



WHEN TRUST MATTERS

TRENDS IN VESSEL TECHNOLOGY

Are we building for the future?



36th Annual International Research Ship Operators (IRSO) meeting; Bergen, Norway.

24 September 2025

Framing of the presentation

Goal

Analyse where global maritime fleet breakthrough technologies are trending towards; and challenge ourselves to think on which ones will apply on future Research Vessels.

Let's think out of the box:

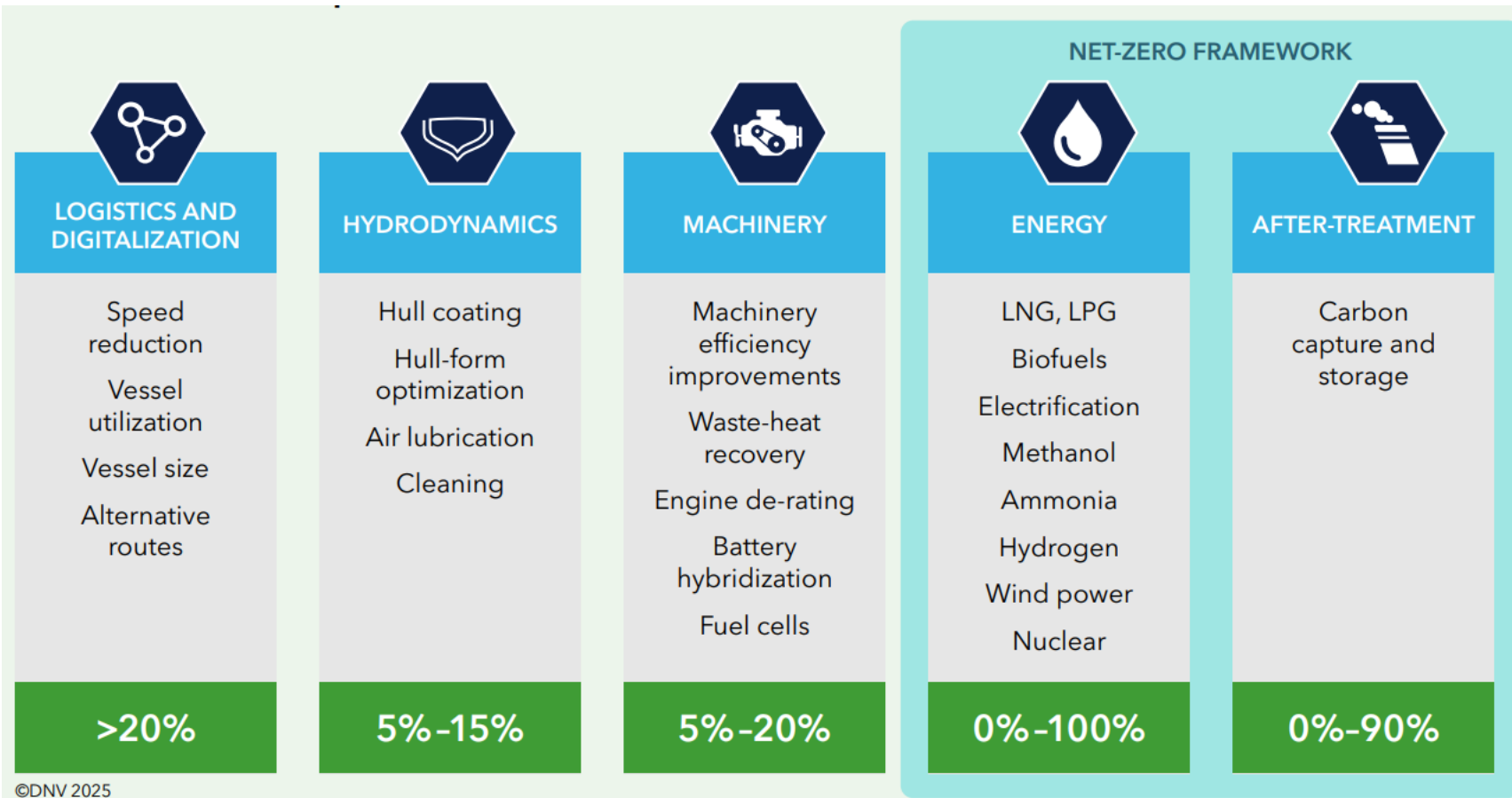
Will ships designed and built today remain viable and sustainable for decades to come?

