



Integrated Navigation System-of-Systems PNT Integrity for Resilience

INSPIRe Project Overview



Imperial College
London

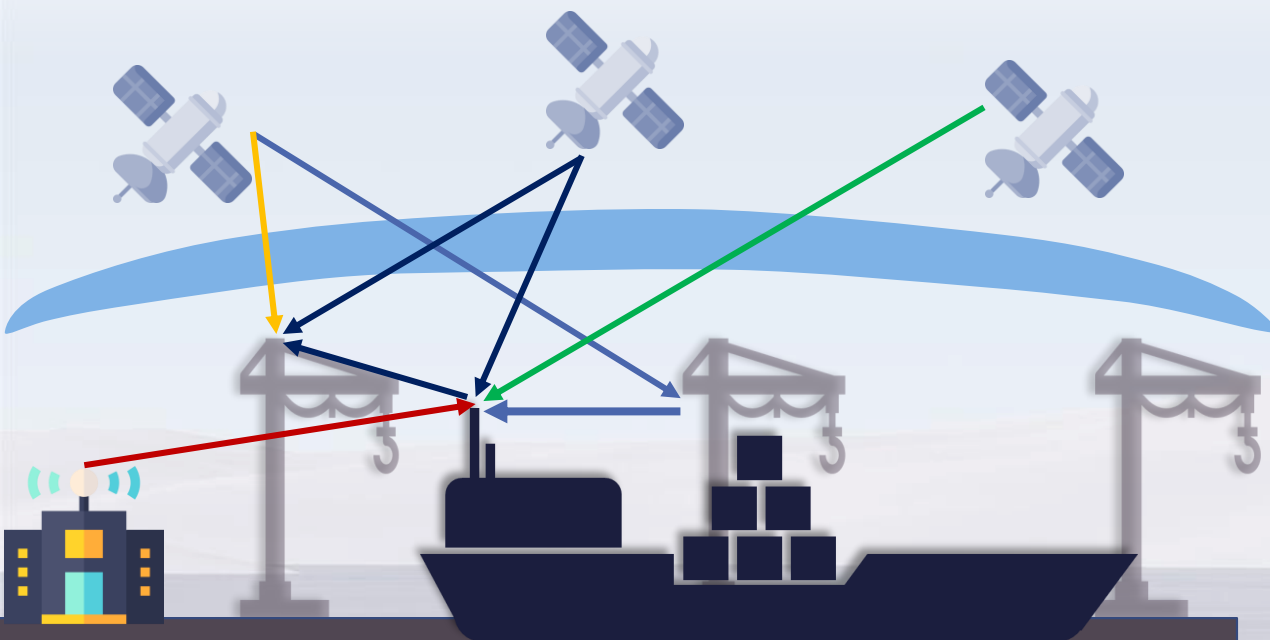


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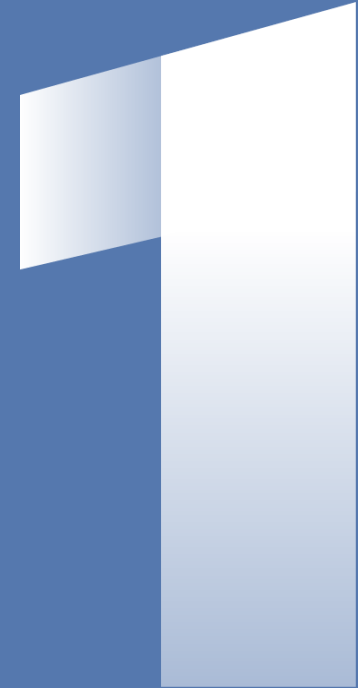
17th June 2022



Agenda

- 1 Introduction to INSPIRe
- 2 Project Scope & Structure
- 3 Questions?

Introduction to INSPIRe



INSPIRe will ensure PNT is provided to the required level of integrity in UK waters, as part of a resilient system

Position

- **Accuracy** – how close the solution is to the truth
- **Availability** – the probability that the solution can be derived at any given time
- **Continuity** – the likelihood of the solution being available over a given time period
- **Integrity** – a measure of the confidence that can be placed in the solution

Navigation

Timing

Focus of
INSPIRe

Resilience –

the ability to anticipate, mitigate and recover from disruption.

