

Using Monitoring of Maritime Traffic Scenarios in the Validation of Maritime Systems

Anna Austel, Lukas Panneke,
Janusz Piotrowski, Nina Wetzig,
Matthias Steidel, Bernd Westphal

*Institute Systems Engineering for Future Mobility,
German Aerospace Center (DLR)*

SYMPOSIUM ON

**MARITIME
INFORMATICS
& ROBOTICS**

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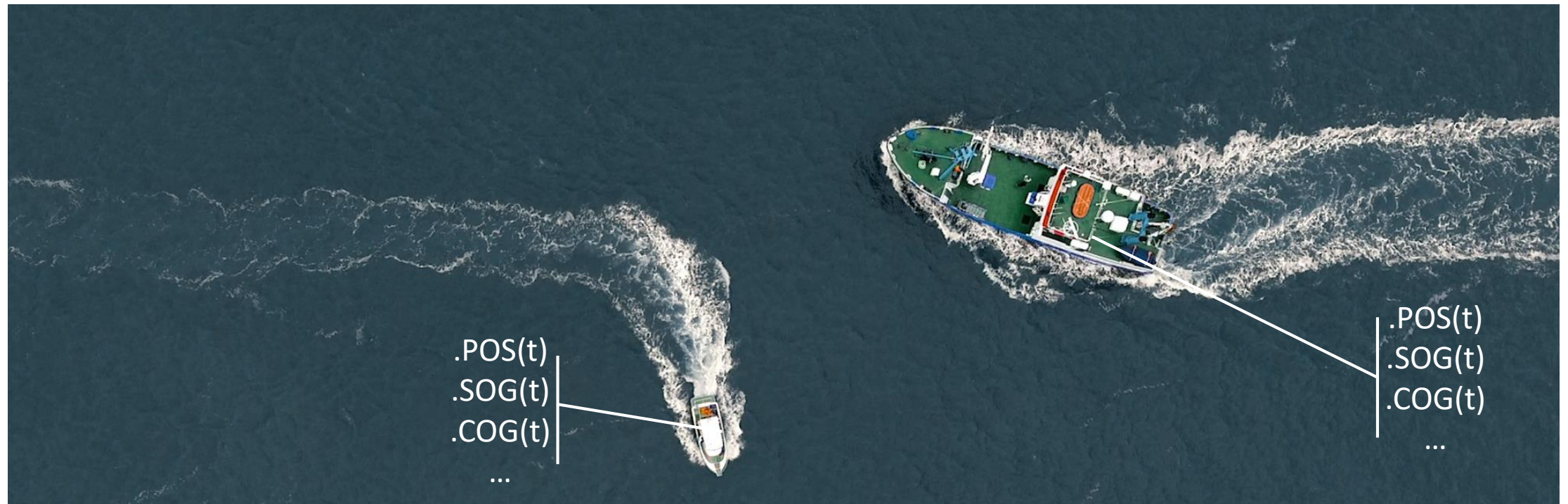
**ERMOUPOLIS, SYROS, GREECE
APOLLON THEATRE**





Traffic Scenario Monitoring:

Assess whether ships **drive** 'correctly'.



