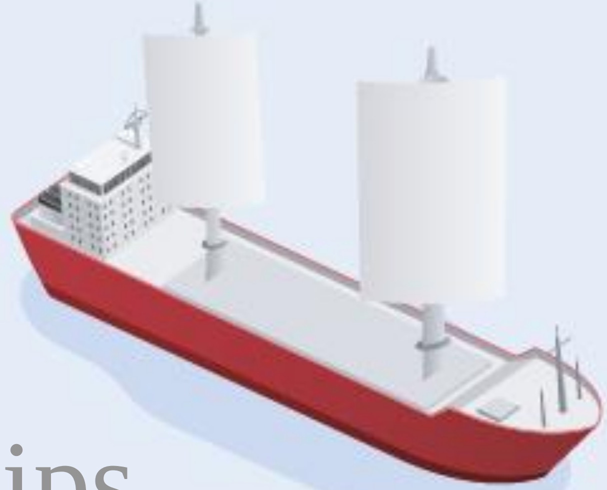
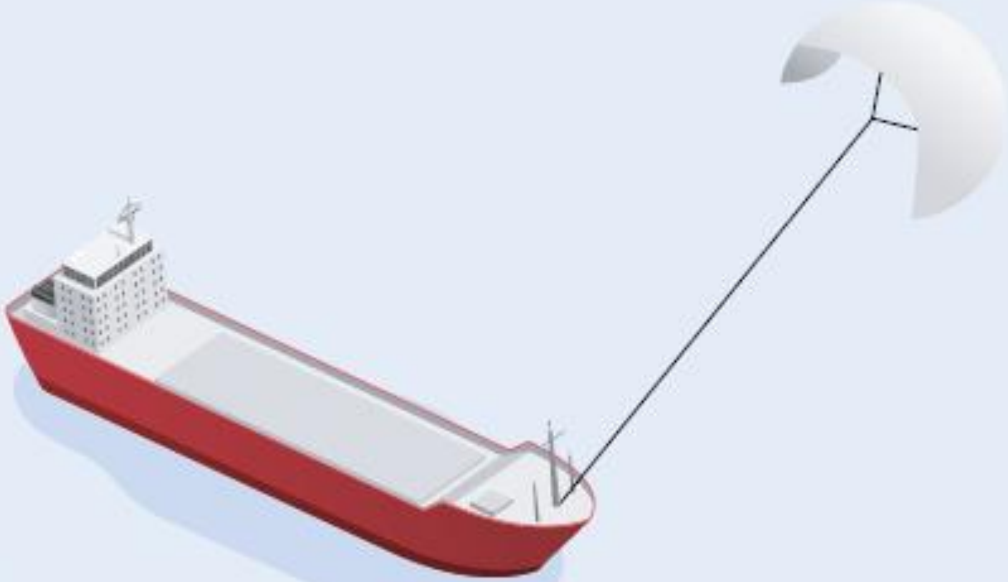


SSPA
Wind-Powered Ships.



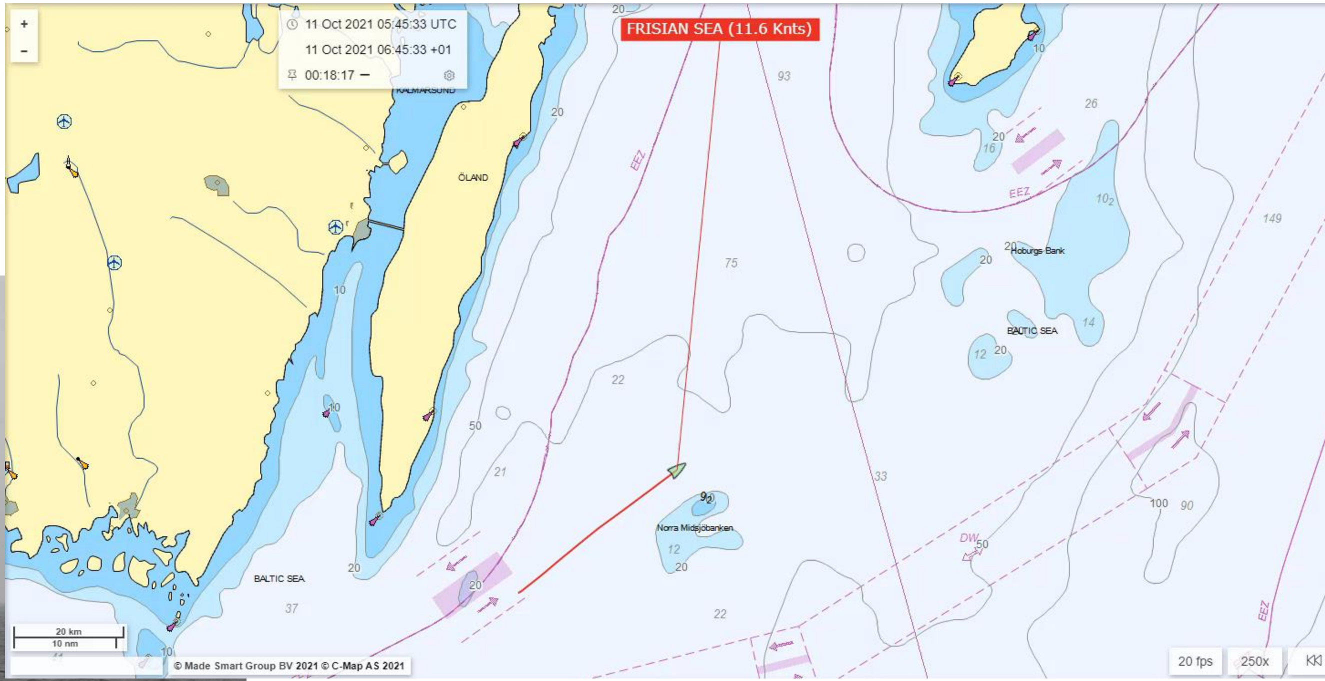
Supporting the maritime industry with independent guidance and assessments of wind-powered ships.

OUR KNOWLEDGE BASE

SSPA WASP Sea Trial
for Wind Powered Ships

Your Maritime
Solution Partner

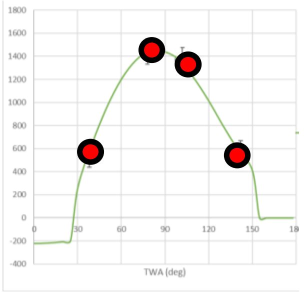
Frisian Sea – with Ventifoils from Econowind



1. Speed trial

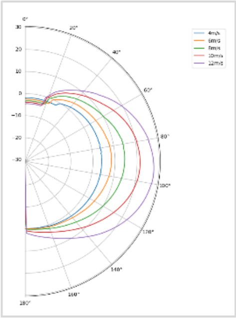
2. Analyse speed trial

Power saving at 1 wind speed



3. Calibrate virtual ship model

Power saving at any wind condition



4. Route analysis

Annual fuel saving

WASP Sea trial methodology

INTERNATIONAL TOWING TANK CONFERENCE	ITTC – Recommended Procedures and Guidelines	7.5-04 -01-01.1 Page 1 of 77	
	Preparation, Conduct and Analysis of Speed/Power Trials	Effective Date 2021	Revision 06

