

Intelligent Marine Solutions of Tomorrow



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Rolls-Royce Plc

World leading supplier addressing four global markets:



Civil Aerospace

- Aero engines
- Helicopter engines



Defence Aerospace

- Aero engines
- Helicopter engines



Marine

- Ship Design
- Equipment systems



Energy

- Gas turbines

55 000 employees



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Marine Division



Offshore



Merchant



Naval



Service

- Second largest division in Rolls-Royce
- Over 9 000 employees in 35 countries
- Over 30 000 vessels with our design and/or equipment



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Fundamental Changes in Shipping

Historic fundamental changes:

- From sail to steam
- Coal to diesel
- Introduction of the container ship
- Cross Atlantic airlifts (end of the ocean liners)
-



What will be the most fundamental changes in shipping during your career?



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Ship Intelligence Trends Today

Today:

- Navigation and station keeping
- Decision support
- Operational real time optimization
- Health monitoring
- Automated reporting

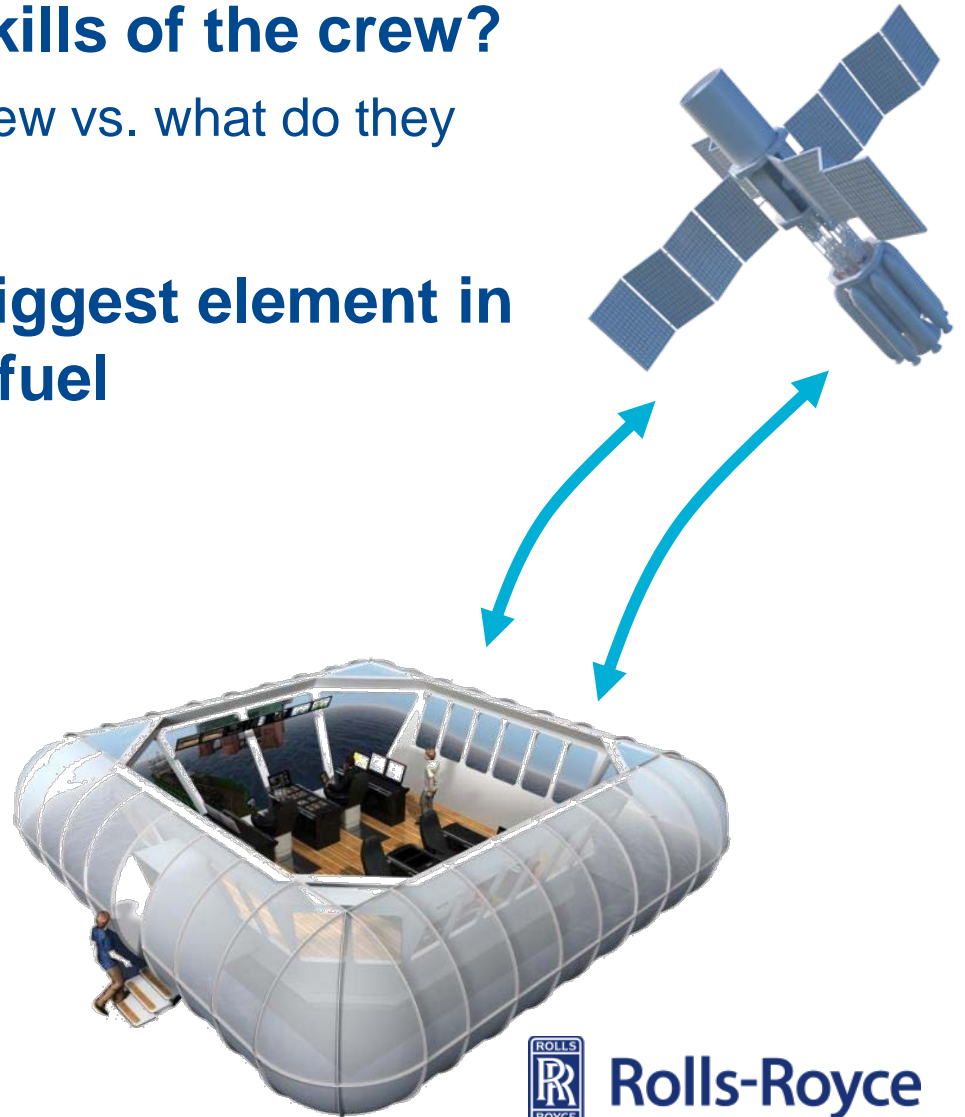
In all areas trend is towards more intelligent and automated systems and the role of crew is in supervising the operation.



