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# Remote & Autonomous ... and Yara Birkeland

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# REMOTE & AUTONOMOUS

Technology/product domains





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# Autonomy vs. manning

## Markets and timing

Distant future

LEVEL OF AUTONOMY

FULL AUTONOMY								NOT LIKELY TO BE FEASIBLE
CONSTRAINED AUTONOMY								
MONITORED AUTONOMY								
SAFE STATE AUTONOMY								
ADVISORY								
NO AUTONOMY								
ONBOARD	FULL MANNING	REDUCED MANNING	PERIODICALLY UNMANNED	MANNING ONBOARD	PERIODICALLY UNMANNED	NO CREW ONBOARD		
ASHORE	NO SHORE CONTROL			REMOTE OPERATION		REMOTE OPERATION	REMOTE SUPERVISION	NO CREW ASHORE



Short term

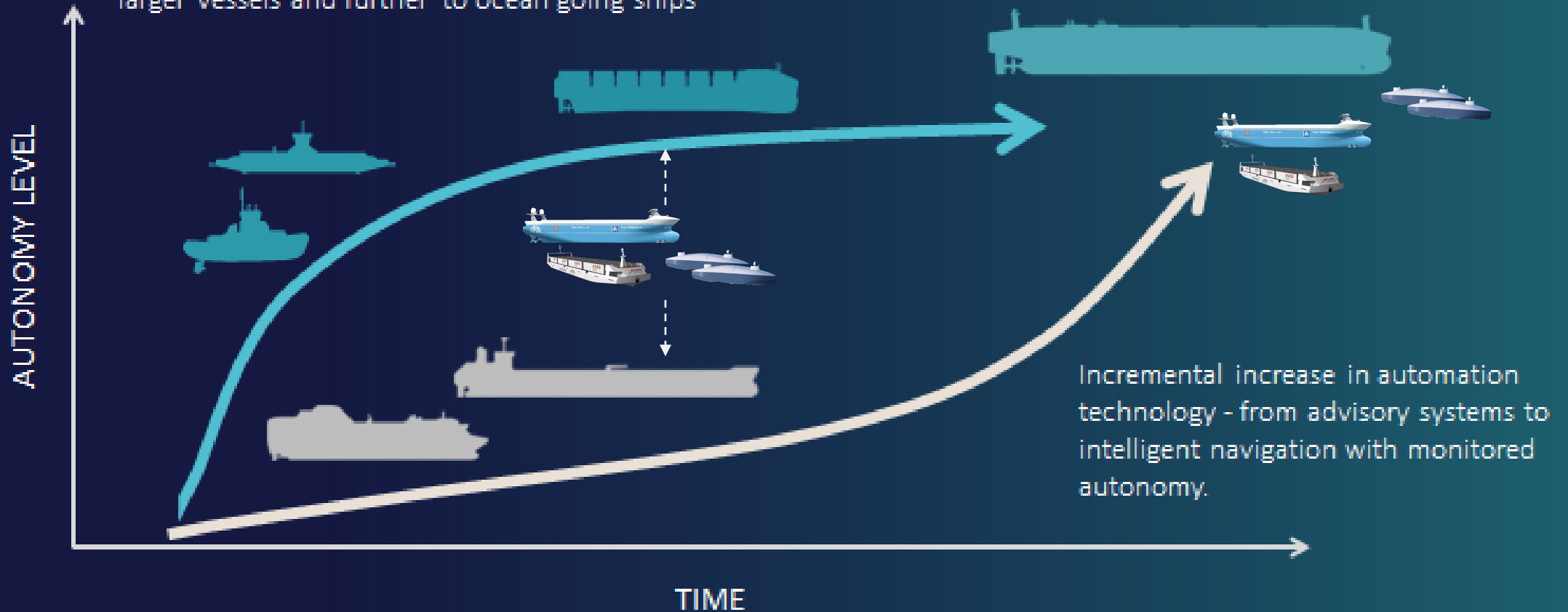
### MANNING



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# Pathways to R&A shipping

Start with full R&A systems in small, locally operated vessels, then grow to coastal and larger vessels and further to ocean going ships





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# Remote & Autonomous Systems

Fundamentals

1



2



3

As Low As  
Reasonably  
Practicable



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# THREE PILLARS OF UNMANNED OPERATIONS





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# Yara Birkeland

Zero emission autonomous container feeder

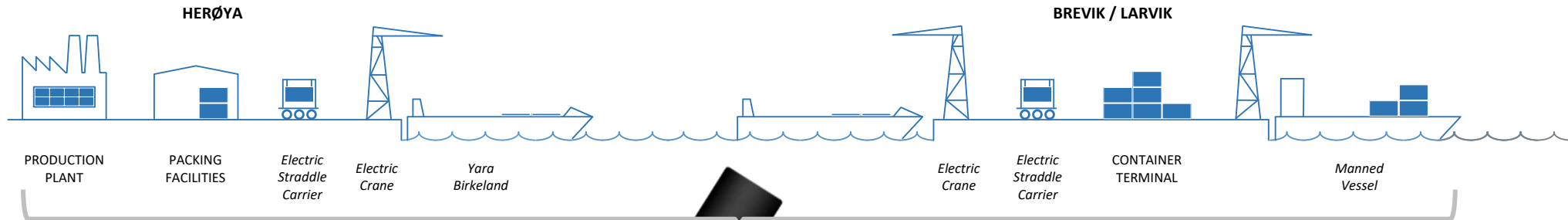
## Autonomy Update





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# Autonomous Shipping in the Value Chain



