S&I Subgroup Webinar

Autonomous robots and vessels

January 18th 2024

DeepWind

Survey & Inspection Subgroup

offshore wind Scotland

Image source – Dean Boyce, SSE Renewables

Image source: Sonardyne

Image source: Rovco

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Introduction from our
Subgroup Co-chairs

- Michael Ellis Sonardyne
- Craig Davis ROVCO

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Environmental Monitoring Innovation

UK registered businesses can apply for a share of up to £5 million for collaborative projects to develop innovative solutions in environmental monitoring. This funding is from Innovate UK and The Department for Environment, Food & Rural Affairs (Defra).

Innovate UK

Department for Environment Food & Rural Affairs

Eligibility

This competition is open to collaborations only.

To lead a project your organisation must:

- be a UK registered business of any size
- collaborate with other UK registered organisations

Opening soon

Opens:

22 January 2024

Closes:

6 March 2024

Innovate UK Smart Grants (£25m fund)

The Innovate UK Smart grant has focused scope and eligibility criteria to support SMEs and their partners in developing genuinely new innovations with significant potential for rapid economic return to the UK. The application process reflects the importance of obtaining economic benefits from public funding, and the potential for successful commercialisation, growth, and exports.

Innovate UK

Open Now: Today

Closes: -**Wednesday 24 April 2024 12:00pm**

Supply Chain Pathway and Challenge Fund

The Challenge Fund supports high-growth potential companies across North-East Scotland's oil and gas sector to enter the low-carbon industry. The Challenge Fund will award grant funding between £50k and £250k to accelerate innovation and market entry, support business growth, and create new jobs in the energy transition into the low-carbon market. Applications may include new facilities, new equipment and existing infrastructure upgrades, including digital infrastructure.

Open Now
Closes: -**12pm on the 9th of April 2024.**

Wind Expert Support Toolkit (WEST)

WEST is a short-term intervention activity which aims to support growth of offshore wind supply chain companies through provision of specialist advice, market intelligence and strategic insight into the sector

Application Status
Closing Date
Wave 8 – Open
26th January 2024 – 5pm

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Andre Fabik

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FUTURE REMOTE & AUTONOMOUS TECHNOLOGIES FOR SURVEY & INSPECTION

Deep Wind Online Webinar

January 2024

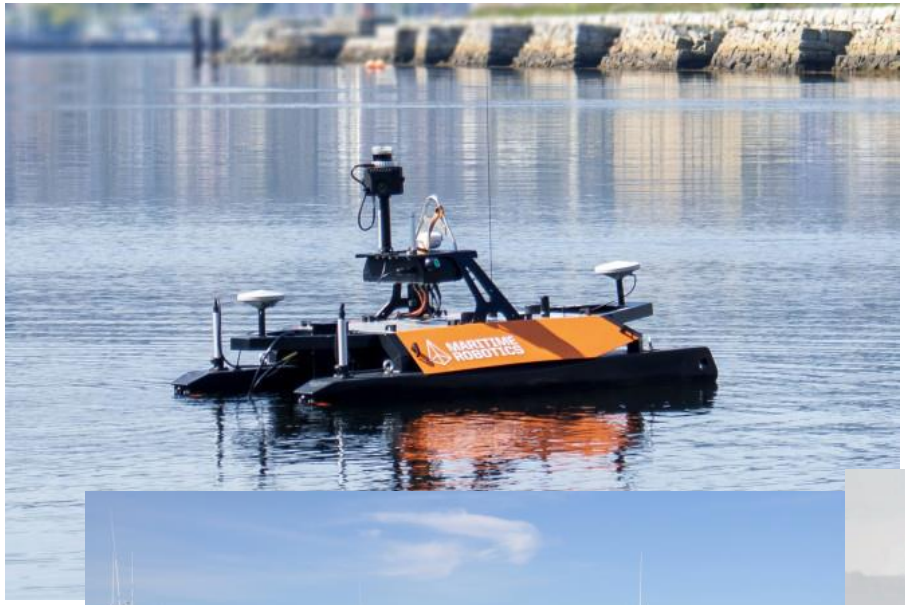
Andre Fabik – Technical Sales Manager

Overview

- Technology Adoption
- Market Drivers
- Required technology strands
- Developments
- Outcome

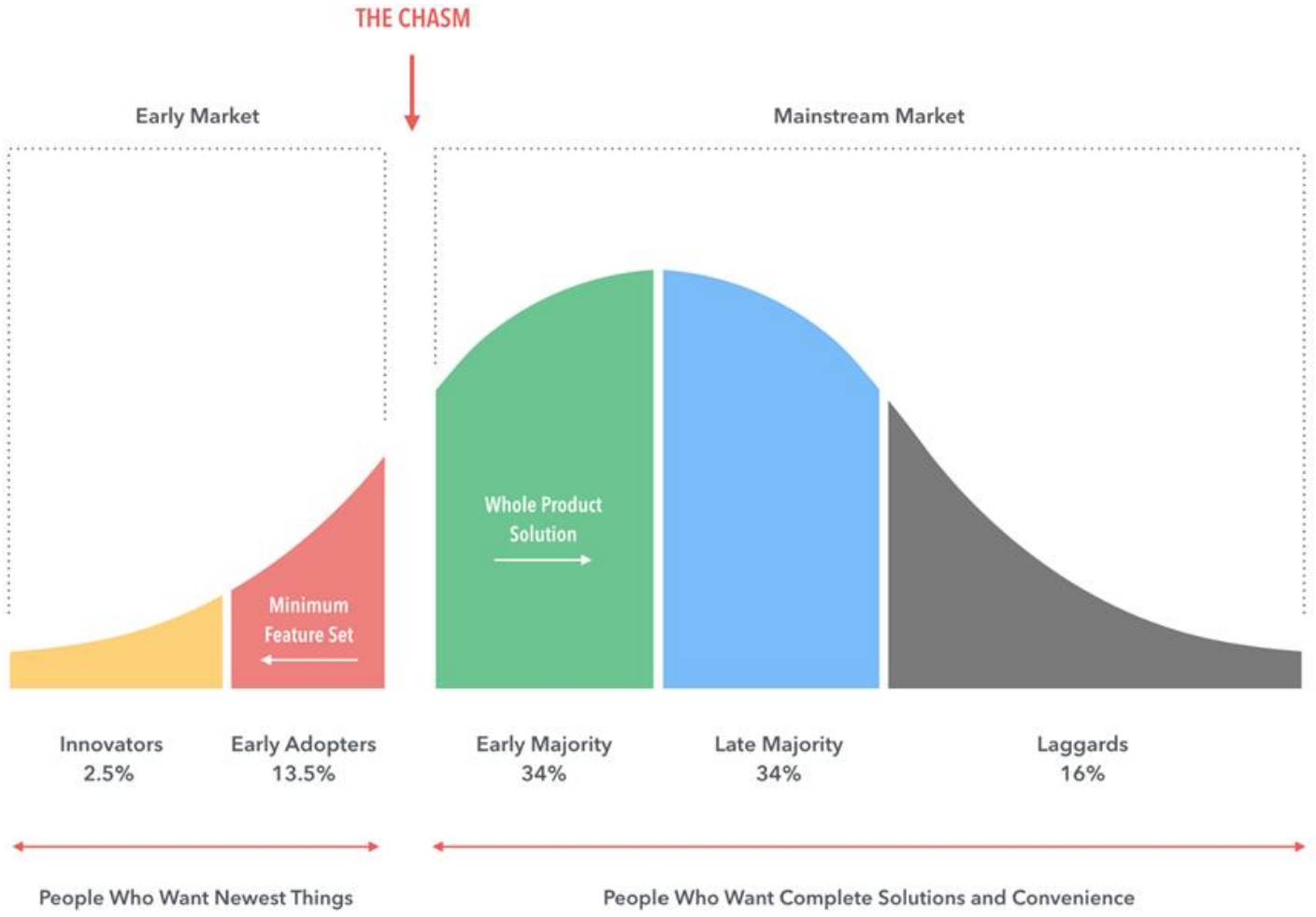
Technology Adoption

- Benefits established
- Range of operating areas
- Accessibility of vehicles
- Acceptance/embrace by customers



