FINNPILOT

AUTONOMOUS VESSEL DEVELOPMENTS

Content

Developments in maritime autonomy - some views from the industry

Finnish legislation

What is remote pilotage?

Next steps

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DIMECC One Sea

One Sea – Autonomous Maritime Ecosystem

MERITEOLLISUUS Finnish Marine Industries
BUSINESS FINLAND
ABB
CARGOTEC
ERICSSON
FinFerries
MEYER TURKU
Rolls-Royce
tieto
WÄRTSILÄ

DIMECC One Sea

One Sea Partners

ABB
Cargotec
Ericsson
FinFerries
Finnpilot Pilotage
Meyer Turku
Rolls-Royce
Tieto
Wärtsilä

Ship Intelligence

Towards Autonomous Vessels

2014
DP in Unified Bridge

2016
R&D Centre in Turku Finland

2016
OneSea – leading ecosystems for autonomous maritime

2017
World's first automatic crossing system

2017
Google Cloud Partnership

2018
Intelligent Awareness launch

2025
Autonomous vessels

2013
Unmanned Vessels Vision launch

2015
AAWA – Autonomous vessel initiative

2016
Offshore center concept launch

2017
World's first remote controlled commercial vessel demo

2017
Chinese alliance for autonomous ships

2017
European Space Agency Partnership

2020+
Remotely operated local vessels

ADVISORY

CONTROL

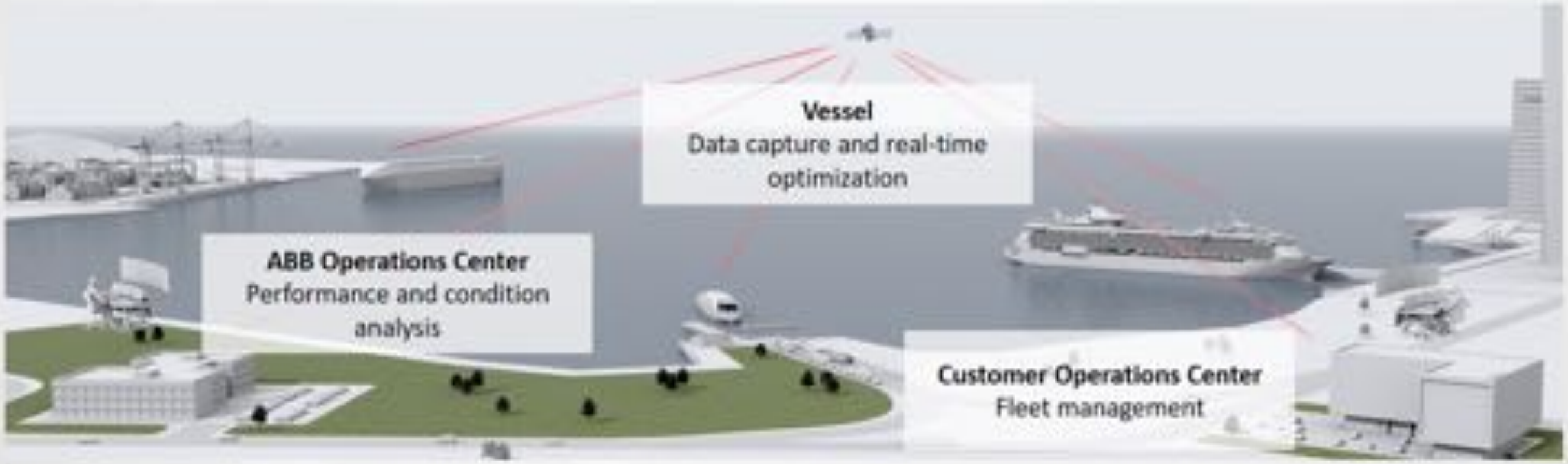
svan

KONGSBERG


ABB

Electric. Digital. Connected.

Transparency



Connecting vessels and shore operations with our experts

Roadmap


Onshore
Onboard Advisory
Onboard Control
Onshore situation awareness
Fleet situation awareness
Remote control and intervention
Docking assistance & situation awareness
Collision prevention advisory
Automatic docking
Automatic collision prevention
B0 bridge (conditionally unmanned)
Automatic operation
Optimized vessel control
Advanced manoeuvring control

Electric. Digital. Connected.

Digital

Digitalization is changing the way ships are designed and operated

Market will develop gradually

Decisive factors

Legislation

Global conventions demand physical presence:

- United Nations Convention on the Law of the Sea
- Safety of Life at Sea

National administrations granting exemptions

Business Models

Utilization

Revenue

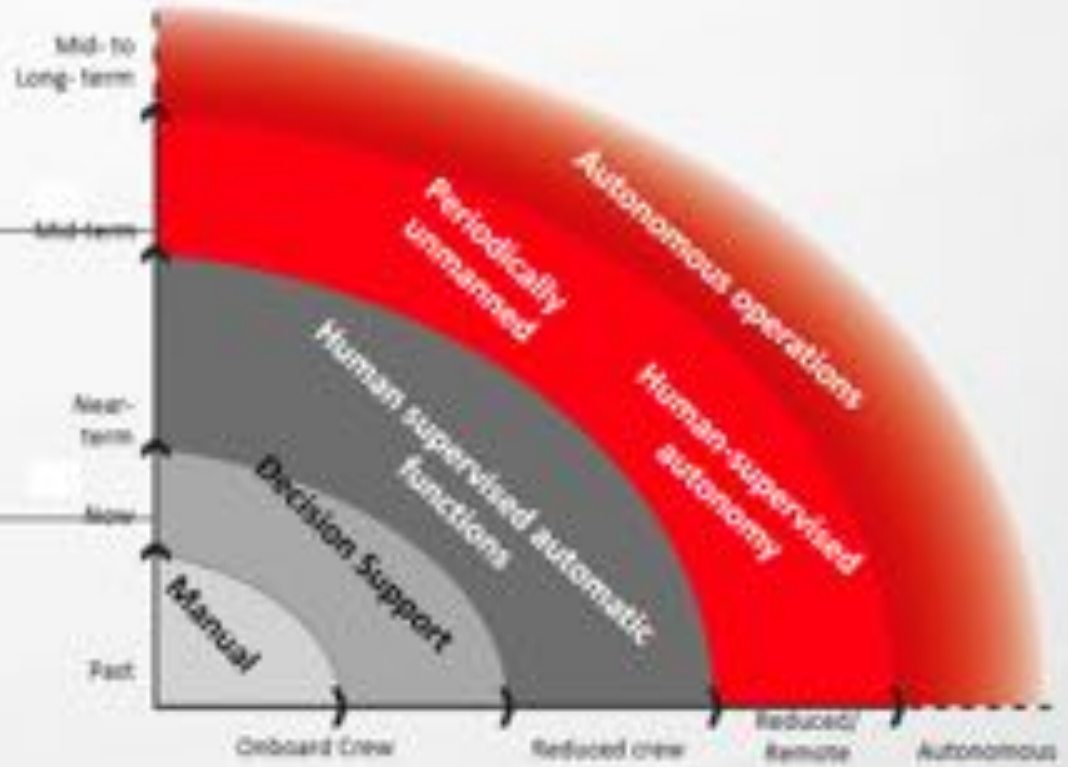
Cost

Risk and Liability

Technology

"Autonomous and remote-controlled ships shall be as safe as conventional ships of the same type"

Technology will develop at an exponential speed.