Focus on newbuildings

The RV Fleet ([Marine Research Infrastructures Database](#))

The Global Fleet ([Bespoke Maritime Data Services | S&P Global](#))

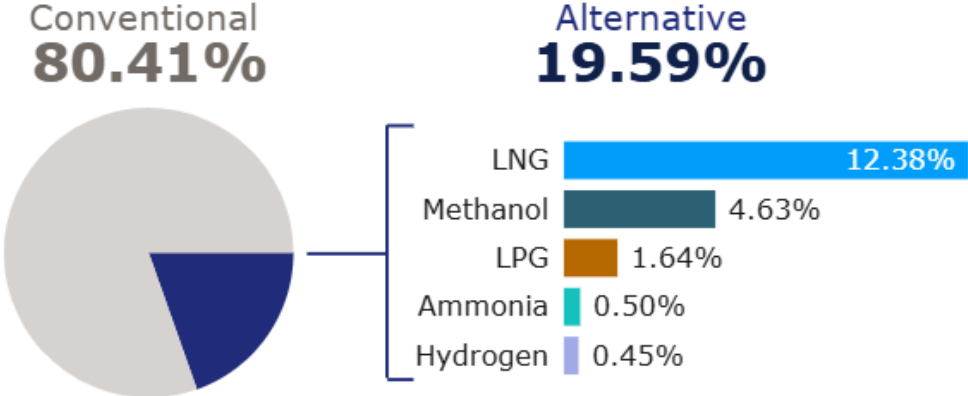
Global maritime fleet: technology trend snapshot



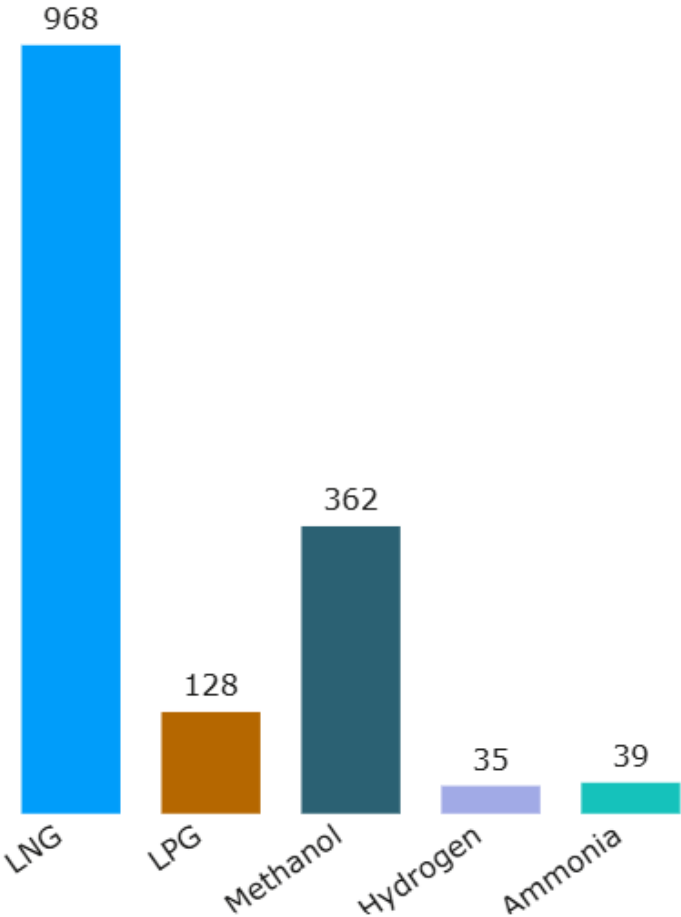
Decarbonization solutions that contribute to reducing a ship's energy consumption and emissions from energy use

