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DSEI 2019

TOWARDS REMOTE & AUTONOMOUS SHIPPING

London, September 11th, 2019

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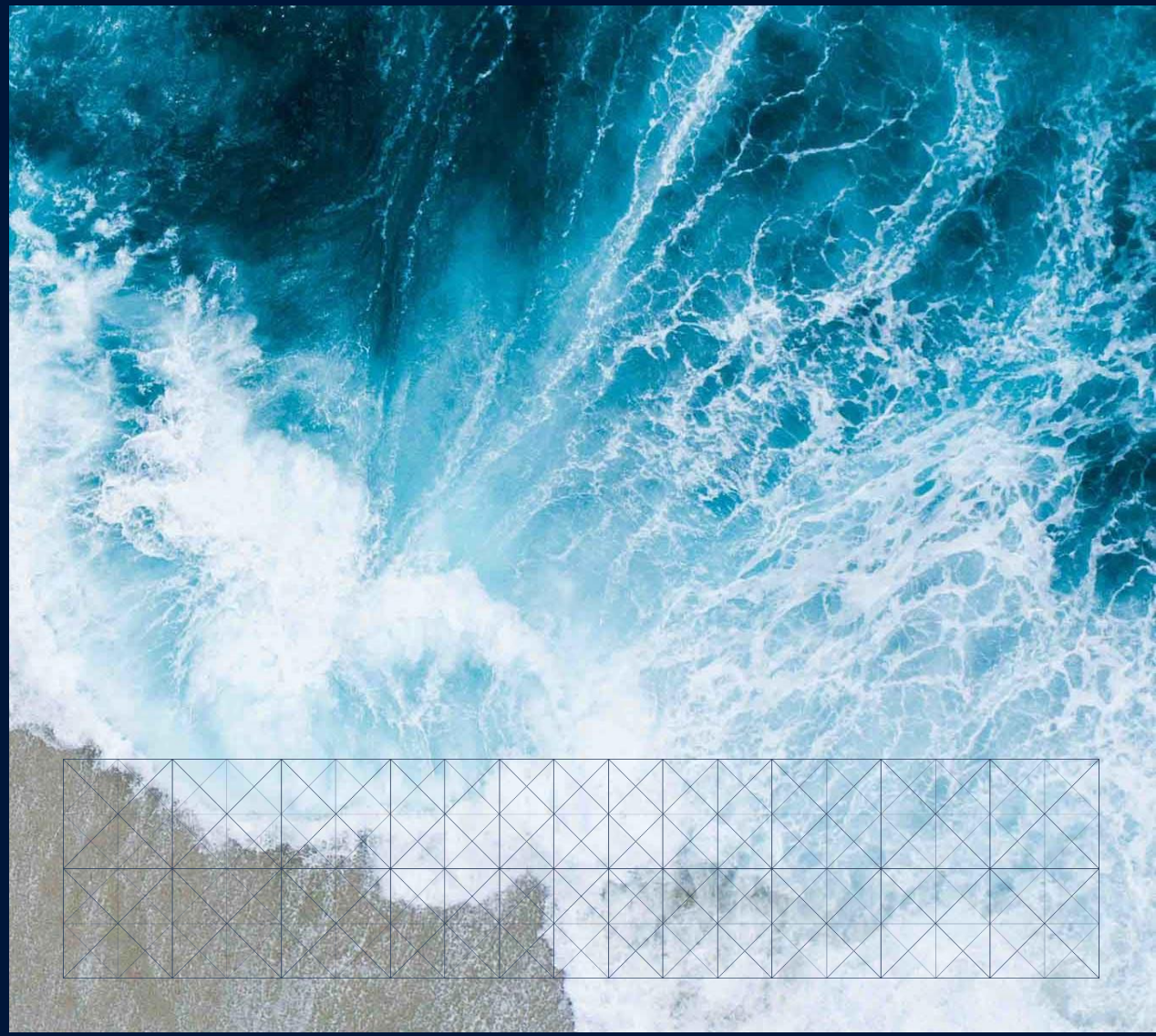
SVP Concept & Innovation, Kongsberg Maritime



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MARINE TRENDS

Digitalization

Platform Economics

Remote & Autonomous

Environment

Low Sulphur fuel

CO_2 and Green House Emissions

Renewables

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Disruptive change

by digitalization

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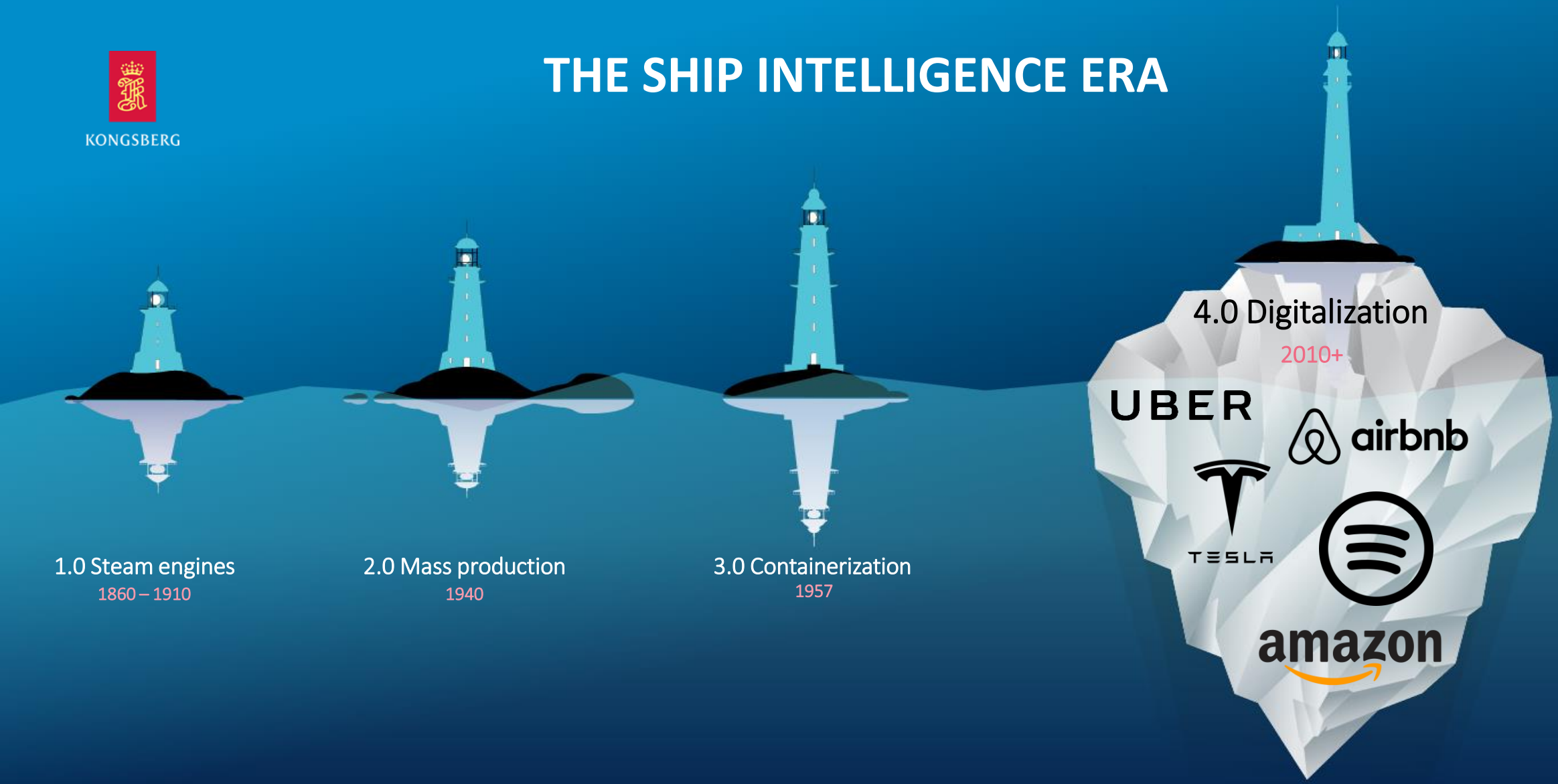
THE SHIP INTELLIGENCE ERA



