FMRI FUTURE MARINE RESEARCH INFRASTRUCTURE

IRSO 2023

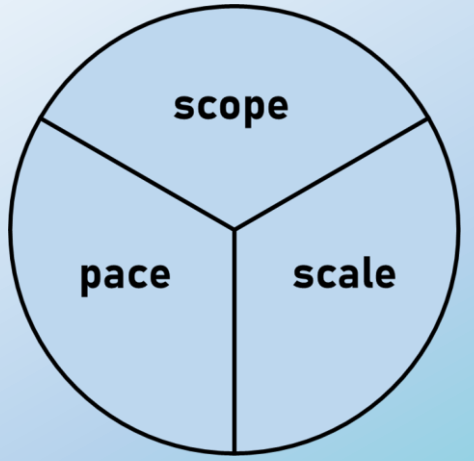
UKRI Natural Environment Research Council

We need to further define:

The **Scope** of activity – process studies/sustained observations/monitoring/forecasting

The **Scale** of activity – where, when, how often?

The **Pace** of change– what are the pull and push factors?

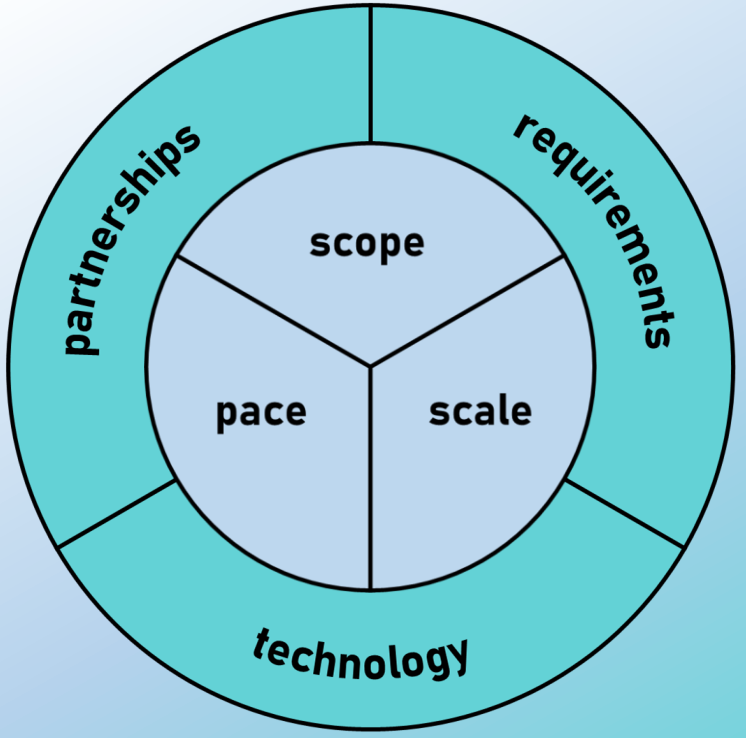


We need to further define:

How the **requirements** (set by the science community) shape the scale and scope?

How **technology** will drive the scale and pace?

What **partnerships** might be supported by the scope and pace?



We need to further define:

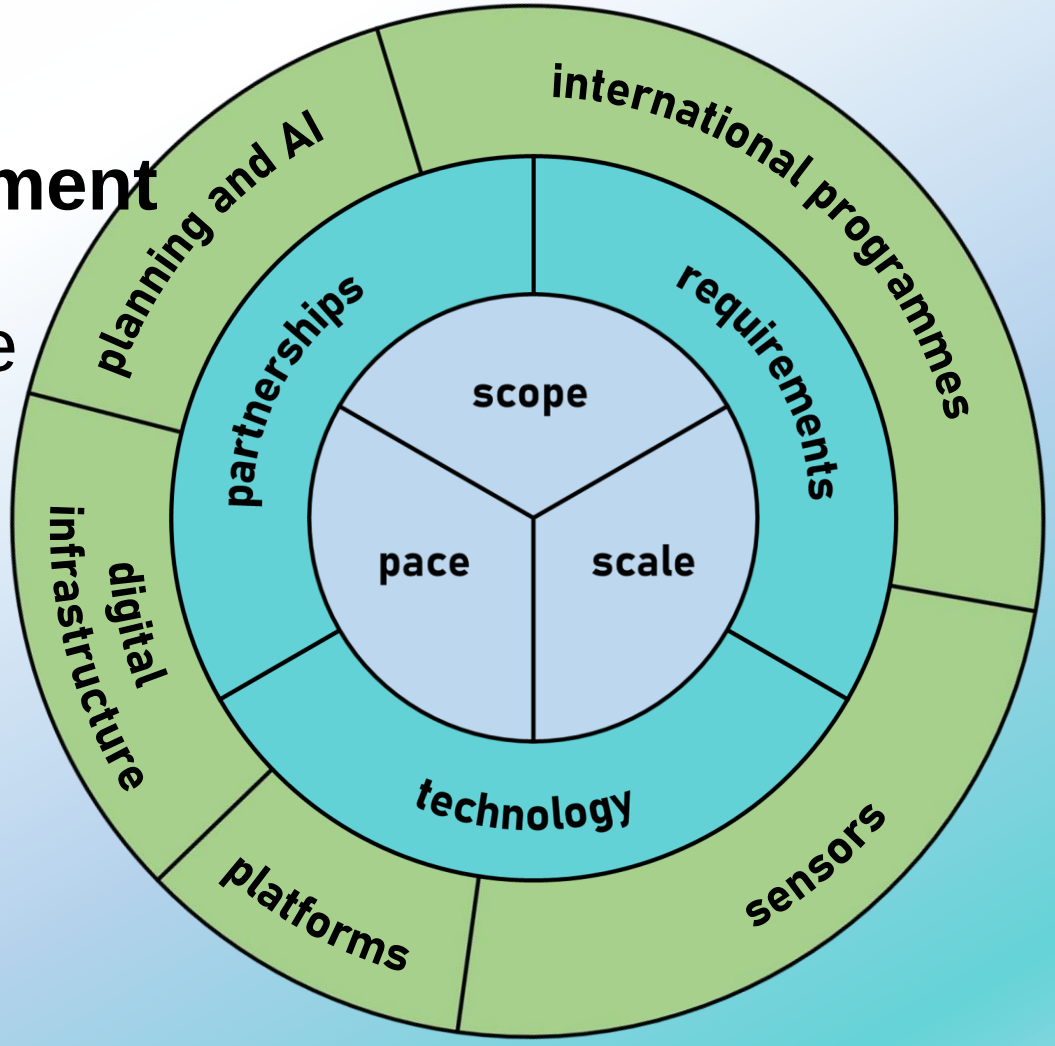
How to accelerate **Sensor development**

