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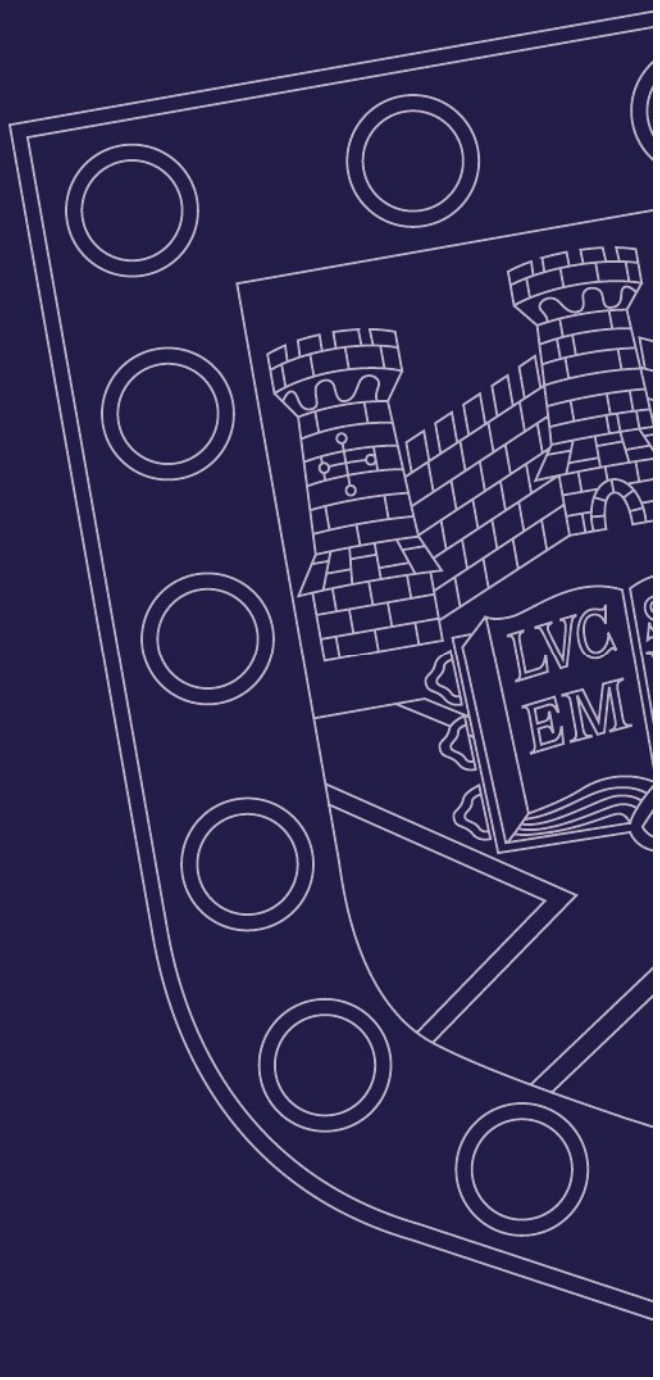
Autonomous Subsea Inspection to Reduce Ship Time, Increase Safety and Reduce Costs

Dr Philipp Thies
Senior Lecturer Offshore Reliability
P.R.Thies@exeter.ac.uk

SUT/STL Ship-based Robotics Workshop
26th Sep 2019, TIC, Penryn



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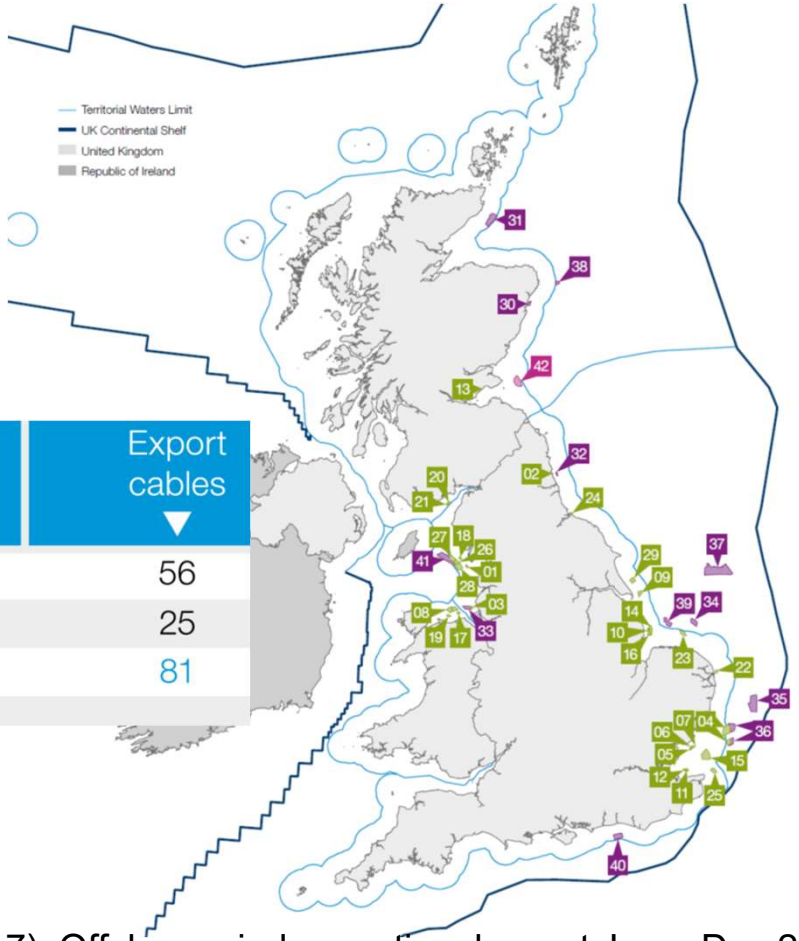
INDUSTRIAL STRATEGY UK Research and Innovation

Overview

- Status Quo
  - Offshore Wind Assets;
  - O&M tasks and Strategy
  - Offshore Health and Safety
- Autonomous Vessels
- Innovate UK project: L3Harris & Exeter University
  - Hydrodynamic Modelling
  - Case study results
- Conclusion

