






We are one

DAMEN

Simulate to integrate: Shaping the future of integration in ship building

Huub van den Broek

Research Engineer

Damen Research, Development & Innovation (RD&I)

Damen Shipyards Group, The Netherlands

Contents

- Company Background
- Need for co-simulations
- Approach
- Some modelling results
- Current status & next steps
- Closing remarks

OUR MISSION

Damen aspires to become the most Sustainable and Connected Shipbuilder of the World.

Navigating to zero

We are active in these markets

- Harbour & Terminal
- Offshore Energy Wind
- Offshore Energy Oil and Gas
- Defence & Security
- Yachting
- Dredging
- Public Transport
- Seagoing Transport
- Inland Shipping
- Fishing
- Aquaculture
- Pontoons & Barges
- Environmental Safety & Control
- Civil
- Specials

SPECIALIZED VESSELS

Portfolio

AMELS 60 LIMITED EDITIONS
Come together

JOINT SUPPORT SHIP
Zr.Ms. Karel Doorman

OFFSHORE CARRIER 8500 CLV
Maersk Connector

CSOV 9020
Bibby Wavemaster Horizon

FAST CREW SUPPLIER 5009
Esnaad 715

FAST CREW SUPPLIER 7011
Aqua helix

SPECIALIZED VESSELS

Sustainable Solutions

RSD TUG 2513 ELECTRIC
Sparky

FAST CREW SUPPLIER 3212 HYBRID

FERRY 2306 ELECTRIC
Bryggen

ROAD FERRY 8117 HYBRID

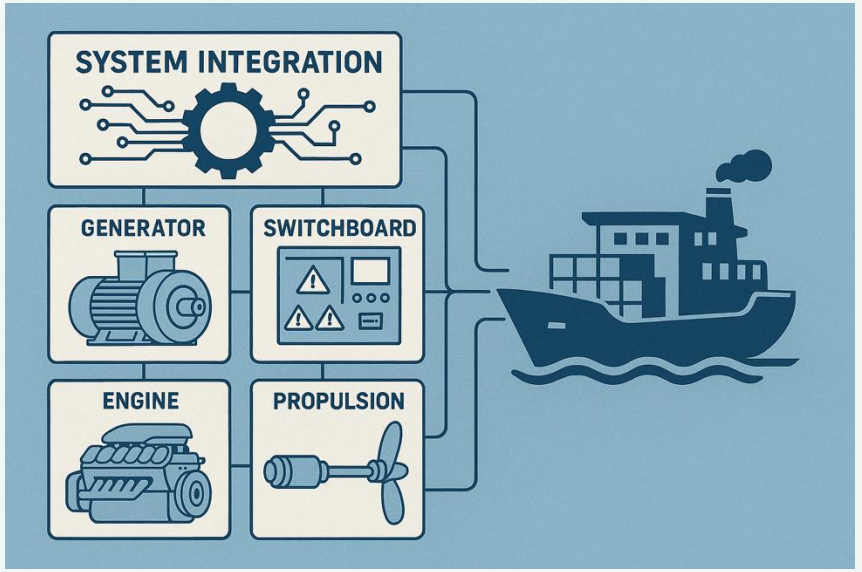
CSOV9020 HYBRID

Ships are becoming more complex

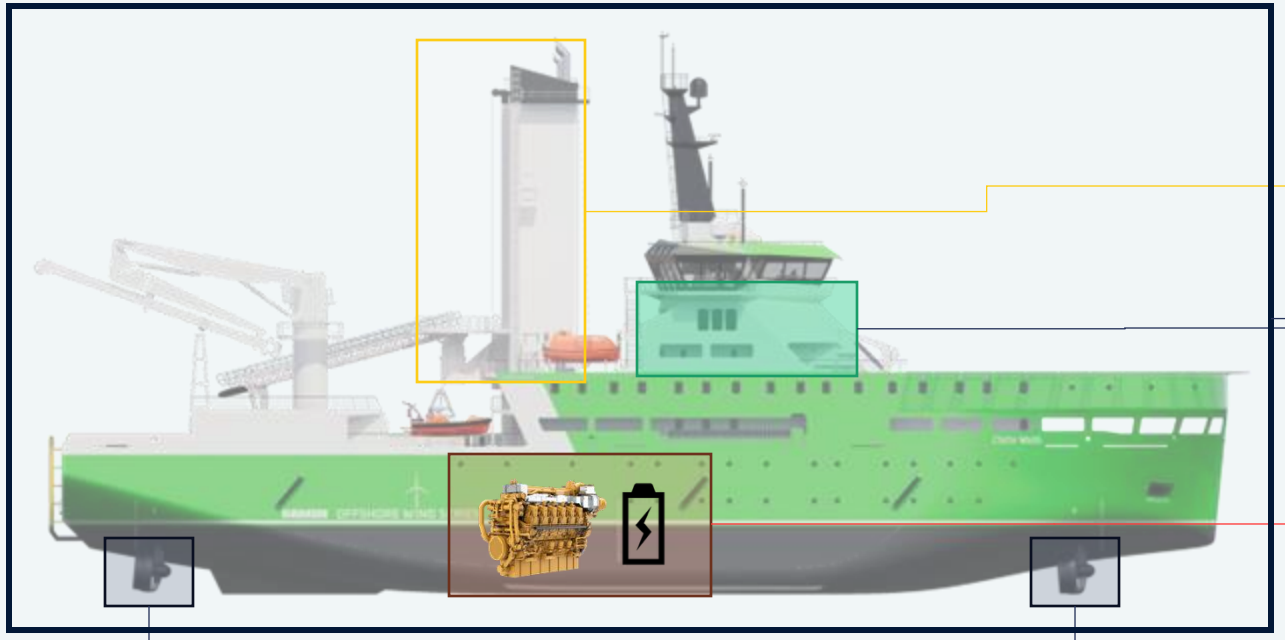
WHY CO-SIMULATIONS

System Integration

- "seamless integration of subsystems functioning in harmony as a single, unified entity.“
- Integration is more complex and more important
- Simulation can help



