

Maritime 2050 Strategy: Implications for research and innovation

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6TH MARCH 2019



**National
Oceanography Centre**
NATURAL ENVIRONMENT RESEARCH COUNCIL

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NERC SCIENCE OF THE
ENVIRONMENT

Maritime 2050

Wider context

R&D intensity of sector

Role of R&D

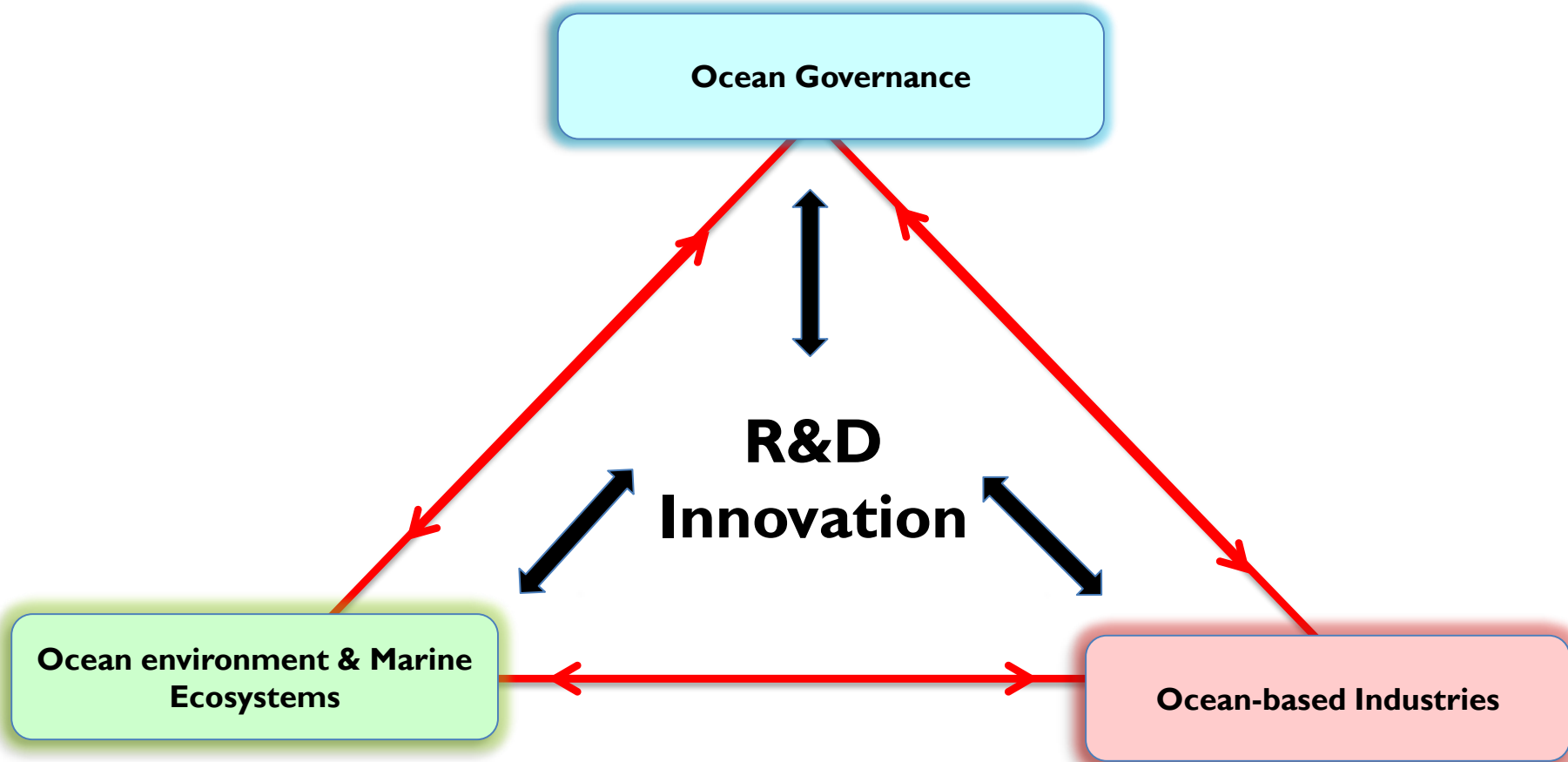
Cases – opportunities and challenges

Conclusions



The ocean economy

Forecast to double from \$1.5 Trillion to \$3 Trillion by 2030 (OECD, 2016)



TOTAL UK ECONOMY £1,800bn GVA

OCEAN ECONOMY £47bn GVA (2.7% GVA)

MARINE & MARITIME SECTOR
£14.5bn GVA



Low-Medium Tech Manufacturing
Shipbuilding
Boatbuilding

Medium-High Tech Manufacturing
Marine engineering
Marine Scientific Equipment

Other Production
Marine Renewables

Knowledge Services
Maritime Business Services
Public Marine Science & Technology
R&D

Marine-related Education
Marine technical consulting
Marine & Maritime Education

Other Services
Ports
Border Agency
Recreational Marine Activities
Support for offshore oil & gas
Support for marine mining
Support for offshore engineering

Low-Medium Tech Manufacturing
Seafood processing

Medium-High Tech Manufacturing
Marine Biotechnology Products

Other Production
Offshore Oil & Gas
Fishing
Aquaculture
Deep Sea Mining
Marine Aggregates
Offshore construction
Subsea cables

Knowledge Services
R&D
Ocean Education

Other Services
Marine & Coastal Tourism
Royal Navy
Maritime & Coastguard Agency
General Lighthouse Authorities

Low-Medium Tech Manufacturing
Food and Beverages
Metal, Plastic and non metal products
Other manufacturing

Medium-High Tech Manufacturing
Chemicals
Aerospace, Automotive
ICT & Precision Instruments
Machinery
Electrical Equipment
Pharmaceuticals

Other Production
Agriculture
Mining
Utilities
Construction

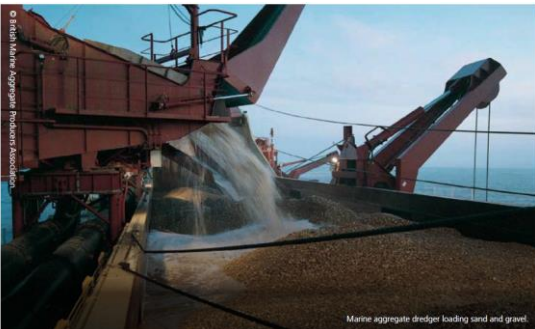
Knowledge Services
Communications
Digital, Creative & Information
Financial Services
Business Services
R&D
Education

Other Services
Hotels & Restaurants
Retail
Transport, Storage, Distribution
Real Estate
Administrative & Support Services
Public Administration & Defence
Health & Social Care
Community, Social & Personal Services

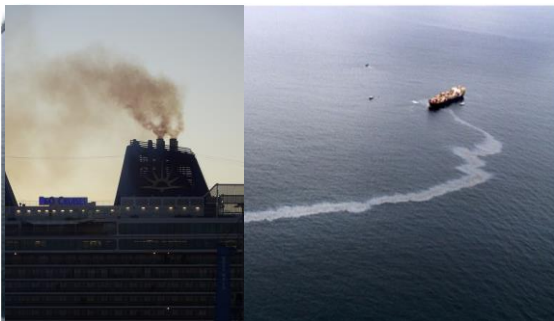
Ocean economy is explicitly defined by its environment



