

TCOMS R & D on Autonomous and Remotely Operated Vessels



Workshop on Port and MASS in Ningbo, China

18 July 2023

Singapore Maritime Institute (SMI)



Technology Centre for Offshore and Marine, Singapore (TCOMS)

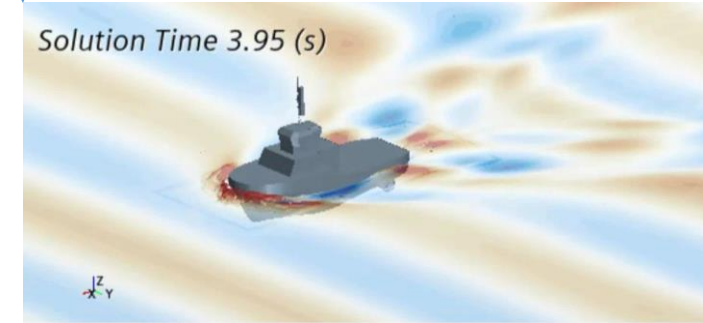
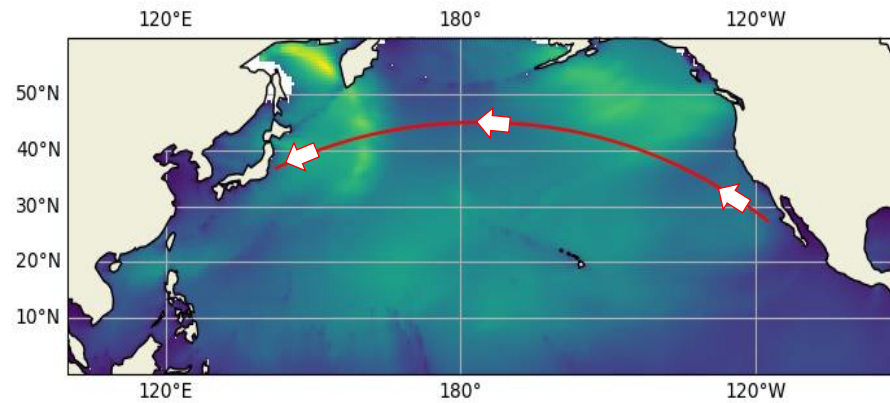
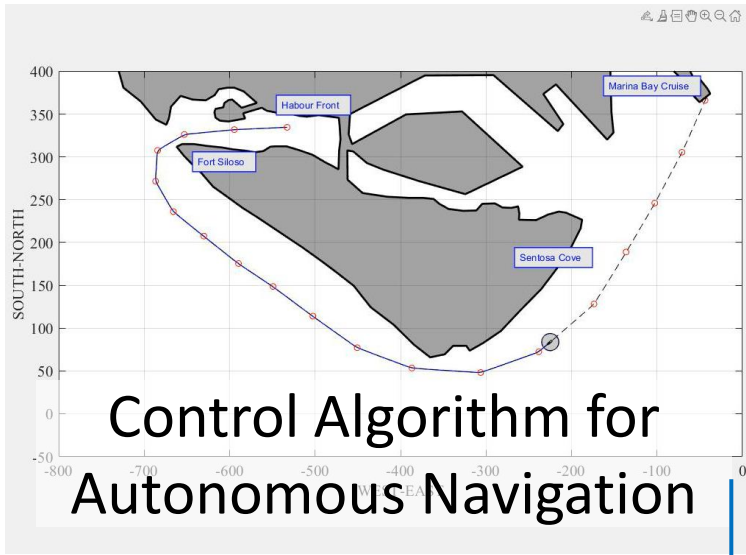
TCOMS is Singapore's national platform for Marine and Maritime R&D. It currently hosts CEAOPS, a CoE for MASS, to drive technology innovation and solutions for safe and efficient operations of autonomous and remotely operated vessels, and vessels equipped with smart maritime systems / solutions.

Our Focus:

Key thrusts in CEAOPS include sensing and met-ocean forecasting, real-time predictions of vessel voyage performance and dynamic assessment of vessel structural health.



