GLOBAL CONTEXT OF MARITIME AUTOMATION AND AUTONOMY

ACHIEVING CRITICAL MASS

SPOTLIGHT ON THE U.S. VESSEL AUTOMATION INDUSTRY

CAPTAIN JÖRGEN STRANDBERG WÄRTSILÄ

Easter morning 1900: 5th Ave, New York City. Spot the automobile.

Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.

Source: George Grantham Bain Collection.

What has happened in shipping in the last 20 years?

Nothing!

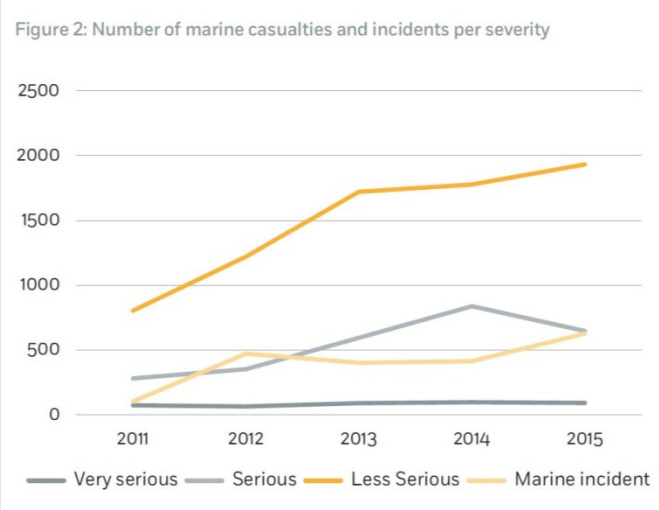
Ships have become larger, and with that also the demand on ports and fairways

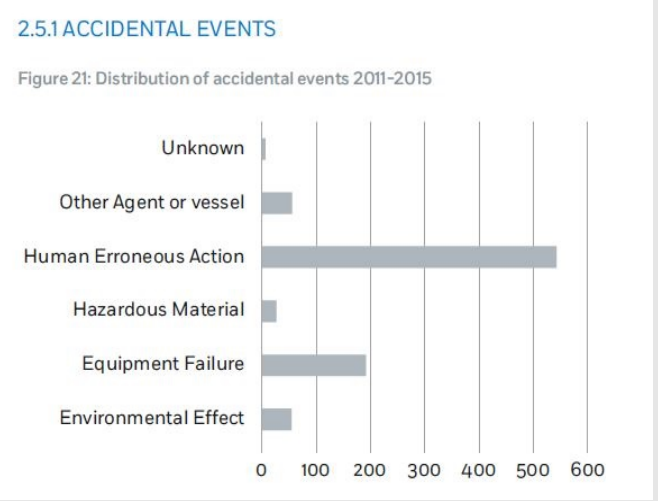
We have the same principal eco system!

We are a low value member of the transportation and logistics

We have the same accident rate!

According to the latest EMSA report, the accident rate is fairly static





While accounting knows about every dollar and cents across the company…

Nobody knows the true operational sweets spots or asset health across the fleet

LACK OF OPTIMIZATION

A daily noon report based on manual input is accepted for performance comparison

Any knowledge is kept in the head of the SI and CE

Preventing best practice to be shared across fleet

TRADITIONAL ECO SYSTEM

- Charterer
- Ship Manager
- Ship Owner
- Bank
- Shipyard

WÄRTSILÄ

Competition is only with other shipping companies

Overall poor service moves freight to rail, road and air

Shipmanagement has been commoditized

LACK OF BUSINESS DEVELOPMENT

Financial control instead of technology

Economy of scale is seen as the only viable opportunity

Shortsighted cost savings targeting crew and maintenance

Market does not rewards quality due to oversupply of ship

TRADITIONAL ECO SYSTEM

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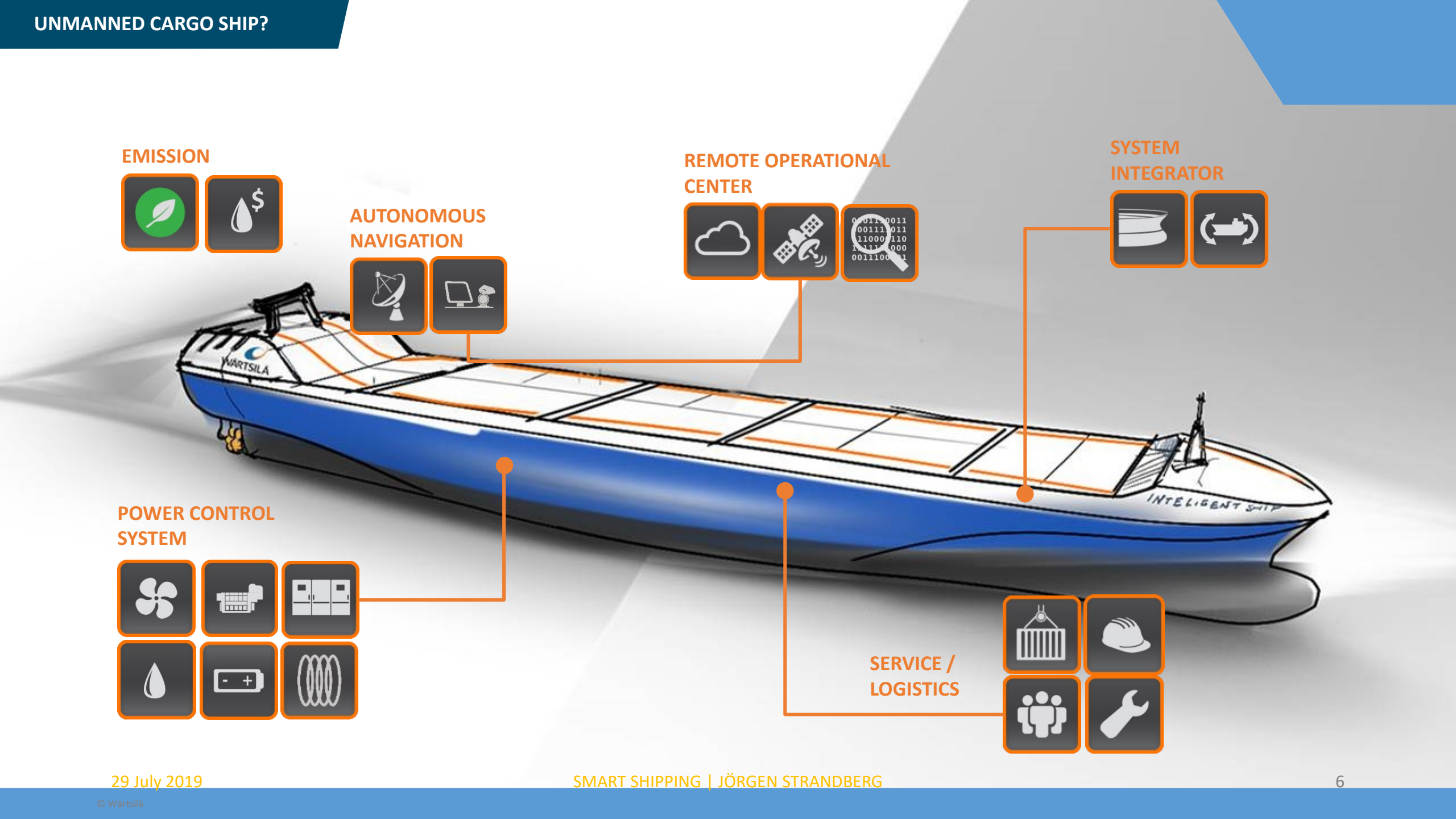
- Ship Manager
- Ship Owner
- Bank
- Shipyard

UNMANNED CARGO SHIP?



Historically – Human needed at every level

COMMAND AND CONTROL

Captain

NAVIGATION dept

Plan a voyage from A to B with safe refuge points along planned path

Optimize voyage for weather and other factors

Verify safety of planned voyage

Execute voyage

Update voyage as optimizations data changes

Monitor health of navigation and anticollision systems and sensors

ENGINE dept

Store energy quantity for planned trip

Manage operations of propulsion plant in service

Monitor health of plant and consumption of energy.