Performance Simulations – use case



Vessel Hydrodynamic System

Gangway System

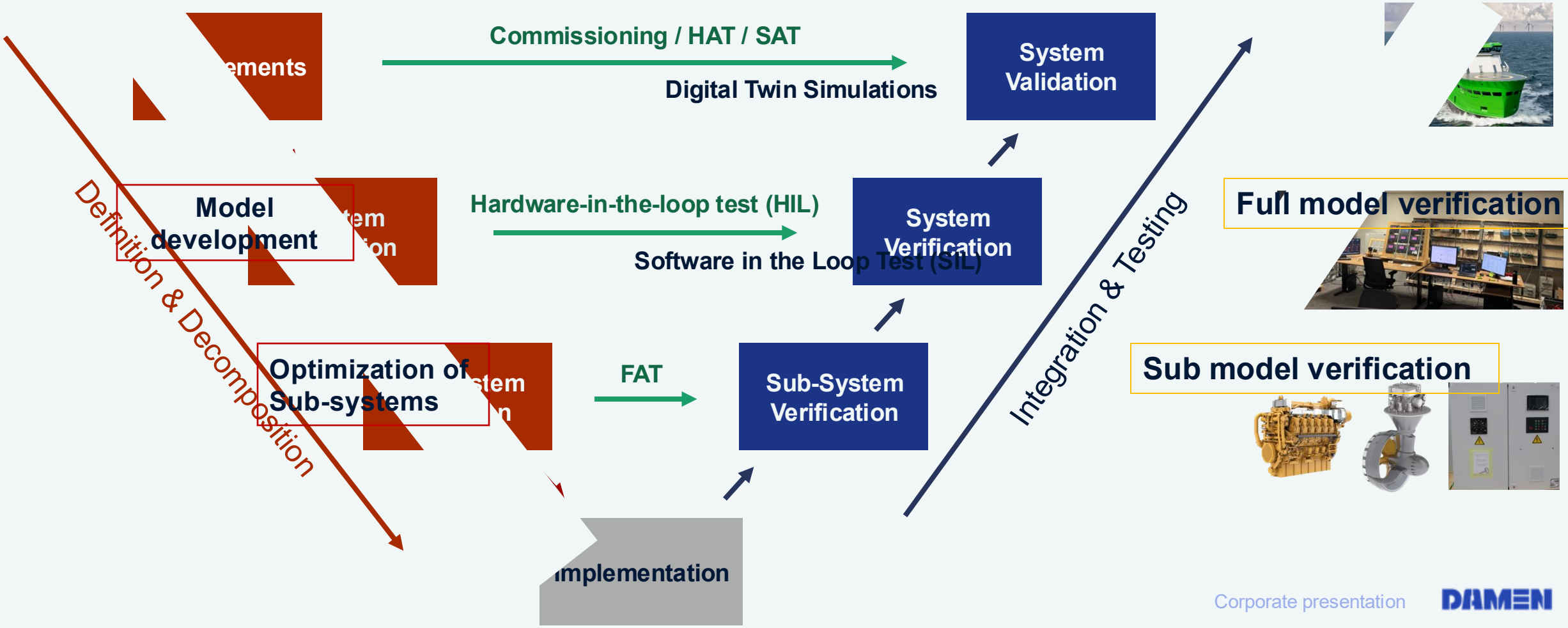
DP Control System

PMS/EMS

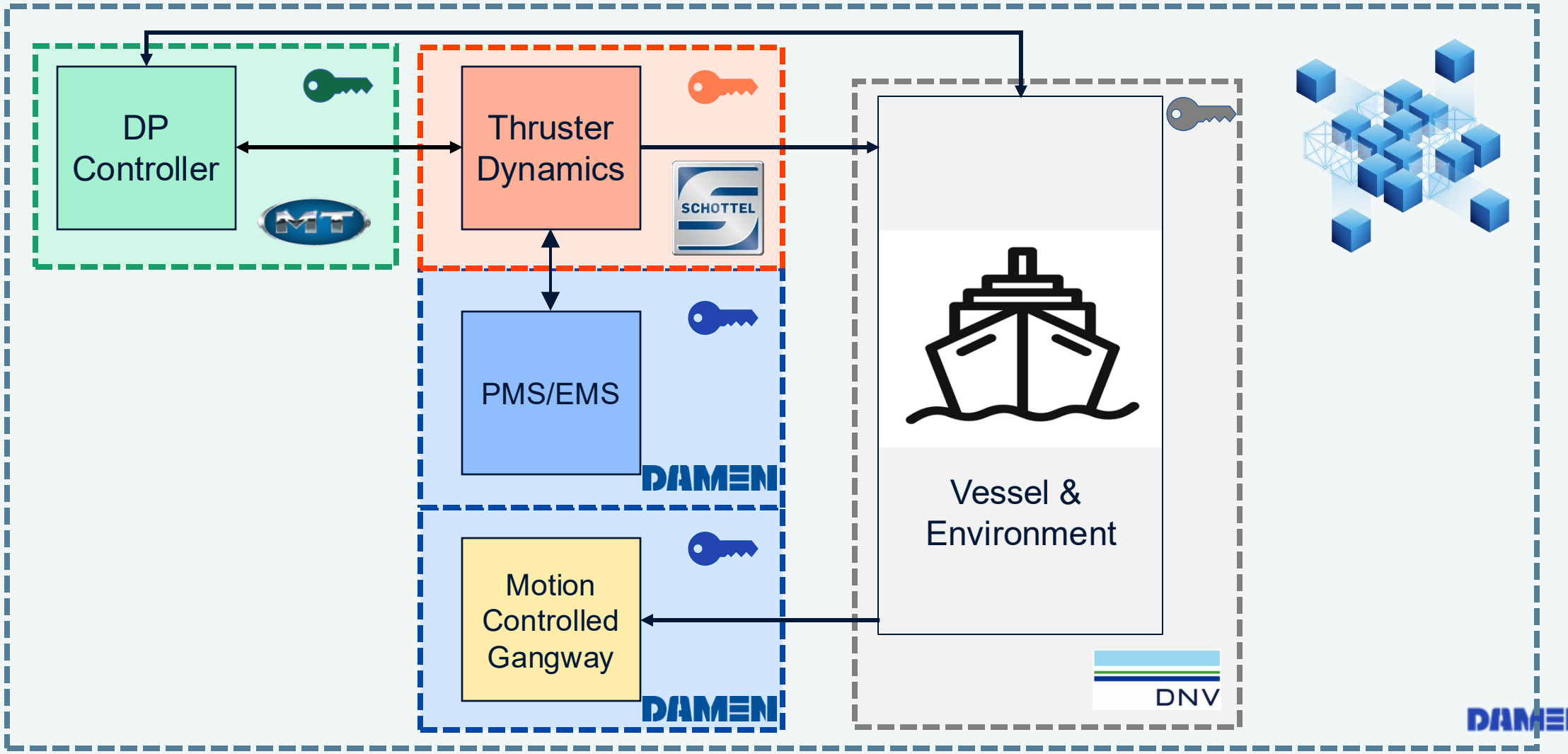
Thruster System

Performance Simulations – use case

