



Welcome to the  
future



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- Multibeam data transfer
- Multibeam data used by autonomous ships

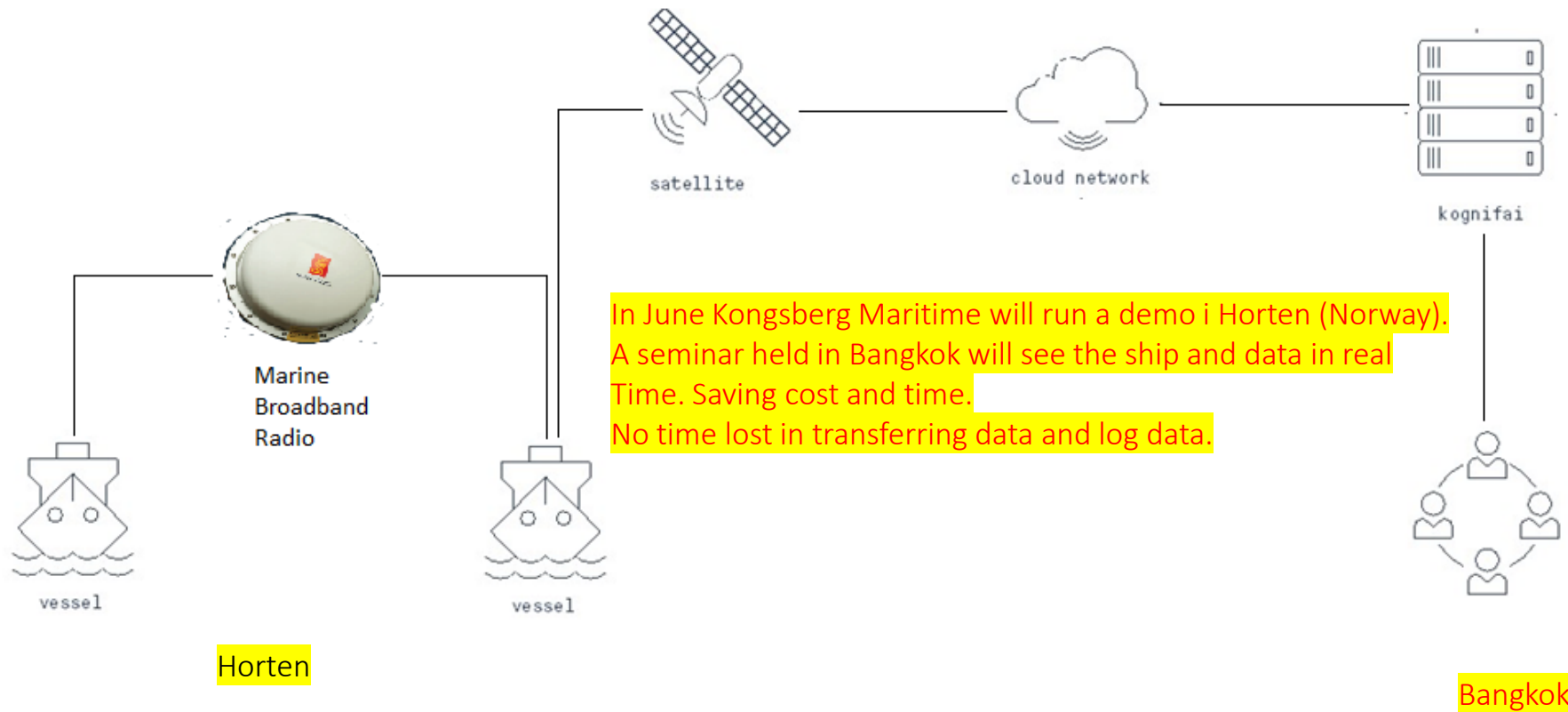




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# Mapping Cloud Real time

Everyone can work on data in real time - no matter where you are in the world





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# Integrated Vessel Systems

Mapping Cloud works together with other Kongsberg products



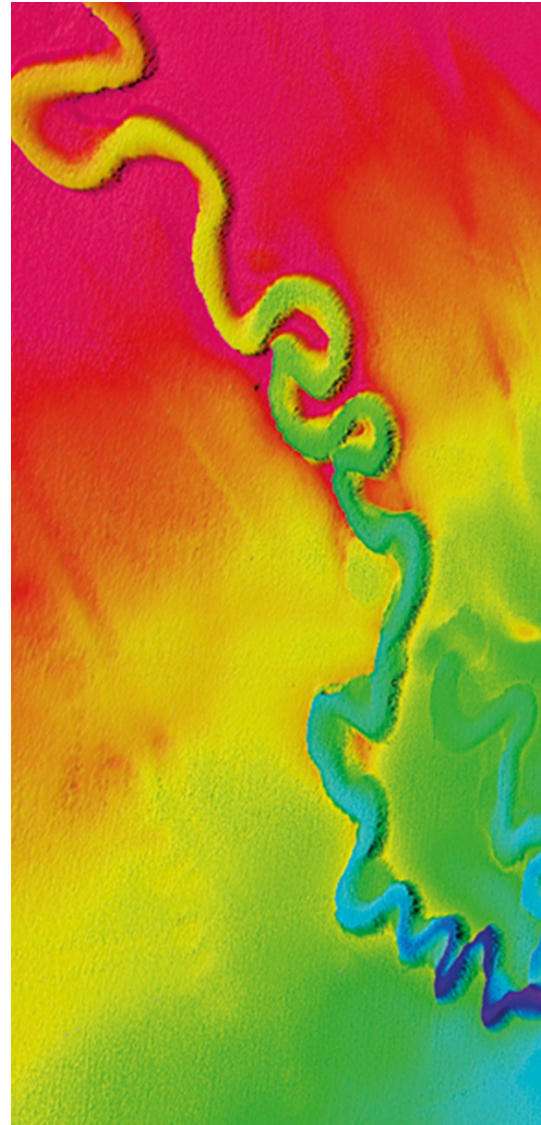




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# Mapping Cloud

- Storage
- Virtual Machine (VM)
- Remote Control
- Connection to Partners



## Processing VM

- Choose preconfigured VMs
- VM is connected to Storage, ready to process data
- Install your own processing software on VM just as a regular PC

## Storage

- Download Windows Desktop Application to help copy files from Local Storage to Mapping Cloud
- Storage App to manage Hot/Cold storage
- File management

## Mapping Cloud

## Partners

- ESRI
- Earth Analytic
- Geocap
- CARIS
- QPS

## Remote Control

- Send real time data from ship to Mapping Cloud
- Interact with acquisition
- Connect to several boats at the same time

# Move Goods from Diesel trucks to Battery driven vessels, reduce pollution and save costs



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# Vessel concept



105 TEU Open Top Container Vessel - fully battery powered solution

Prepared for remote control and autonomous operation. Will replace 40 000 truck loads every year

## ESTIMATED FACTS & FIGURES

### Main particulars

LOA 60 m

LPP 57 m

Beam 15 m

Depth 12 m

Draught (full) 5 m

Draught (ballast) 3 m

Service speed 10 kn

### Capacity

Cargo capacity 105 TEU

Deadweight 1 250 mt

### Propulsion

2 Azimuth pods

2 Tunnel thruster



Figures based on DNV GL's Revolt concept





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Pilot area:

Herøya – Brevik (approx. 7,5 nm)

Herøya – Larvik (approx. 25 nm)

Mapped using multibeam onboard  
Ship and AUV (Hugin)

Future Area:

