



OPERATIONAL SUPPORT BY CONTROLLING SHIP MOTIONS DP PLOUGH OPERATIONS

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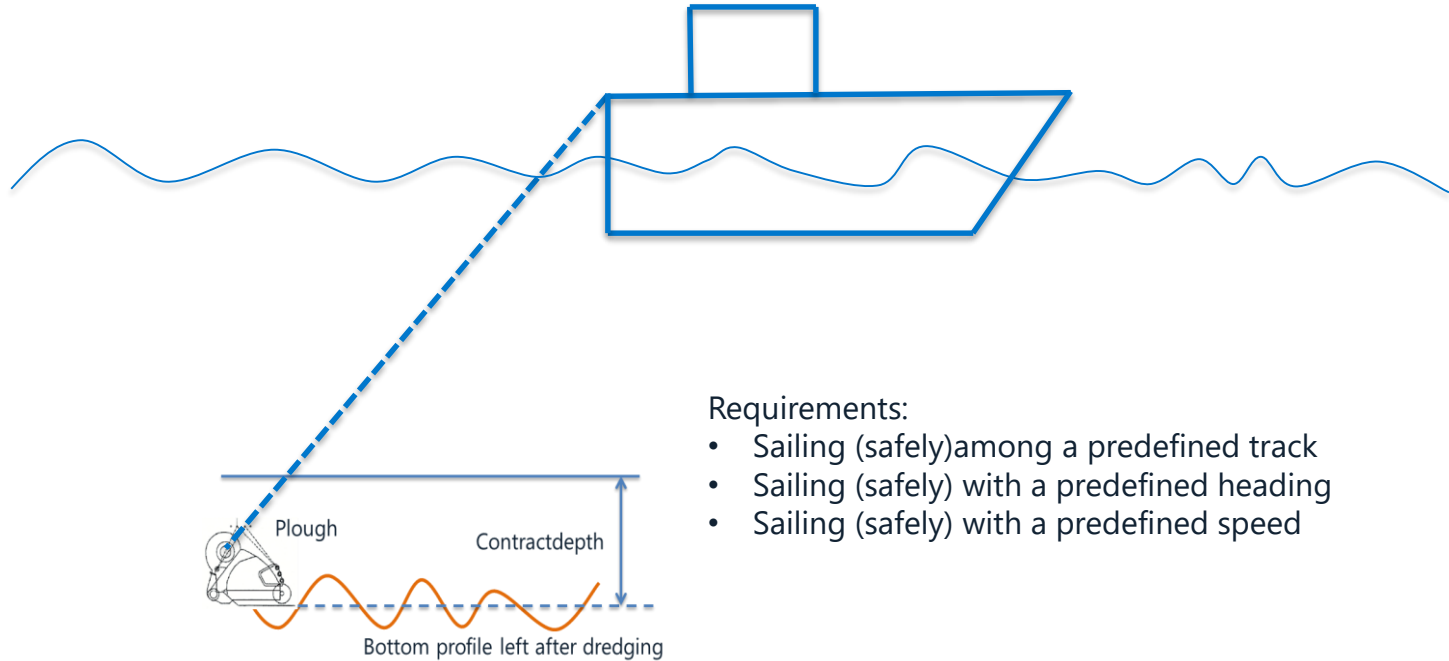
OPERATIONAL SUPPORT BY CONTROLLING SHIP MOTIONS

DP plough operations

CONTENT PRESENTATION

- Introduction into the plough operation (from a ship motion control perspective)
- Plough operational modes (from a ship motion control perspective)
- Scope implementation plough operation into DP system
- Implementation Plough module into DP control system
- Conclusion/results