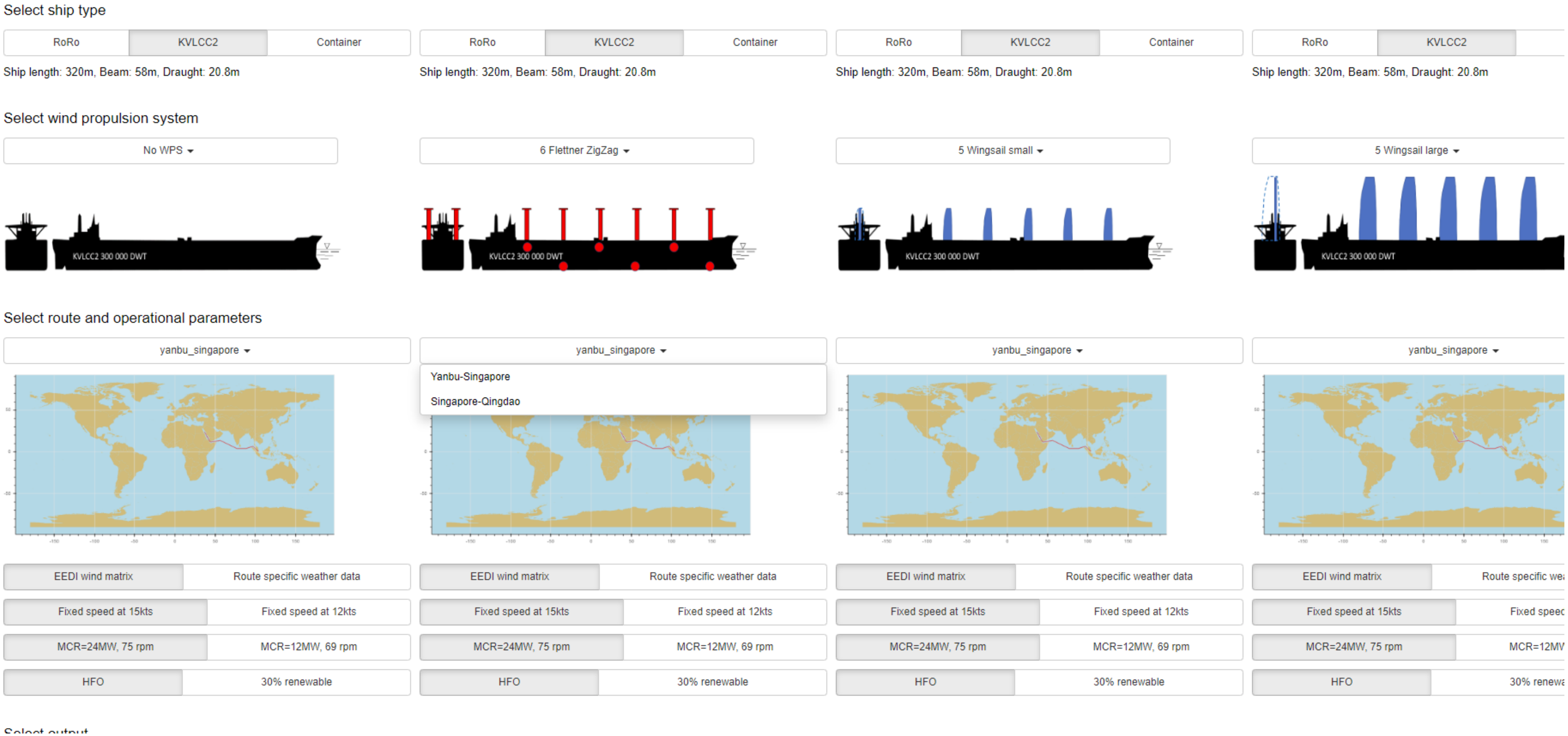
ITTC Quality System Manual

Recommended Procedures and Guidelines

Procedure

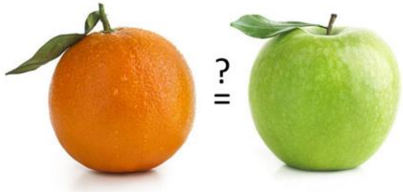
Preparation, Conduct and Analysis of Speed/Power Trials

SEAMAN winds – The Wind Propulsion Showroom



Business case support for ship owners

How do you select a WPS?



What is best? A rotor or a wingsail? How large?

What happens if the wind dies?

- Ship owners
- Ship operators
- Etc..

Payback time?

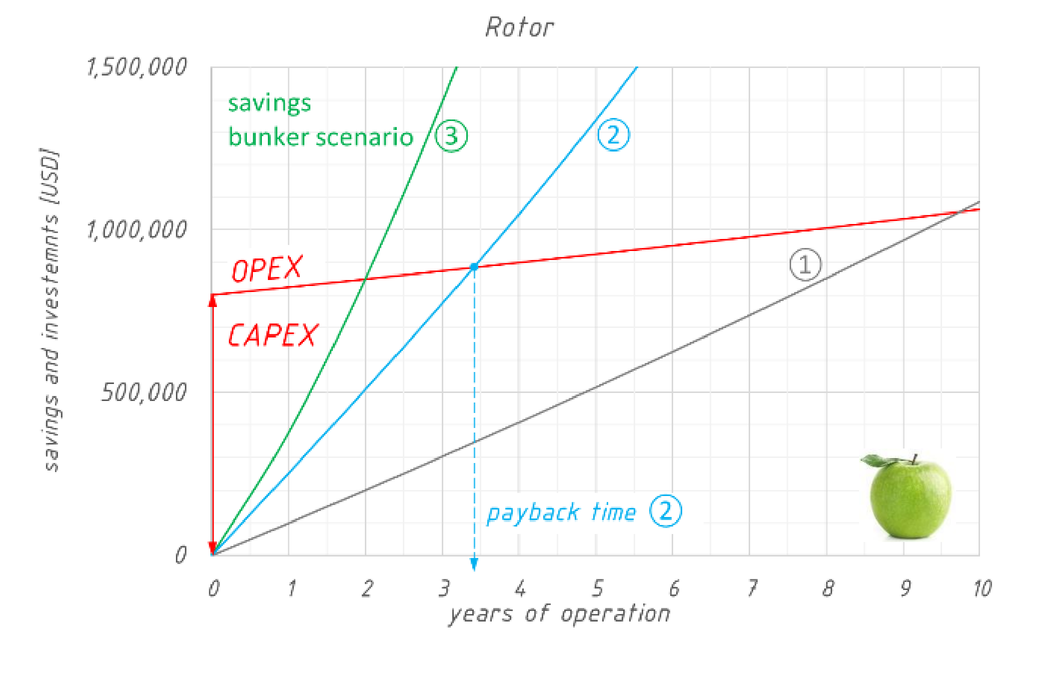
EEDI, EEXI, CII?