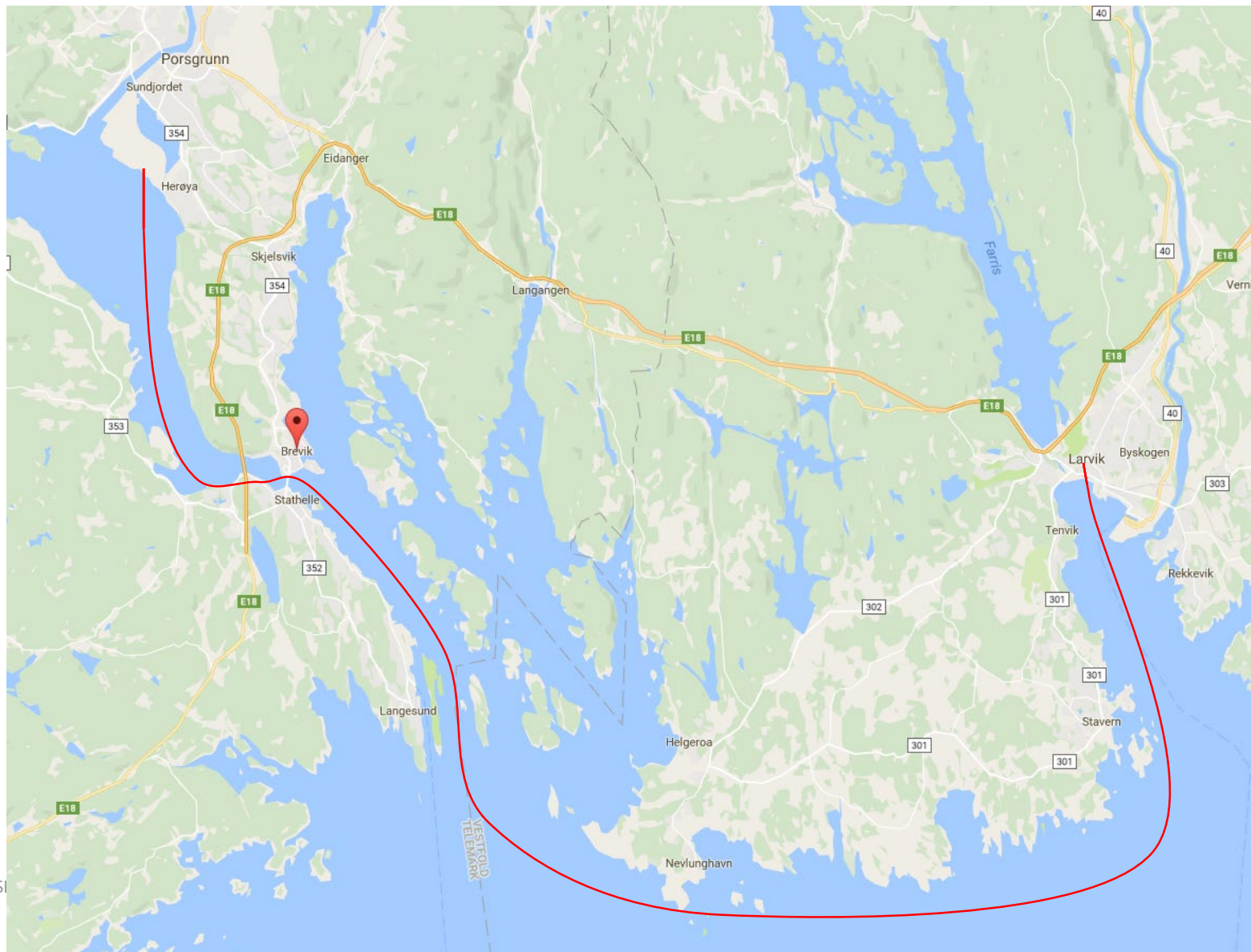
Goteborg/Hamburg/Rotterdam



Area completely covered by  
Kystverket's VTS system

(delivered by Kongsberg Norcontrol)

## Operational area



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# Remote Operation



Remote monitoring & control to ensure safe operation

- Emergency and exception handling
- Condition monitoring
- Operational Monitoring
- Decision support

Yara

- Vessel monitoring
- Planning / scheduling

Kongsberg Maritime

- Vessel & onboard systems
- Condition monitoring, validation & diagnostics
- Failure detection & correction

Kystverket - Vessel Traffic Surveillance

- Autonomous vessel surveillance
- Route Guidance
- General traffic information
- Emergency handling / rerouting?