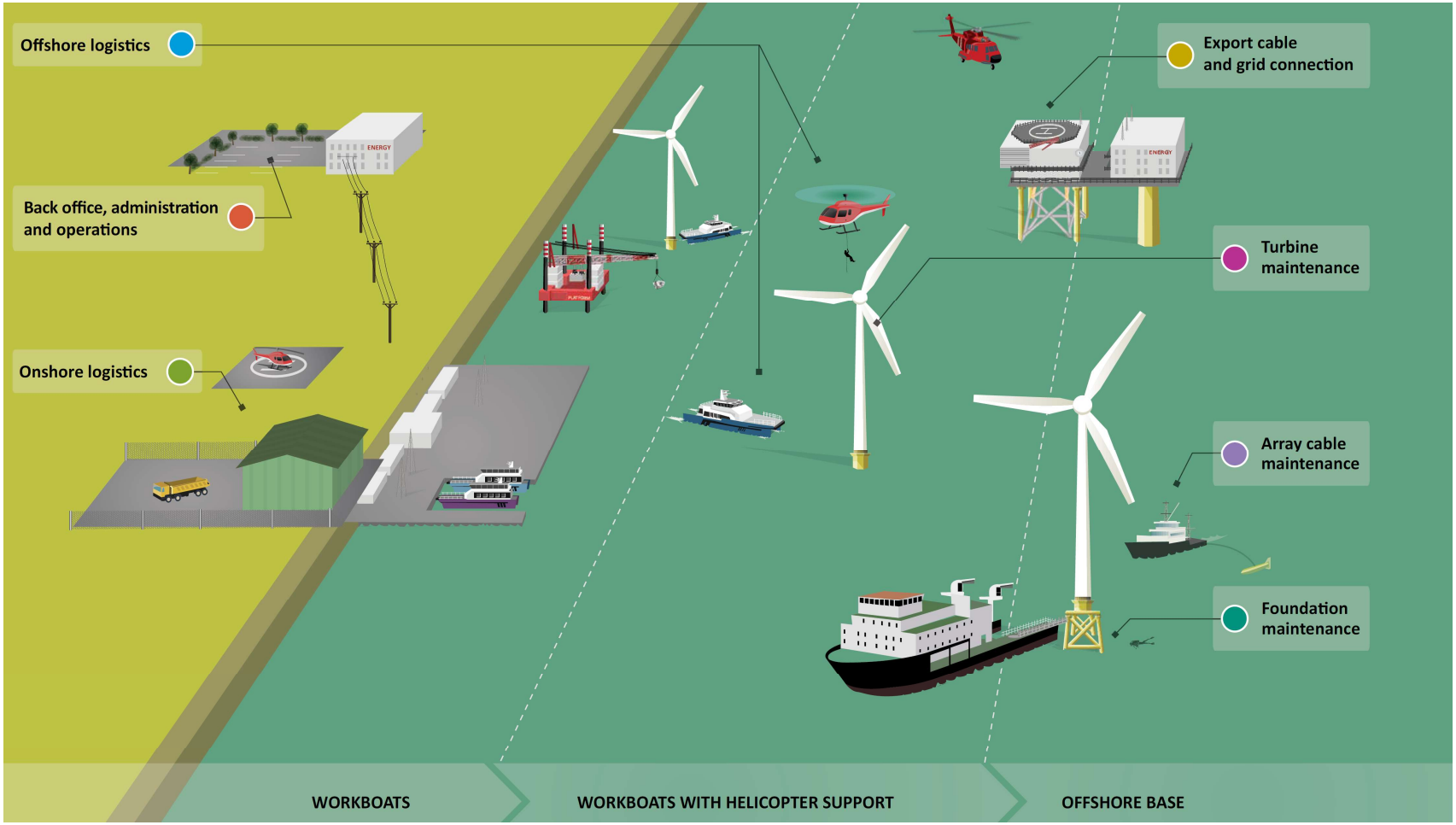
Offshore Wind Assets

	Offshore turbines	Offshore substations	Export cables
Operating	1,463	20	56
Under construction*	830	14	25
Total	2,293	34	81



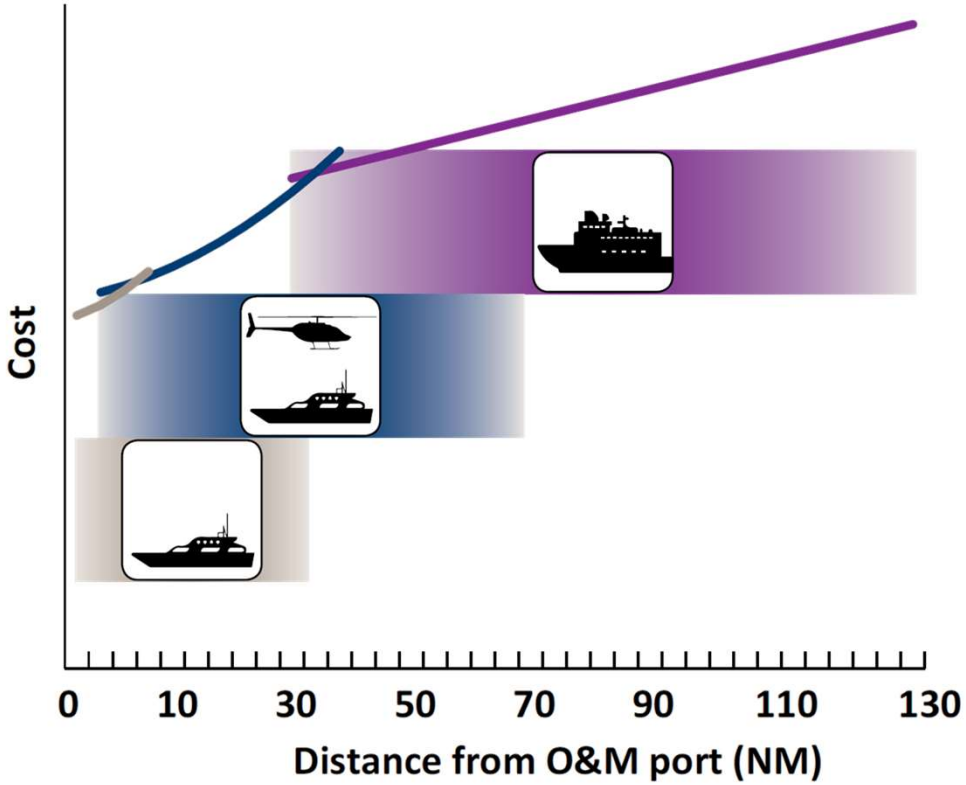
Source: Crown Estate (2017). Offshore wind operational report Jan – Dec 2016

Status Quo



Source: GL Garrad Hassan (2013). A guide to UK Offshore Wind O&M.

Status Quo



Workboat-based

Operating from a port base.

