DYNAMIC POSITIONING CONFERENCE
October 13-14, 2015

DESIGN 1

Past, Present and Future of Hydrodynamic Research for DP Applications

Hans Cozin and Eelco Frickel
MARIN

PAST, PRESENT AND FUTURE OF HYDRODYNAMIC RESEARCH FOR DP APPLICATIONS

Hans Cozijn and Eelco Frickel

PRESENTATION OUTLINE

- Background
- Past
- Present
- Future
  - Advanced Allocation Algorithms
  - DP with Large External Loads
  - Multi-body DP
  - Motion Compensation
  - Wave Feed Forward
- Concluding Remarks

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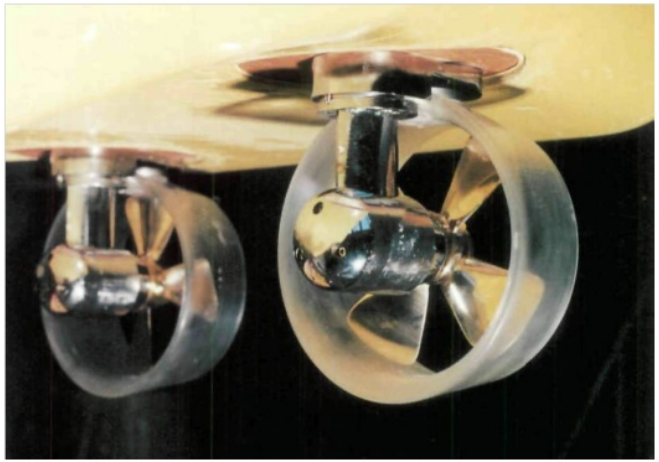
DYNAMIC POSITIONING RESEARCH AT MARIN

- Model Azimuthing Thrusters
- First DP Model Tests
- Thruster-interaction Research
- First Time-domain Simulation Models (3 DoF, LF)



1980s

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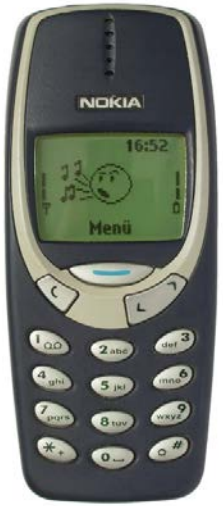
DYNAMIC POSITIONING RESEARCH AT MARIN

- DP Model Tests in Commercial Projects
- Improved Time-domain Simulation Models (3 DoF, LF + WF)



1990s

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DYNAMIC POSITIONING RESEARCH AT MARIN

- DP Model Tests in New Offshore Basin, with up-dated Model DP System
- Improved Time-domain Simulation Models (6 DoF, LF + WF, multi-body)

2000s

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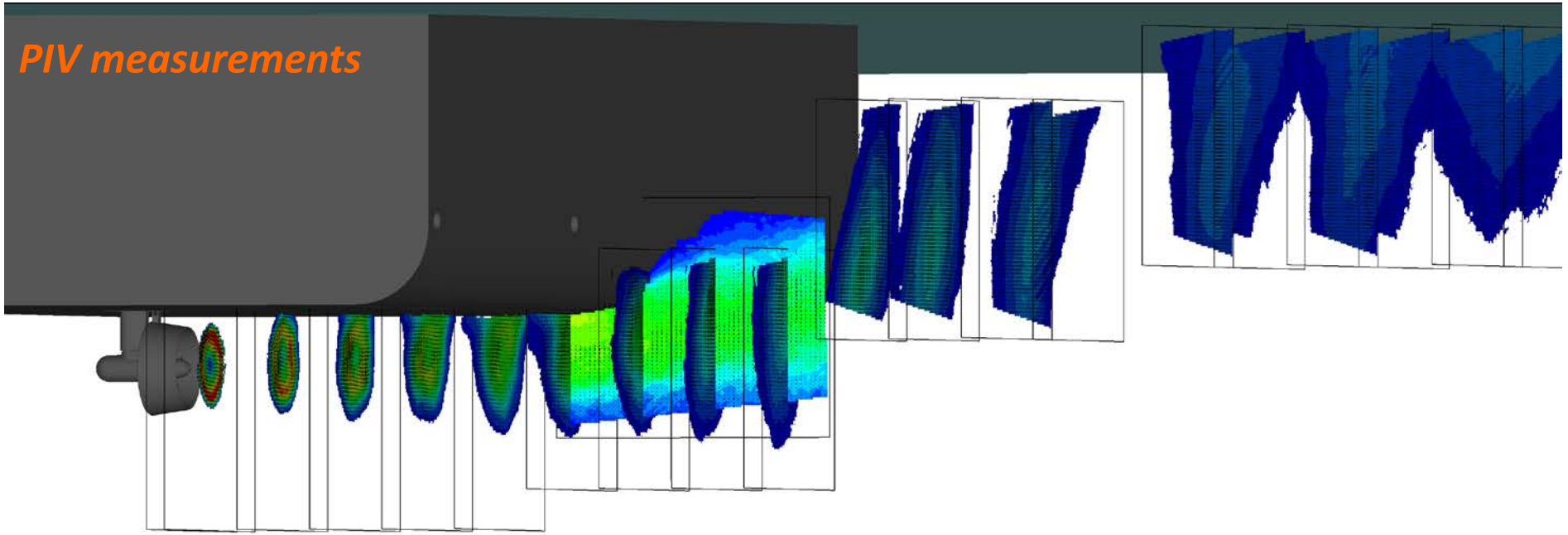
THRUSTER-INTERACTION RESEARCH