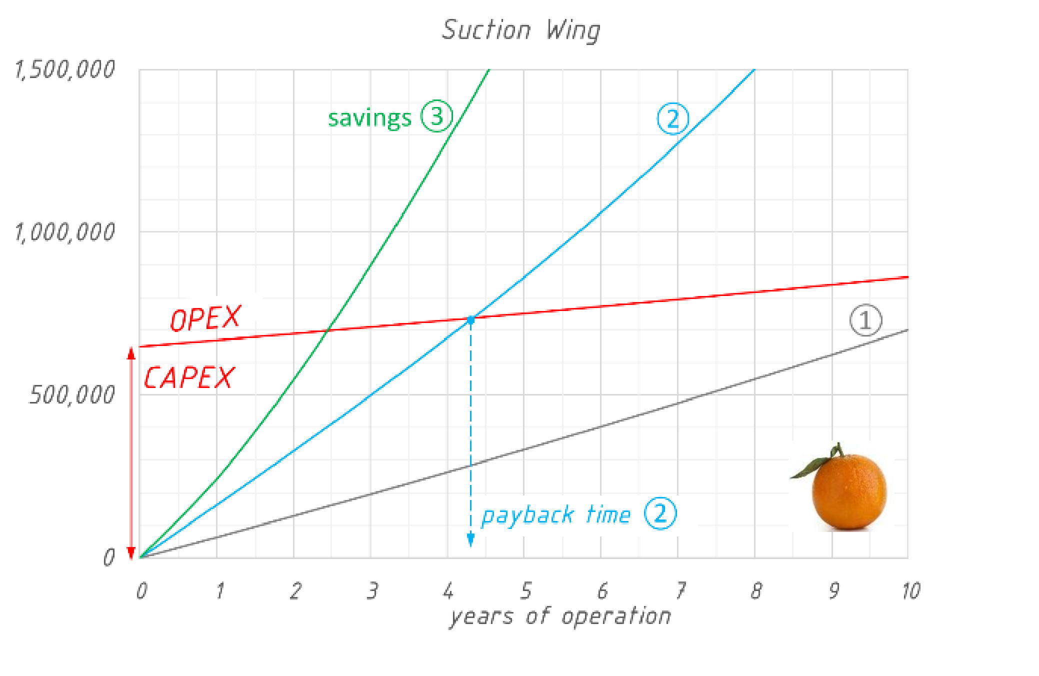
What are the risks?

How much fuel will it save?

Results
route + case specific!

Case	Actual	Hypothetical
WPS	**Rotor (R)**	**Suction Wing (SW)**
Principal of operation	Magnus Effect	High lift wing profile, boundary layer suction to delay stall
		
Dimensions	30 m x 5 m	24.8 m x 6.13 m
Area *S*	150 m^2	152 m^2





WPS	**Rotor (R)**	**Suction Wing (SW)**
Power savings	3.9 % annualy	2.5 % annualy
Energy saved	1 240 MWh/a	800 MWh/a
Bunker savings	248 t/a	160 t/a
CO_2 savings	771 t/a	498 t/a
Payback time for bunker scenar.③/②/①	2/3.5/9.75 years	2.5/4.3/13 years

1a) Verified aerodynamic data WPS 1

1b) Verified aerodynamic data WPS 2

2. Set up virtual ship model

3. Route analysis

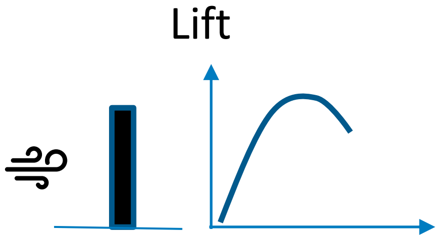
Annual fuel saving 1

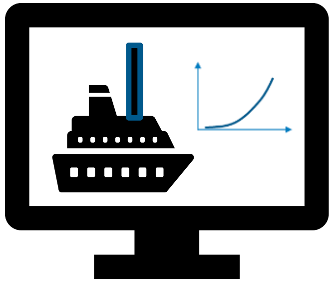
Annual fuel saving 2

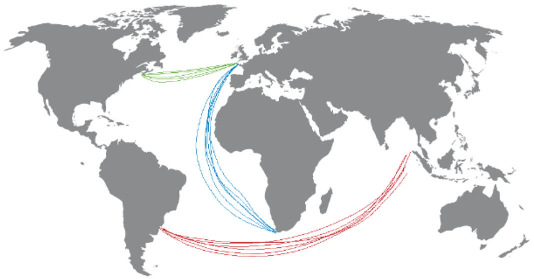
4. Financial analysis

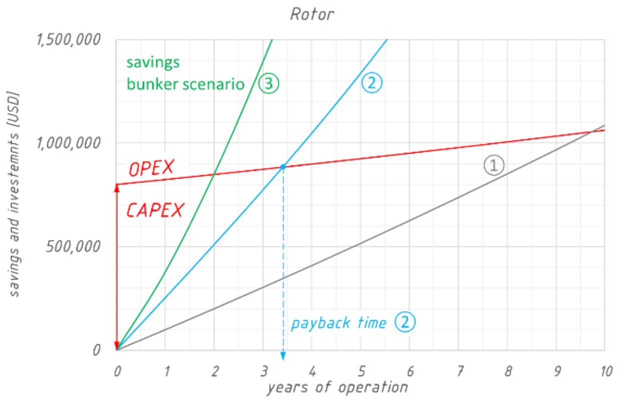
Business Case 1

Business Case 2









- **Wind tunnel data**
- **Extensive CFD**
- **Sea trial results**

- Ship specific
- **SSPAs database** of model test results
- Interaction models (Hull-WPS and WPS-WPS)