Heli-support

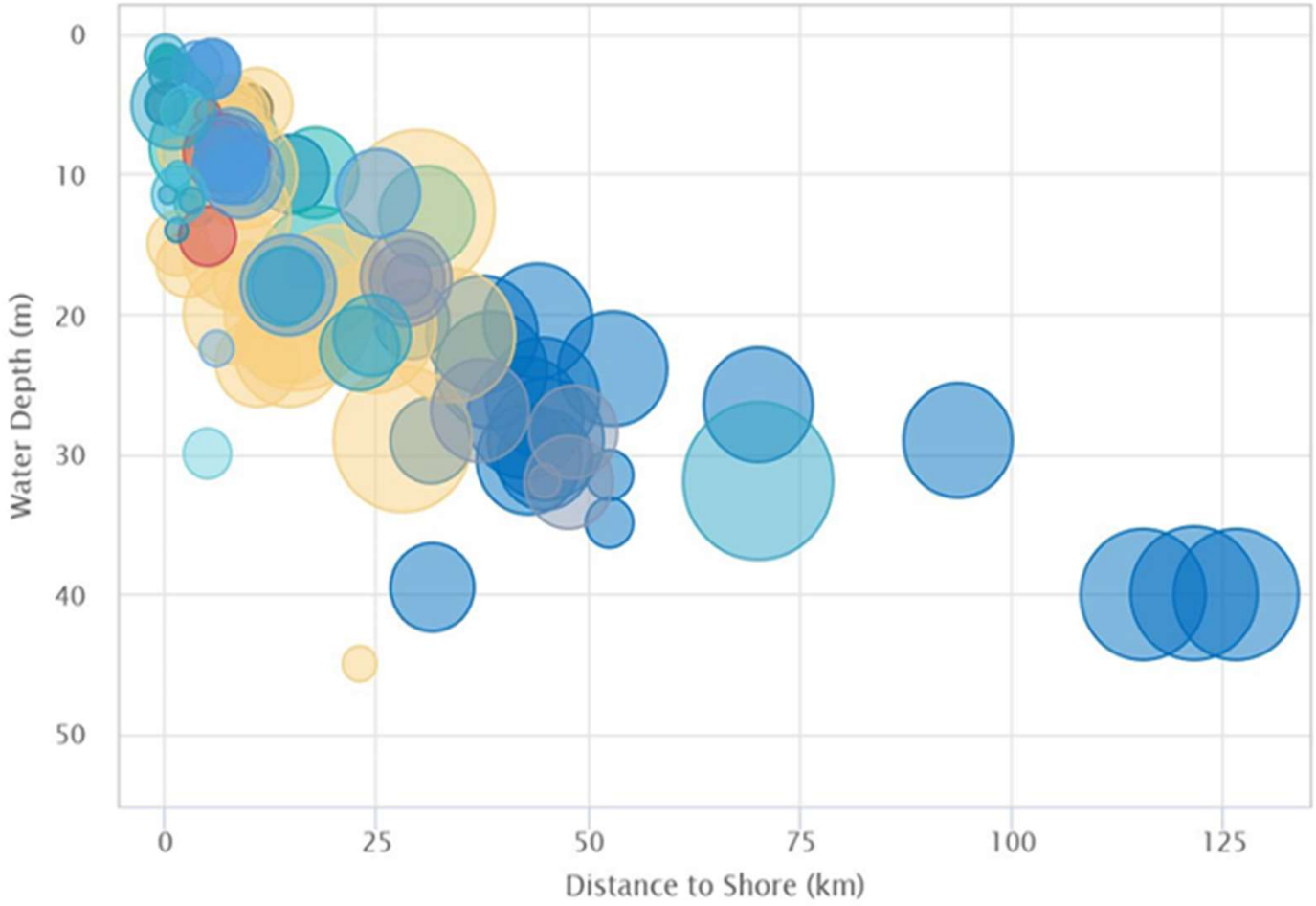
Workboats with support from helicopters.

Offshore-based

With fixed or floating offshore accommodation.

Source: GL Garrad Hassan (2013). A guide to UK Offshore Wind O&M.

Status Quo



Data: RCG 2018.

Status Quo – Health & Safety

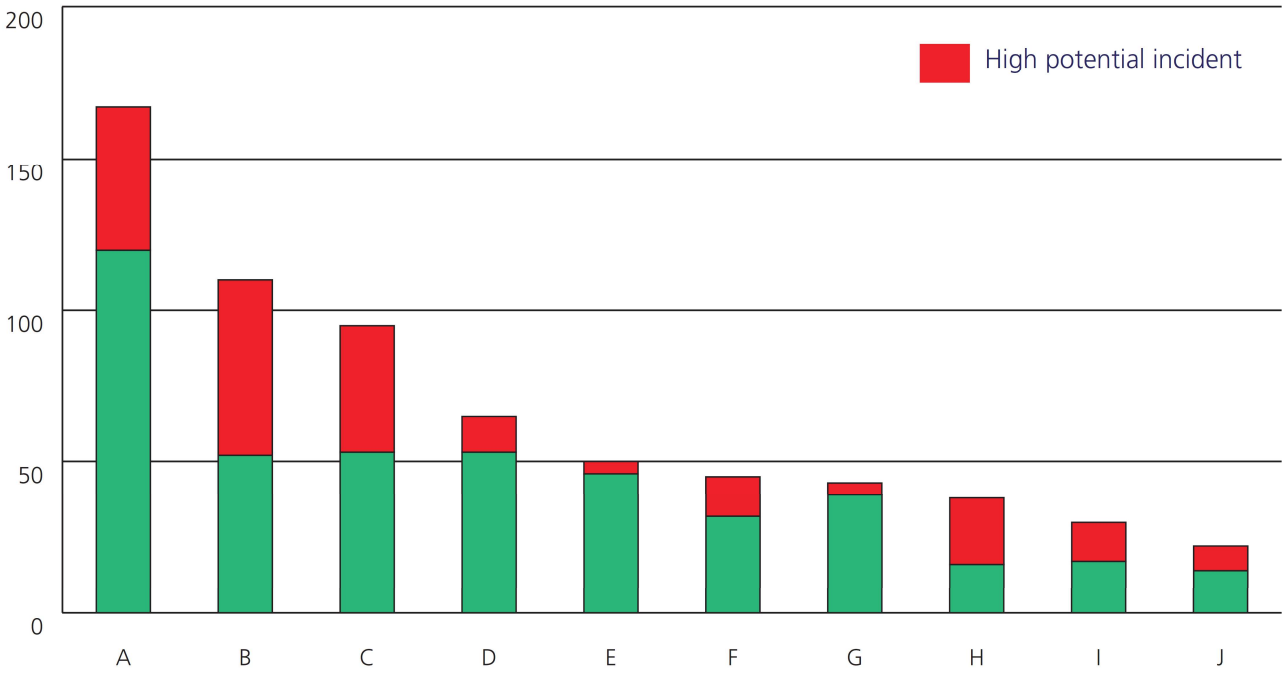
G+ 2016 Incident Data Summary – Consequence data (UK sites only)

- Hazards **539**
- Near hits **269**
- First aid **62**
- Medical treatment injuries **41**
- Restricted work day incident **34**
- Lost work day incidents **38**

Overview of UK Offshore wind Health and Safety Figures

Source: Crown Estate (2017). Offshore wind operational report Jan – Dec 2016

UK Offshore Wind Incident data analysis



Key

- A Marine operations
- B Working at heights
- C Lifting operations
- D Operating plant and machinery
- E Manual handling
- F O&M building maintenance
- G Other
- H Civil works
- I Working on energized systems
- J Working with hand tools/power tools

Recorded incidents in relation to per work process

Source: G+ Global Offshore Wind (2017). UK Offshore wind health and safety statistics 2016 report

