



UK National  
Clean Maritime  
Research Hub

# Clean Maritime Assembly 2026

Collaboration | Innovation | Transformation



Engineering and  
Physical Sciences  
Research Council



Funded by  
UK Government



# Enabling the Clean Maritime Transition

## Clean Maritime Assembly

Claudene Sharp-Patel

June 2026



# My journey into maritime



# No ordinary Coffee house...

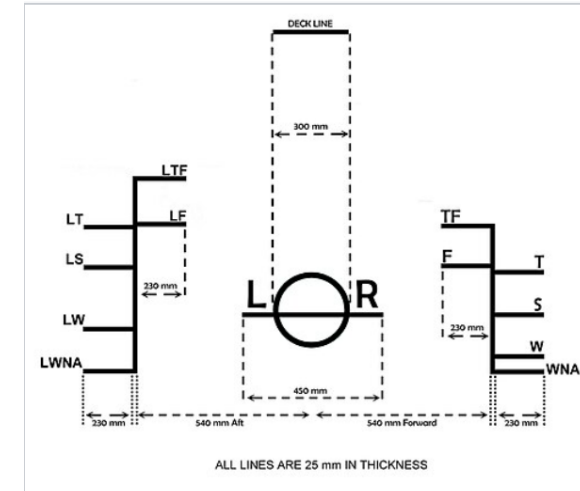


- Edward Lloyd's Coffee house opened in Great Tower Street, 1680
- Unofficial commercial office to rival pubs and taverns;
- Maritime centre- a meeting place for shipping business and intelligence;
- 1760- Foundation of the Society for the Registry of Shipping- later to become Lloyd's Register.
- Register Society employed retired sea captains, to call at 15 ports around the UK and inspect vessels
- Formed by underwriters, merchants and shipowners to provide a register of inspected ships to give an indication of their construction and condition;
- Register of Ships published, 1764. Subscriptions generated would pay surveyors to carry out the inspections;
- **Emerged as the world's first classification body.**



# Why class a ship?

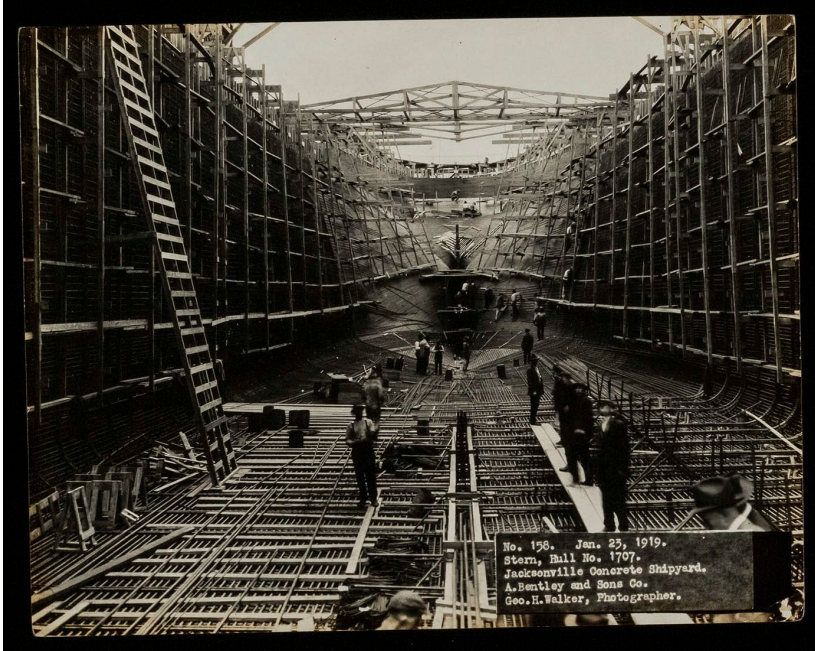
- Classification is an assessment against defined standards of a vessel's seaworthiness either from its construction or already in existence;
  - To reduce the risk and help to prevent loss of life and property;
  - Support for informed decision making for stakeholders in the shipping industry;
    - Underwriting;
    - Merchants and chartering;
    - Resale value.
- LR's prescribed load lines since 1835, then known as the Lloyd's Rule
  - Benjamin Martell, Chief Surveyor worked closely with Sir Samuel Plimsoll to develop the load line for his parliamentary campaign against the 'coffin ships.'
  - In 1882 the load line become compulsory for LR class, 8yrs before the 1890 Merchant Shipping Act making it legally compulsory for all British ships. Today it is a legal requirement for all participating states of the International Maritime Organisation.



Load Line Mark and Lines and Timber Load Line Mark and Lines for power driven merchant vessels



# Lloyd's Register and Marine



- Emerging after the Second World War in a changed shipping landscape, Lloyd's Register continued its process of technical innovation;
- LR continually worked with the fledging IMO with the establishment of conventions, regulations and international legislation, e.g. MARPOL, and the international load line conventions;
- LR continues to work with national and area committees to ensure adherence and informed development of rules and regulations for the future across the world;
- This new era also heralded an expansion beyond marine...



Foundation

# LR Foundation and LR's social purpose

## Meet some of LR Foundation's partners

The shared mission to make the world a safer, more sustainable place between LR and LR Foundation has culminated in joint initiatives, notably the [LR Maritime Decarbonisation Hub](#) and [Safetytech Accelerator](#).

## Meet Lloyd's Register Foundation

LR Foundation is the sole shareholder of LR Group. The Foundation is a politically and financially independent global charity that aims to engineer a safer world through promoting safety and education. For a thriving ocean economy, LR and LR Foundation work together through a shared social purpose mission to make the world a safer place by funding research, fostering industry collaboration and developing action-oriented solutions.

The Foundation focuses on the most pressing global safety challenges, establishing the best **evidence and insight** to better understand the complex factors that affect safety, and by building **partnerships for change**.

LR Foundation **reduces risk** and **enhances the safety** of the critical infrastructure that modern society relies on. It focuses on areas such as energy, transport as well as food by supporting **high quality research** and accelerating technology through **education** and **public outreach**.



Find out more about our  
impact in your region  
through this [interactive map](#)

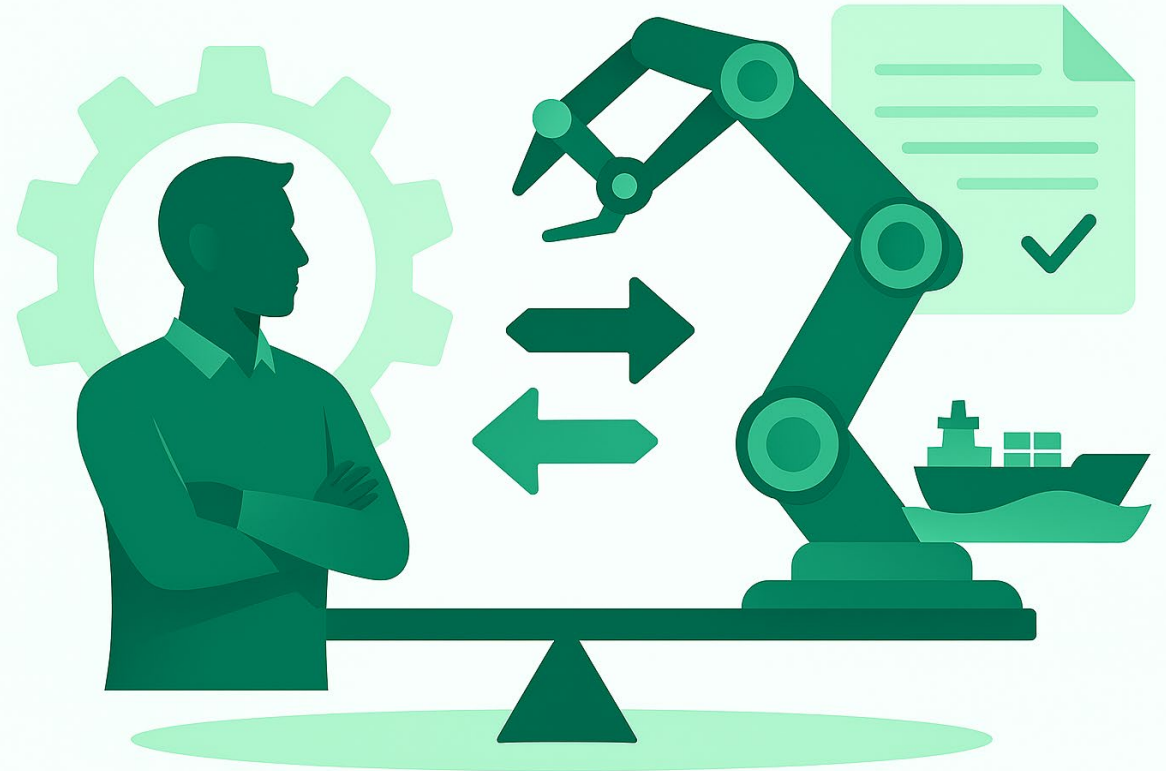
# Navigating the Push–Pull Dynamics

Human expertise drives innovation but faces rapid change.