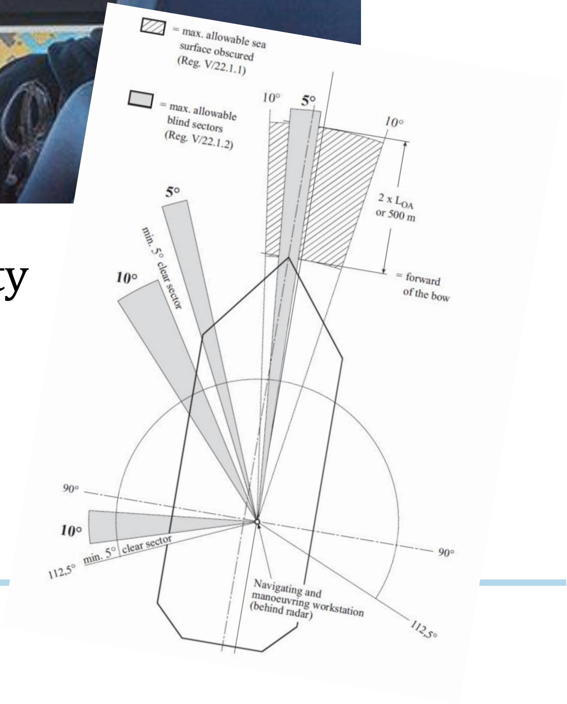
- Trading and operational profile

SSPA simulators and wind-powered ships

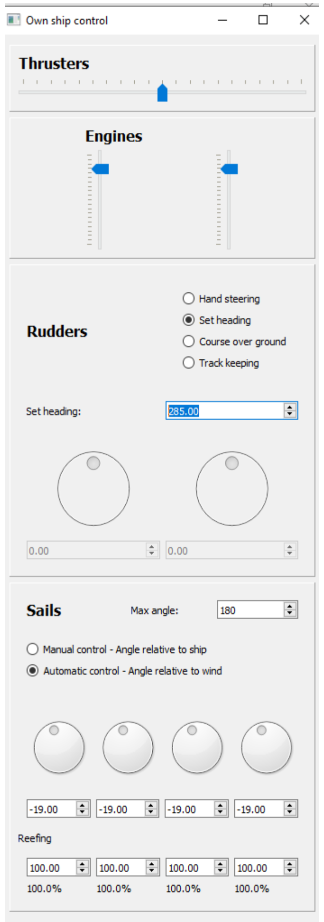
Desktop

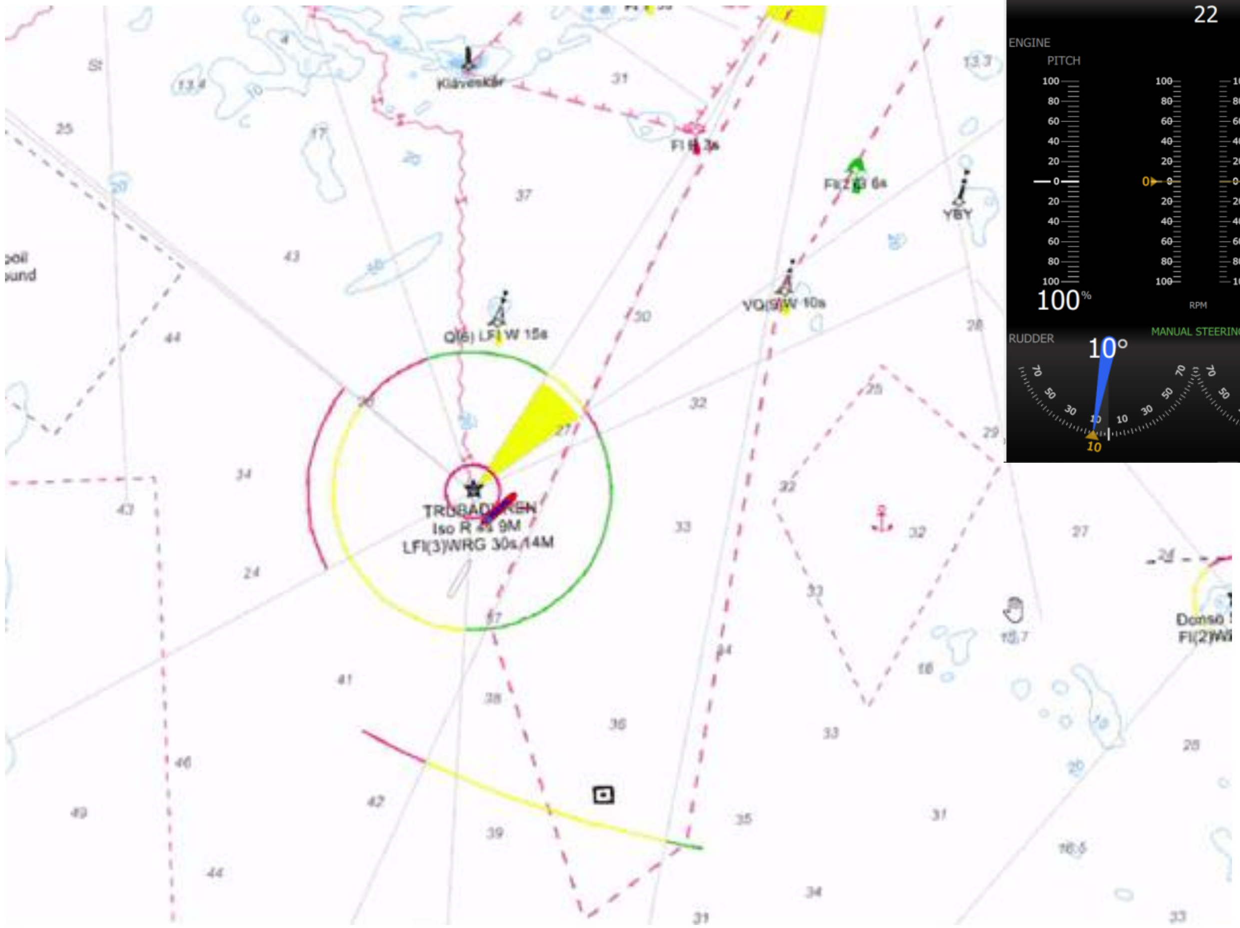
Bridge, full mission

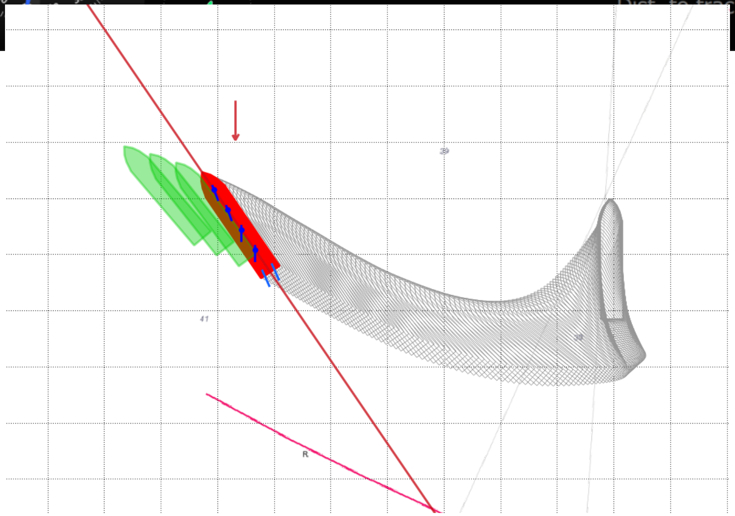
Navigation bridge visibility



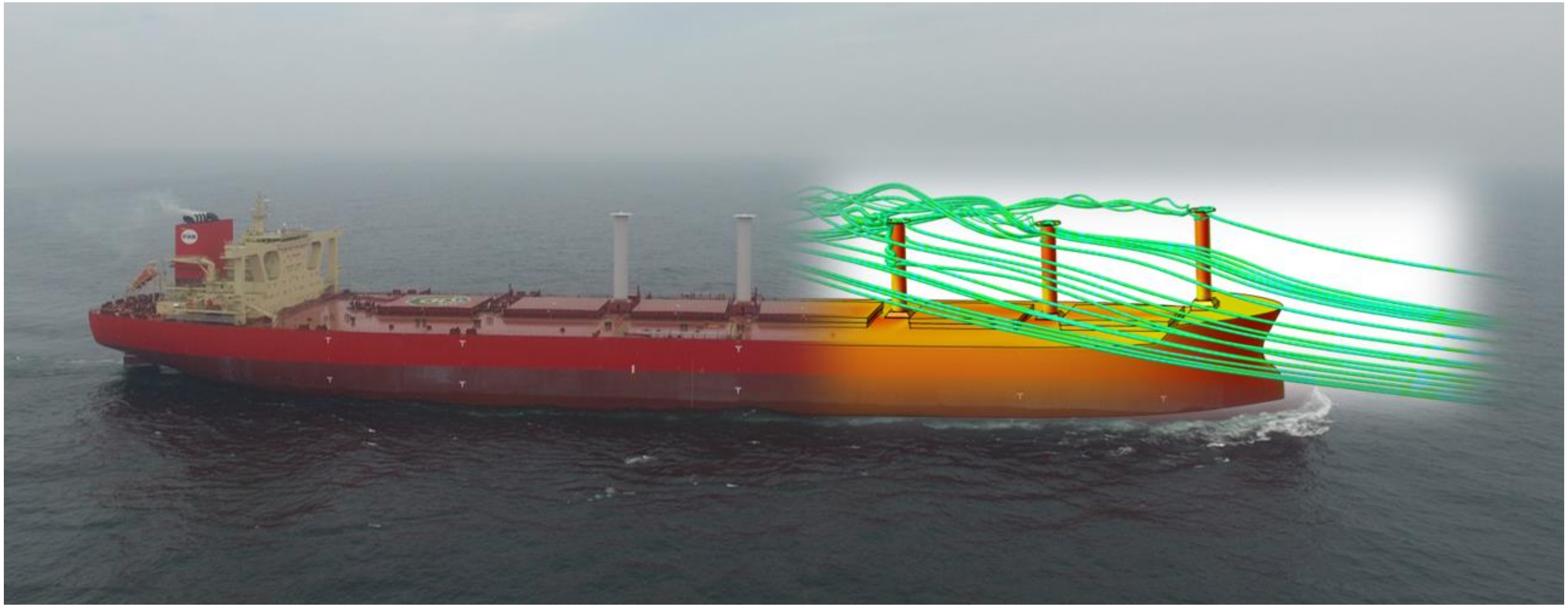
Manoeuvre simulations and HMI development