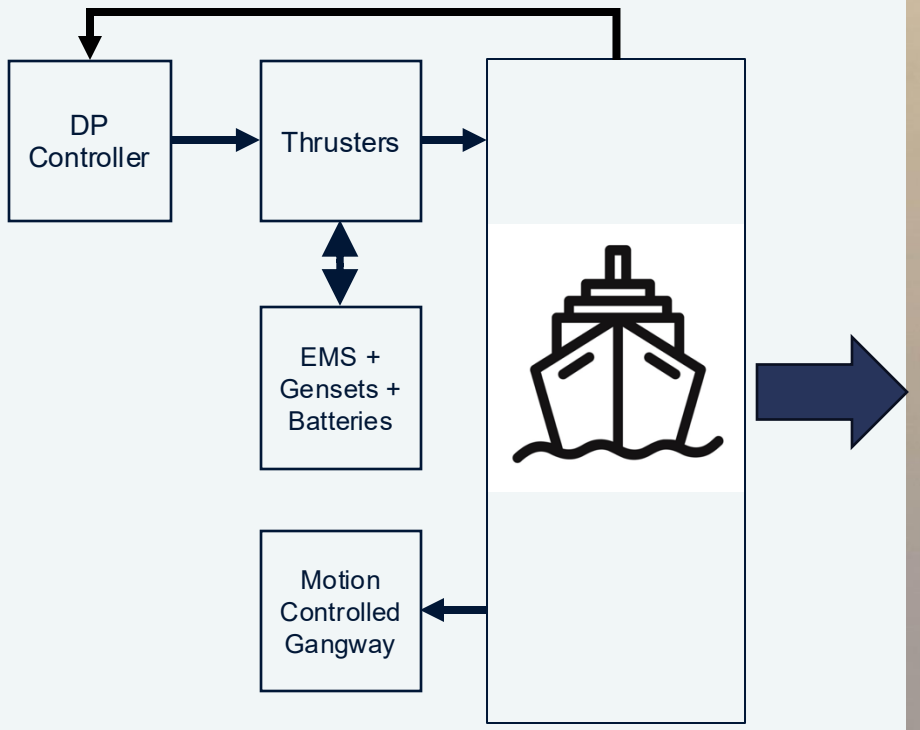
V model – With System Simulations

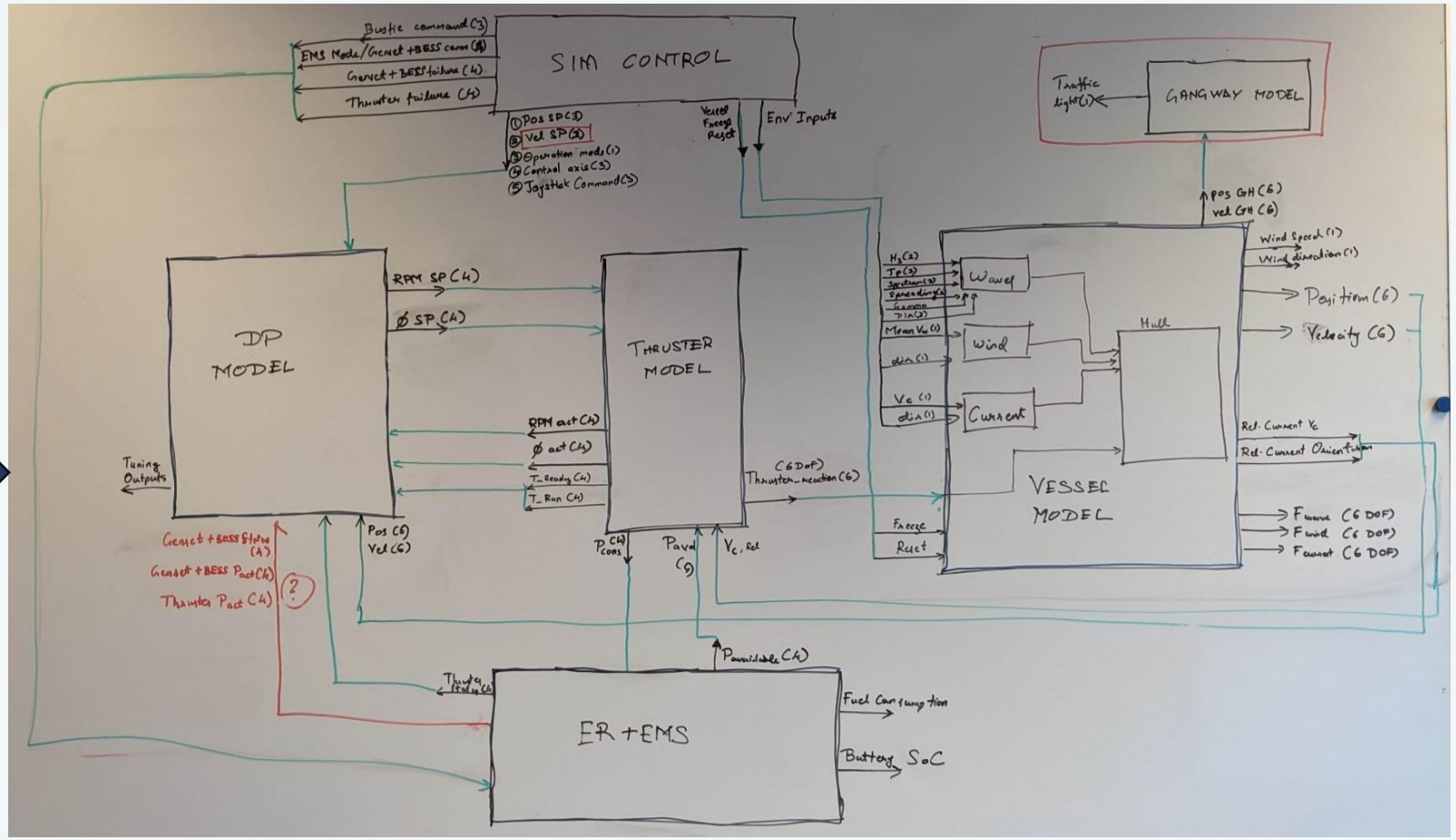


CSOV Co-simulations – Model

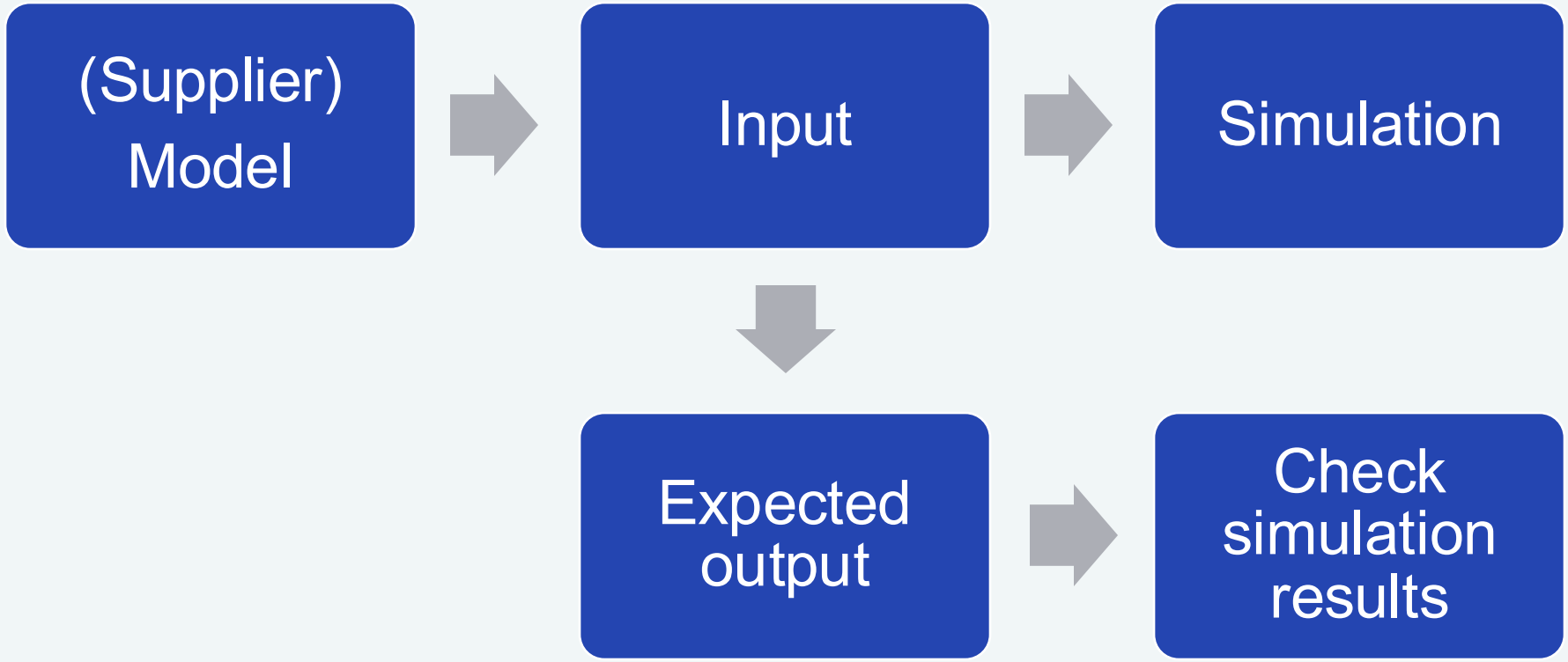


Setting up model definitions