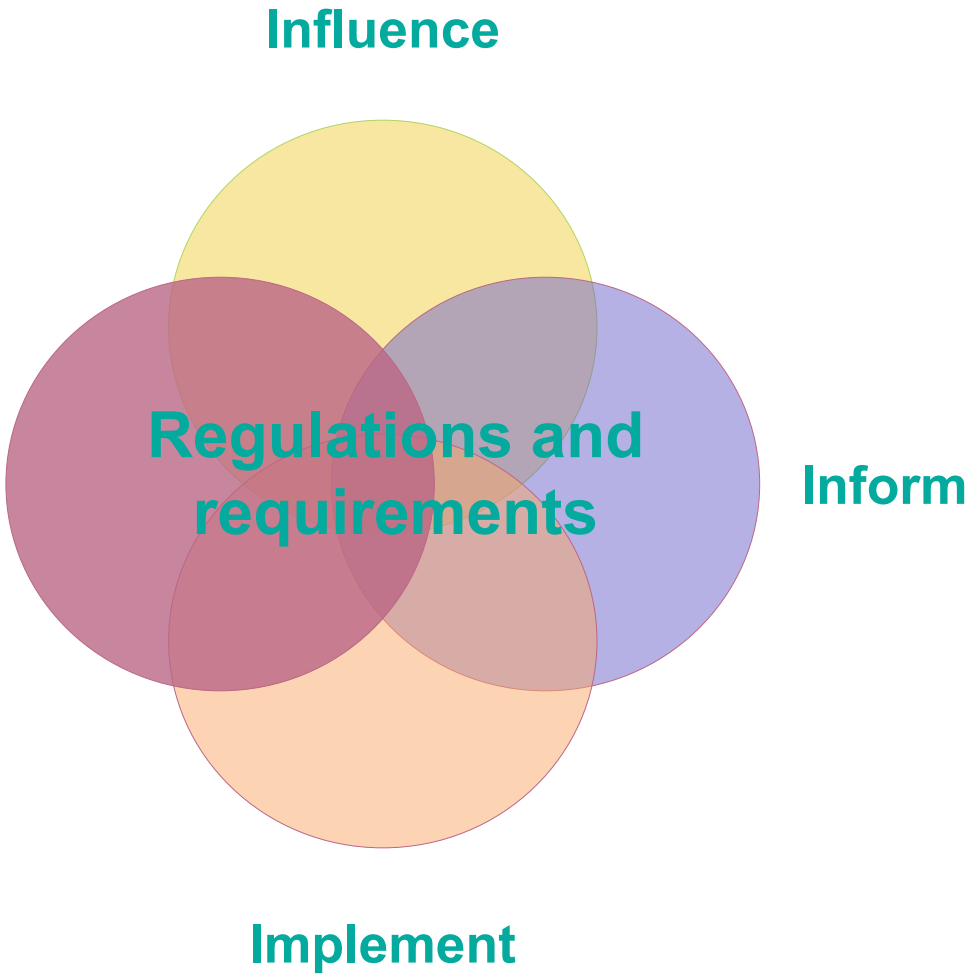
Technology accelerates faster than regulatory cycles.

Regulations aim to protect safety & environment but add complexity.

Maritime sector must balance capability, safety, cost, and ambition.



# Role of LR within Regulations today

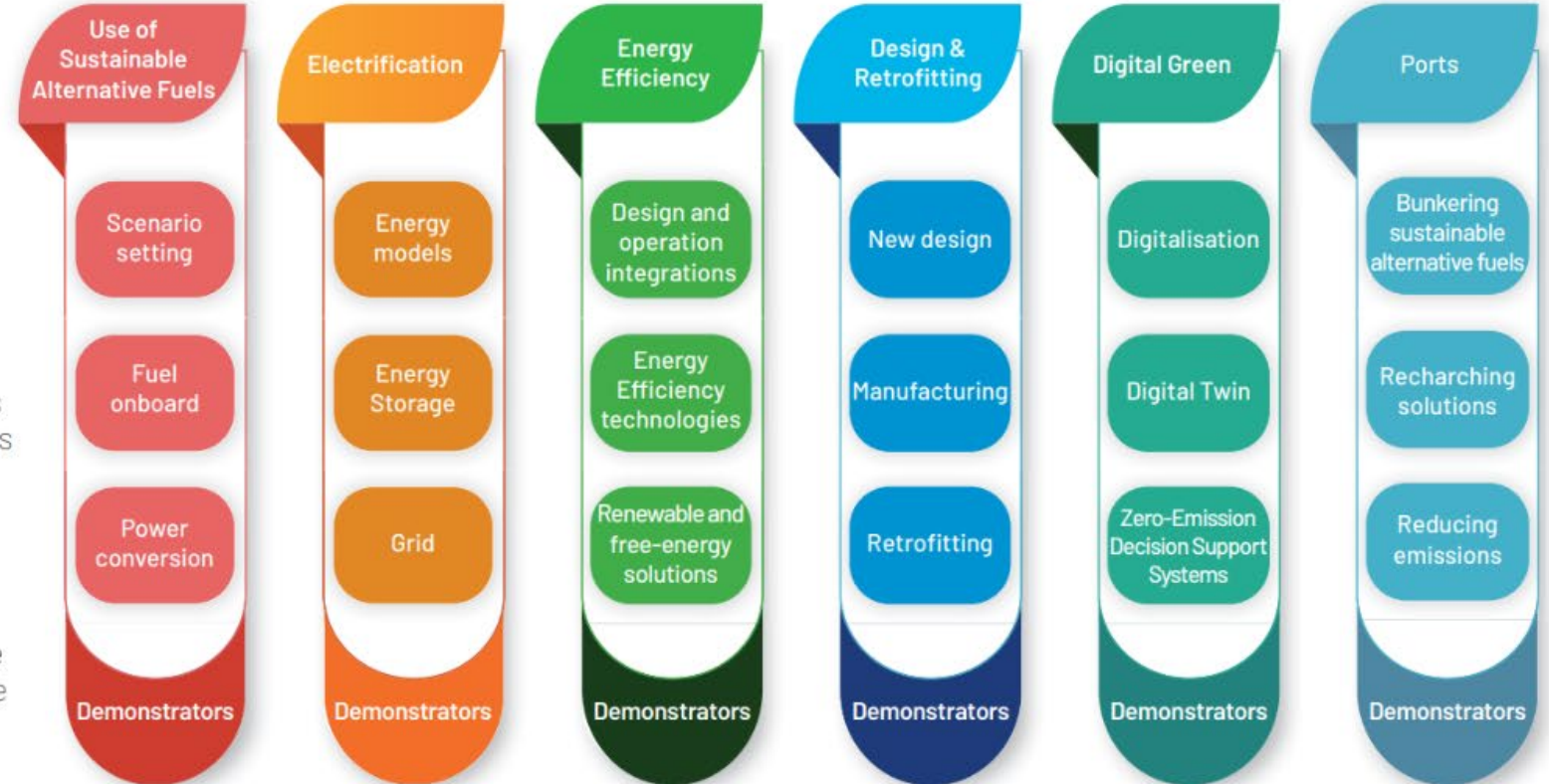


## Activities

The technical content of this strategic research and innovation agenda is divided into six parallel activities. These activities are:

- Use of Sustainable Alternative Fuels<sup>30</sup>
- Electrification
- Energy Efficiency
- Design and Retrofitting
- Digital green
- Ports

The relationship between the Partnership's objectives and these Activities has been explained in the previous sections. In the next section, a brief presentation of each of the 6 activities and related sub activities will be given, with a description including the relevance concerning the Partnership's operational objectives and the innovative aspects with respect to the current state-of-the-art. Moreover, an overview of the proposed topics for the first 2 years of Horizon Europe (short-term) is provided.



# People at the Heart of Transformation



Evolving skills for digitalised & decarbonised shipping.



Competence needed for alternative fuels & new technologies.



Safety culture remains essential to avoid emerging risks.



Crew welfare and readiness are key IMO/ILO priorities.

# Technology as Enabler and Disruptor



- **Energy Saving Devices**

- **Wind Assisted Propulsion**

- **Fuel Cells**

- **Human Factor/Element**

- **Hybrid Electrical Power Systems**

- **Long term Metocean conditions** and Climate change impact on things like:

- review of Hull design,
- Wave height assessment
- Cargo carriage challenges
- Passenger ship windows

- **CCS and CCUS**

- **Digital transformation, Digital Twins, AI applications**

Growth in autonomy, AI, digital twins, and advanced testing.

Alternative fuel systems introduce new risks.

Human-machine interface challenges increasing.

Technology outpaces regulatory adaptation.

- **Additive Manufacturing and its effect of ships structure and containment systems**

# Regulation as Guardrail for Innovation

IMO & EU  
frameworks  
expanding  
rapidly.