Global maritime fleet: technology trend snapshot

On order



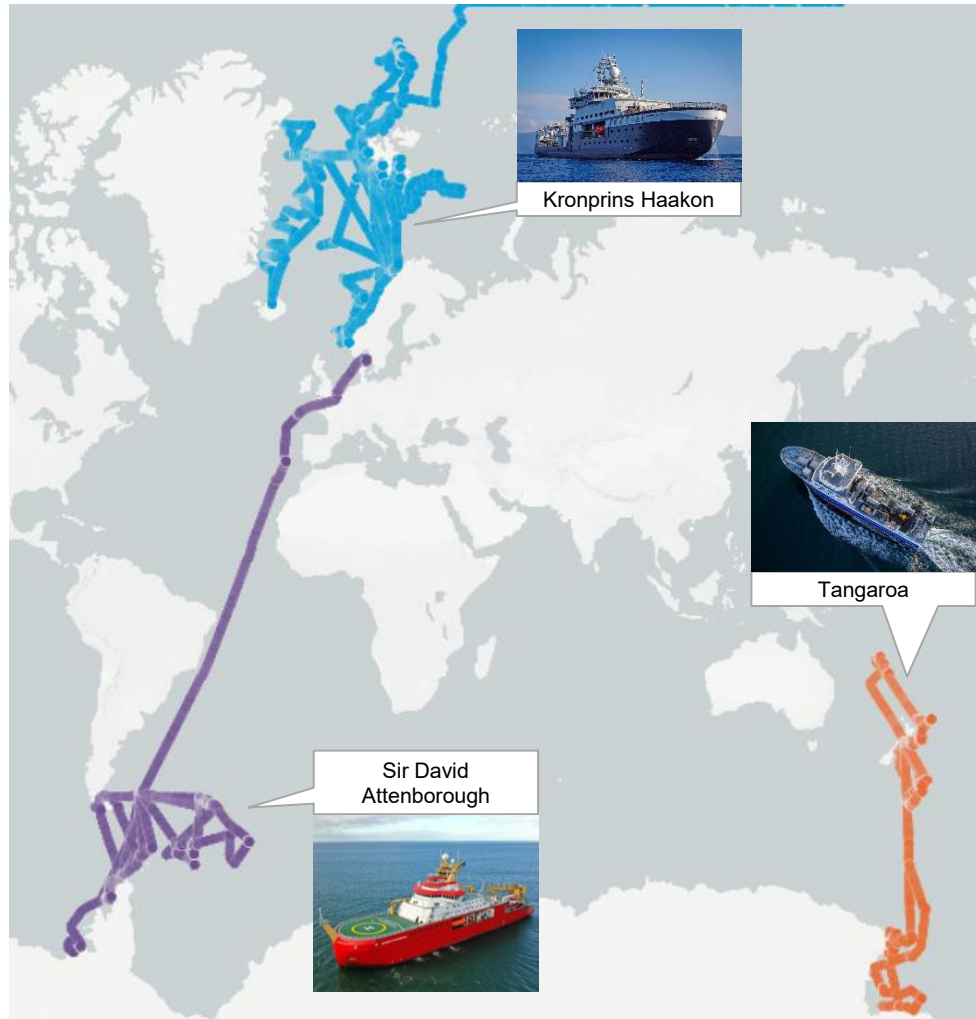
Number of vessels by fuel type



Global Maritime Fleet Orderbook (merchant): conventional vs alternative fuels

Data plays a key role: improving future performance is possible

AIS Positions of selected Research Vessels, 2025 YTD



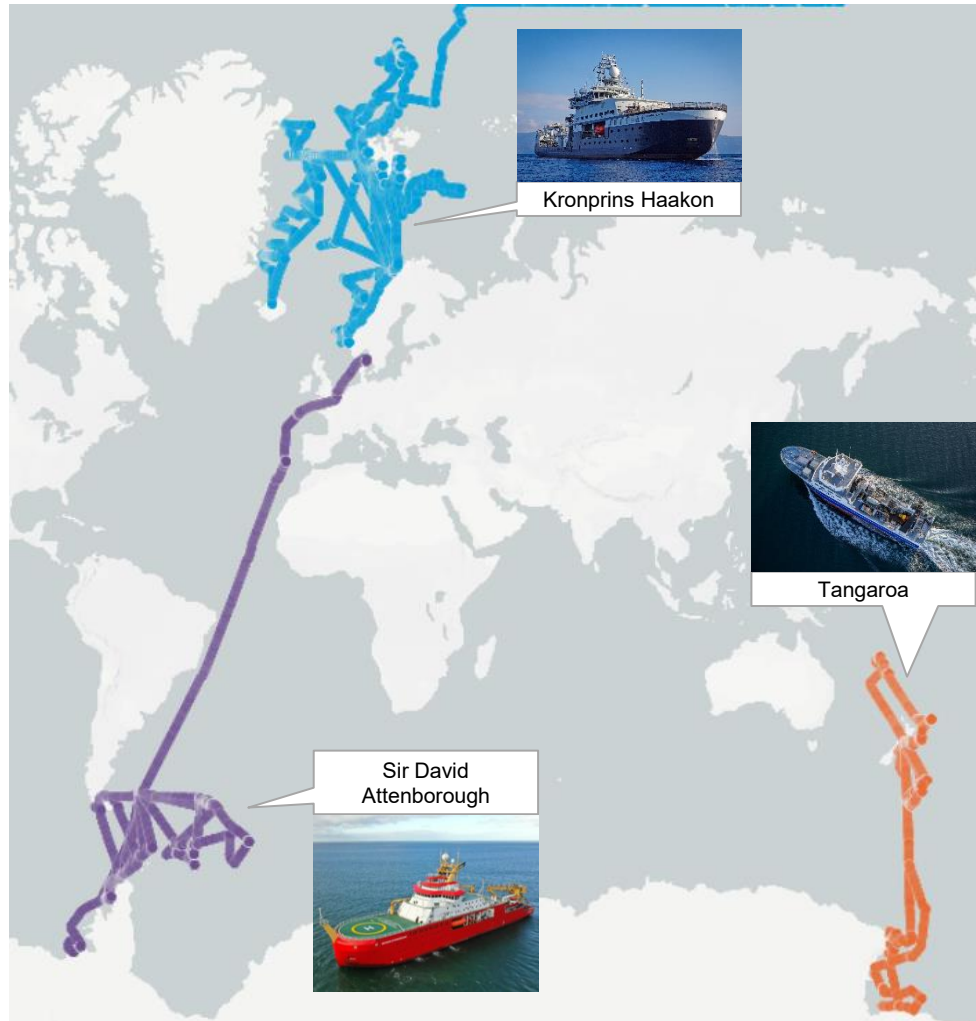
Kronprins Haakon, 9,145 GT, 100m x 21m, built 2017, DNV class and operated by the Norwegian Institute of Marine Research