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Crew Competence

- **How to best utilise the skills of the crew?**
 - What is the core skill of the crew vs. what do they spend their time doing?
- **Crew is usually the 2nd biggest element in ship running costs after fuel**



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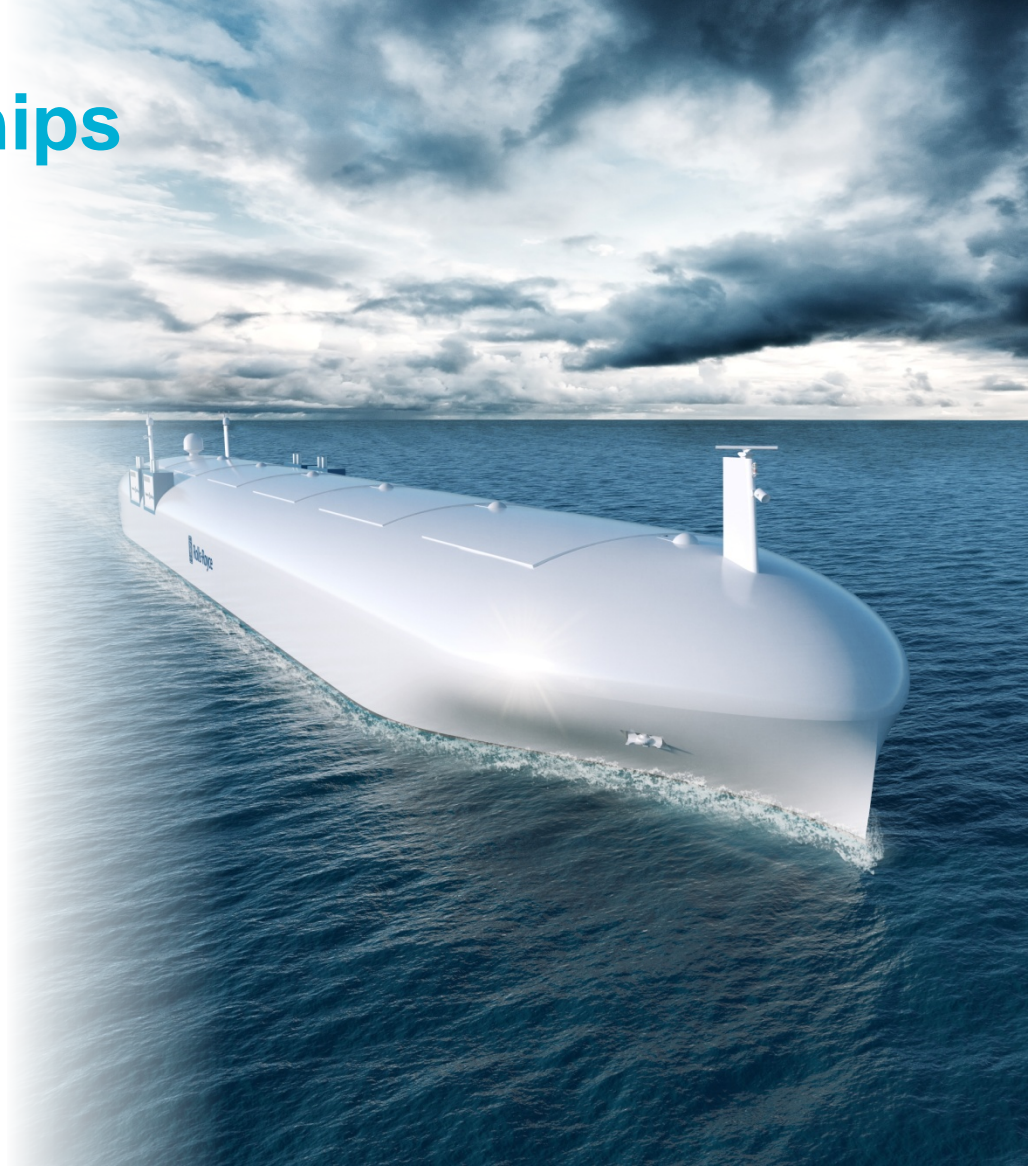
Making ship transport more efficient and safe!