UK Offshore Wind Incident data analysis

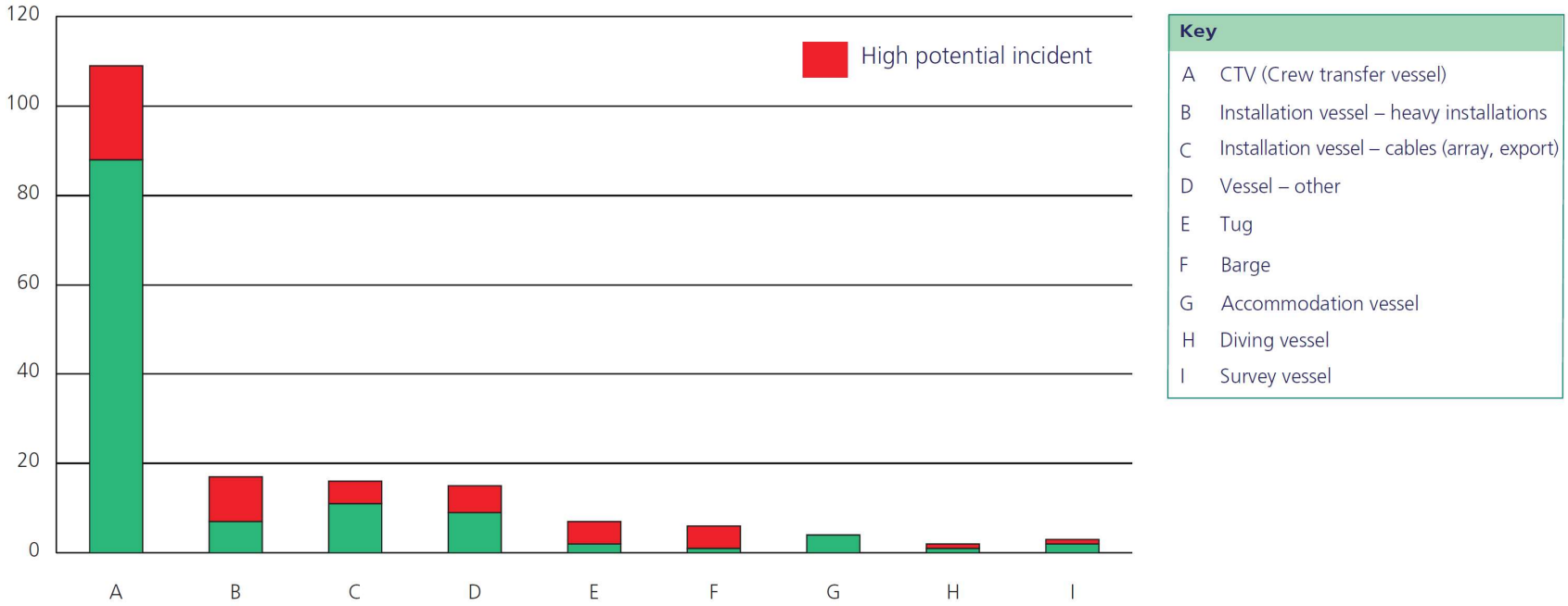


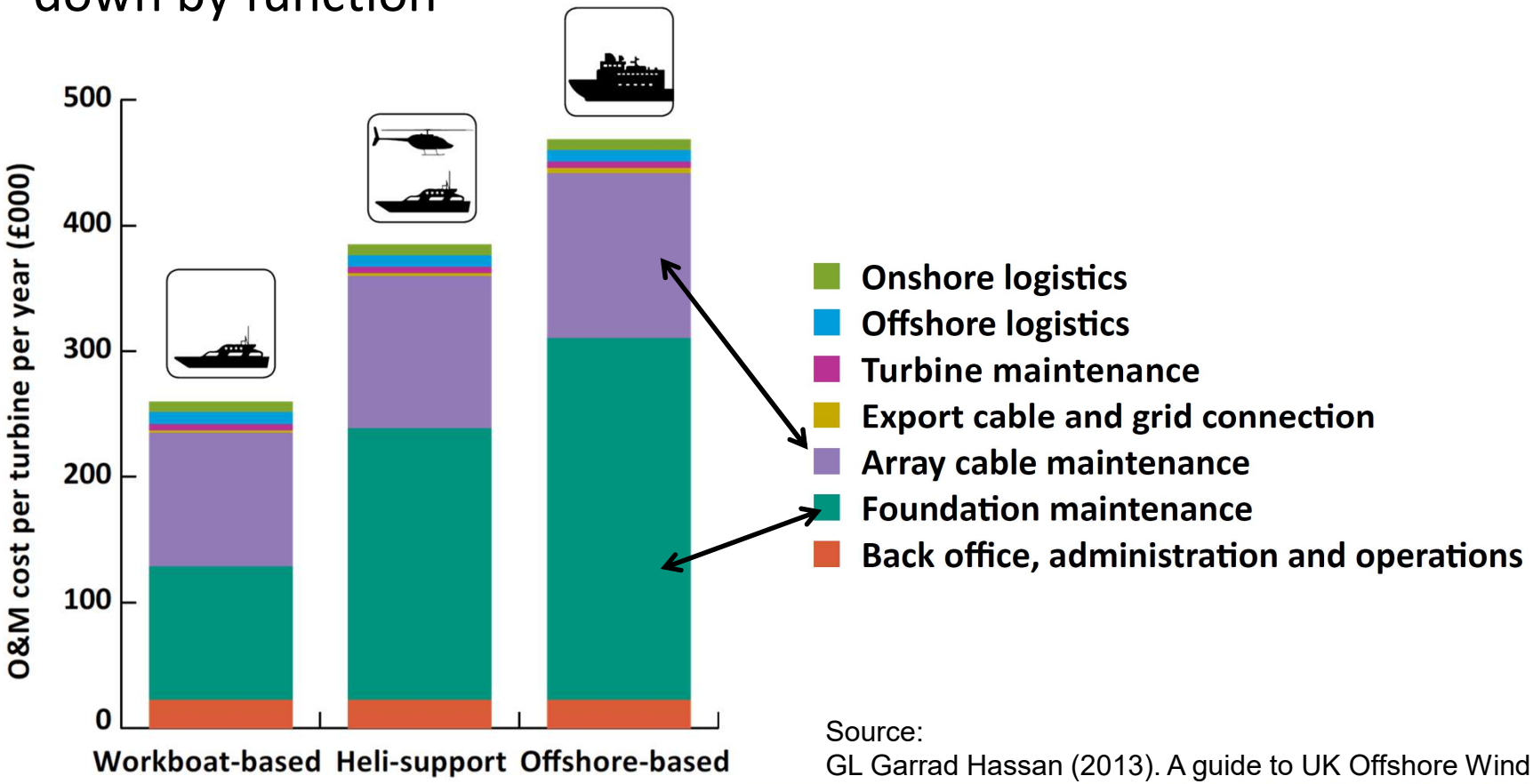
Figure 20: Incidents on vessels – breakdown by vessel type with high potential incidents identified