Technology Adoption

- Bridged ‘The Chasm’
- Widespread adoption
- One caveat

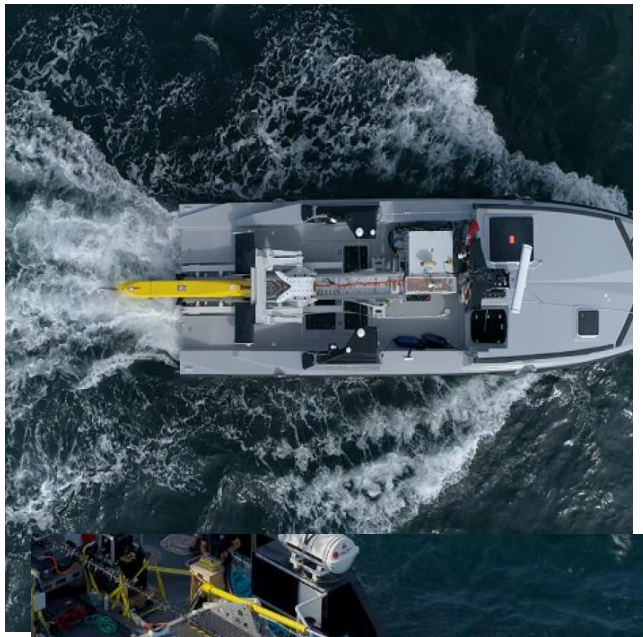


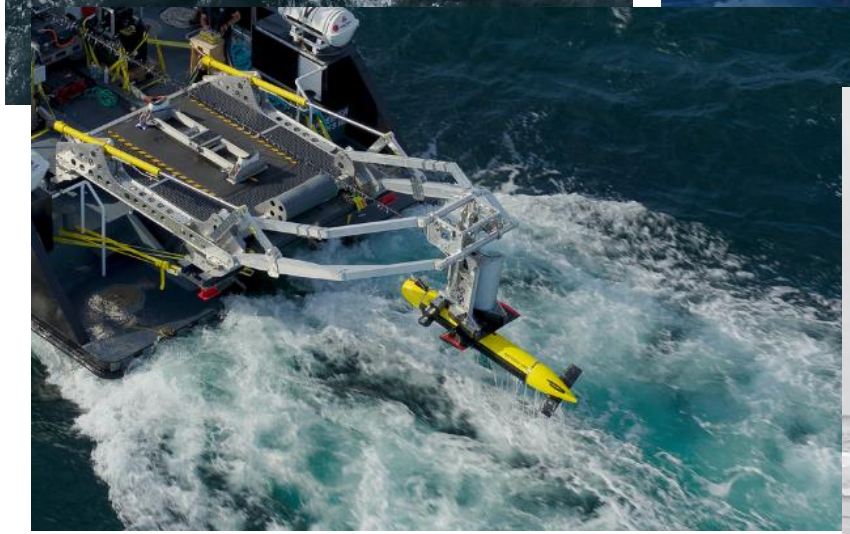
Market Drivers & Required Technology Strands

- Complete solutions
- Market asking for broader scope
- Parallel tech strands barriers to provision
- LARS
- Satellite internet services
- USV control systems

Launch and Recovery Systems

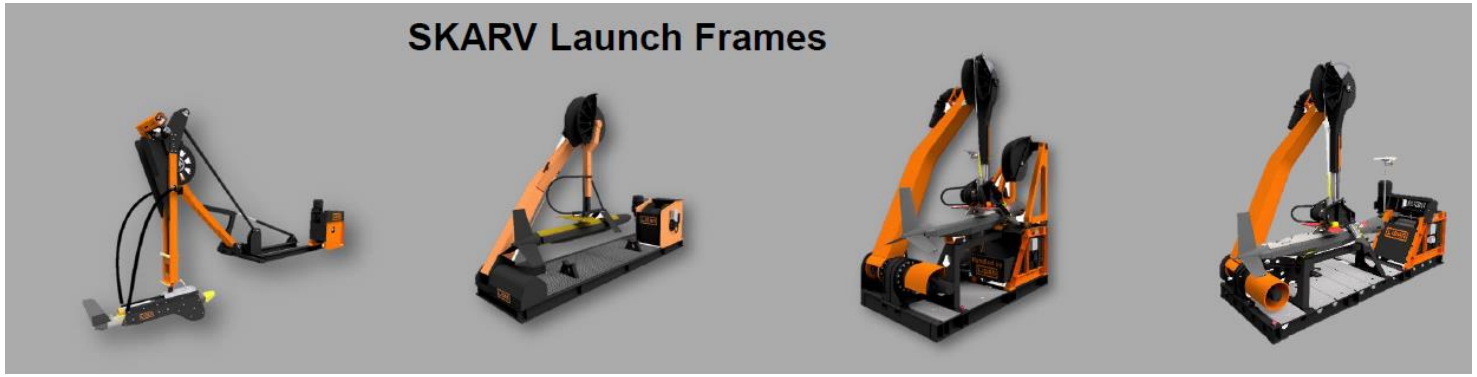
- **Most cited obstacle**
- **Tech problem requiring significant resource to be solved**
- **First development driven by military requirements**
- **Tech now becoming available in commercial sector**

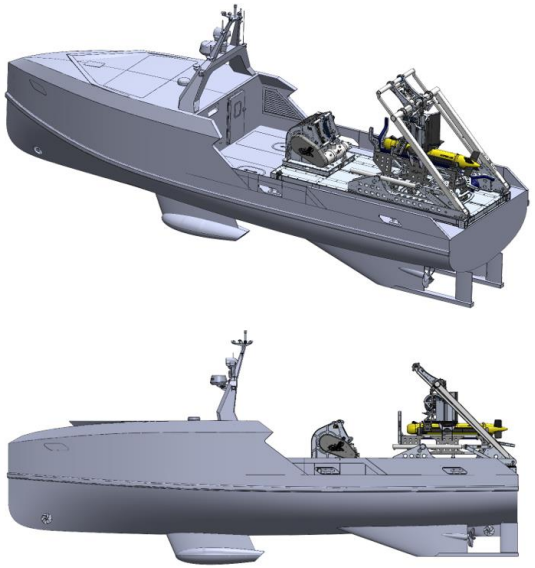


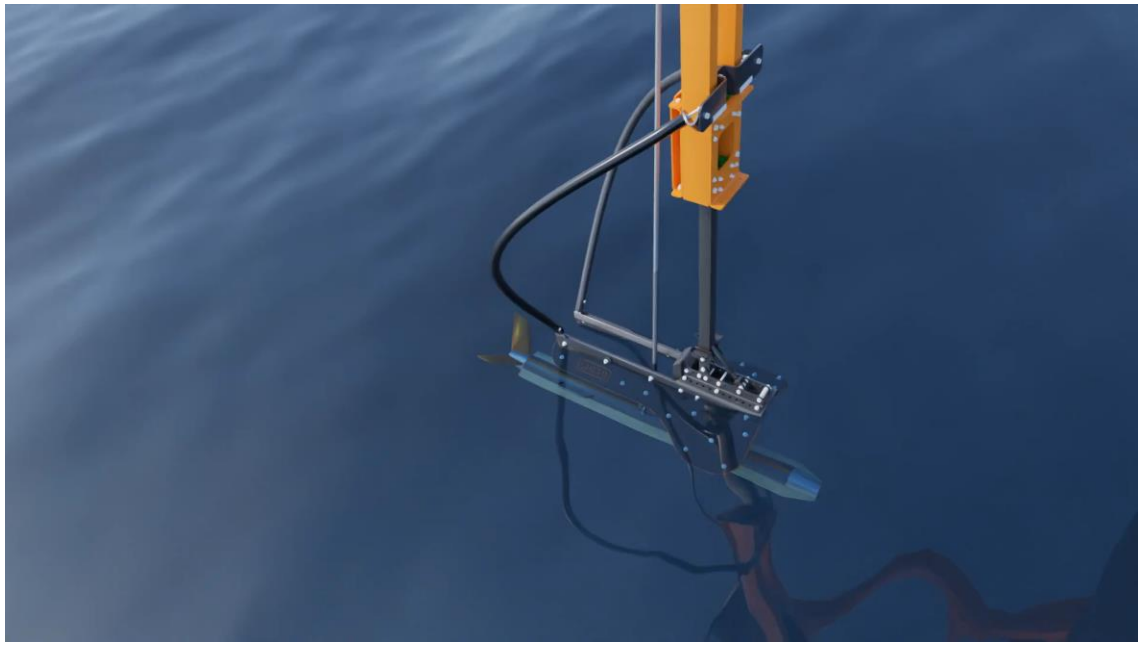


Launch and Recovery Systems

- **Systems still concentrated in military domain**
- **Commercial demand now recognised**
- **Not just for uncrewed vessels**