RRS Sir David Attenborough, 15,609 GT, 129m x 24m, built 2021, LR class and operated by the British Antarctic Survey

Tangaroa, 2,291 GT, 70m x 14m, built 1991, DNV class and operated by the National Institute of Water and Atmospheric Research

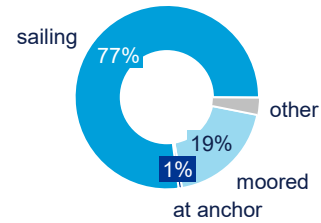
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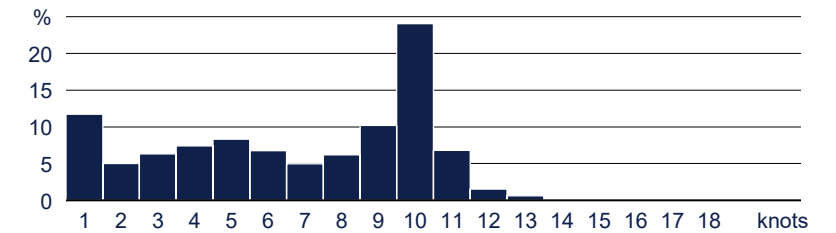


Kronprins Haakon

Navigational Status (% of time)

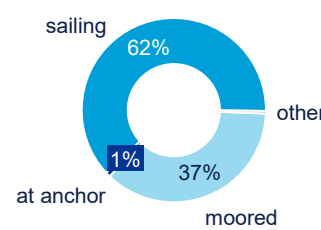


Speed profile (% of time per knots in sailing mode)

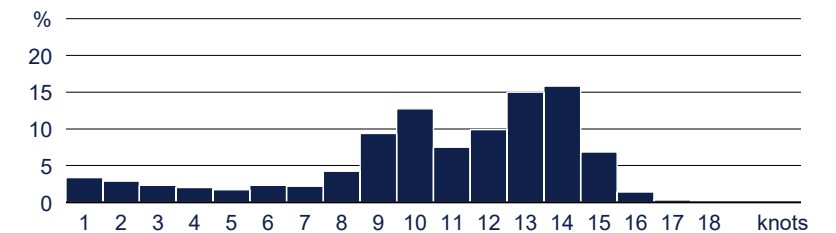


RRS Sir David Attenborough

Navigational Status (% of time)

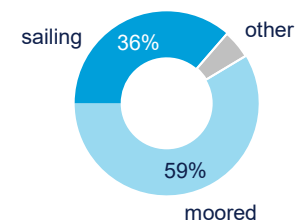


Speed profile (% of time per knots in sailing mode)

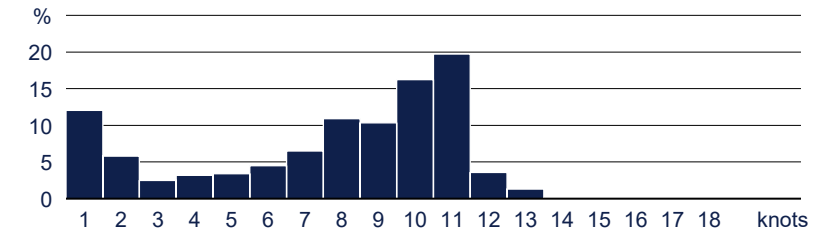


Tangaroa

Navigational Status (% of time)



Speed profile (% of time per knots in sailing mode)



Drivers of change

Unprecedented Transformation in Maritime Shipping

The "comparative effect" and the impact of commercial shipping developments challenges the current status quo on oceanographic research vessel design and operation (e.g. fuel prices, shipyards slot availability, hiring specialist staff...)

Lifespan for modern RVs is 20 to 25 years; are we sure?

Evolving Scientific Missions

Longer deployment, deeper ocean access, new scientific equipment and multi-disciplinary capabilities for advanced scientific missions...

Environmental Regulations

Increasing environmental and regulatory pressures: FuelEU, IMO NZF, Polar Code updates...

Operational Efficiency

Focusing on fuel savings, modular retrofits, and maintenance to manage lifecycle costs effectively.