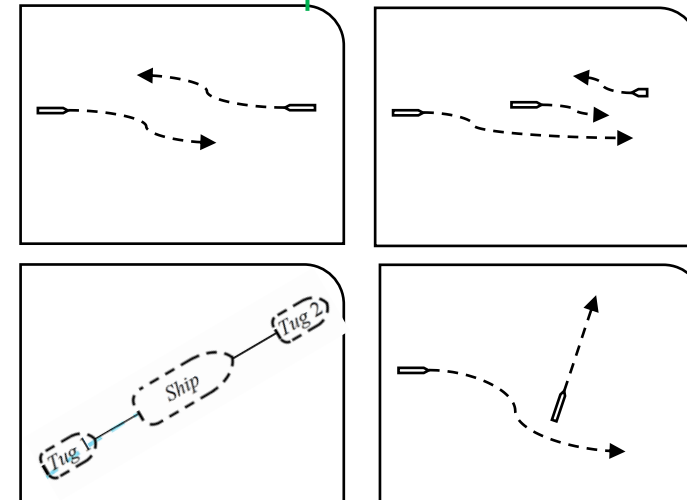
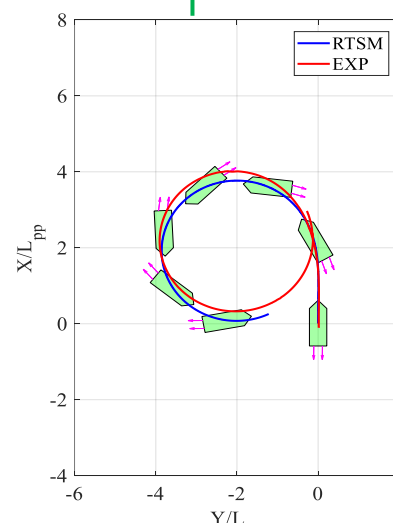
Enhancing the Predictability of Vessel Behaviour and Response



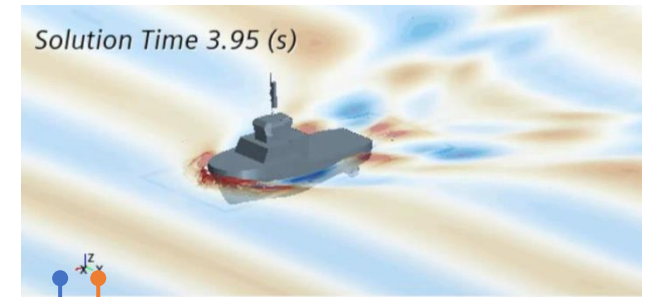
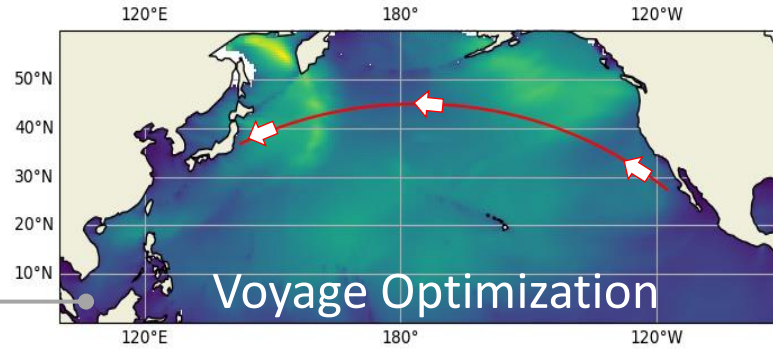
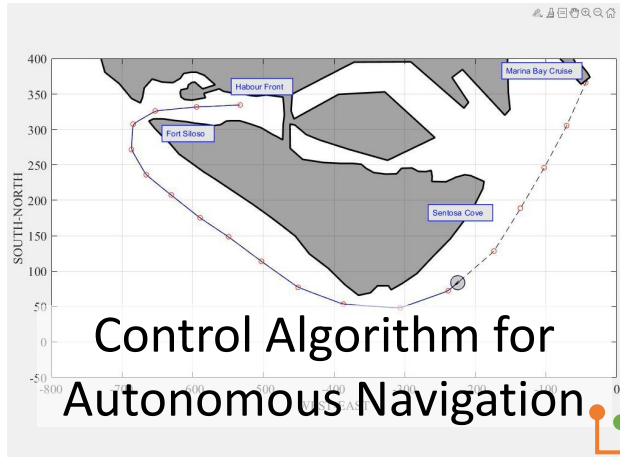
Completed R & D

Current R & D

Planned R & D



Leveraging Capabilities for Useful Industry Applications

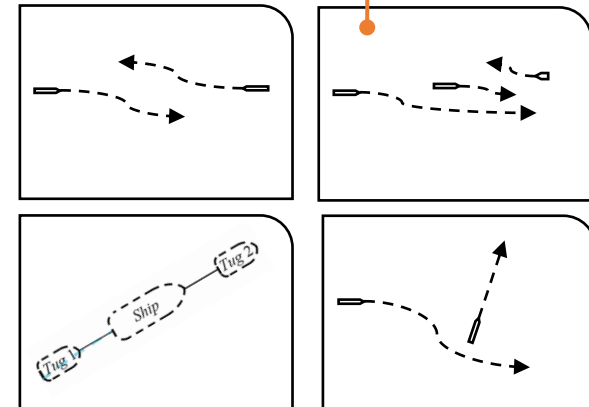
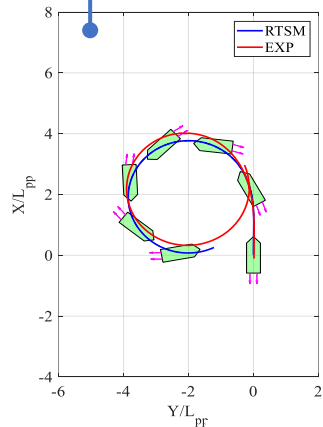