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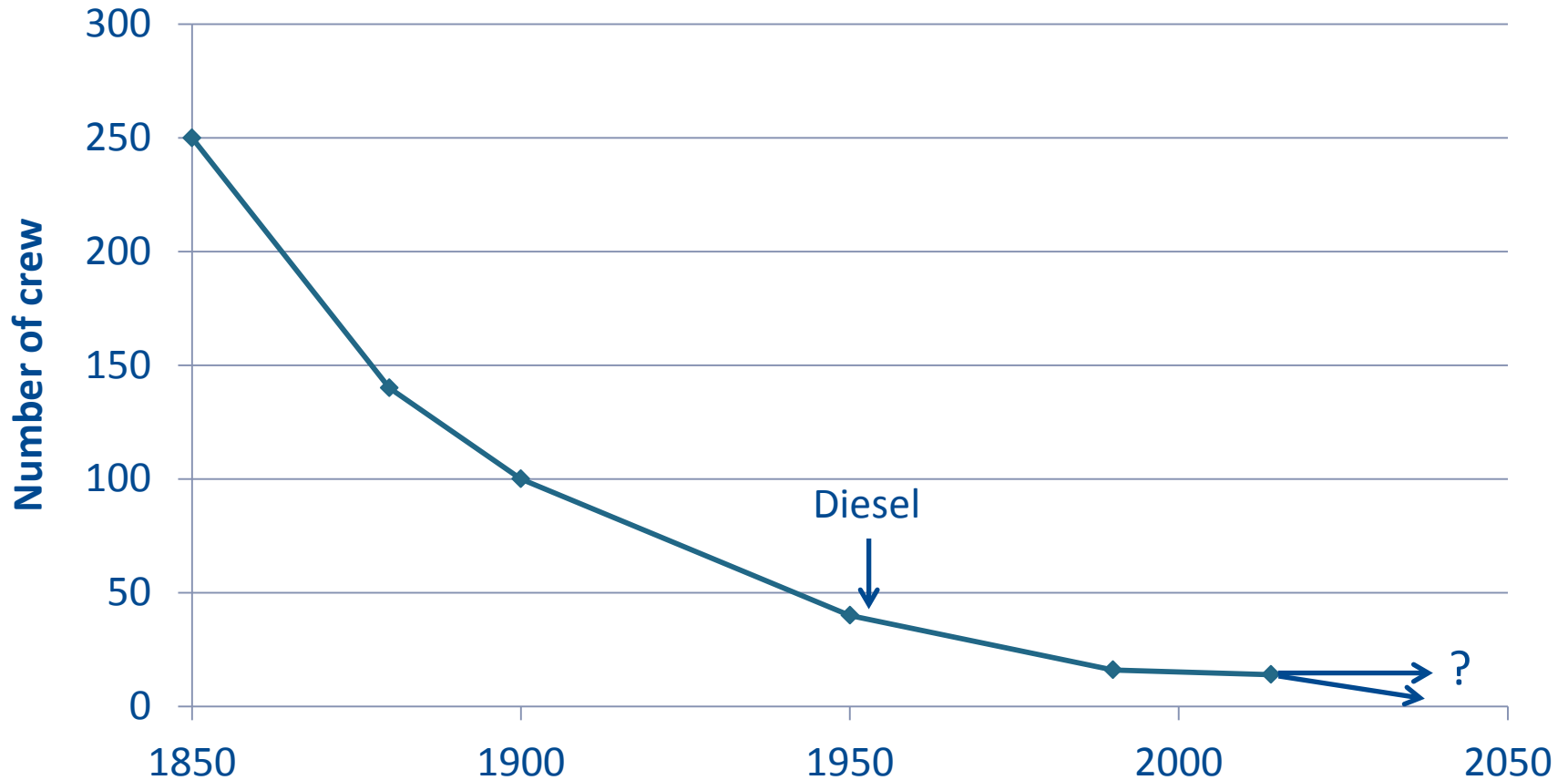
Remote Controlled Ships

- Crew costs
- Access to competent crew
- Provide better conditions for the seafarers of tomorrow
- Better ship efficiency
- Improved safety



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Crew Trends – Ocean Going Ships



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Other Unmanned Vehicles

- Airplanes
- Helicopters
- Cars
- Trains and subways
- Submarines
- ROV:s
- Offshore installations
- ...



It is not if, it is when...
Marine is only following today's trend!



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Safety

Remote controlled ship must be as safe or safer than today's ships!