WORLD CLASS – Through people, technology and dedication

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# Technologies for Autonomy



## Sensors

Surroundings  
Condition monitoring



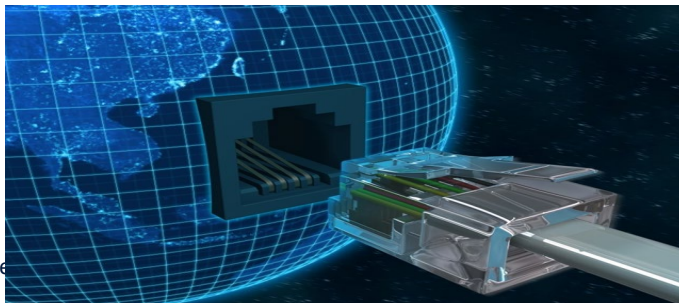
## Perception

Analysis of signals  
and data  
Generate proximity  
awareness



## Communication

Secure



WORLD CLASS – Through people

ETARY - See Statemen



## Cognition

Planning, learning and  
adaption



## Localization and mapping

Relative positioning  
Wider environment



## Human-Machine Interaction

Remote control  
Man in the loop





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# Autonomous operation



## Navigation Safety

- Collision and Grounding Avoidance
- COLREGs compliance

## Sensors and Situation Awareness

- Camera, Radar, AIS, Lidar, IR Camera
- Sensor fusion and redundancy
- Handle failures and false detections

## Verification

- How to verify
- Requirements for safe operation

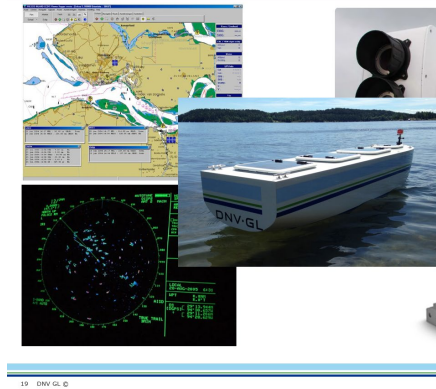
## Automated Mooring & Charging

- Approach and connection

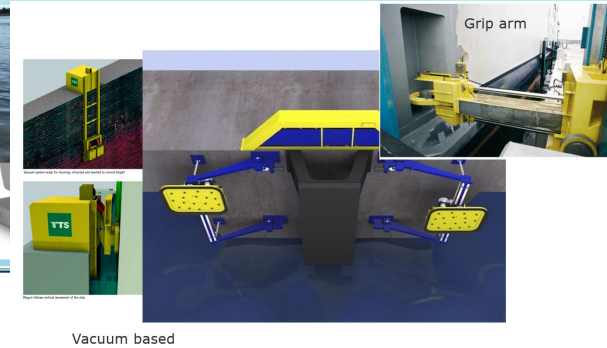
## Cargo Handling

- Autonomous Container Crane
- Autonomous movement of goods Herøya

### Autonomy



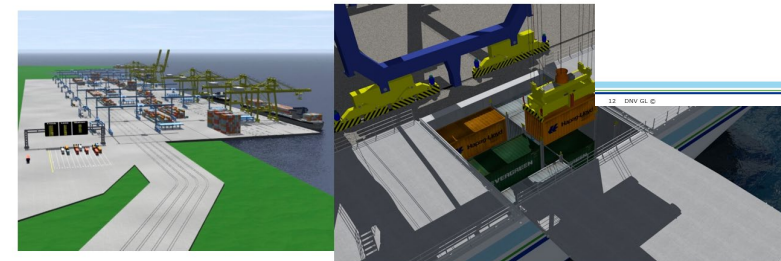
### Automatic mooring



Vacuum based

### Cargo handling

Dedicated cargo terminals for fast cargo handling



Extended hull sides to eliminate the need for extra lashing

# What is an autonomous ship?

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IMO definition – for regulatory scoping exercise:

*“Maritime Autonomous Surface Ship (MASS)” is defined as a ship which, to a varying degree, can operate independently of human interaction.*



Various degrees of autonomy:

- Automated processes and decision support: Seafarers are on board to operate the ship, but some operations are automated
- Remotely controlled ship with seafarers on board
- Remotely controlled ship without seafarers on board
- Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself

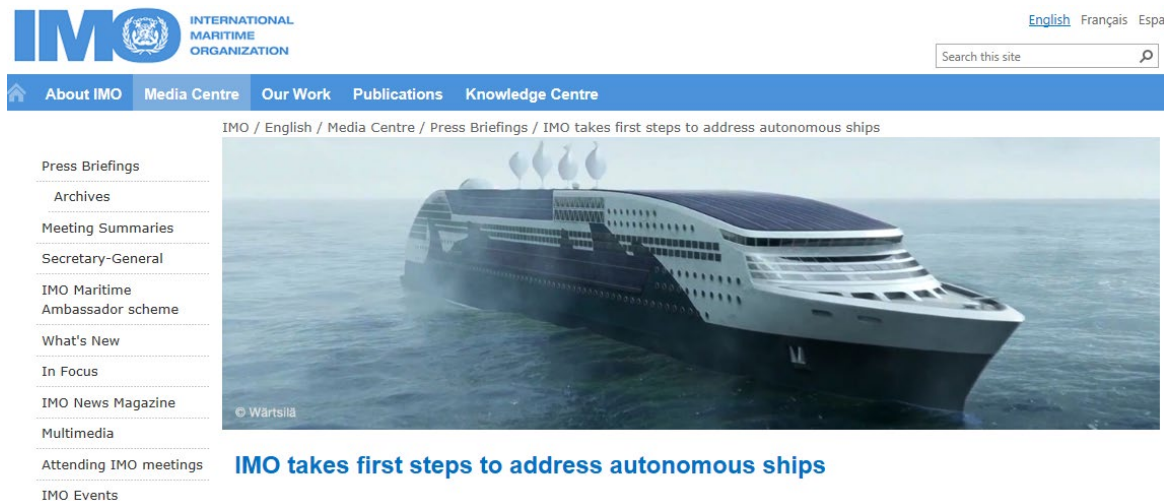


## CLASS GUIDELINE

DNVGL-CG-0264

Edition September 2018

### Autonomous and remotely operated ships



The screenshot shows the IMO (International Maritime Organization) website. The header includes the IMO logo and navigation links: About IMO, Media Centre, Our Work, Publications, and Knowledge Centre. A search bar is also present. The main content area features a large image of a modern cargo ship at sea, with the text "IMO takes first steps to address autonomous ships" overlaid. To the left of the image is a sidebar menu with links: Press Briefings, Archives, Meeting Summaries, Secretary-General, IMO Maritime Ambassador scheme, What's New, In Focus, IMO News Magazine, Multimedia, Attending IMO meetings, and IMO Events. The breadcrumb trail at the top of the content area reads: IMO / English / Media Centre / Press Briefings / IMO takes first steps to address autonomous ships.

- The IMO instruments governing the safety of commercial shipping do not provide any regulations for autonomous operations, but IMO has started a scoping exercise
- National or regional regulatory bodies are free to support the introduction of novel technologies and operational concepts within their territorial waters.