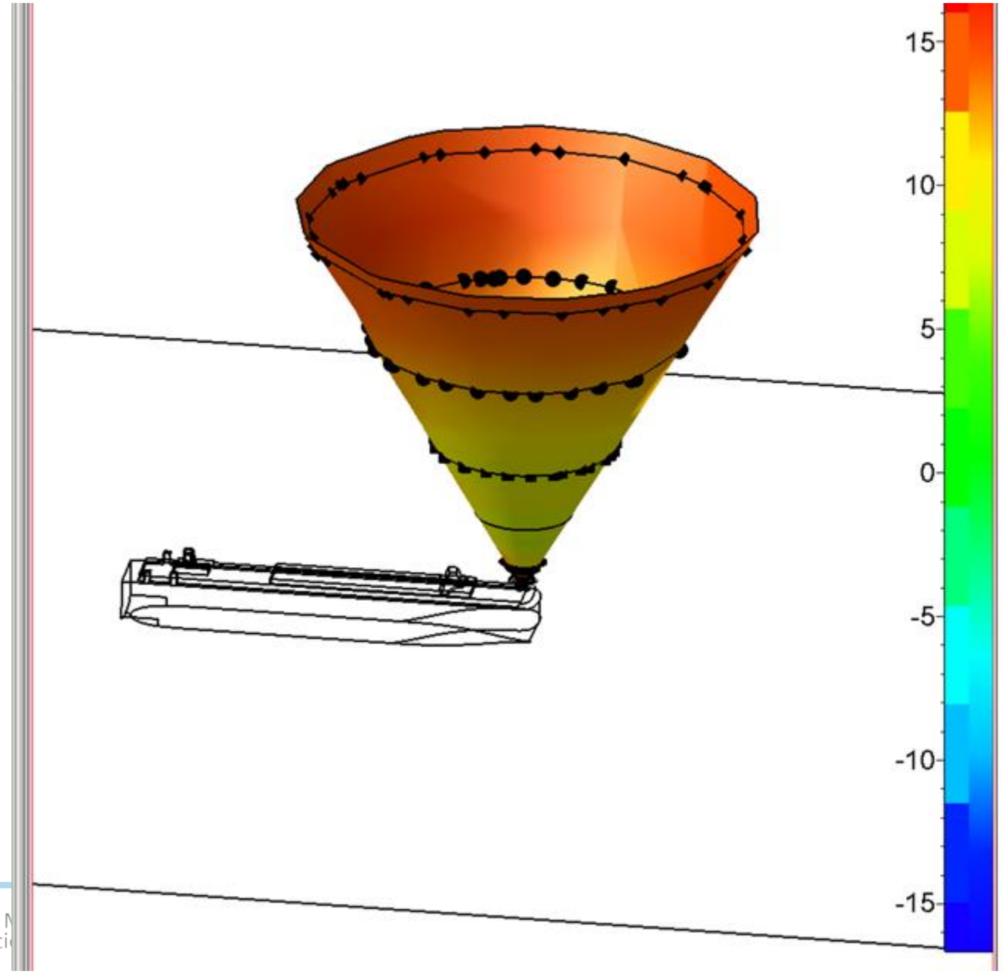
Aerodynamics

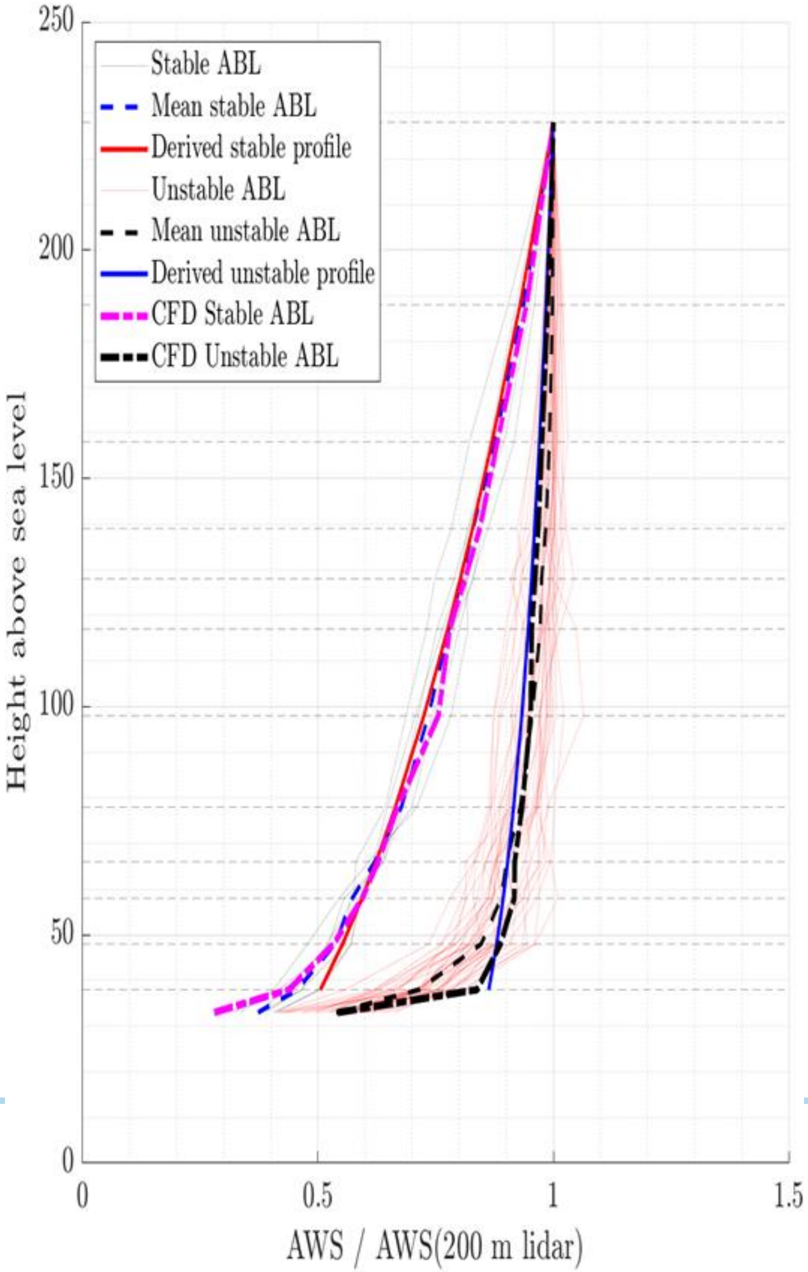


Above: The Brazilian company Vale recently had rotor sails installed on *Sea Zhoushan*, one of the largest ships in the world. SSPA was involved from the very start.