Resilience *in the maritime context* –

the provision of a user-level integrity guarantee, which makes a position solution robust to safety and security threats, likely to occur in the real world, e.g. cyber threat, space weather, deliberate jamming.

INSPIRe will focus on integrity aspects, principally the developments in receiver autonomous integrity monitoring of the MarRINav outcomes.

- Develop and bench-test user-level integrity solutions, based on:
 - Dual-frequency multi-constellation GNSS
 - EGNOS (as a source of error characterisation of GNSS)
 - Dead Reckoning systems (inertial)
- Define ground-based integrity support systems needed to:
 - Generate system level integrity
 - Support derivation of user-level integrity on-board vessel
 - Receive crowd-sourced user-derived integrity and retransmit as an eNavigation service

A number of specific objectives have been identified for the project

1

Investigate, develop and bench-test techniques and algorithms for autonomous user-level integrity monitoring, based on:

- Dual-frequency multi-constellation GNSS
- EGNOS (as a source of error characterisation of GNSS)
- Dead Reckoning systems (inertial)

2

Investigate, develop and bench-test equipment for:

- Receiver autonomous integrity monitoring (RAIM) availability prediction
- Terrestrial monitoring of system-level integrity

3

Investigate, develop and build a prototype for EGNOS performance monitoring

- Required for service assurance in absence of UK access to EGNOS SoL service

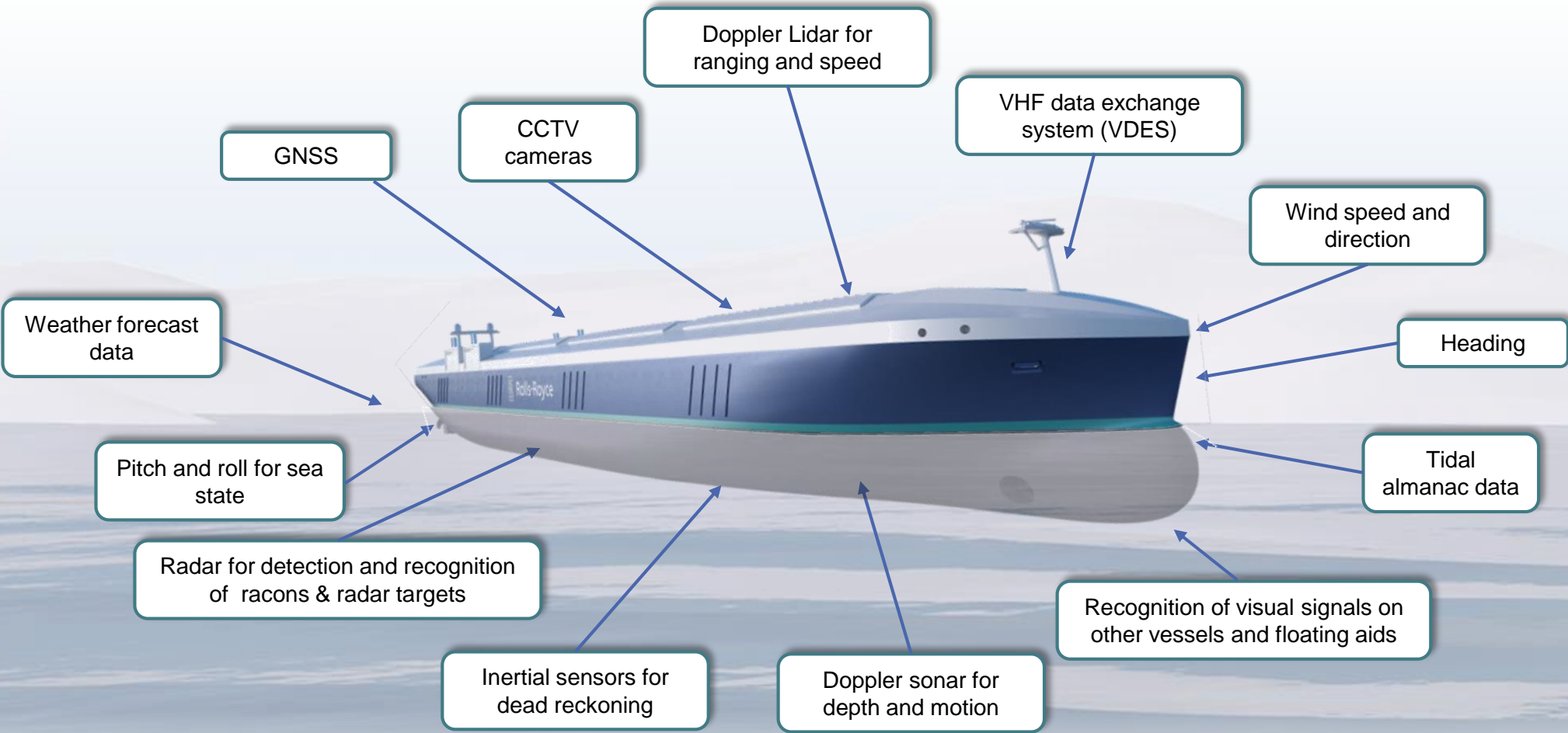
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Investigate the feasibility, provide a functional design, and define development and exploitation plans for an e-Navigation service to provide supplementary integrity data to vessels considering:

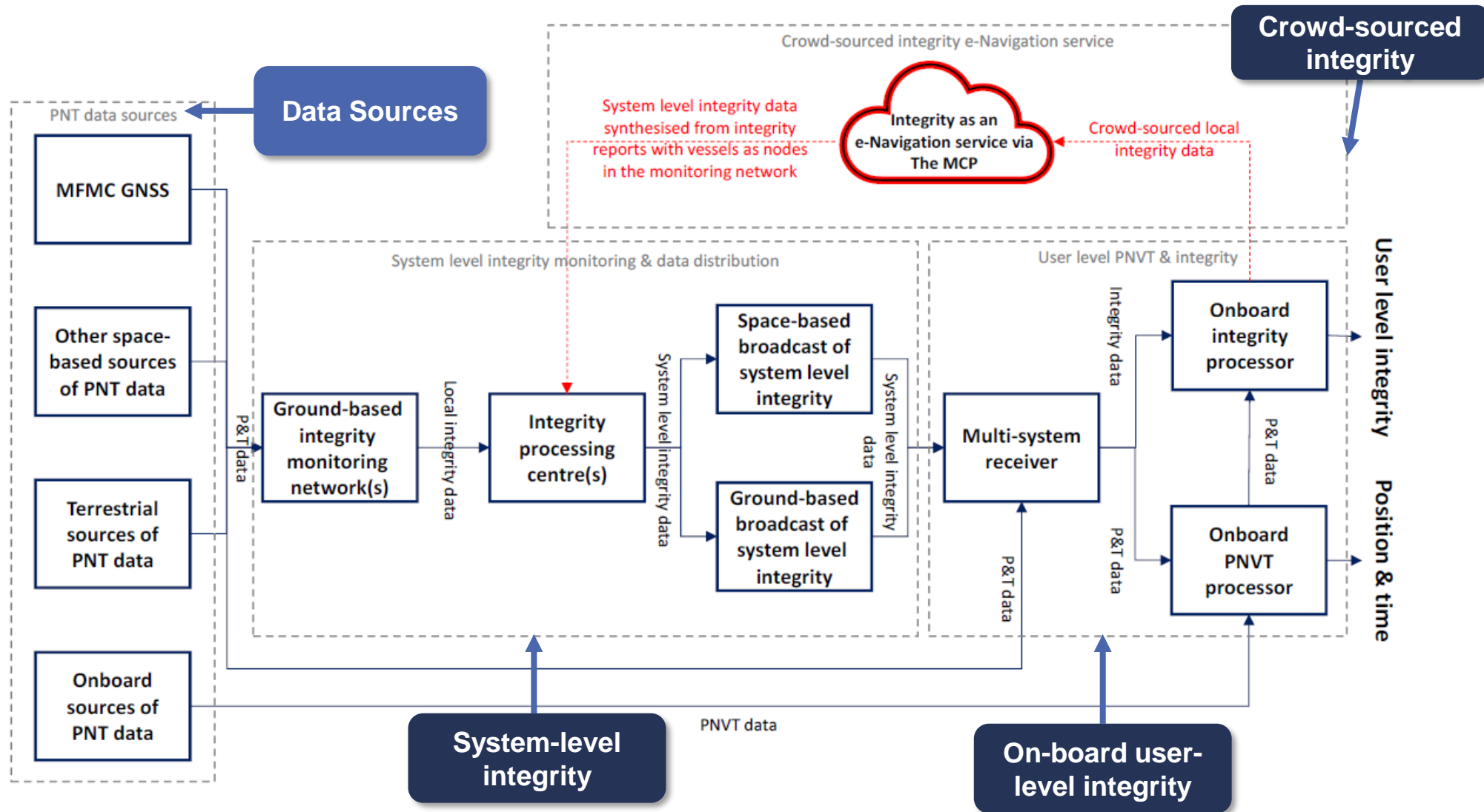
- GNSS terrestrial integrity monitoring
- Crowd sourced data from maritime users
- Potential expansion to other user sectors