1.0 Steam engines
1860 – 1910

2.0 Mass production
1940

3.0 Containerization
1957

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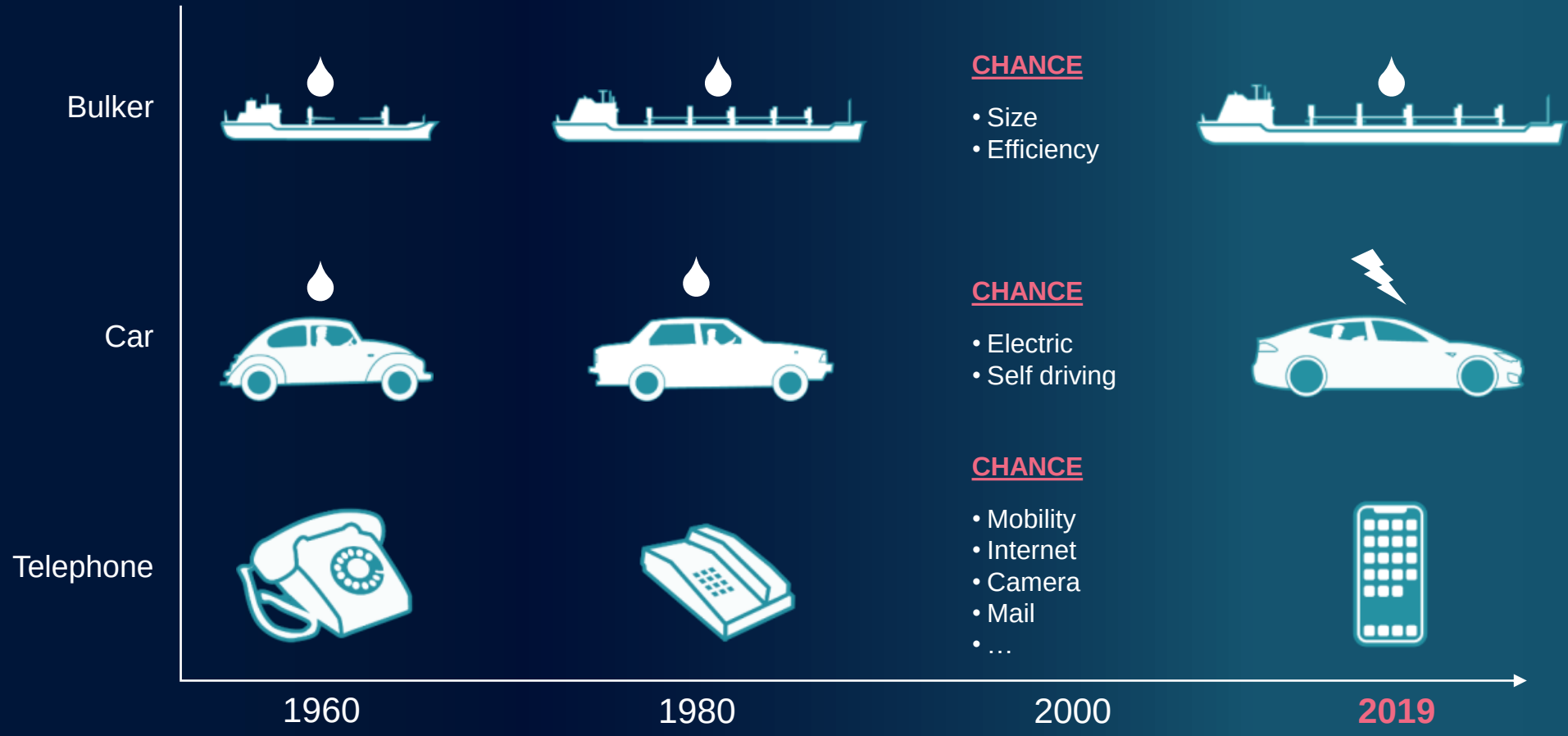
TIME FOR CHANGE!



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CHANGE DRIVEN BY DIGITALIZATION

BUSINESS

OPERATION

MANAGEMENT

TECHNOLOGY

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Disruptive change
Remote & autonomous shipping