- CFD : Quantify Thruster-interaction Effects in Early Design Stage
- PIV : Detailed 3D Flow Visualizations



THRUSTER-INTERACTION RESEARCH

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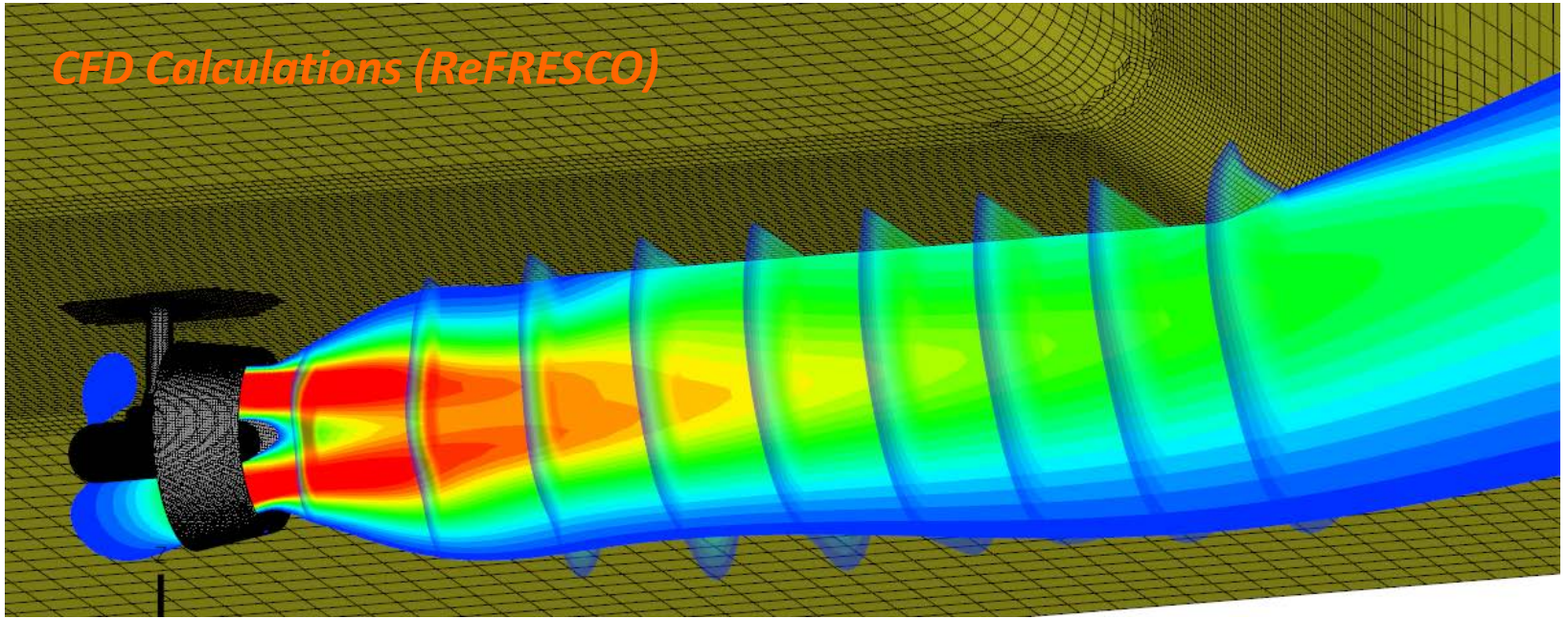
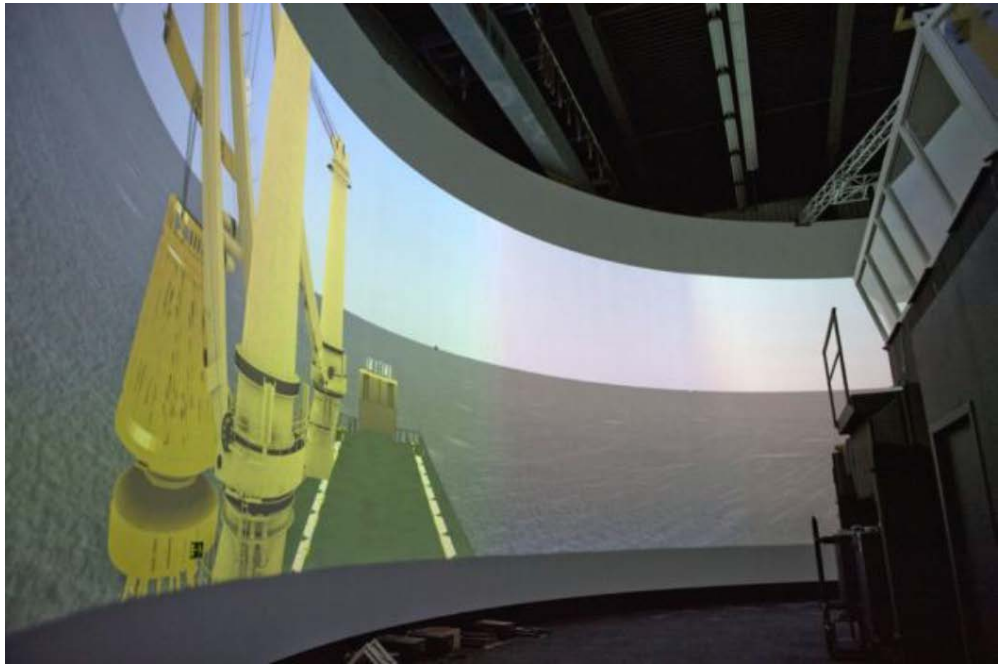