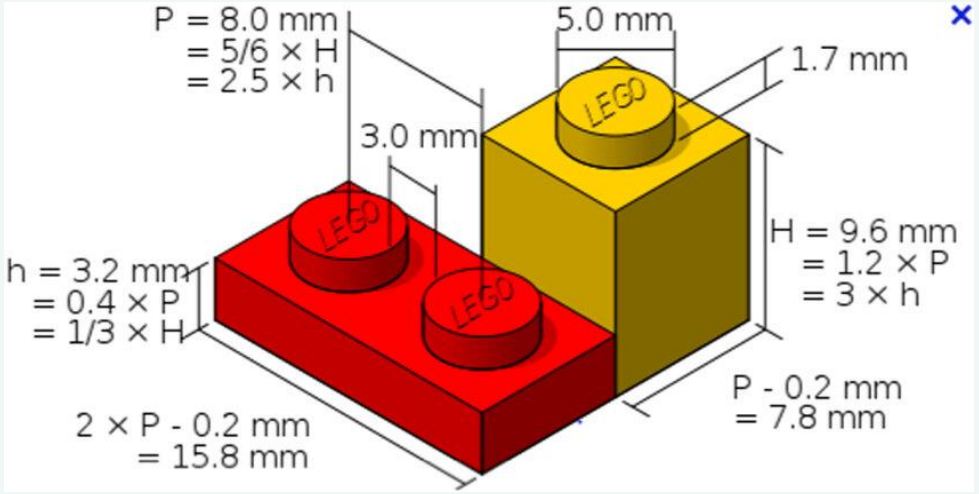


Individual model testing



Model integration

- Connecting all models in the STC platform
- Starting with first complete model simulations
- Probably you will encounter some challenges