Knowledge grows

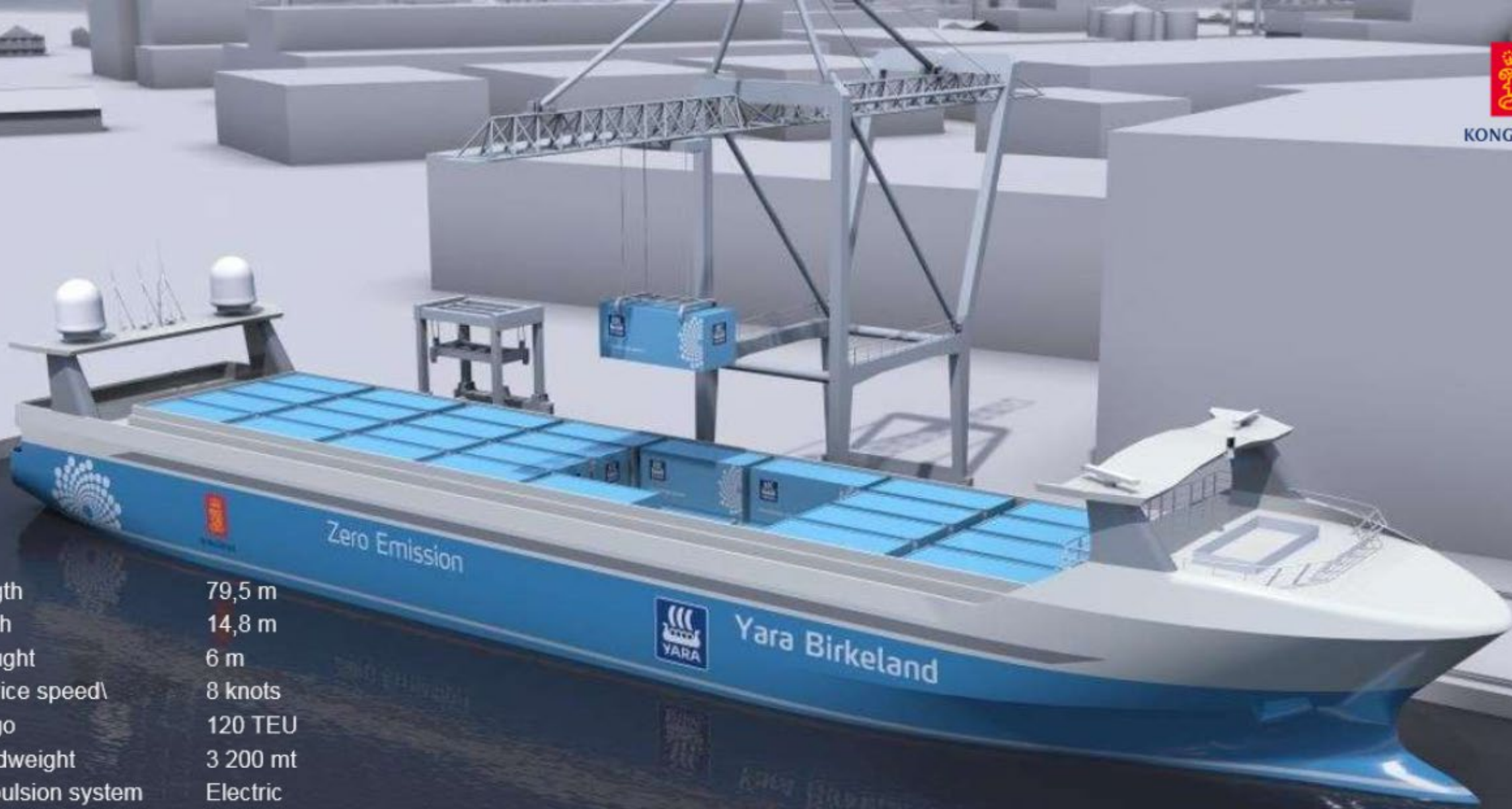
WORLD CLASS – Through people, technology and dedication

KONGSBERG PROPRIETARY - See Statement of Proprietary information





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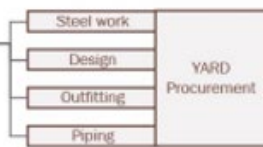
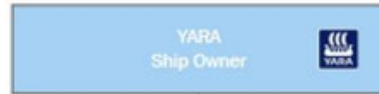
Length	79,5 m
Width	14,8 m
Draught	6 m
Service speed\	8 knots
Cargo	120 TEU
Deadweight	3 200 mt
Propulsion system	Electric
Propellers	2 Azimuth pods
Thrusters	2 Tunnel thruster
Battery pack	7 MWh



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# Yara Birkeland

2018



2019



2020



2021





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# Yara Birkeland

On journey towards unmanned operation



Detachable Wheelhouse

Cargo capacity of 104 containers

Enable unmanned operation

2020

*Start fitting Automatic Capabilities for Reduced crew*

Yara Birkeland will operate between Herøya and Brevik  
Two voyages per week

Automated capabilities

- Auto Docking
- Auto Crossing
- Obstacle and target detection
- Collision risk warning
- Automatic Mooring
- Ship2Shore communication
- Monitoring from ROC

Targeted to start operation beginning of 2022

Monitor and supervise from ROC

Analyze operational data to train systems and algorithms

Incrementally introduce new autonomous capabilities

*Supervision and Intervention from ROC*

Autonomous capabilities:

- Mission Management
- Automatic navigation
- Maneuver control
- Automatic Machinery Control
- Bi-directional connectivity
- Intrusion detection
- Intervention from ROC