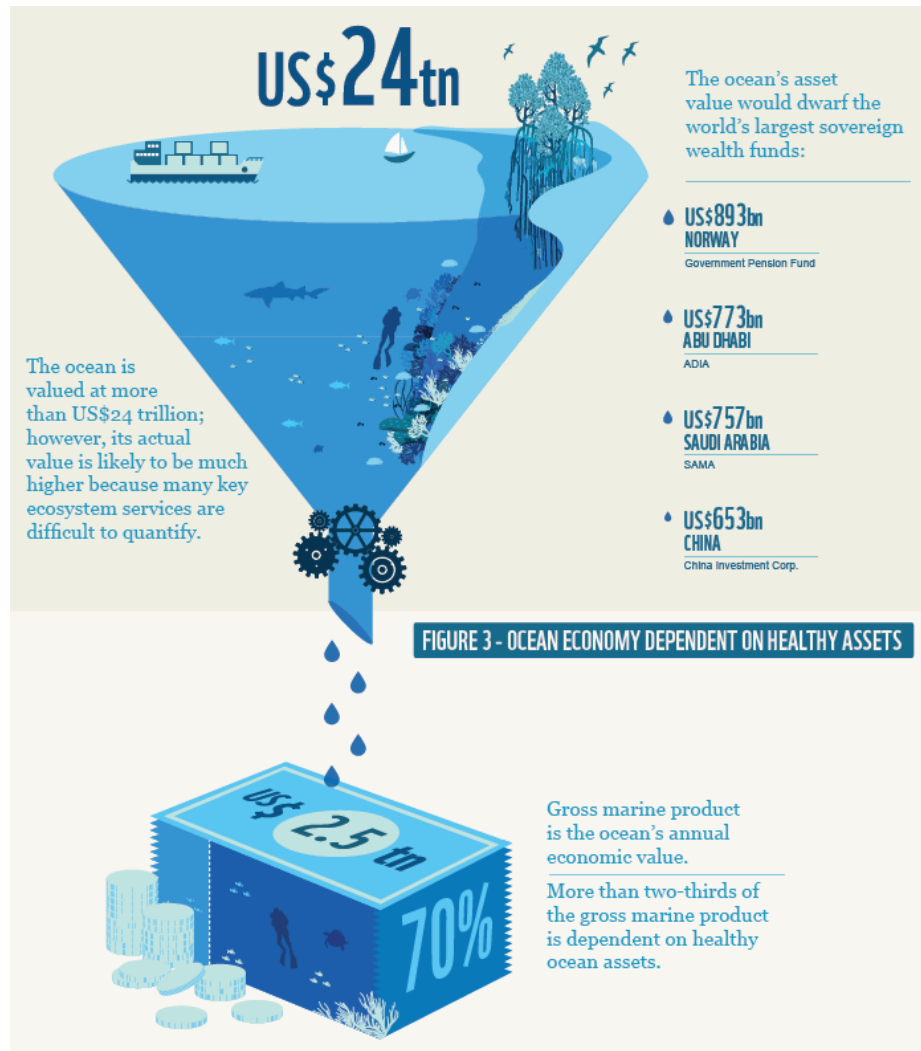
Impacted by the sea



Based on marine resources

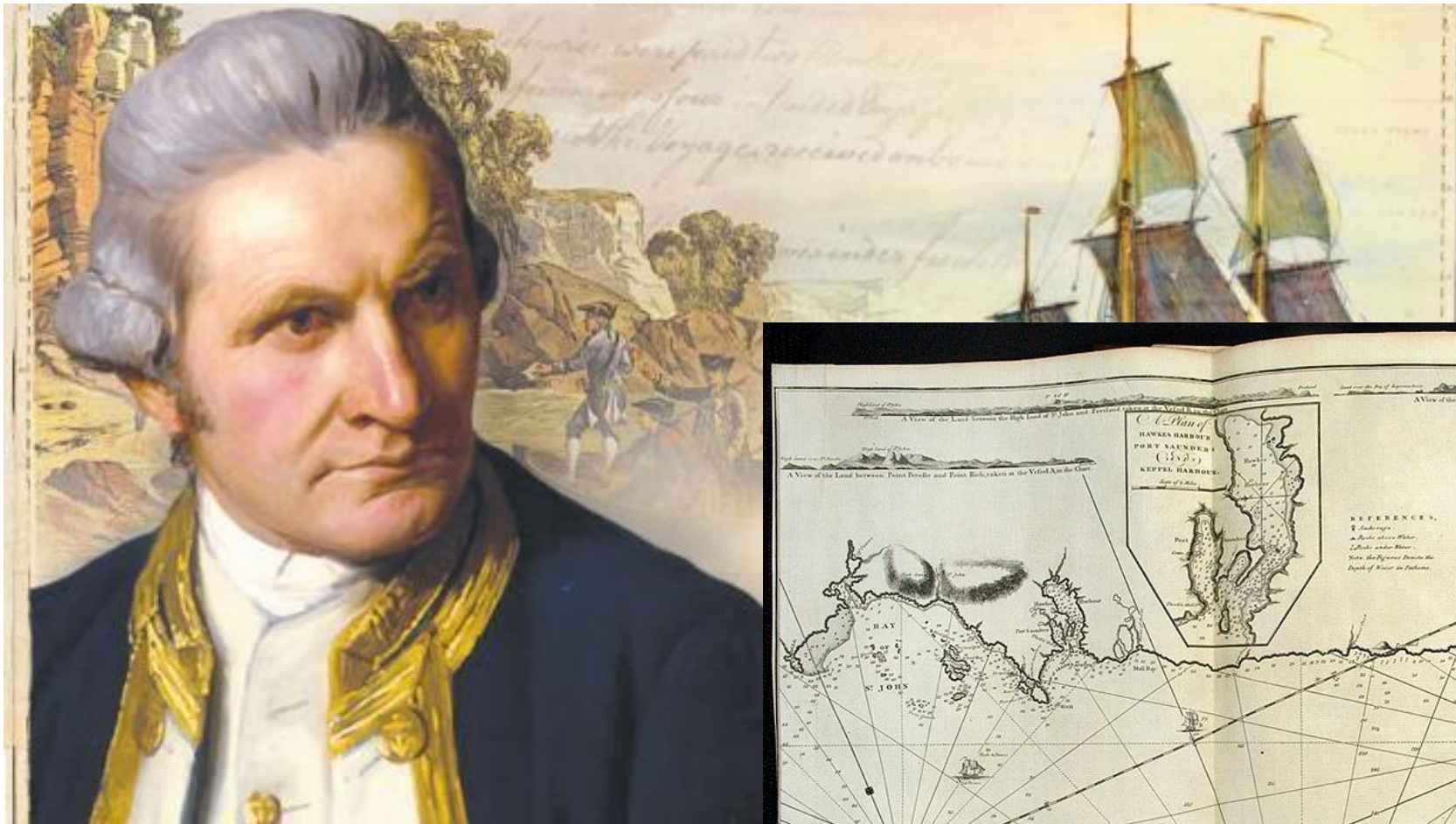


Impacting the ocean environment



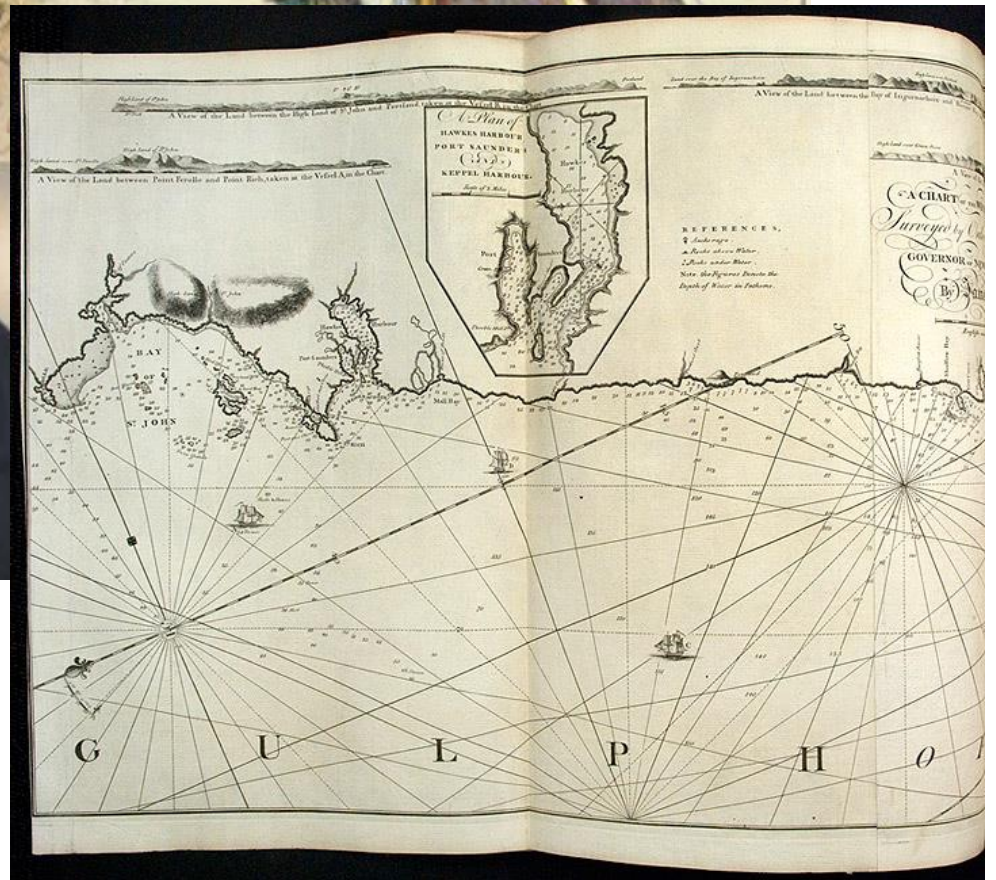
Nexus of ocean economy and the ocean environment
70% of economic benefit from the sea depends on health

The ocean economy is a knowledge-based economy