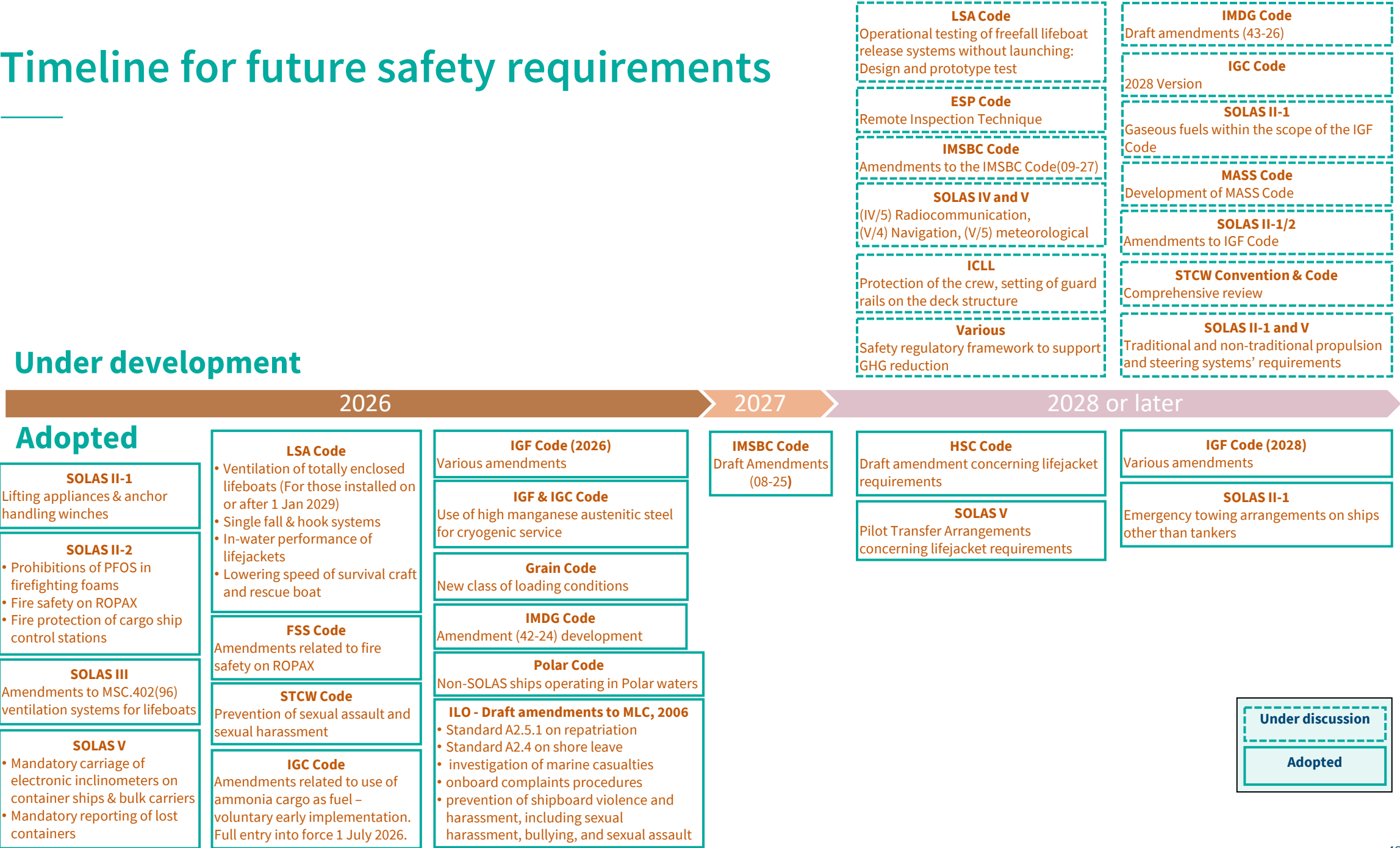
Compliance  
pressure can  
accelerate or  
delay innovation.

Global alignment  
remains difficult  
but essential.

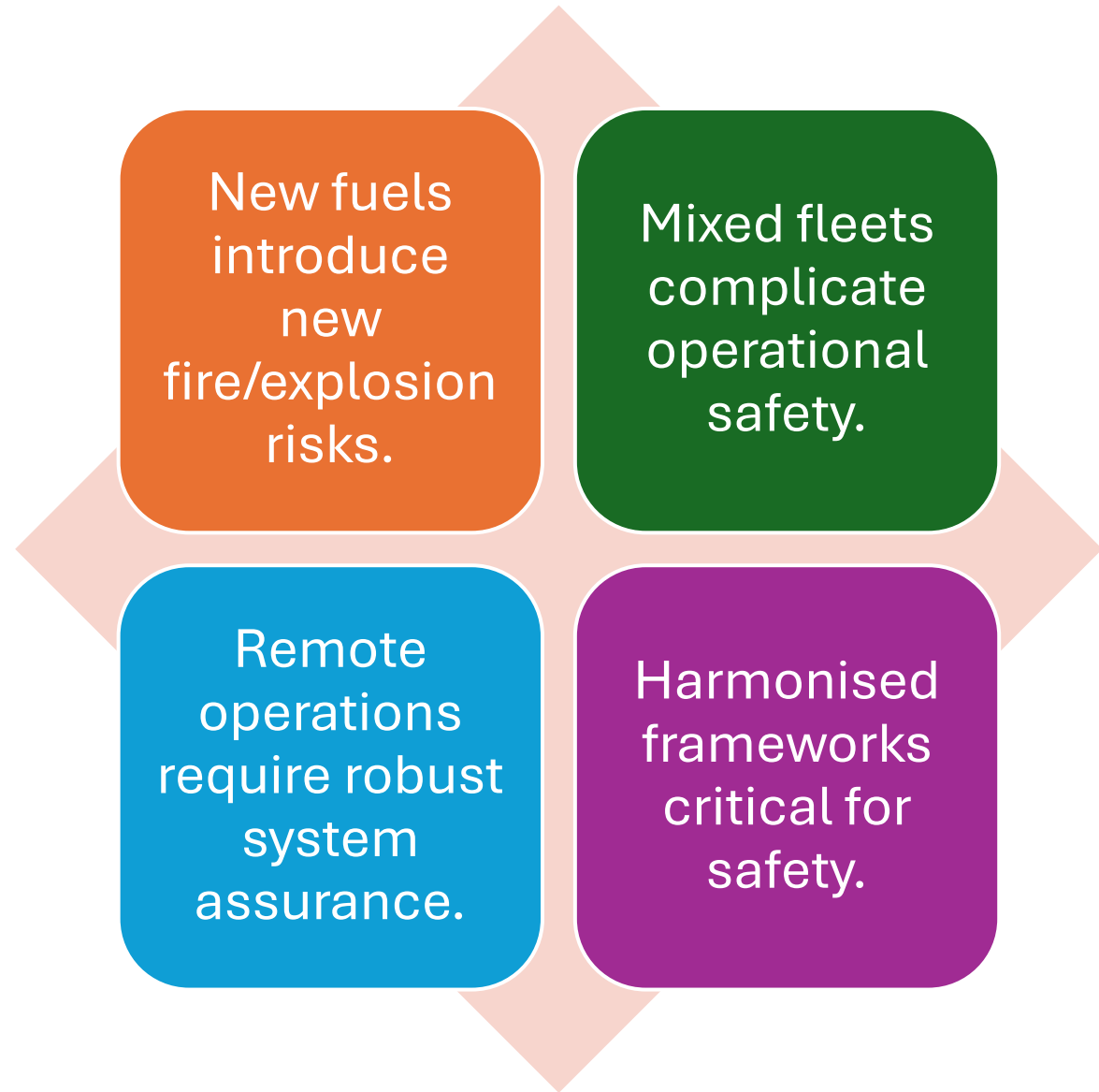
LR supports  
interpretation and  
implementation  
of new rules.