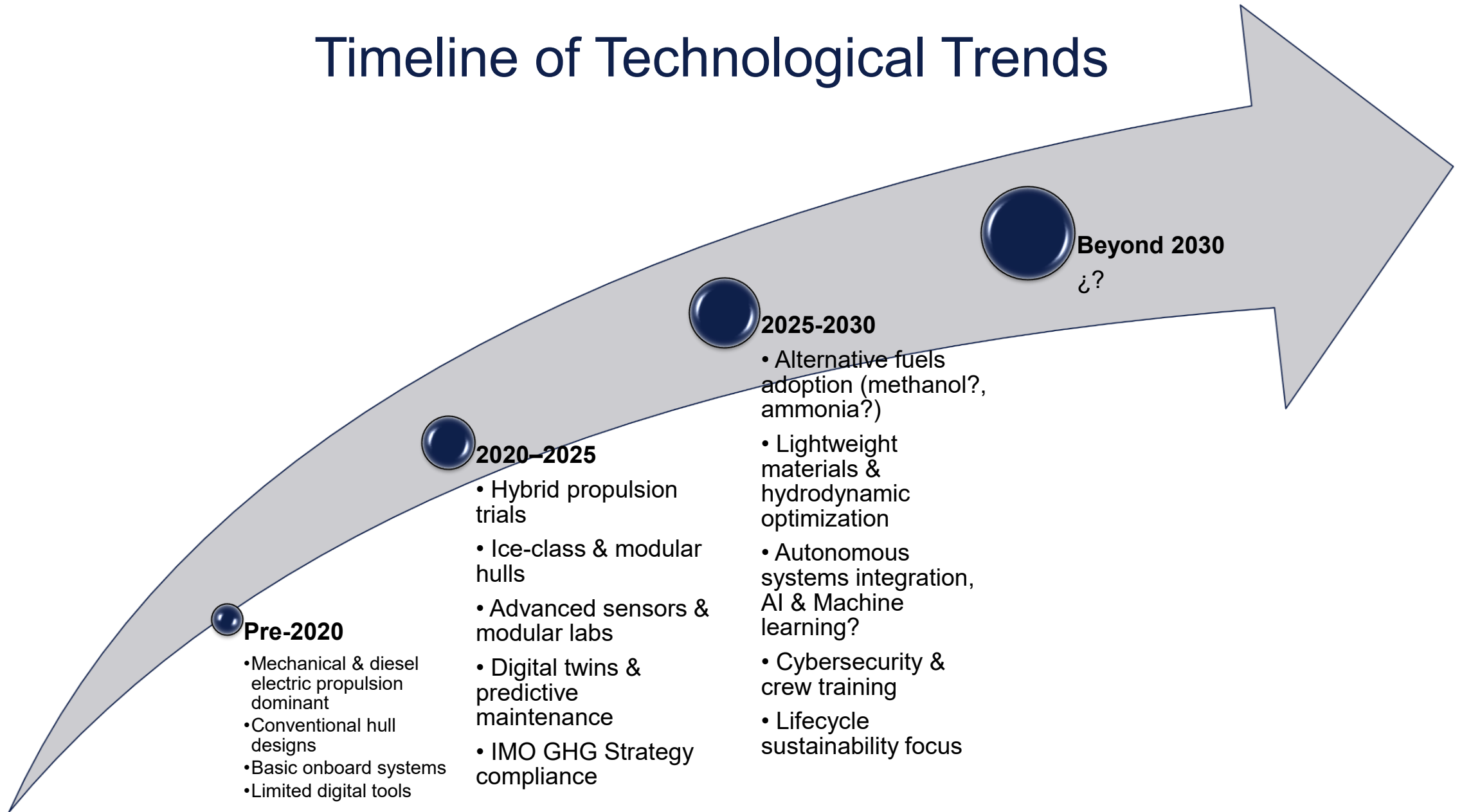
Geopolitical shifts and evolving social challenges

Growing environmental and social awareness, geopolitics, planning for budgeting fluctuations over operational cycle, port infrastructure developments...

Accelerating growth in technology

The observed exponential nature of the rate of technological change in recent history: AI, game-changing semiconductor technologies, quantum computing, carbon capture and storage...

Timeline of Technological Trends



Trends on Propulsion & Energy Systems

Hybrid and Electric Propulsion

Hybrid and full-electric systems reduce vessel emissions and improve overall energy efficiency.