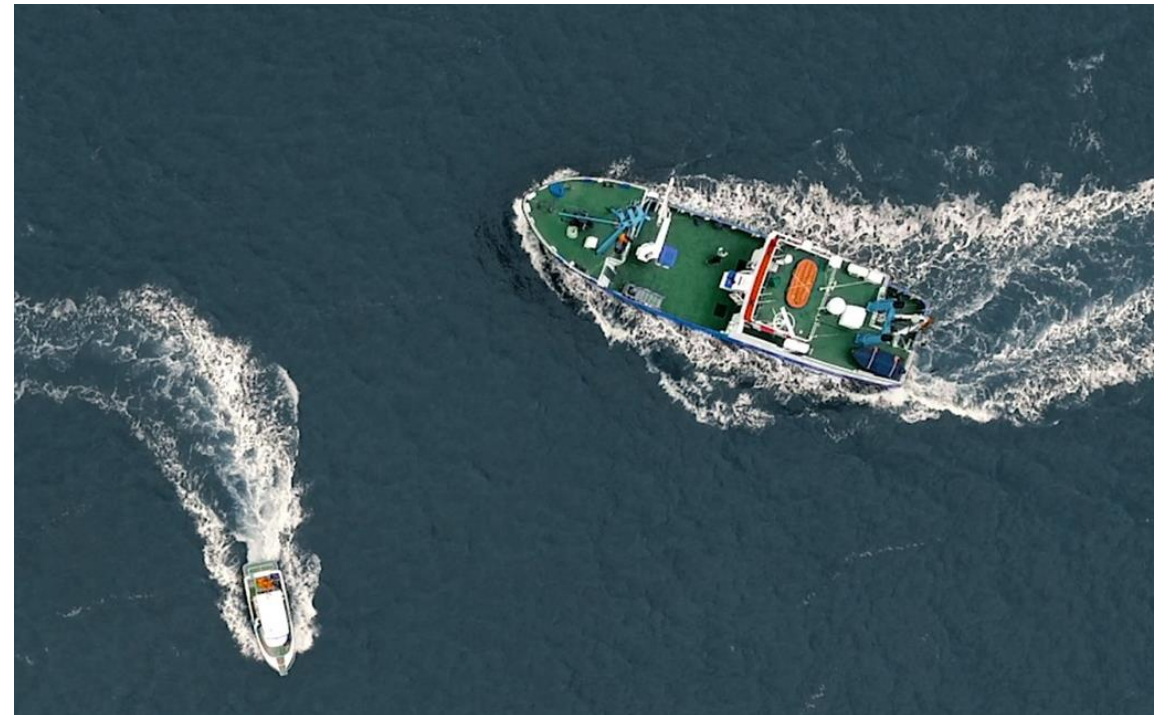
Kollisionsvermeidung von hochautomatisierten Schiffen
Credit: DLR (CC BY-NC-ND 3.0)



Applications

Assess whether ships drive
'correctly' e.g.,

- follow *traffic rules*
- satisfy *safety requirements* for autonomous vessels
- conduct *test scenario* from Scenario-based testing
- ...