Remote control will bring new aids to the navigation of ships

- Cameras with better vision than the human eye
- Automatic detection of objects in the water
- Complete ship traffic overview

Most marine accidents are related to human errors

- Big part is due to lack of rest and concentration
- Shore based control stations will provide a better working environment

Machinery with predictive maintenance schemes will improve reliability

- A new thinking in marine reliability needs to be established

Automatic safe mode if loss of control occurs

Unmanned operation is not suited for all types of ships – we will still have seafarers at sea in the future



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Safety



What is safer?

- 20 persons onboard a vessel in the North Sea in a raging storm, or
- 2 persons in a control room on land?



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Remote Controlled Ships - Features

No deck house

More cargo

Communications

IT security



No hotel systems

- Water production
- Water heating
- AC
- Sewage treatment
- ...

Lower LWT



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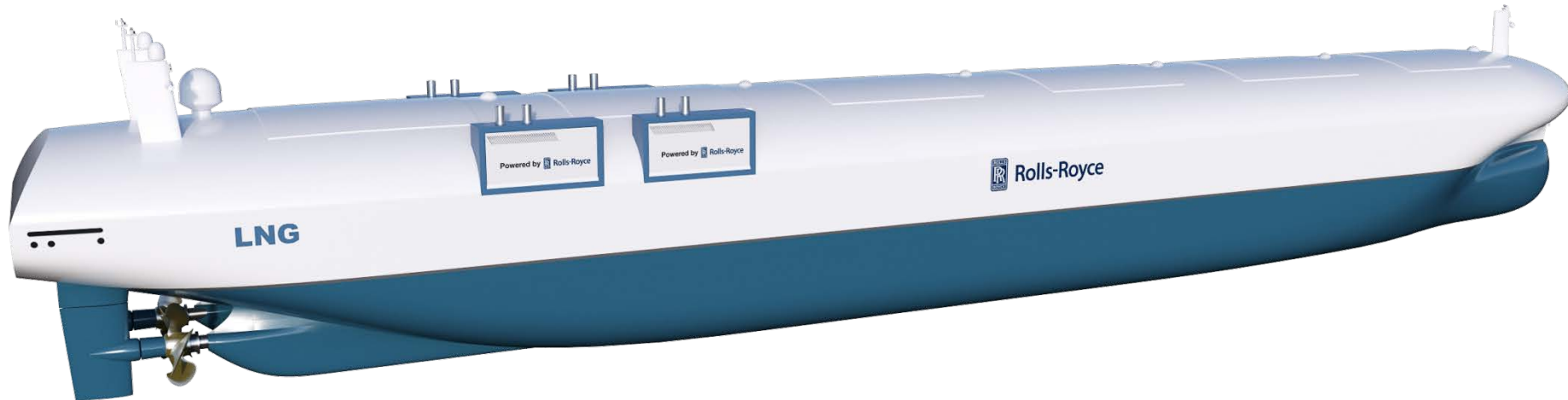
Remote Controlled Ships - Features

New possibilities

- New machinery locations
- Novel machinery types
- Better cargo handling
- ...

Better weight distribution

Lower costs



Redundant machinery

Lower power demand

- Lower resistance from reduced LWT
- Lower hotel load
- ...