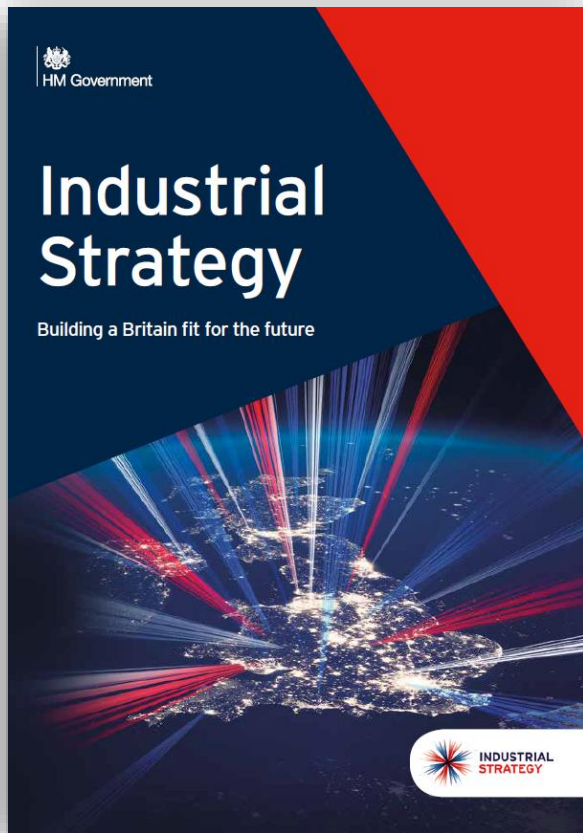


Captain James Cook FRS

Pioneer of marine geospatial data



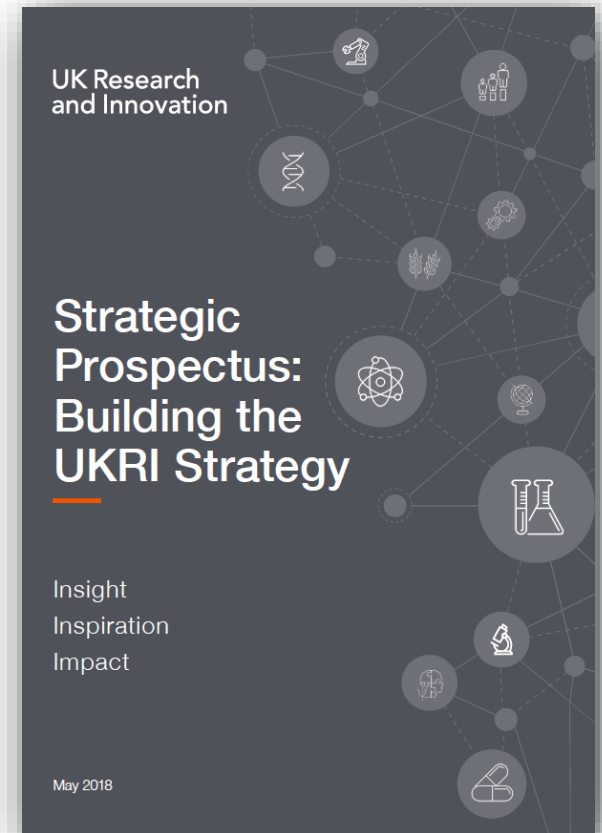
Context of wider UK ambitions



Industry
2017



Environment
2018

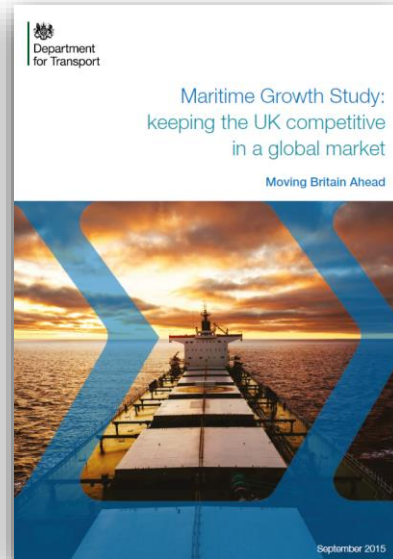


Research &
Innovation
2018

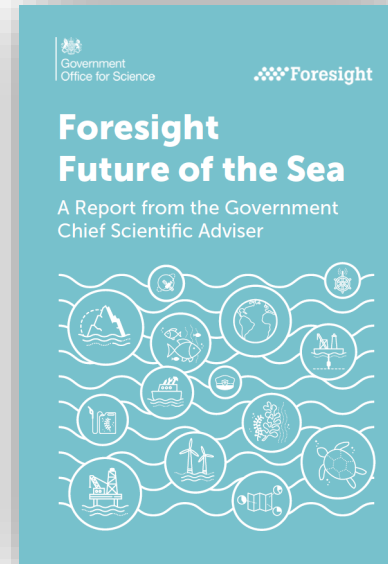
A lot of recent thinking about the Ocean