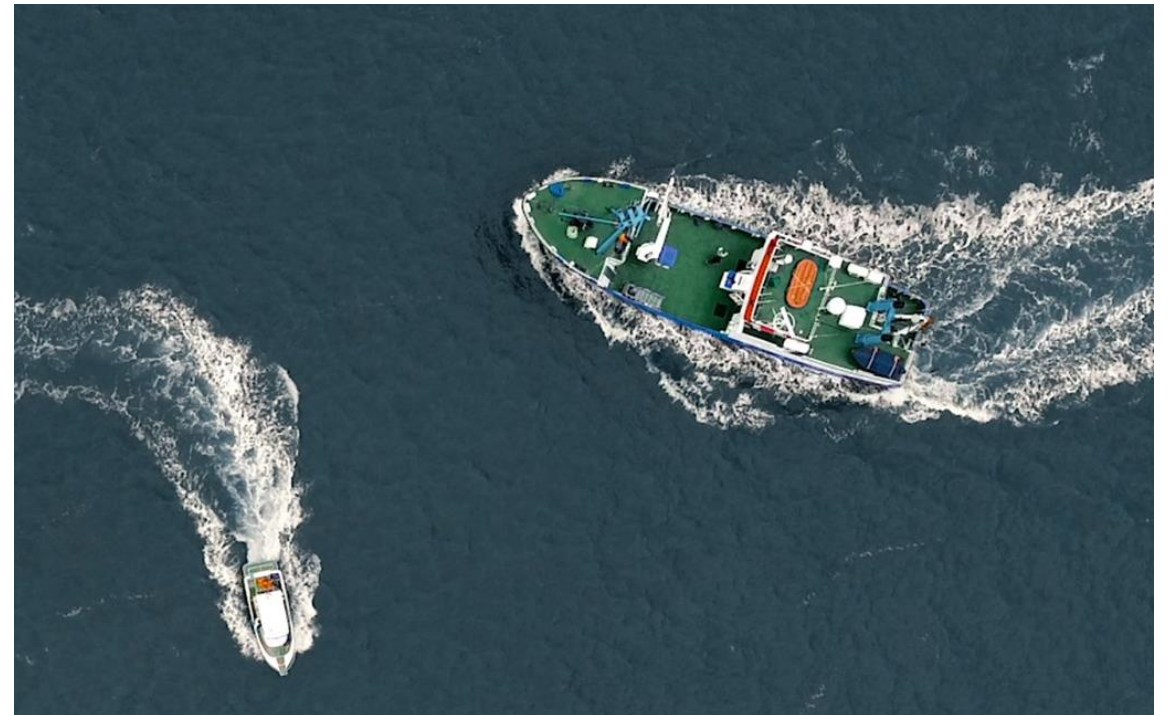


Kollisionsvermeidung von hochautomatisierten Schiffen
Credit: DLR (CC BY-NC-ND 3.0)



Contribution

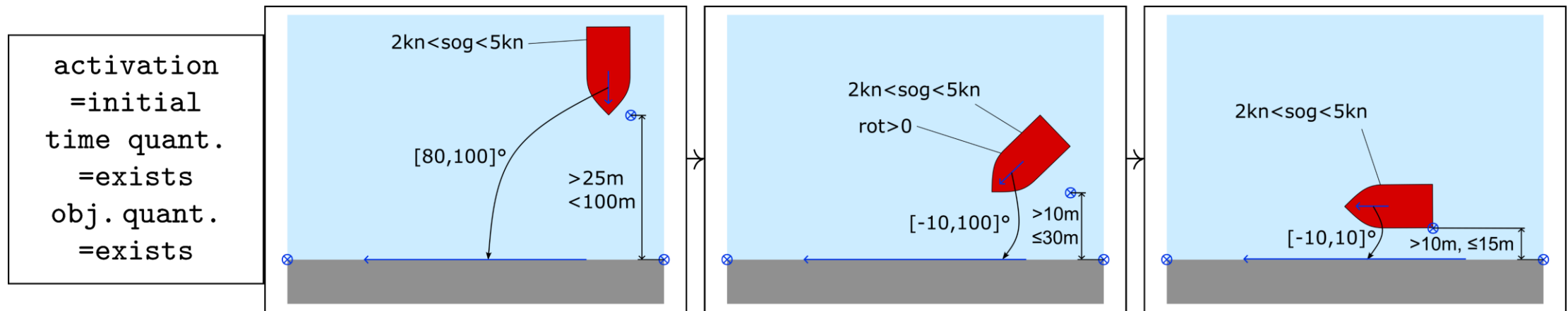
Monitor ships' behaviour at runtime, relative to formal specification of traffic scenario in simulation and test-field.



Kollisionsvermeidung von hochautomatisierten Schiffen
Credit: [DLR](#) (CC BY-NC-ND 3.0)