SOME THINGS ARE ONLY SOLVED AFTER YOU ENCOUNTER IT

Difficulties encountered

- Clear model functions / boundaries
- Coordinate frames / sign conventions
- Hard coded time step dependencies

Results visualization

Making it visible helps in understanding what is happening

Graphically show and compare performance

Can make debugging easier

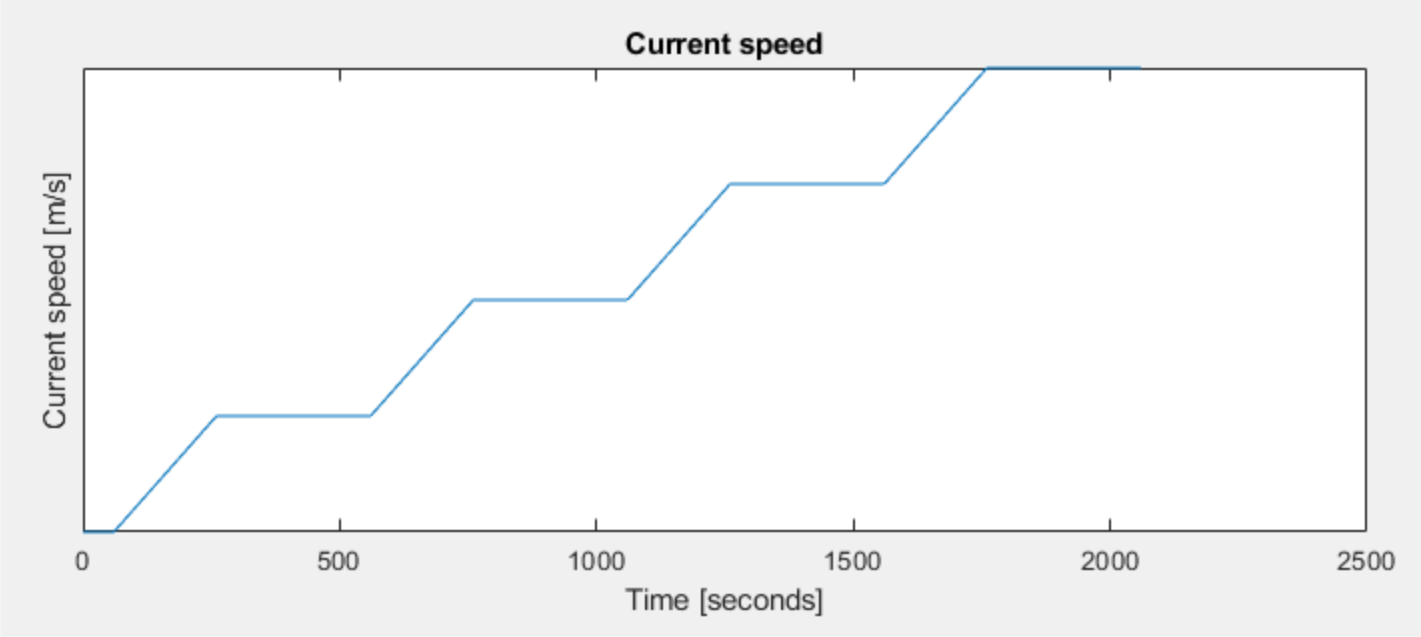
FROM SIMULATION TO VISUALIZATION

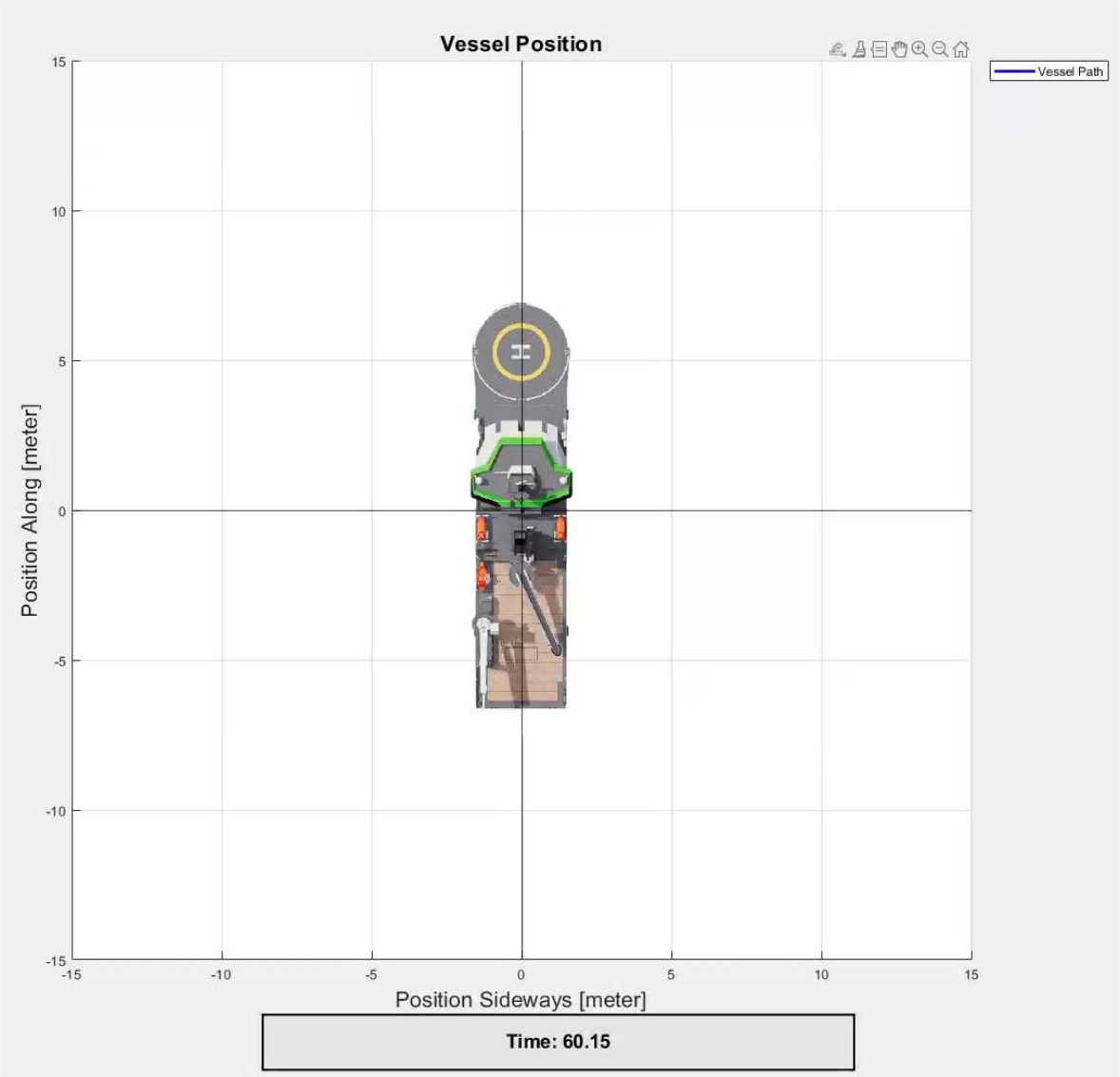
How

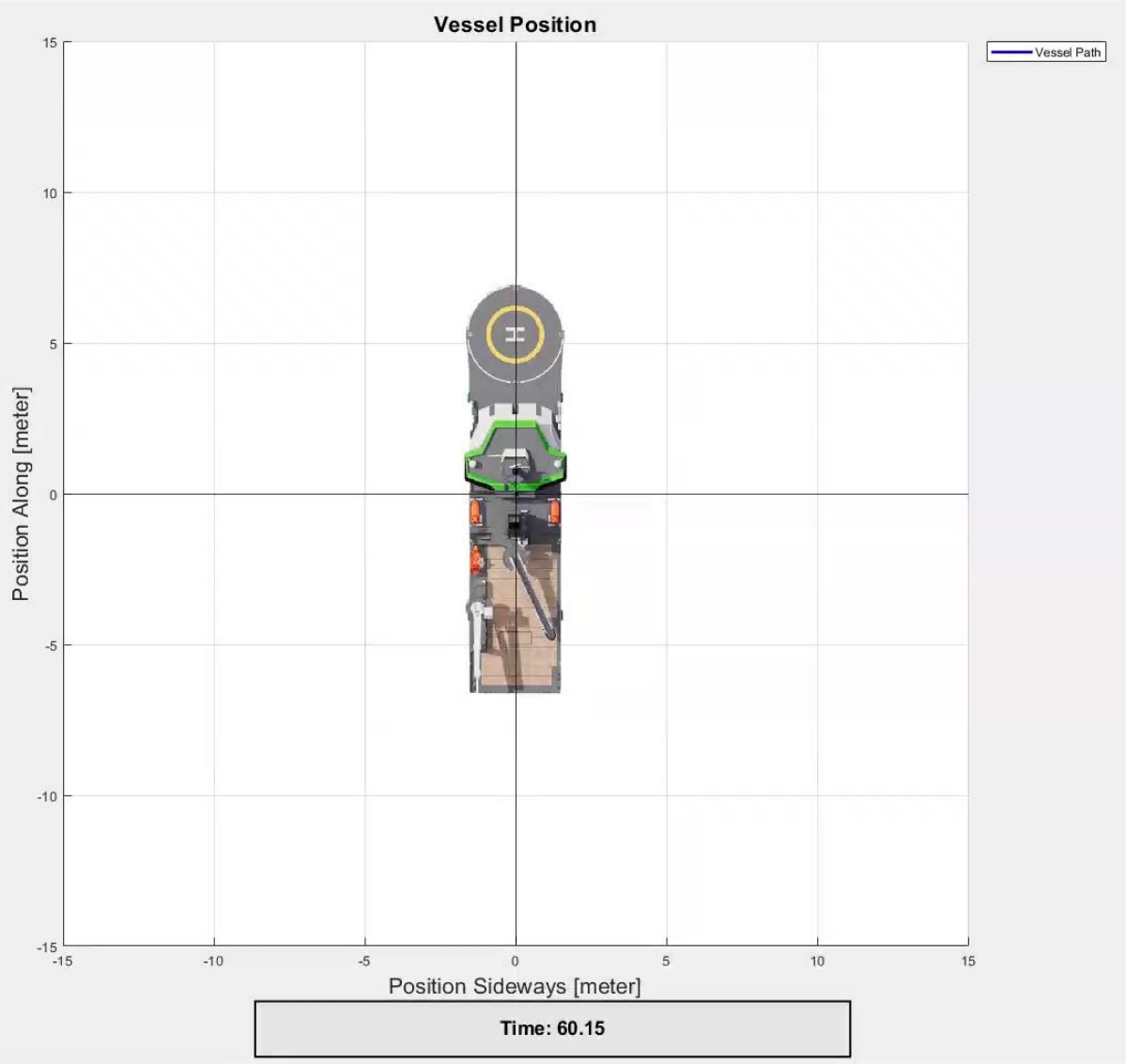
Run	Run simulations on the STC platform
Download	Download the result CSV files
Process	Use Matlab to read all data
Visualise	Visualise the data with Matlab plots