ABB

Market will develop gradually

Local traffic

Autonomy

Innovations applied differently

Situational awareness

Motion control

Collision avoidance & Object recognition

Electric and self-healing machinery

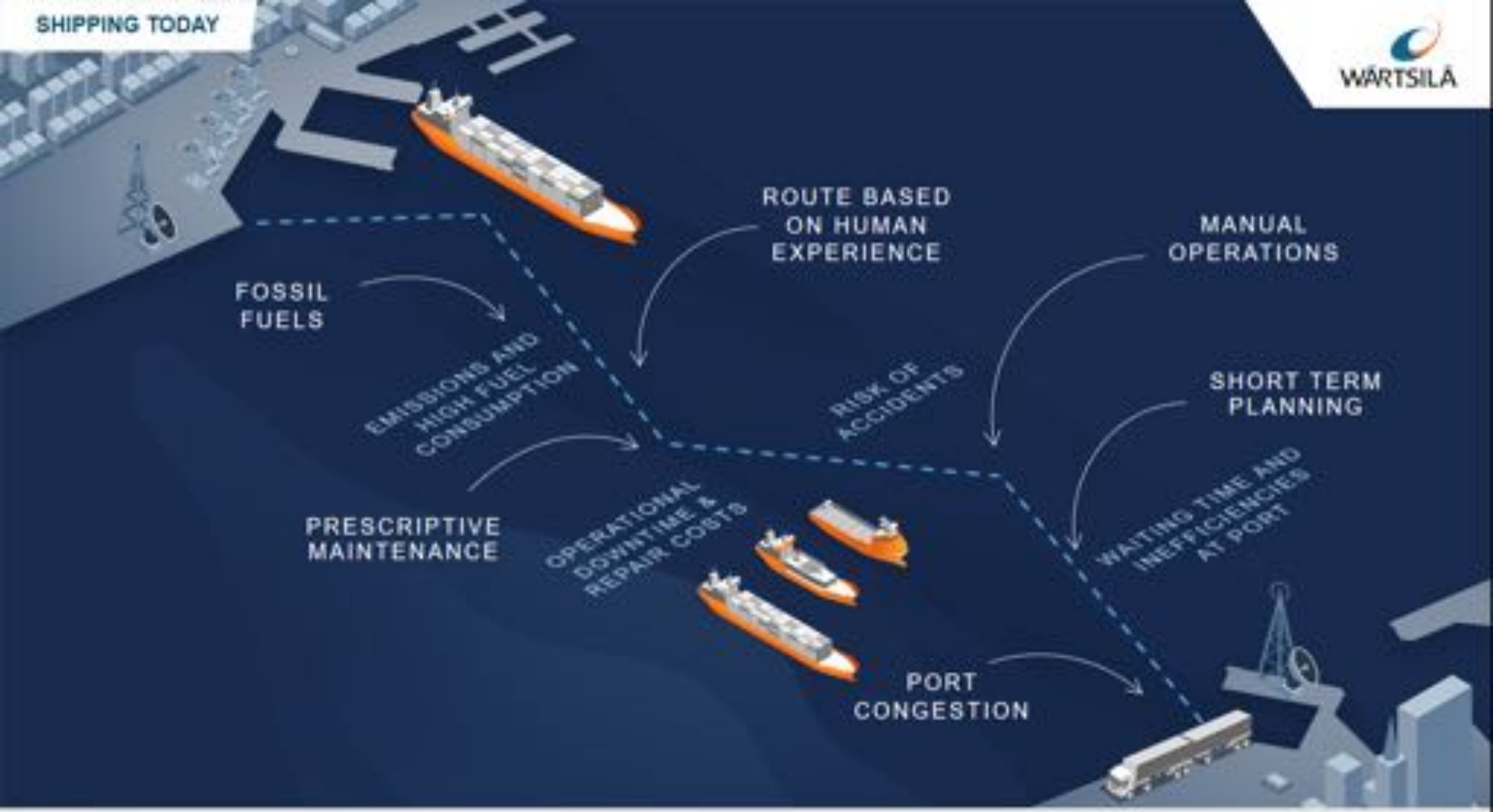
Autonomy

Ocean Going

Same technology – different applications

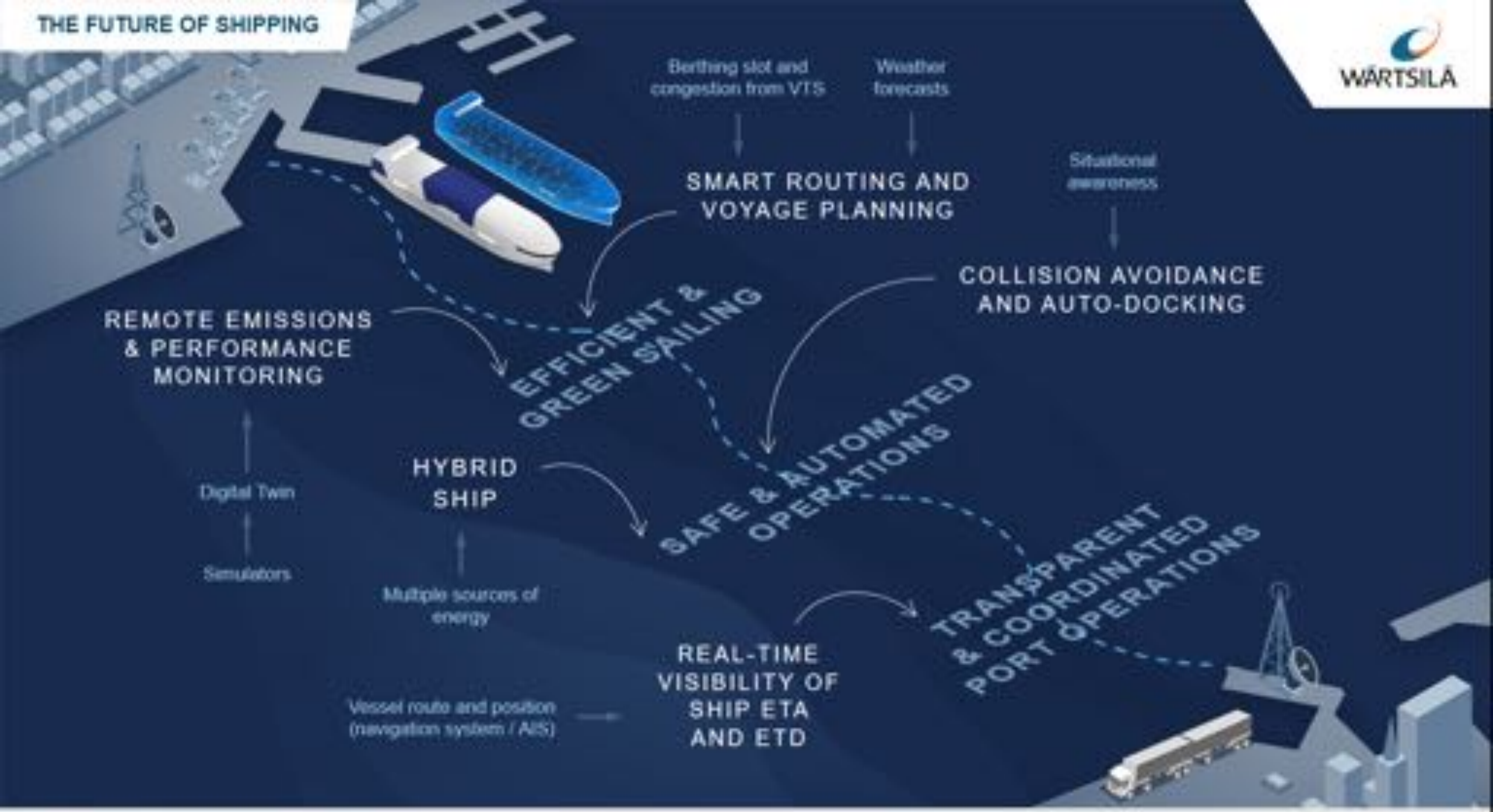
ABB


TRANSAS & WÄRTSILÄ
WÄRTSILÄ
The Smart Marine Ecosystem

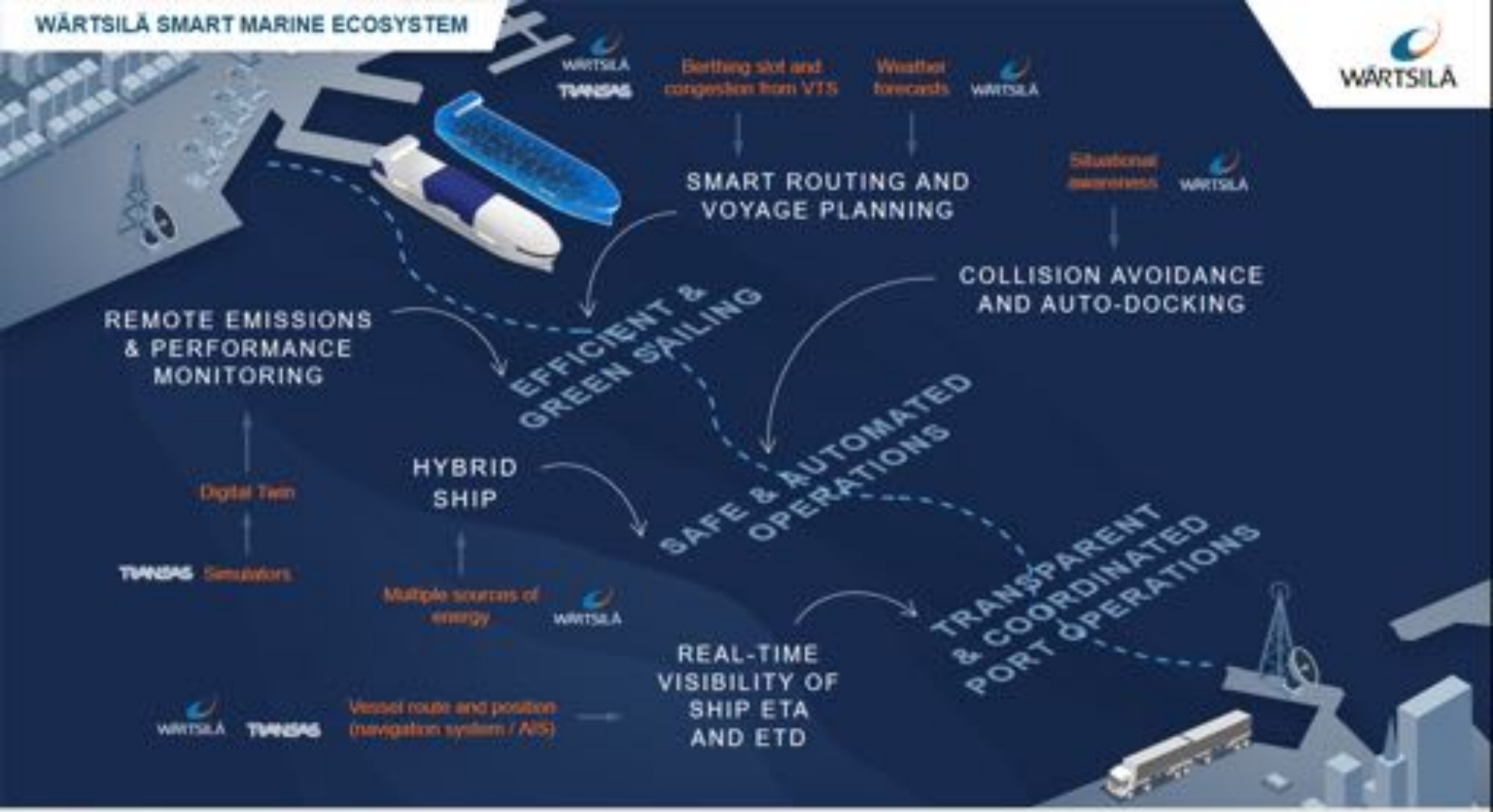

SHIPPING TODAY
WÄRTSILÄ
ROUTE BASED ON HUMAN EXPERIENCE
MANUAL OPERATIONS
FOSSIL FUELS
EMISSIONS AND HIGH FUEL CONSUMPTION
RISK OF ACCIDENTS
SHORT TERM PLANNING
PRESCRIPTIVE MAINTENANCE
OPERATIONAL DOWNTIME & REPAIR COSTS
WAITING TIME AND INEFFICIENCIES AT PORT
PORT CONGESTION

THE FUTURE OF SHIPPING

WÄRTSILÄ



WÄRTSILÄ SMART MARINE ECOSYSTEM



Finnish Pilotage Act
(amendments in force 1.2.2019)

- A “law for the future”
- Allowing the pilot to perform his or her duties somewhere else than onboard the vessel.
  - Permit applied from Finnish Transport and Communications Agency, valid for 5 yrs.
  - Only Finnpilot Pilotage Ltd may apply the permit and provide remote pilotage.
- Pilotage Act includes regulations on
  - content of the application,
  - approval process,
  - amendments to permit,
  - reasons for cancelling the permit,
  - conditions of the permit and
  - renewal of the permit.

Remote pilotage allowed

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Remote pilotage

- Pilotage company has to apply for an authorization (permit) from the pilotage authority. The application shall include describtions on various issues:
  - Where (fairway)
  - To whom: type(s) of ship(s)
  - How (technology, communications, “RPC”, …)
  - Operational procedures
  - Information to be used, its reliability, availability and up-to-date
  - Conditions under which service is provided (environmental conditions, ship condition)
  - Responsible persons and number on personnel involved with remote pilotage
  - Risk assessment

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Remote pilotage

Permit for remote pilotage can only be granted if remote pilotage will not as such or in combination with other functions cause any danger to vessel traffic safety or any harm to other vessel traffic or the environment.

- Finnpilot must demonstrate safety and quality of remote pilotage.
- Authority decides finally what is acceptable remote pilotage.
- The master of the ship has always right to refuse from remote pilotage.
- The responsibility of the pilot is limited by law if any technical or communicational problems occur or the operational procedures are not executable.

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How to develop (remote) pilotage?

Testing

- Methodology
- Technology
- Operational procedures

Defining

- Means for ensuring the safety of piloted ships including the safty of human lives and the marine environment
- Risk control and mitigation measures
- Potential fairways, ports and ships
- Personnel and competences required and training needed.

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Pilotage - What does the customer buy?