2024



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# Sailing Area

## Ports

Herøya-Brevik 7nm

Herøya-Larvik 30nm

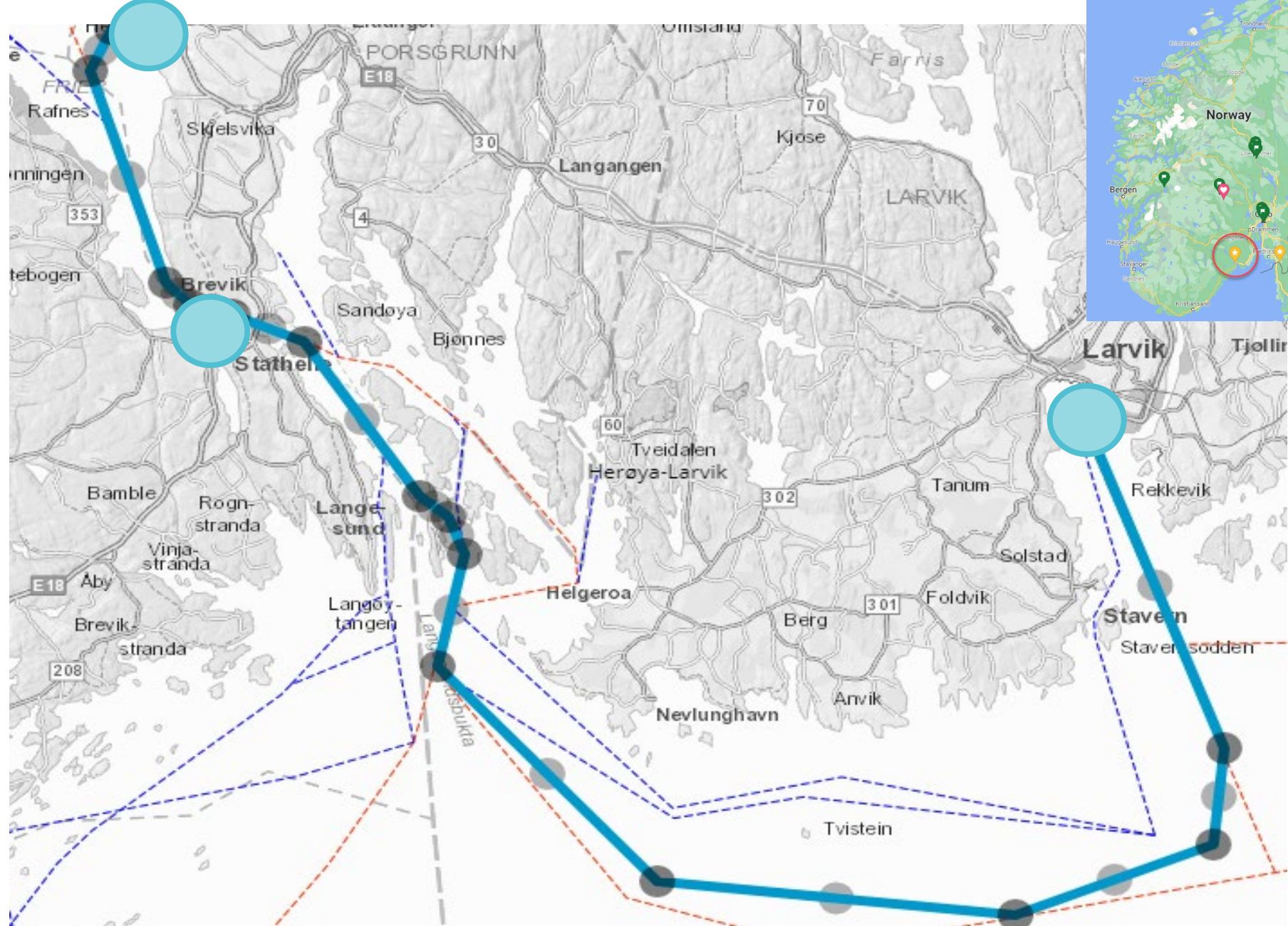
## Infrastructure

VTS

Test area

Loading/Discharging

Charging





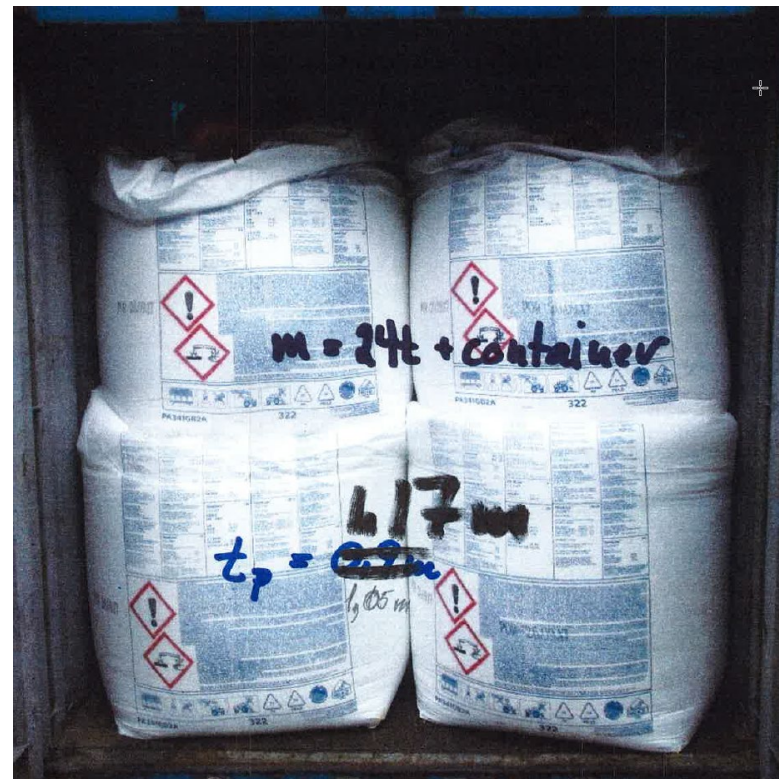
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# Cargo types