While the focus is on current sources of PNT data and the maritime domain, solutions will be capable of expansion to incorporate new data sources and exploitation by other domains.

INSPIRe will bring together Position, Navigation, Velocity and Timing related data from a wide range of sources



The project will examine integrity derived at system and user level via on-board systems, and crowd-sourced data



Project Scope & Structure



INSPIRe will be delivered by a team bringing expertise in many different areas

TAYLOR | AIREY

Taylor Airey bring project management expertise



Imperial College
London

ICL brings world leading PNT research and development



GRAD (part of the lighthouse authority) will provide maritime domain expertise



LE brings expertise in economic assessments of PNT



GMV NSL specialises in space; position, navigation and timing



KTN offers knowledge transfer and PNT expertise and will manage the stakeholders



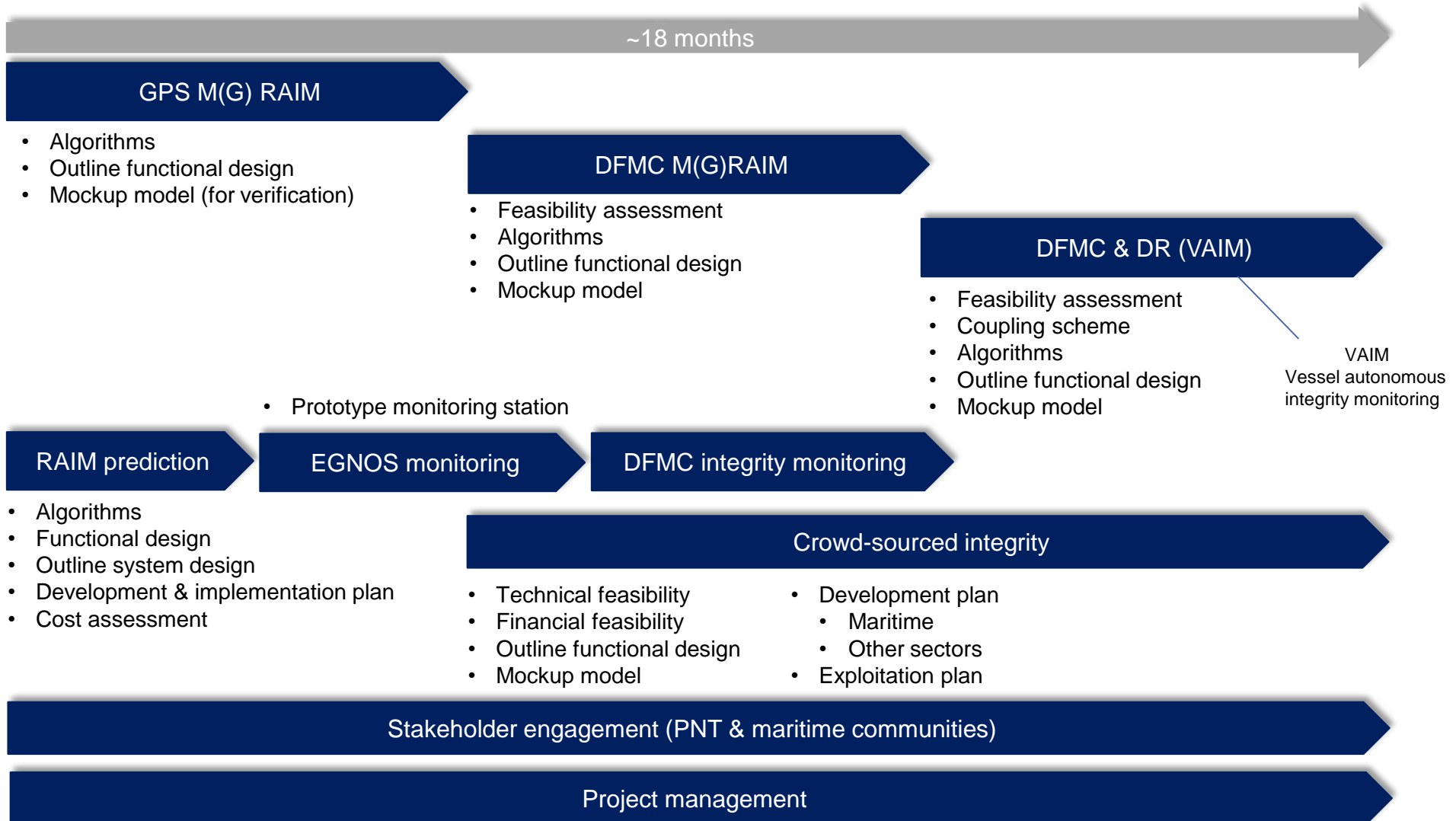
CGI will lead the development of the outline a design for a DFMC integrity monitoring system