- Fairway navigation, ship handling
- Ice navigation and icebreaker assistance
- Cooperation with tugs
- Harbour manouevring
- Local knowledge (conditions, operation,formalities, contacts, responsibilities,…)
- Relevant port call information

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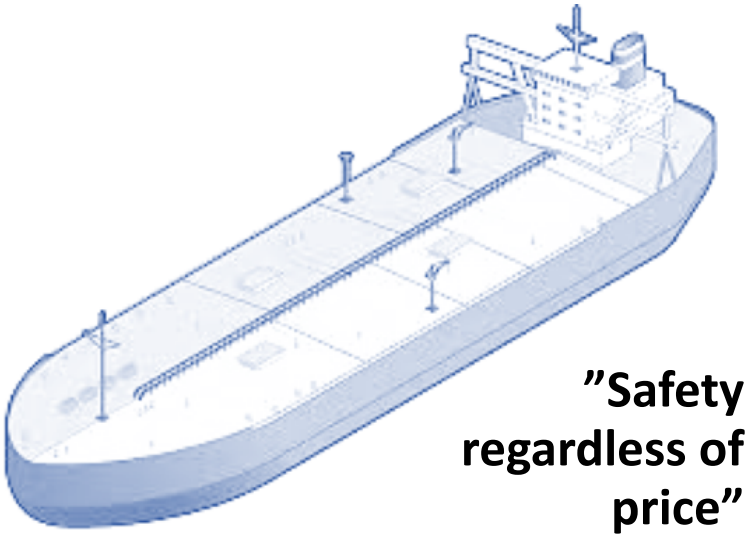
Customer segments from safety perspective

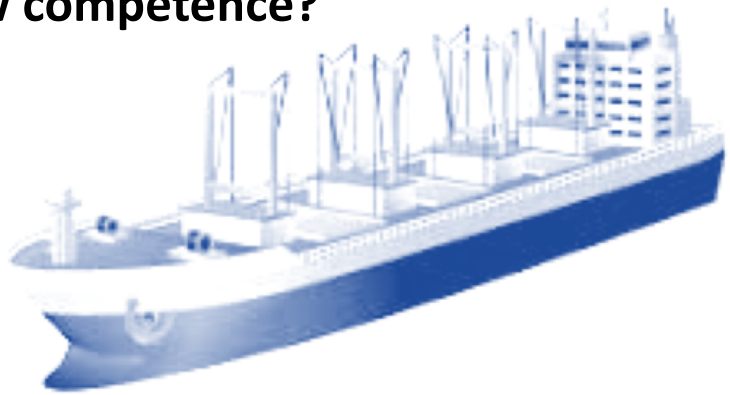
”Liner traffic with efficient cargo handling”



”Safety regardless of price”

”Accurately scheduled production of experiences with high safety standards”

Low profit – low costs – low competence?



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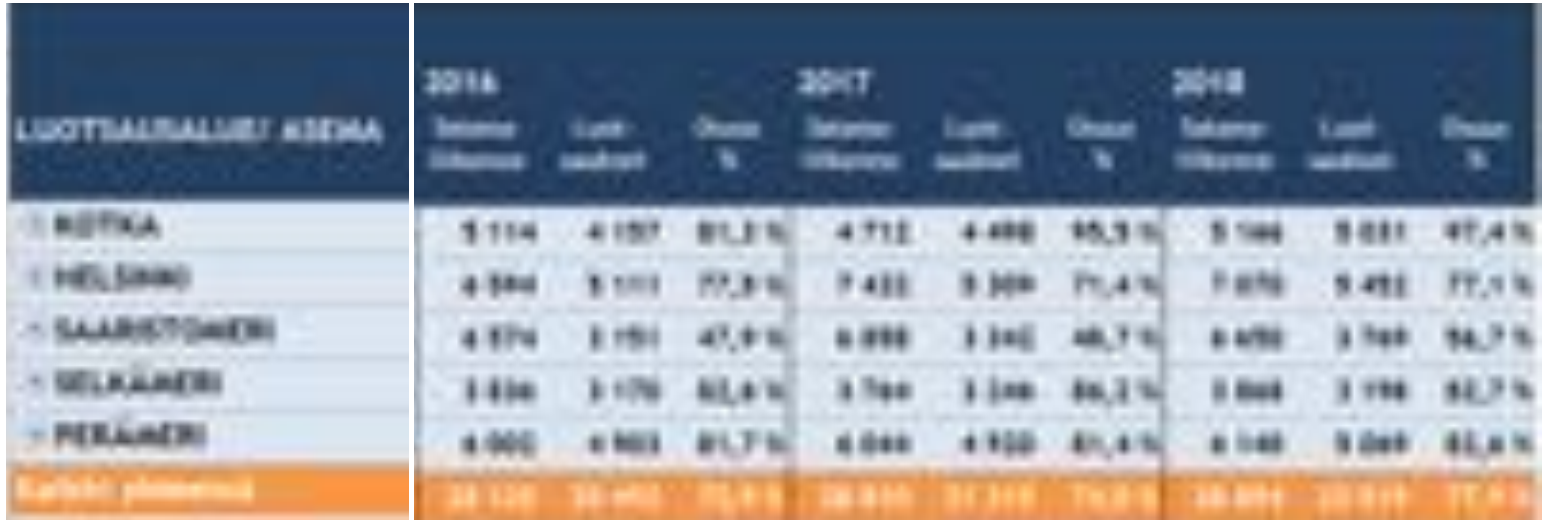
Finnpilot “market share”

All port calls



Foreign traffic (cruise, passanger and ropax traffic excluded)

Statistics from Finnish Transport Agency and Finnpilot

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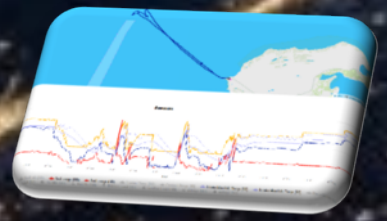
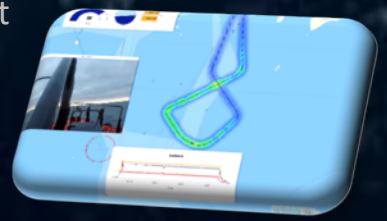
DATA INTENSITY





Collecting AIS data

Internal processes digitalized

Vessel independent navigation

Fleet management

Analysing tool

Pilot Online

Pilotage data collection

Remote controlled cutter

Analysing process for pilotages

Data set for pilot from analysing tool

ePilotage

Future Fairway Navigation

TODAY

TIME

ePilotage concept is a set of actions aimed at the development of the pilotage service process i.e.

- transportation,
- transportation planning,
- resource planning,
- pilotage and
- invoicing.

The main focus of ePilotage is the development of information gathering, production and processing to enhance the pilotage service process.

The outcome of ePilotage is new methods for providing pilotage such as remote pilotage and new solutions to improve the pilotage today.

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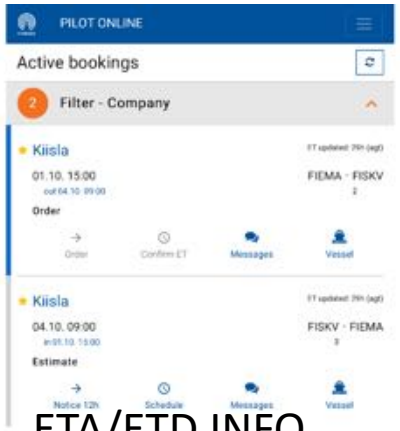
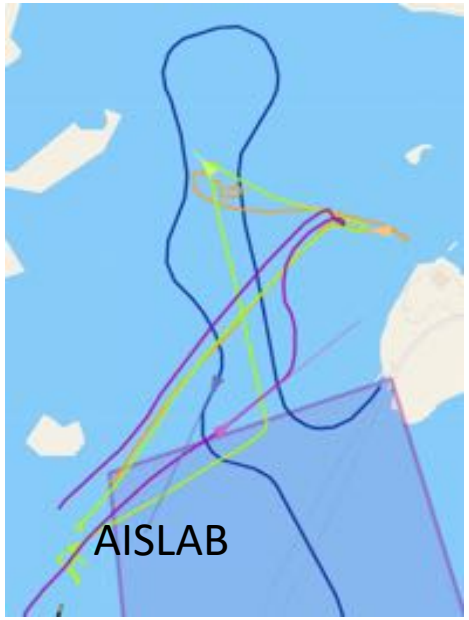