Store or produce life support commodities (potable water, heating, cooling, grey and back water

Monitor and manage life saving equipment

DECK dept

Monitor and manage all mooring and anchoring arrangements, all shell doors and hatches, all tanks and voids

Monitor and manage medical services, life saving equipment

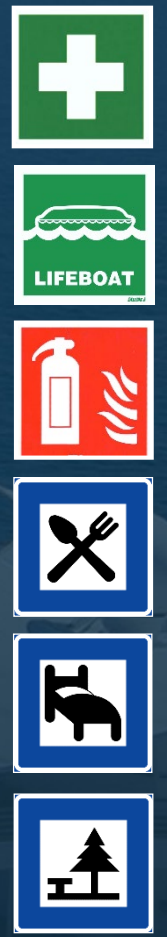
Monitor ships health and integrity of commercial payload. Manage payload activities as necessary

HOTEL dept

Store food and other provisions for the intended trip

Produce meals and drinks for the wellbeing of the occupants

Provide adequate facilities for rest and recreation



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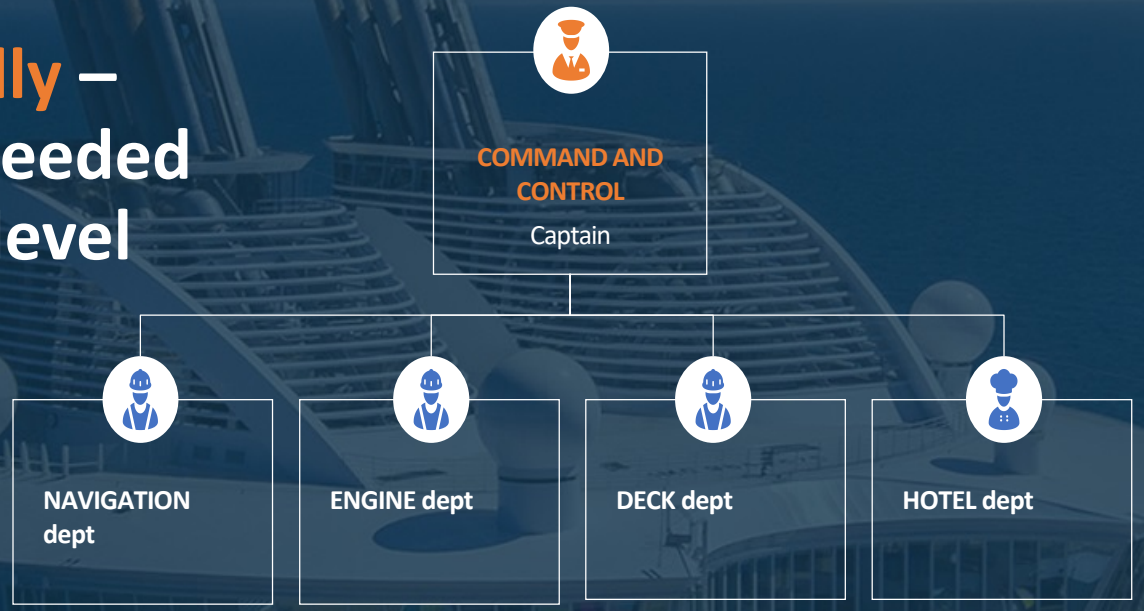
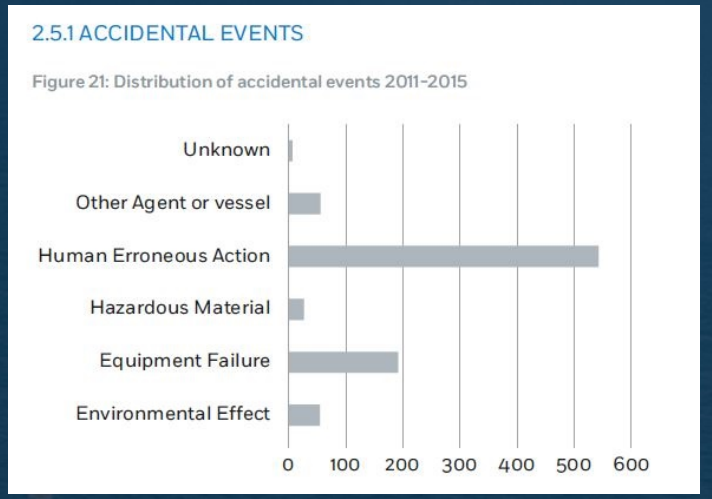


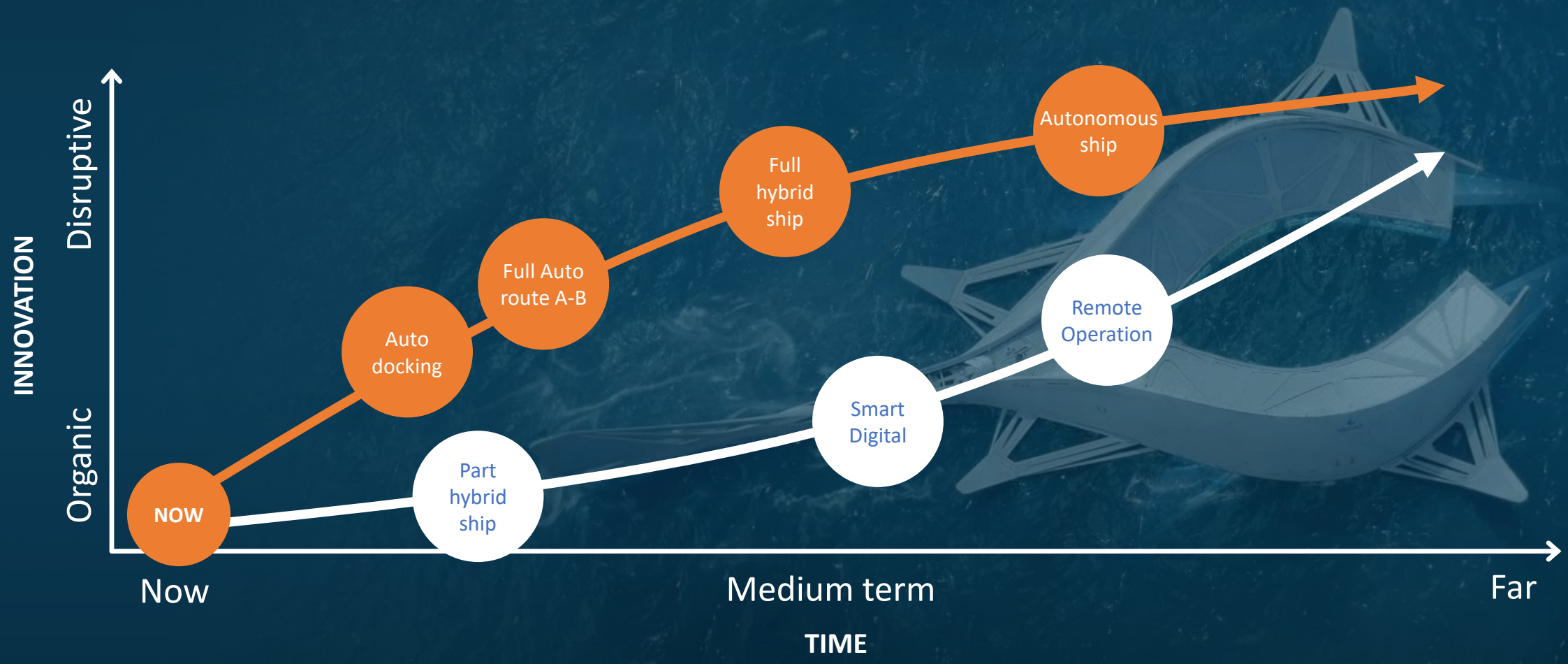


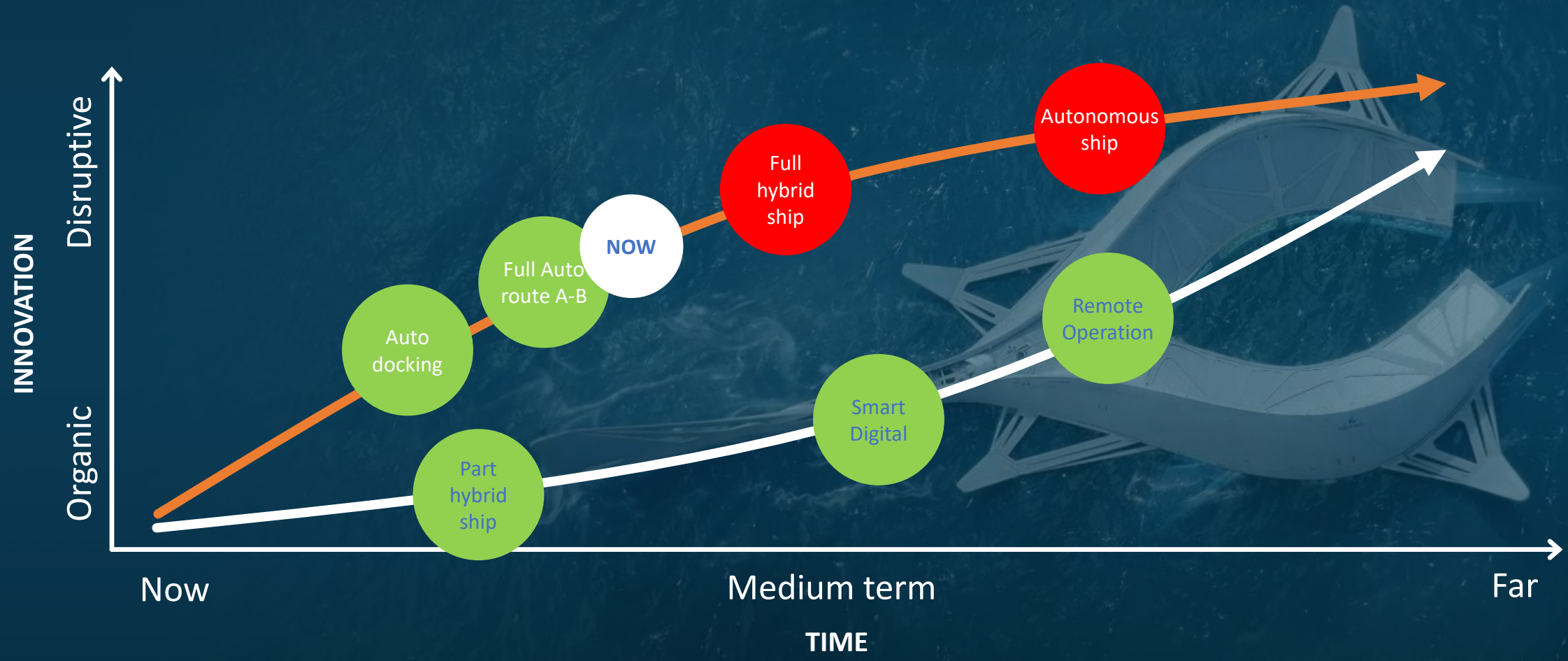
The human is

- The sensor – eyes and ears
- The integrator
- The decision maker
- The automation
- The back-up

It is not strange then, that human error is the top reason for accidents…

TIME AND LEVEL OF INNOVATION - 2016




INNOVATION
Disruptive
Organic
Auto docking
Full Auto route A-B
NOW
Full hybrid ship
Autonomous ship
Part hybrid ship
Smart Digital
Remote Operation
Now
Medium term
Far
TIME

Future – where do we have to have humans?