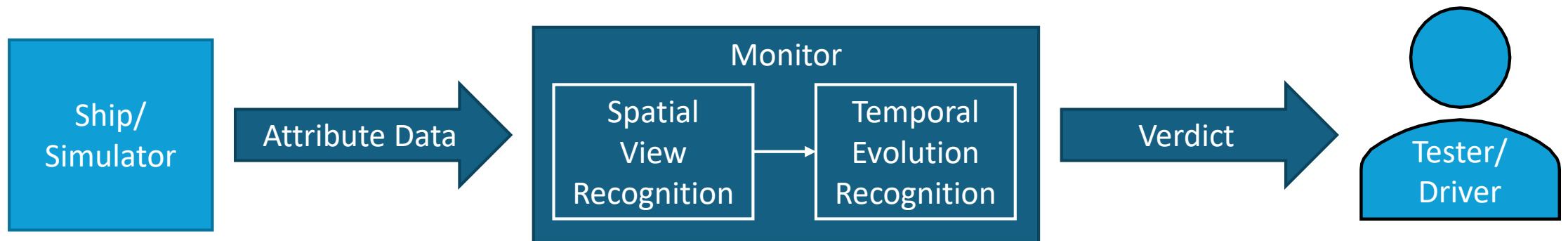
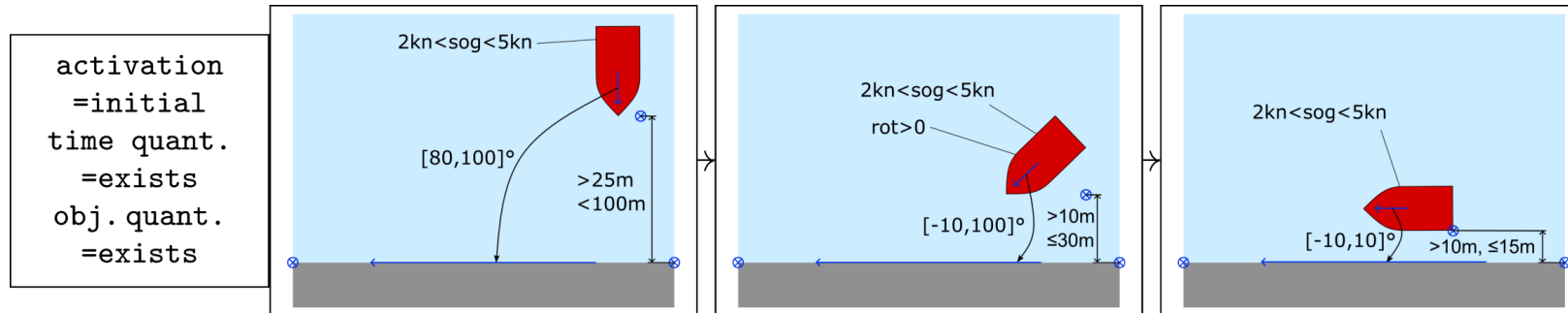
Online Monitoring of Traffic Scenarios



Traffic Sequence Chart formalizing 'Approaching Quay Wall'.