How to ensure **Platforms** deliver the necessary coverage

How the **Digital infrastructure** can support FAIR principles

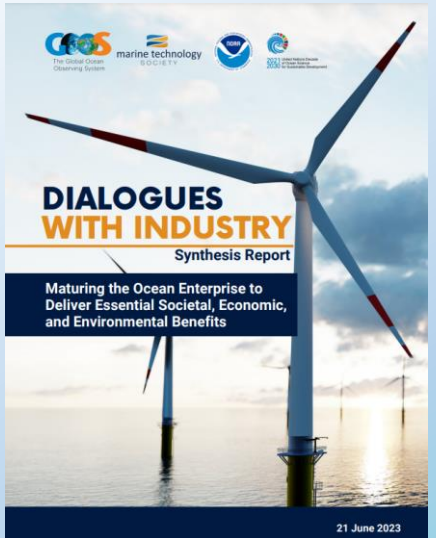
How **Planning** frameworks can support network effects

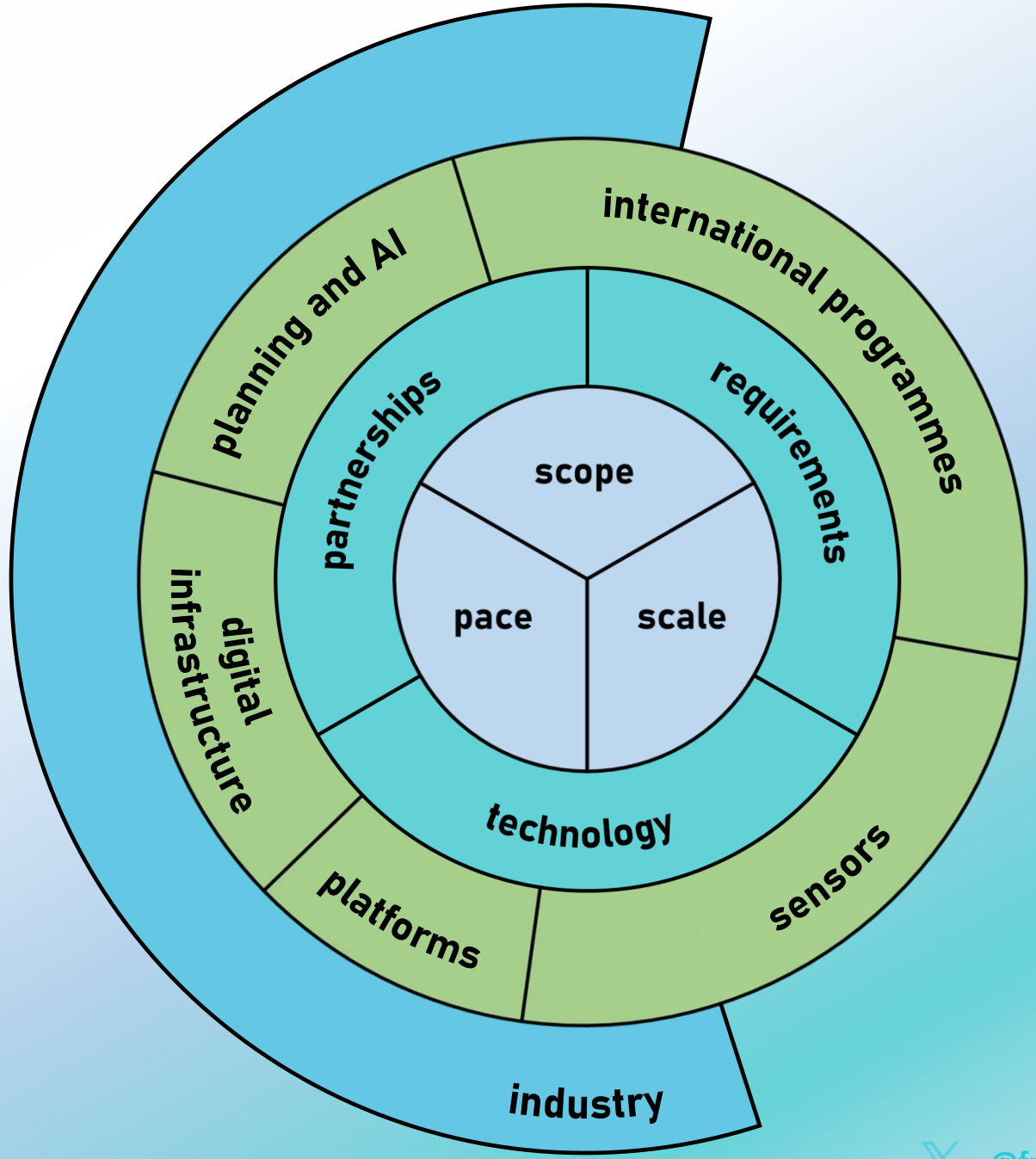
How to align with **International Programmes**