SOFTWARE DEVELOPMENTS

- How can we link engineering (desk top studies; fast time) to operational analysis and training (bridge simulator; real time) ?



SOFTWARE DEVELOPMENTS

- How can we link engineering (desk top studies; fast time) to operational analysis and training (bridge simulator; real time) ?

- **XMF** : eXtensible Modeling Frame work
  - Floater motions, mooring, offloading, DP, heavy lift, ..., etc.
  - Models shared between different user-groups and applications
  - **aNySIM** multi-body time-domain tool, built using XMF components
  - Identical DP system in model tests, simulations and simulator
  - Link with DP systems from external suppliers

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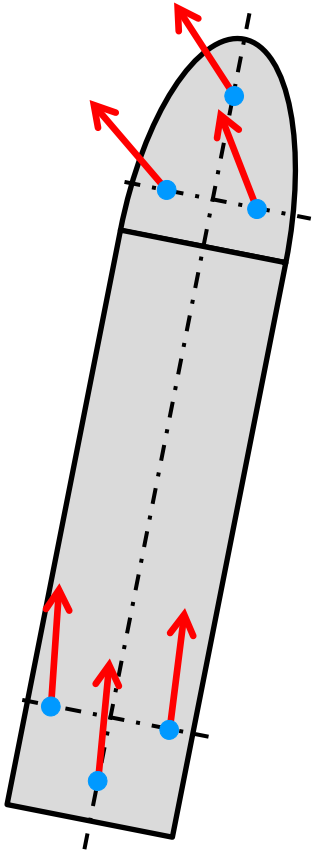
ADVANCED ALLOCATION ALGORITHMS