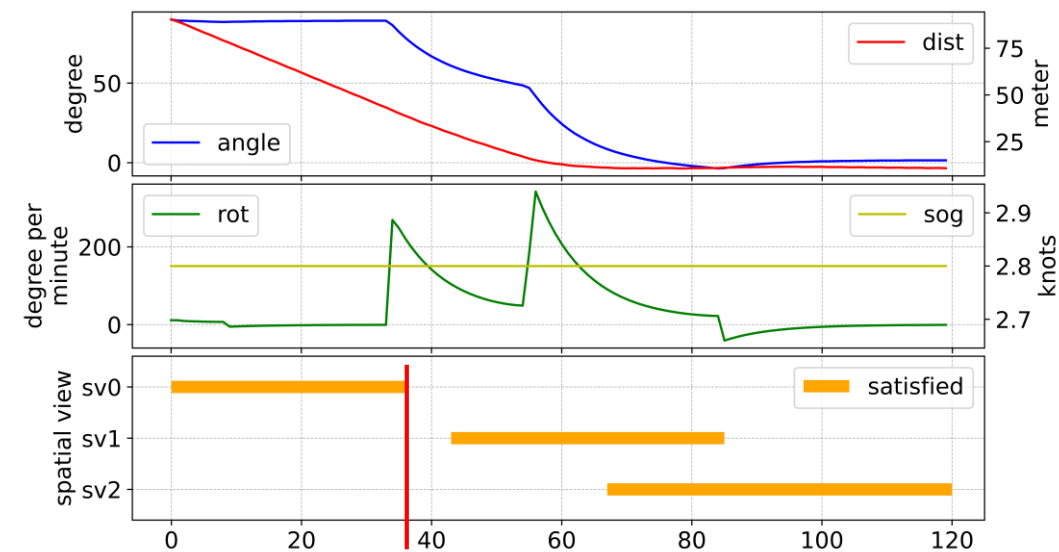
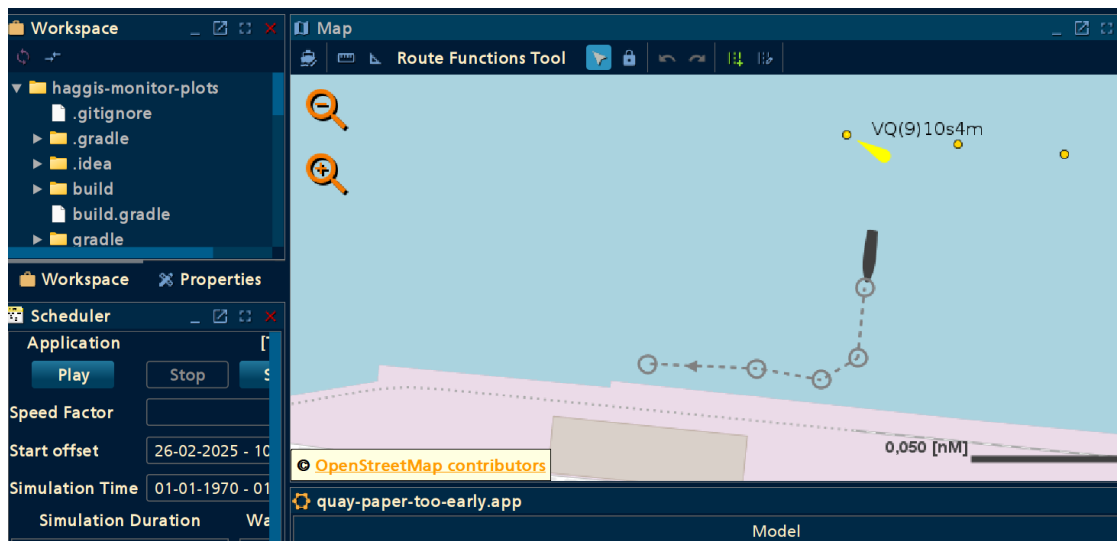
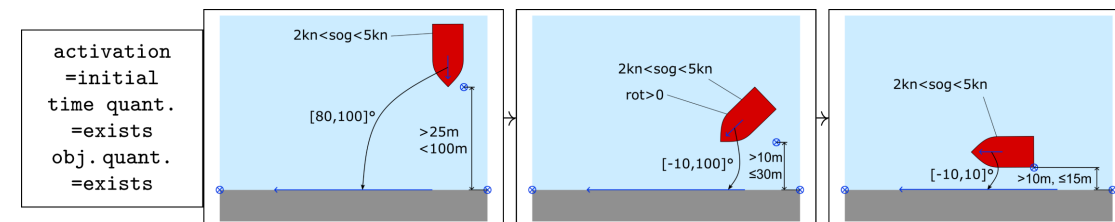