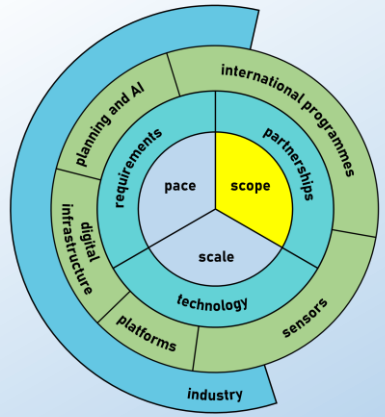
We need to further define:

How we engage with industry - join up R&D programmes, develop long-term relationships with suppliers, share risk and reduce costs



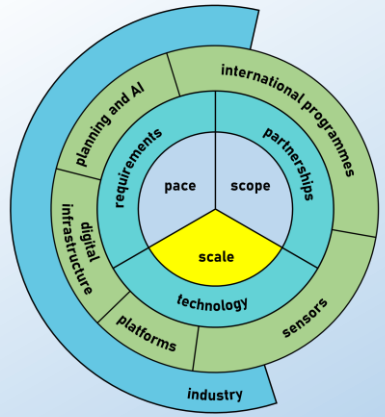


Scope



- What are the future scientific priorities?
- What rate of observation is required to support future models? How might the concept of Digital Twins inform that?
- How far are scientists testing the boundaries between sustained and experimental observations with the technology and research infrastructure available today and how might that change in the future?

Scale



- A direct comparison between autonomous platforms and research ships is unhelpful in this transition (but often happens).
- Instead, we should ‘calculate’ what is required to support the likely requirements for sustained and experimental observations, double it to account for optimism bias and stuff breaking and then reduce by 1.3 to benefit from data being truly findable, accessible, interoperable and retrievable:

Pace

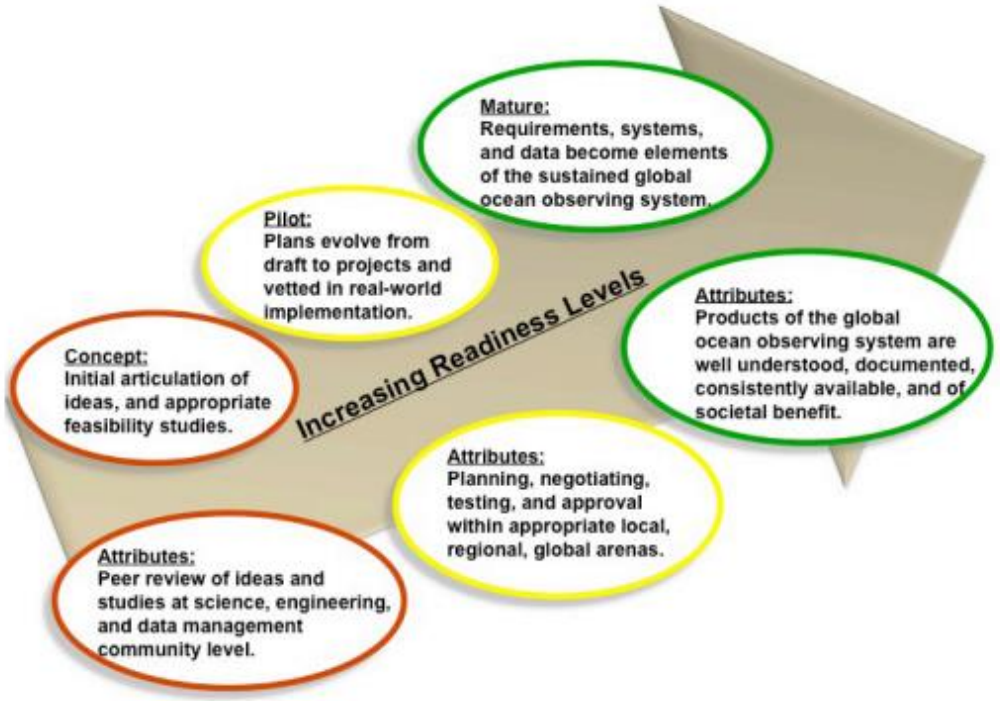
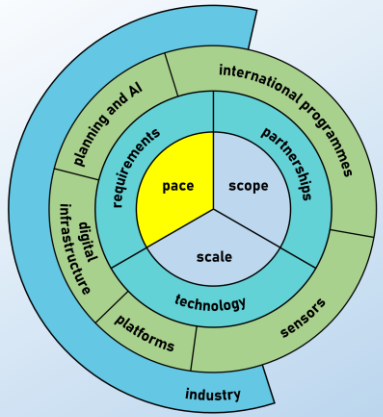


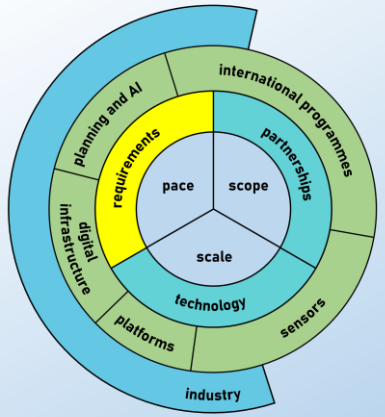
Figure 5. The Concept of Readiness Levels. *How ocean observing activities will be assessed for inclusion in the Framework for Ocean Observing. The scale and scope of activities at each readiness level will vary according to the needs of a particular EOV.*