REMOTE/ AUTON.

COMMAND AND CONTROL

Captain

REMOTE/ AUTON.

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FULL HYBRID SHIP

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Store or produce life support commodities (potable water, heating, cooling, grey and back water

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SHORE WORKERS

DECK dept

Monitor and manage all mooring and anchoring arrangements, all shell doors and hatches, all tanks and voids

Monitor and manage medical services, life saving equipment

Monitor ships health and integrity of commercial payload. Manage payload activities as necessary

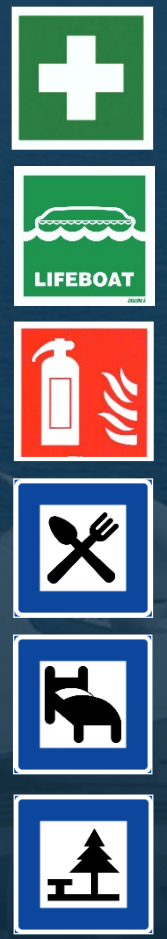
NO CUSTOMERS!

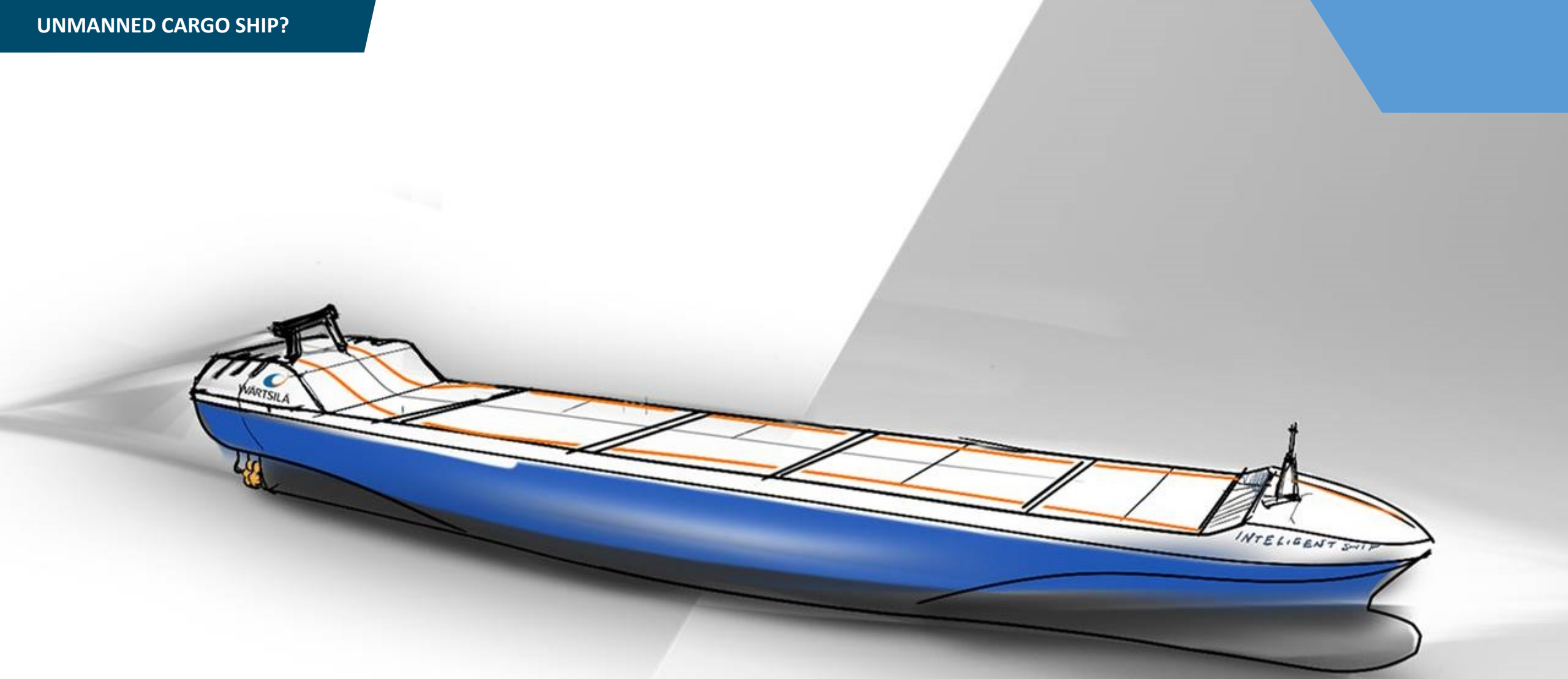
HOTEL dept

Store food and other provisions for the intended trip

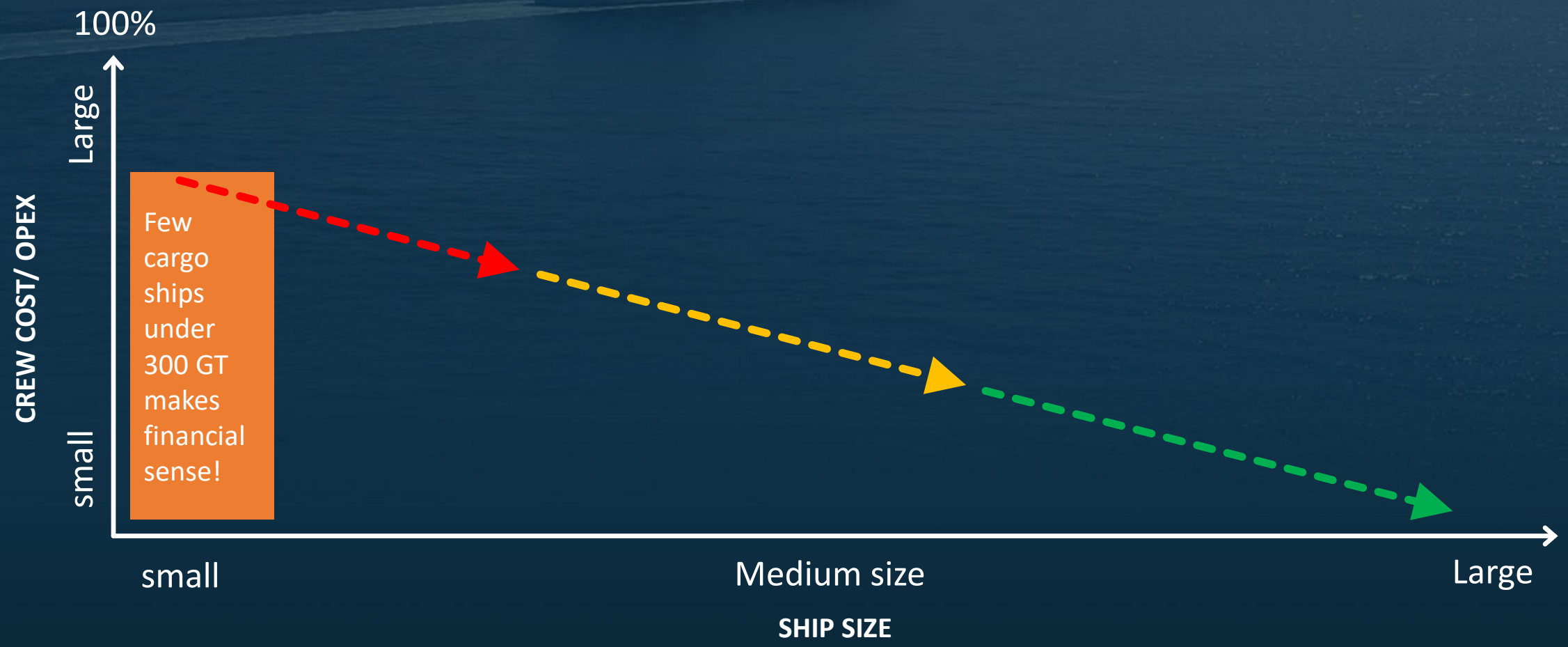
Produce meals and drinks for the wellbeing of the occupants