DRIVERS FOR R&A SHIPPING

SAFETY

MONEY

SUSTAINABILITY

RISK

BUSINESS

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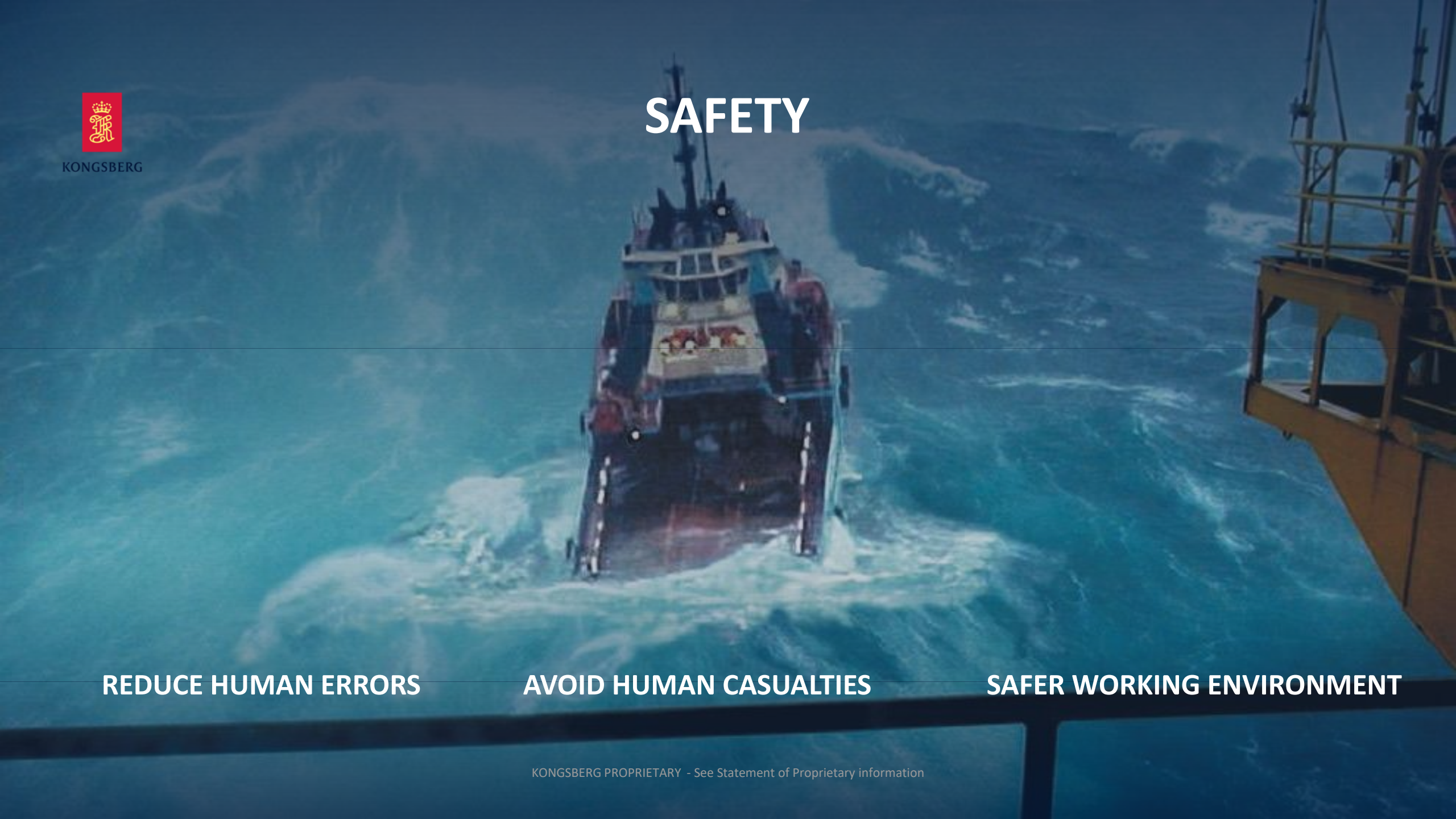

SAFETY

REDUCE HUMAN ERRORS

AVOID HUMAN CASUALTIES

SAFER WORKING ENVIRONMENT

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Remote & autonomous operation

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Remote & autonomous operation

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Rolls-Royce Proprietary Information

AUTONOMY VS MANNING

There is not one concept that fits all

LEVEL OF AUTONOMY

FULL AUTONOMY								
CONSTRAINED AUTONOMY								
MONITORED 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

MANNING

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UNMANNED OR CREW ABOARD?

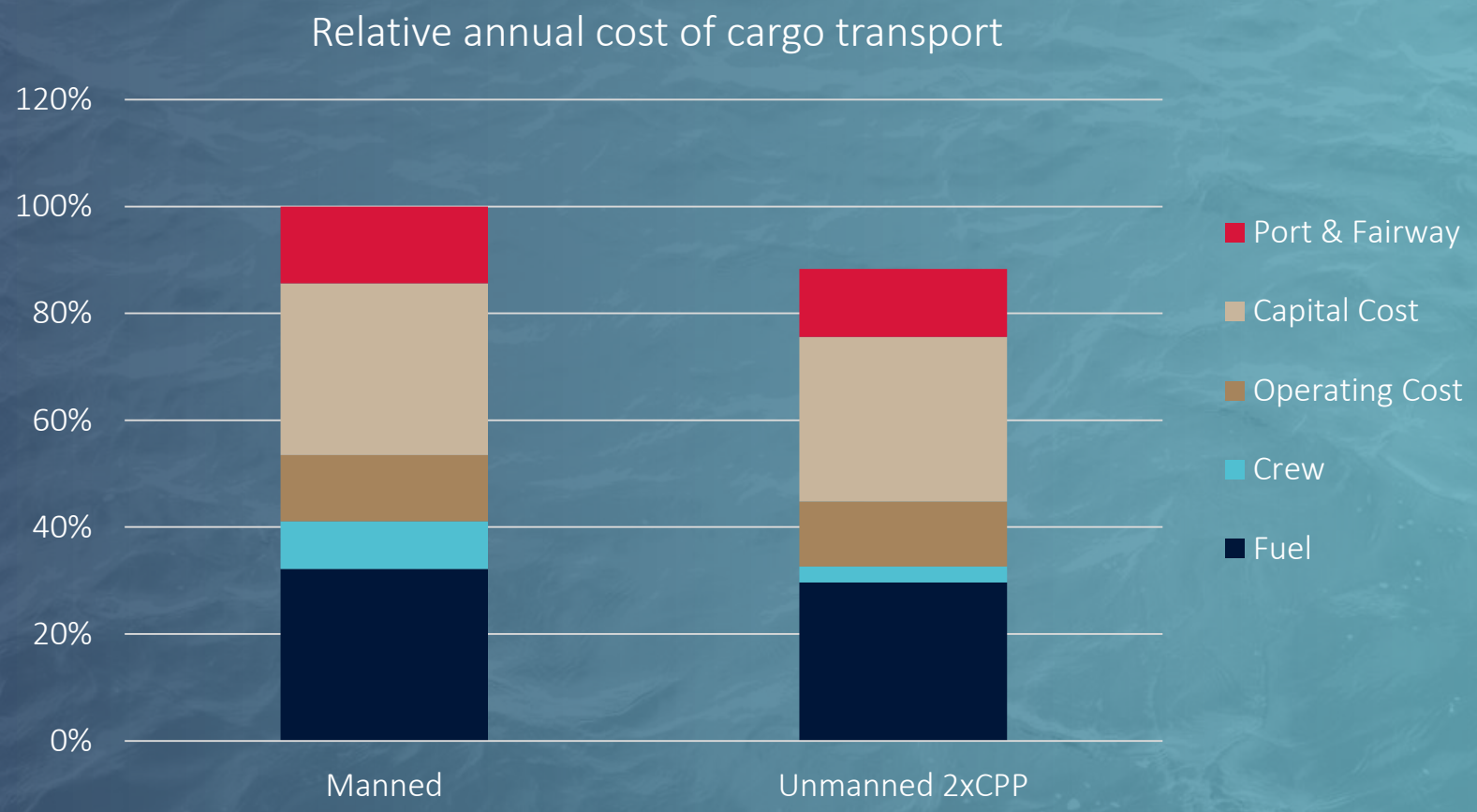
There is not one concept that fits all

	Normal manning R&A technology	Low manning R&A technology	Unmanned Full scope
Bulker			
General cargo			
Feeder container			
Large container			
Tanker			
LNG/LPG			
OSV			
Tug			
Road ferry			
RoRo			
RoPax			
Cruise			

UNMANNED ECONOMICS

Bulker 35 000 DWT

Example: total transport cost for a 35k DWT bulker results in economic gain for the unmanned concepts (~12%)