Online Monitoring of Traffic Scenarios



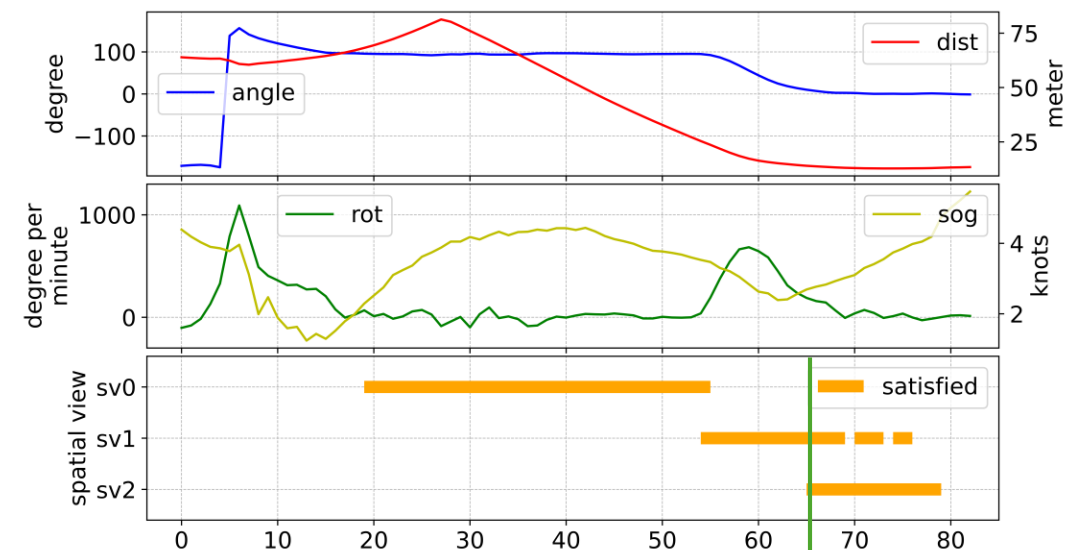
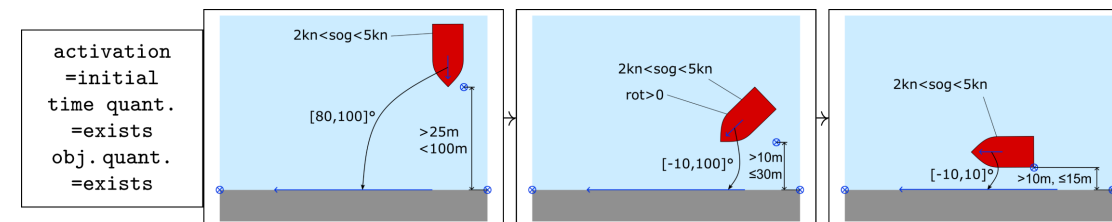
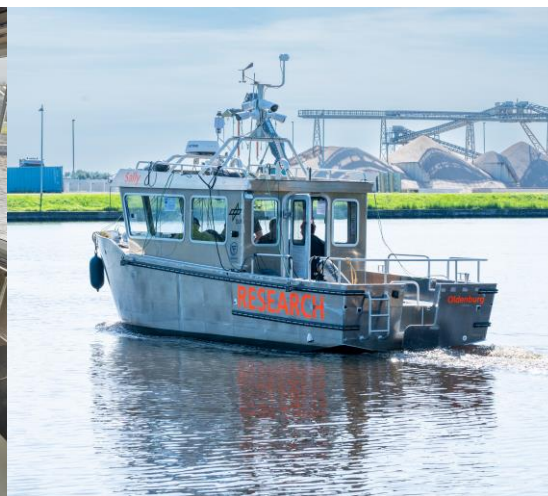