Provide adequate facilities for rest and recreation

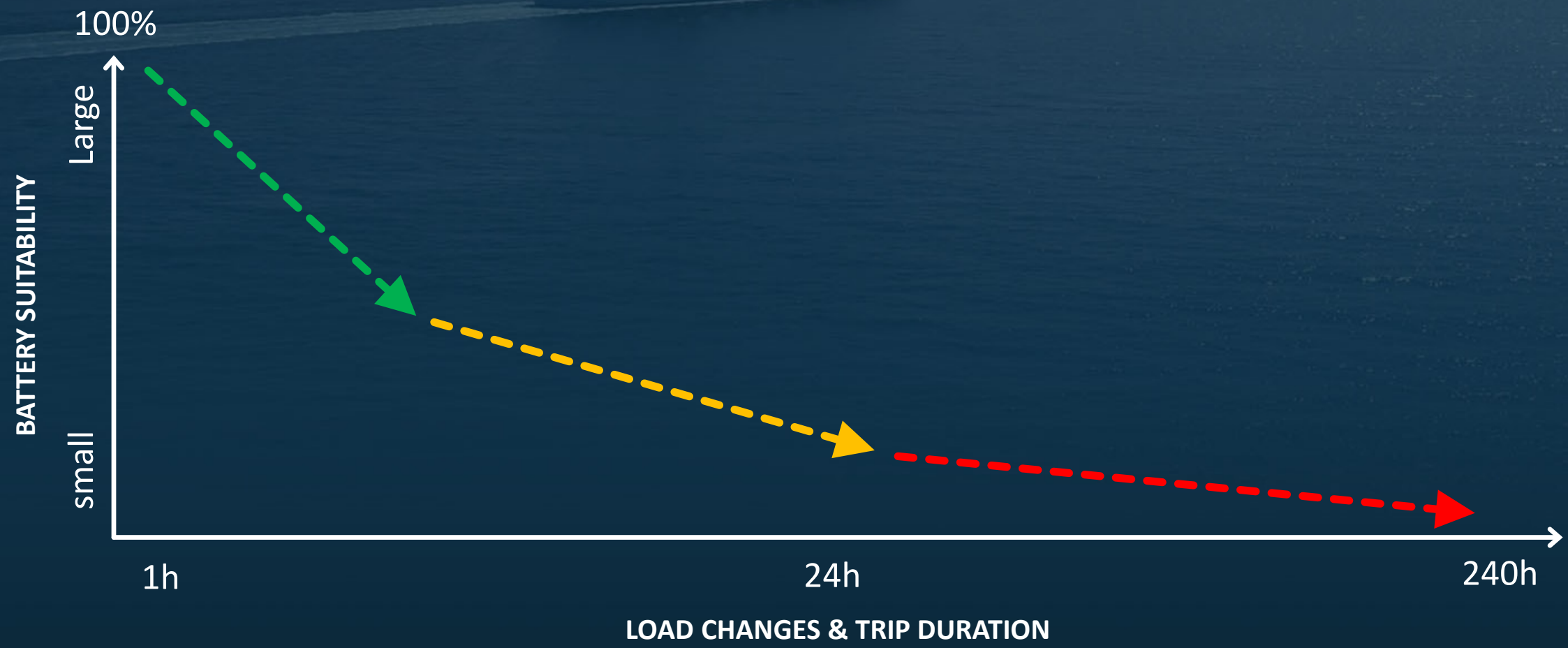




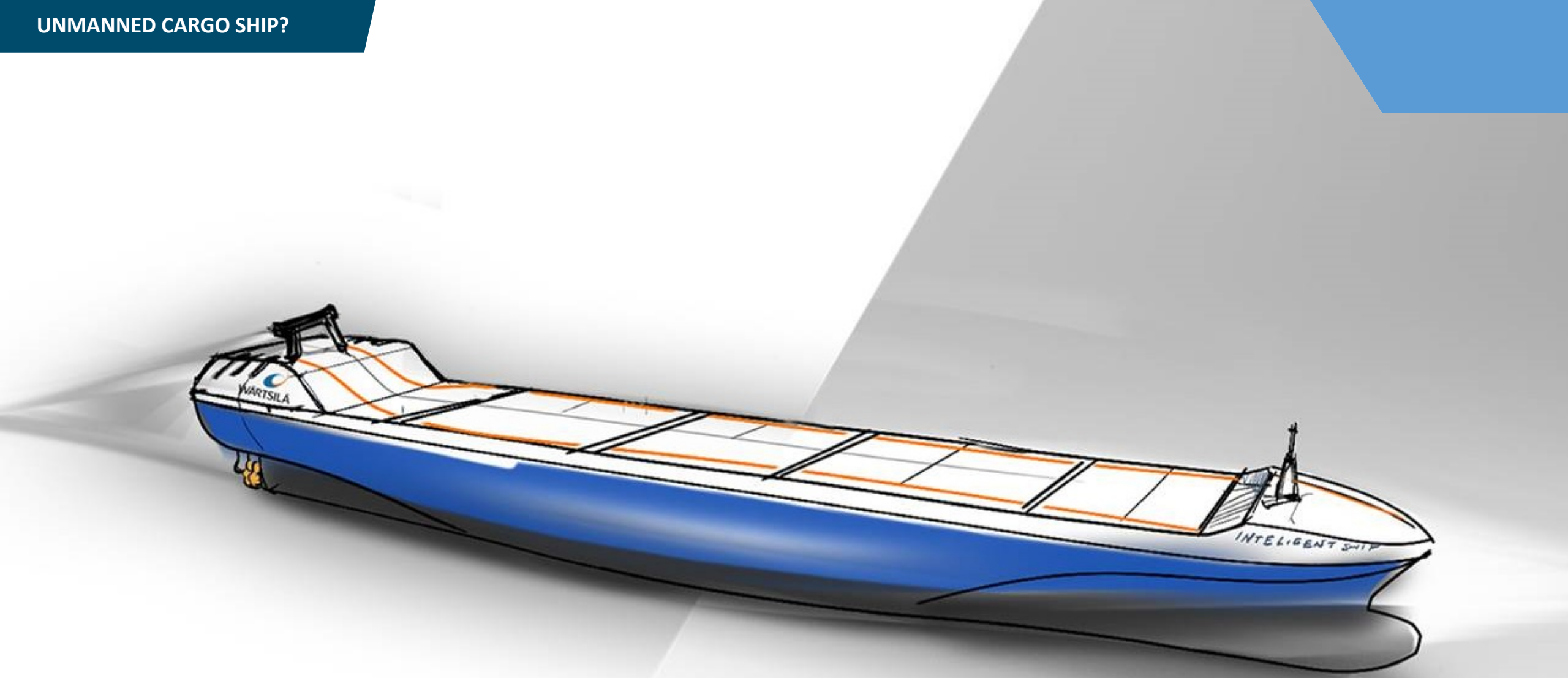
Soooo….?