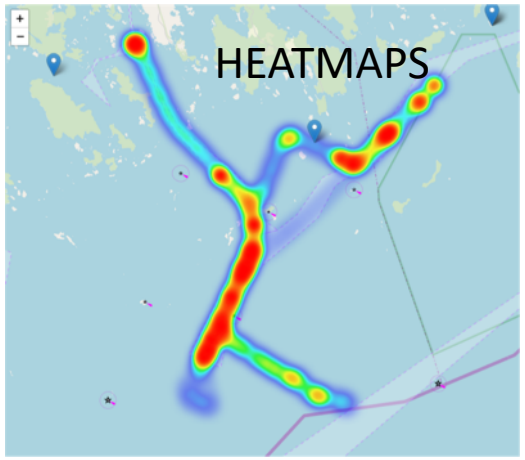
ETA/ETD INFO



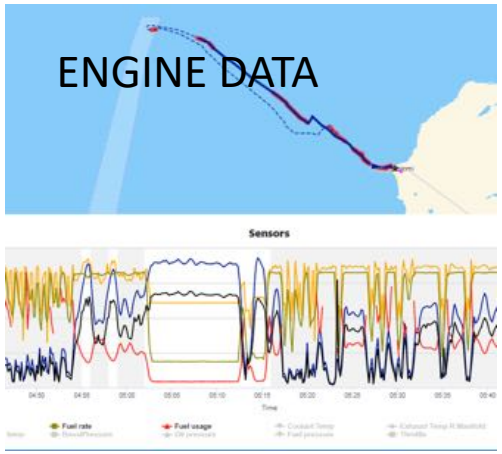
AISLAB

TIMESERIES

ENERGY EFFICIENCY

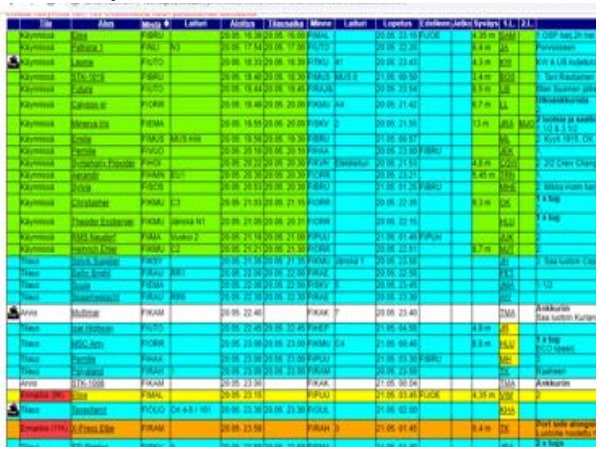


HEATMAPS



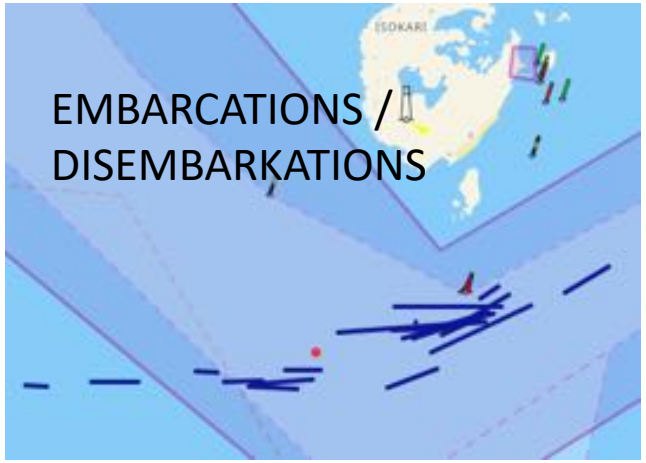
ENGINE DATA

XYZ-DATA



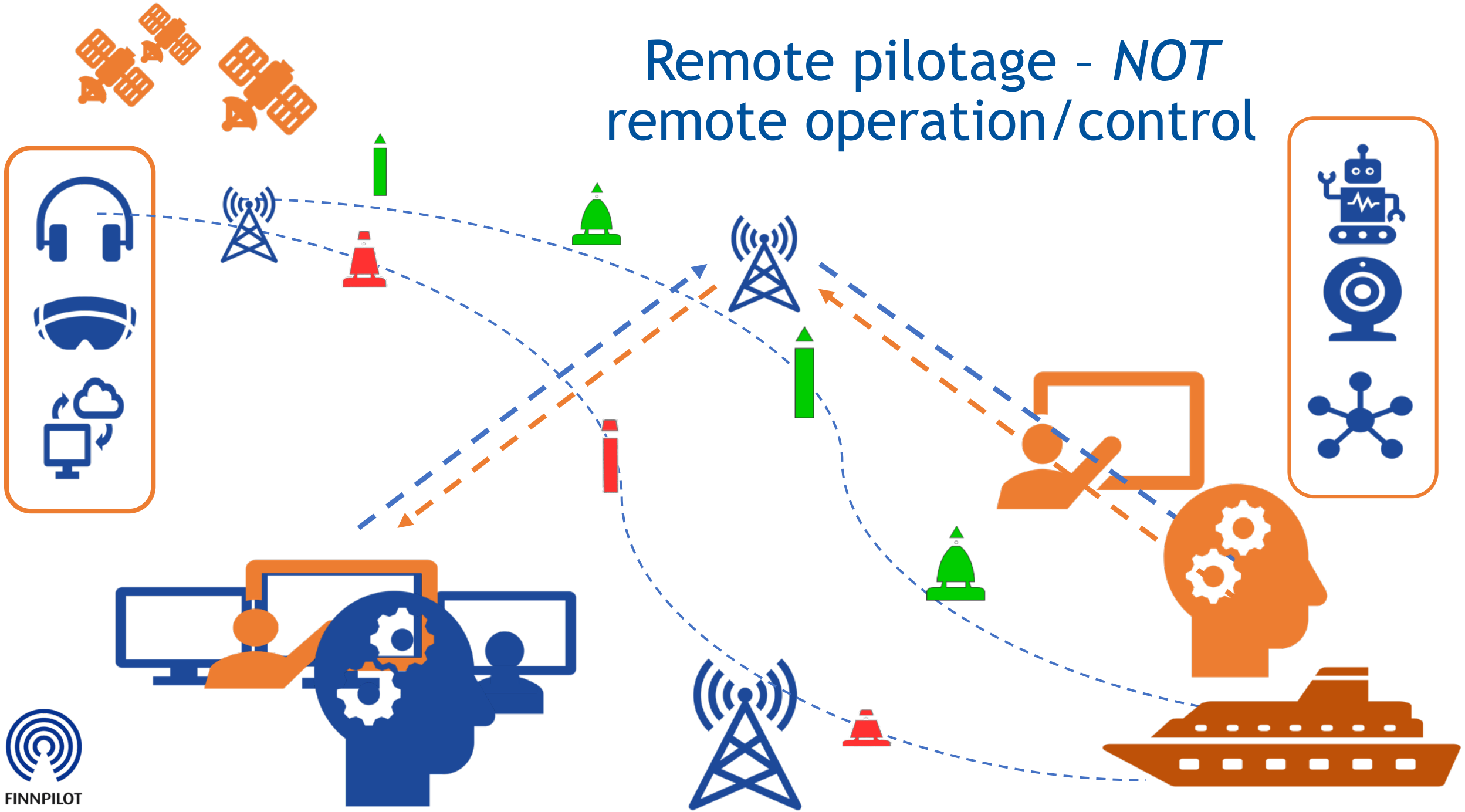
AtoN FAULTS TO PPUs

ROUTE IDENTIFICATION



EMBARCATIONS / DISEMBARKATIONS

Remote pilotage – *NOT* remote operation/control



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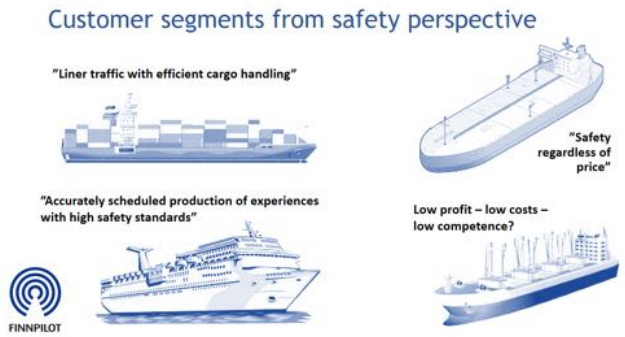
Information to enhance pilotage