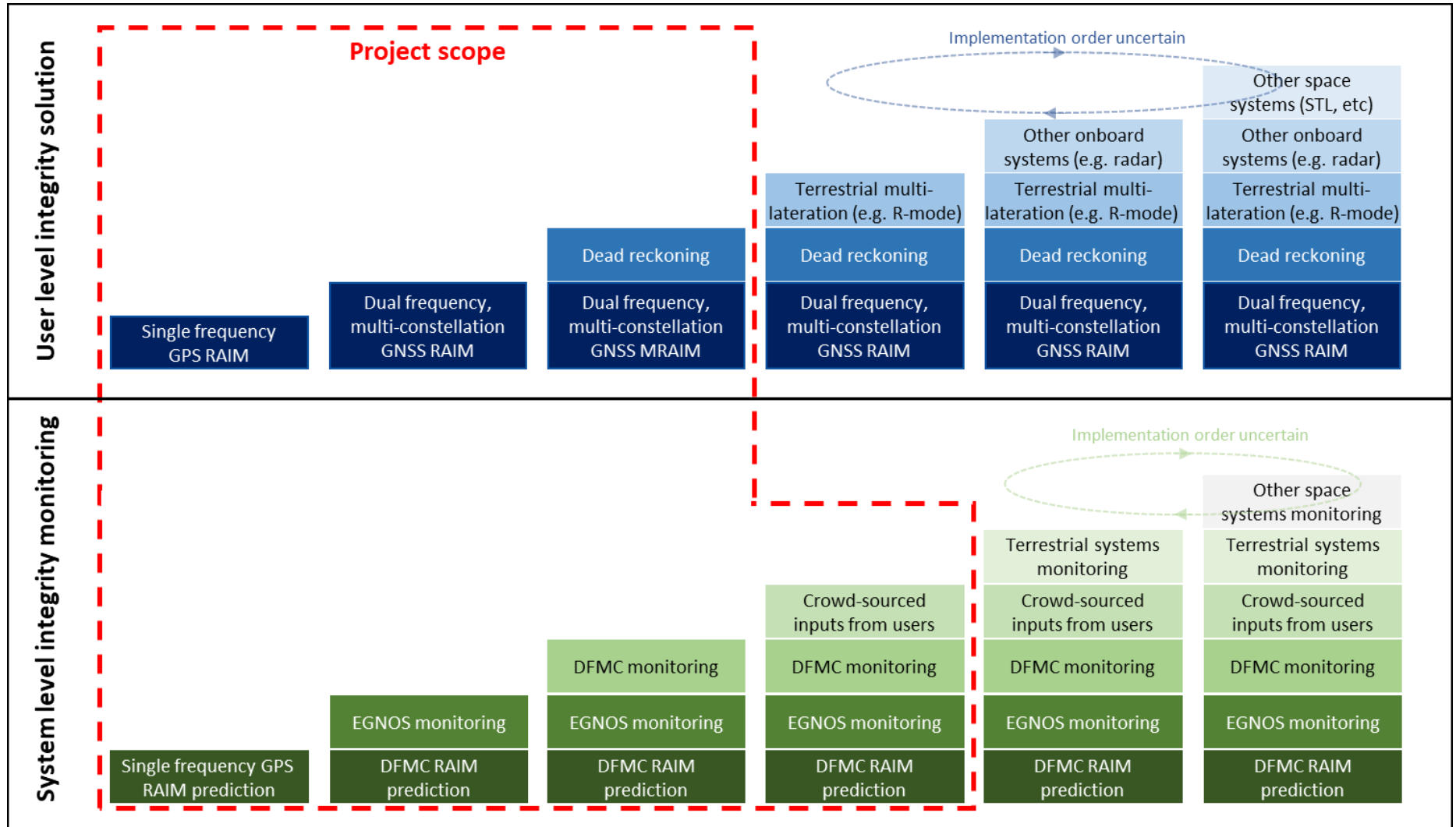
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NLAI offers specialist expertise in the field of navigation and PNT