Alternative Fuels

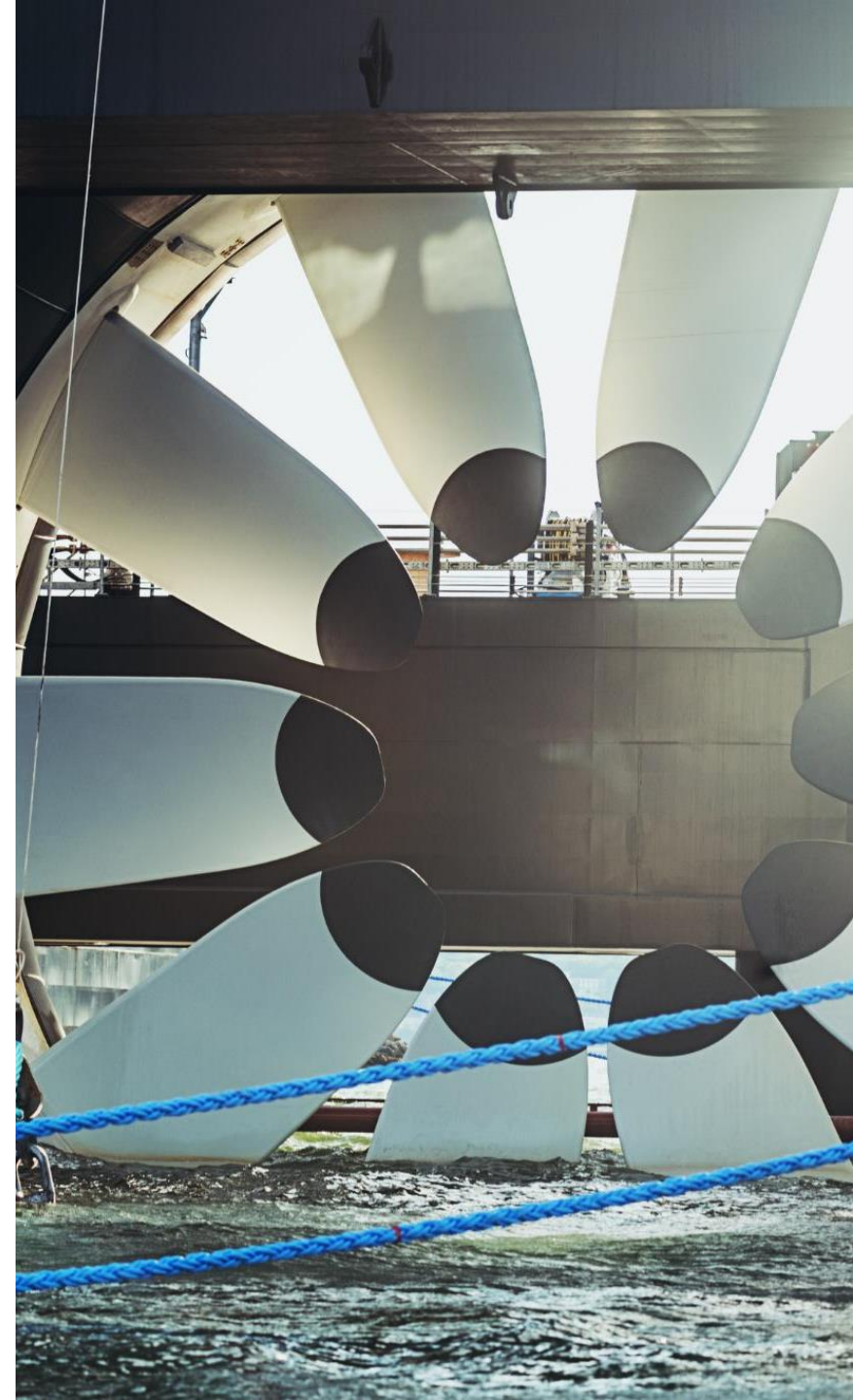
Methanol, ammonia, and hydrogen offer green fuel options but challenge safety and engine compatibility.

Energy Storage Solutions

Advanced batteries and fuel cells support zero-emission operations and increase energy resilience onboard.

Collaborative Transition Efforts

Cleaner propulsion development requires cooperation among suppliers, manufacturers, and regulators.



Trends on Hull & Structure

Increasing number of Ice-Class and Polar Class Designs

Ice-class hulls ensure structural integrity and thermal insulation for safe Arctic and Antarctic missions.

Lightweight & Recyclable Materials: hot topic

Advanced composites and high-strength steels reduce weight, improve fuel efficiency, and enhance manoeuvrability.

High demand of Hydrodynamic Optimization

Refined hull shapes and appendages increase vessel speed and stability through hydrodynamic efficiency.

Modular Designs

Modular designs enable mission-specific retrofits, allowing vessels to adapt without major overhauls.