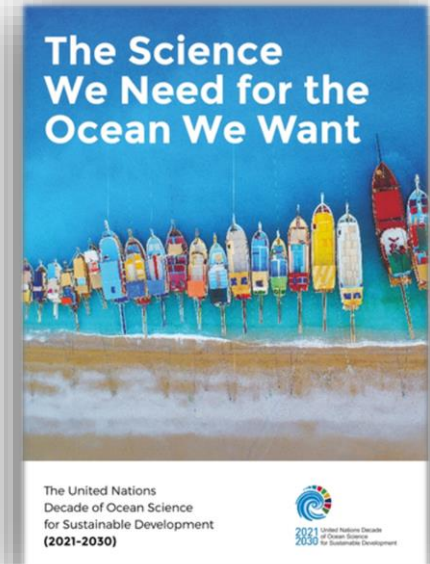
Ocean Economy 2016



Maritime Growth 2015



Science 2018



Science 2018



Maritime Economy 2013

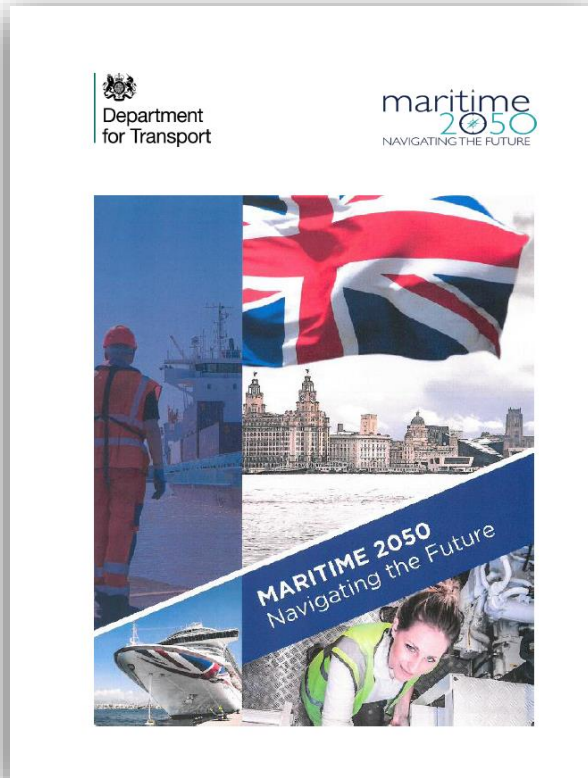


Health of Marine Ecosystems 2013



International Dimensions 2019

Innovation and R&D in Maritime 2050



5 Values

- Premium brand
- Balanced priorities
- Rules-based commitment
- Global United Kingdom
- Real Partnership

Word analysis of Maritime 2050's re

7 Thematic Visions

UK Competitive advantage
forefront of innovation, research,
thought leadership

185 Recommendations (16%

Competitive Advantage

- Ties - government, industry, academia
- Thought leadership
- Support maritime innovation

Technology

- Testing autonomous vessels
- Maritime Innovation Hub
- Mapping seabed
- Analogue Aerospace Technology Institute

Other

- STEM skills

Innovation and image of sector?

- **History** of transformative innovation
- **Artefact** sector's scope as defined
- **Service sector** (70%)
- **Leisure Sector**
- **Outside Expectations**
(low/medium technology)
- **Self Perceptions**
(already highly innovative SMEs)
- **Frontier capability demands**
(space, exploration, FI)
- **Masking** by public R&D

Containerisation



Leisure

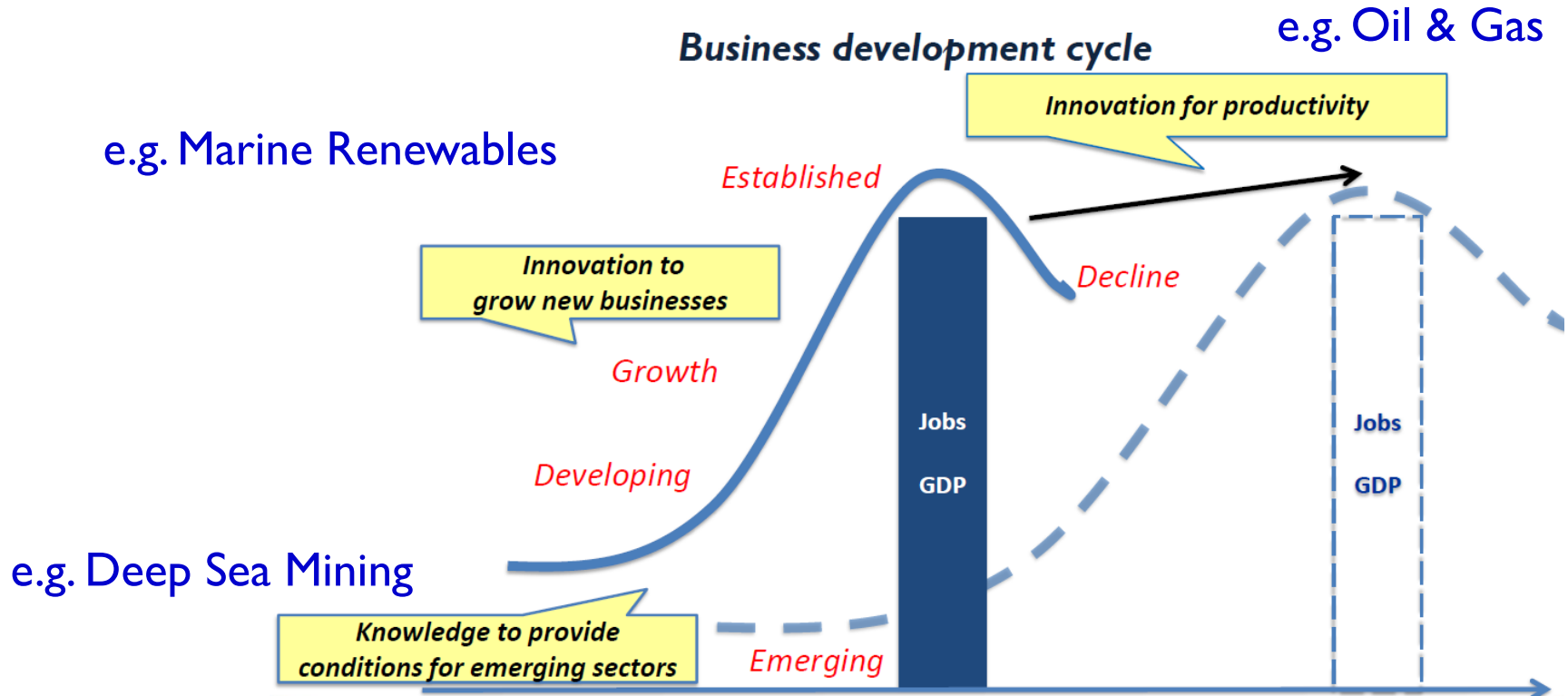


Polar vessel



Role of R&D led innovation

Seen as important where it impacts the bottom line and growth of businesses



AND WHERE:

- Consumer interest/pressure
- Need for social licence
- Threat/opportunity of regulation