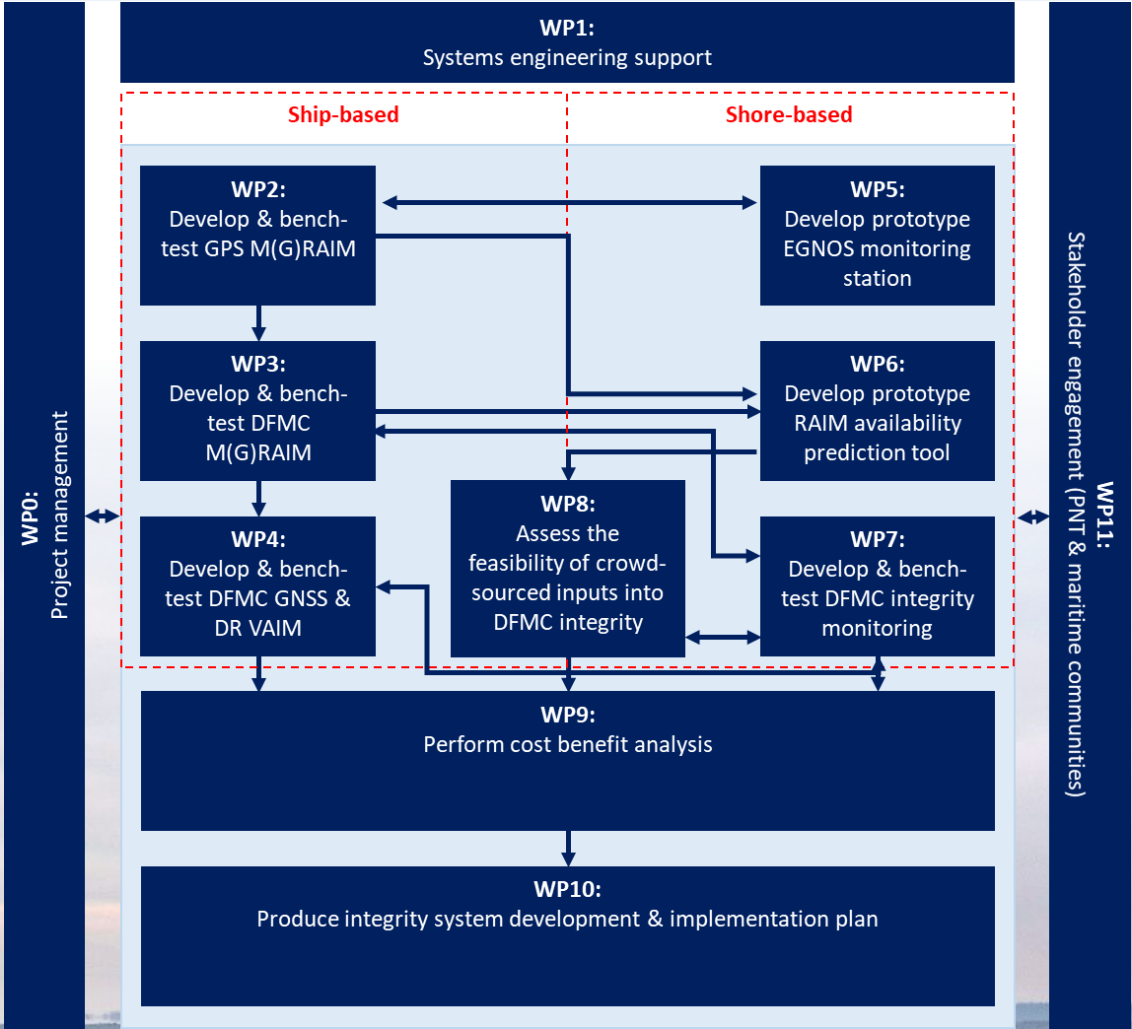
The project will be delivered over an 18-month period with project outputs delivered throughout