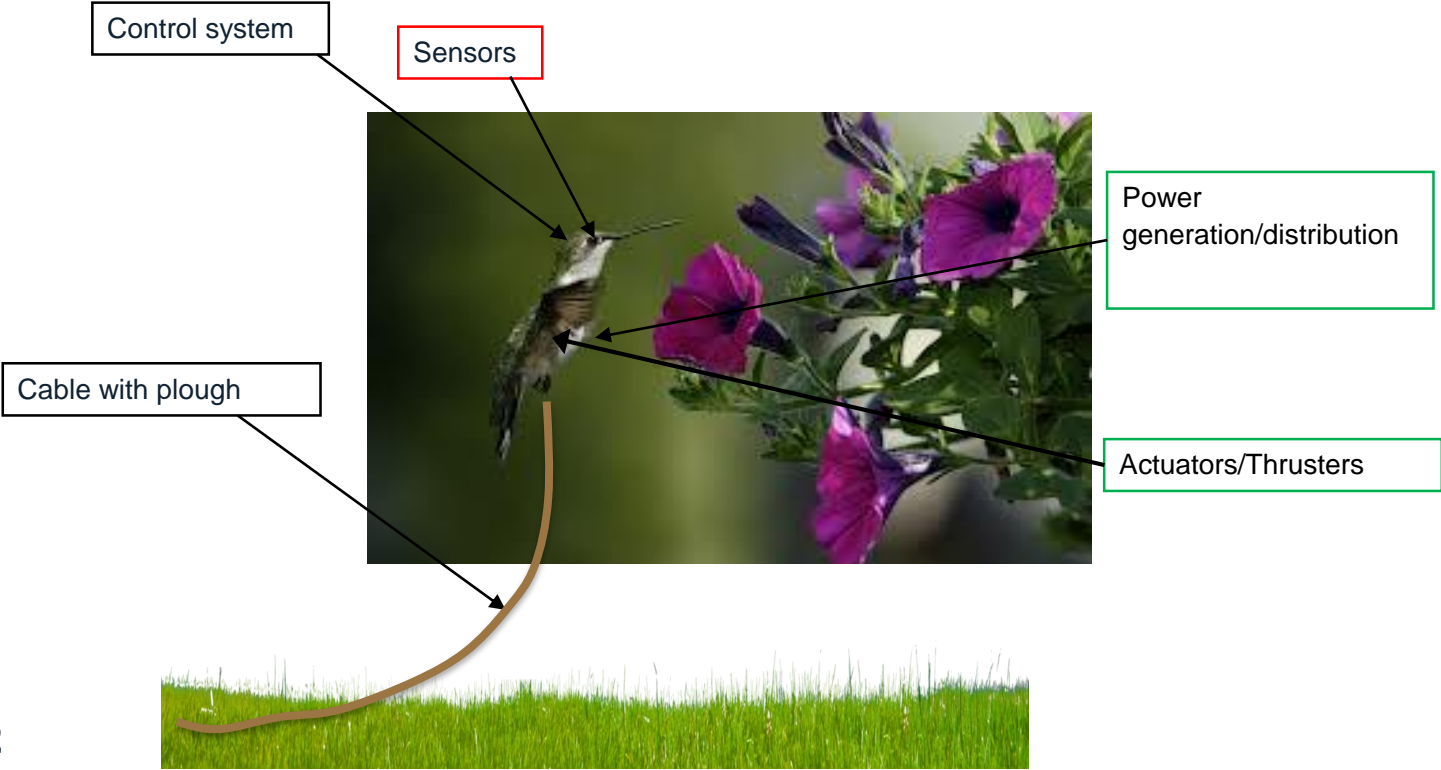
INTRODUCTION INTO THE PLOUGH OPERATION



Requirements:

- Sailing (safely) along a predefined track
- Sailing (safely) with a predefined heading
- Sailing (safely) with a predefined speed