Challenge

- Improve Stationkeeping Accuracy and Fuel Efficiency

Research Areas

- Expected Thruster-interaction Effects Included in Power Optimization
  - Better match total thrust forces
  - No need to specify forbidden zones; in-efficient solutions are automatically avoided



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DP WITH LARGE EXTERNAL FORCES

Challenge

- Large, Irregular and Intermittent Loads Disturb DP Performance

Research Areas

- Filter and Controller
  - Modified settings
  - Alternative approach
- Force Feedback

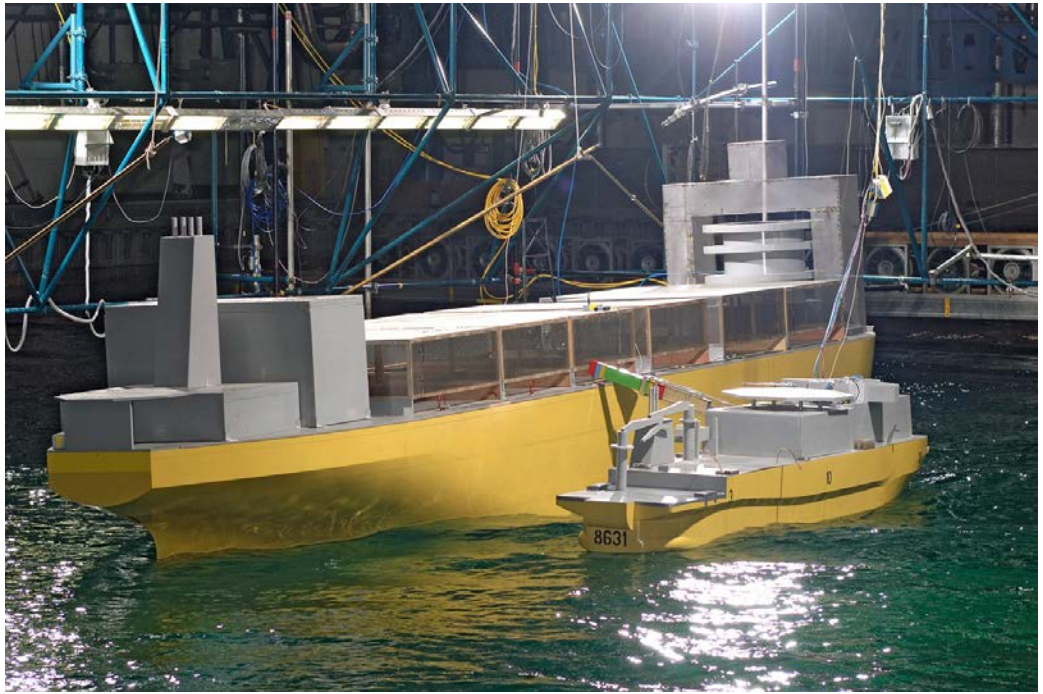
MULTI-BODY DP

Challenge

- Accurate and Reliable Relative DP

Research Areas

- Control Strategies
- Kalman Filter
- Environmental Loads



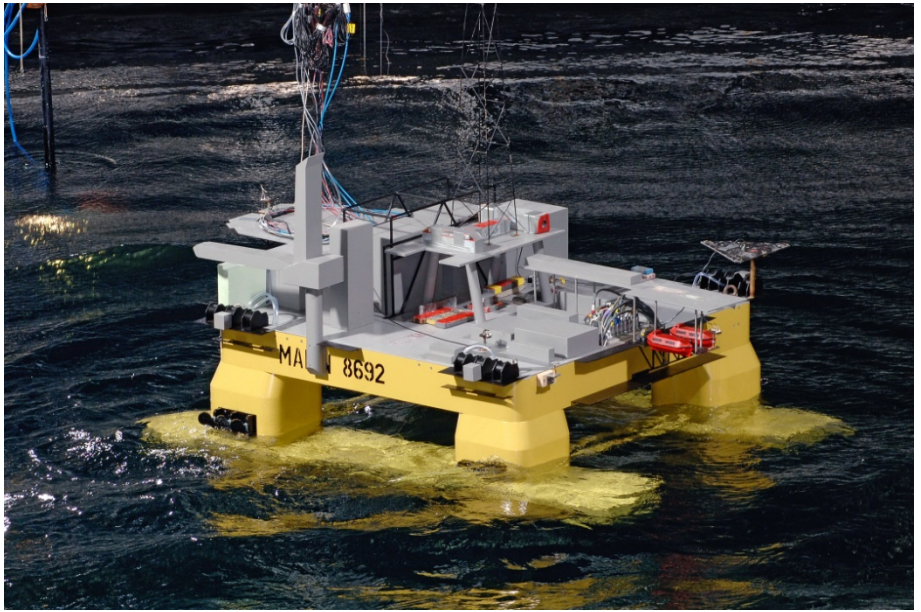
MOTION COMPENSATION

Challenge

- Use of Thrusters to Reduce Floater Motions

