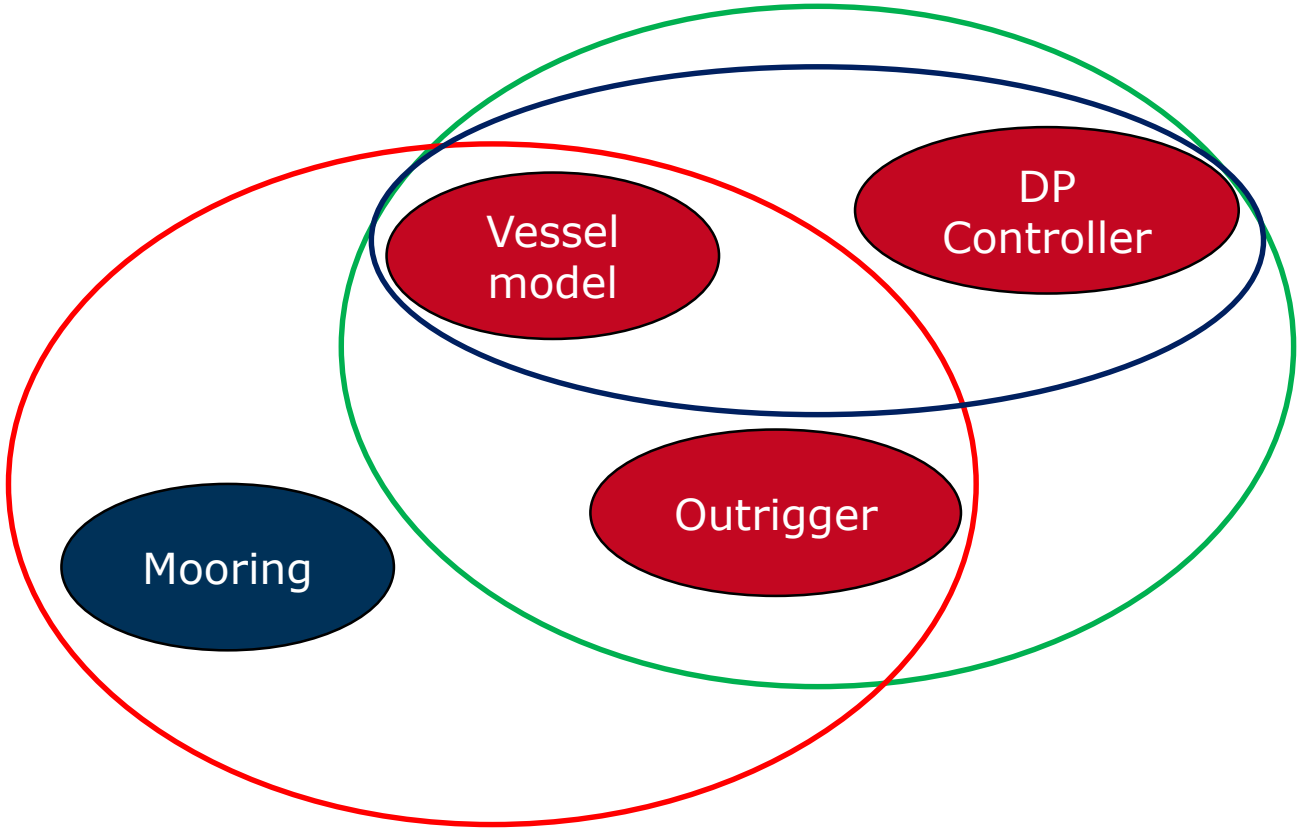
MP Installation on DP

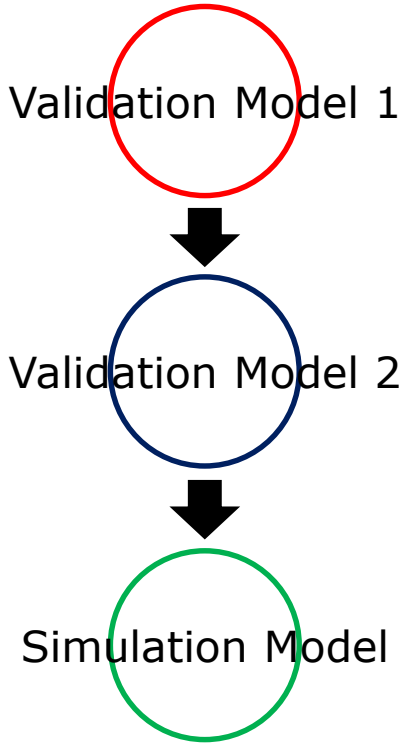
Outrigger + DP, what are the risks compared to Outrigger + Mooring?