Validation with LIDAR measurement of ABL (in harbour case)

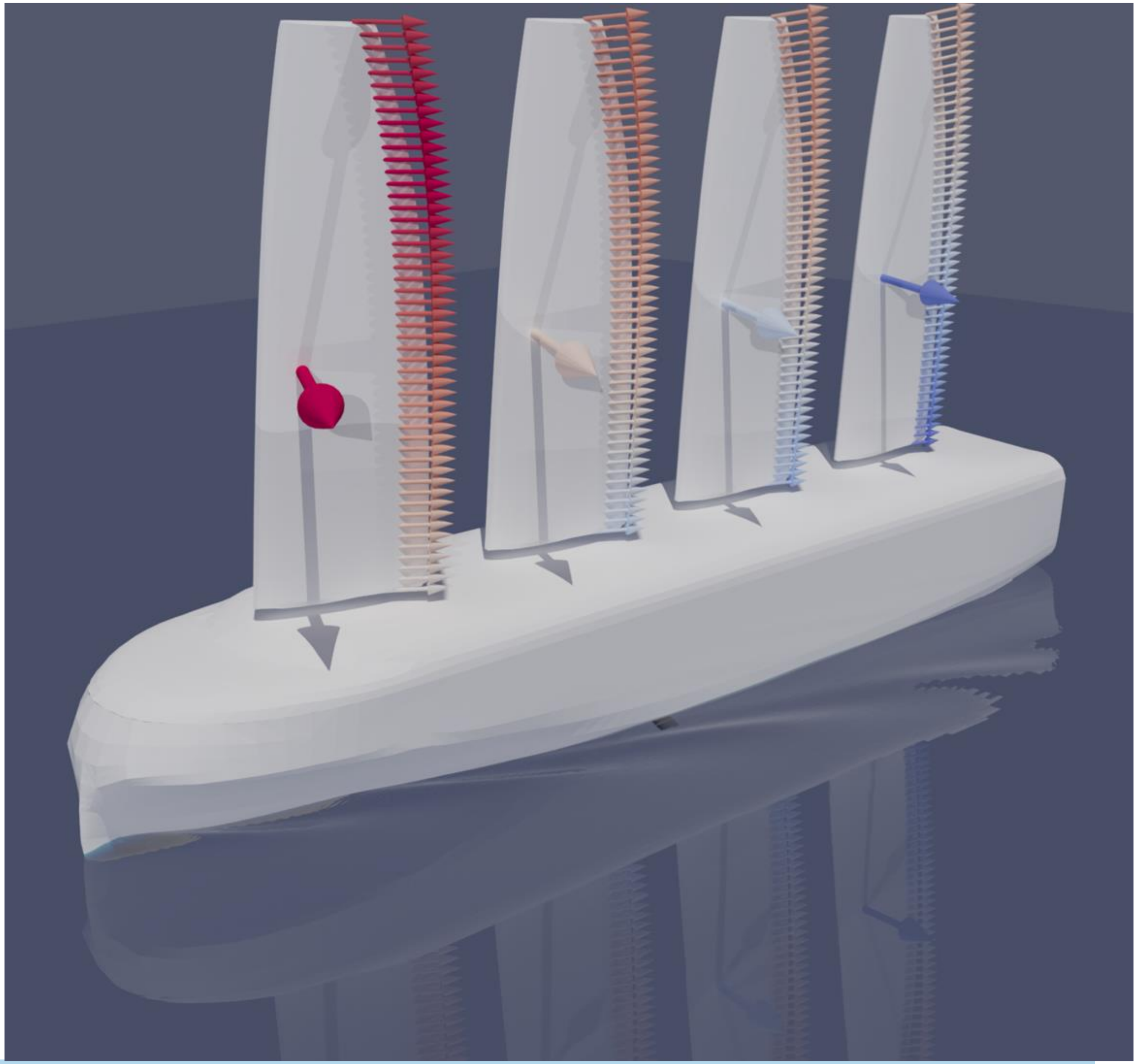
- Collaboration with KTH



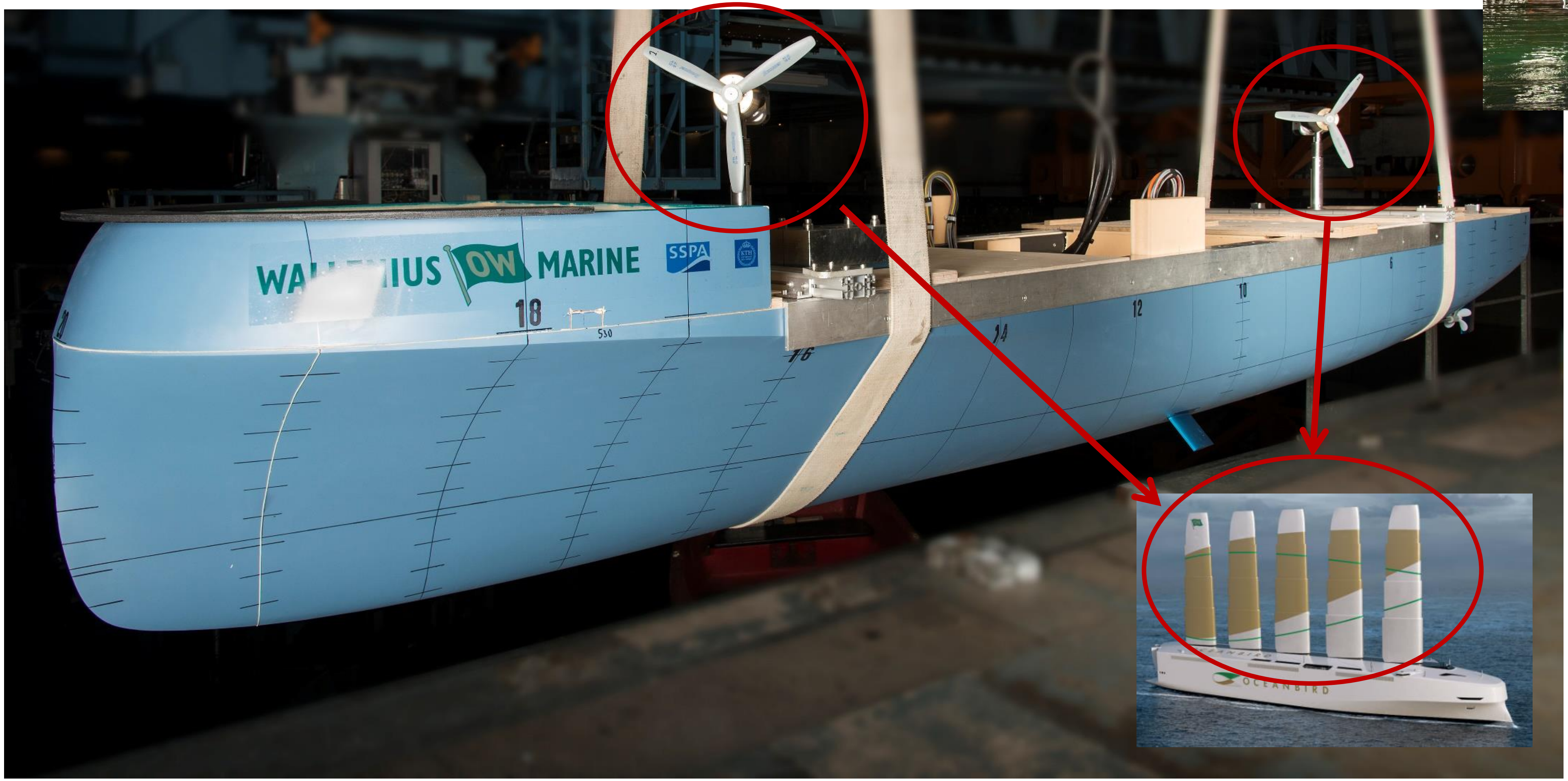