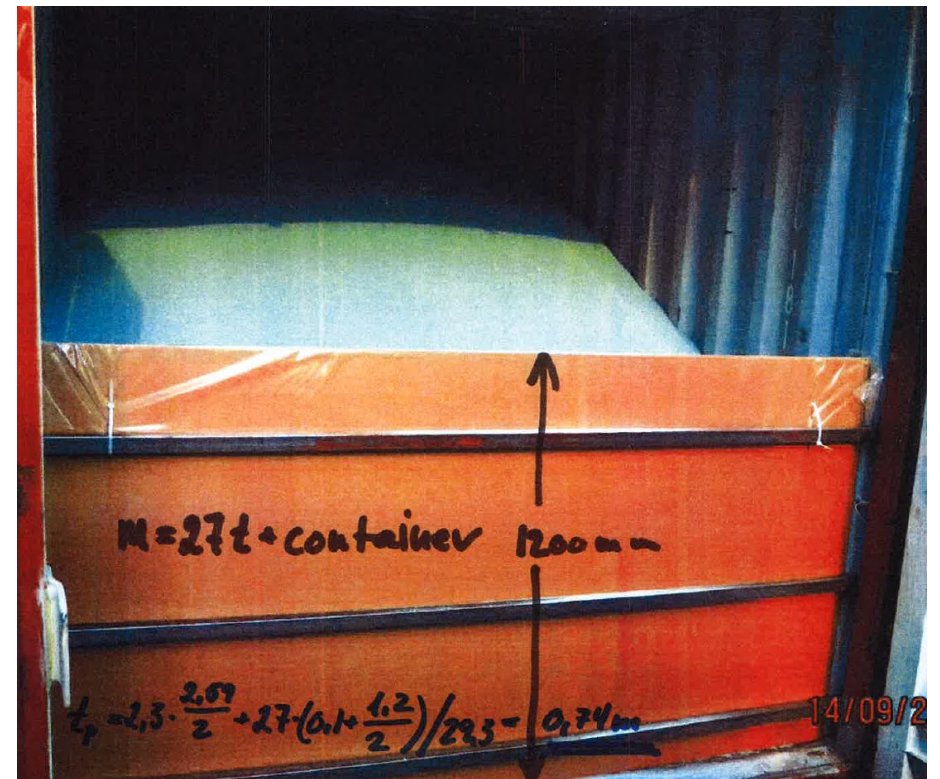
Small bag / 26,3 t



Big bag / 26,3 t



Bulk / 29,3 t

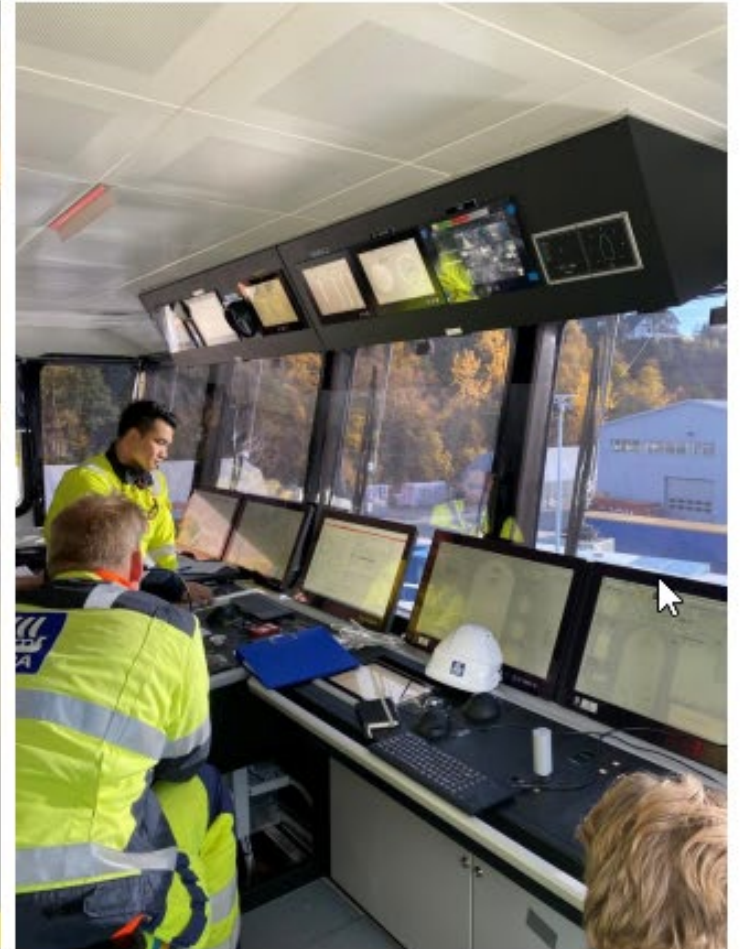




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# Yara Birkeland

Detachable Modular Bridge





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# Yara Birkeland

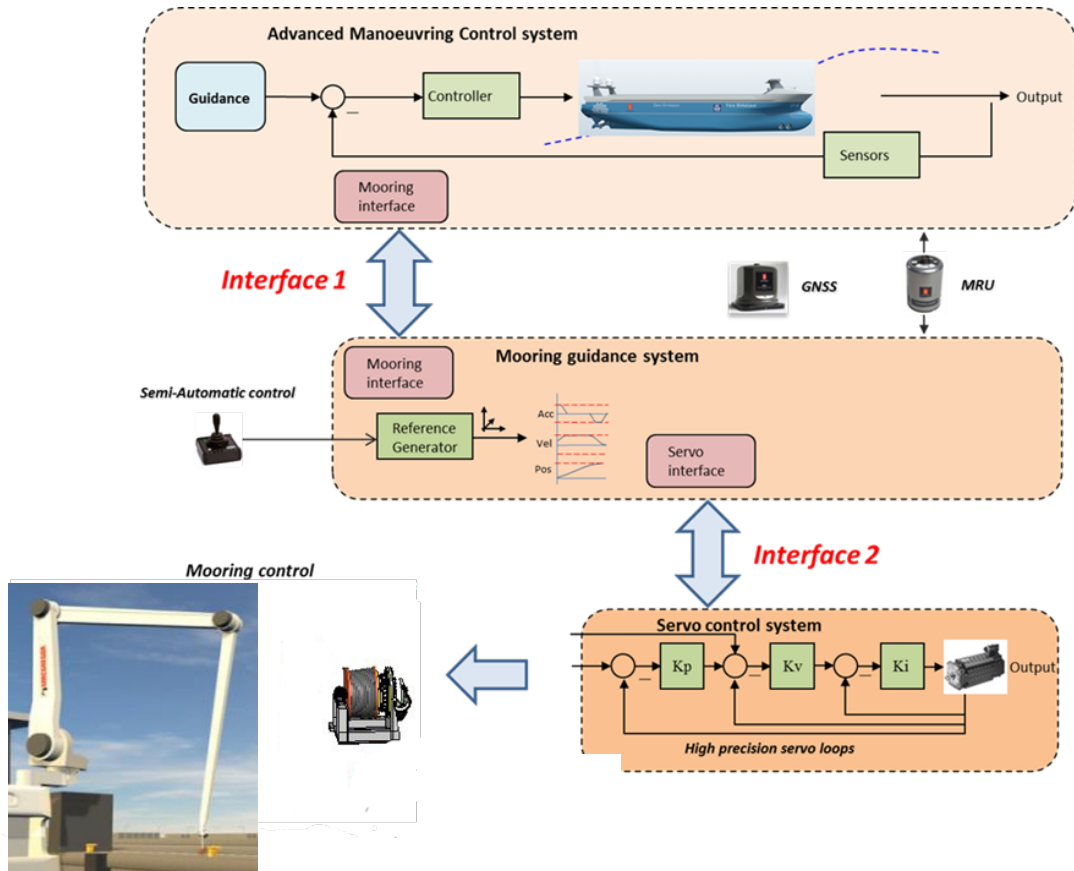
## Power Management





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# Automatic mooring



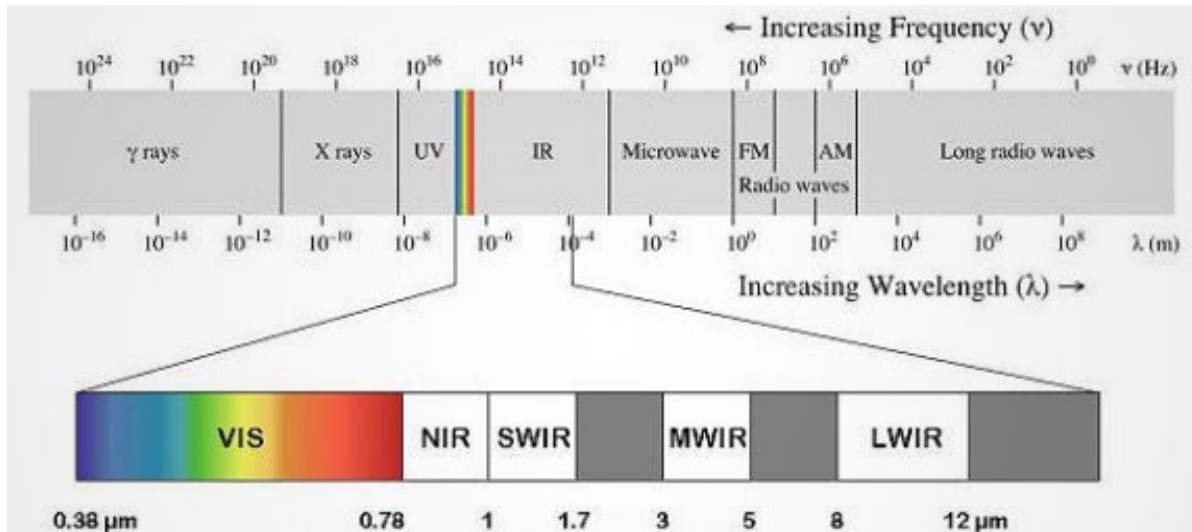