- Weather
- Data from Pilot Plug
- Deviation reports
- AIS
- Pilot's route plan
- AtoN malfuctions
- Intelligent AtoNs
- Ship's route plan
- Ice information
- Sweeping information
- Coastal radar data
- Ship manouevring
- Ship movement observation systems outside the ship
- Ship movement observation systems inside the ship
- Shared situational awareness

Potential for remote pilotage

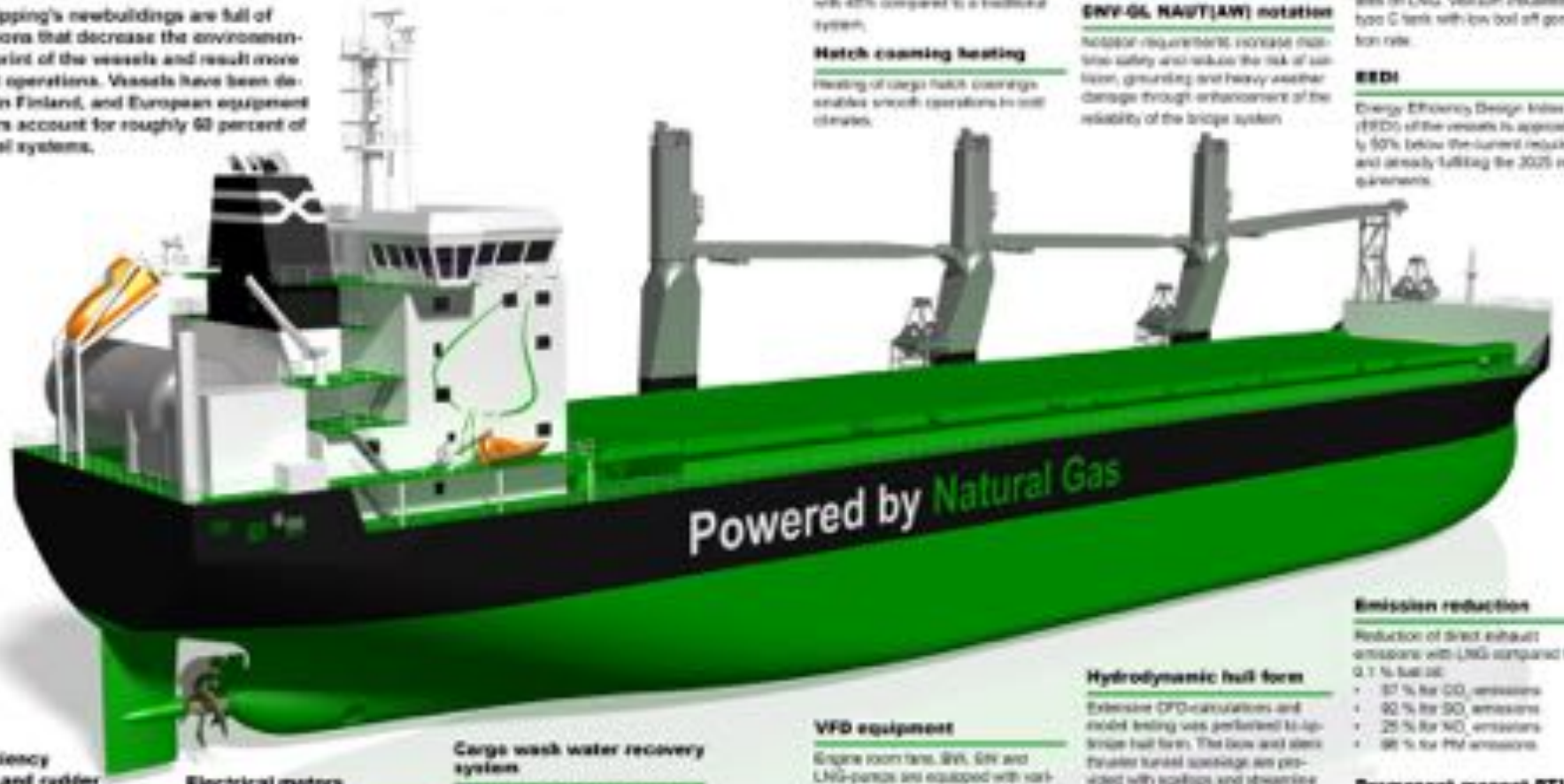
- Customer segments – not a service for all!



- Quality ships with competent masters/officers
- PEC requires training – why not remote pilotage

INNOVATIVE NEWBUILDINGS

ESL Shipping's newbuildings are full of innovations that decrease the environmental footprint of the vessels and result more efficient operations. Vessels have been designed in Finland, and European equipment suppliers account for roughly 60 percent of all vessel systems.



Thermal insulation & Heat recovery

Vessels have improved thermal insulation and are equipped with energy saving solution for air handling unit. Heat recovery wheel reduces cooling energy consumption with 30% and heating energy consumption with 45% compared to a traditional system.

Hatch coaming heating

Heating of cargo hatch coamings enables smooth operations in cold climates.

DNV GL Clean Design notation

The notation requires special features such as 5-ppm bilge water separator, biofouling management, ODP = 0 (Ozone depletion potential), GWP-Kex 1300 (Global warming potential).

DNV-GL NAUT(AW) notation

Notation requirements increase maritime safety and reduce the risk of collision, grounding and heavy weather damage through enhancement of the reliability of the bridge system.

Energy management system

The system enables crew to optimize energy consumption.

All LNG-powered

All engines and boiler burner operates on LNG. Vacuum insulated IMO type C tank with low boil off generation rate.

EEDI

Energy Efficiency Design Index (EEDI) of the vessels is approximately 50% below the current requirement and already fulfilling the 2025 requirements.

Emission reduction

Reduction of direct exhaust emissions with LNG compared to 0.1 % fuel oil:

- 97 % for CO_2 emissions
- 92 % for SO_x emissions
- 25 % for NO_x emissions
- 98 % for PM emissions

Permanent magnet PTI/PTO shaft generator with VFD drive

Shaft generator enables flexible and efficient operation of propulsion and power generation at sea as well as extra power for ice conditions through power take in/power take out shaft generator.

High efficiency propeller and rudder

Optimal hydrodynamic design with rudder bulb to optimize the water flow.

Exhaust gas heat recovery

Efficient exhaust gas heat recovery for all combustion engines.

Electrical motors

In general, electrical motors of 7.5 kW and above has an energy efficiency class of IE3.

Shore power

Vessel can perform operations in port on shore-electricity, reducing emissions in port up to 100%.