Simulation Results

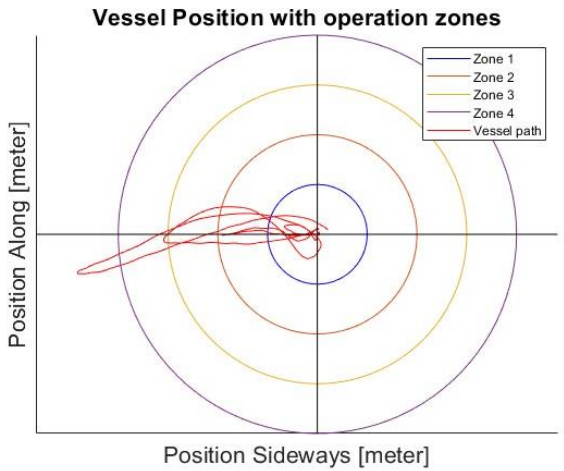
Current

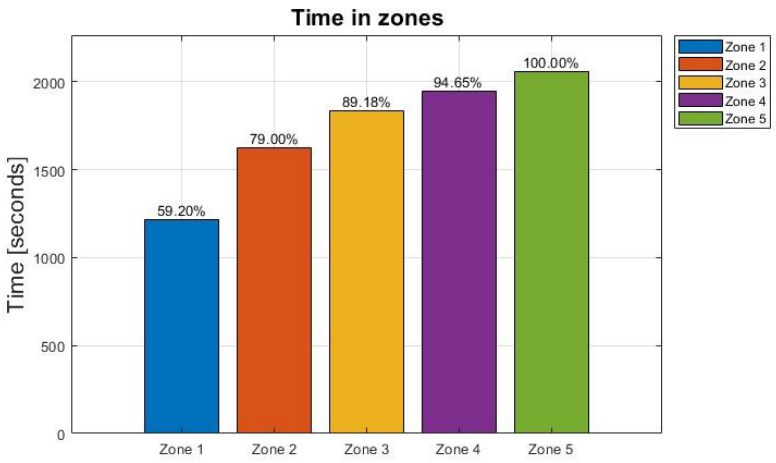


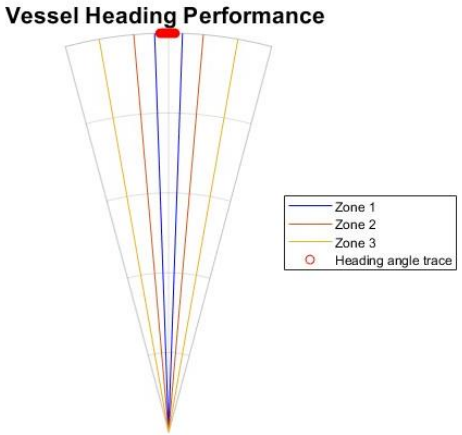

Vessel Position
Vessel Path
Position Along [meter]
Position Sideways [meter]
15
10
5
0
-5
-10
-15
Time: 60.15

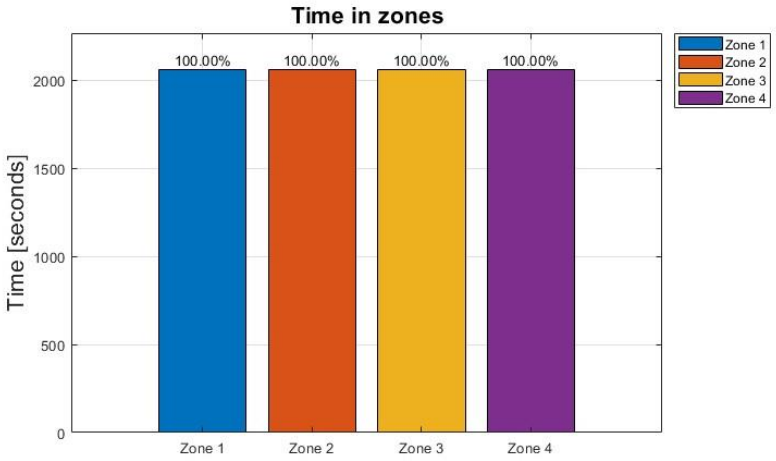

Vessel Position
Vessel Path
Position Along [meter]
Position Sideways [meter]
15
10
5
0
-5
-10
-15
Time: 60.15