SCOPE IMPLEMENTATION PLOUGH OPERATION INTO DP SYSTEM



PLOUGH OPERATION INTO DP CONTROL SYSTEM

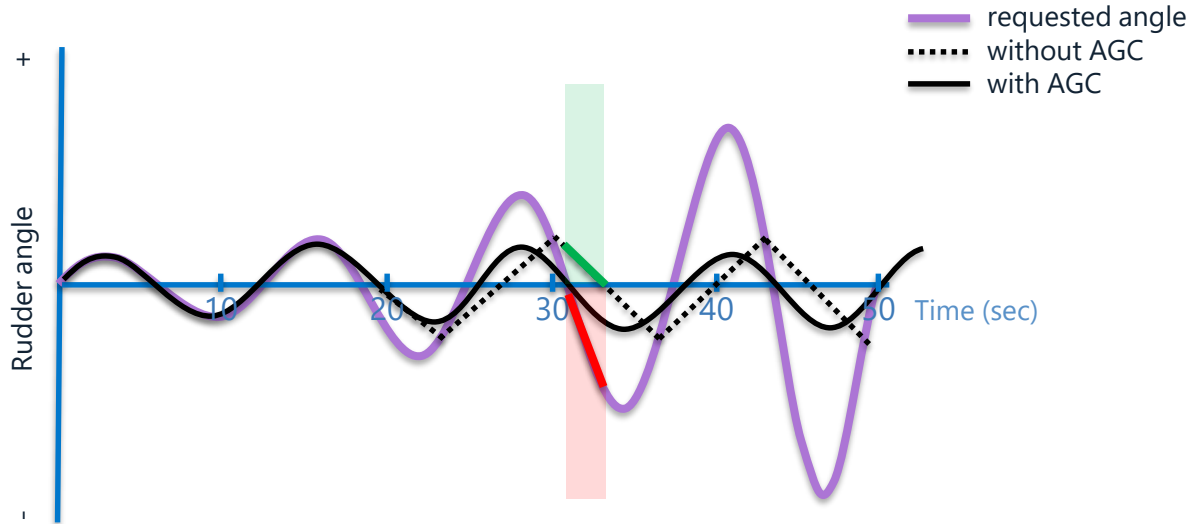
- Why could the DP plough operation be challenging
 - Large “unknown” forces
 - Large “unknown” fast fluctuating forces

PLOUGH OPERATIONAL MODES

Operational mode	Required response/action
1. Happy Flow	Feedforward Plough forces/moments
2. Fast force fluctuation	Adjust total control demand
3. Reduced performance	Decrease speed set point demand
4. Track maintaining not possible	Change control mode
5. Too large roll/pitch movements	Decrease speed set point demand