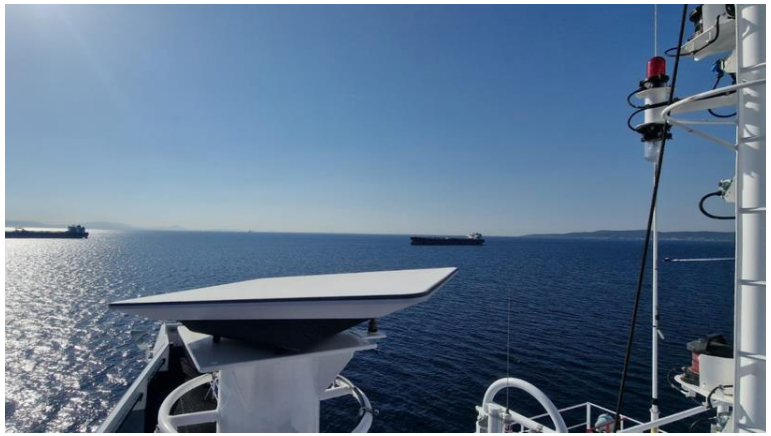


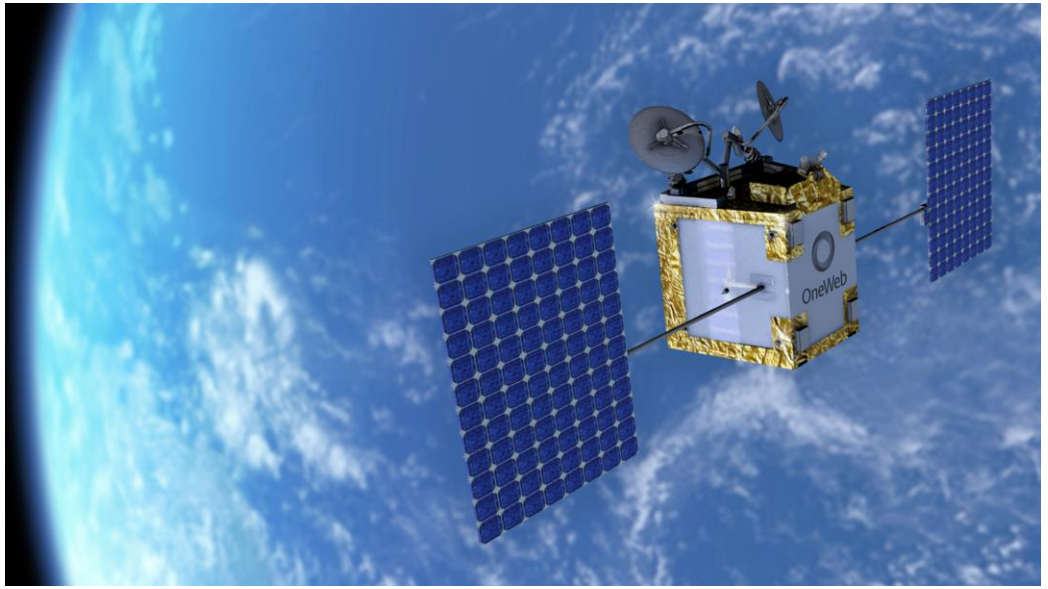




Satellite Communications

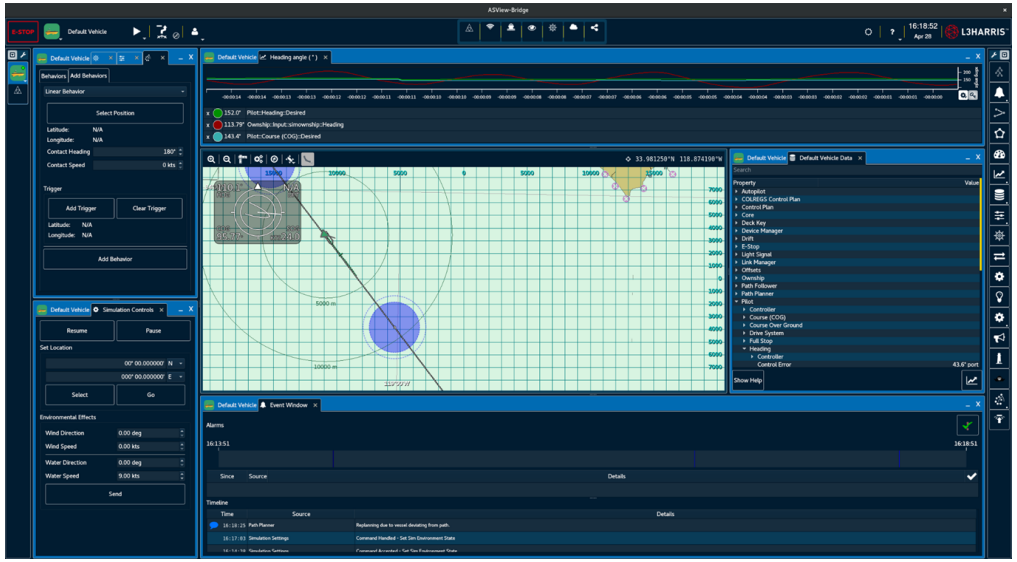
- **Specifically LEO constellations**
- **Starlink, ONEWEB**
- **Again conceived for military requirements**
- **Has been on the horizon for a while**
- **Gamechanger in a number of ways**

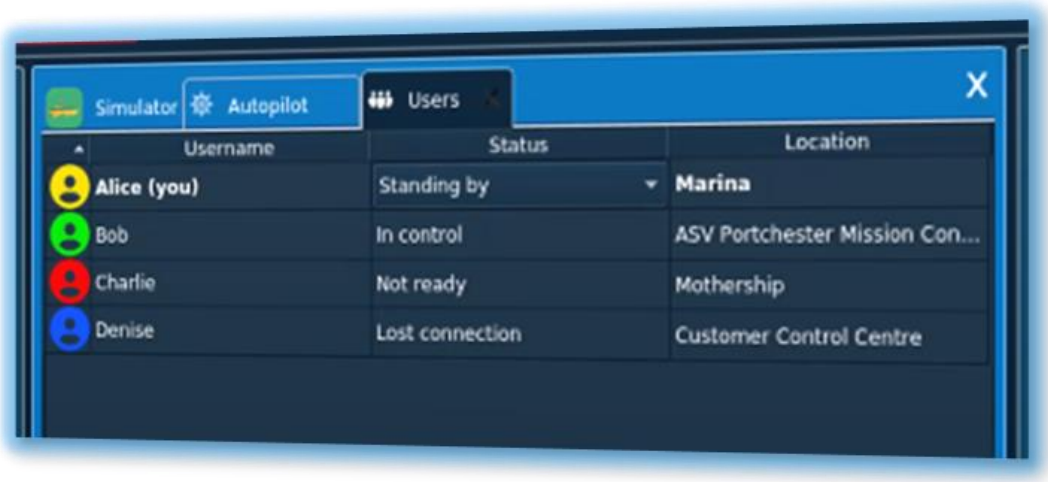




Control Software

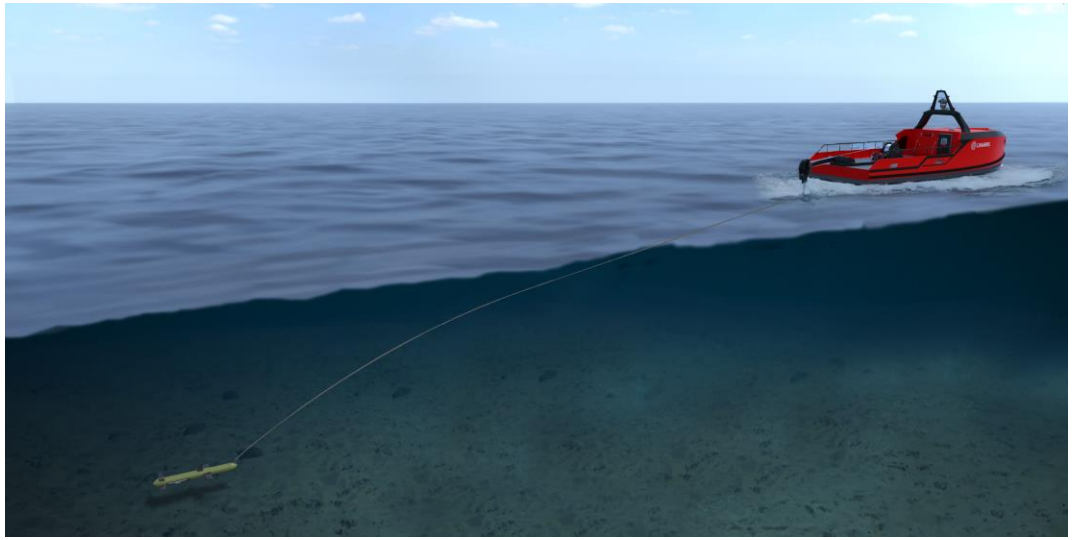
- Gradual process
- Mature, Assured
- Open architectures
- Multi-user/Multi-location