# Timeline for future safety requirements

## Under development



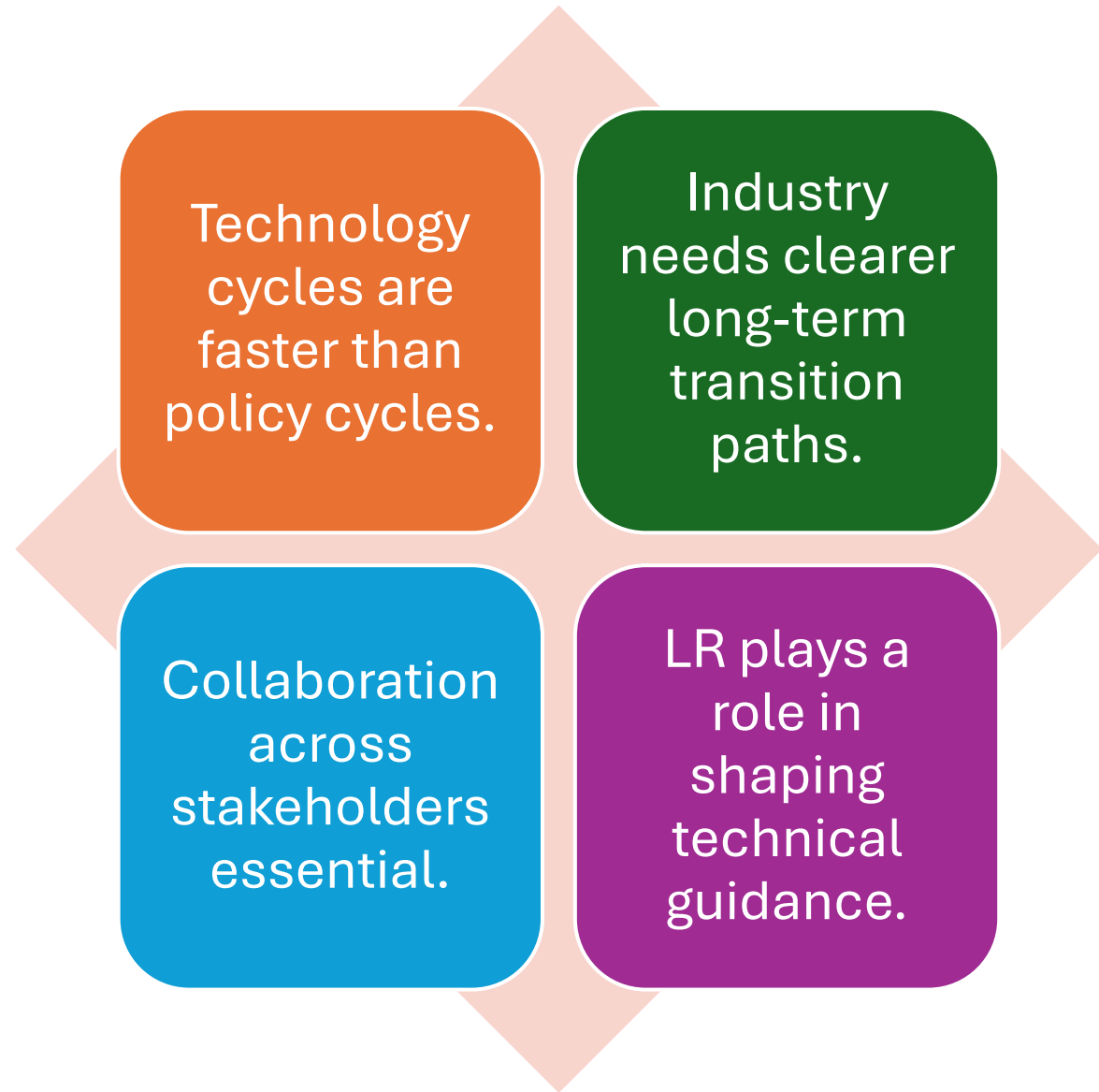
# Safety Implications of Change



# Safe and acceptable innovative technology induction



# Bridging the Innovation–Regulation Gap



# Energy Saving Devices - Overview



Energy saving devices (ESDs) have emerged as innovative technologies designed to enhance ships' efficiency, optimize fuel consumption, and improve their emission profile. ESDs are mainly designed to:

- ✓ Generate renewable energy to power and propel the ship such as solar and wind energy
- ✓ Minimize hull frictional resistance through innovative coatings and optimised hull designs
- ✓ Enhance propellers' performance by conditioning the hydrodynamic flow in the stern area
- ✓ Directly optimise or integrate energy-efficiency technologies, such as waste heat recovery systems, to optimise the performance of existing subsystems
- ✓ Improve ships' operational profile by incorporating digital solutions and continuously monitoring ships' performance

## Renewable Energy Assisted Propulsion

- Rigid Sails
- Suction Wings
- Flettner Rotors
- Solar Panels

## Hull Resistance Reduction

- Hull Optimisation/Bulbous Bow
- Hull Coatings
- Air Lubrication Systems (ALS)
- Hull Fins/Vanes

## Propeller Flow Conditioning

### Propeller Optimisation

- Pre-Swirl Devices
  - Stator Fins
- Propeller Ducts
- Wale Equalizing Ducts

### Post-Swirl Devices

- PBCF
- Rudder Bulb/Fin

## Subsystems Modifications

- Waste Heat Recovery Systems (WHRS)/Organic Rankine Cycle (ORC)
  - Exhaust Gas Economiser
- Electric Lighting
- Shaft Generators (PTO/PTI)

## Other Technologies

- Battery Propulsion
- Carbon Capture Systems
- Auto Pilot Optimisation
- Performance Monitoring
- Route/Trim Optimisation

# Energy transition Fuel for thought® insights for alternative fuels



Fuel for thought® research programme - Award winning series of reports, videos, webinars and more on alternative fuels for maritime



Ammonia

Biofuel

Hydrogen

LNG

Methanol

Nuclear

Electric

LPG

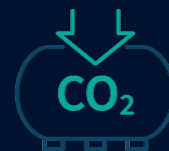
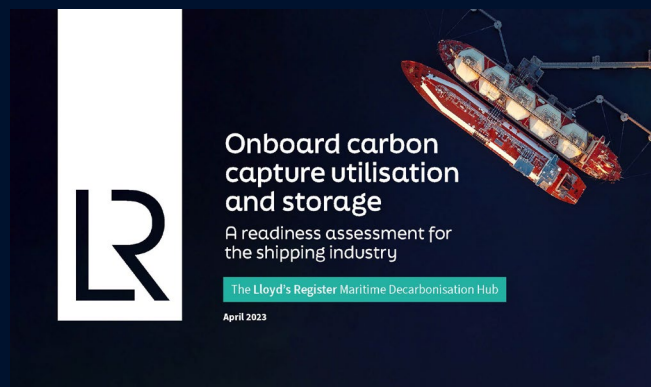


[lr.org/fuelforthought](https://lr.org/fuelforthought)



# Energy transition: insights for retrofits-

## Retrofit Research Programme



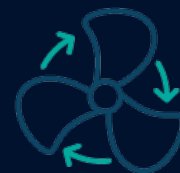
Carbon Capture



Engine retrofit



Hull enhancements



Propeller



Wind- Propulsion



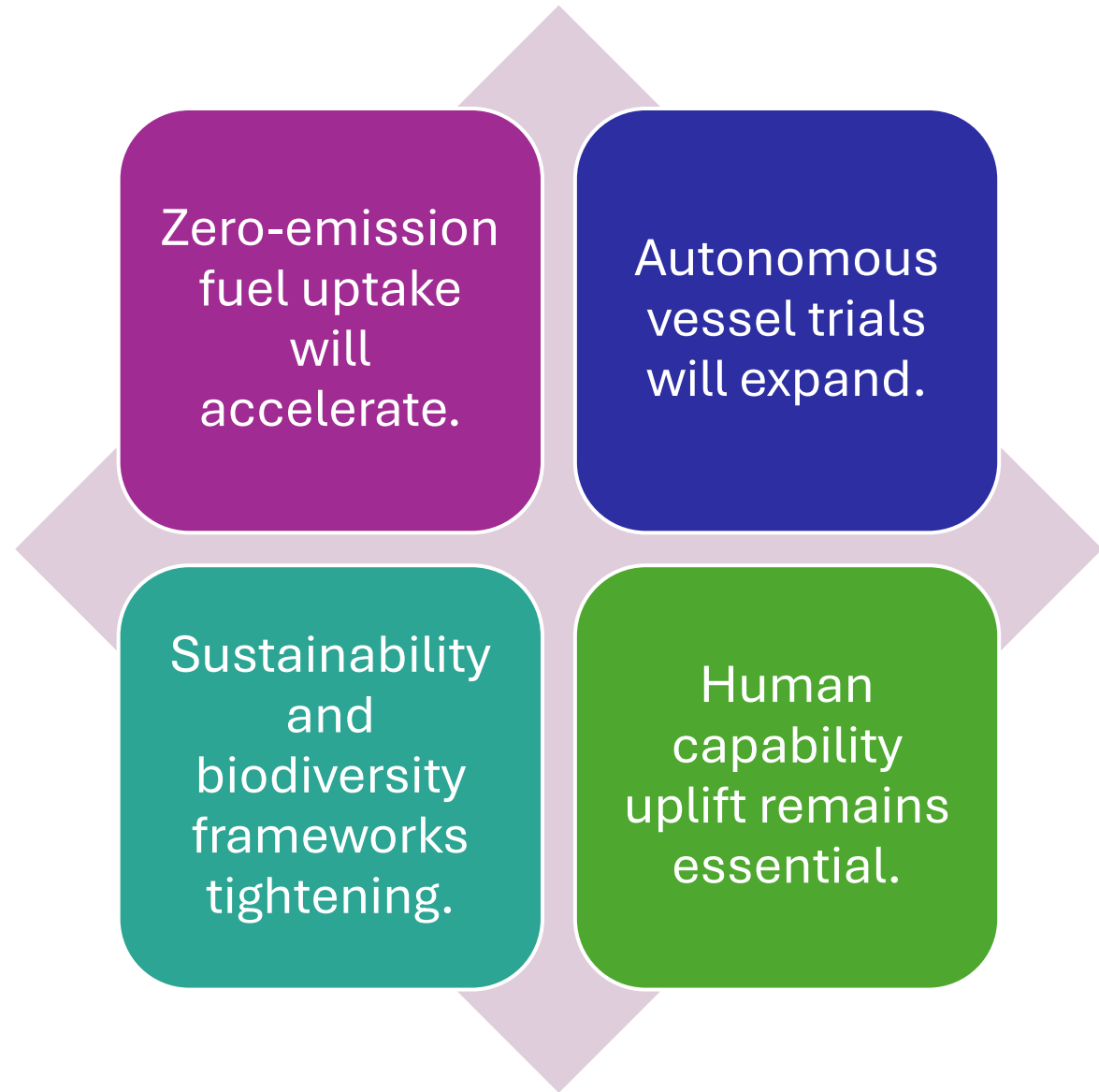
[lr.org/RRP](https://lr.org/RRP)