PLOUGH OPERATIONAL MODES

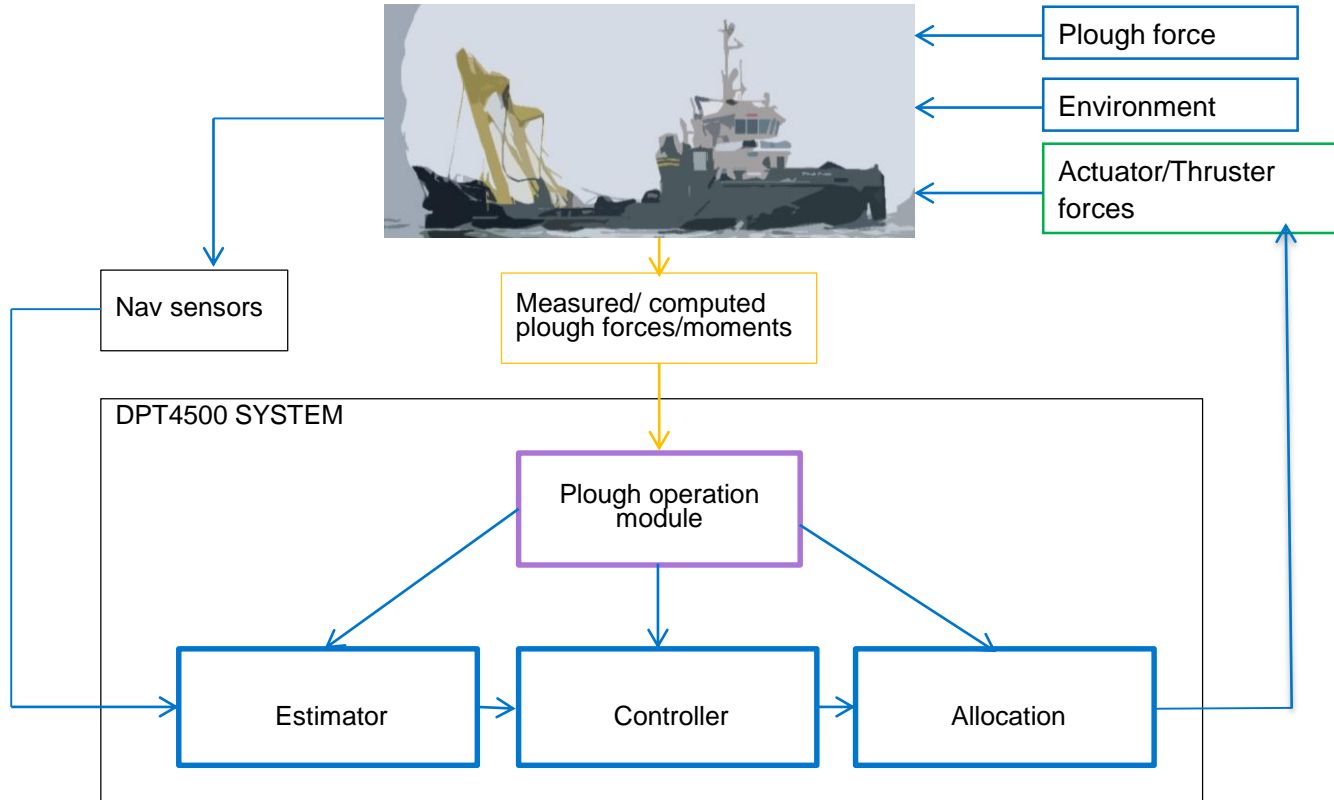
Fast force fluctuation



Rudder Roll Stabilization for Ships*

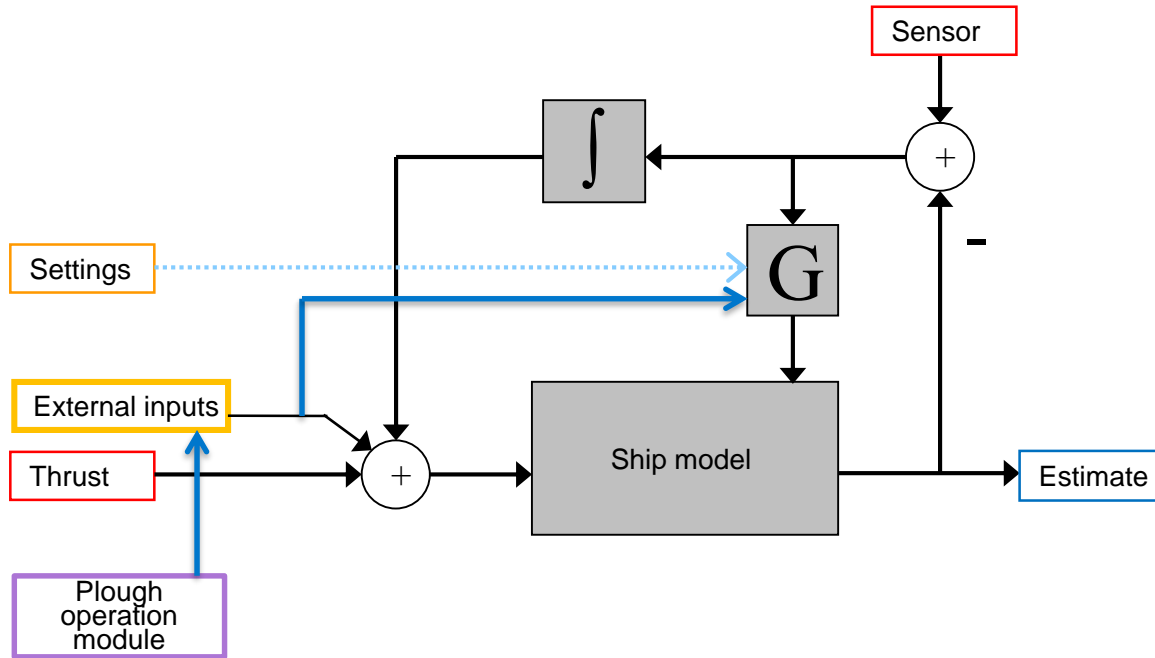
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IMPLEMENTATION PLOUGH MODULE INTO DP CONTROL SYSTEM