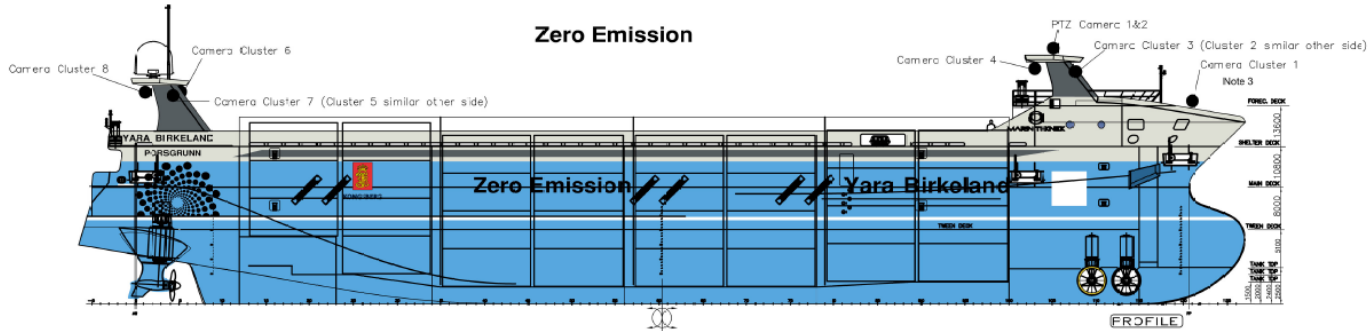




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# Visual Sensors & Positioning Systems

Yara Birkeland



- CCTV (for reduced manning phase)
- Visual/IR-Sensors:
  - Local situational awareness:
  - Pan-Tilt-Zoom sensors (multiple bandwidths)
- Multiple positioning technologies/sensors
- Relative position reference systems
- Redundant systems receiving and processing information from these systems



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# Sense and Analyze Environment