Retrofit Research Programme



# Preparing for 2030 and Beyond



# Today's Reality ...

## Ships

Electronic Chart Display Information System (ECDIS)  
Autopilot (soon with collision avoidance capability?)  
Automatic Identification Systems (AIS)  
Electronically Controlled Engines  
Power and Energy Management Systems  
Information Technology and Operational Technology



## Satellite Navigation and Communications

Global Navigation Satellite Systems (GNSS)  
Satellite Broadband

## Offshore

Dynamic Positioning Systems (DP)  
Industrial Control Systems (ICS)

## Harbour / Operations

Vessel Traffic Services (VTS)  
Route Planning  
Maintenance Optimisation  
Remote Monitoring and Control Centres



introducing cyber threats

Information and Communications Technologies,  
(ICT) fully populate the maritime supply chain

# Digital Transformation



## Digital technologies



AI/Analytics



Automation



IoT



Virtual Reality



Digital Twin



Blockchain

## Key enablers



Digital strategy



Connectivity



Culture & Training



Cloud storage / Computing



Digitisation  
Standardization  
Integration

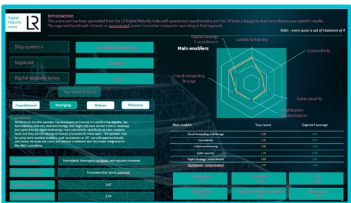


Cyber security



Quality Data

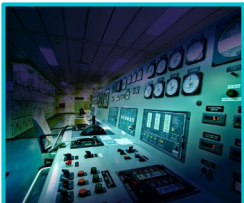
## LR solutions



Benchmarking digital maturity



Ship and Shore management tools from OneOcean



Human centered design; ergonomics; alarm management etc.



New Rules approaches developed by our Technical Directorate



Supported by collaborative research funded by LRF

# Enabling digitalisation



[lr.org/dtrp](https://lr.org/dtrp)

Digital Transformation Research Programme

## The Balanced Path Forward

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- Innovation must coexist with safety and compliance.
- Alignment between humans, technology, and rules is critical.
- LR provides technical authority and assurance.
- Sector success depends on integrated decision-making.





# Thank you

**Claudene Sharp-Patel, Lloyd's Register**

Global Technical Director, Marine and Offshore

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Lloyd's Register, Global Technology Centre, Hampshire  
House, Hampshire Corporate Park, Southampton SO53 3RY



# **Beyond Cleaner Seas: Putting People at the Heart of Maritime Innovation**

**Clean Maritime Assembly**

**June 2026**

**Prof. Catriona Savage**

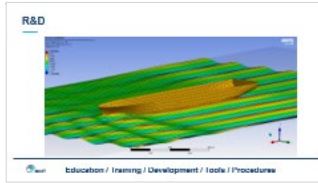
# Introduction



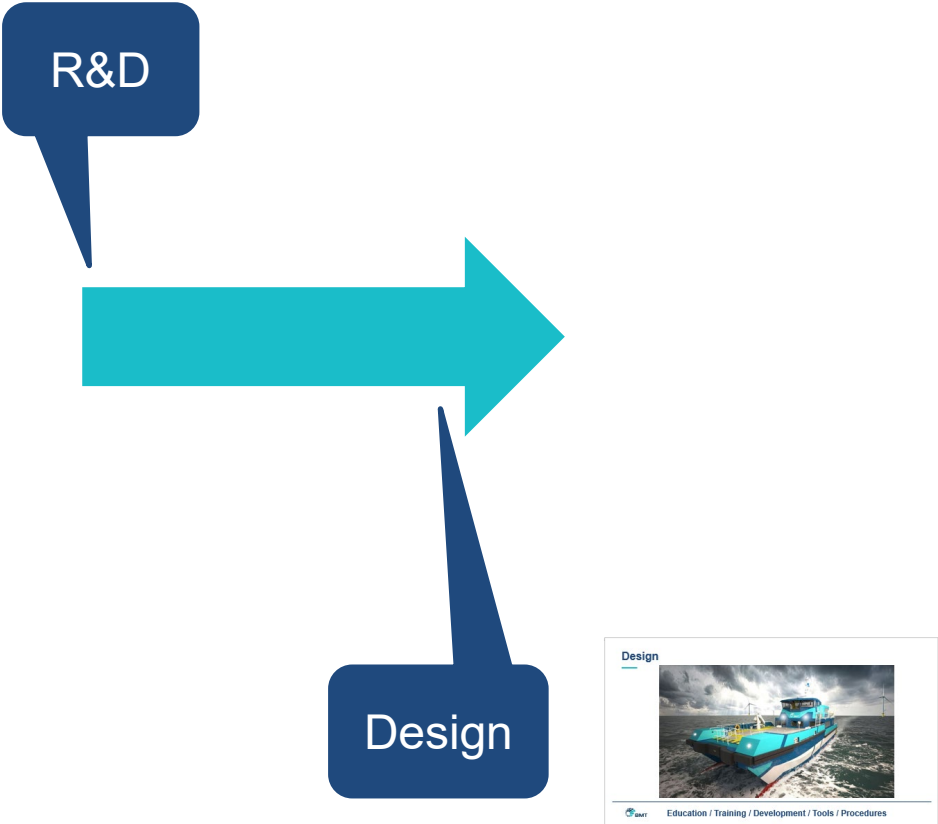
# Vessel / Technology Timeline

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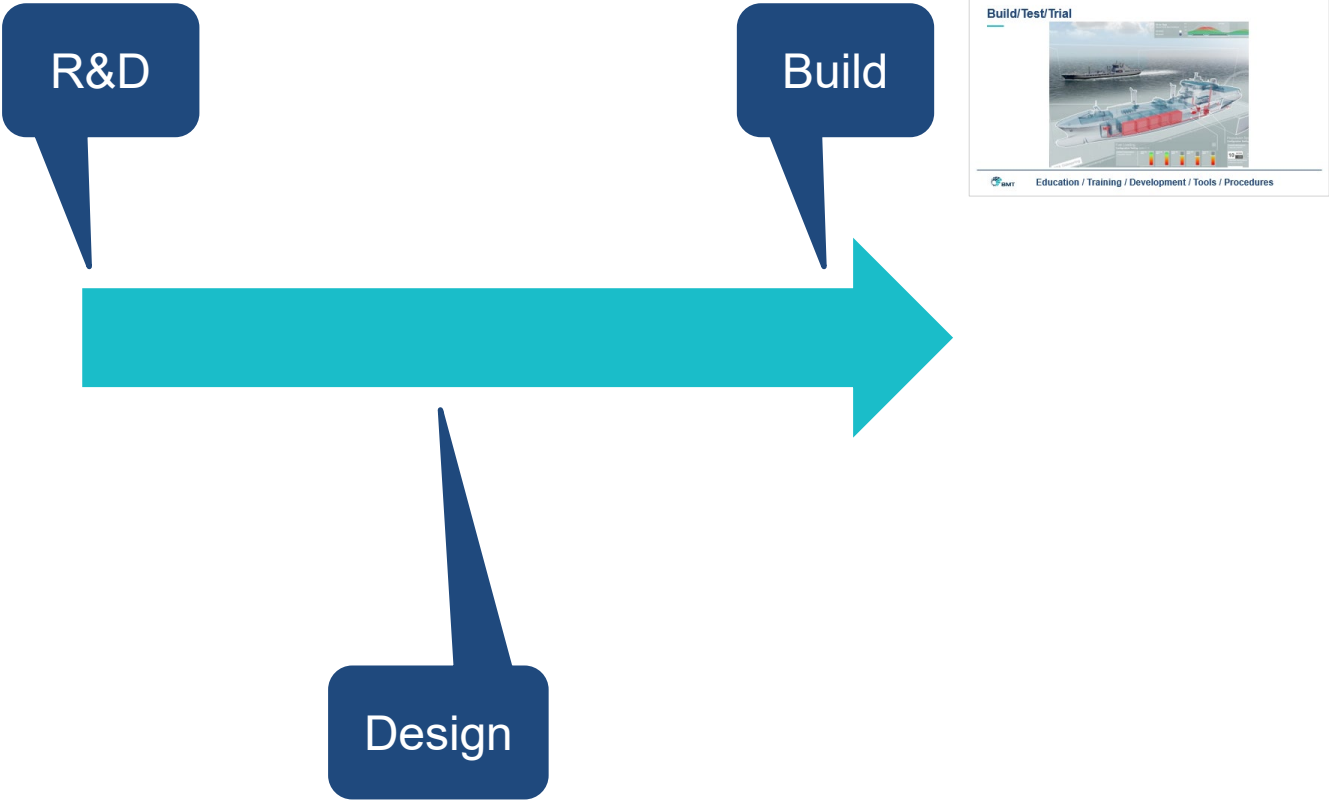
R&D