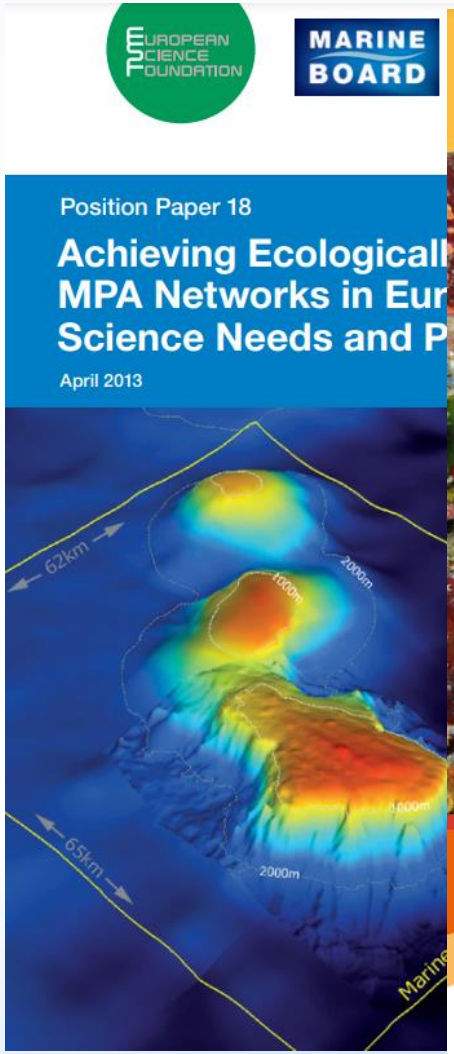


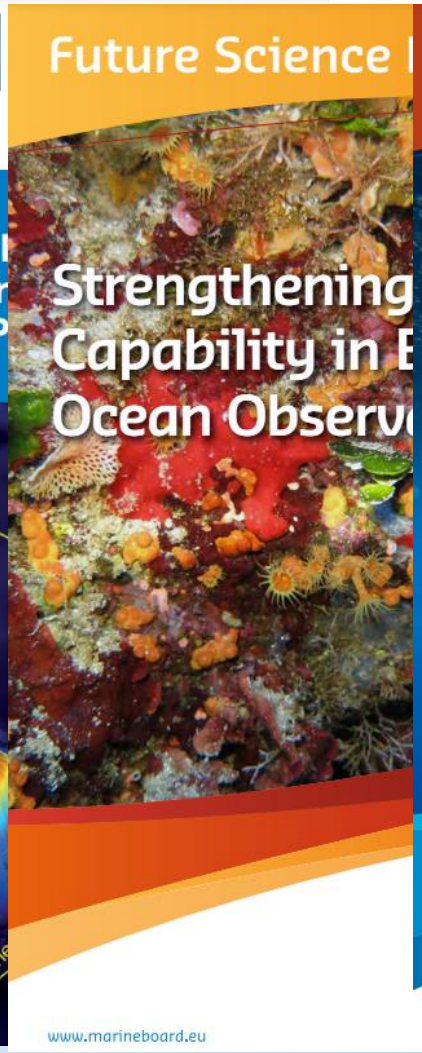
The pace is informed by the level of investment, the level of interoperability required, the robustness and reliability necessary, the precision and accuracy mandated and the willingness to adopt and adapt to using those new technologies.

A Framework for Ocean Observing. By the Task Team for an Integrated Framework for Sustained Ocean Observing, UNESCO 2012, IOC/INF-1284, doi: 10.5270/OceanObs09-FOO

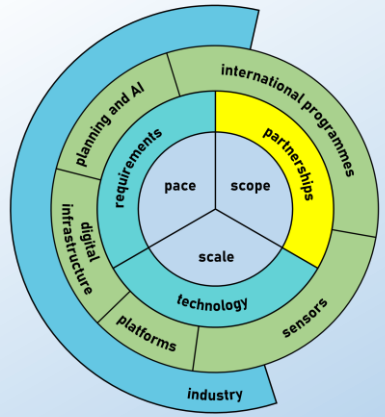
Requirements





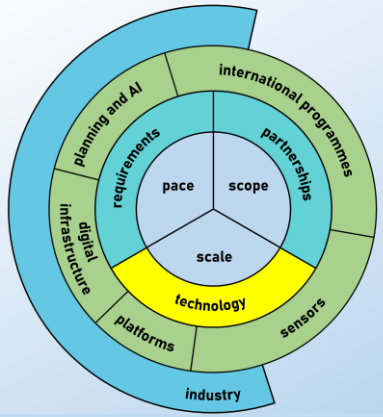


Partnerships

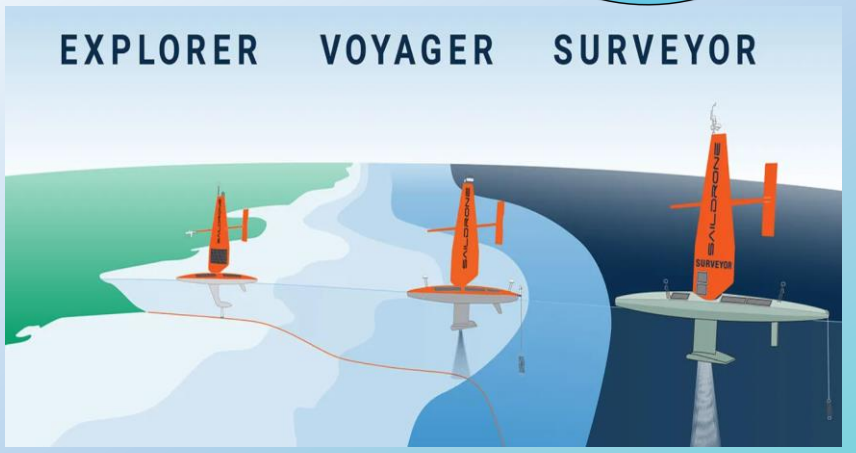


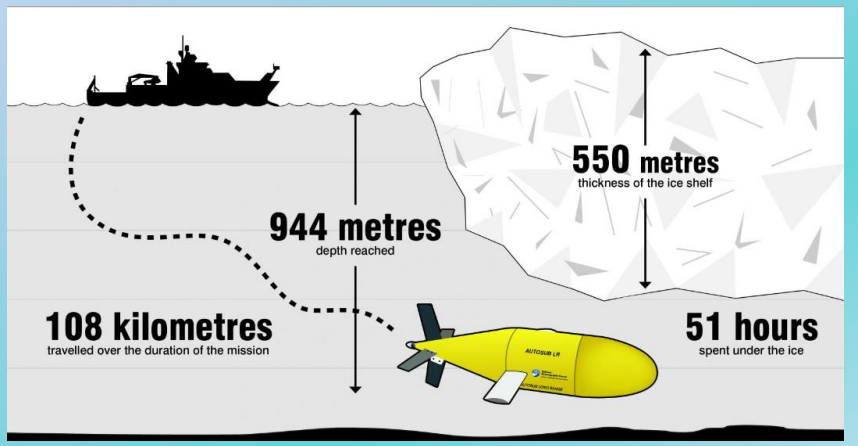
- GROOM II (https://www.groom-ri.eu/activities/)
  - Providing efficiency and economy of scale
  - Ensuring high quality data and access to data