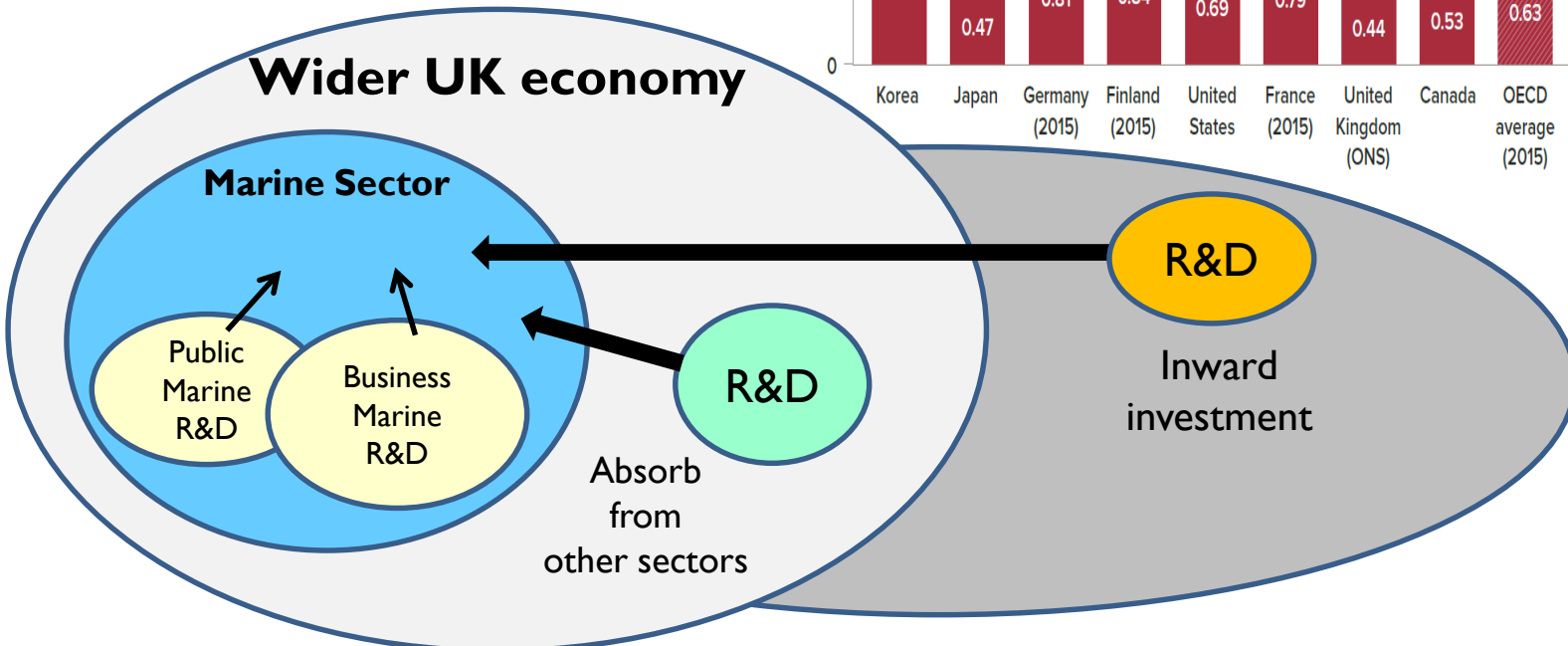
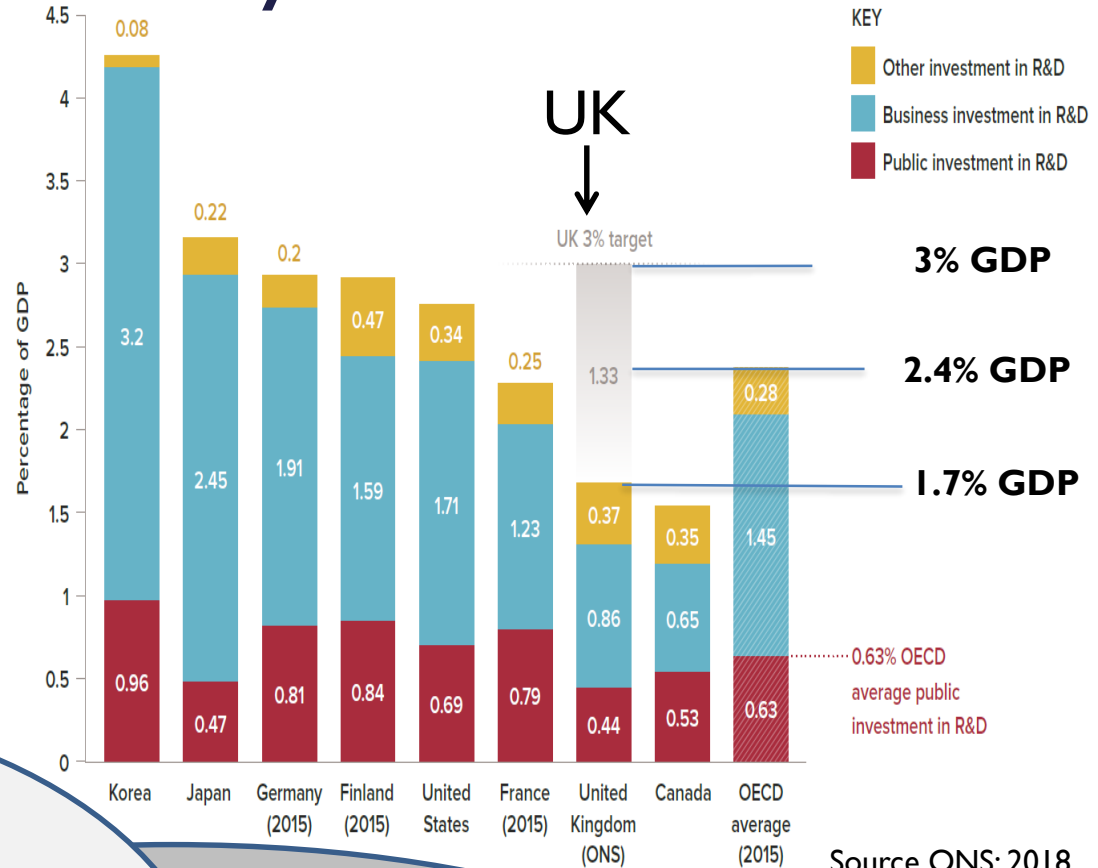
ENABLED BY:

- Clear needs that can be **solved by research**
- Leverage by public R&D investment

Increasing R&D intensity in the sector ?

Target UK R&D investment
3% GDP
 (2.4% by 2027, OECD average)

- **R&D intensity of sector now?**
- **Largest increase from business (60% Business 40% Public)**
- **What this mean for sector?**