Leading to Bastø Fosen Ferry

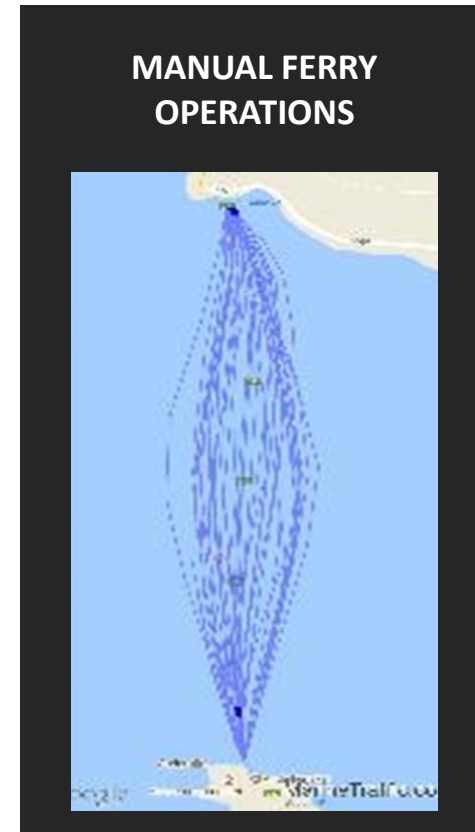
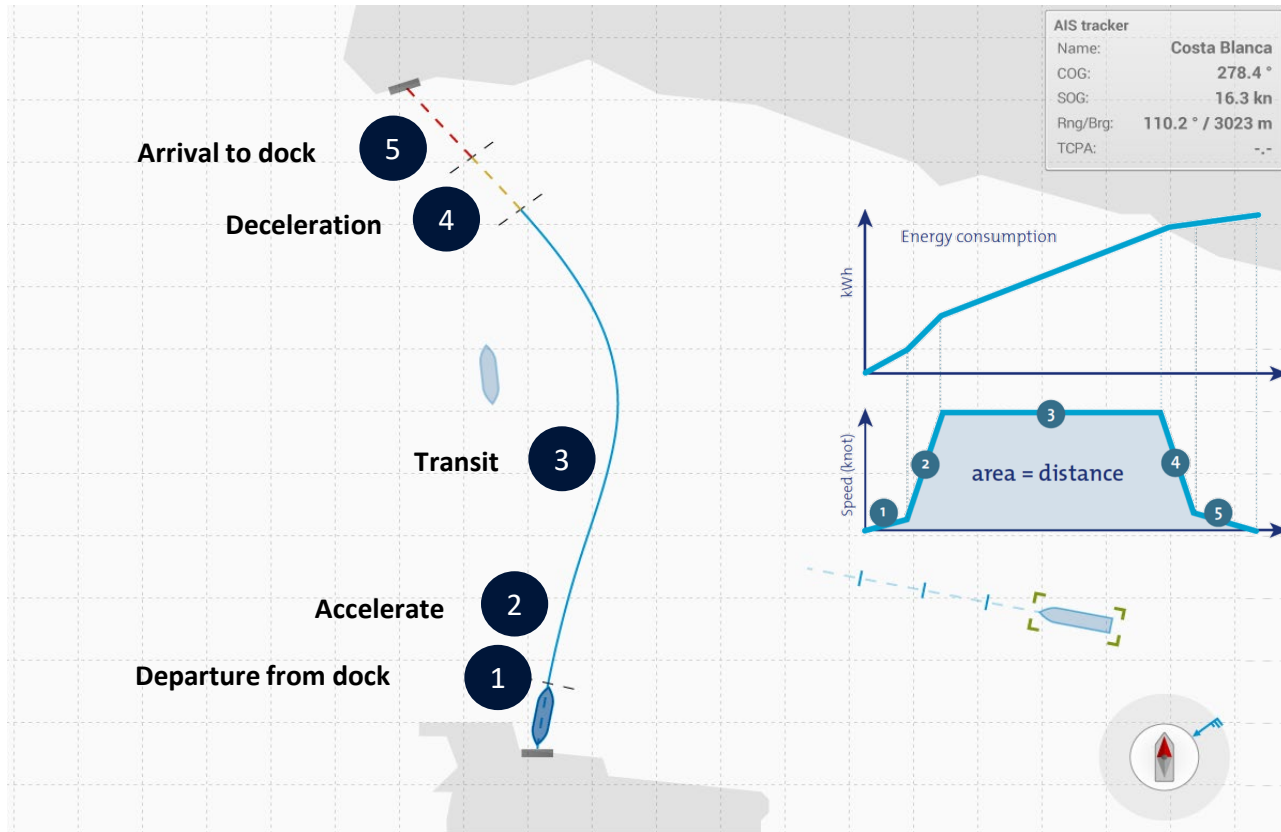




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# Automatic crossing

Autocrossing allows for significant efficiencies across the ferry's journey. The system enables an optimal use of propellers and power during automated trip phases.





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# Ongoing Development

Situation Awareness & Visualisation

## Systems

SeaEye

SeaAware

ANS

Bridge simulator

VTS

Radar

Lidar

PTZ cameras

Vessel Insight

## Dynamic data

Video

Own vessel position

Other vessels

Own route

Other routes

Alarms / states

Advice

Exclusion zones



## Static data

Navigational chart

Terrain

Bathymetry

Shore structure geometry

Vessel models



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# Remote Operations Centre

Building on years of experience



VTS Experience from Kongsberg Norcontrol with 250 maritime surveillance systems to customers worldwide.



- SCC located at Wilhelmsen's offices in Lysaker
- Massterly is a JV between KONGSBERG and Wilhelmsen responsible for the operation of autonomous vessels

SCC at Lysaker, Oslo



# Massterly - a JV with Wilhelmsen



- World leader in automation
- Frontrunner in digital development
- Leading in development of autonomy

[www.kongsberg.com](http://www.kongsberg.com)

- Major logistics operator at sea and on land
- Owns and operates 20+ terminals
- A global network - 2 200 ports in 74 countries

[www.wilhelmsen.com](http://www.wilhelmsen.com)





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Enabling remote operations of vessels and other floating structures in a safe, efficient and secure manner in different types of operations

# REMOTE OPERATIONS CENTRE

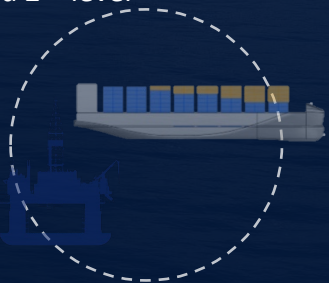
## Categories of Operations



### MONITORING & SUPPORT OPERATIONS

Empowering the onboard crew by **remote monitoring and support** in an expert in the loop setting

1<sup>st</sup> and 2<sup>nd</sup> level



### DIRECT CONTROL OPERATIONS

Enabling manned/unmanned vessel operations from a remote location with **direct control** capability

Alleviate the workload of the onboard crew by providing **assisted control** capability

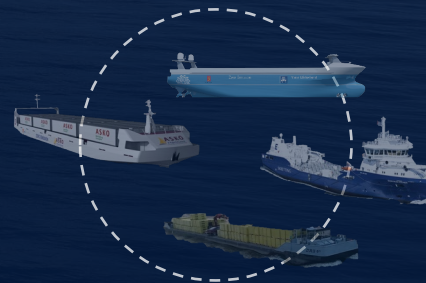
1<sup>st</sup> level



### AUTONOMOUS OPERATIONS

Autonomous vessel operations with **monitoring, supervision** and **intervention** capability from a remote location

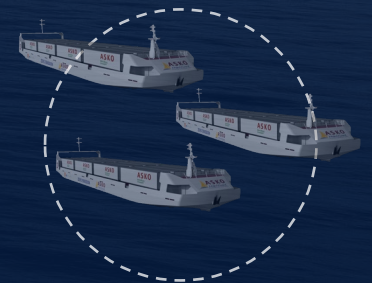
1<sup>st</sup> and 2<sup>nd</sup> level



### FLEET OPERATIONS

Large scale fleet operations solution including **mission management, planning, scheduling, resource management** supplementary to other categories of operations.

3<sup>rd</sup> level





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# REMOTE OPERATIONS CENTRE

Operator Environment



## MAIN CAPABILITY

### LARGE SCREEN DISPLAY

- A scalable display surface for presentation of situational awareness data, PiP information, AR objects and specific UI:s in a flexible way.

### NEAR SCREENS

- A flexible monitor setup providing the detailed view of critical systems.

### CONTROL OBJECTS

- Providing the needed control capability for onboard systems and operator environment

### USER EXPERIENCE & ERGONOMICS

- Designed in accordance with standards ISO 11064, ISO 7250, ISO 9241 and relevant guidelines for remote control centres.