Breakdown of ‘Marine operations’ incidents

Source: G+ Global Offshore Wind (2017). UK Offshore wind health and safety statistics 2016 report

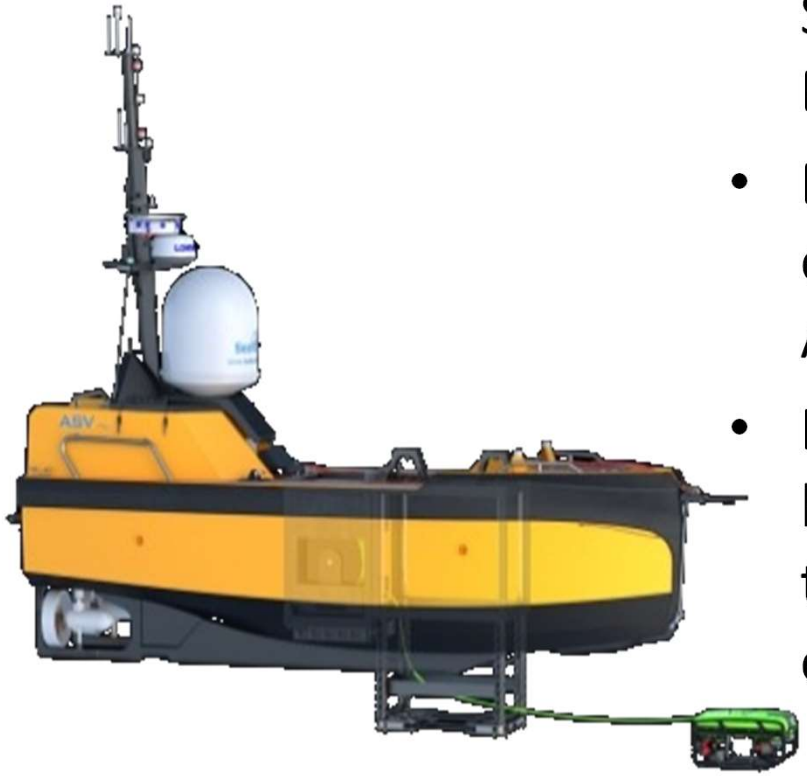
Opportunity

O&M cost per turbine for 3 classes of O&M strategy broken down by function



Source:
GL Garrad Hassan (2013). A guide to UK Offshore Wind O&M.

Project overview / objective



- Autonomous Robotic Intervention System For Extreme Maritime Environments
- Develop intervention system, jointly employing work class ROV's and Autonomous Surface Vessels (ASV)
- Inspection and intervention in hazardous offshore environments – towards unmanned marine operations.

Launch and Recovery Systems (LARS)

ON&T, 2014

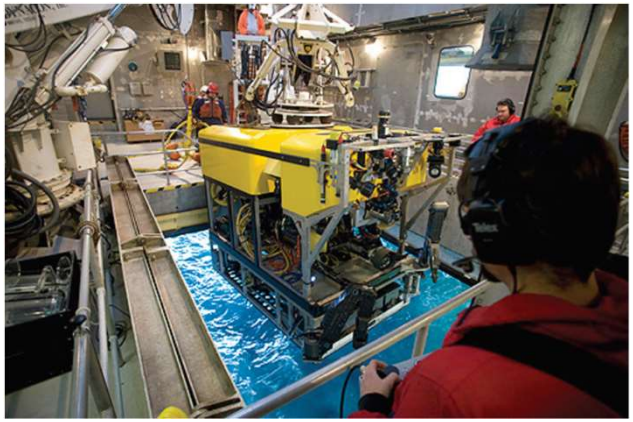
A Frame

Oceaneering, 2018

Cage/Garage

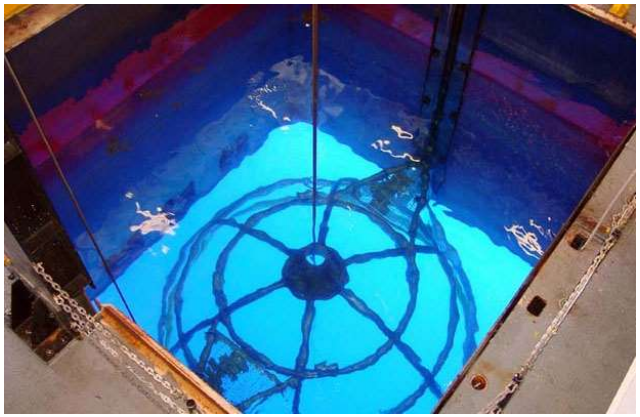
MarineTech, 2015

Cage + Rail & Cursor



IMCA 2013

Moonpool

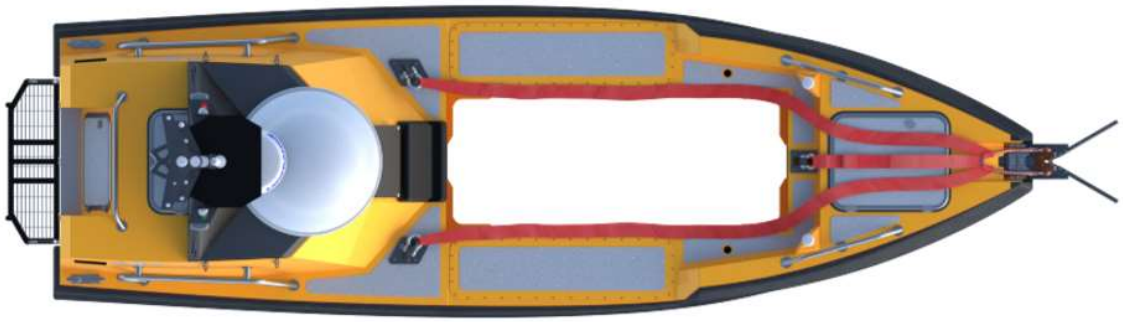


Lauhglin, 2010

Moonpool (cursor)

Moonpool LARS integration

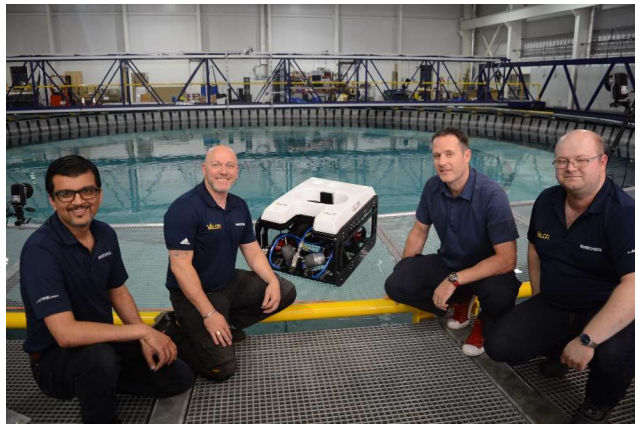
LARS	Class I	Class II	Class III	Class VI
Manual	*			*
Crane	*	*		*
A-frame		*	*	*
Moonpool	*	*	*	*
Stern ramp				*