(1)Instability of the control systems
(2)Thruster failure
(3)Human factor in joystick mode
(4)…



Simulation Models





Vessel Model

Simulink model based on AQWA input
Hydrodynamic parameters based on offshore test, model test and CFD analysis

WIND FORCES

CURRENT FORCES

1st ORDER WAVE FORCES

2nd ORDER WAVE FORCES

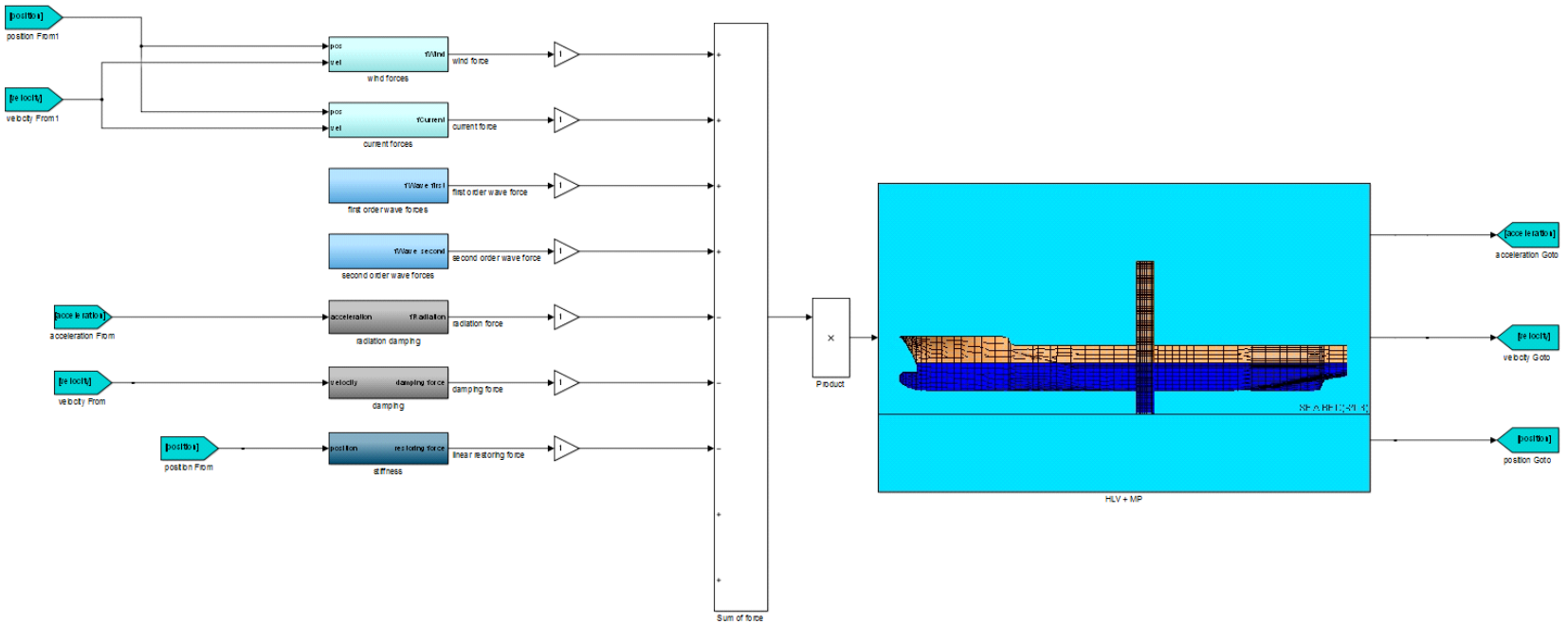
RADIATION DAMPING

VISCOUS DAMPING

RESTORING FORCE

OUTRIGGER FORCE
MOORING FORCE
OR DP FORCE