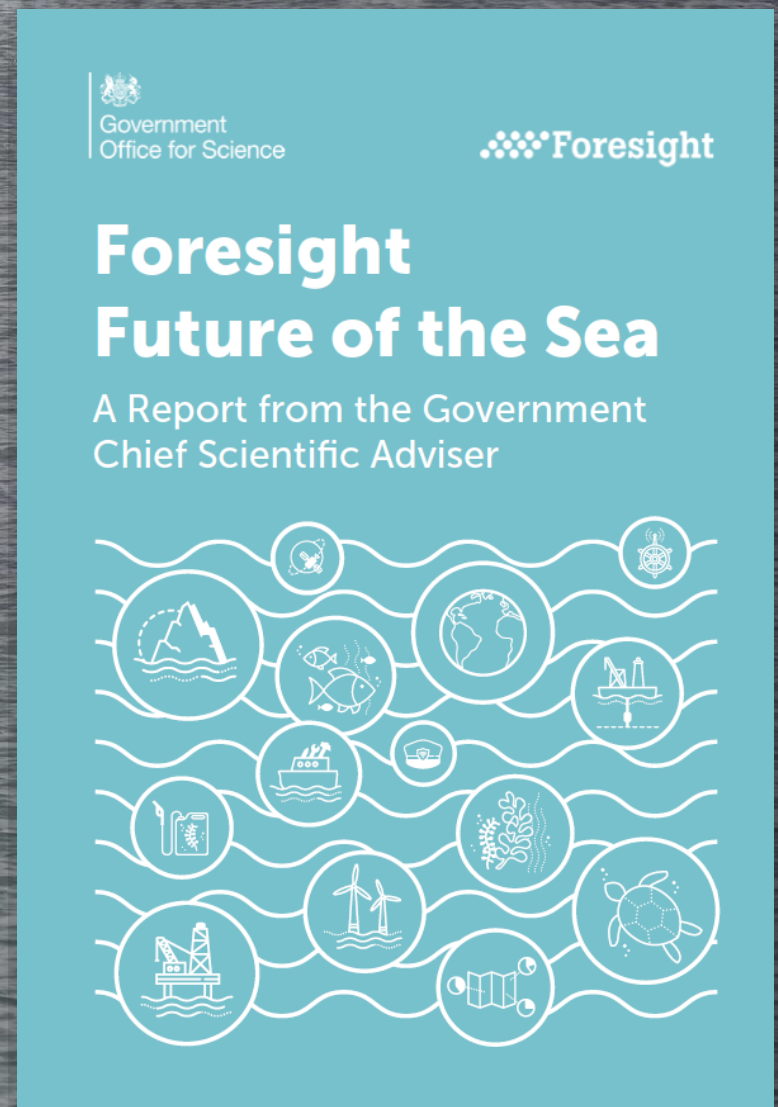
What Foresight identified

Structural issues to address:

- “Sea blindness”
- Coordination
- Long-term approaches needed
- Overwhelmingly global

Recommendations concerning:

- Economy
- Environment
- International Engagement
- Marine Science



Overall

- ✓ UK develop **more strategic position** regarding its marine interests
[Maritime 2050, International Ocean Strategy]

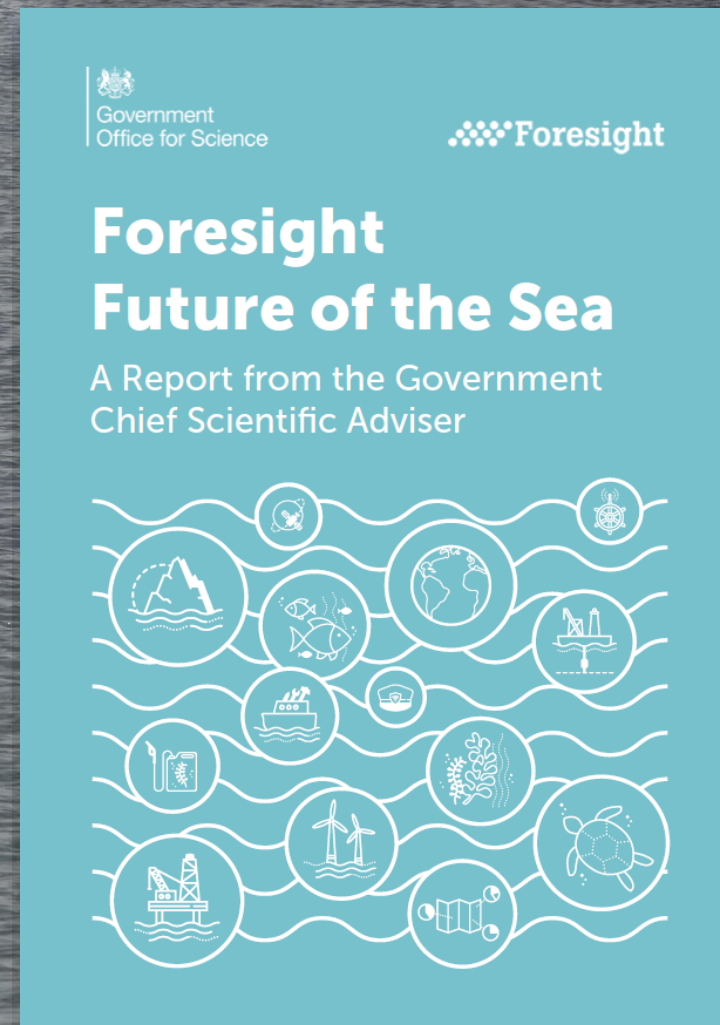
Ocean Economy

- ✓ Address insufficient **join up** between the diverse sectors of the marine economy around **common research, infrastructure and skills needs**
- ✓ Better **capitalise on UK's science, technology and engineering base**

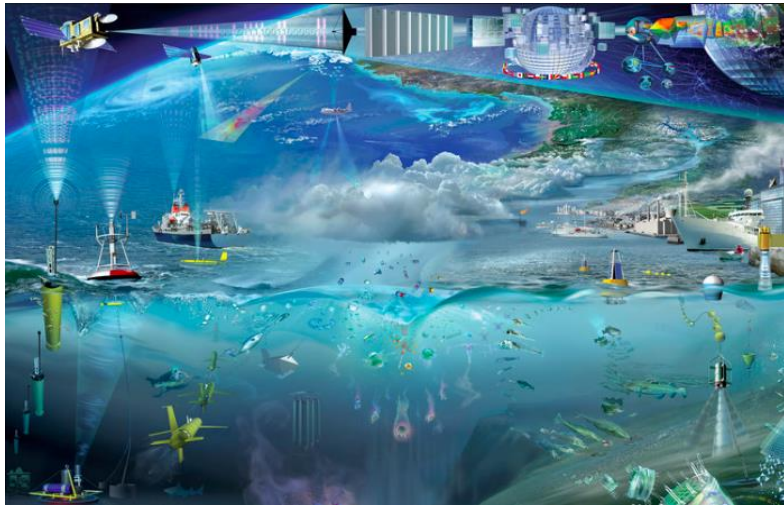
Science

- ✓ Ensure scientific activity is joined up and positioned to deliver **UK priorities**
- ✓ Prioritise key **research needs**
- ✓ Enable **big data** to be a driver of innovation
- ✓ Improve our understanding of the sea through UK contributions to systematic, globally coordinated and sustained **global ocean observations and seabed mapping**

Key recommendations



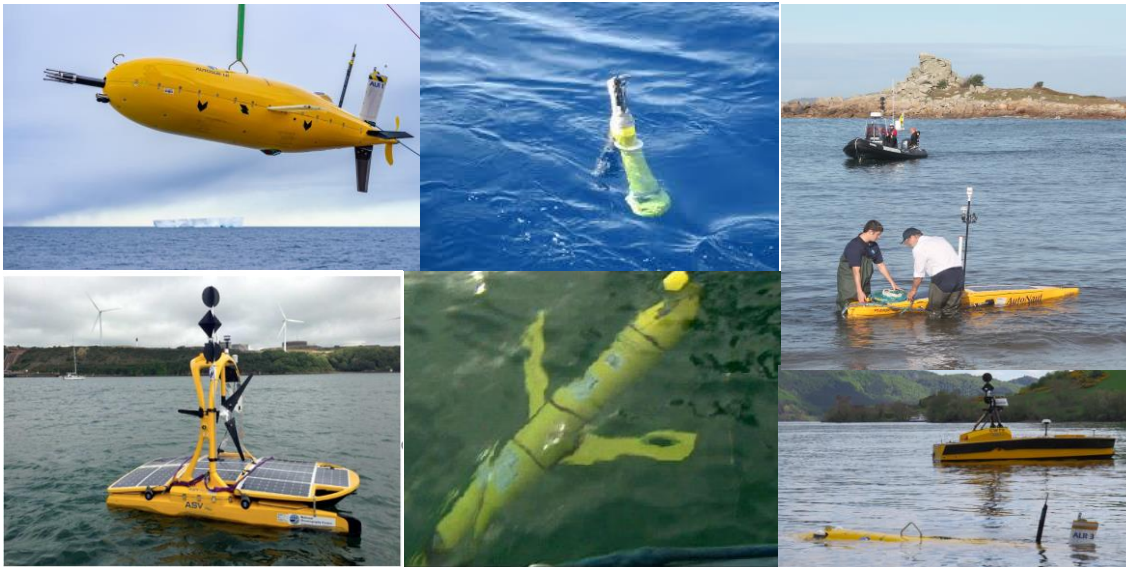
Case I: Autonomous Continuous Ocean Monitoring