Technology

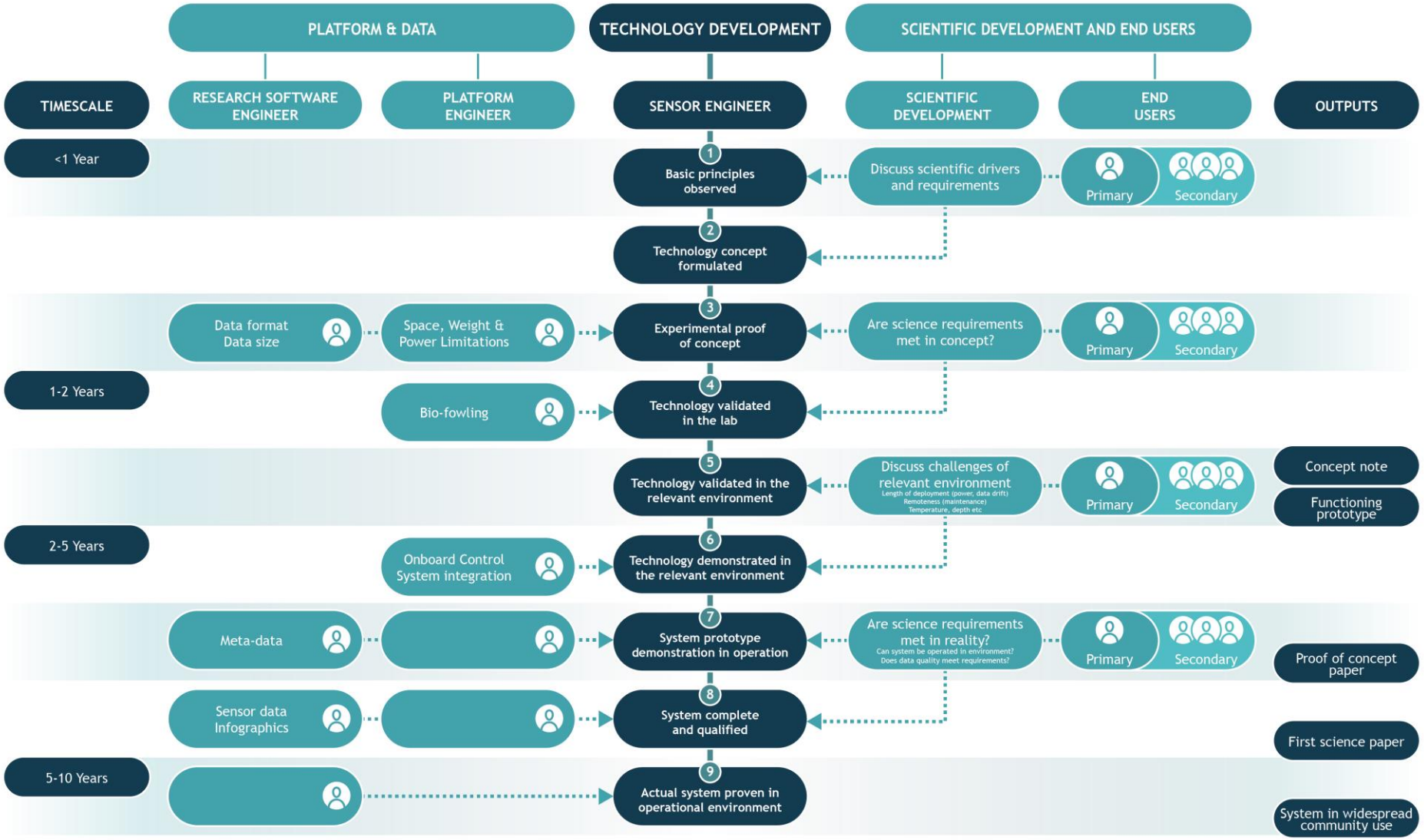


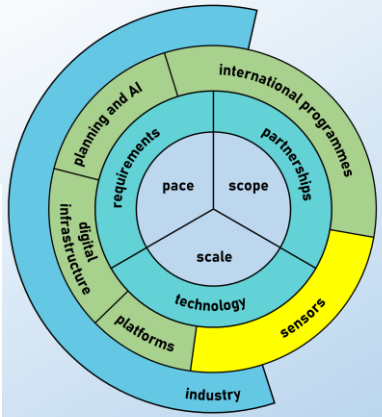
- Much of the platform technology is advancing at a predictable pace but AI and ML are about to transform how the technology is ‘bought together’ and used to deliver data to multiple users in real time.
- Regulation remains an area of uncertainty as does the application of UNCLOS MSR rules for autonomy.
- Easily integrated sensors remain the priority development area