ASV, 2018

Engineering Implementation

ROV – Seatronics Valor



USV/LARs – ASV C
Worker 7 / Moonpool

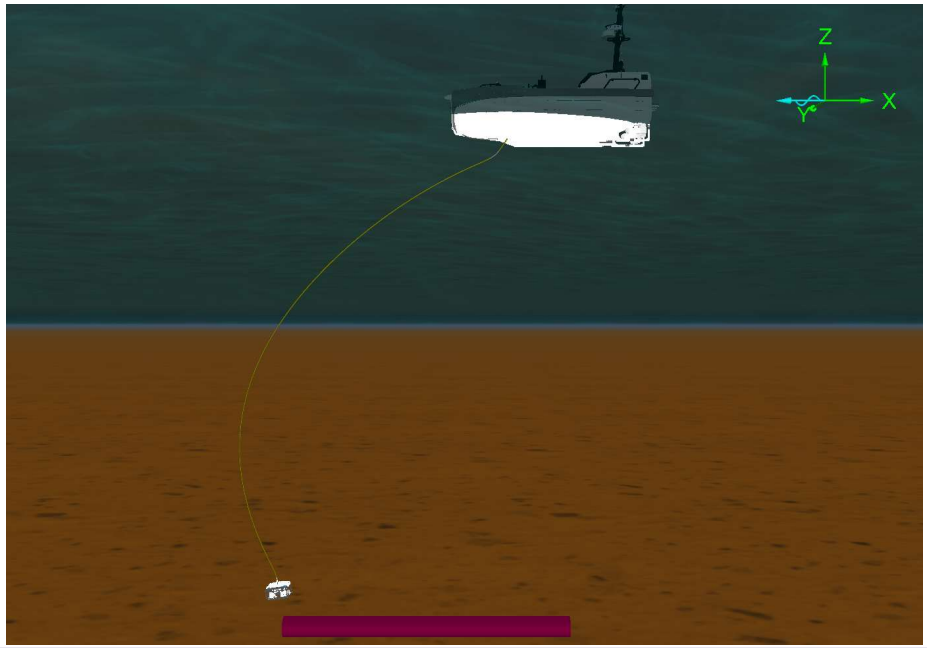
Seatronics, 2018

ASV Global, unpub.

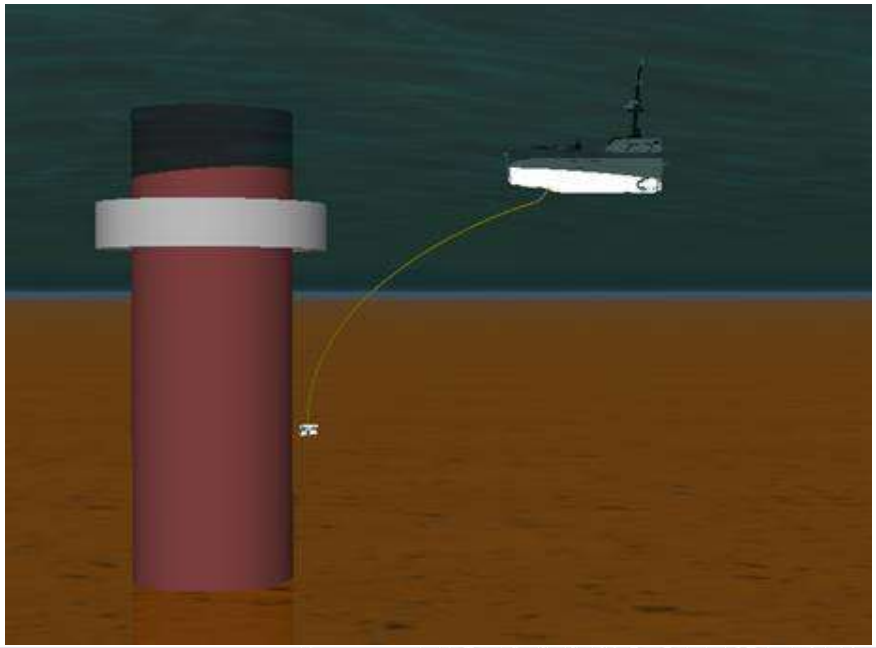
Hydrodynamic modelling

OrcaFlex model for site specific assessments of ROV operations.