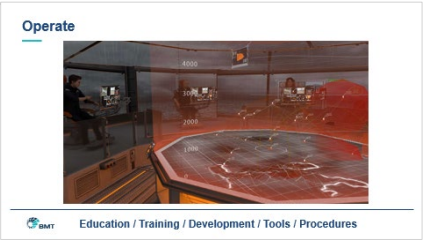
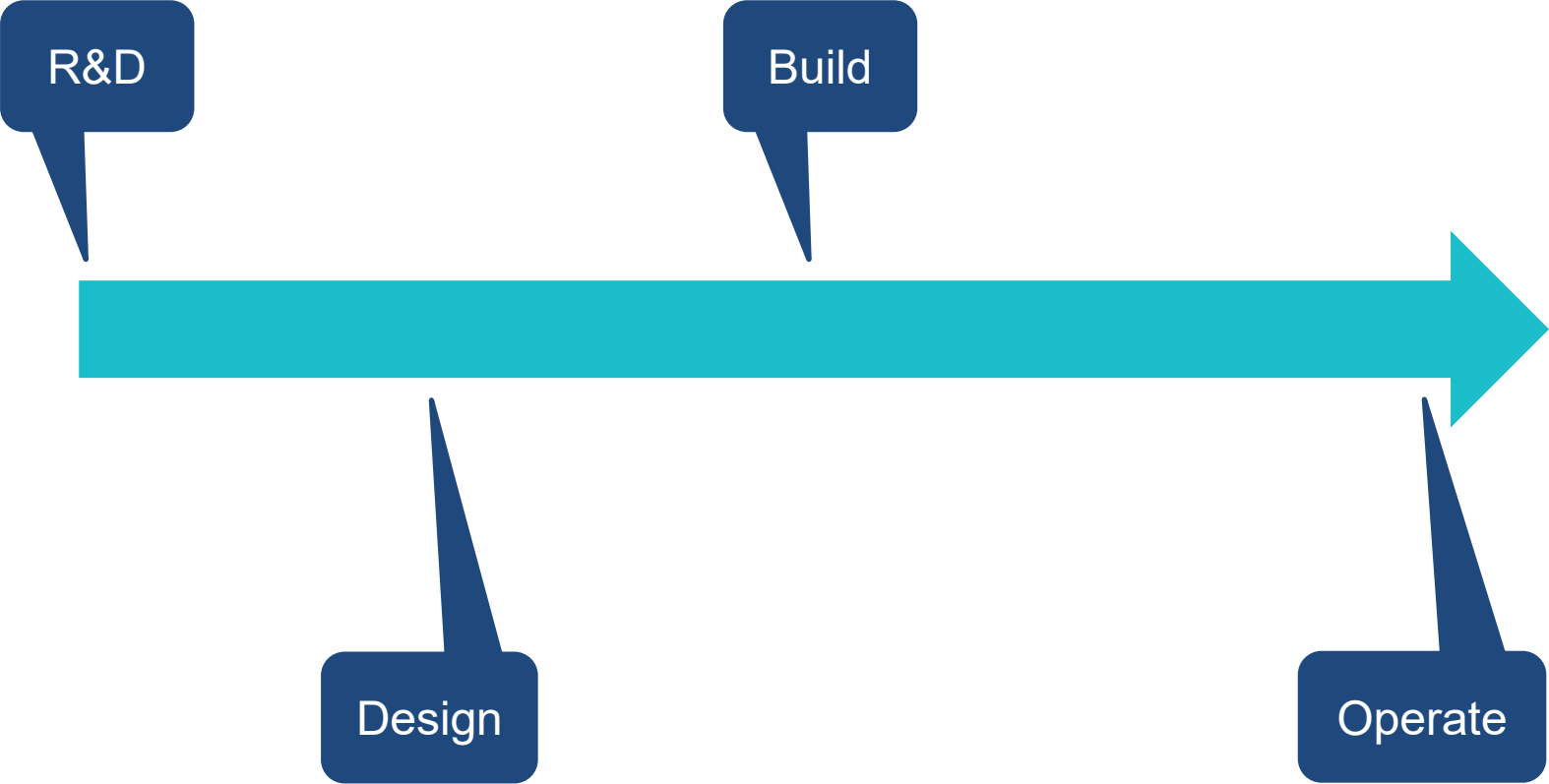
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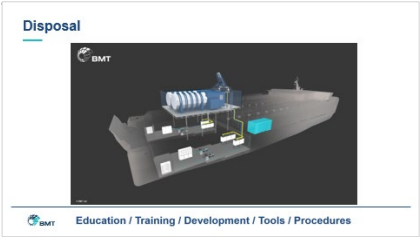
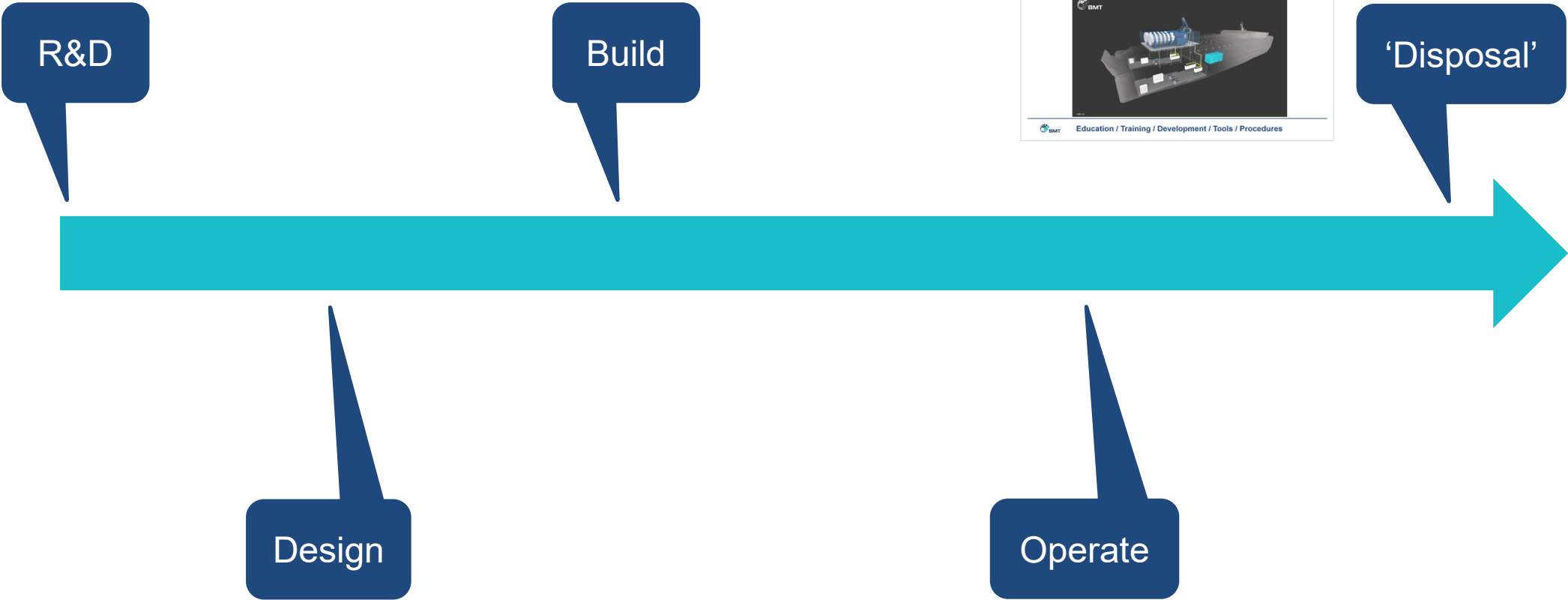
# Vessel / Technology Timeline