LARGE SCREEN  
DISPLAY

NEAR SCREENS

CONTROL  
OBJECTS

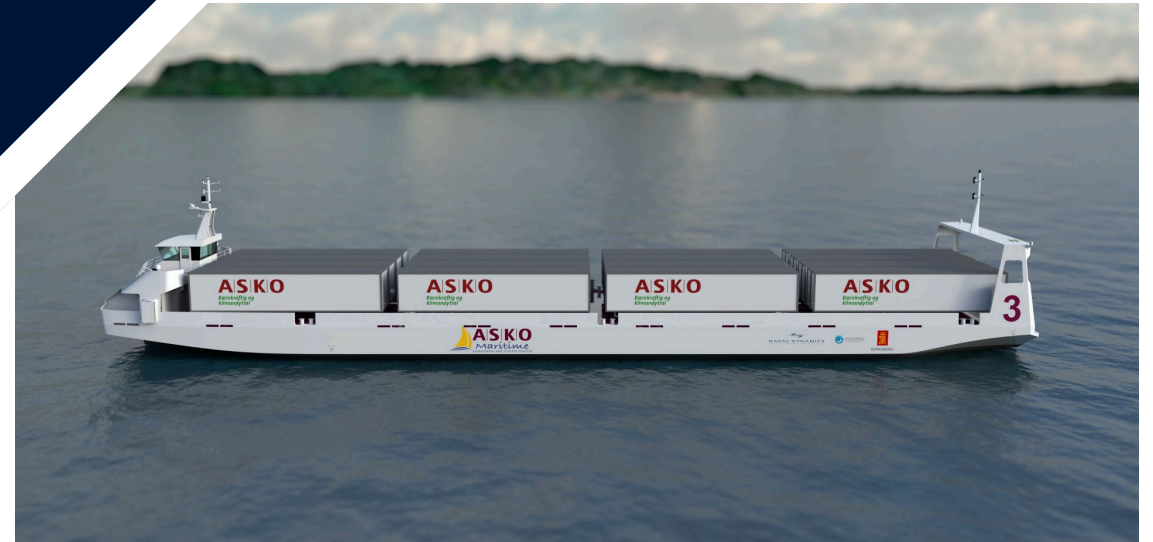




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# Other Commercial Projects

Remote & Autonomous





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# ASKO AutoBarge

Fully autonomous zero emission trailer ferry

- Front End Engineering Design efforts ongoing
- Letter of Intention executed January 2020
- First operational phase with reduced manning
- Second operational phase: Constrained Autonomous & Continuous Unmanned Ship
- Operational area: Moss-Holmestrand
- Fully electric, 16 trailers, autonomous mooring, trailers loaded/discharged using autonomous harbour trucks

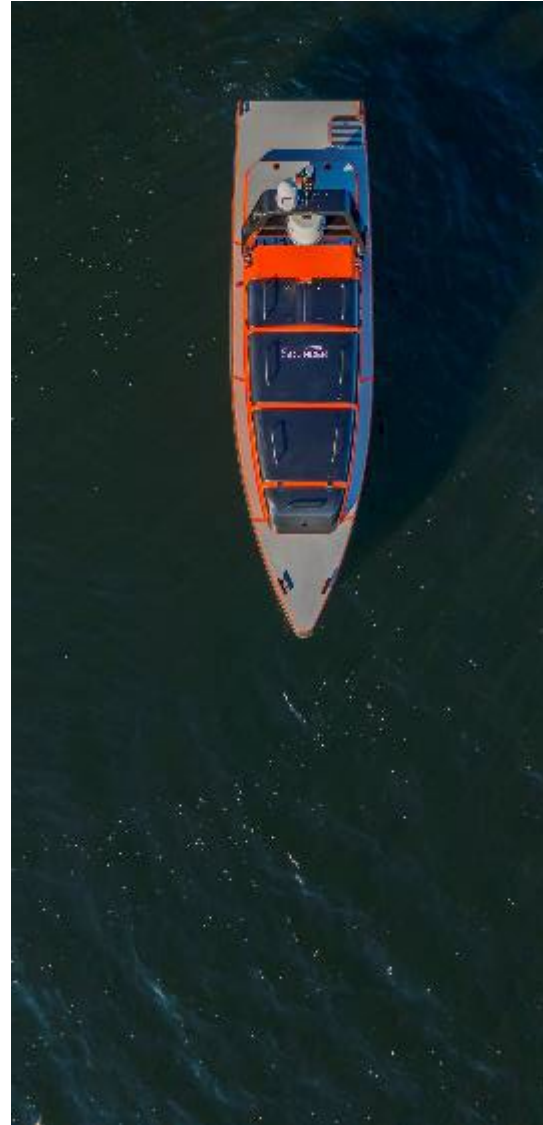




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## Sounder USV

- Product launched in the Marine Robotics family in 2019
- Multi-purpose USV optimized for hydro-acoustic applications
- Delivery to customer in 2020 for fishery applications



SOUNDER





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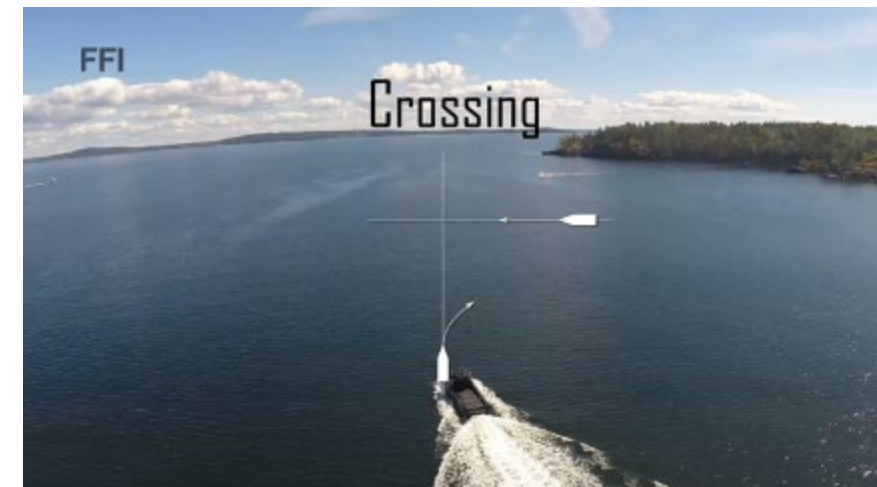