L3Harris C-Worker 15 USV

- **Brings together these advances**
- **21 day endurance, OTH**
- **LAR towed sensors and Inspection class ROV payloads**



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Iain Vincent

SoAR

Symbiosis of Adaptive Robots

Iain Vincent
Director & General Manager, ecoSUB Robotics
SoAR Project Lead
January 2024 – DeepWind - Survey & Inspection Subgroup

SoAR overview

- An Innovate UK funded project
- Budget: nearly GBP 2 million
- 2-year project, 1 October 2021 – 30 September 2023
- Project partners:
  - Planet Ocean / ecoSUB Robotics – Project Lead
  - Sonardyne
  - HydroSurv
  - National Oceanography Centre
  - Royal Holloway University of London
  - Offshore Renewable Energy Catapult
- Objective: step change in the use of role specific, multi-platform robotic swarms

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Squads of Adaptive Robots

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Sonardyne

HydroSurv
Unmanned Ingenuity

National Oceanography Centre

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SoAR objectives

- Develop an accessible solution to operate heterogeneous networks of robots
  - An open network – any robot can join
- Provide a dynamic and scalable communications protocol
- Autonomy engine
  - Squad mission planning
  - Continuous monitoring of networked vehicles
  - Re-tasking of the fleet to ensure mission objectives are completed
- Simplify the operation of collecting data with squads of robots

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The squad

REAV-60
HydroSurv
USV – Gateway coms

ecoSUBm5-Power+ Scout
ecoSUB Robotics
AUV Fleet – Large area survey

AUTOSUB Hover-1
National Oceanography Centre
AUV – Close inspection

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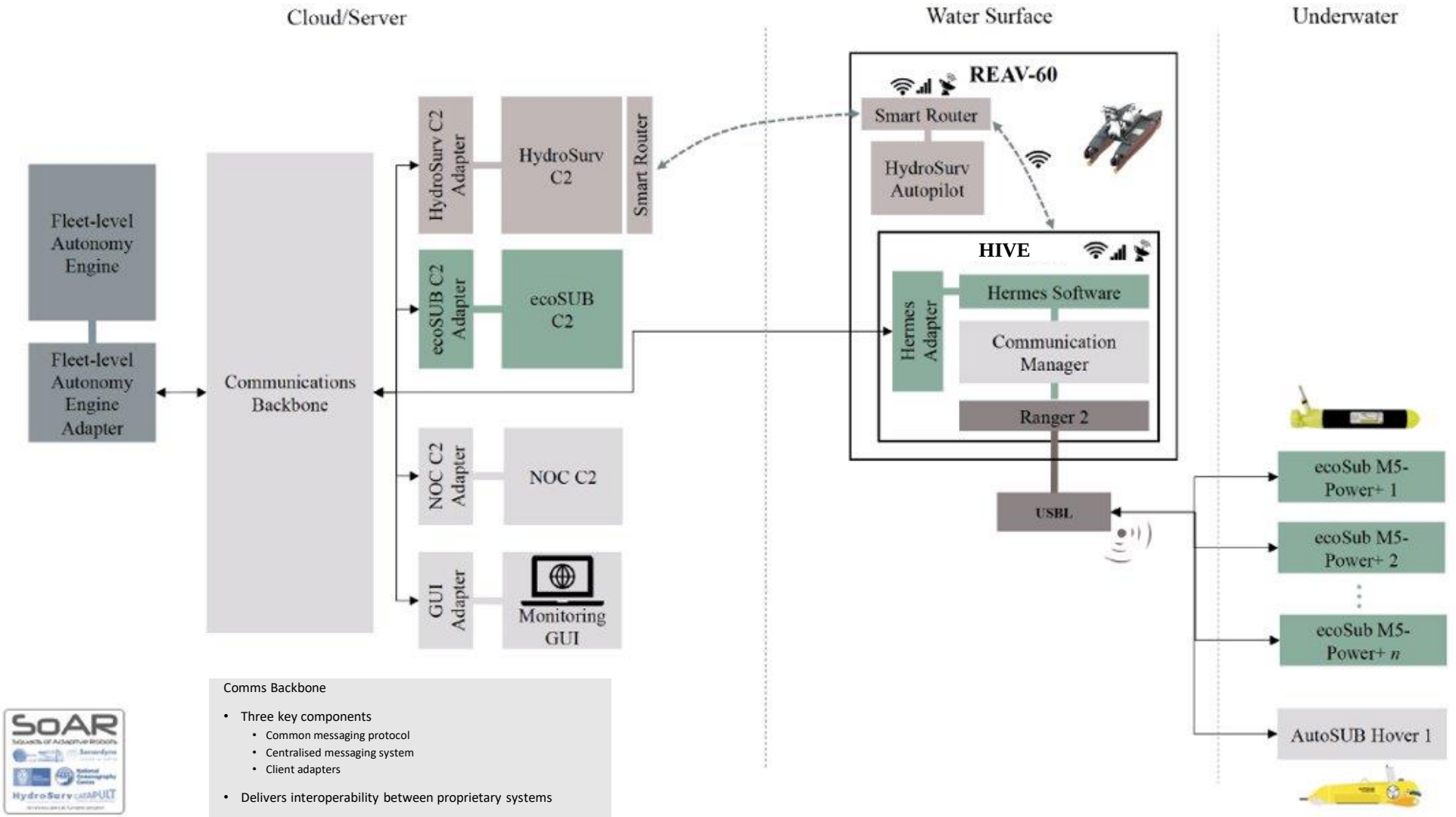
Major project outputs – Architecture