**Guiding principle: Autonomous and remote control of vessel functions to have a level of safety equivalent or better compared to conventional operations of vessels with respect to safeguarding life, property and the environment.**





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# Timeline



Proposed Model for Implementation (3 – 5 Years)

Concept  
Development

Project  
Implementation

Manual  
Operation

Remote Operation

Autonomous  
Operation



Concept  
description

Contract KM

Contract Yard

Manual  
Operation

Commissioning

Remote  
Operation

Autonomous  
Operation

**Yara**

Contract Quayside Herøya

Contract Quayside  
Brevik/Larvik

2016

2017

2018

2019

2020

Test period for Autonomous operation estimated to start 2 years after delivery from yard.



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## Footprint improvement

**30%**

slower travel



**50%**

fuel saving

- Reduced speed is a key factor in making maritime transport more environmentally friendly.
- Autonomous vessels can easily adopt slow speed as there are no crew restrictions.
- Final result is reduced exhaust emissions and lower Co2 footprint

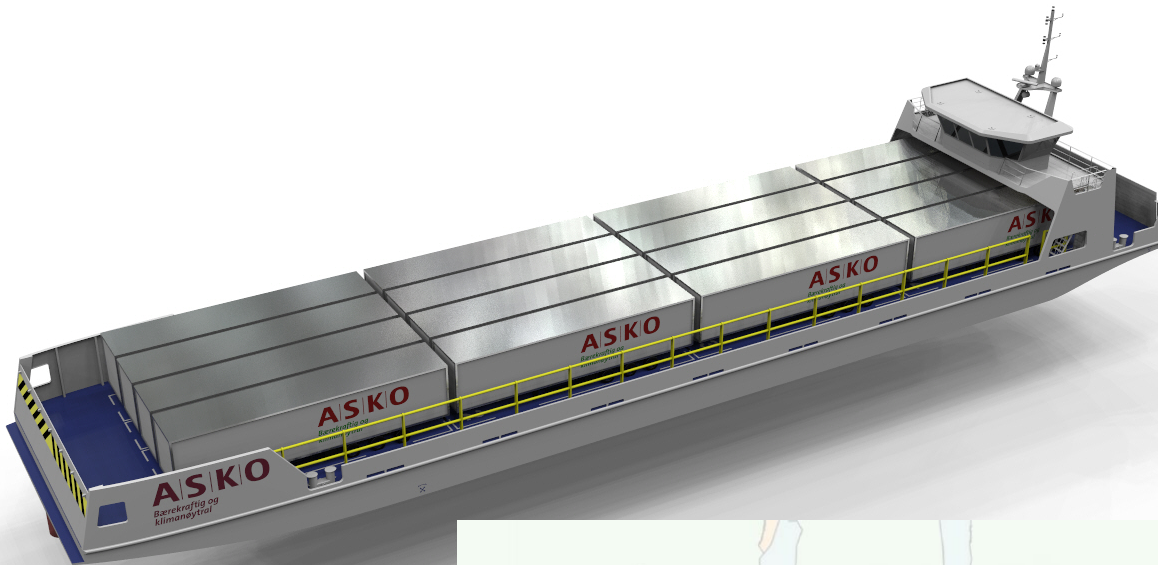




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# ASKO project:

## - fully electric autonomous RoRo feeders for 16 trailers



- Sailing between Moss, Holmestrand and Langøya (NOAH)
- Replacing 1 million truck-kms/year
- Length: 66 m
- Width: 15 m
- Service speed: 8 knots
- Battery capacity: 1,1 MWh
- Target delivery: 2020
- Fully autonomous in 2021







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# Concept: Remotely-operated Fireboats for Ports

enable more aggressive on-water firefighting while reducing risk and improving personnel safety (Robert Allan & Kongsberg partnership)



# Autonomy is already available for conventional vessels

## - Auto Docking and Adaptive Transit / Collision Avoidance



RoPax ferries in the Oslo Fjord;

- 36,000 crossings/year
- saves fuel on every docking
- less contact damages
- reduced risk of collisions in crossings