For small ships, the crew cost is a large portion of overall opex



Batteries only make sense for short trips, hybrid when load varies frequently



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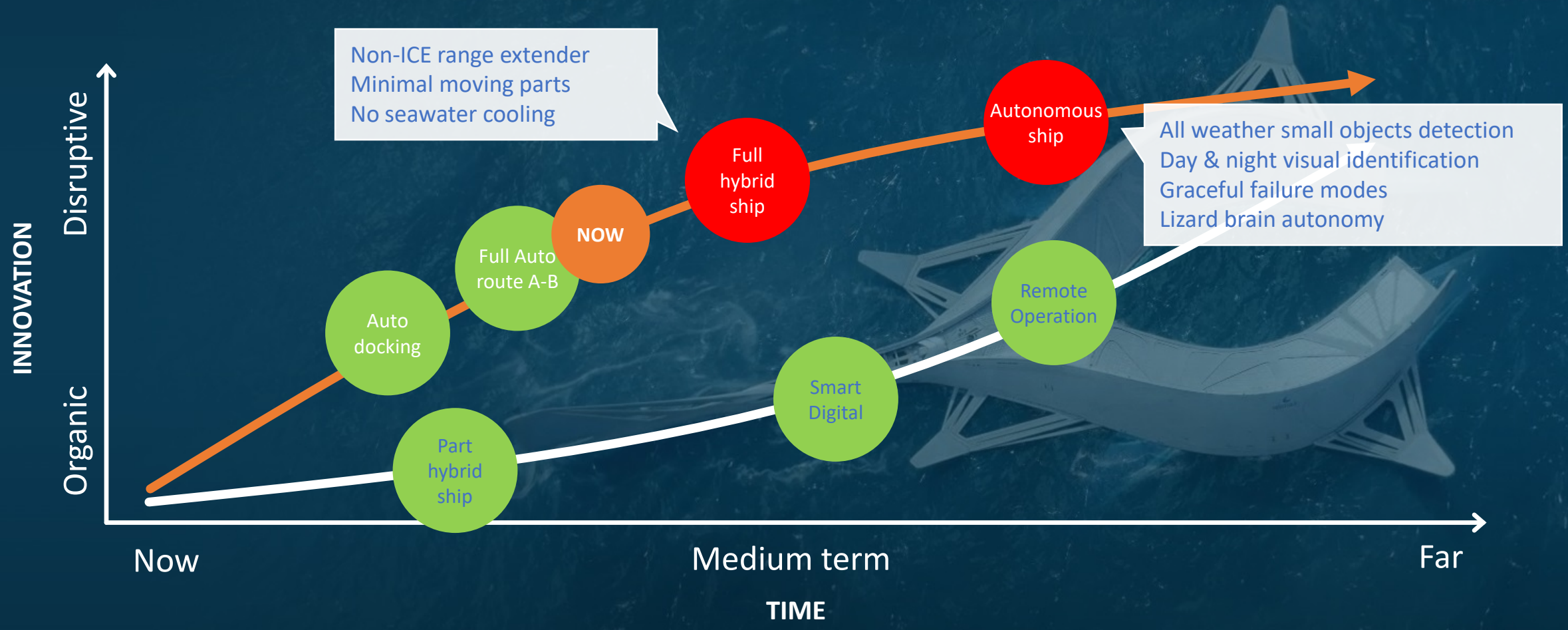
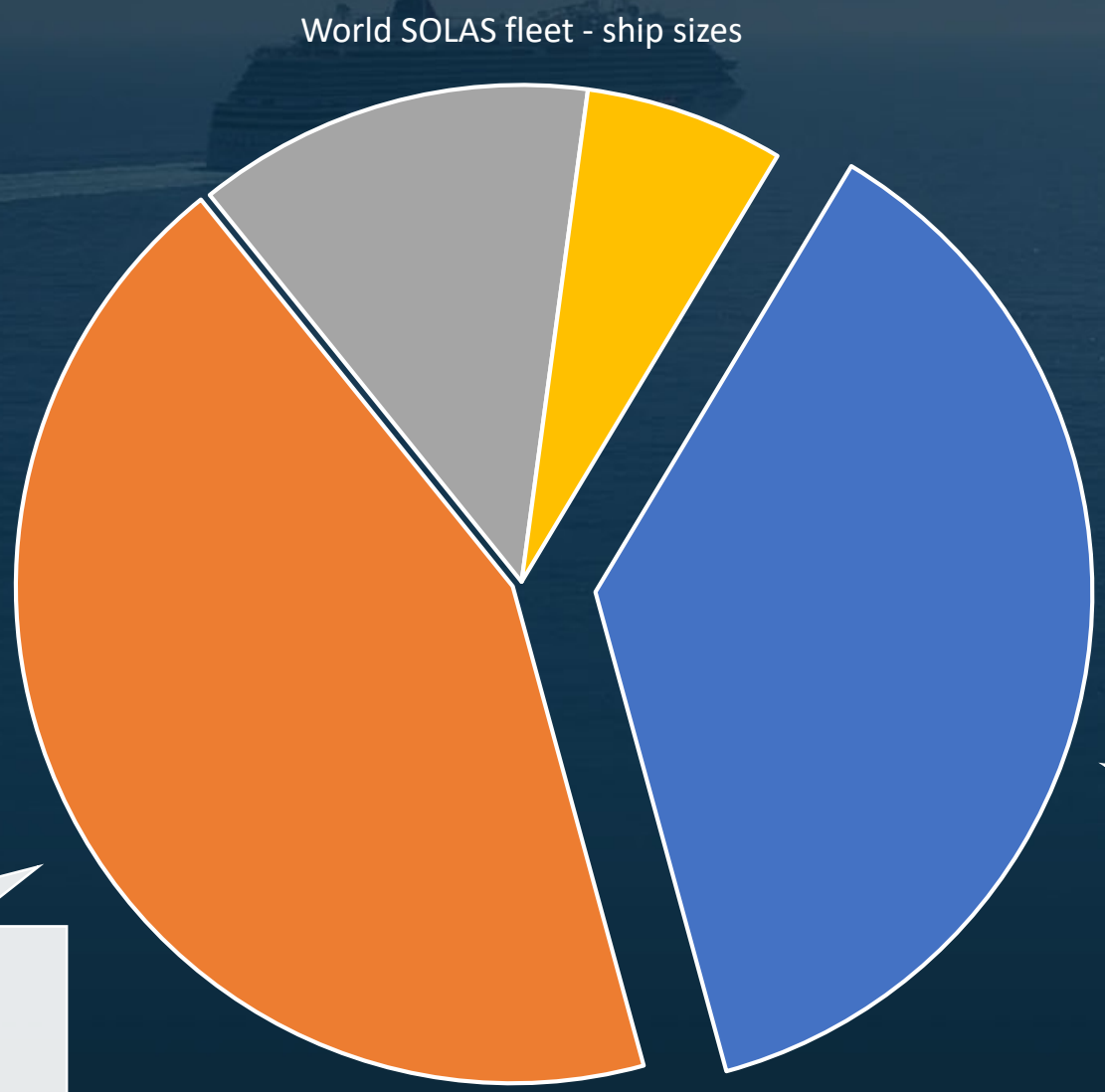
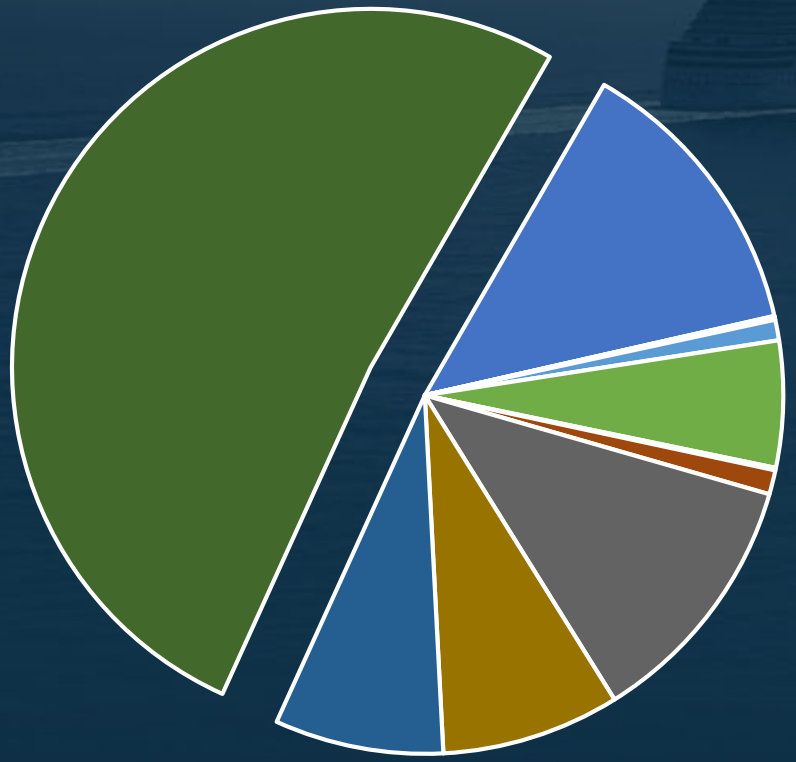

Non-ICE range extender
Minimal moving parts
No seawater cooling
All weather small objects detection
Day & night visual identification
Graceful failure modes
Lizard brain autonomy
INNOVATION
Disruptive
Organic
Auto docking
Full Auto route A-B
NOW
Full hybrid ship
Autonomous ship
Part hybrid ship
Smart Digital
Remote Operation
Now
Medium term
Far
TIME