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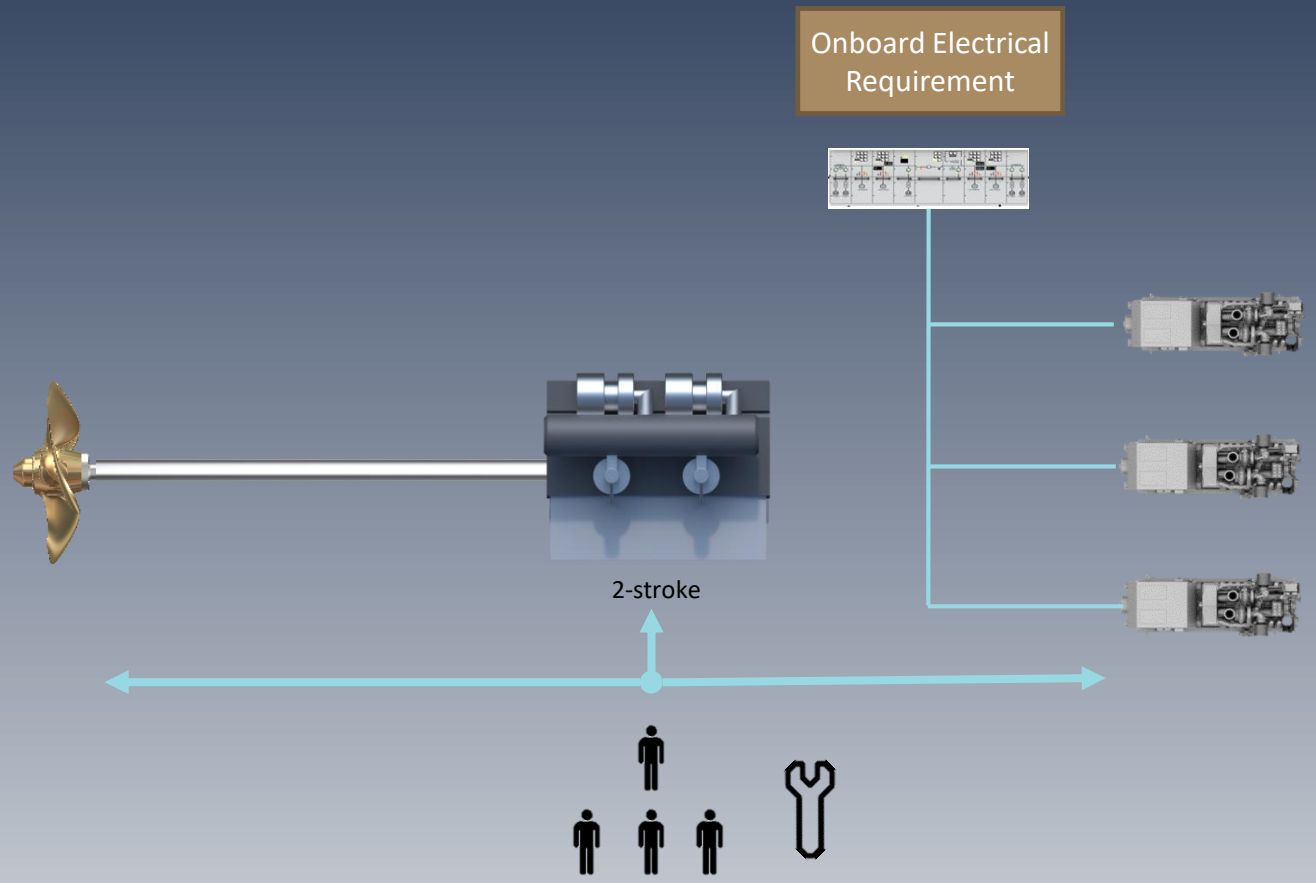
THE CHALLENGE OF UNMANNED MACHINERY

Traditional cargo vessel machinery reliability

- Traditional 2-stroke mechanic propulsion
- Both components and system are not designed for unmanned operation
- Reliability is maintained by having human engineers available 24 hours per day.



PROPULSION AND MACHINERY FOR RELIABILITY

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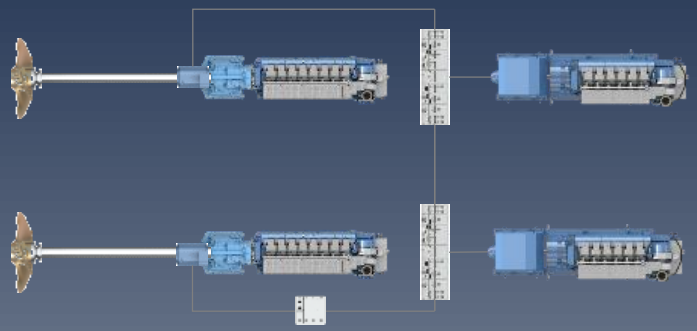
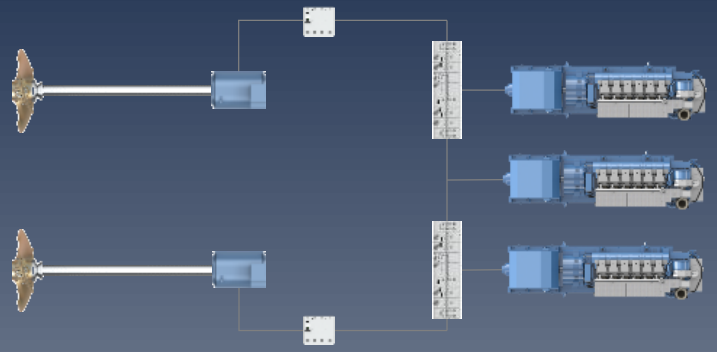


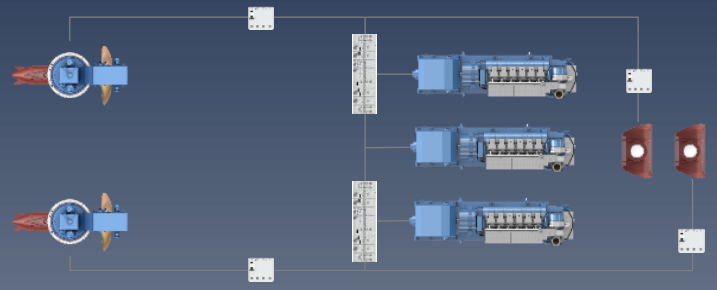
Twin CPP Hybrid

- Simplest machinery that offers redundancy, however reduced propulsion capability if ME failure
- Cost: +120-160% of traditional
- Propulsion Reliability: +



Twin FPP DE

- Diesel electric system allowing for small consequence of Main Gen-Set failure
- Cost: +200-240% of traditional
- Propulsion Reliability: ++