Sensors





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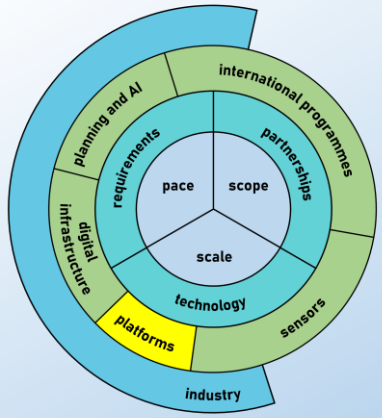
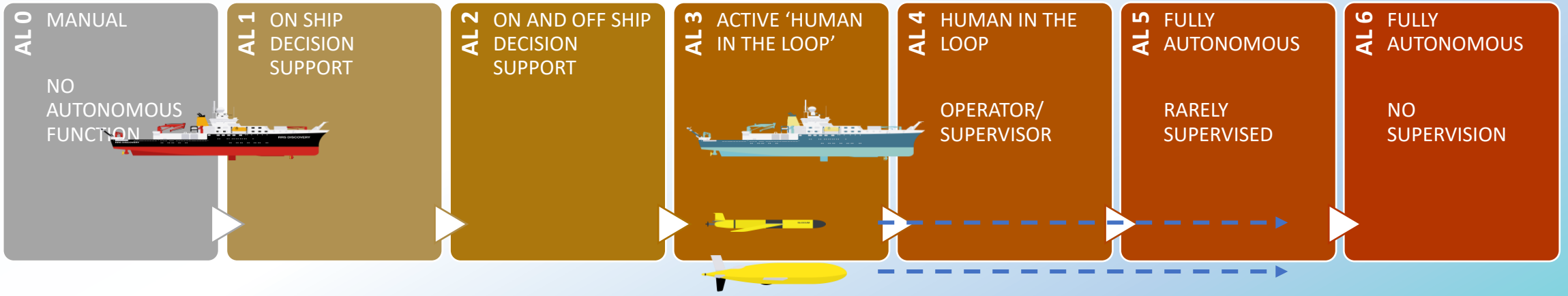
Platforms regulation/training/accreditation



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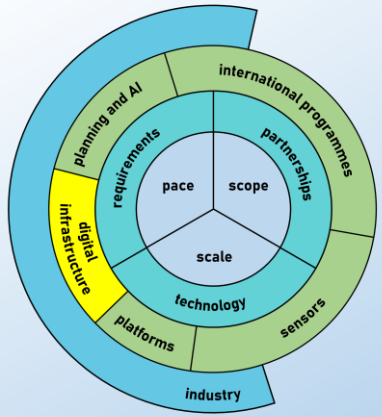
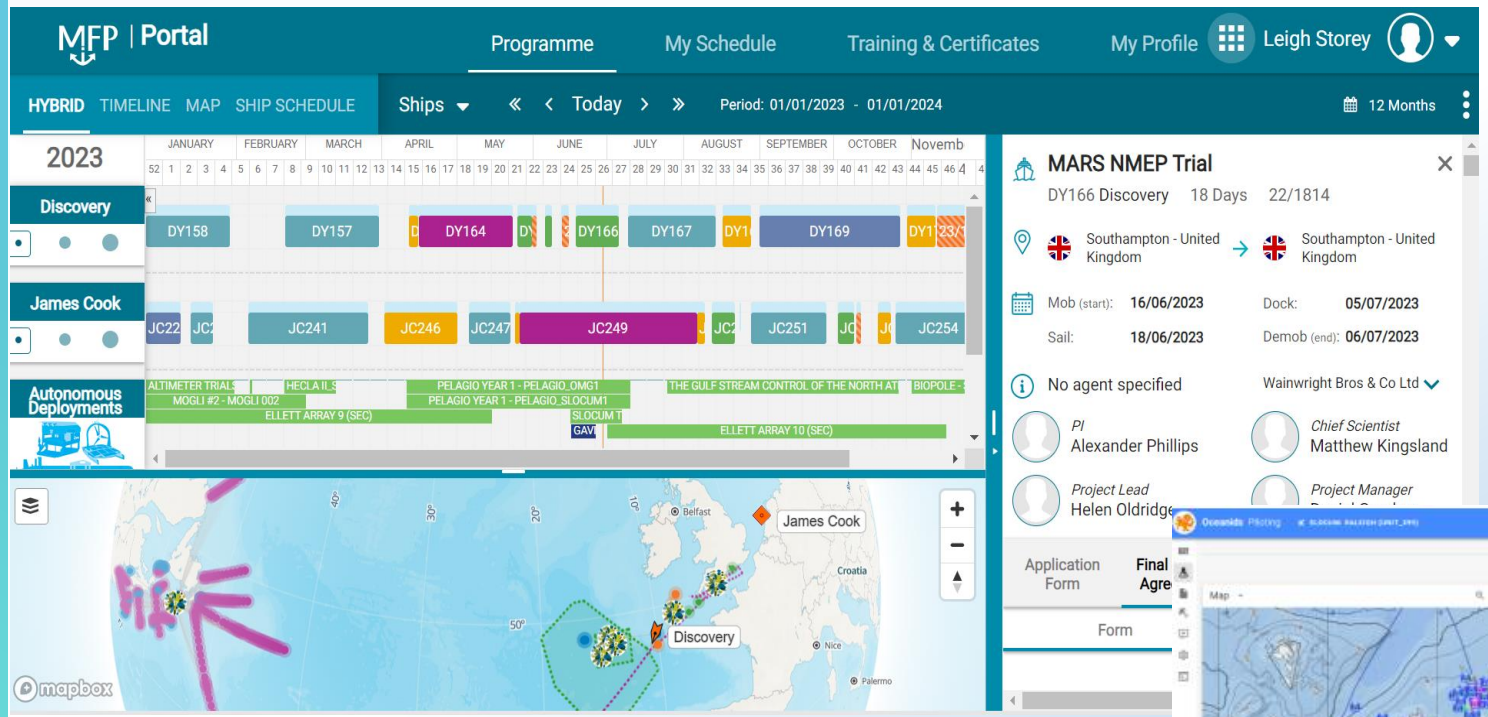
Identifying seafarer training needs for operating future autonomous ships: a systematic literature review