Larger ships benefits more from smart technologies

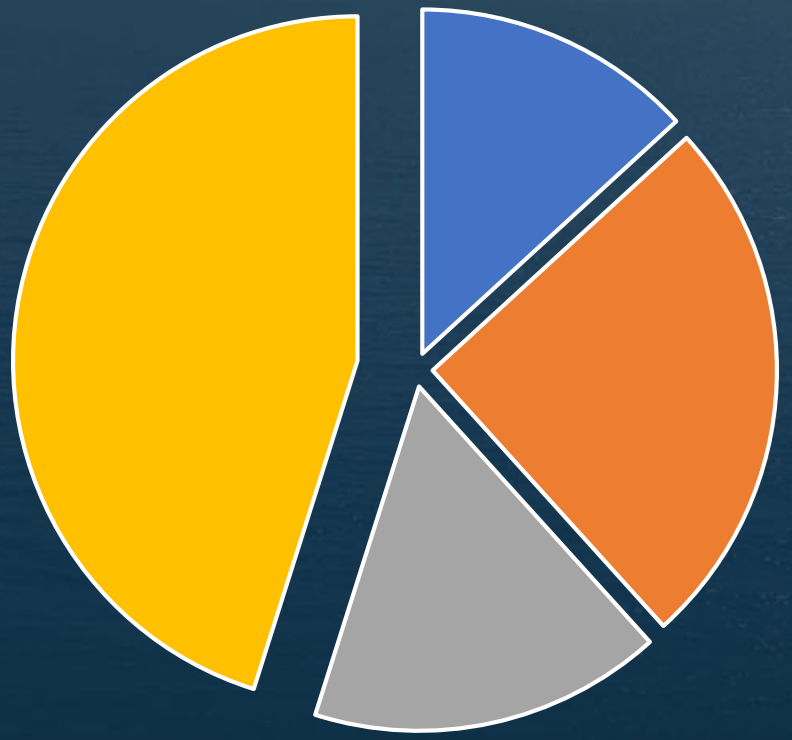
Primary area of interest for autonomy

Small ships by **Type**

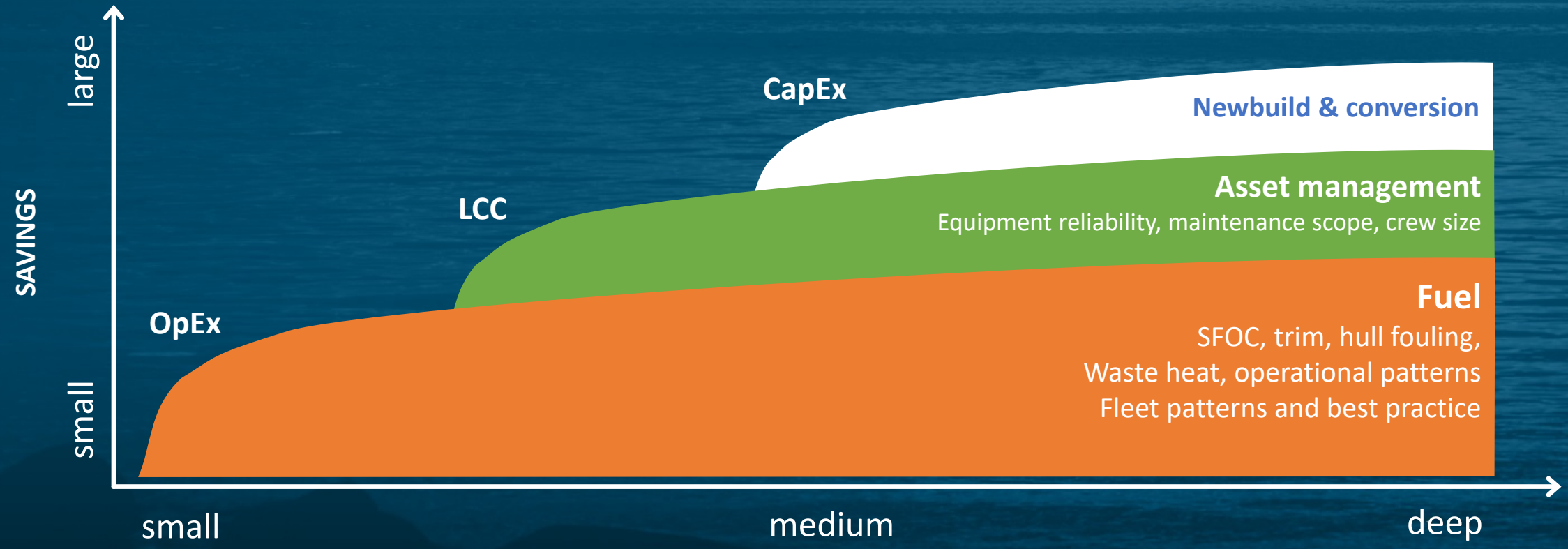


- **General cargo ship**
- Container
- Bulk
- Gas
- Passenger
- Service ships
- Specialized Cargo ships
- RoRo
- Oil / Chemical
- Other Tanker
- Offshore
- Tugs

Small ship **age** distribution



- 0-4 years old
- 5-14 years old
- 15-24 years old
- **´+25years old**


SAVINGS
large
small
CapEx
LCC
OpEx
Newbuild & conversion
Asset management
Equipment reliability, maintenance scope, crew size
Fuel
SFOC, trim, hull fouling,
Waste heat, operational patterns
Fleet patterns and best practice
small
medium
deep
LEVEL AND DEPTH OF DIGITALIZATION

Conclusion

Autonomous ships will create new business opportunities in areas with

- High labour costs
- 3D – dirty – dangerous - demeaning
- Small – short
- Point to point

At the same time, conventional shipping will benefit from the new technologies such as

- Remote control, autonomous navigation and collision avoidance
- Digitalization and optimization

Smart Marine
In essence

SMART MARINE VISION

WÄRTSILÄ VISION

ASSET MANAGEMENT

Connect as many installations as possible, leverage data to optimize the asset performance throughout the asset life cycle, and convert this to value added services

PERFECT THE CORE

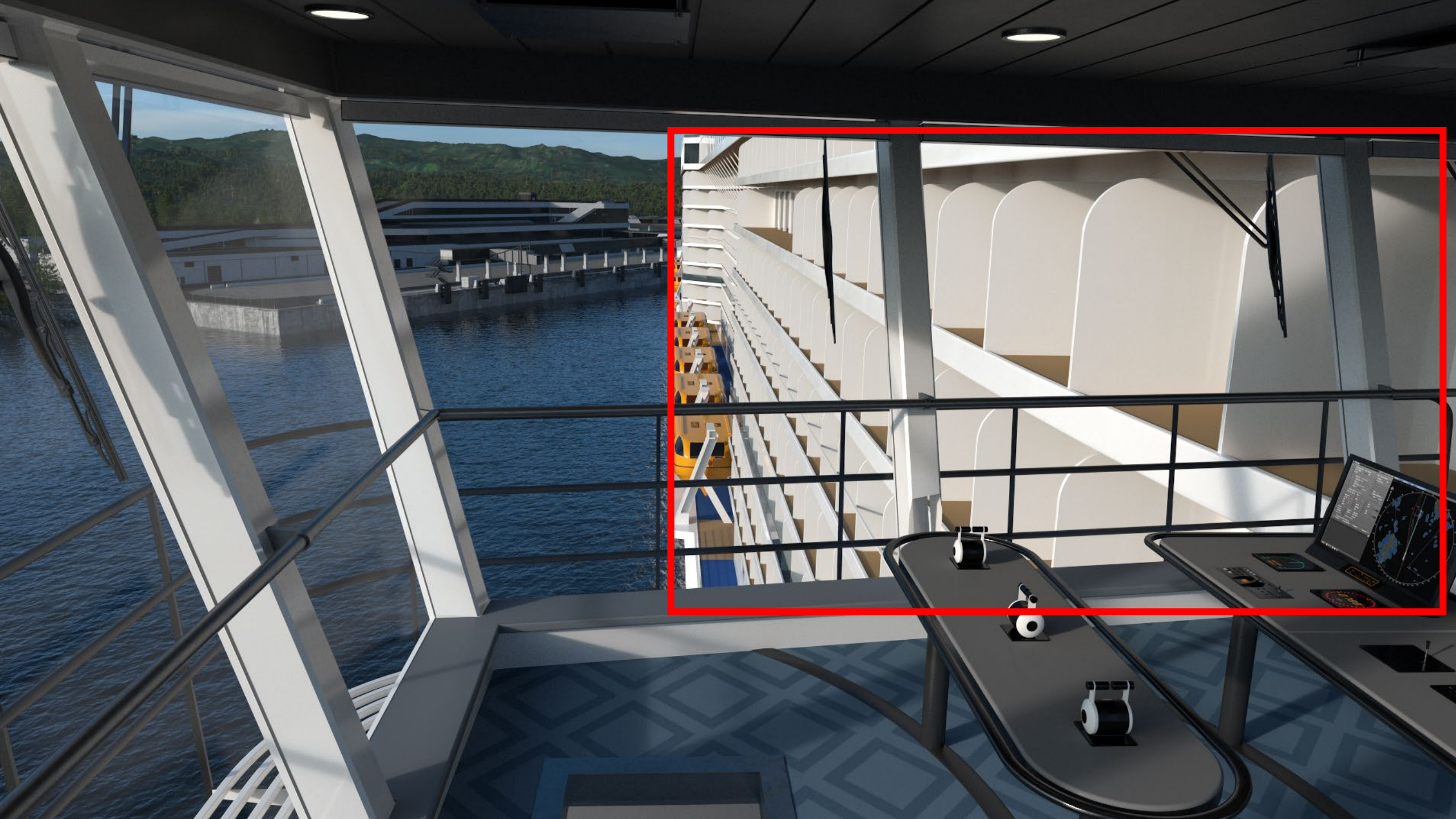
Superior and vast product portfolio and lifecycle customer services