Digital Twinning of Electric Harbour-crafts

Virtual Testbed

Maritime Autonomous Surface Ships

Smart Towing Solutions



Interaction, coupling of vessels

Structural Health Management (SHM) - Enhancing Safety and Efficiency, thru Comprehensive Cyber-Physical Model, Real-Time Sensor Data and Data Assimilation



Completed R & D

Current R & D

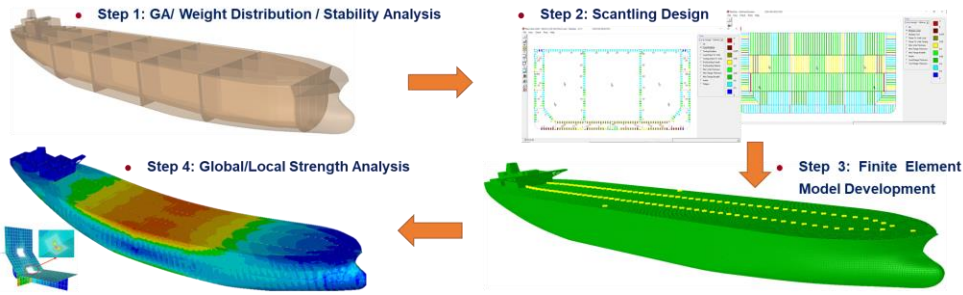
Planned R & D

Physics-based Model Prediction Methodology

Real Time Data Driven Model

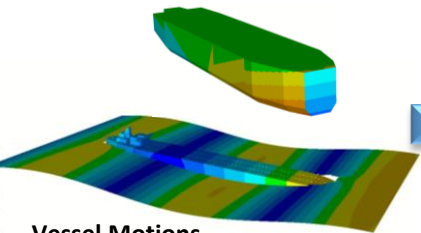
Prototype development With industry partner

Structural model development



Hydrodynamic Loads

Liquid Cargo Pressure

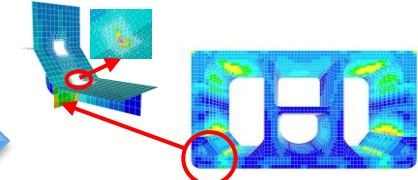


Vessel Motions

External Wave Pressure

Structure Responses

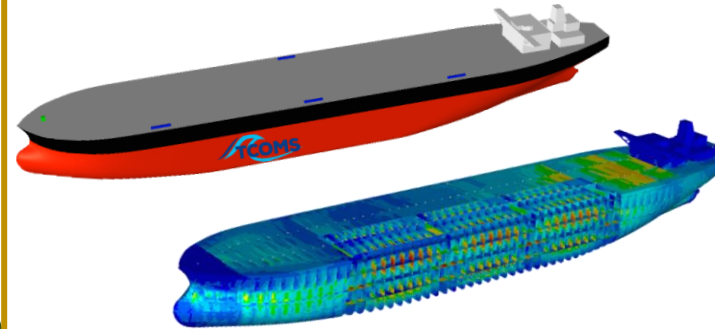
Local FE Analysis



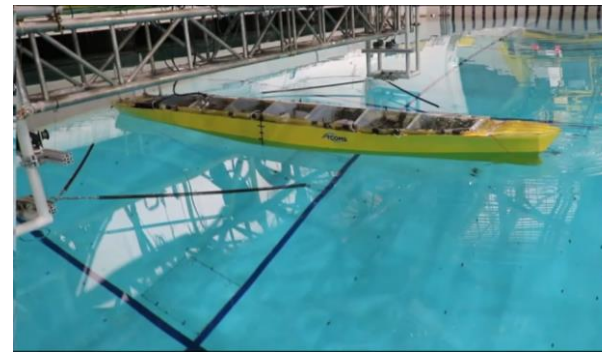
Stress Responses of Web Frames

Global Stress Responses

Hybrid Twin (sensor + numerical model)



Account for Hydro-elastic effects.



Operationalise SHM Solution:

- Seek Class Approved In Principle (AIP)
- Pursue Prototype Development
- Collaborate with industry to validation/verification solution.

Potential Benefit

Couple SHM with structural optimisation to harvest the benefit of reduced manning, payload efficiency and fuel saving.

Co-creating Technology with Industry Partners



Maritime
Autonomous Surface
Ships (MASS)

Development of standards, policies and guidelines for the adoption of smart and autonomous solutions

Electrification

Digital twinning of electric harbour-crafts for decarbonization through efficient design and operations

Virtual Testbed

‘System-of-systems’: Integration of multiple tools, capabilities and simulations on a virtual test platform

Decarbonization

Decarbonization and sustainability of coastal ecosystem through digital twin and voyage optimization

Possible Collaboration Areas

Possible collaboration areas includes:

- Explore common **operational scenarios** for MASS.
- Develop common **framework** for MASS.
- Develop efficient **autonomous /remotely controlled harbour-craft solutions**.

Thank you