Following

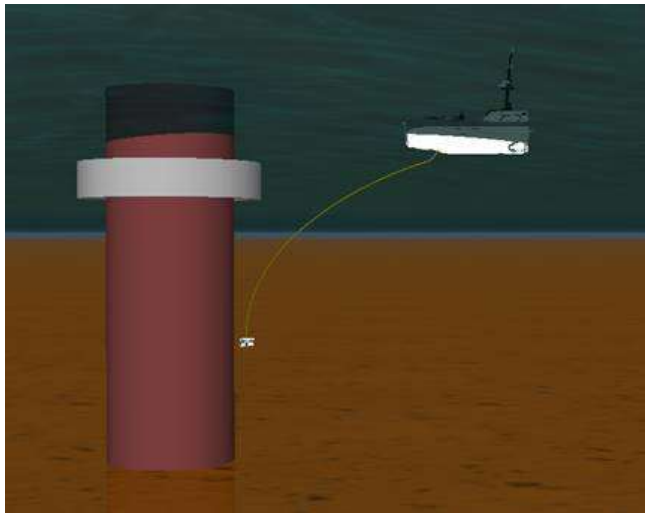


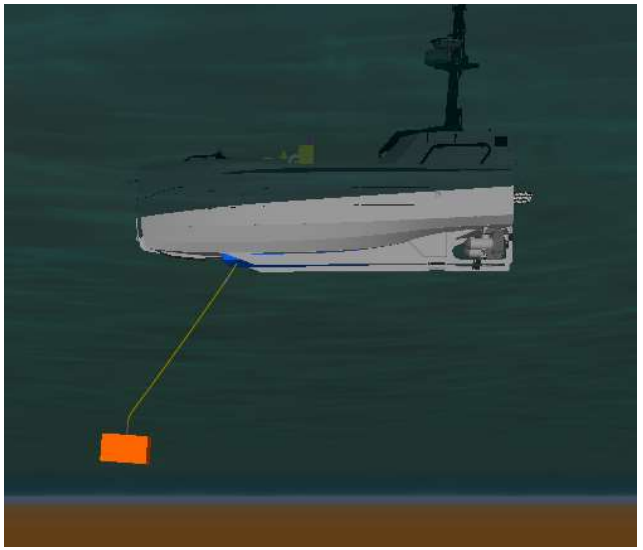
Station-keeping



Model Observations

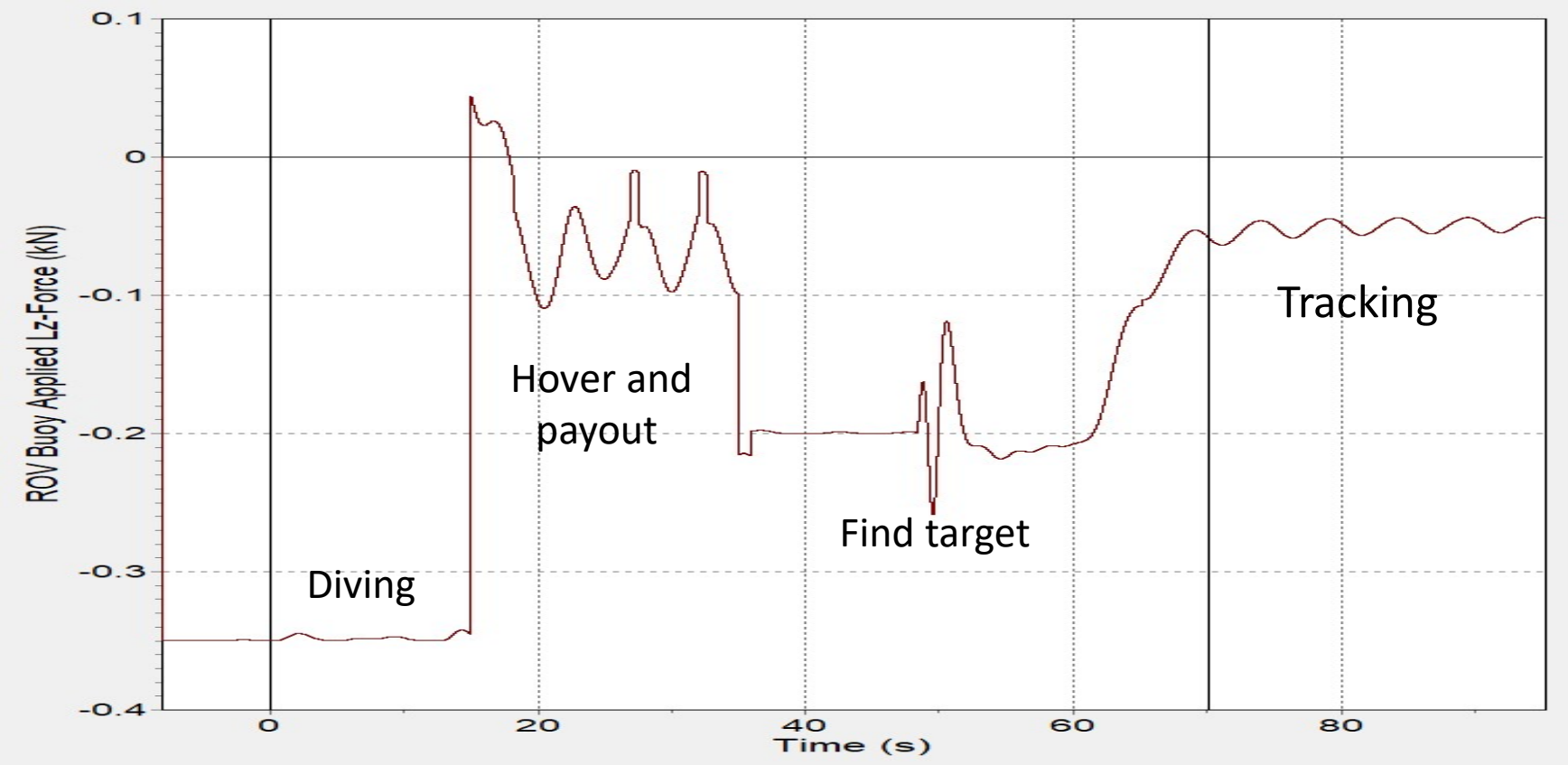
- Challenges
  - Cable tension
  - ROV pitching
  - Controlled recovery
  - Tether management