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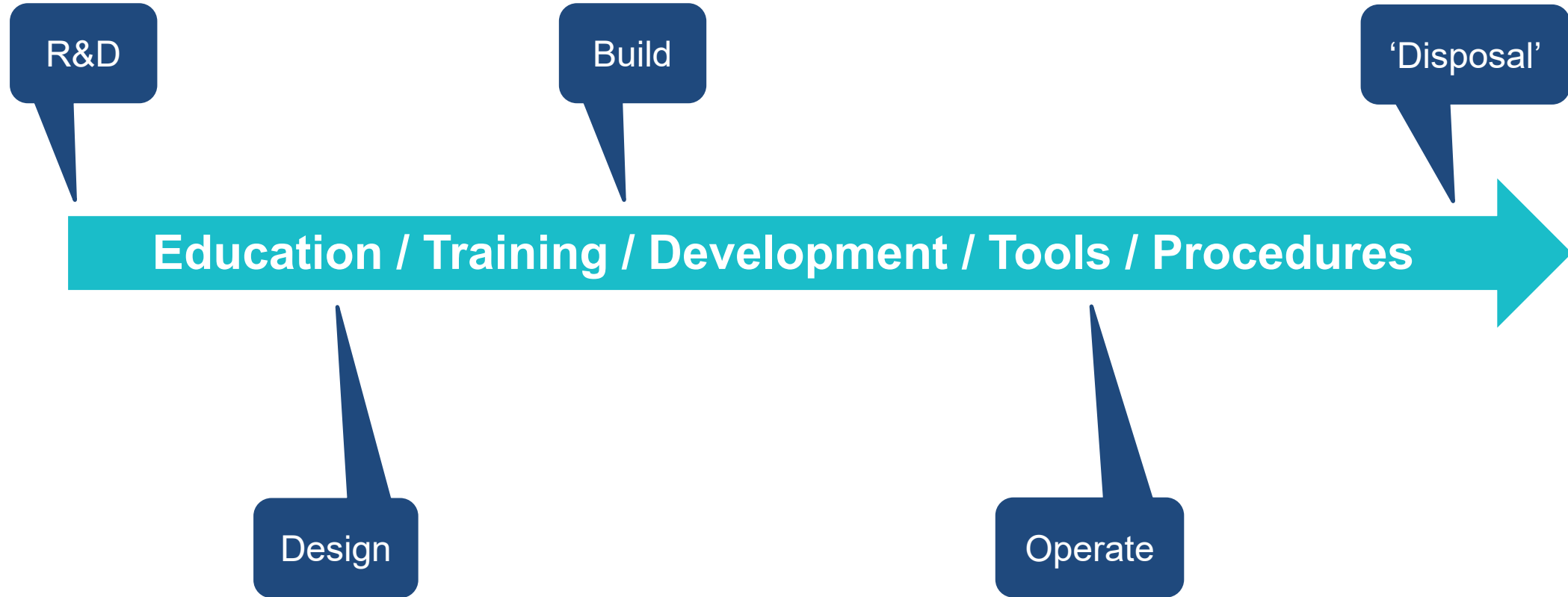


# Vessel / Technology Timeline

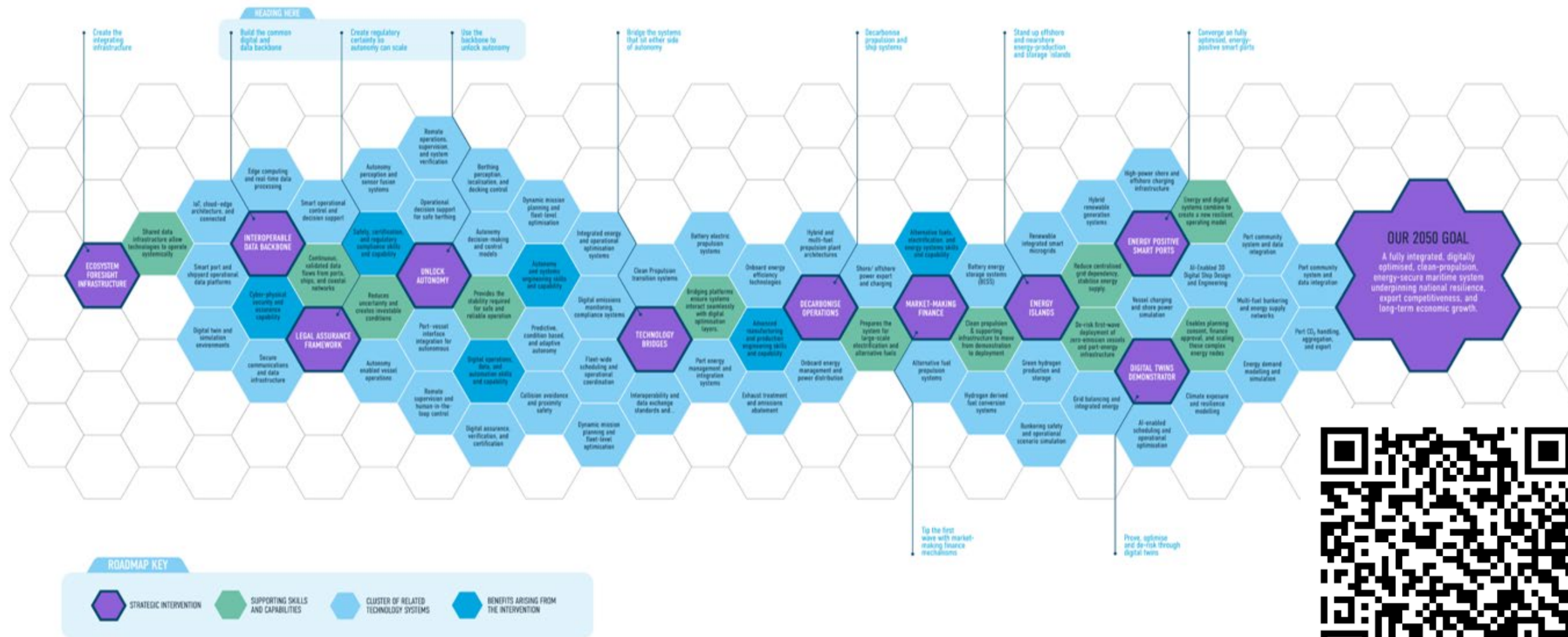


# Vessel / Technology Timeline

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# Roadmap at a glance



# The Roadmap Participants



National Shipbuilding Office



Department for Transport



Maritime and Coastguard Agency



Department for Business & Trade



uk defence solutions centre



Scottish Government  
Riaghaltas na h-Alba  
gov.scot



THE CROWN ESTATE



Babcock

BAE SYSTEMS



BMT



Lloyd's Register

QINETIQ



STRATEGIC DIRECTION  
— MARITIME —



UK CHAMBER  
of SHIPPING



Scottish Enterprise



MERSEY  
MARITIME



SCOTTISH  
MARITIME  
CLUSTER



CATAPULT  
Connected Places



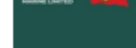
Walker Subsea  
Engineering • Design • Consultancy



MSE  
INTERNATIONAL



National Oceanography  
Centre



THE ROYAL  
INSTITUTION  
OF NAVAL  
ARCHITECTS



# The Role of Professional Engineering Institutions



Professional Development

Mentoring

Thought Leadership

Knowledge Sharing

Networking

Education and Training

Discussion Groups

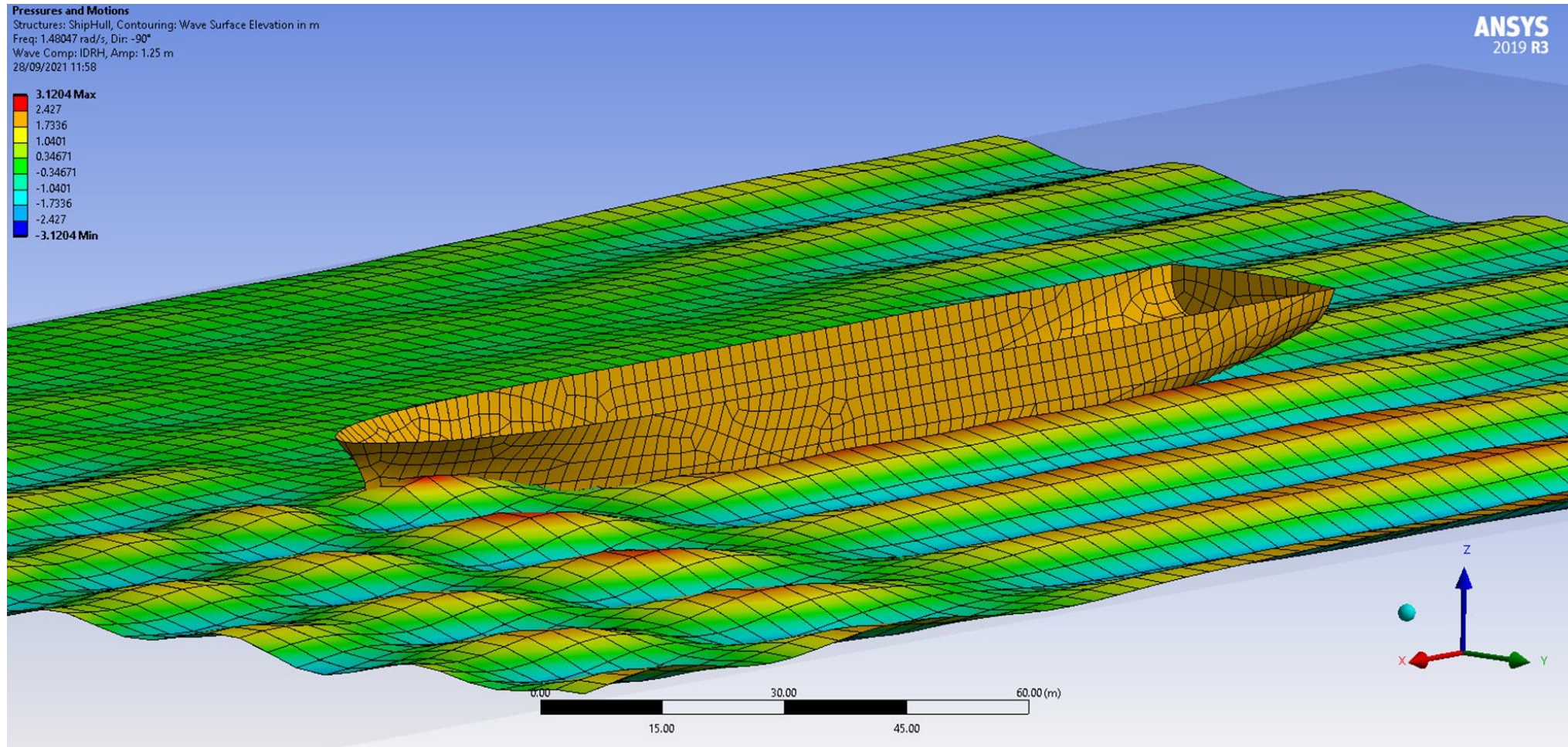
Webinars





# Thank you

Any questions or queries please email me at:  
[Catriona.Savage@uk.bmt.org](mailto:Catriona.Savage@uk.bmt.org)