Cargo wash water recovery system

Vessel is able to re-use the washing water and discharge used washing water to port facilities.

Ballast water treatment systems

Capacity 2 x 1000 m^3, UV-type, United States Coast Guard approved ballast treatment units.

VFD equipment

Engine room fans, BW, SW and LNG-pumps are equipped with variable frequency drive (VFD) to reduce the power consumption.

Hull coating

Hull is painted with low friction ice resistant paint. No harmful antifouling paint is used. Frequent hull cleaning will be performed to reduce the drag of the hull.

Hydrodynamic hull form

Extensive CFD-calculations and model testing was performed to optimize hull form. The bow and stern thruster tunnel openings are provided with scallops and streamline grids. Special attention for monitoring of hull surface roughness was done during the building stage.

Stator fins

The vessel is equipped with four stator fins in order to optimize the flow to the propeller and to increase propeller efficiency.

ESL Shipping

Elements of future fairway navigation

I. Autonomous/intelligent ship (”self-sufficient”)

II. Autonomous/intelligent ship utilizing Intelligent fairway infrastructure

III. Intelligent fairway infrastructure

FUTURE?

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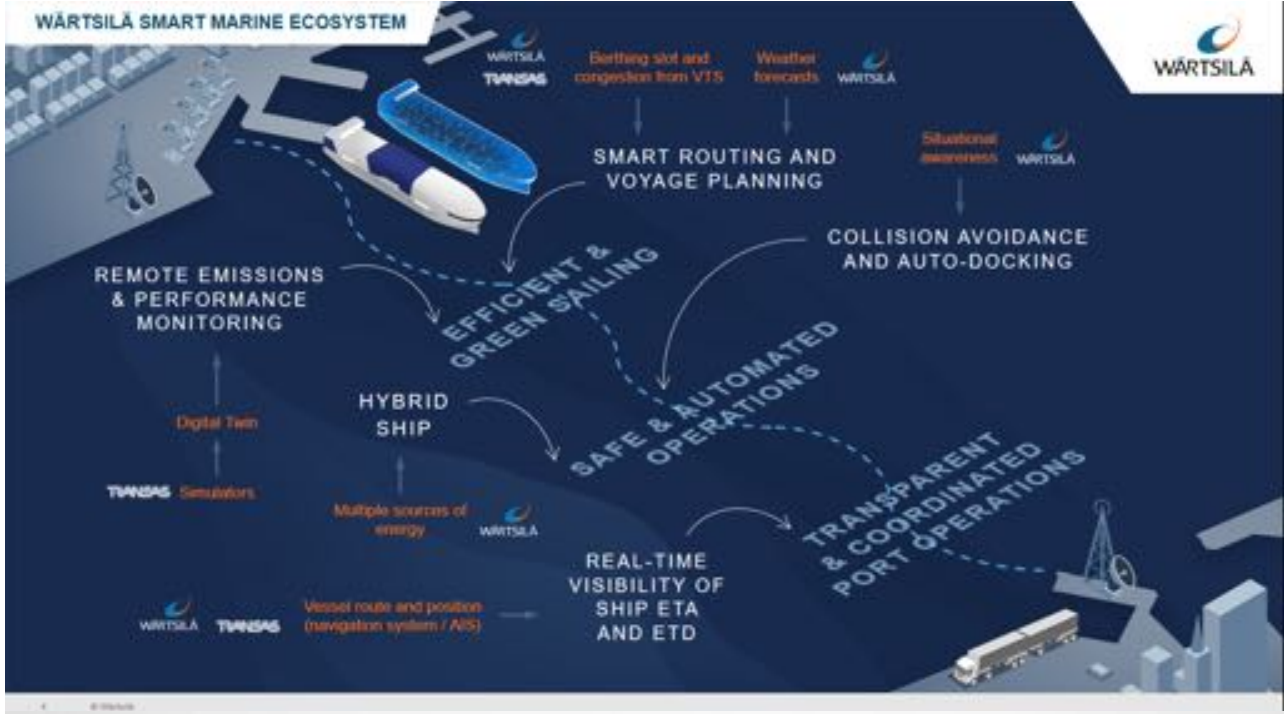

Development path to future pilotage services

Conrete steps:
Wärtsilä PPU, Trenz PP, Faults in AtoNs to PPU, AISLAB, etc.

Conrete steps:
Continuos measures to increase data exchange and utilization.

Conrete steps:
Remote operated heavy pilot boat

Research & Development:

- Sea for Value (S4V)
- MasterSIM
- …

TRA2020
Interactive Demonstraatio(t), Technical tour

The aim

Availability of required technology and information exchange, equipment, training, competence and the operational procedures for both on-shore and on-board operation.

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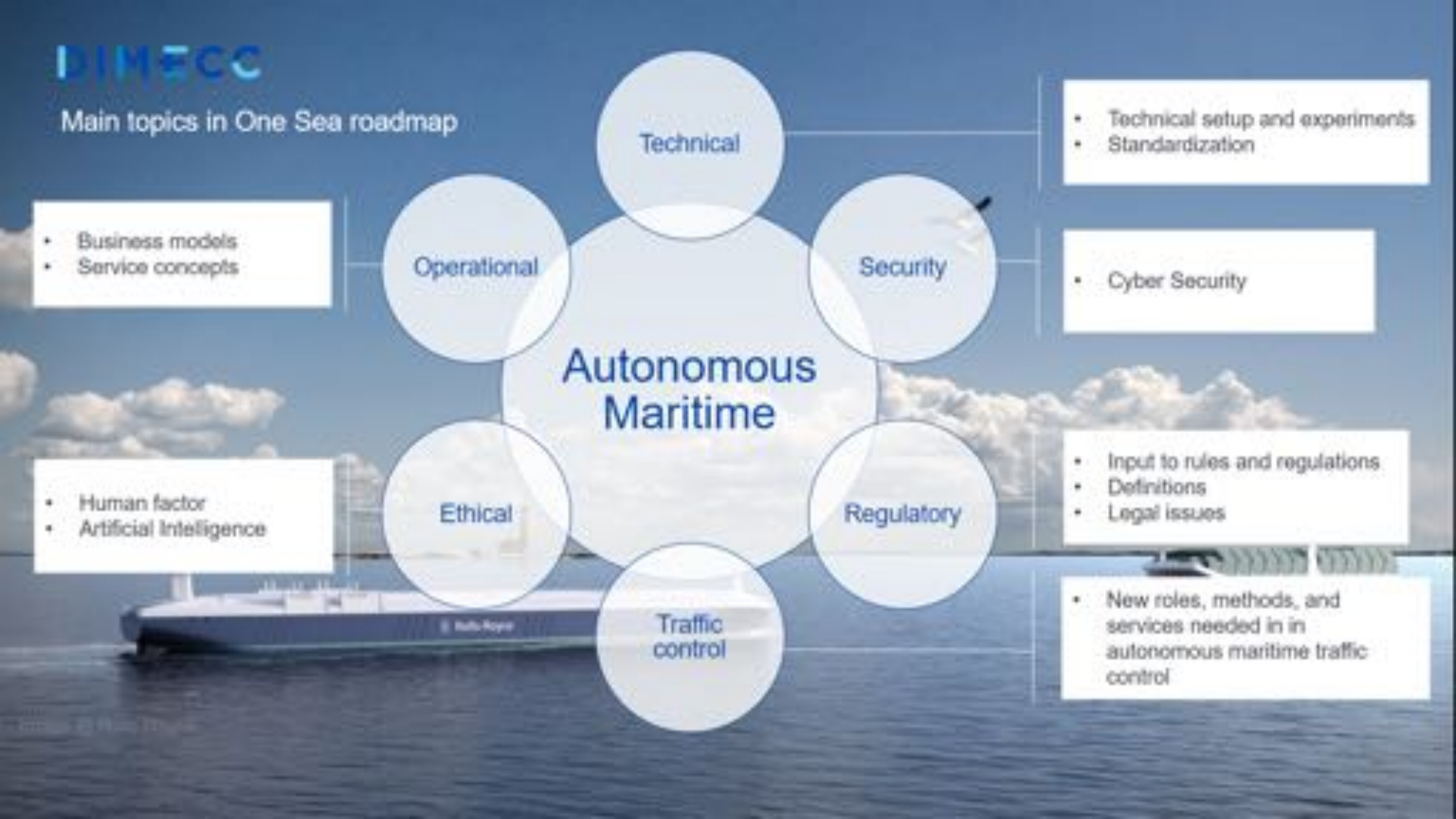
DIMECC