“It is not about the picture; it is the concept behind the picture”

Trends on Onboard Systems & Scientific Infrastructure

Advanced Sensor Integration

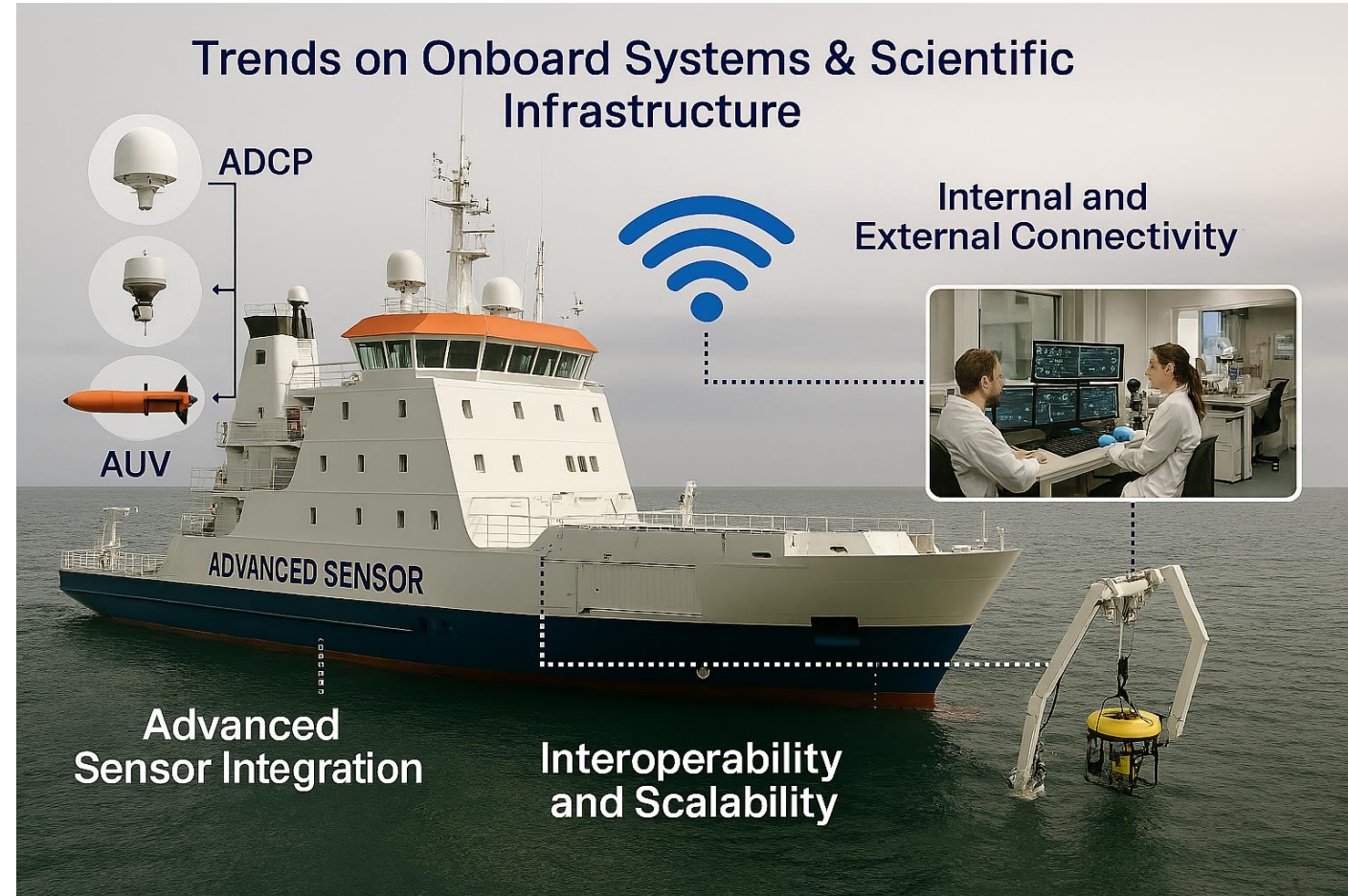
Integration of advanced sensors allows real-time monitoring, data analysis, and transmission during research operations.

Modular Labs & Flexible Decks

Modular laboratories and flexible deck layouts enable diverse research activities from marine biology to geophysics on board.

Interoperability and Scalability

Systems are designed for interoperability, scalability, and ease of maintenance to support evolving scientific needs.



“It is not about the picture; it is the concept behind the picture”



Digitalization; a must-have in every debate

Remote Monitoring and Predictive Maintenance

Sensors and analytics enable early issue detection to reduce downtime and lower maintenance costs.

Digital Twins for Asset Management

Virtual replicas help simulate performance and plan asset lifecycle effectively.

Autonomous and Remotely Operated Vehicles

ROVs and AUVs extend research capabilities while enhancing safety and efficiency.

Cybersecurity and Training

Robust cybersecurity, crew training, and regulation ensure safe autonomous system deployment.

Balancing innovation with operational reliability



Which best reflects our future scientific tasks?