Seakeeping CFD

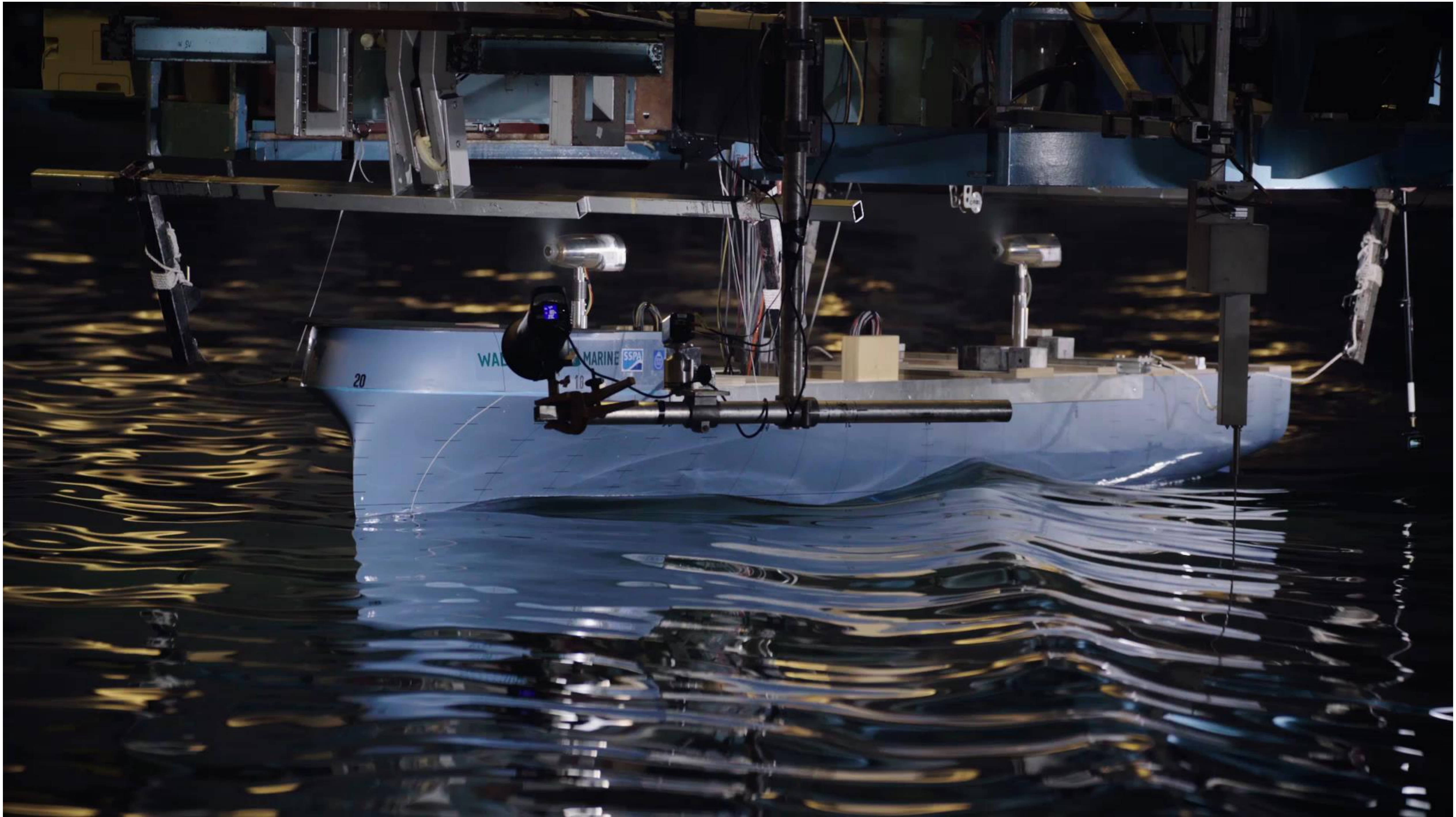
Assessing dynamic loads of wind powered ship in waves – an important input in the design process and class approval.