Research Areas

- Control in 6DoF,
  instead of 'Normal' DP
  with Motion Control Add-on
  - Filter and controller
  - Allocation



WAVE FEED FORWARD

Challenge

- Reliable and Accurate Real-time Wave Drift Force Estimation

Research Areas

- Wave Field Predictions based on Radar Signals
- Drift Loads on Semi-submersibles

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CONCLUDING REMARKS

- MARIN has a Long History in DP Model Tests and Simulations
- Goal : to Link Engineering Simulations to Simulator Training
- Research Ambitions
  - Advanced Allocation Algorithms
  - DP with Large External Forces
  - Multi-body DP
  - Motion Compensation
  - Wave Feed Forward
- New JIP Initiative : **openDP**

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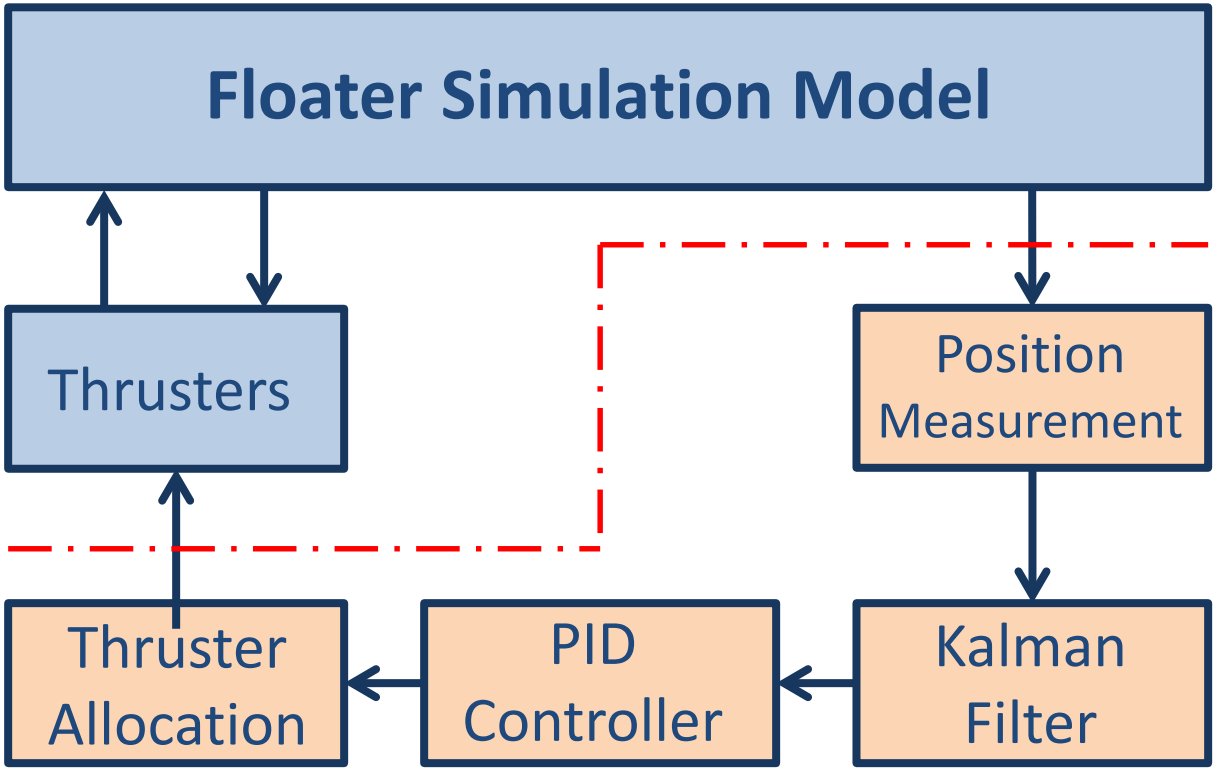
OPEN DP JOINT INDUSTRY PROJECT