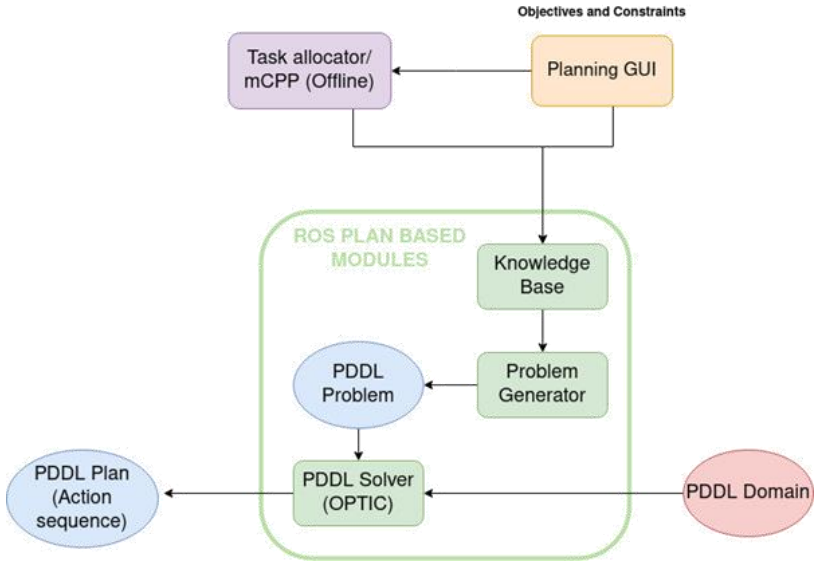


Comms Backbone

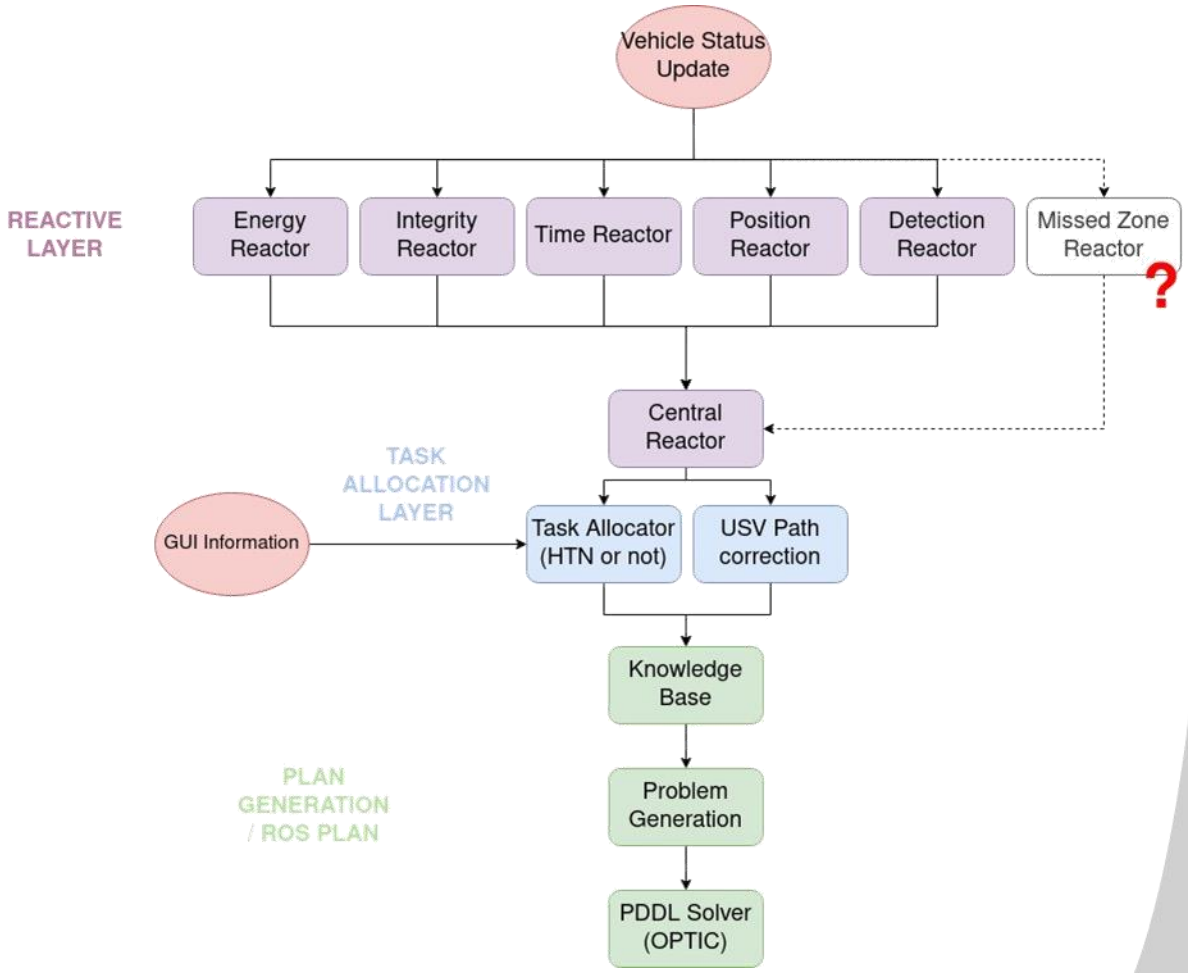
- Three key components
  - Common messaging protocol
  - Centralised messaging system
  - Client adapters
- Delivers interoperability between proprietary systems
- Collaborative mission control, management and connectivity

Major project outputs – Autonomy Engine

Offline part architecture



Online part architecture



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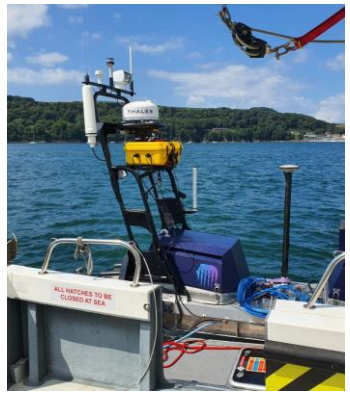
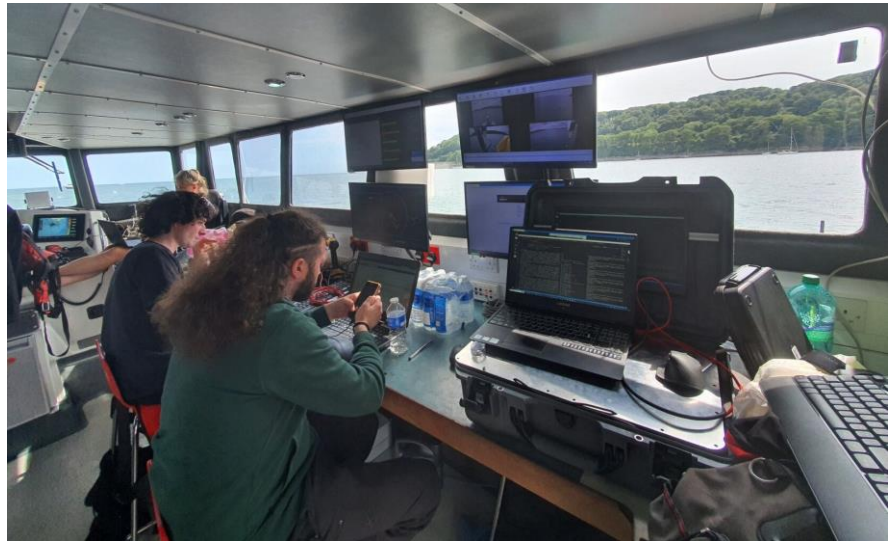
Major project outputs - HIVE

- HIVE
  - Gateway system
    - Hermes C3 integrated for ecoSUB coms
    - Sonardyne Ranger 2 integration for USBL tracking and navigation aid
    - SoAR message handling
    - Interface between Coms Backbone and Coms Manager
    - Ability to be local host for SoAR Autonomy Engine





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Major project outputs - HydroSurv

- Remote Operations Centre (ROC)
  - Central hub for human oversight and coordination of the entire fleet of USVs and AUVs
  - The modularised ROC features three operator stations and enables secure Beyond Visual Line of Sight (BVLoS) operations via a VPN connection
- REAV-60 Long Endurance USV
  - Upgrades to ensure compliance with the latest regulatory standards
  - Significantly elevated the system's integrity and performance in real-world operational environments

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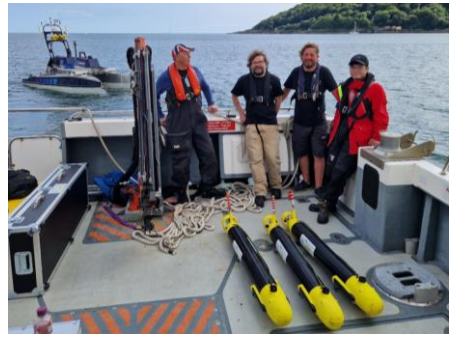
Major project outputs - ecoSUB

- ecoSUBm5-Power+ AUV
  - Increased power for payload or range
  - Increased payload capacity
  - Increased propulsion power
  - Integrated Sonardyne AvTrak 6 Nano modem
  - Jetson Orin Nano (JON) backseat computer
  - ecoCAM 4k video and still camera encoding on JON for machine vision applications
  - Dry weight 17kg