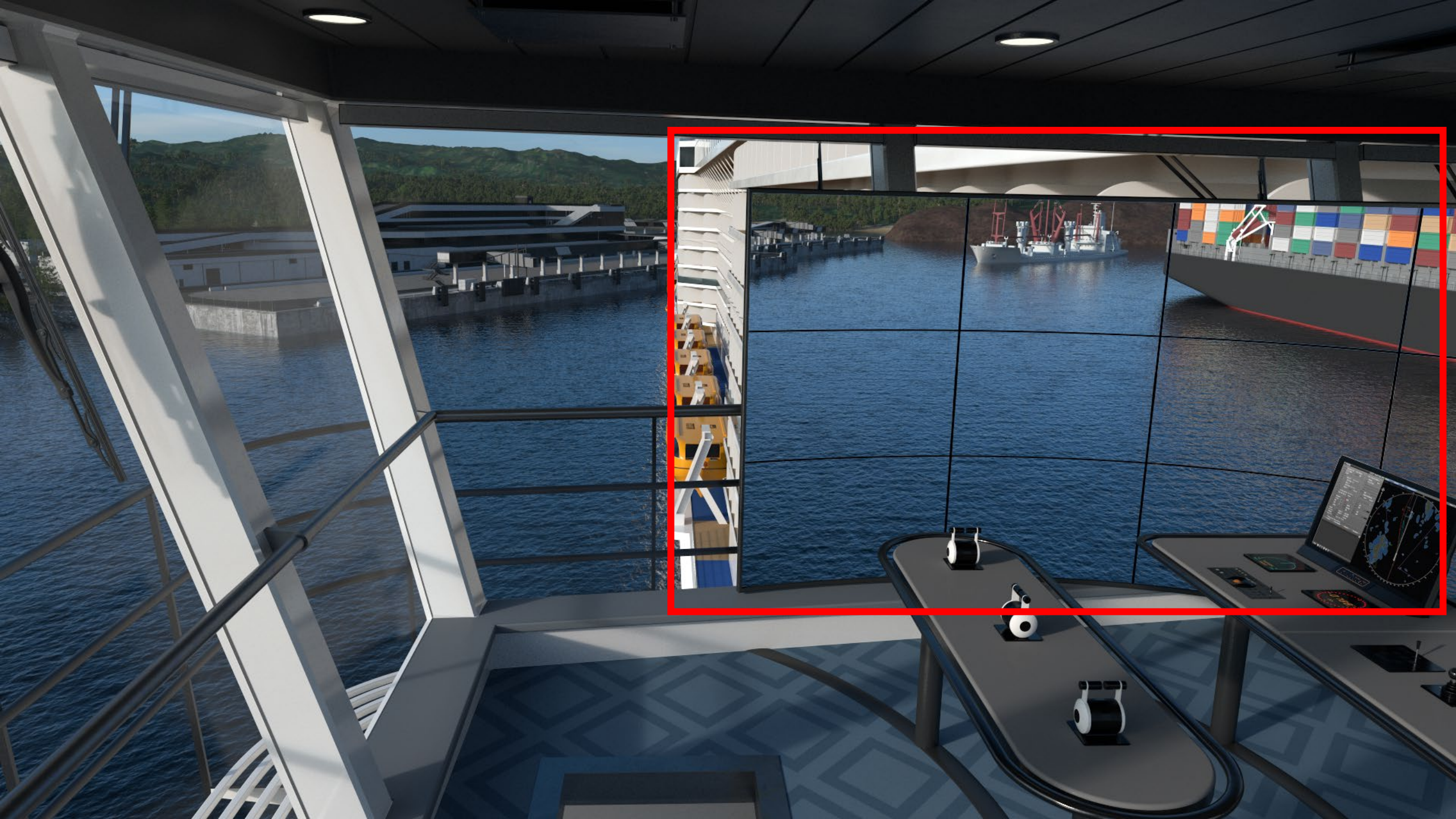
VOYAGE MANAGEMENT

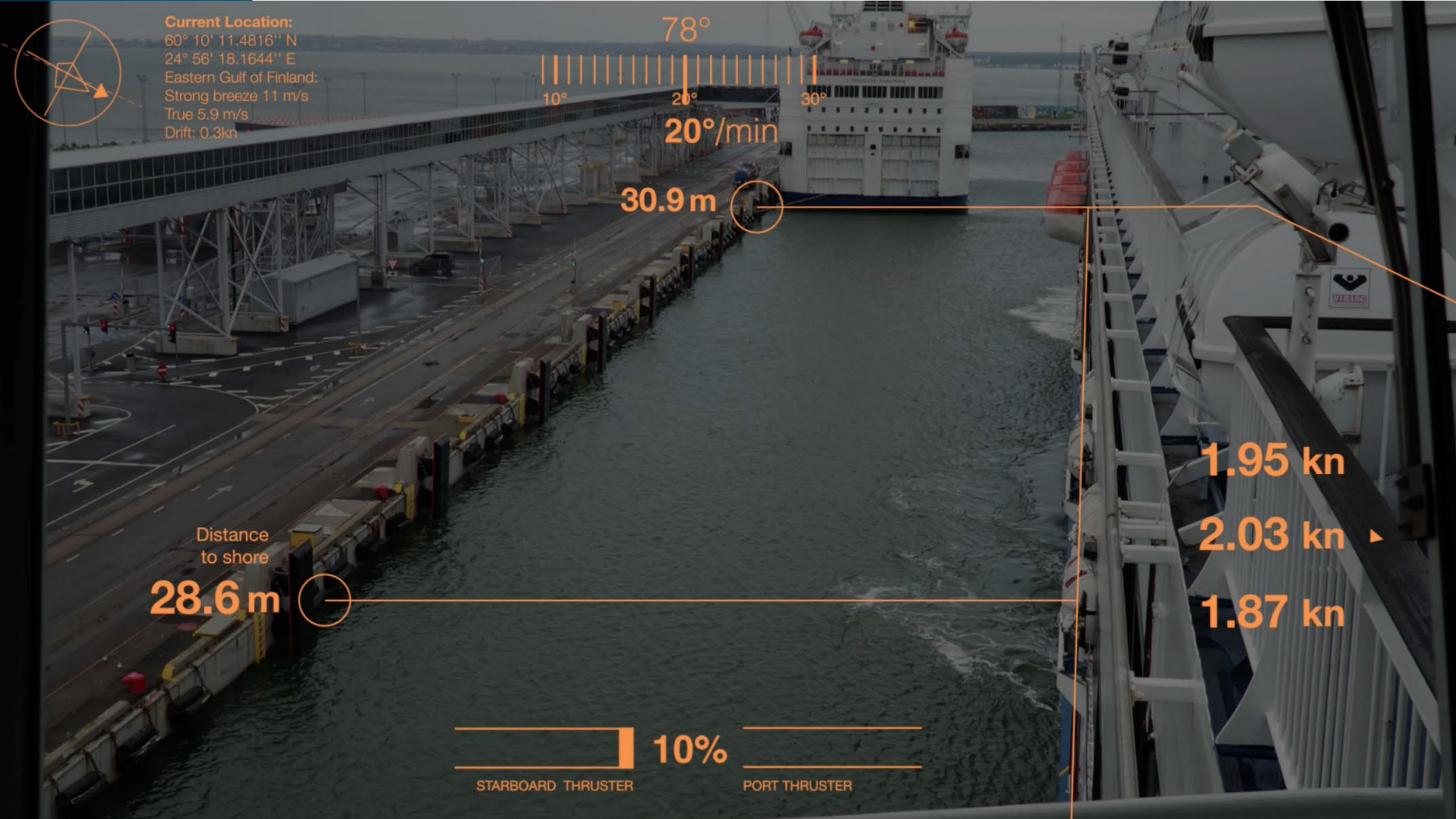
Develop the Intelligent Vessel of the future, connect it to the Smart Ports, optimize the voyage from berth to berth to address the waste of the marine supply chain

THREE BUILDING BLOCKS

DATA



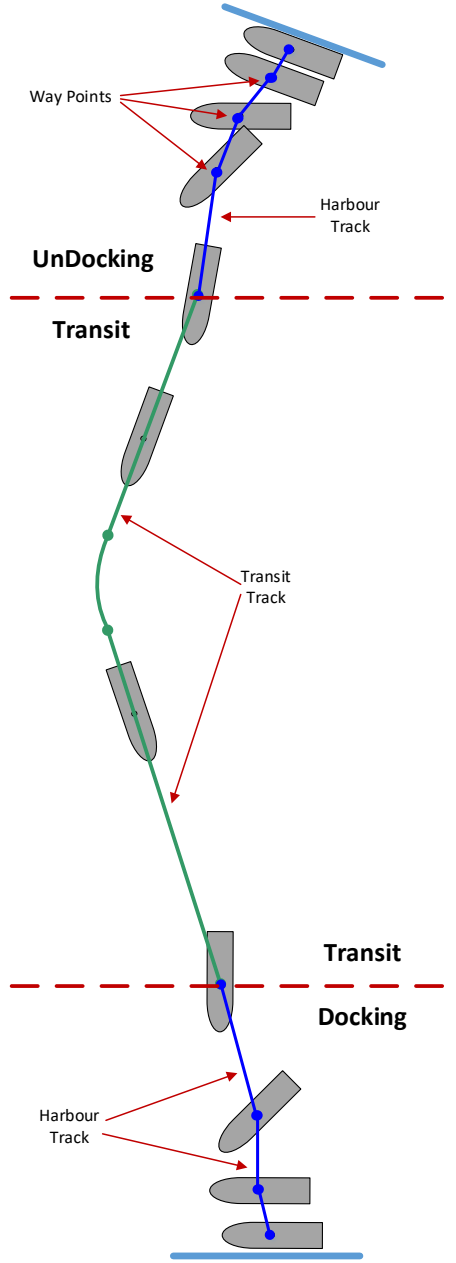



Current Location:
60° 10' 11.4816'' N
24° 56' 18.1644'' E
Eastern Gulf of Finland:
Strong breeze 11 m/s
True 5.9 m/s
Drift: 0.3kn
78°
10°
20°
30°
20°/min
30.9 m
1.95 kn
2.03 kn
1.87 kn
Distance
to shore
28.6 m
10%
STARBOARD THRUSTER
PORT THRUSTER

Auto Docking

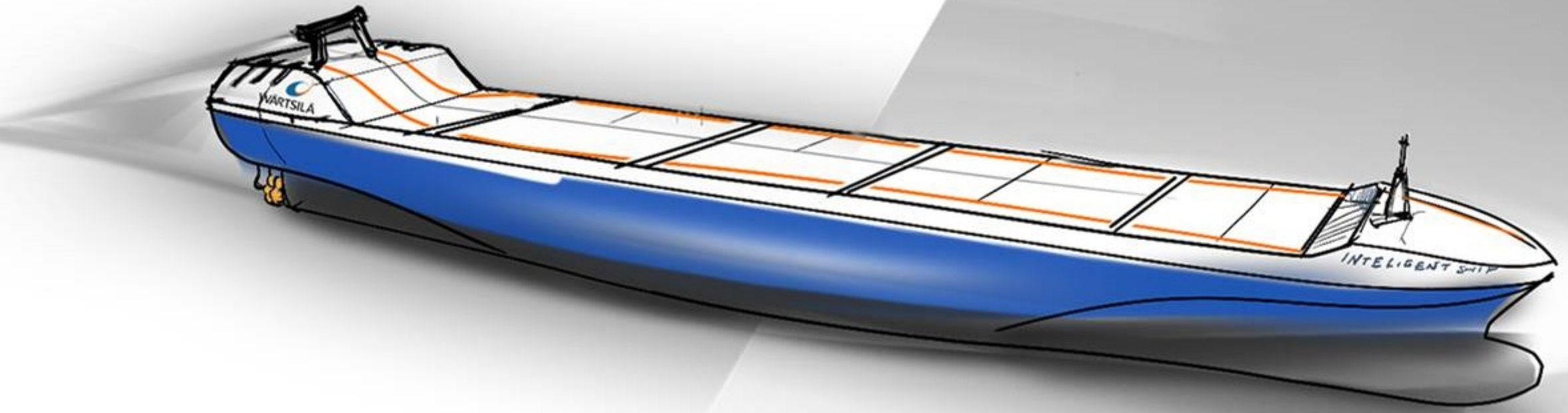
Provides for autonomous dock-to-dock operation, optimized energy consumption and minimized danger of collisions.