Dream

- ✓ Climate variability
- ✓ Hazards
- ✓ Resource exploitation
- ✓ Subsea infrastructure
- ✓ Protected Areas
- ✓ Governance

Not a dream – its real



Case 2: Marine Robotics Innovation Centre - Southampton

Innovation Hub Autonomous and Robot Systems

26 companies

Developing
technologies

Shaping use of
autonomy



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Case 3: Thought leadership in frontier maritime capabilities

Large highly autonomous exploration/survey/research platforms of tomorrow



↑ Today



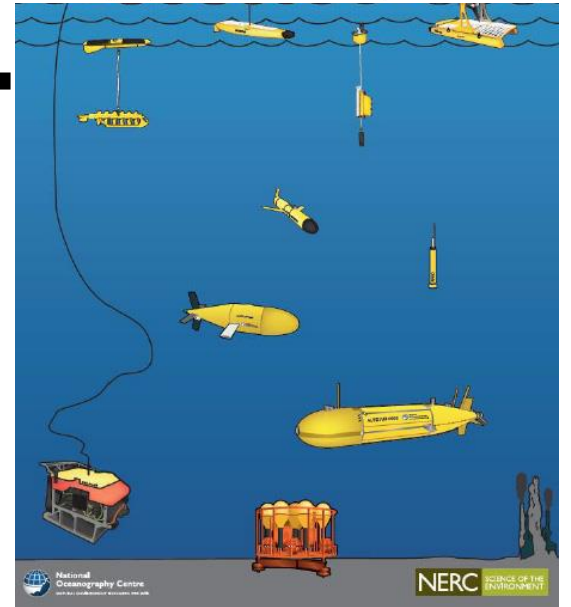
HMS Challenger
1872-1876

2030-2040



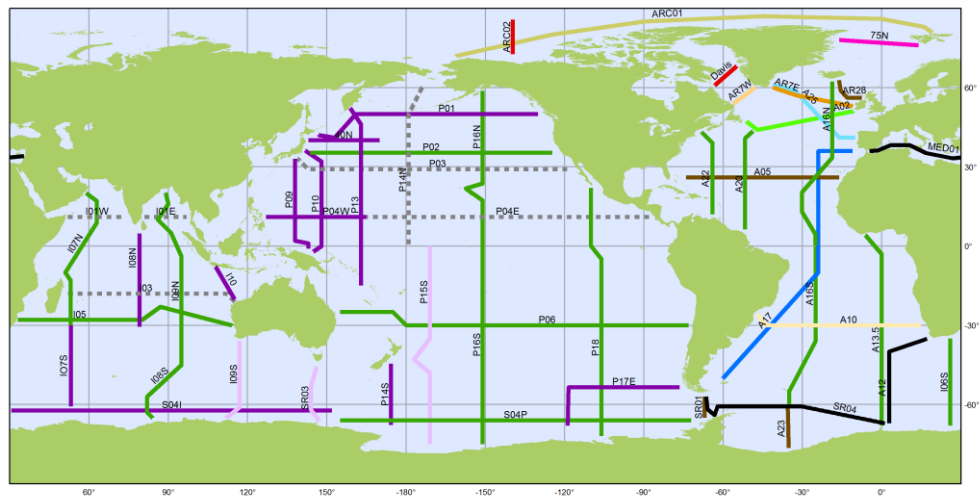
Driverless autonomous cargo ship concept: Reprinted with the kind permission of Rolls Royce

Requirements
More Autonomous
Clean and Green
Combined with MAS
Shore based science



Case 4: Infrastructural approaches to ocean measurement

Funding & business model innovation needs to keep pace with what technology enables