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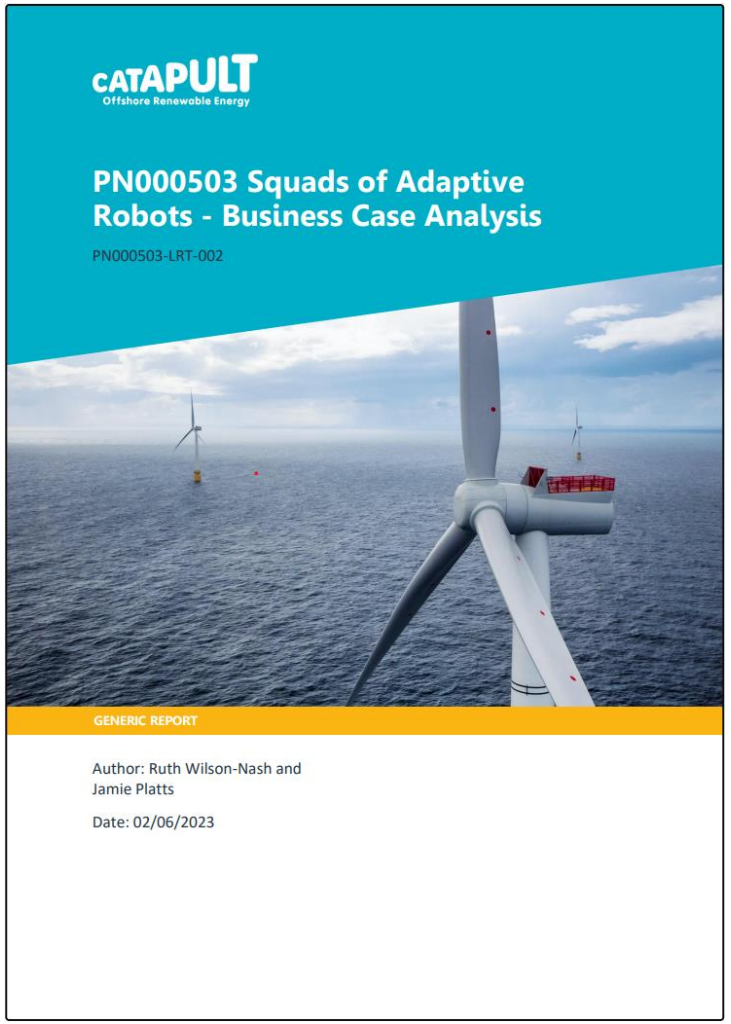
Major project outputs – ORE Catapult

- PN000503 Squads of Adaptive Robots – Business Case Analysis
  - Comprehensive study
  - Analysis of impact of SoAR model compared against current approach
  - Identified cost reduction of 78% for geophysical survey
    - Reduced mission time
    - Quicker surveying (with squad)
    - Simultaneous survey activity
    - Requires mothership where robots return for charging



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July 2023 SoAR Trials

- 18-member core team, plus support and observers
- Operated in Plymouth Sound
- Four support vessels from Sonadyne, MBA and HydroSurv

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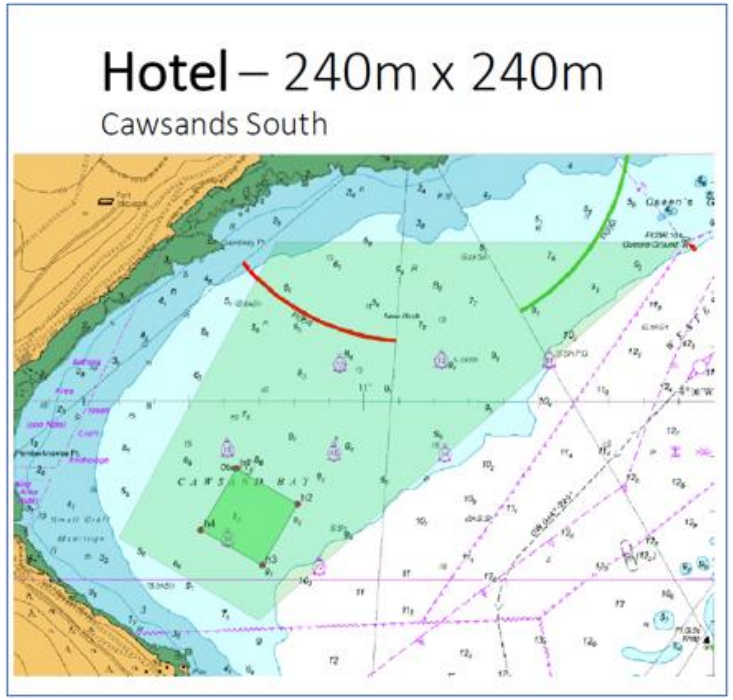
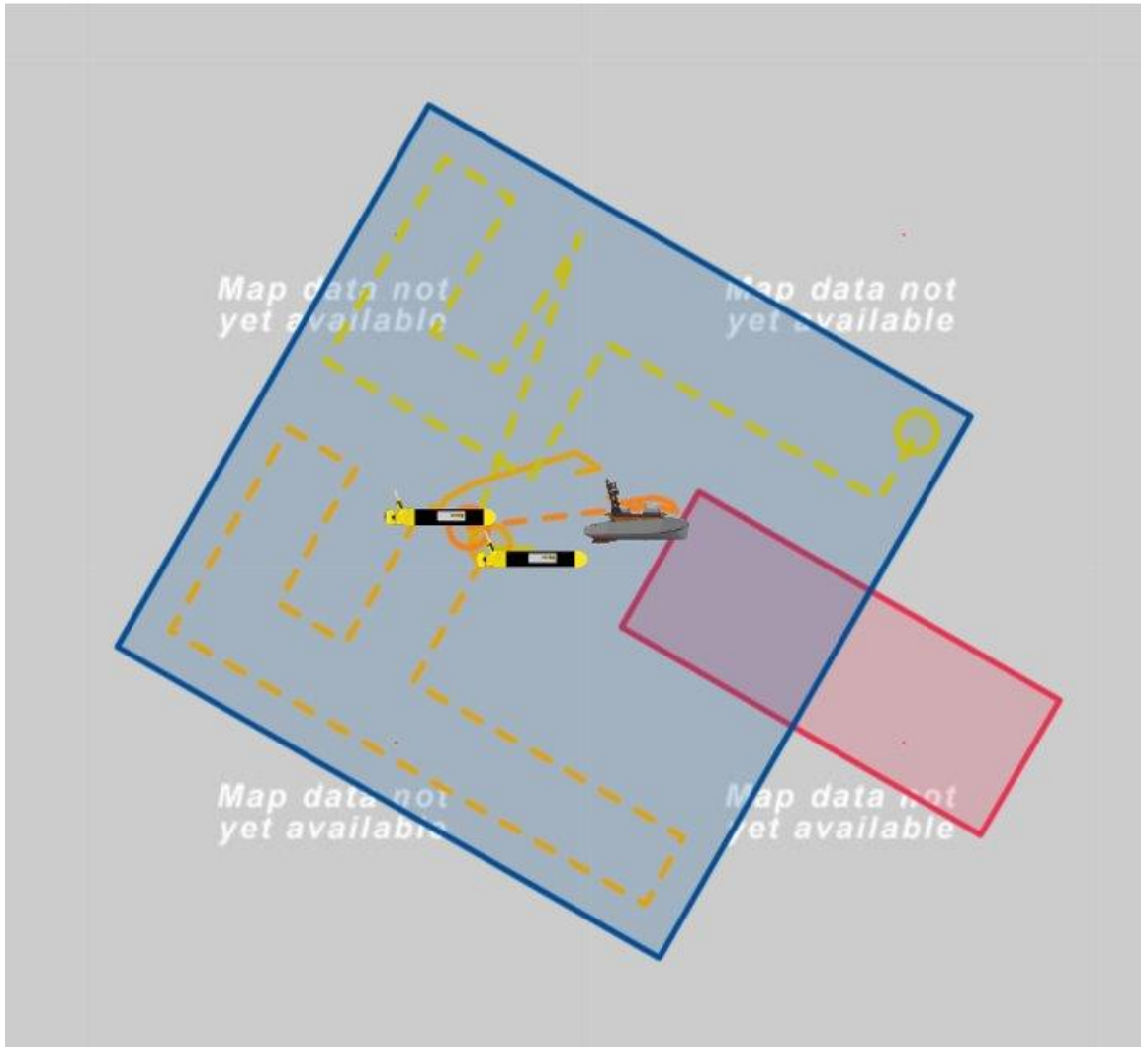
Example mission