openDP JIP :
Software Frame Work for DP Developments

DP

- Support Developments
- Encourage Discussion
- Share Ideas



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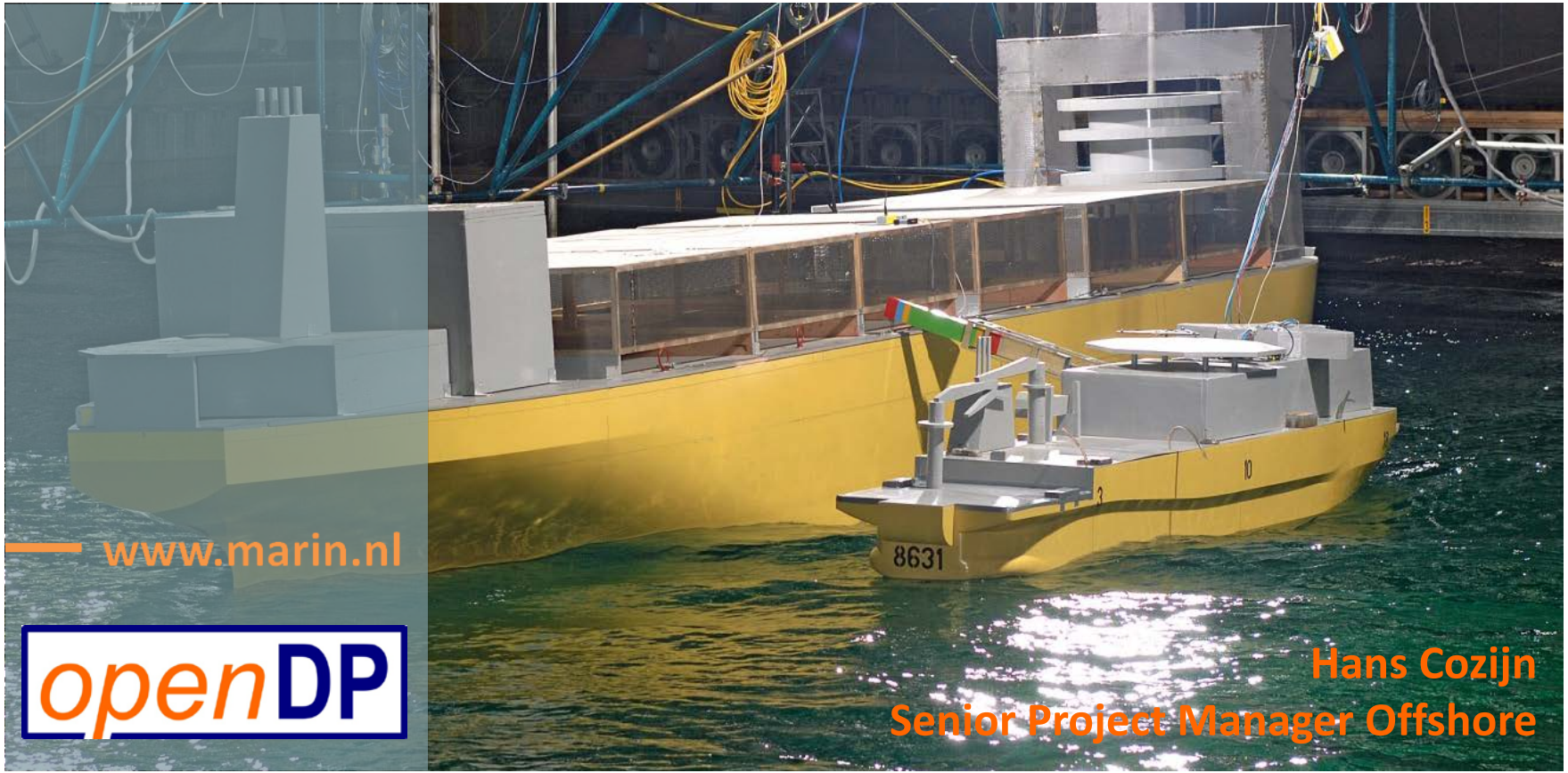
THANK YOU !



www.marin.nl

openDP

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