Building future-ready vessels: This is already happening;



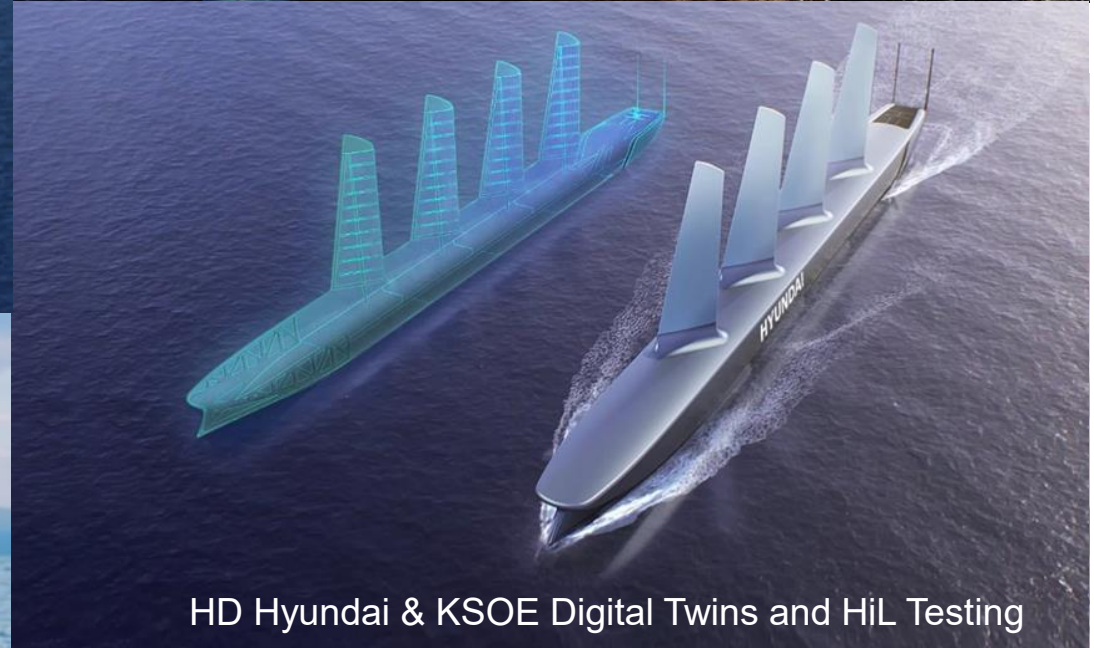
BUQUEBUS 130m catamaran - World's largest electric ferry (40MWh)



EARTH 300 Research Vessel



OCEAN INFINITY 78m - Remotely Supported OSV



HD Hyundai & KSOE Digital Twins and HiL Testing

Building future-ready vessels: This is already happening;



REACH REMOTE 1 - 24m Unmanned Survey Vessel



BIBBY OSV - 89.6m eCSOV (25MWh)

Building future-ready vessels: This is already happening;

Pictures Subject to Copyright

Building future-ready research vessels

Requires adaptability to Evolving Demands

Future vessels must integrate new technologies and meet changing scientific and environmental requirements.

@ DNV

Guiding innovation and compliance with evolving standards for research vessels with unique demands.

- ✓ SILENT notation for RVs complying with specified maximum underwater noise emission
- ✓ COMF notation for RVs complying with Habitability requirements to noise and vibrations onboard
- ✓ QUIET notation for RVs complying with requirements related to external airborne noise emission of vessels in port.
- ✓ WAPS notation for Wind Assisted Propulsion System
- ✓ AROS notation for Autonomous and Remotely Operated Ships
- ✓ OCCS notation for ships fitted with reduction of CO2 emissions to air by use of pre- or post- combustion capture and storage
- ✓ REW and DDV class notations related to data driven services
- ✓ SHORE POWER...

DATA is crucial for making decisions when designing future platforms for science:

Collaborative Development, including both Global and Regional Perspectives

Operators, designers, and shipyards must collaborate to align vessel capabilities with mission needs.

Strategic Planning, investment and R&D towards...

Building a Shared Vision

Beyond 2030

- Zero-emission vessels?
- Fully autonomous research platforms?
- Mix of large and small lean platforms?
- Global data-sharing ecosystems?
- AI-driven mission planning?
- Circular design principles?

...what else?

How DNV can support RV developments?

Classification Services

- Additional class notations for RVs
- Approval in Principle
- Type Approval

Independent Oceanography Services for Aquaculture

- Modeling and assessment of environmental conditions
- Dispersion and Allowable Zone of Effect modeling
- Biosecurity: modeling the spread of diseases
- ...

Independent Maritime Advisory Services

- Ship concept assessment
- Hydrodynamic analysis
- Structural analysis
- Risk assessment
- Decarbonization planning
- Performance assessment
- Performance verification
- Noise and vibration troubleshooting

Winds of change; the voyage from Fossil to Future



“Often in the waves of change, we discover our true direction.”

Andrew Pacholyk, from his book *Barefoot ~ A Surfer's View of the Universe*



Thank you.

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