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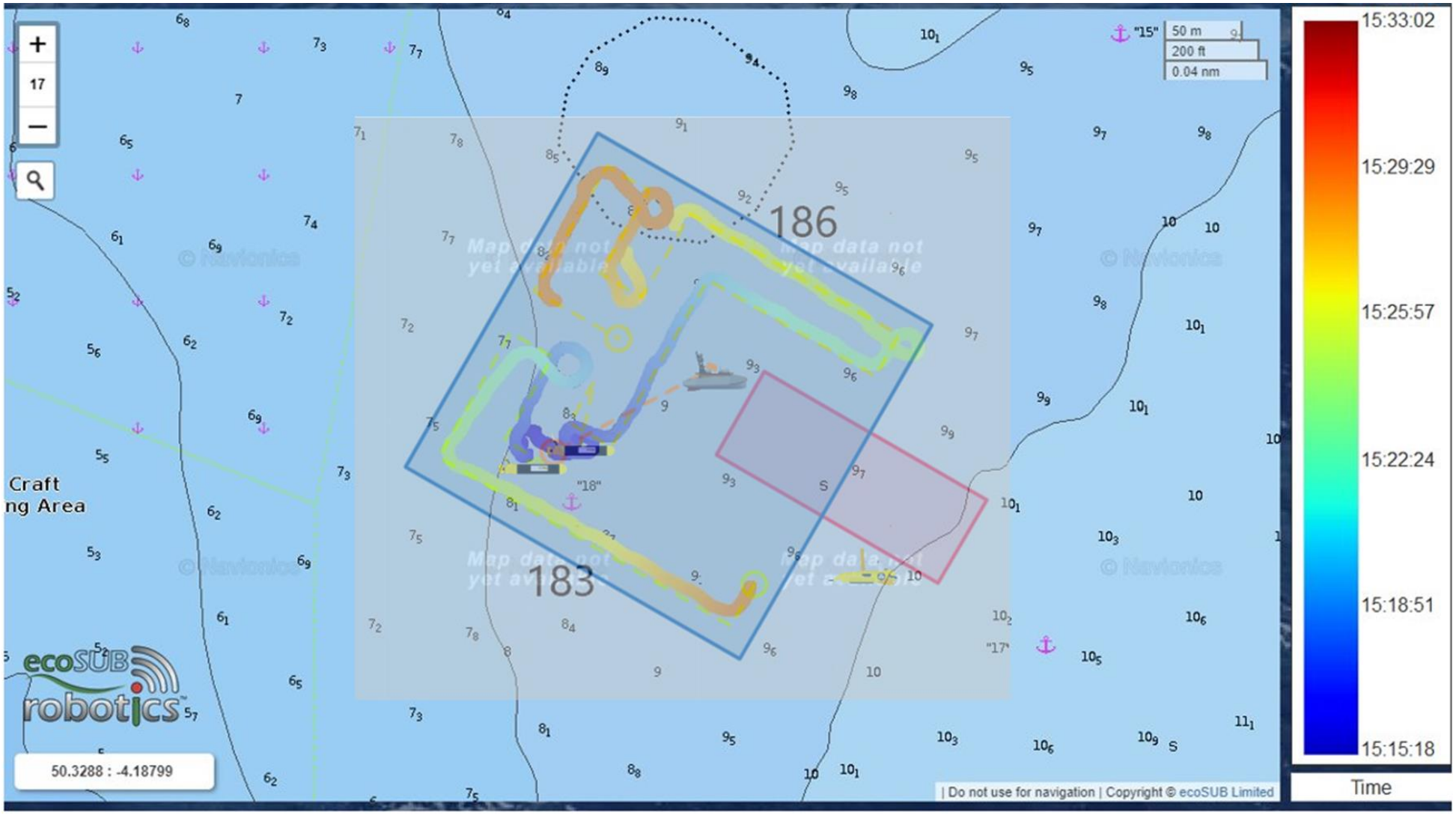
Example mission



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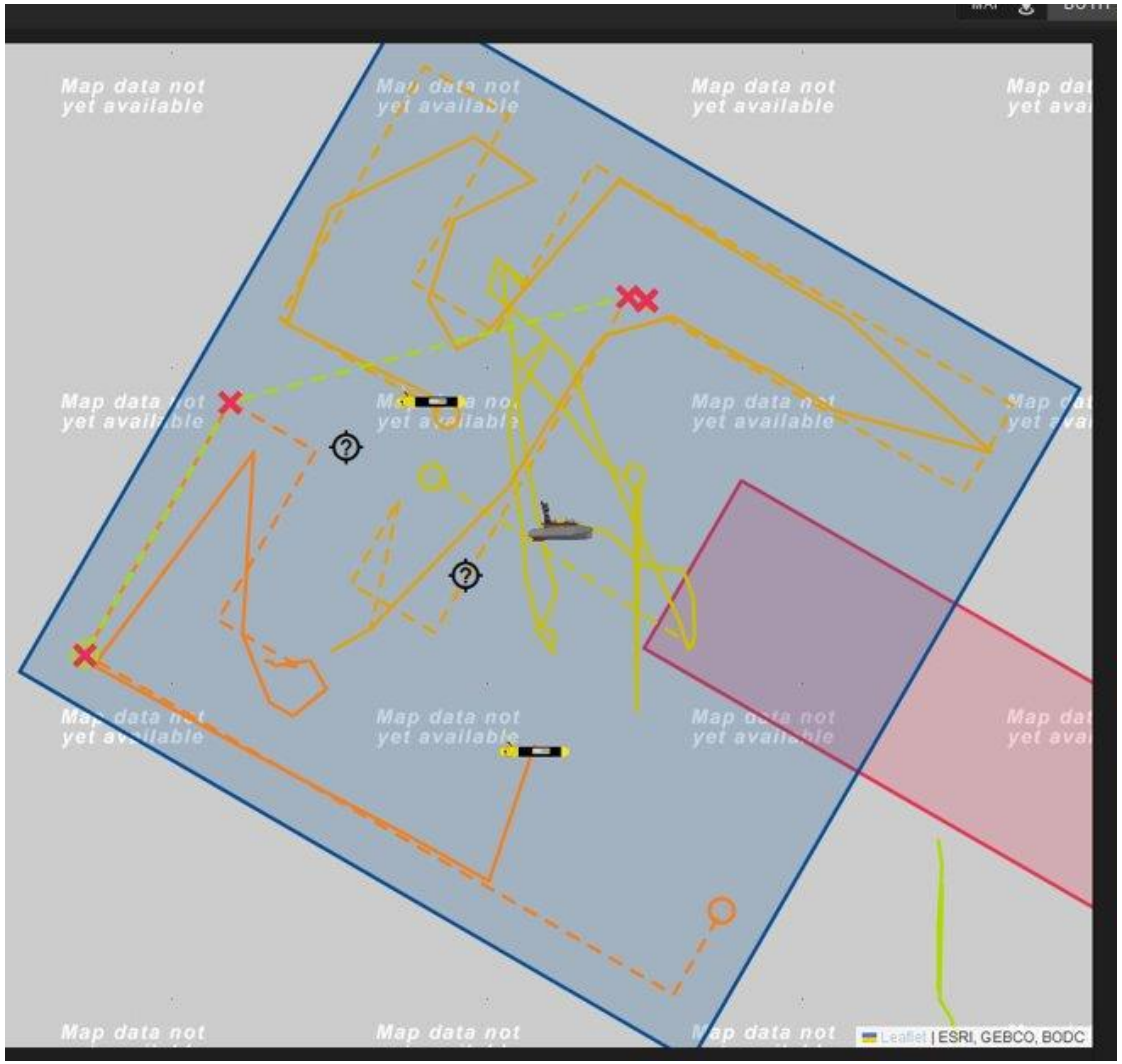
Example mission