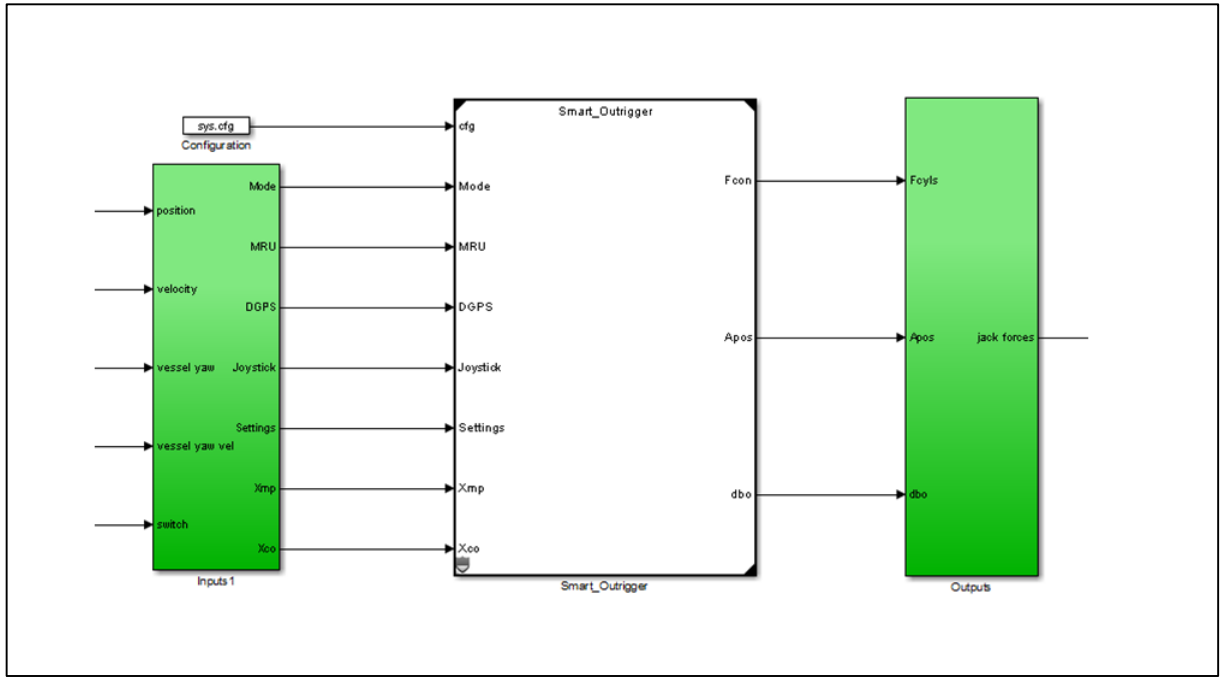
EQUATION OF MOTION



Outrigger

Simulation model developed by Bosch Rexroth

- Same controller settings as used for Dudgeon



DP Controller

DP Controller developed by RH Marine

- Configuration created for Seaway Strashnov

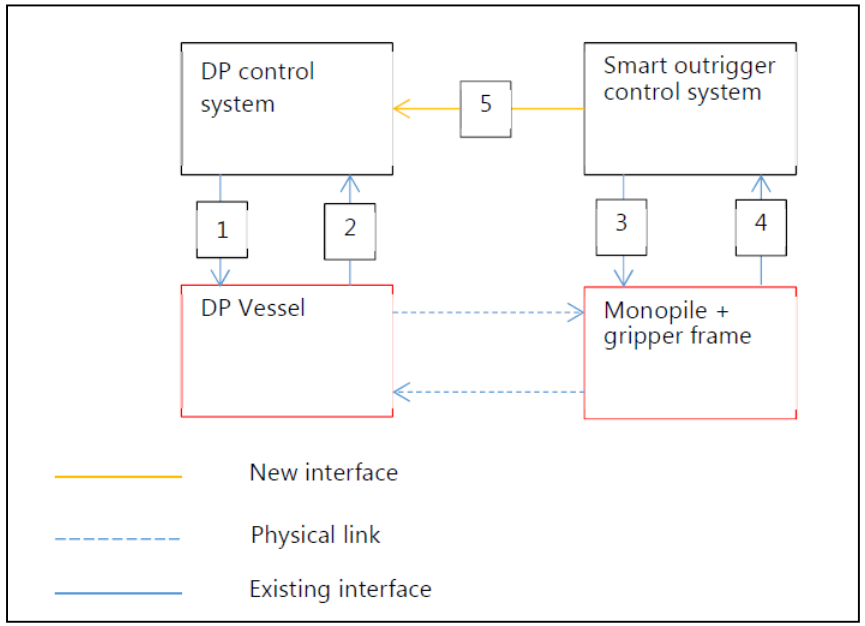
Model Validation

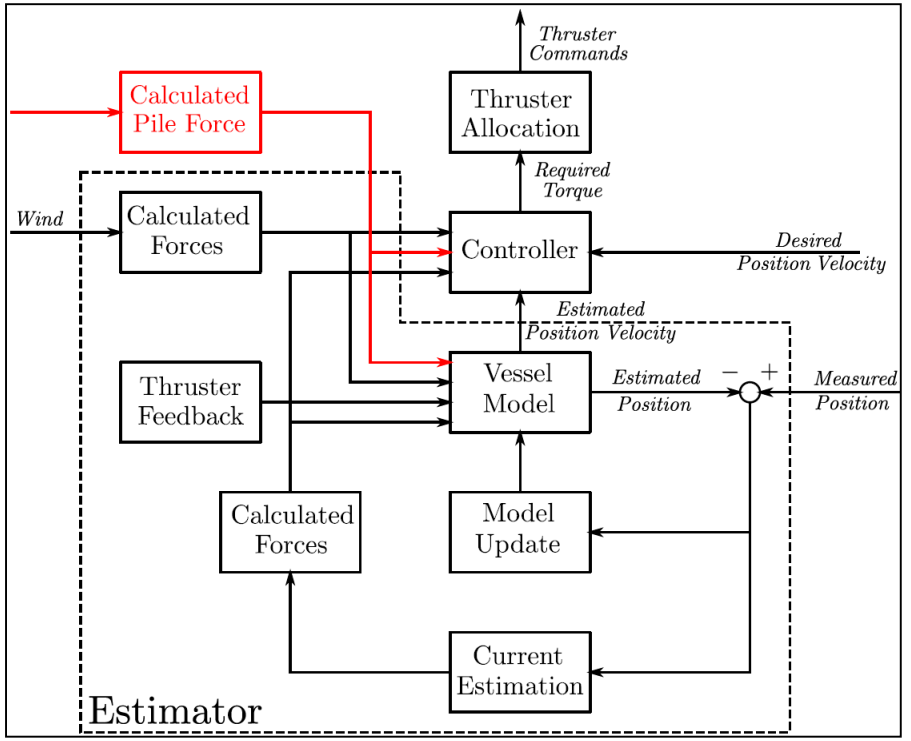
OS + OR + mooring -> Dudgeon MP installation data

	Measured	Simulation
Max jack force	~ 40 ton	~40 ton
Period auto mode	~16 s	~15.5 s