Pod DE

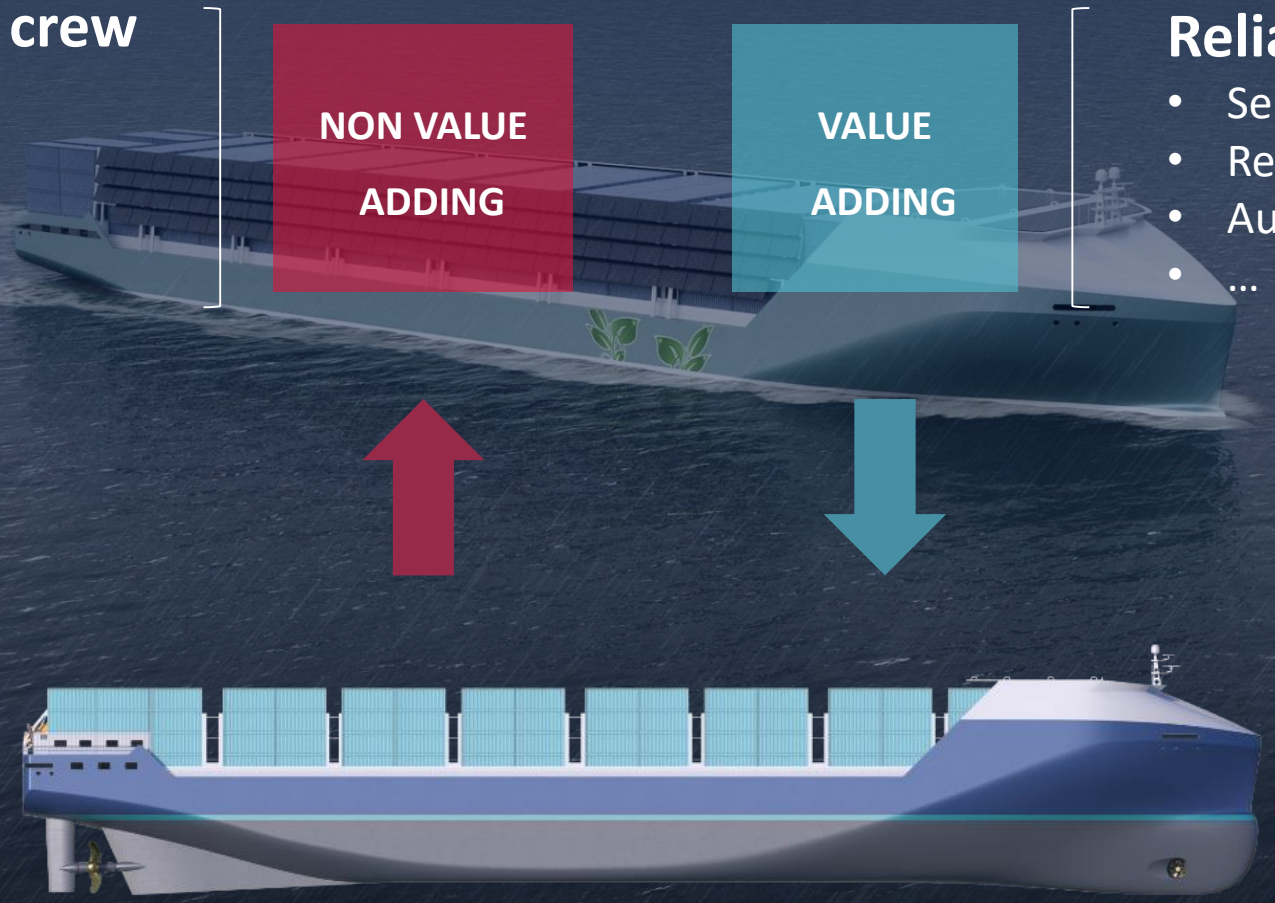
- Diesel electric system allowing for small consequence of Main Gen-Set failure
- Cost: +220-260% of traditional
- Propulsion Reliability: ++
- Additional maneuverability benefit

UNMANNED SHIPPING

How to go from low cost to high end systems

Systems for crew

- Sewage
- A/C
- Galley
- Life saving
- …



Reliability

- Sensors
- Redundancy
- Automation
- …

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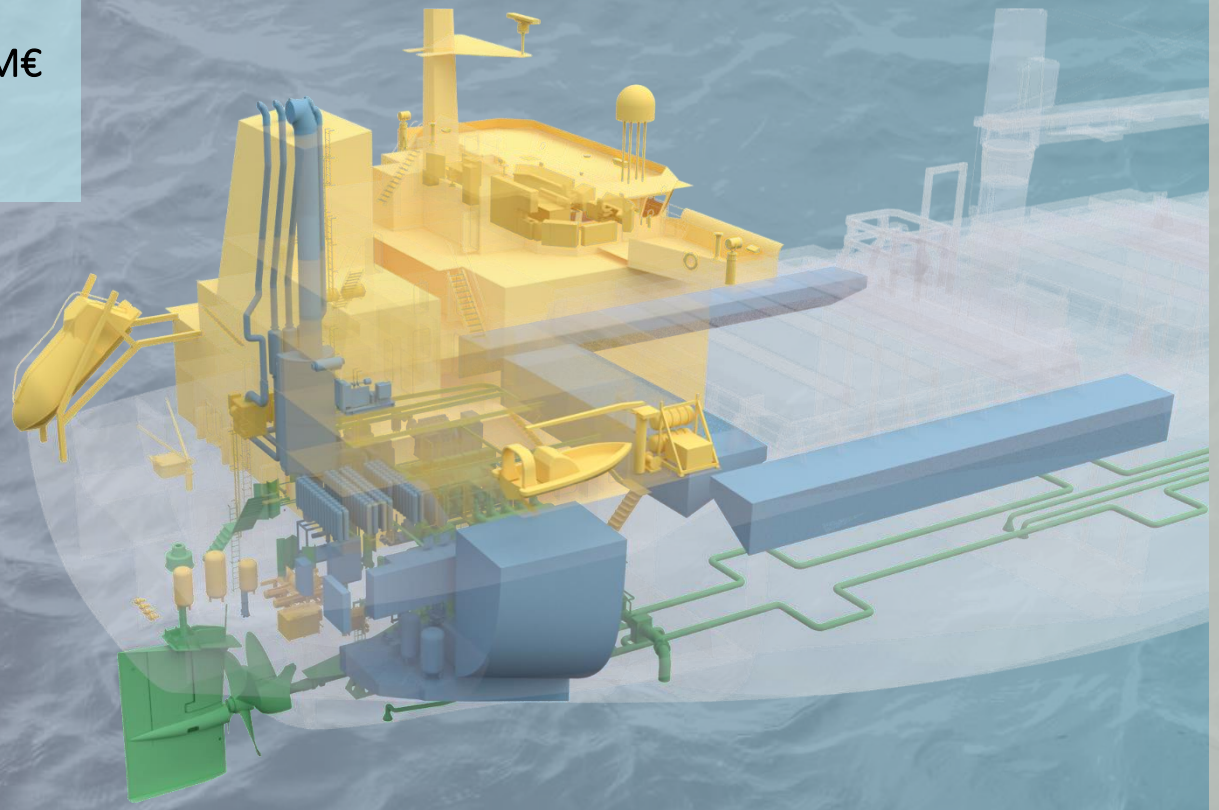
LEAN VESSEL