Photo: FFI

## ODIN CONCEPT USV

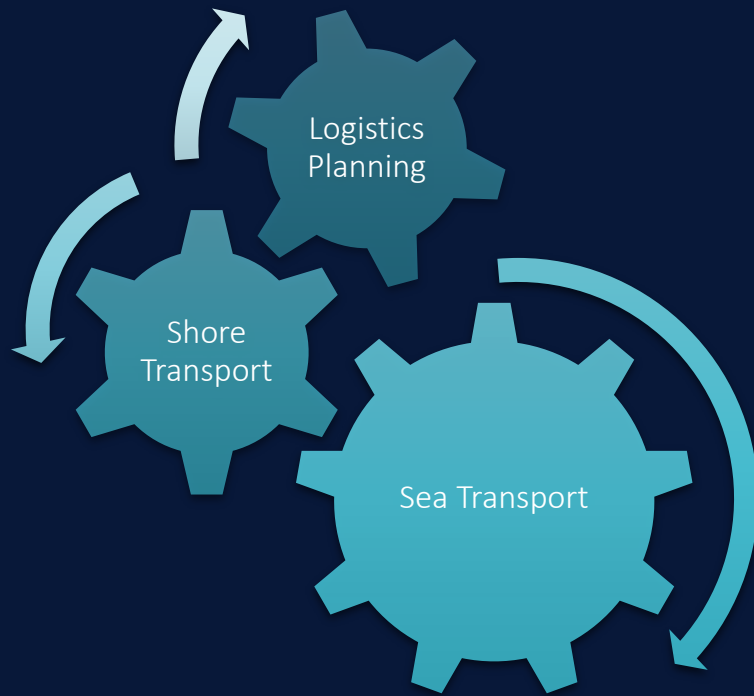
- Collaboration between Kongsberg Maritime, Kongsberg Defense & Aerospace and The Norwegian Defence Research Establishment (FFI)
- Maritime Mine Countermeasure(MCM) application
- Research platform for surface vehicle autonomy
- Designed to carry HUGIN, Minesniper, Towed equipment, AUV LARS
- Technology transfer from HUGIN development to USV's

**FFI** Forsvarets  
forskningsinstitutt  
Norwegian Defence Research Establishment





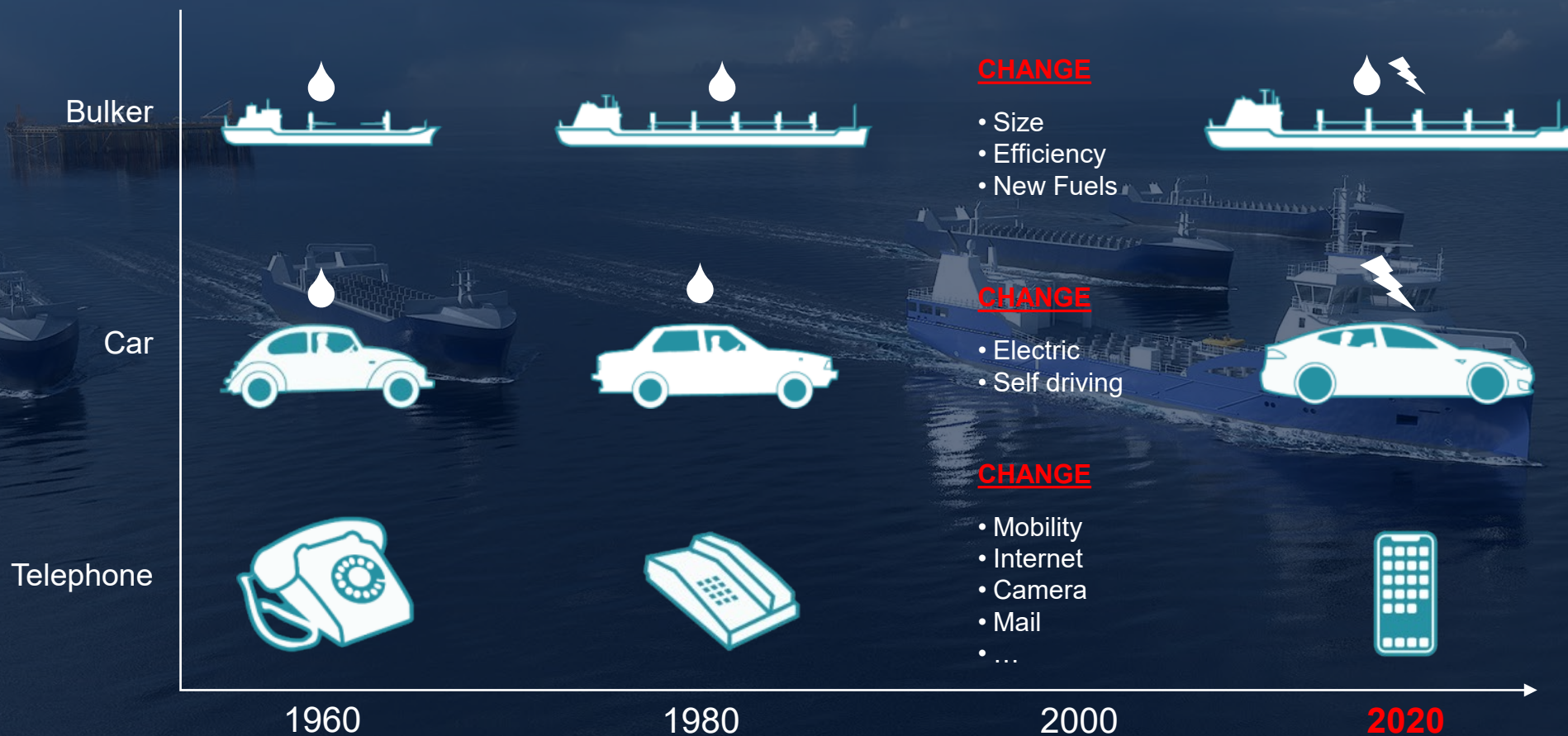
# Collaboration is Key





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# ~~REVOLUTION~~ EVOLUTION





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**Thank you!**

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