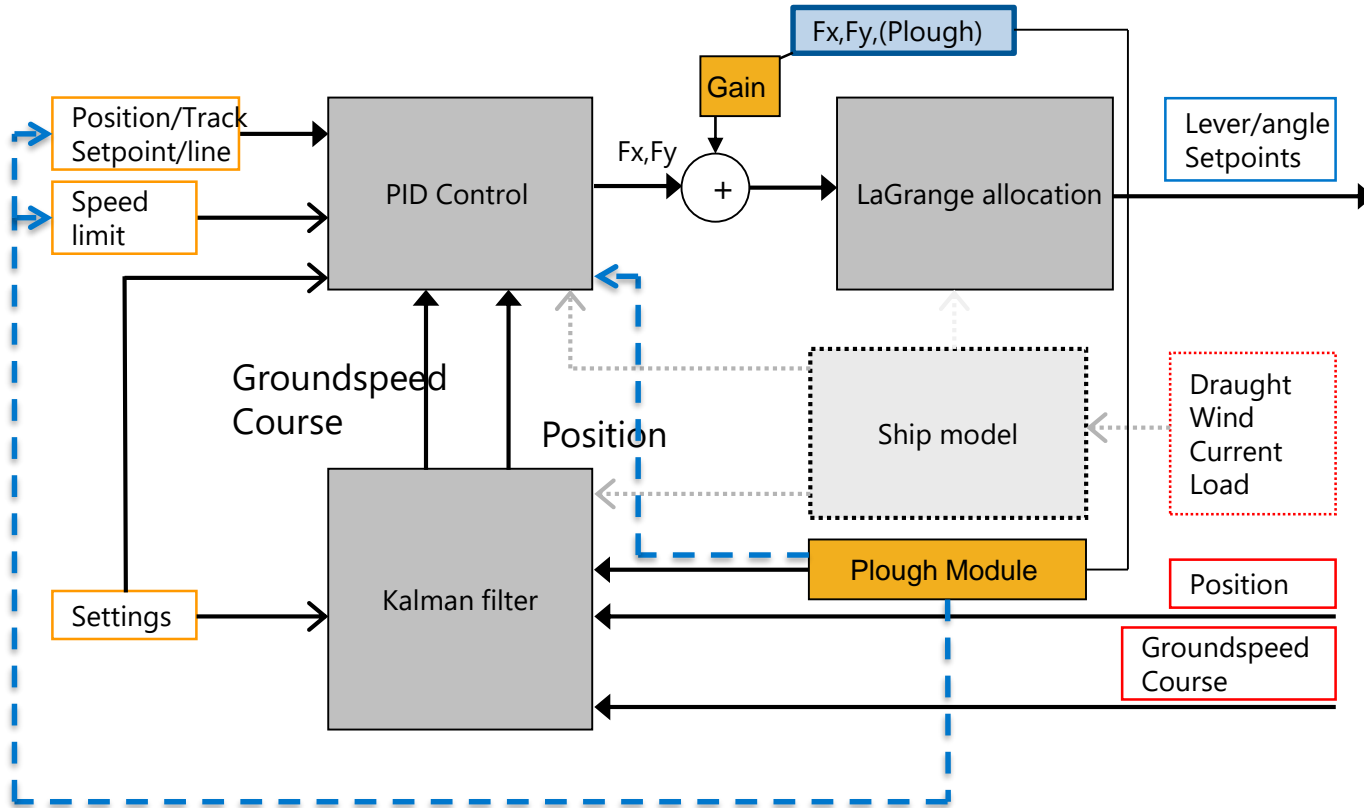


IMPLEMENTATION PLOUGH MODULE ESTIMATOR

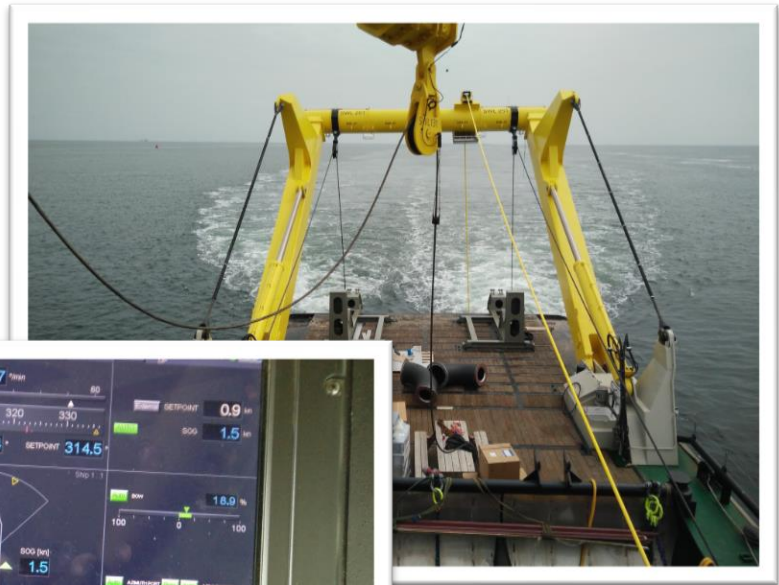
Filtering: Kalman principle



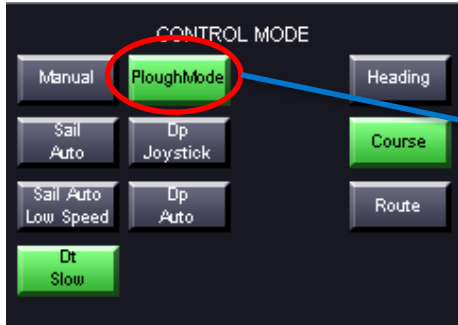
IMPLEMENTATION PLOUGH MODULE CONTROLLER



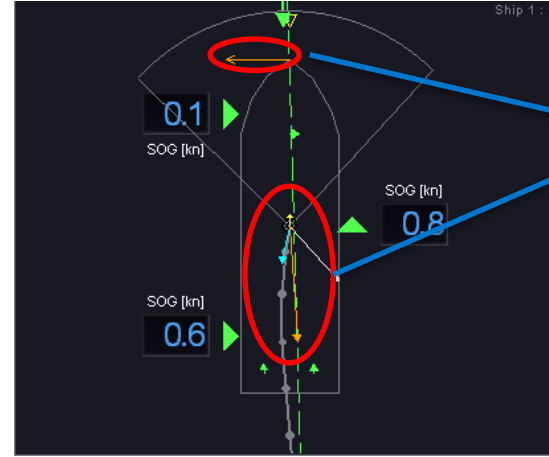
CONCLUSION & RESULTS



CONCLUSION & RESULTS



Additional mode



External Force x/y plane indication



Orange speed setpoint -> automatically reduced

Alarms to report automatic intervention





Thank you.

Questions?