Capital and Energy Reductions

Total Price Reduction: **3,5 – 5 M€**
Energy Reduction: ~250kW



ITEMS REMOVED

- Deckhouse
- Cabins
- Navigation systems
- Internal Communication
- Working and control air systems
- Workshops and stores
- Inventory and tools
- Air Conditioning
- Freshwater generation
- Black Water Systems
- Grey Water Systems
- Deck Stores
- Lifeboats, Rescue boats, Davits
- Windows
- Outfitting labor costs

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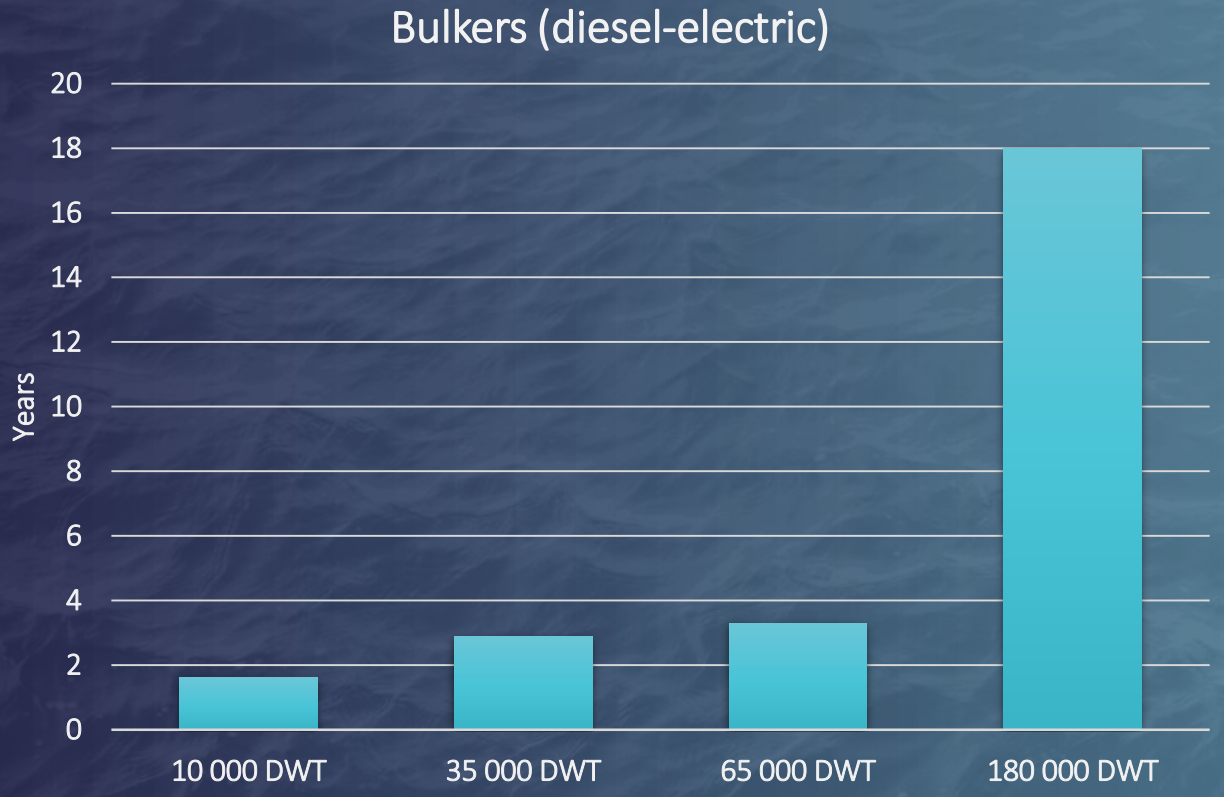
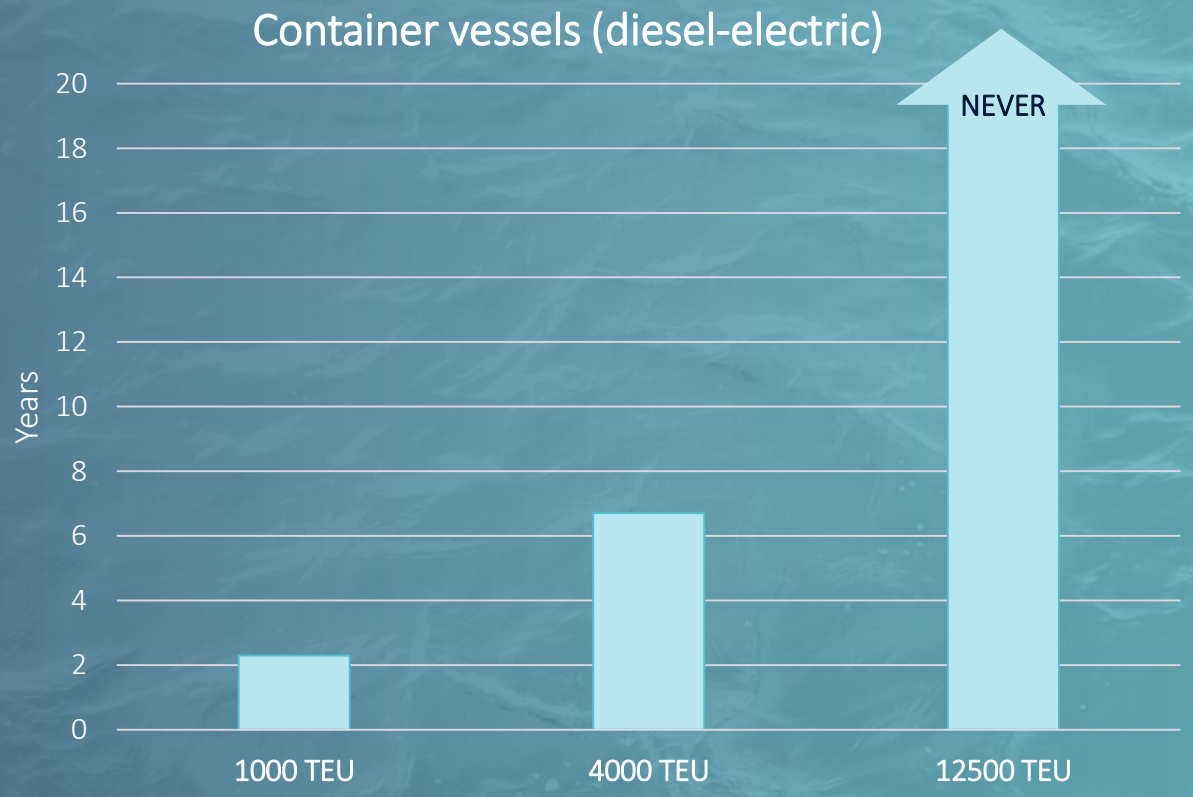
UNMANNED ECONOMICS