- Uses mature DP controller to follow dedicated Harbor and Transit tracks:
  - Full 3 axis control (surge, sway, yaw) at low speed (docking and un-docking)
  - 2 axis control (surge and yaw) at high speed (transit)
- Captain responsible for collision detection and avoidance.
- Functions can also be used standalone – such as for autonomous docking or un-docking only.
- Full dock-to-dock operation tested Nov 2019 using the Norwegian ferry Folgefonn.
  - Video available: https://m.youtube.com/watch?feature=youtu.be&v=8uedSwkeaUg



“Flashy corporate video”

Folgefonn autodocking



Folgefonn

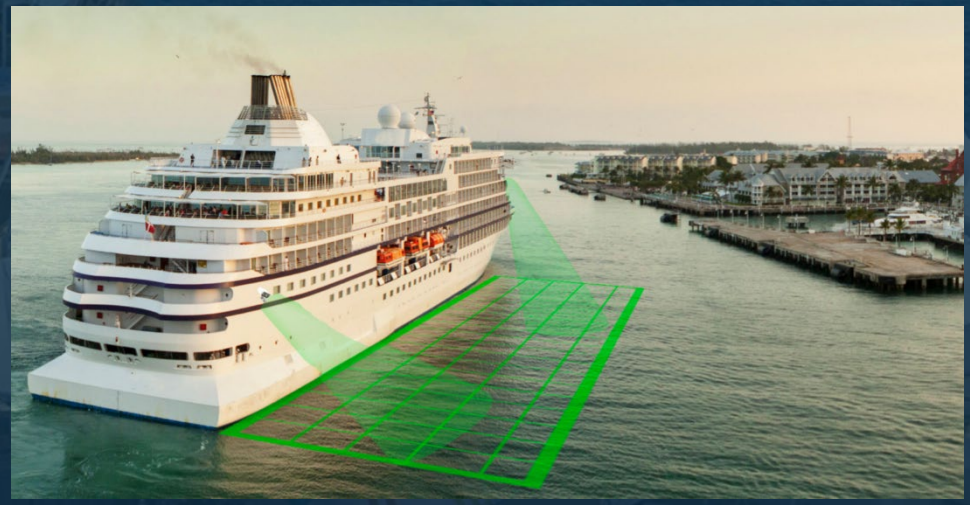
- The Folgefonn ferry in Norway has been converted to fully electric, with the old diesel engines as back-up
- She has also been converted to induction charging
- She is also equipped with an autodocking feature, which takes her from berth to berth.

Nearfield Sensors

- Availability of new near field sensor suit provided by Wärtsilä Guidance Marine
- Integration of nearfield sensors based on different technologies into NACOS Platinum
  - 24GHz Radar
  - Lidar
  - IR Cameras

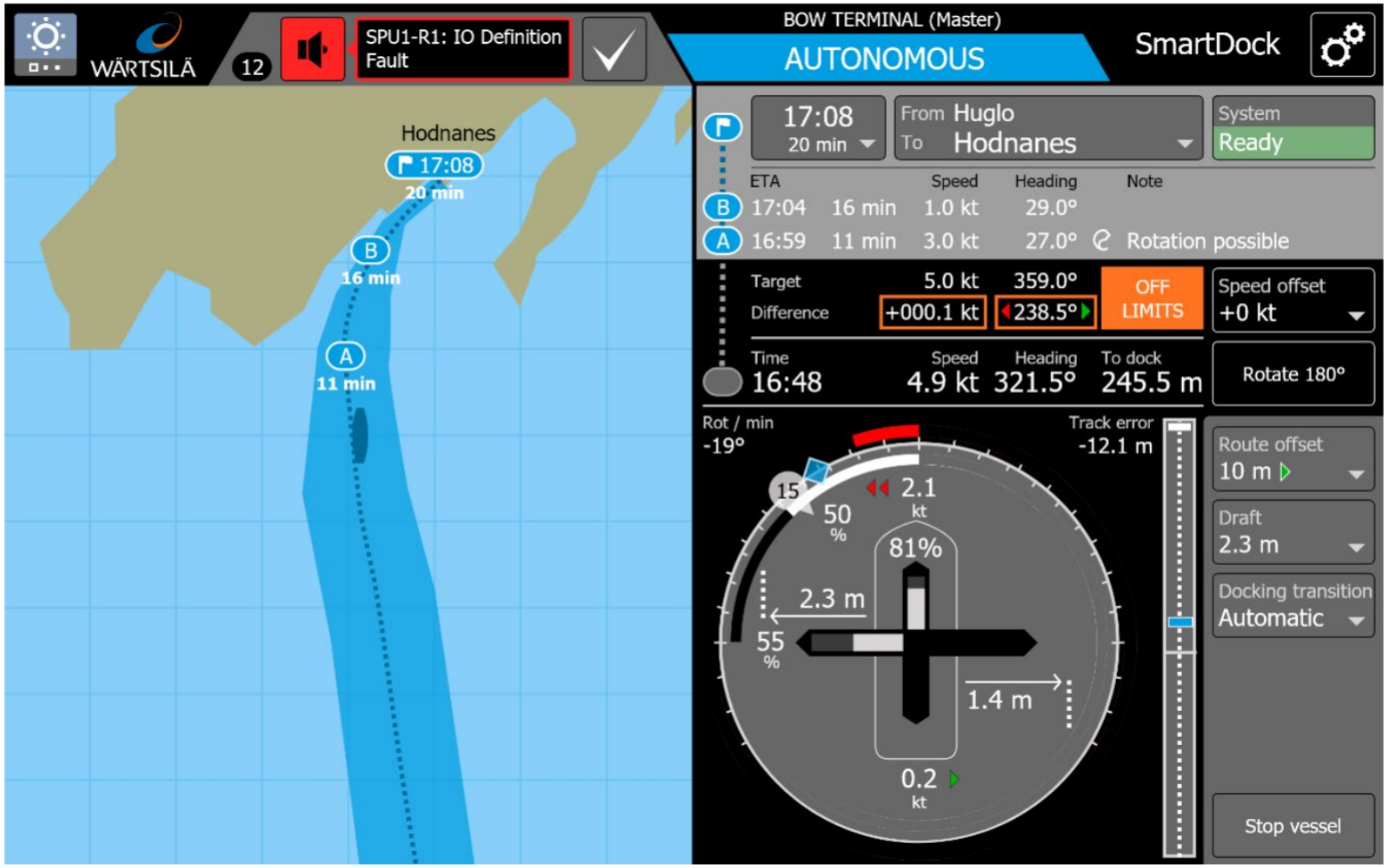
Smart Quay – application for smart docking

- Camera based distance measurement (absolute)
- Integration into NACOS Platinum using AR technology



Auto Docking

- New and simpler HMI design
- Product can be scaled up:
  - Base system uses a single controller, operator workstation, and one sensor of each type.
  - Additional controllers, operator workstations, and/or sensors can be added if redundancy is required



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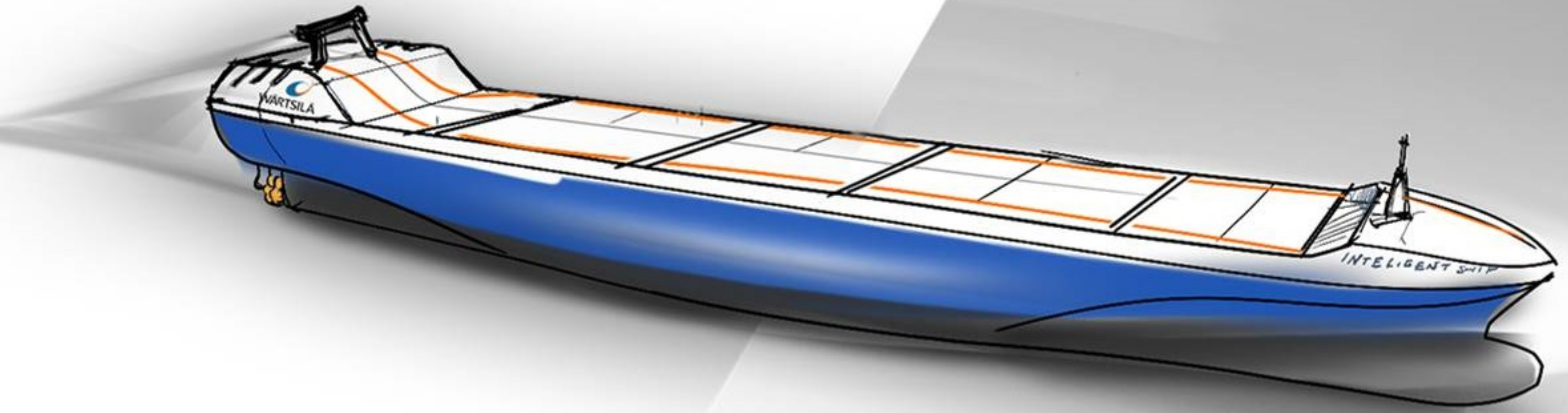
Intellitug



Intellitug

- harbour tug with autonomous navigation
- Singapore PSA & MPA cooperation

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Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.

Source: George Grantham Bain Collection.

1769 — 1885 — 1900 — 1908 — 1913 — 1931

THANK YOU

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