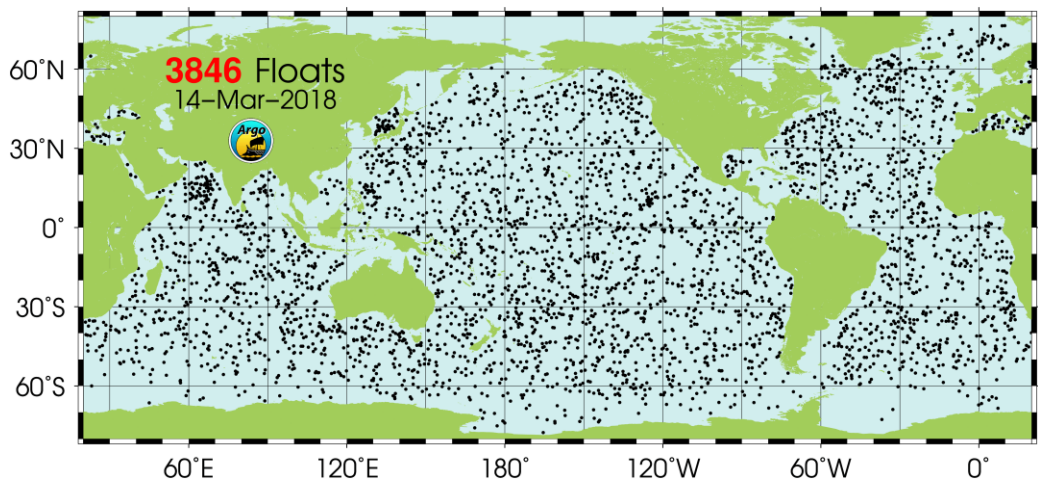


GO-SHIP 2012-2023 Survey (54 Core Lines): Lines by Nation January 2017

AUS	ESP	IRE	NOR-UK	USA-GER
CAN	FRA-ESP	JAP	UK	USA-UK-GER
CAN-UK	GER	NOR	USA	nil

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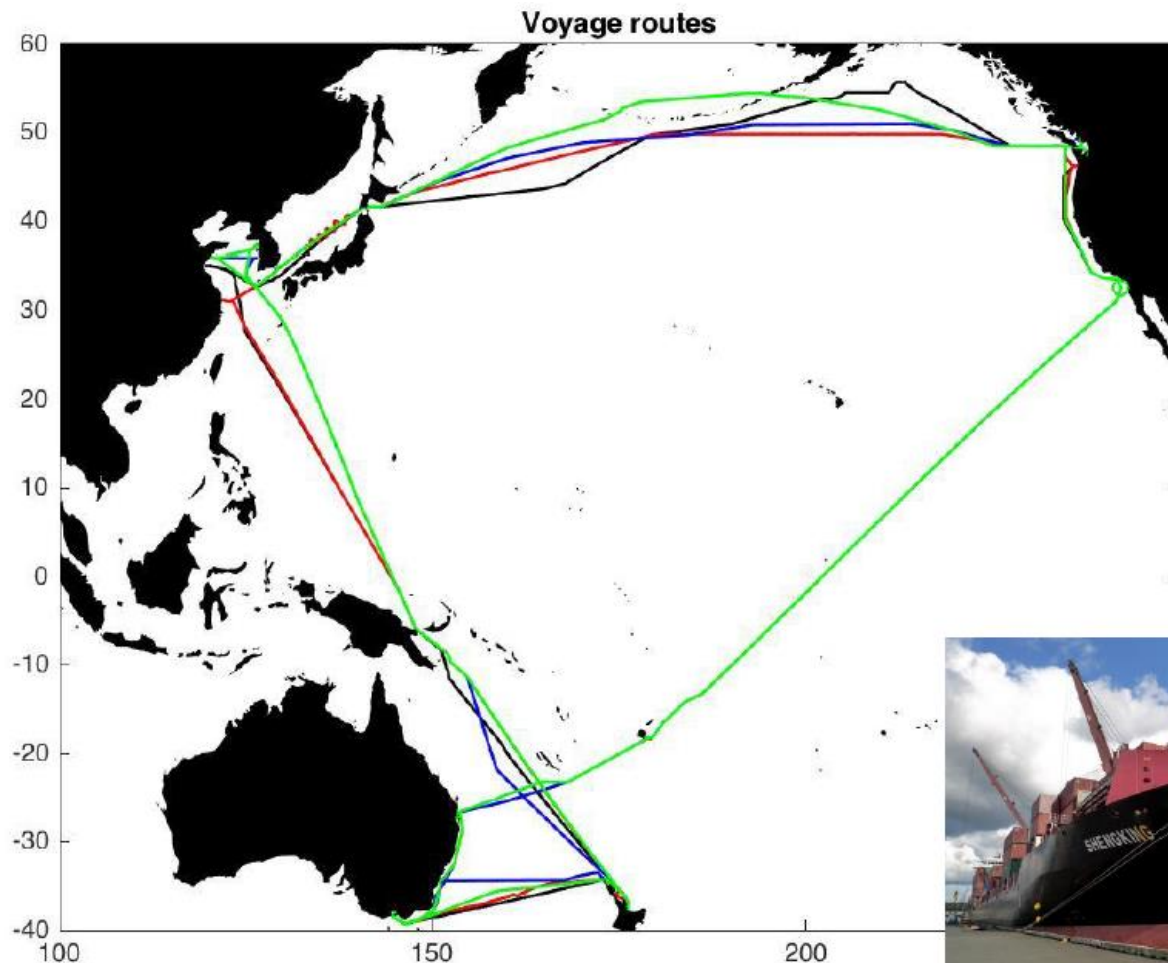
Ship-based
 One-off (10 year intervals)
 Delayed-mode data (1-2 yr)
 Main purpose is science
 Science Project funded



Autonomous platforms
 Continuous presence
 Real-time data
 Multi-purpose uses
Funded – how ?
 UK contributes 5% of global array

Case 5: Maritime industry supporting science

Swire Shipping and China Navigation working with the National Oceanography Centre to advance marine and climate research (surface CO₂ measurements by ship of opportunity)



Case 6: Mapping the ocean floor



UK Hydrographic
Office

Outcome

Global digital data infrastructure
270 x 10¹⁸ Bytes

The Task

350m resolution at 5km depth
One ship 1,000 years
Cost \$3bn (Mars Mission)
Scalable (Autonomy accelerates)

Benefits

UK and Overseas Territories EEZ

Safety, Marine planning
Strategic assessment

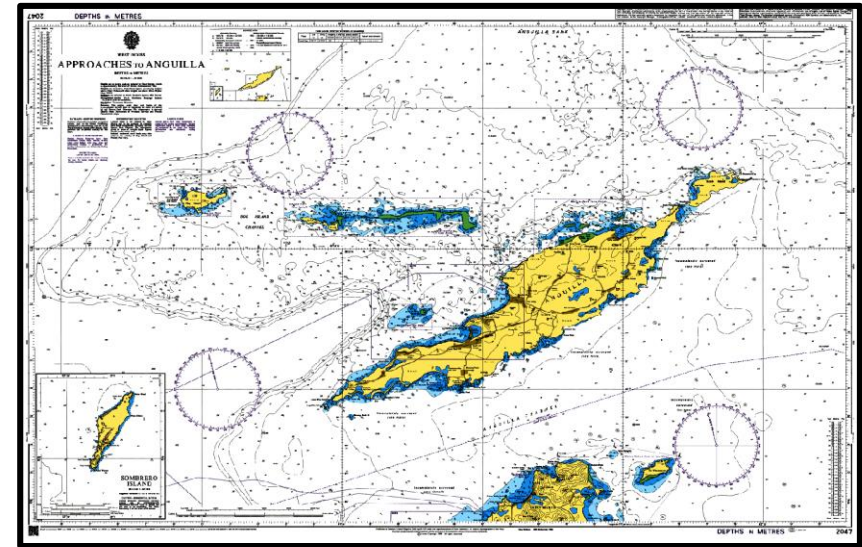
At least 4: return on investment

Deep International Waters

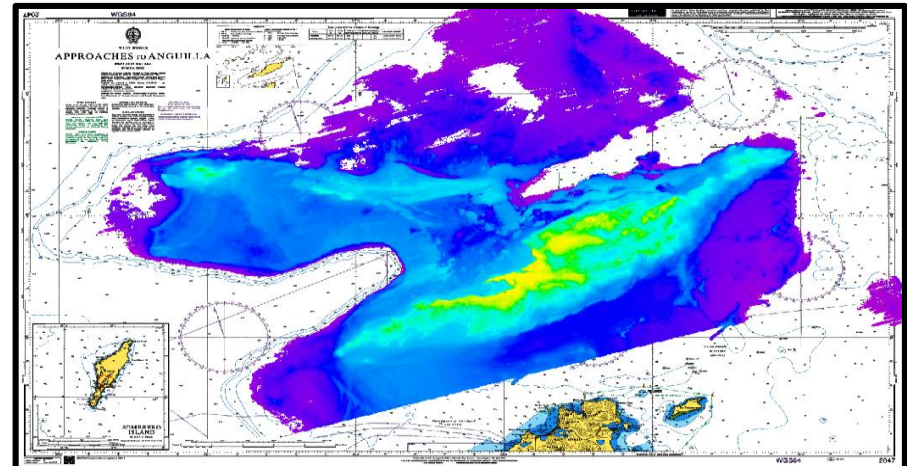
Future ocean economy
International Ocean Governance

**Post EU exit, suggest UK joins Atlantic
Ocean Research Alliance (AORA)
EU, USA, Canada + UK**

Approaches to Anguilla



Data: UK: 1810-1847; Ne & Fr 1970-76



Plus Data: UK: 2016 multi-beam, 2017 LIDAR
Commonwealth Marine Economies Programme

Summary

- Define common research needs across whole ocean economy
- Better understand nature of R&D intensity in sector
- Address what 3% GDP R&D means for sector
- Dialogue with research base to:
 - Define specific research needs (researchable)
 - Influence strategies and roadmaps for investment (Maritime UK, UKRI)
- How to support more infrastructural data (ocean monitoring, mapping)
- UK join AORA in its own right (EU, USA, Canada + UK)