Seakeeping and Manoeuvring model test

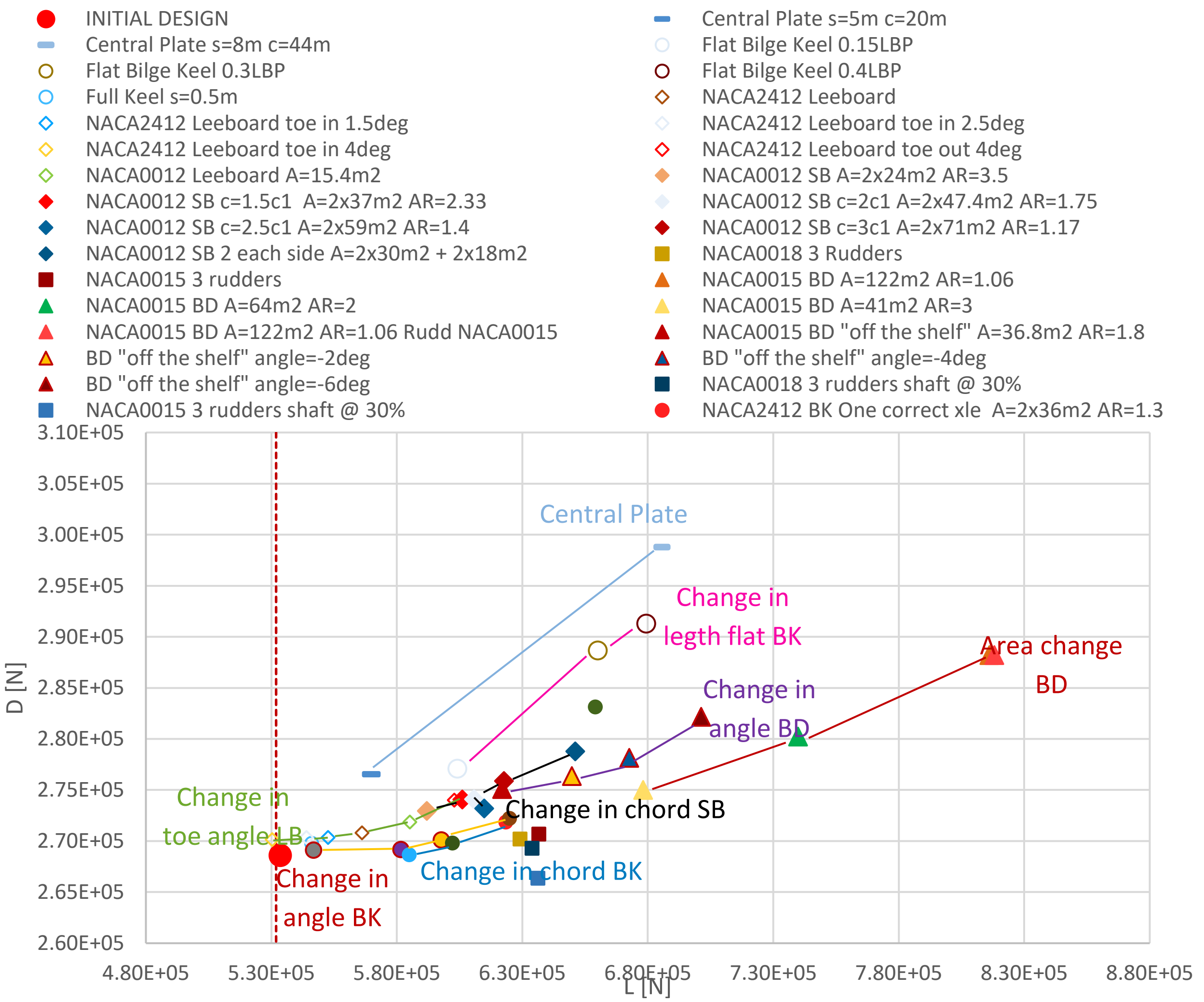


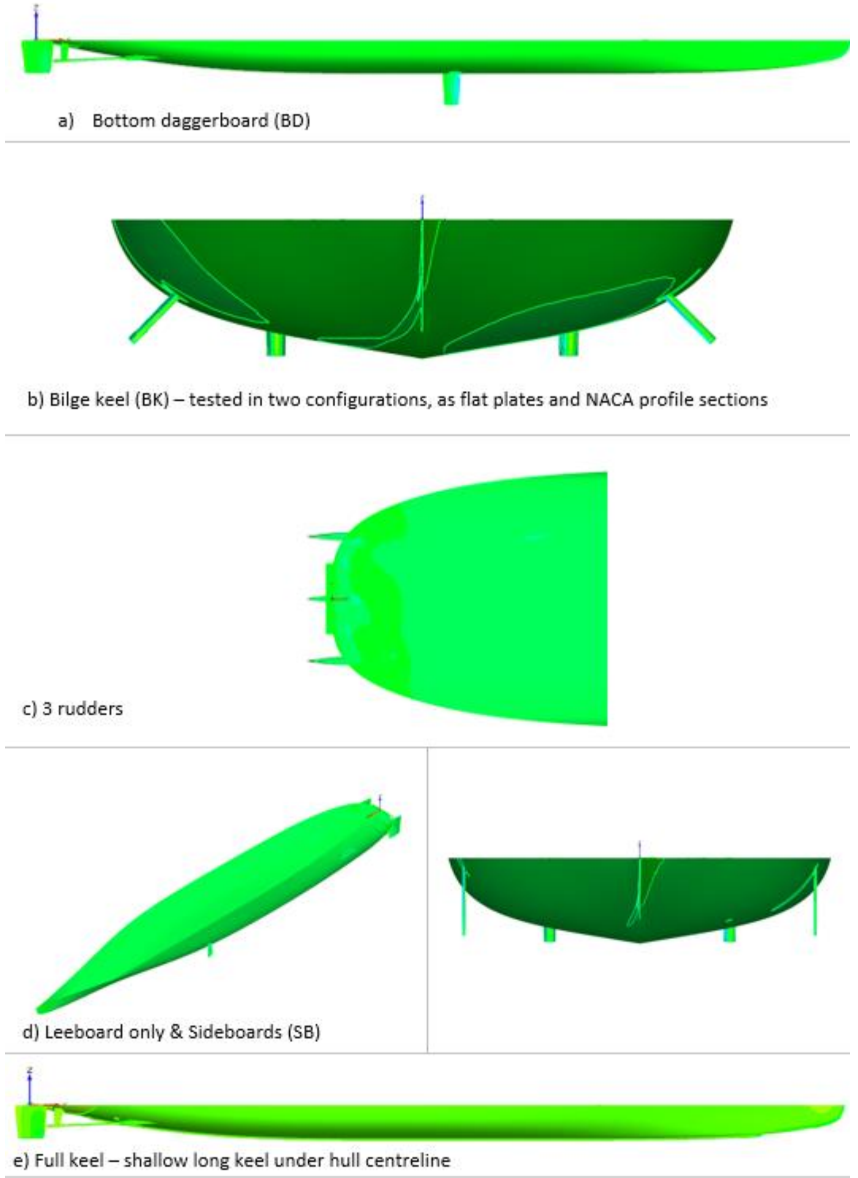
Wind propulsion units are modelled using pulling fans

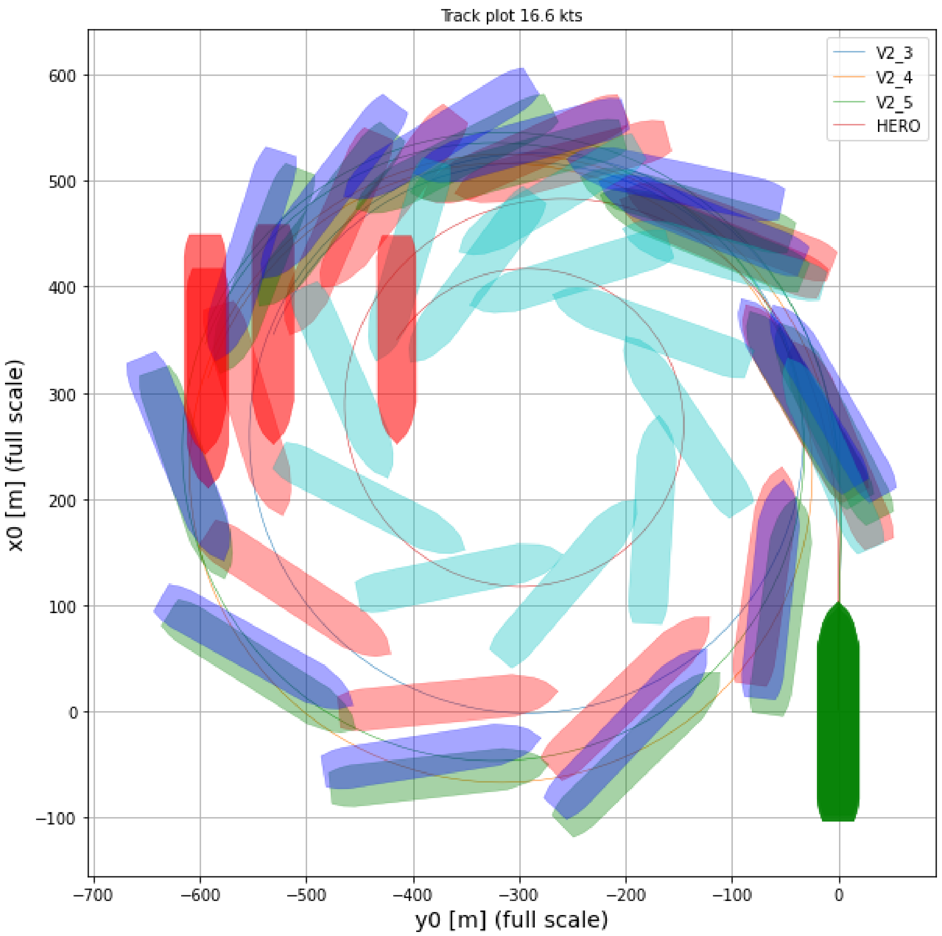

MARINE
SSPA
20

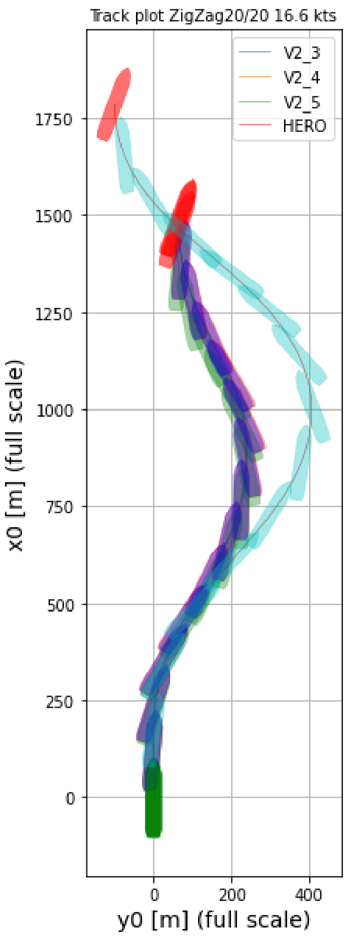
Hydrodynamics - Appendages

Appendge design






Track plot 16.6 kts
V2_3
V2_4
V2_5
HERO
x0 [m] (full scale)
y0 [m] (full scale)
600
500
400
300
200
100
0
−100
−700
−600
−500
−400
−300
−200
−100
0


Track plot ZigZag20/20 16.6 kts
V2_3
V2_4
V2_5
HERO
x0 [m] (full scale)
y0 [m] (full scale)
1750
1500
1250
1000
750
500
250
0
0
200
400

SSPA

Wind powered ships