Unmanned vessel payback periods





EARNINGS AT DIFFERENT MARKET CONDITIONS

Manned versus unmanned in freight market

FREIGHT RATE: 8.4 $/T	FREIGHT RATE: 9.5 $/T	FREIGHT RATE: 14.5 $/T	FREIGHT RATE: 17.1 $/T
Unmanned Speed: 11 knots Earnings: $163 / Day	Unmanned Speed: 12 knots Earnings: $2 918 / Day	Unmanned Speed: 13 knots Earnings: $16 427 / Day	Unmanned Speed: 14 knots Earnings: $ 23 274 / Day
Manned - Cannot offer transport without making a loss - Layup, or take voyage at loss	Manned Speed: 12 knots Earnings: $789 / Day	Manned Speed: 14 knots Earnings: $14 270 / Day	Manned Speed: 14 knots Earnings: $21 376 / Day

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R&A Vessels and Sustainability

- Lower energy demand
- Ideal for slow steaming
- Combine with renewable power sources and energy saving devices

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New Ship Types

eg. R&A Supply concept

Game Changers

eg. Autonomous ROV mother vessel

Journey to R&A shipping

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WORLD'S FIRST REMOTELY CONTROLLED COMMERCIAL TUG

KONGSBERG
and
Svitzer Remote Control
Demo in 2017

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Automatic Crossing System

More than 20 System in operation or on order!

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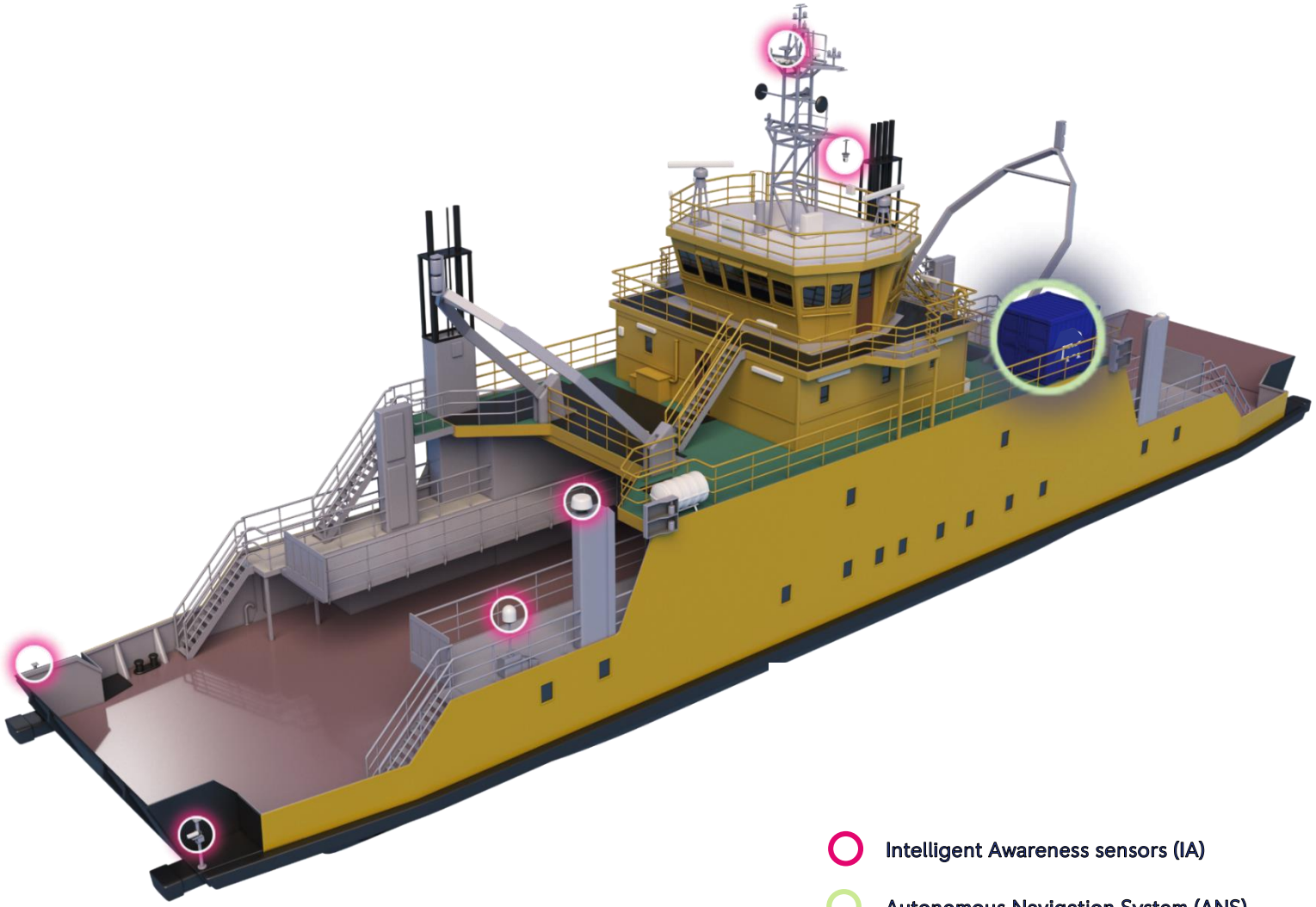
FinFerries

WORLD'S FIRST AUTONOMOUS FERRY – FINFERRIES FALCO

SVAN is a demonstration (2018) of the world's first remote and autonomous ferry with a focus on improving the safety and efficiency of vessel operations and supporting the crew.

WORD'S FIRST AUTONOMOUS FERRY

Remote Control Station



Intelligent Awareness sensors (IA)

Autonomous Navigation System (ANS)