Experiment: Simulation



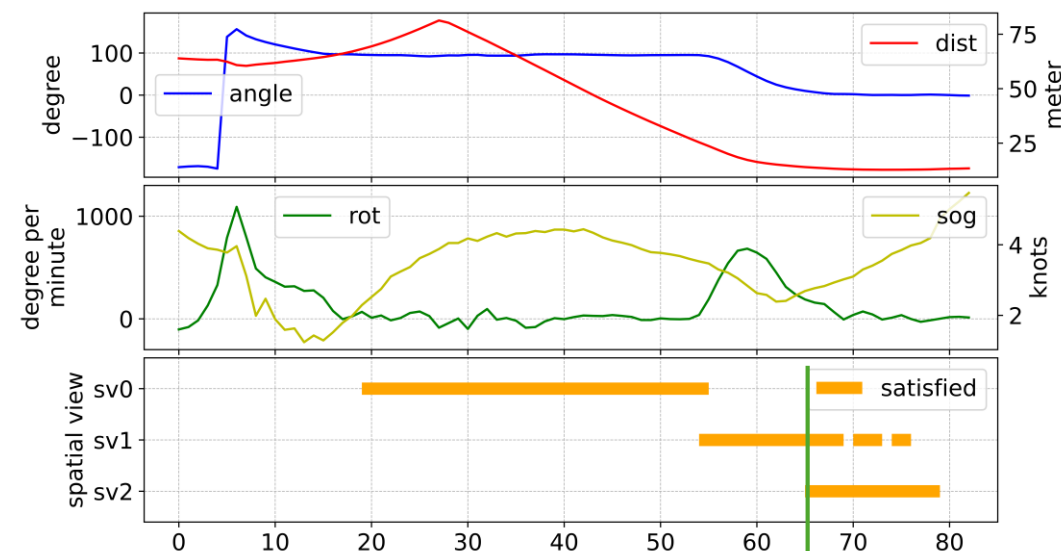
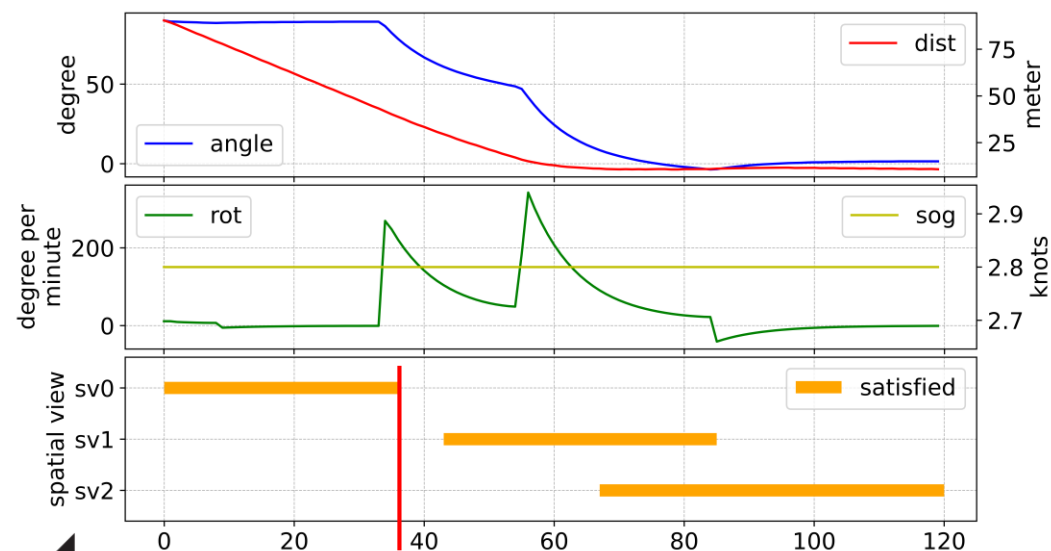
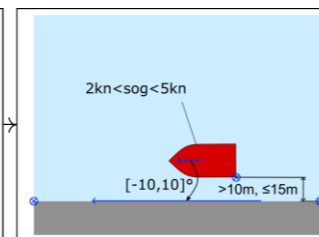
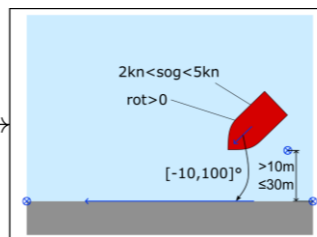
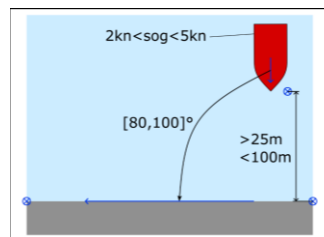
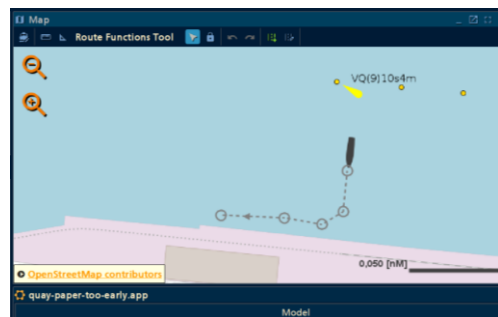


Experiment: Research Ship





Experiment: Comparison





Conclusion and Outlook

We can monitor correctness of ships behaviour relative to TSC-specifications in simulation and real world at runtime.

Next steps to improve usability include:

- Extending the user-interface for verdicts and further information
- predictive monitoring: taking ship dynamics into account
- handling unreliable input data