Max pile angle	0.2 deg	0.2 deg
Max outrigger horizontal movements	0.06 m	0.07 m

Integrated Simulation

Coupled simulations with concept interface





Results

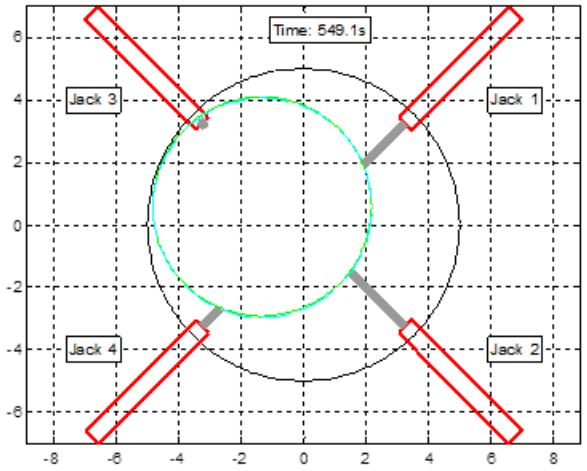
Conclusion based on simulation:

- Uncoupled system is not able to install all piles on DP
- Coupled system will increase the DP workability

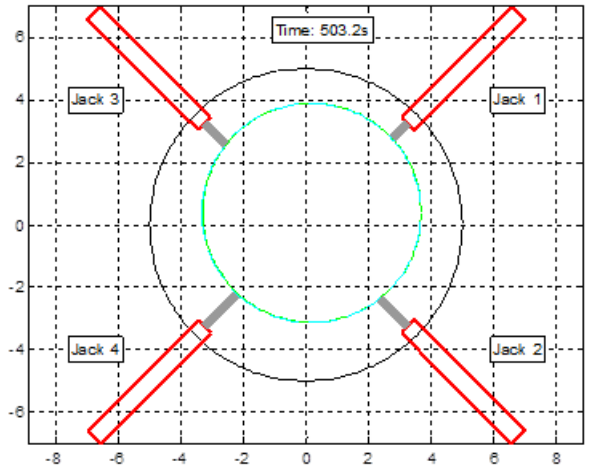
Next steps

- Interface development
- Failure case study

Uncoupled



Coupled



THANK YOU