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Yara Birkeland

A fully electric, autonomous 120 TEU feeder vessel

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The Challenges

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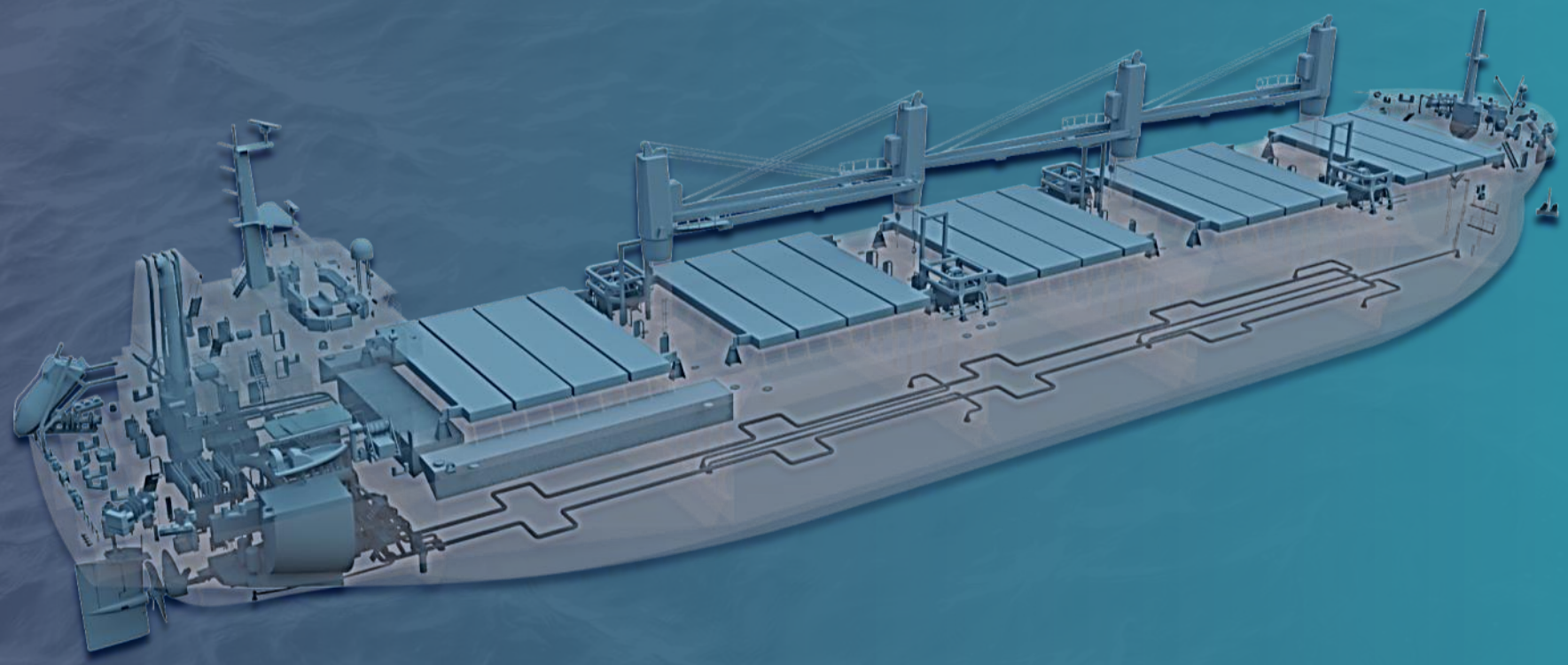
RELIABILITY

How to ensure that all systems are available at sea



STANDARDIZATION **VALIDATION** **HEALTH MANAGEMENT** **SENSORS AND TRENDING** **DIGITAL TWINS**

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Remote & autonomous will change the market demand

Turn today's main stream shipping into high end commodities

RULES & REGULATIONS

IMO

SOLAS

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IMO

DEFINITIONS

Maritime Autonomous Surface Ship (MASS) =

"a ship which, to a varying degree, can operate independently of human interaction"

MASS autonomy levels	Description
Ship with automated processes and decision support	Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.
Remotely controlled ship with seafarers onboard	The ship is controlled and operated from another location, but seafarers are on board.
Remotely controlled ship without seafarers on board	The ship is controlled and operated from another location. There are no seafarers on board.
Fully autonomous ship	The operating system of the ship is able to make decisions and determine actions by itself.

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AUTONOMY VS. MANNING

Regulative point of view

VERY CHALLENGING TO GET ACCEPTED

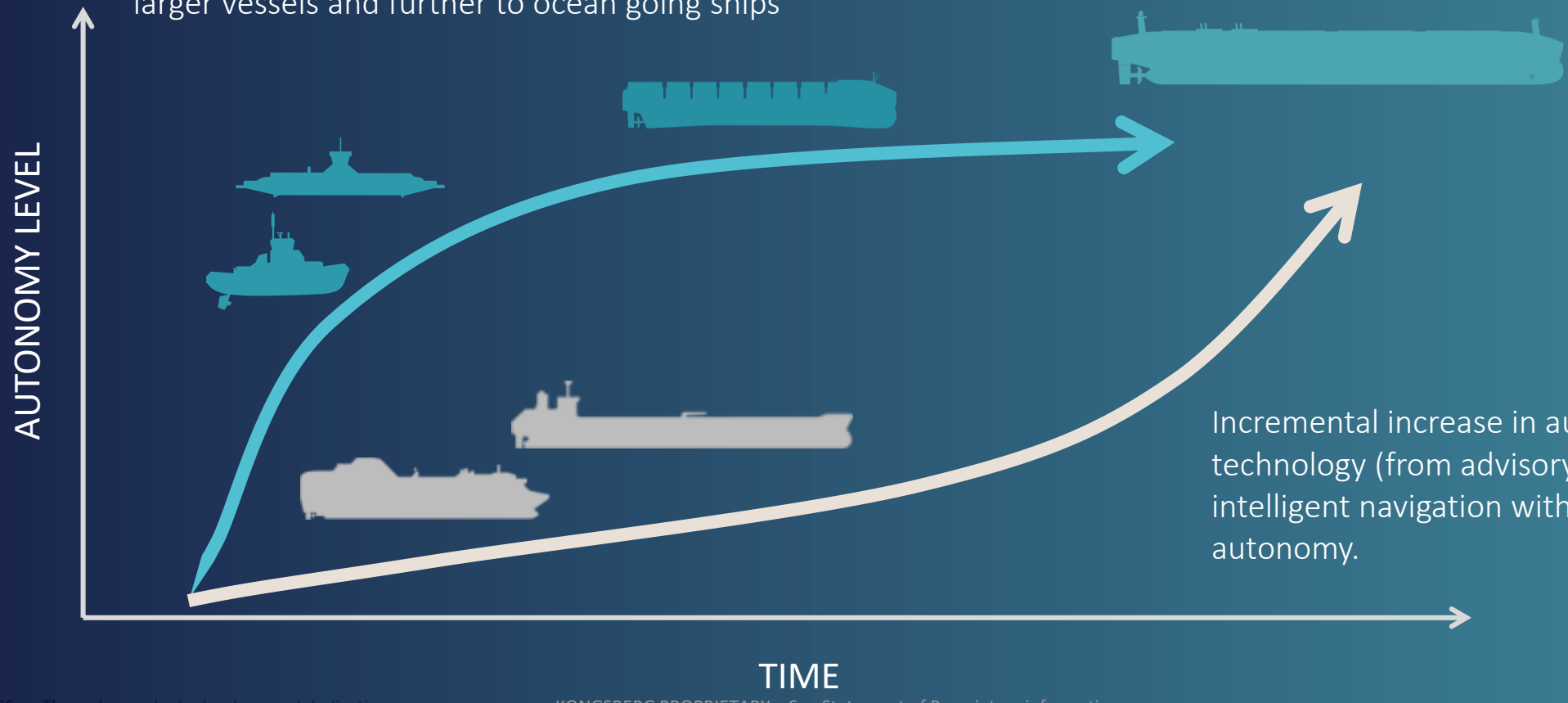
LEVEL OF AUTONOMY									
FULL AUTONOMY									NOT LIKELY TO BE FEASIBLE
CONSTRAINED AUTONOMY				WITH REMOTE SUPERVISION	WITH REMOTE SUPERVISION				
MONITORED AUTONOMY									
ADVISORY						REQUIRES SAFE STATE AUTONOMY			
NO AUTONOMY									
ONBOARD	FULL MANNING	REDUCED MANNING	PERIODICALLY UNMANNED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

MANNING

CAN BE COVERED BY TODAYS RULES

PATHS 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



Incremental increase in automation technology (from advisory systems to intelligent navigation with monitored autonomy.

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REDEFINING SHIPPING WITH SHIP INTELLIGENCE

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