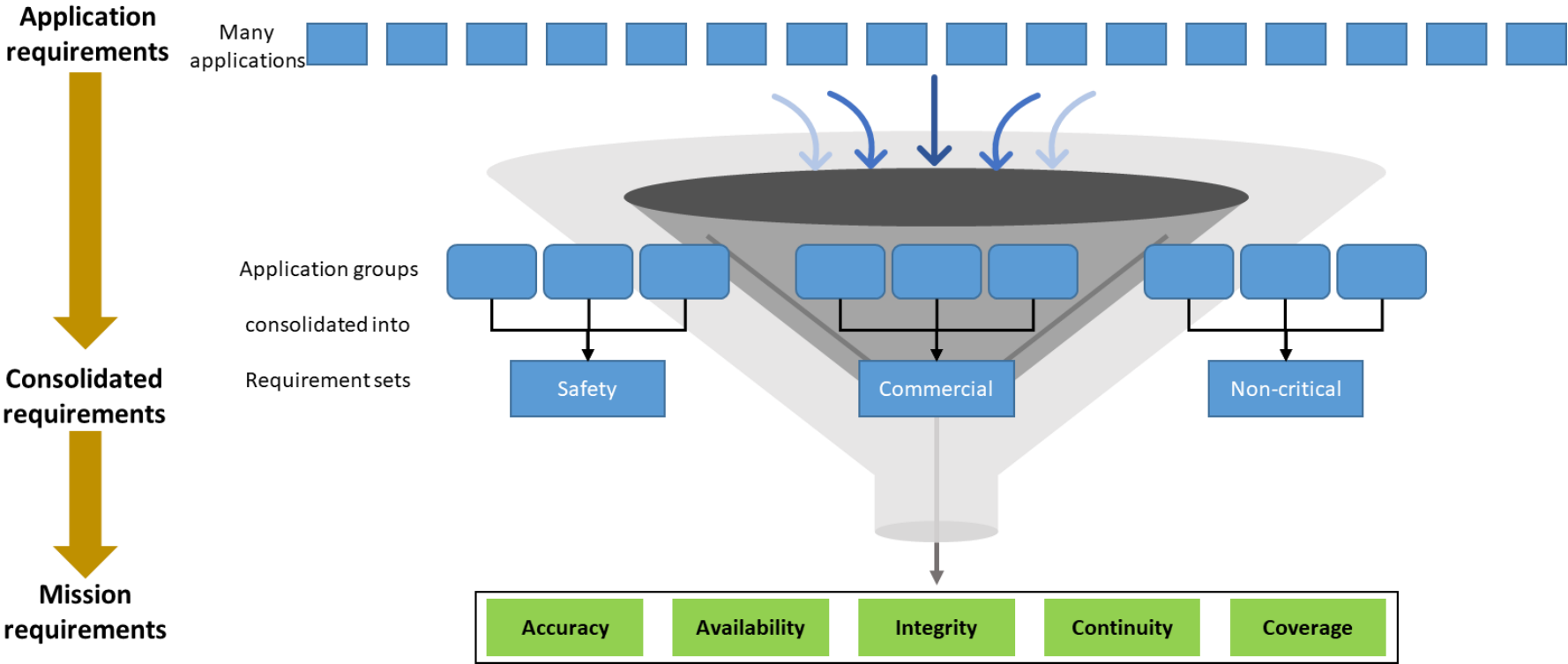
The scope of the project has been clearly defined to ensure delivery of the objectives within this 18-month timescale



Work packages have been defined and lead-roles assigned across consortium partners as appropriate



The project will start by critically assessing and consolidating the maritime mission requirements



Questions?

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For further questions or more information, please contact Phil Taylor at Taylor Airey



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