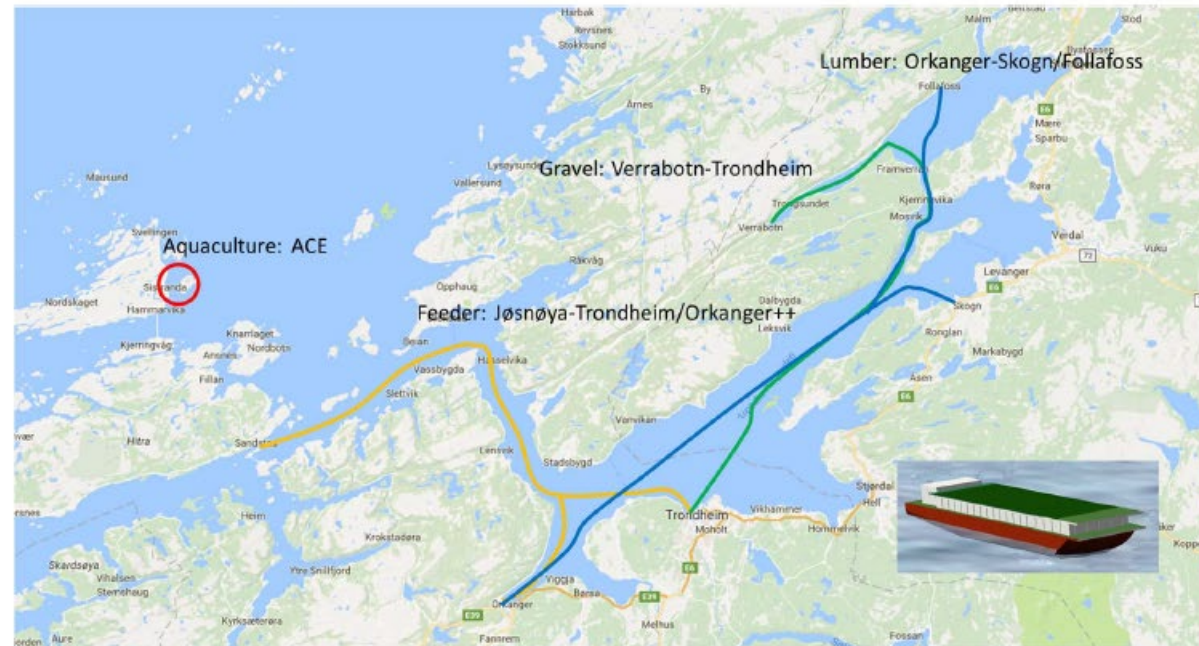




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# Autonomous ship

- Short voyages
- 12-50 TEU
- Inland, fjords/sheltered
- Low cost: Wait in port
- Legs 4-12 hours
- Port cranes
- Automated berthing
- Batteries



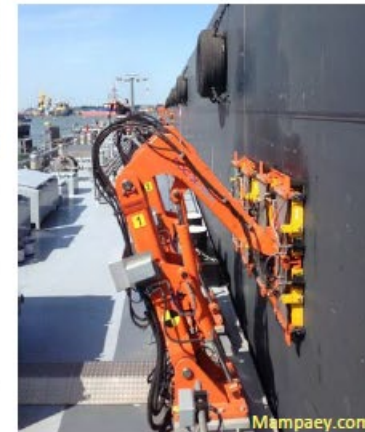
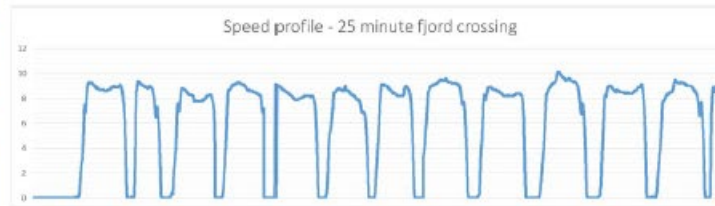




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# Battery ship

## Automated highway ferries





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## GeoSwath - USV a few examples

Not to forget that we also have AUV, USV ++





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# GeoSwath – Compact Survey Vessel



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