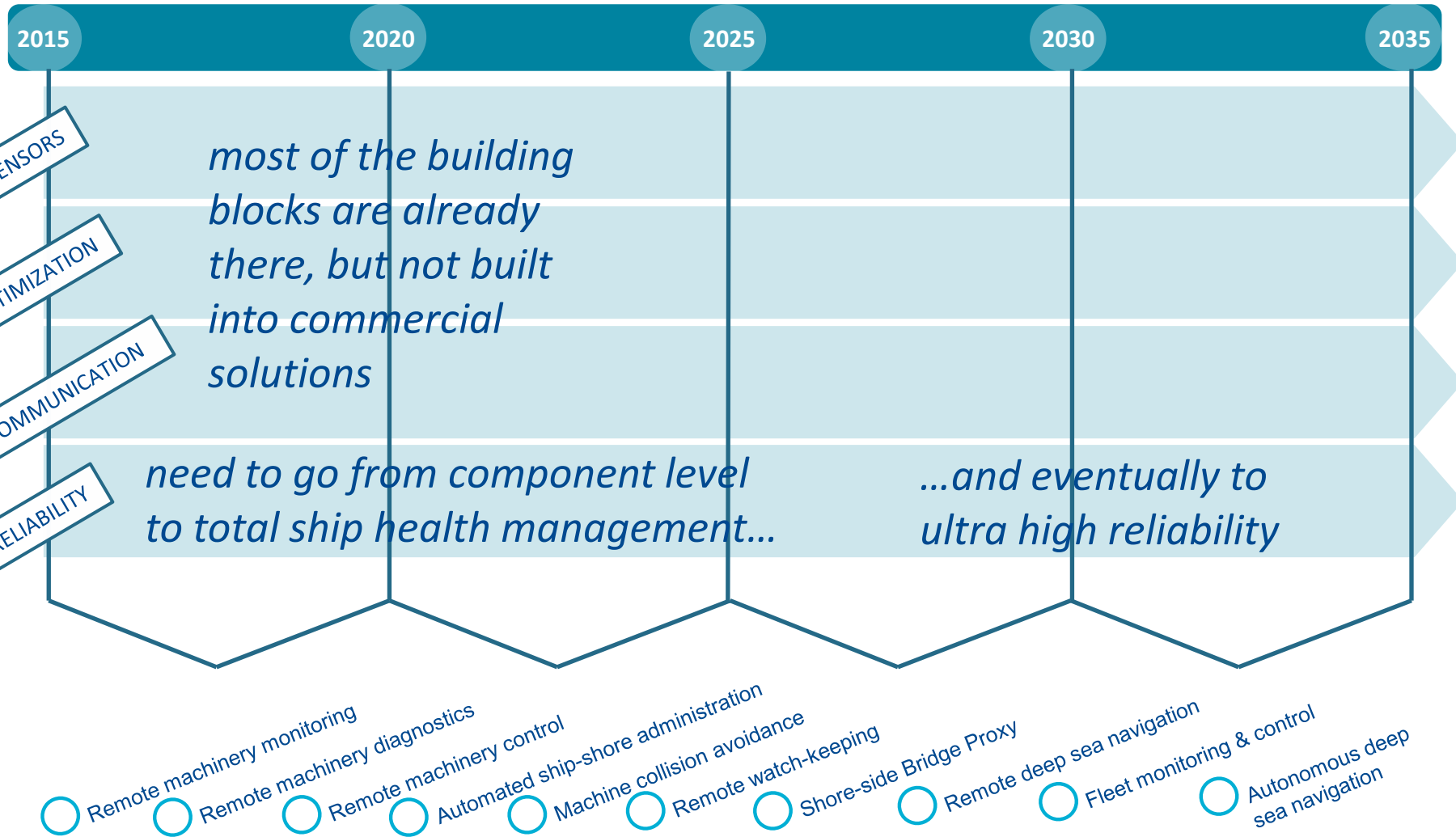
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ROADMAP for Unmanned Ships