Main topics in One Sea roadmap



DIMECC One Sea

Digital and autonomous maritime transport chain

Program Domain

Application domain #1
Smart Harbour

Application domain #2
Smart fairway navigation

Application domain #3
Smart shipping

Smart harbour operations and logistics connect the road, rail and maritime transport systems and enable multimodal transportation.

Fairway is the navigation channel by which the existing vessels and future autonomous ships use to travel safely in the transfer of goods

Asset monitoring, visibility to cargo status, electronic corridors and interconnection are the building blocks of safe and secure shipping in the future.

DIMECC One Sea

Ecosystem approach for joint development

"Companies and research organisations jointly develop new knowledge and innovations"

Primary contributor companies in **bold**

Smart harbour

Smart harbour operations and logistics connect the road, rail and maritime transport systems and enable multimodal transportation.

Experiments

- Automated Cargo handling and logistics
- Information flow and API's

Companies

- Ericsson,
- **Euroports**
- **F-Secure,**
- **Lingsoft,**
- **MacGregor,**
- **Port of Rauma**
- Rolls-Royce
- Satel
- **Tieto**
- **UPM**
- **Wapice**
- Finnpilot
- **Finnish Transport Infrastructure Agency**
- Finnish Meteorological Institute
- Traficom

Research organisations

- Aalto
- Novia
- JyU
- UTU
- TUT+UTA (tuni.fi)
- VTT
- AA

Smart fairway navigation

Fairway is the navigation channel by which the existing vessels and future autonomous ships use to travel safely in the transfer of goods.

Experiments

- Remote pilotage
- Robotic systems for VTS & SAR
- Smart aids to navigation

Companies

- **Alamarin-Jet**
- **ESL Shipping**
- **Ericsson**
- **F-Secure,**
- **Lingsoft**
- **Meyer Turku**
- **Port of Rauma**
- Rolls-Royce
- Satel
- **Tieto**
- **Wapice**
- **Finnish Transport Infrastructure Agency**
- **Finnish Meteorological Institute**
- Traficom
- MeriTalo
- Arcta
- **Estonian Maritime Administration**
- **Finnpilot**

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- VTT
- AA

Smart shipping

Asset monitoring, visibility to cargo status, electronic corridors and interconnection are the building blocks of safe and secure shipping in the future.

Experiments

- Tallinn-Helsinki electronic corridor for smart shipping

Companies

- **Ericsson,**
- **F-Secure,**
- **Lingsoft**
- **MacGregor**
- **Meyer Turku**
- Port of Rauma
- **Rolls-Royce**
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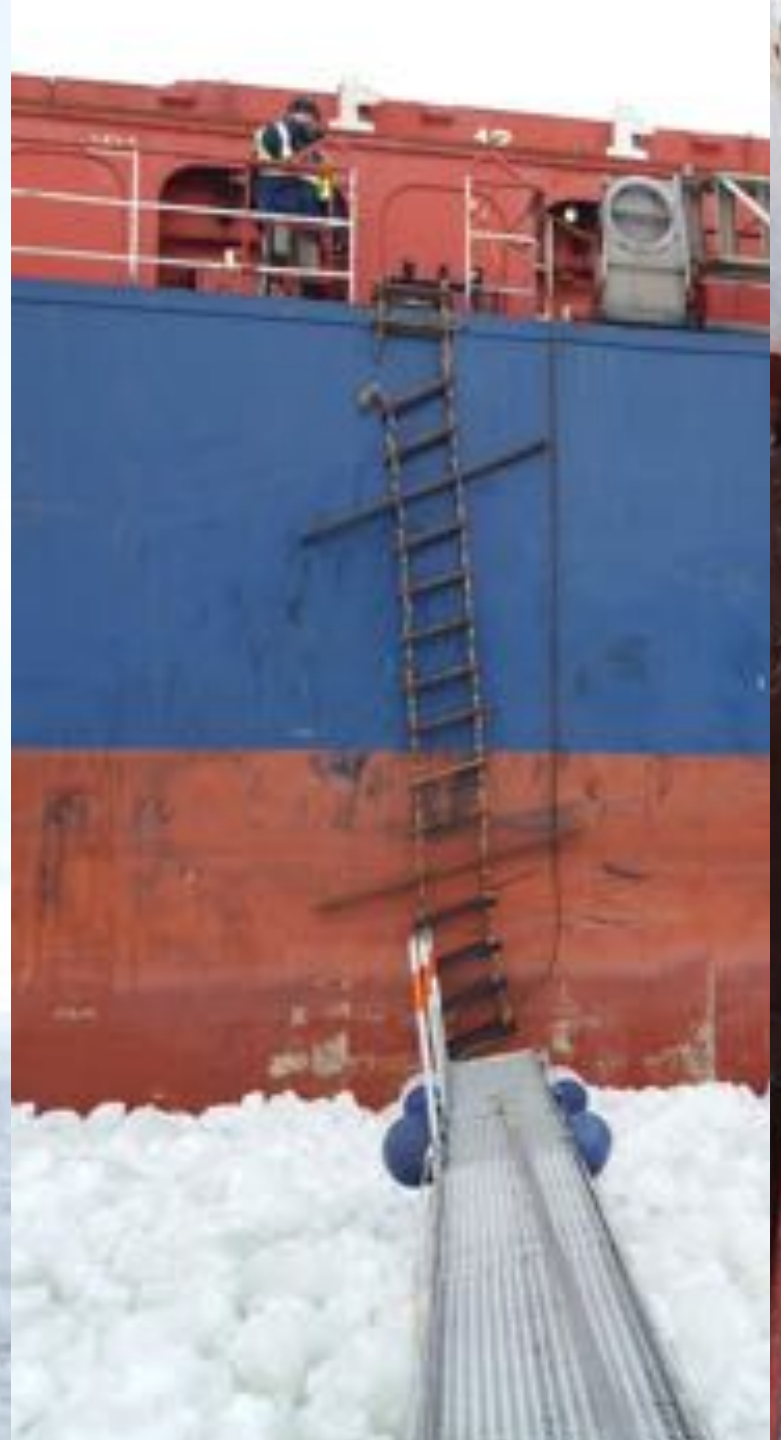
- VTT
- AA

REALITY…


PTR HOLLAND B.V.
PILOT LADDER
Type
Model
ISO 799/SOLAS
Length
2.60 MTR S=9
Prod. date
20-09-2013
Prod. nr
3125013/SOLAS
Approval
MED/80/5063
www.ptrholland.com





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Both ropes broke when the pilot was climing down and the pilot fell onto the boat deck with the ladder.

THANK YOU!

FINNPILOT