# Design

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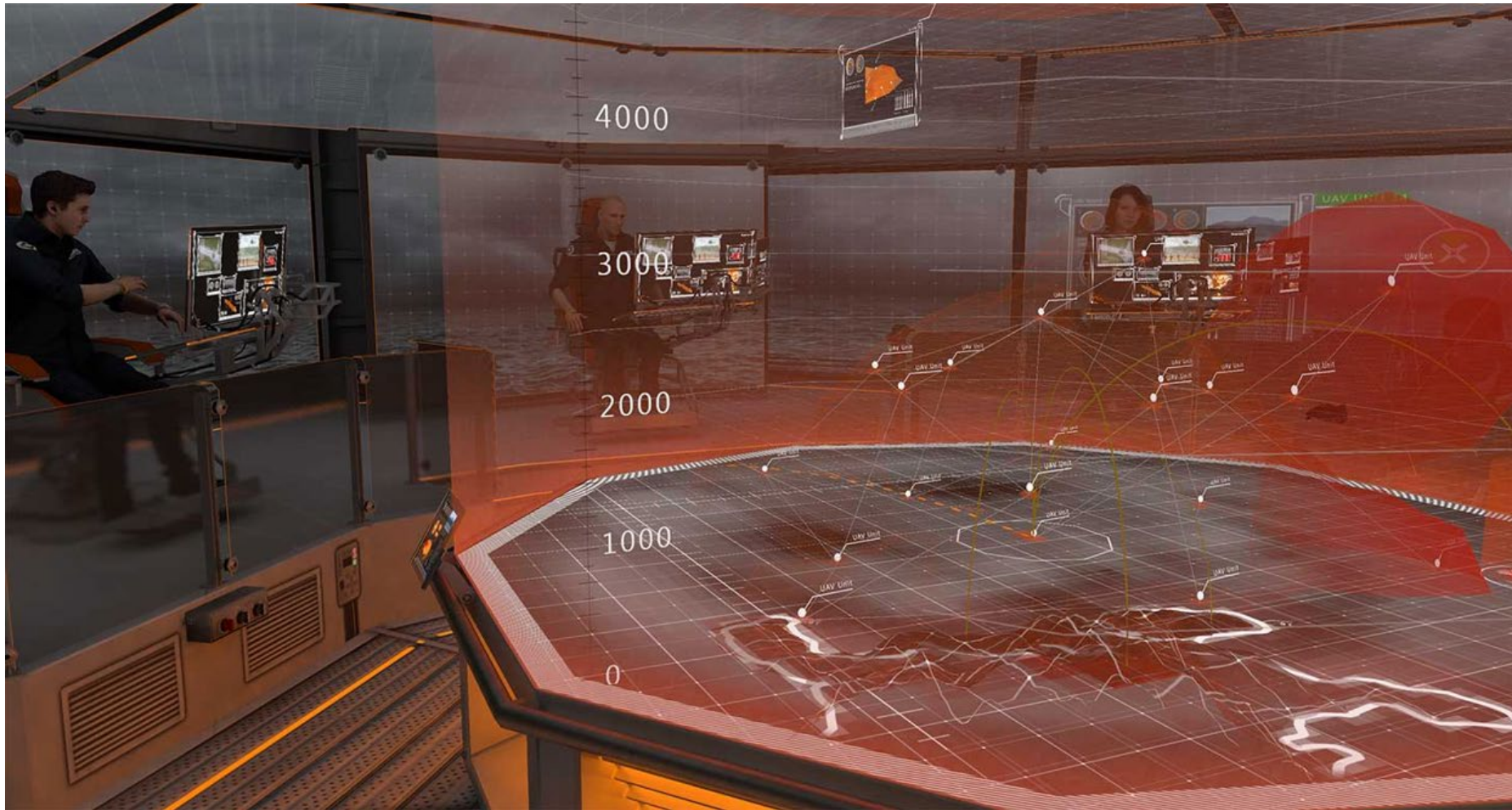


# Build/Test/Trial



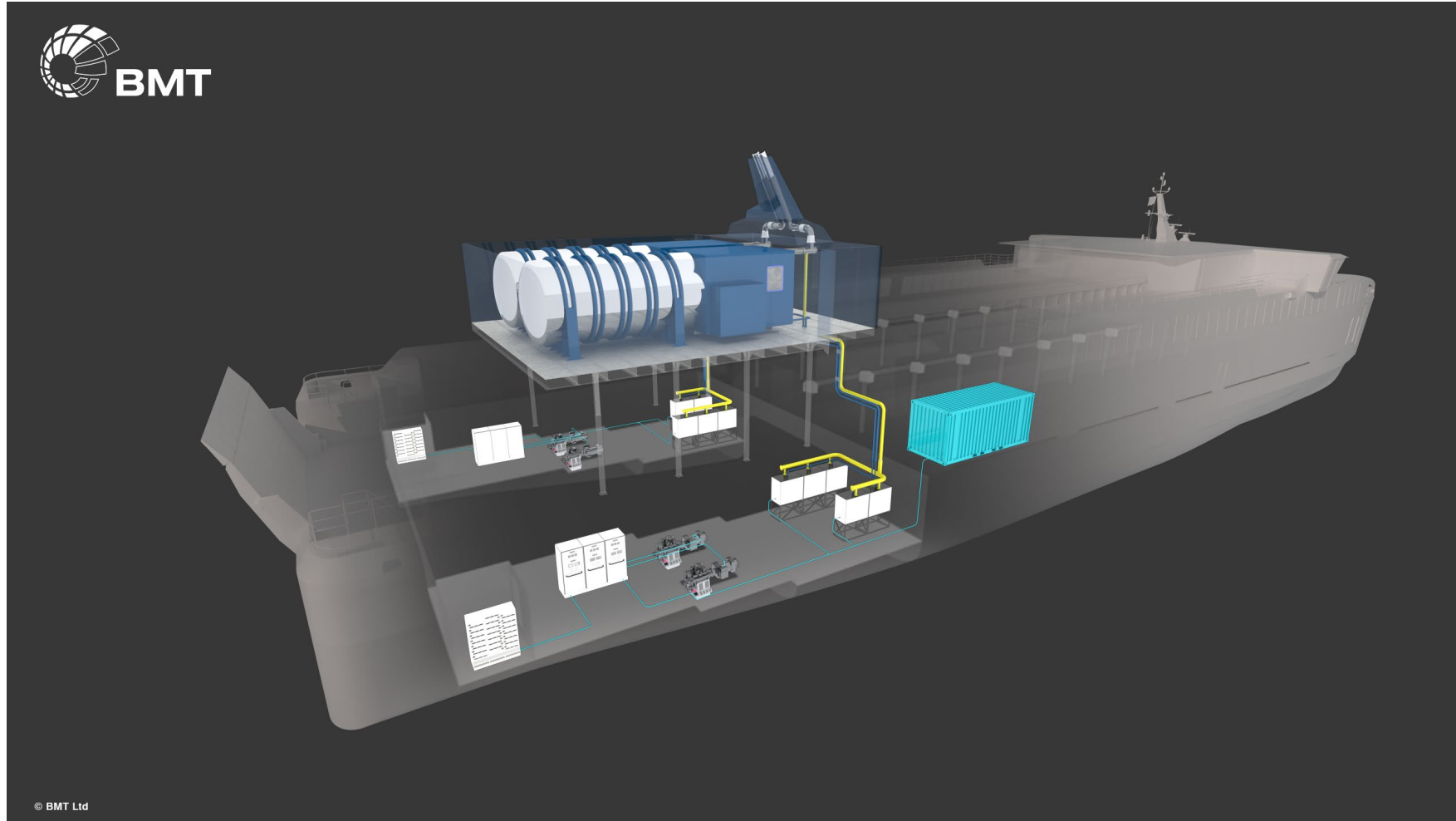
# Operate

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# Disposal

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# Thank You

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Engineering and  
Physical Sciences  
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Funded by  
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