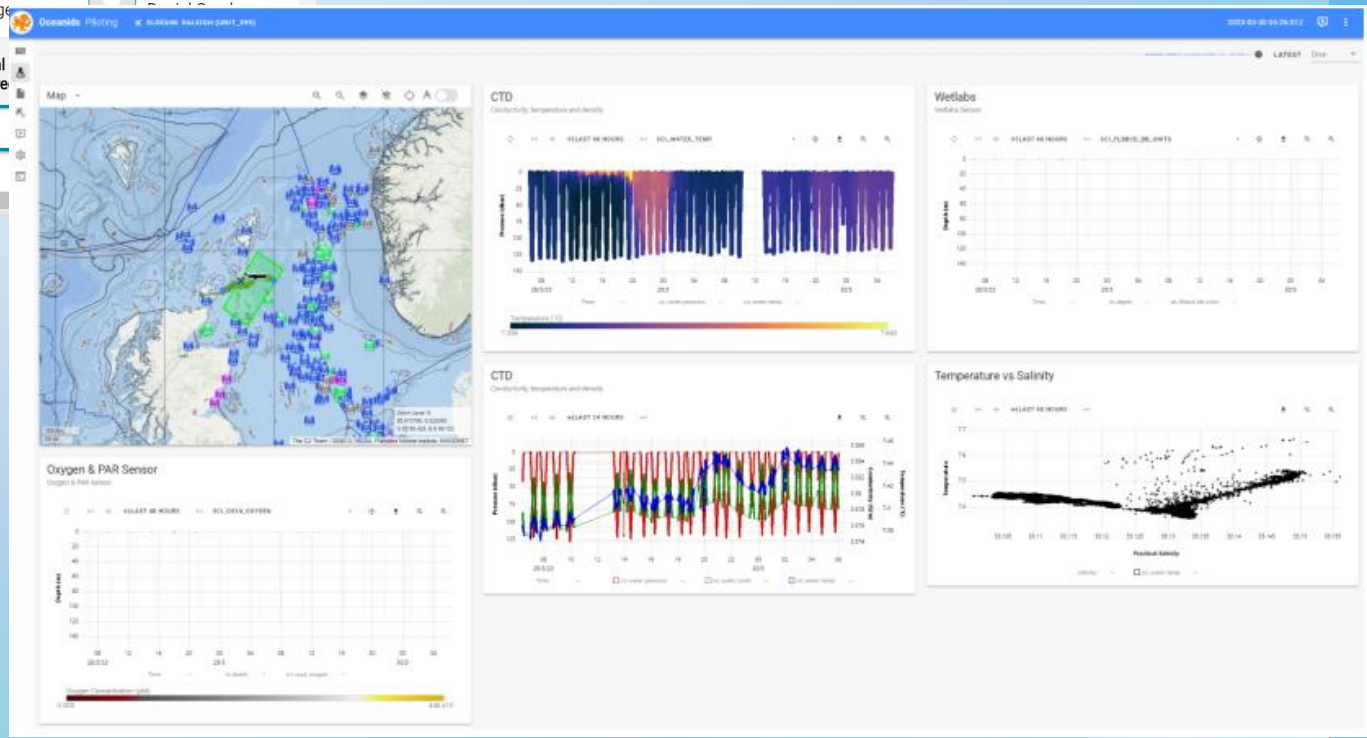
Reza Emad, Hossein Enshaei & Samrat Ghosh

Reza Emad, Hossein Enshaei & Samrat Ghosh (2021): Identifying seafarer training needs for operating future autonomous ships: a systematic literature review, Australian Journal of Maritime & Ocean Affairs, DOI: 10.1080/18366503.2021.1941725