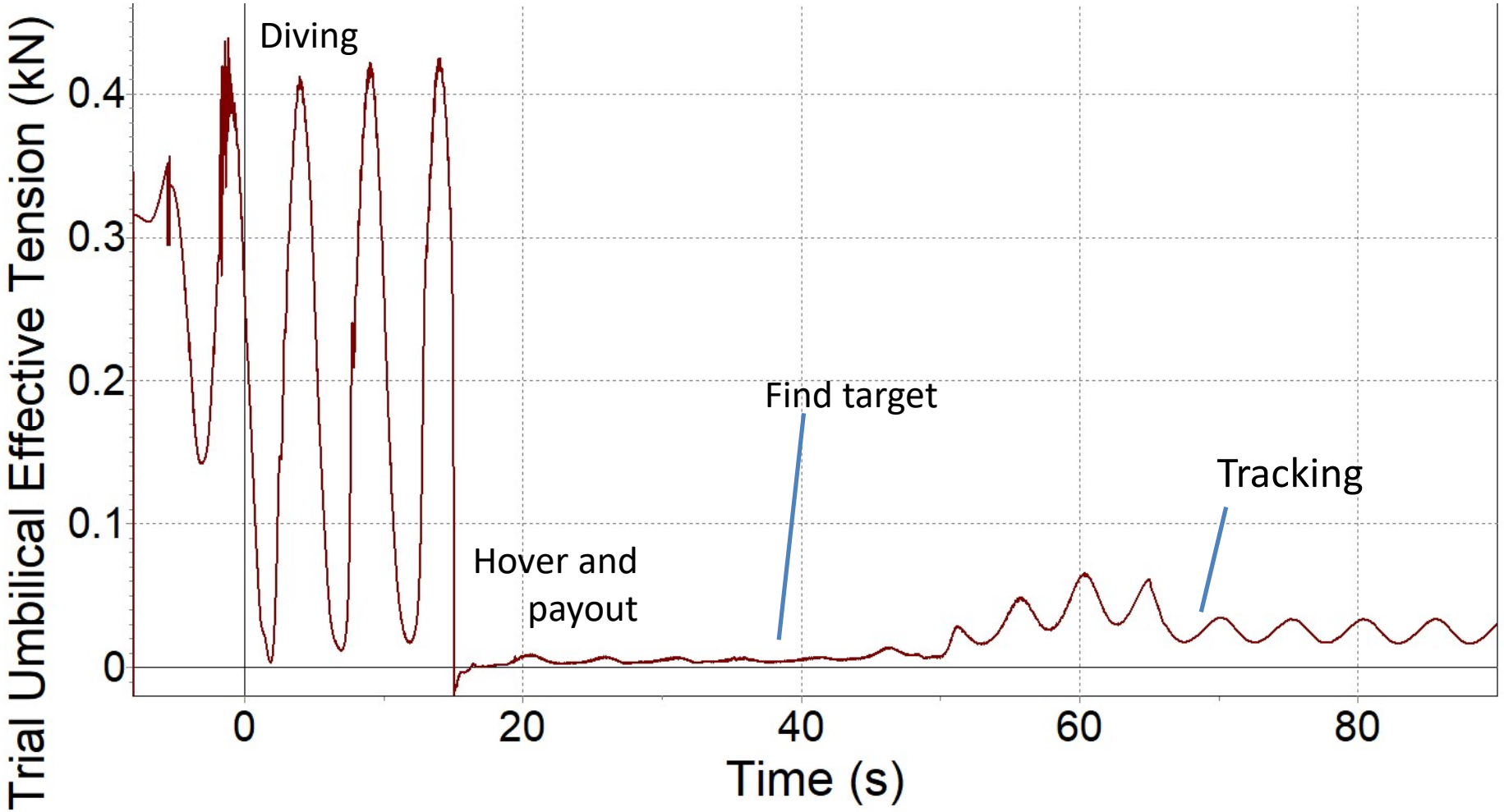


Example results

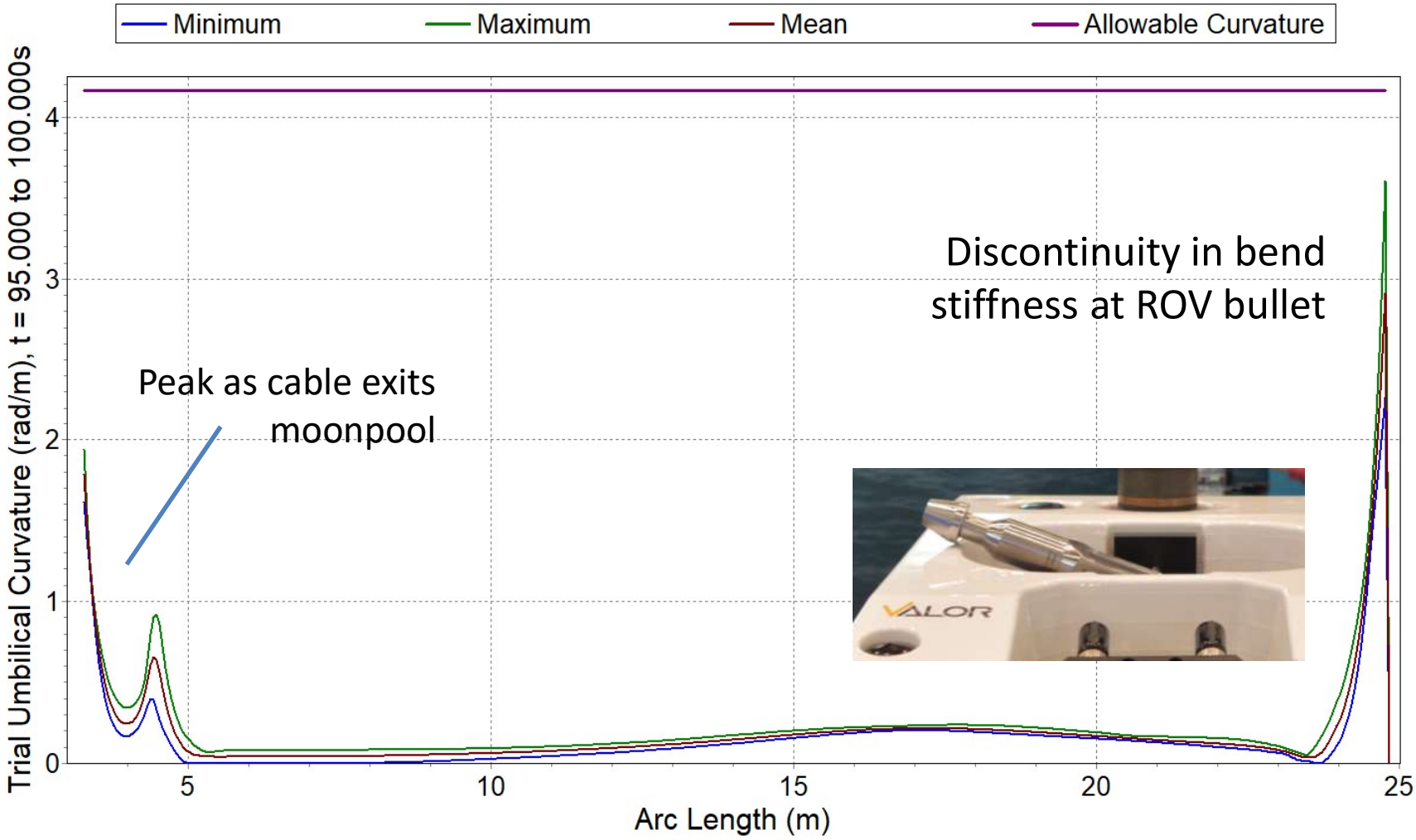
ROV thrust during launch: Down force control algorithms



Results – Umbilical cable tension

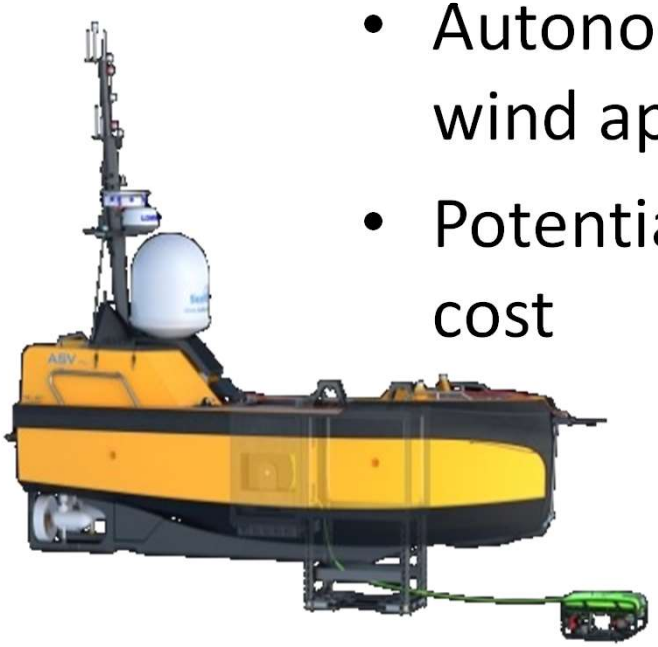


Results – Umbilical cable tension



Conclusions

- Autonomous launch of ROVs feasible, challenge is the sea state/recovery
- Moonpool launch preferred option
- Autonomous ROV potential offshore wind applications
- Potential to increase H&S, and reduce cost



Acknowledgments

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Team members:

ASV: Sue Tobin, Phil Hart, James Cowles, Engineering team

Exeter: Chenyu Zhao, Prof Lars Johanning, Laurence Fahrni, Lucas Vatinel

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