Actual ecoSUB and USV tracks shown

USV station keeping within a defined radius

ecoSUB delivered requested routes, with one early finish

Small test area created unrealistic turn constraints
Targets manually inserted



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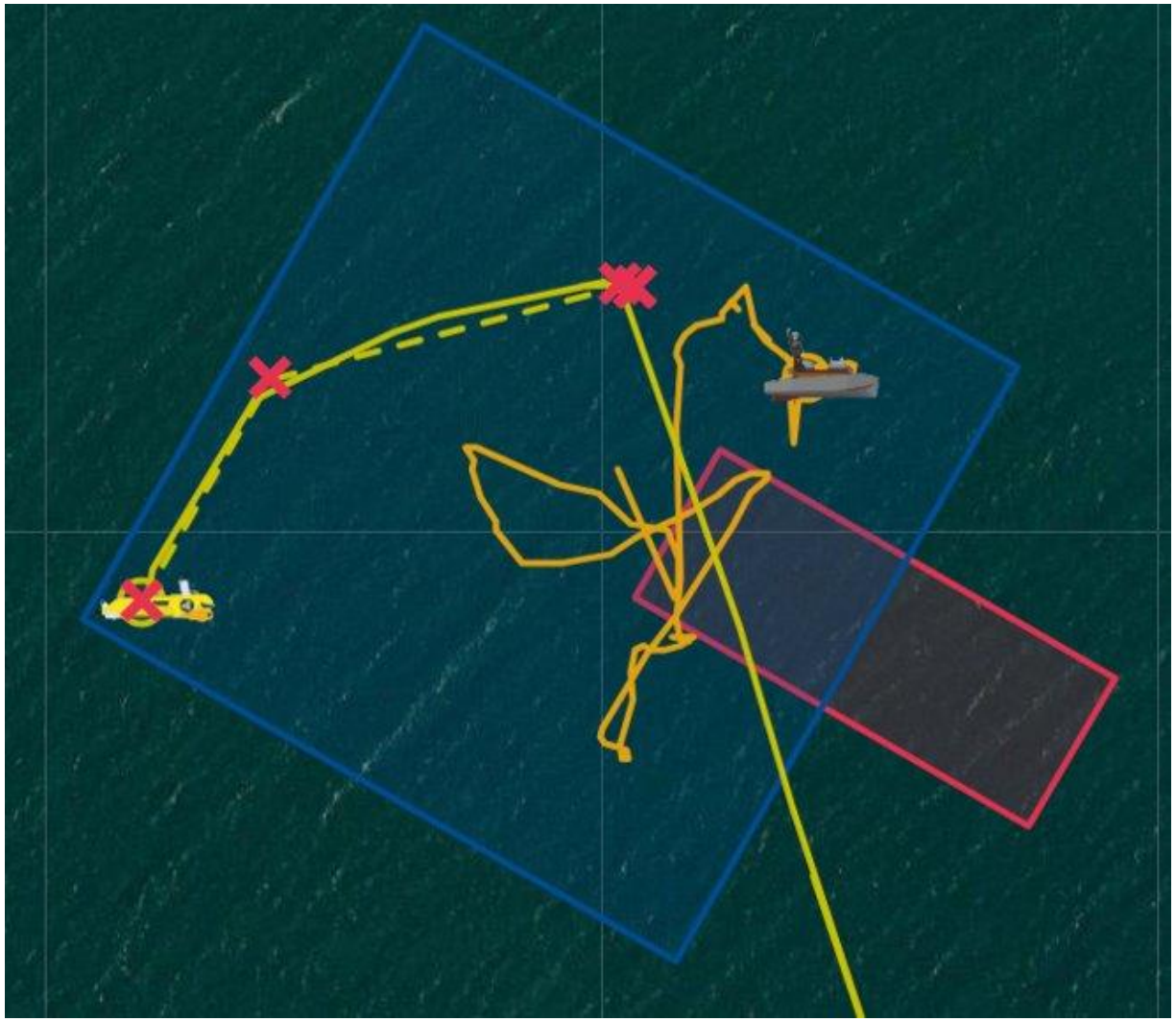
Example mission

AH-1 tasking to
visit target locations
(ecoSUB tracks removed
for clarity)

Exclusion zone lifted due
to constrained operating area.

Note several options
for exclusion:
- no go
- no survey
- no surface transit
- sub-surface constraint...



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System Trials – key outcomes

- Various hardware developments that stand-up on their own merit
- Autonomy Engine delivered mission plans, constraints, surface vehicle re-tasking based on understanding of vehicle and environmental parameters
- The communications backbone shared missions, position data and vehicle status around the system
- The USV effective as coms gateway, enabled by Sonardyne's USBL system and HIVE
- Mission visualisation via the GUI – viewable from anywhere
- Safety controls including vehicle aborts demonstrated
- Full Autonomy Engine solution not ready for commercialisation immediately, but huge progress made

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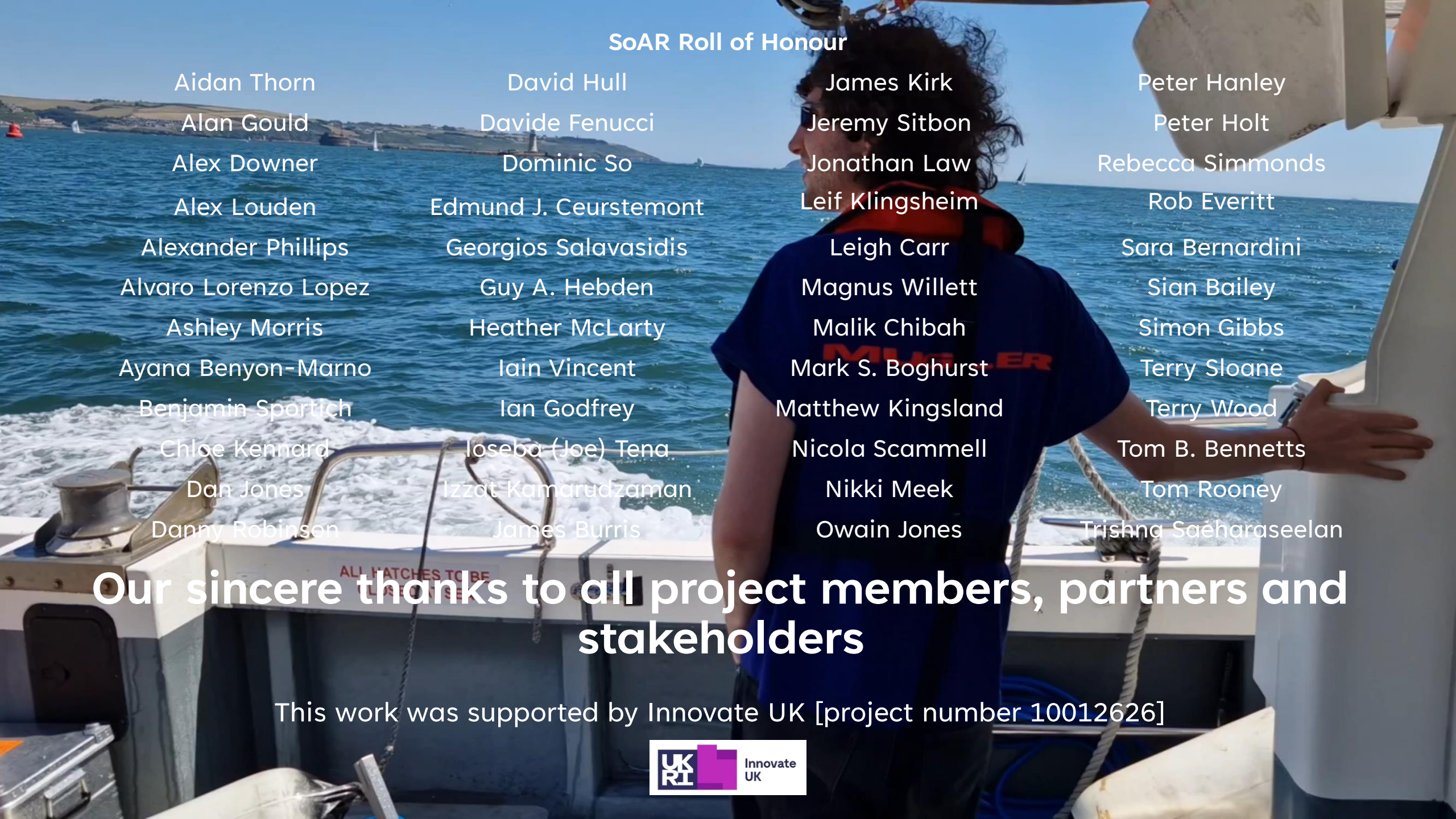

SoAR Roll of Honour

Aidan Thorn
Alan Gould
Alex Downer
Alex Louden
Alexander Phillips
Alvaro Lorenzo Lopez
Ashley Morris
Ayana Benyon-Marno
Benjamin Sportich
Chloe Kennard
Dan Jones
Danny Robinson
David Hull
Davide Fenucci
Dominic So
Edmund J. Ceurstemont
Georgios Salavasidis
Guy A. Hebden
Heather McLarty
Iain Vincent
Ian Godfrey
Ioseba (Joe) Tena
Izzat Kamarudzaman
James Burris
James Kirk
Jeremy Sitbon
Jonathan Law
Leif Klingsheim
Leigh Carr
Magnus Willett
Malik Chibah
Mark S. Boghurst
Matthew Kingsland
Nicola Scammell
Nikki Meek
Owain Jones
Peter Hanley
Peter Holt
Rebecca Simmonds
Rob Everitt
Sara Bernardini
Sian Bailey
Simon Gibbs
Terry Sloane
Terry Wood
Tom B. Bennetts
Tom Rooney
Trishna Saeharaseelan

Our sincere thanks to all project members, partners and stakeholders

This work was supported by Innovate UK [project number 10012626]

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Q&A Session

Panel session and general subgroup discussion

Craig Davis

ROVCO

Michael Ellis

Sonardyne

Andre Fabik

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