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Technology Development

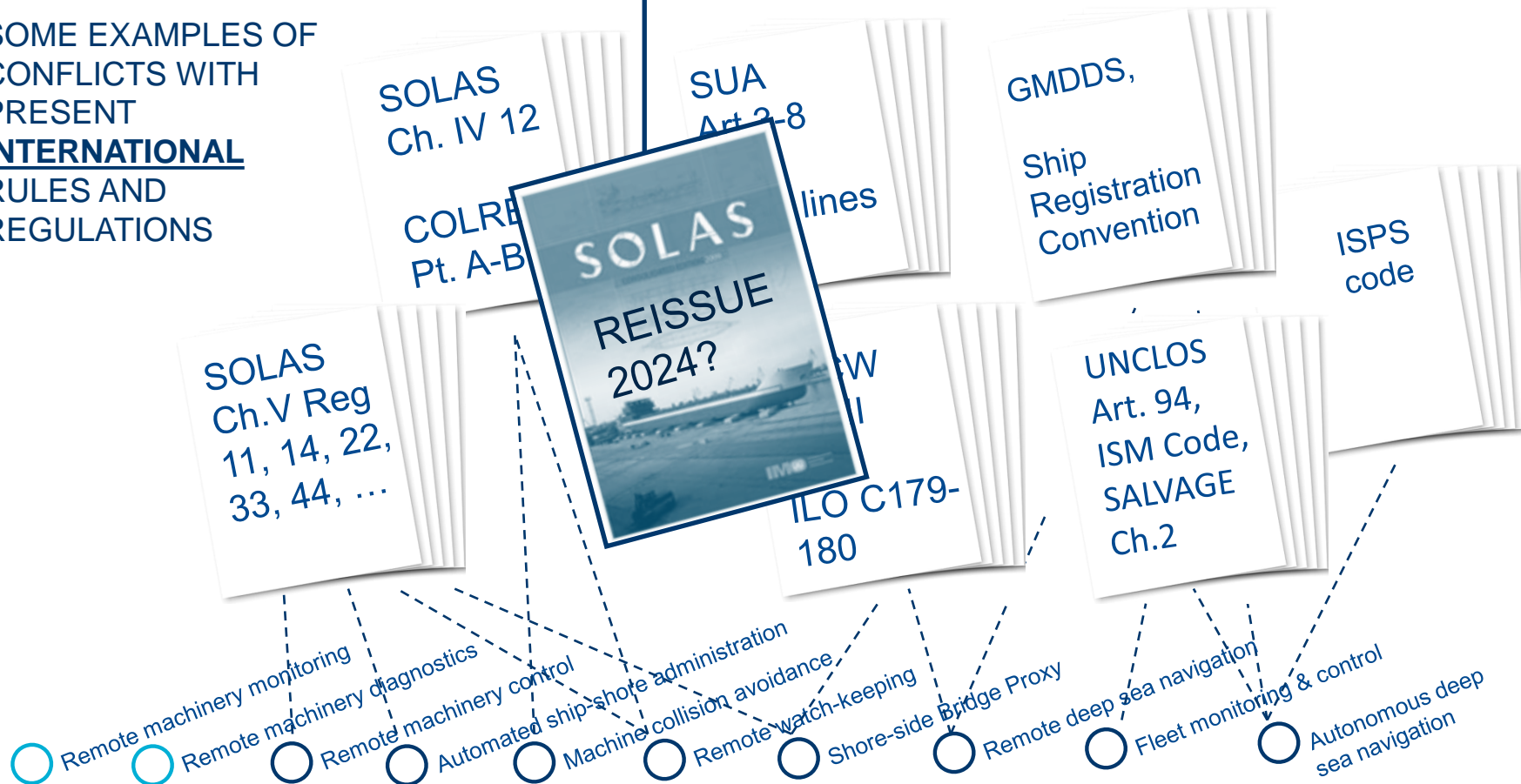


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International Regulatory Obstacles



SOME EXAMPLES OF CONFLICTS WITH PRESENT INTERNATIONAL RULES AND REGULATIONS



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Local Regulations Can Be More Flexible