Performance Overview



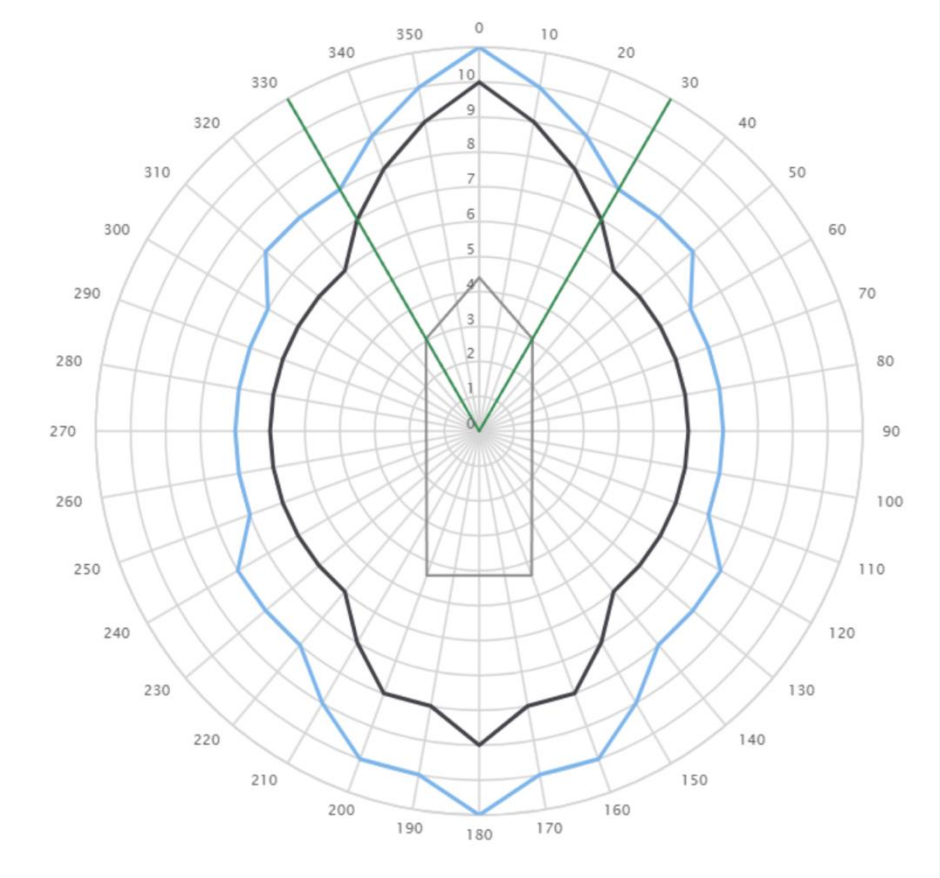




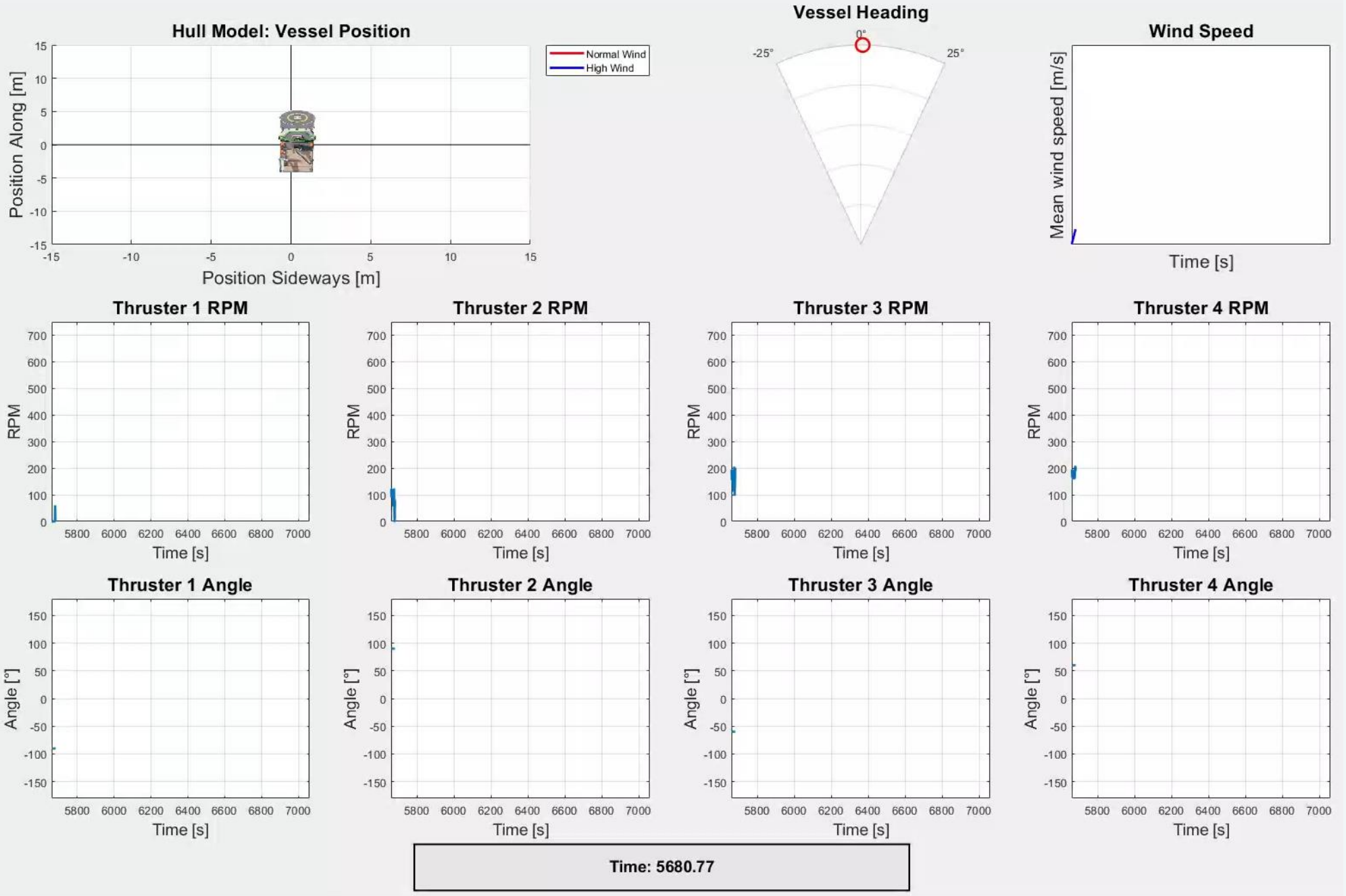


DP capability simulations

- Create a DP capability plot
  - Sweep across the Beaufort scale



M


Hull Model: Vessel Position
Position Along [m]
Position Sideways [m]
Normal Wind
High Wind
Vessel Heading
-25°
25°
Wind Speed
Mean wind speed [m/s]
Time [s]
Thruster 1 RPM
Thruster 2 RPM
Thruster 3 RPM
Thruster 4 RPM
RPM
Time [s]
Thruster 1 Angle
Thruster 2 Angle
Thruster 3 Angle
Thruster 4 Angle
Angle [°]
Time: 5680.77

CSOV9020 HYBRID

Current Status & Next Steps

- Model is operational
- Performance simulations
- Optimisation
- Validation (sea trail data)

- Customer use: Location specific vessel operability assessment

Closing remarks

- Took longer then expected (priorities)
- Interest from the business to start using more simulations in projects
- Models might become part of supplier contracts
- Big potential for smoother system integration
- Black box modelling makes debugging more difficult than traditional modelling approach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