Digital Infrastructure







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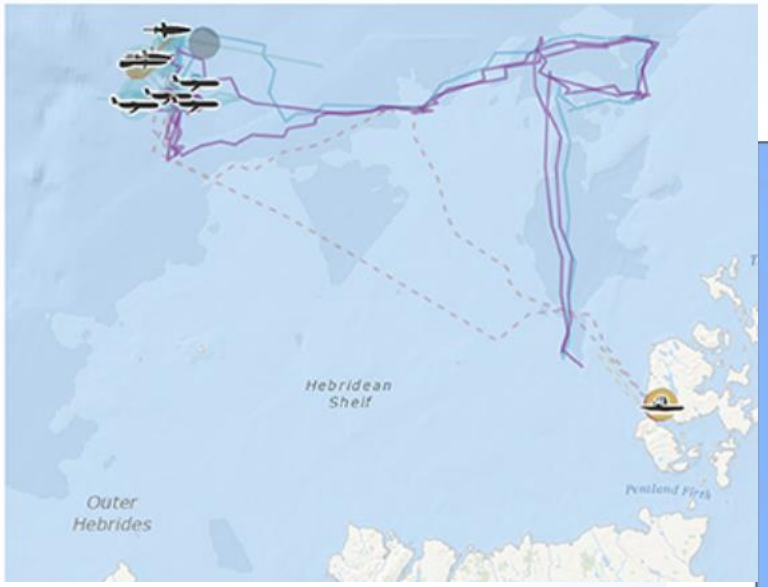
Planning & AI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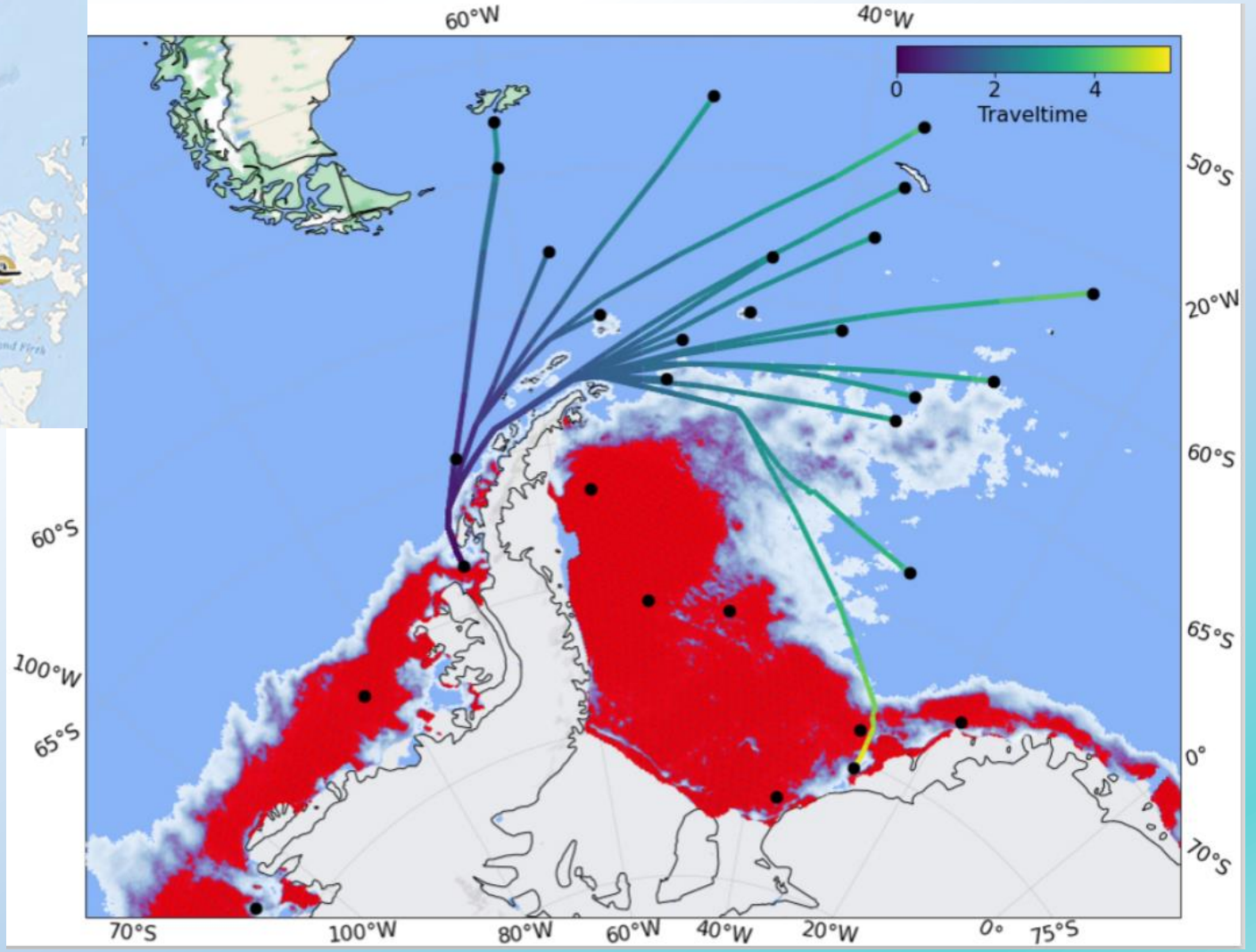
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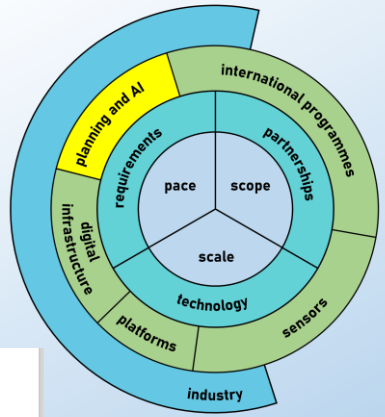
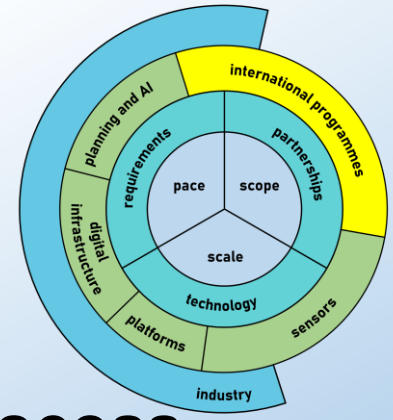
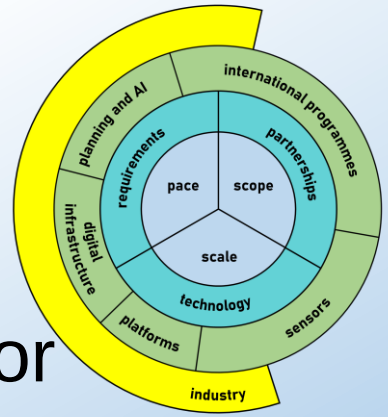

international programmes
partnerships
sensors
industry
platforms
digital infrastructure
planning and AI
requirements
pace
scope
scale
technology

International Programmes



- Internationally agreed strategies/priorities for sustained obs (GOOS, WIGOS)
- Research priorities - key knowledge gaps requiring better process understanding (UN Ocean Decade, WCRP, Future Earth,)
- Strengthened observation infrastructure sharing and collaboration (OceanOps, also groups such as Ocean Facilities Exchange Group)
- Sensor development - Priorities, standards and best practices; coordinated development and scale up (Ocean Best Practices Project)
- Data sharing and data infrastructure (ODIS, WIS 2.0, Ocean Decade Data and Information Strategy).
- Model/Observation system co-design, digital twins… (OceanPredict, UN Ocean Decade programmes (various), DCC Ocean Prediction).

Industry



- Building research ships is often a one-off activity delivering a bespoke outcome that is then integrated into a wider fleet or partnering arrangement.
- Autonomous systems present a very different scenario upon which funders and operators might develop procurement strategies:
  - Shorter equipment life-cycles
  - Identical platforms with standardised sensor fits
  - Share R&D investment/risk
  - Rapid trial of new technologies

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