2015

2020

2025

2030

2035

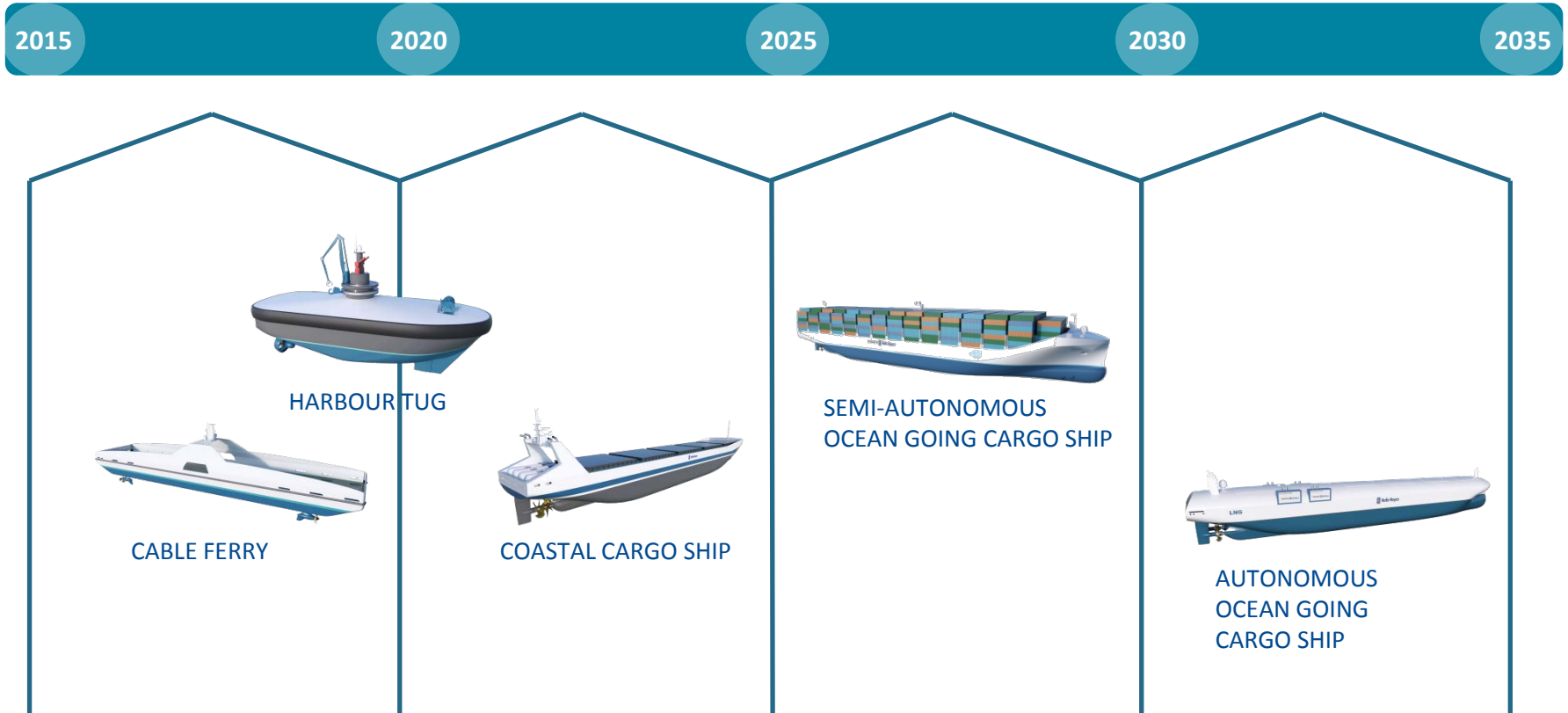
- Ships operating in restricted areas and not engaged in international traffic can be exempted by the Flag State
- Adoption of the technologies and functionalities towards autonomy is thus likely to start from locally operating vessels

- Remote machinery monitoring
- Remote machinery diagnostics
- Remote machinery control
- Automated ship-shore administration
- Machine collision avoidance
- Remote watch-keeping
- Shore-side Bridge Proxy
- Remote deep sea navigation
- Fleet monitoring & control
- Autonomous deep sea navigation



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Potential Timeline For Ship Concepts



- Remote machinery monitoring
- Remote machinery diagnostics
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Benefits Along The Way

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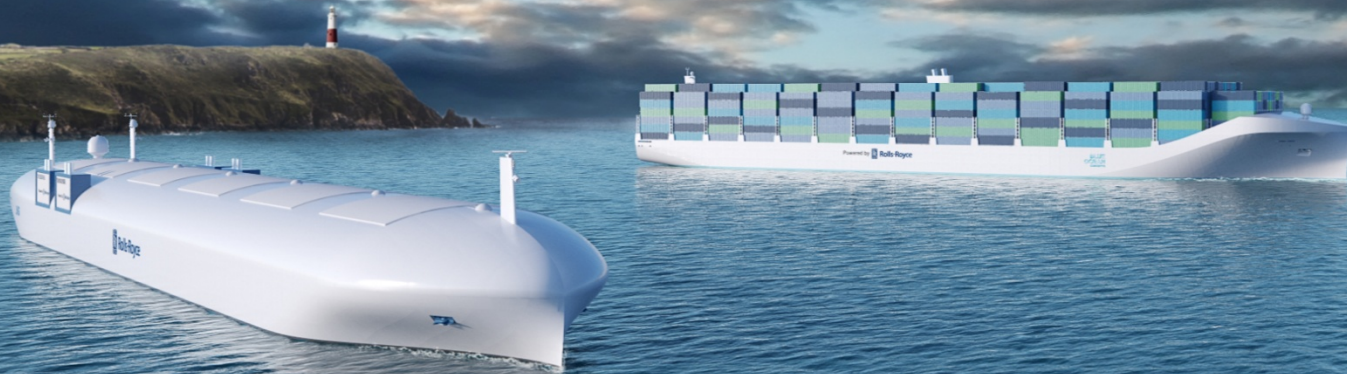
- **Improved safety**
- **Higher efficiency**
- **Increased flexibility**
- **etc...**

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Better Power for a Changing World



Thank You for Your Attention!



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