



Testing of Inspection Robotics in Offshore Wind

13/01/2021

Hamish Macdonald

Agenda

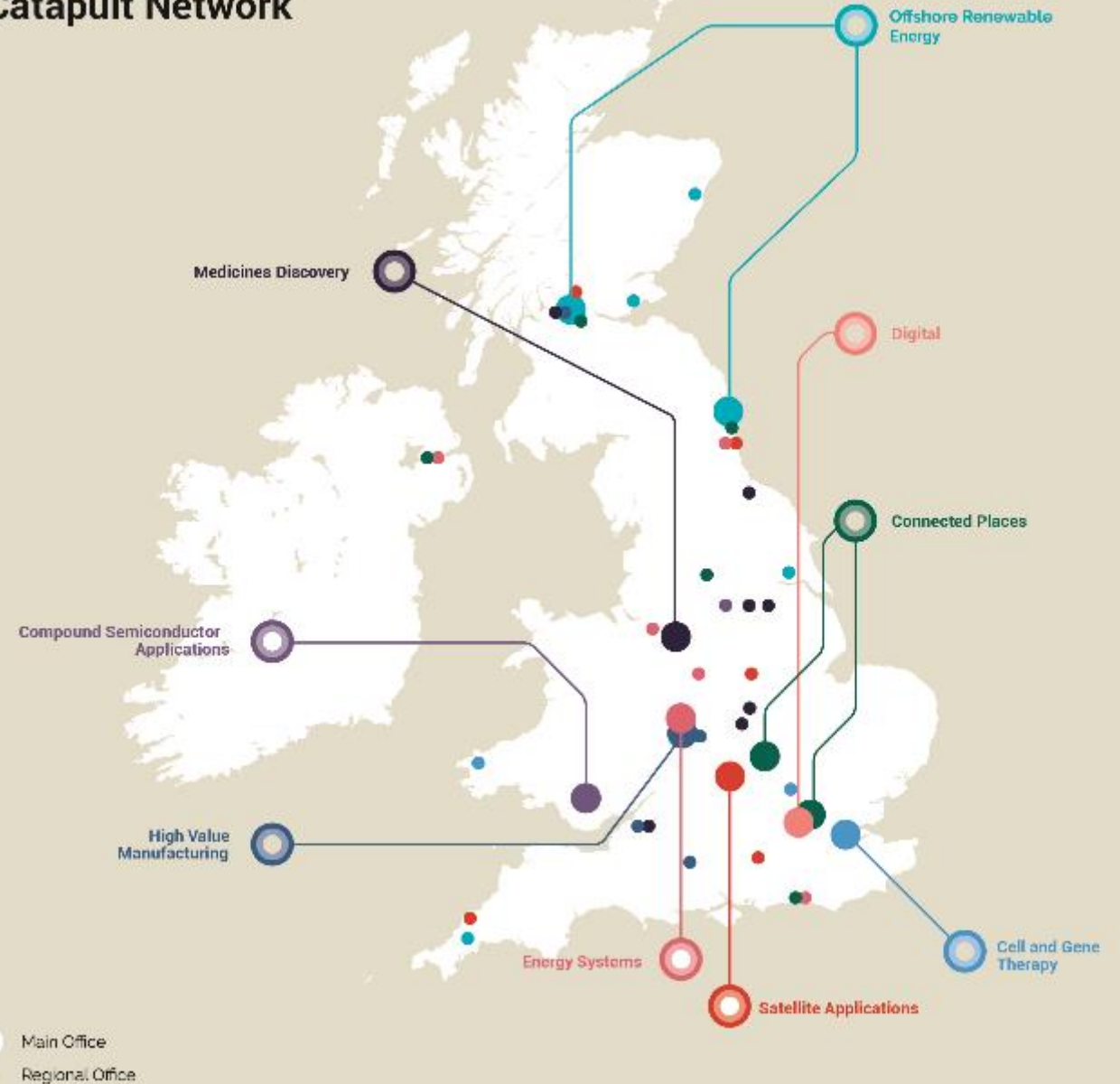
- Offshore Wind Trends
- Utilisation and Future Potential for Robotic Systems
- Testing and Demonstration

The Catapult Network – a national capability

- Network of 9 world-leading technology innovation centres
- Supporting businesses in transforming great ideas into valuable products and services
- Independent, not-for-profit
- Delivering impact across the UK economy, enabling businesses to thrive in global markets

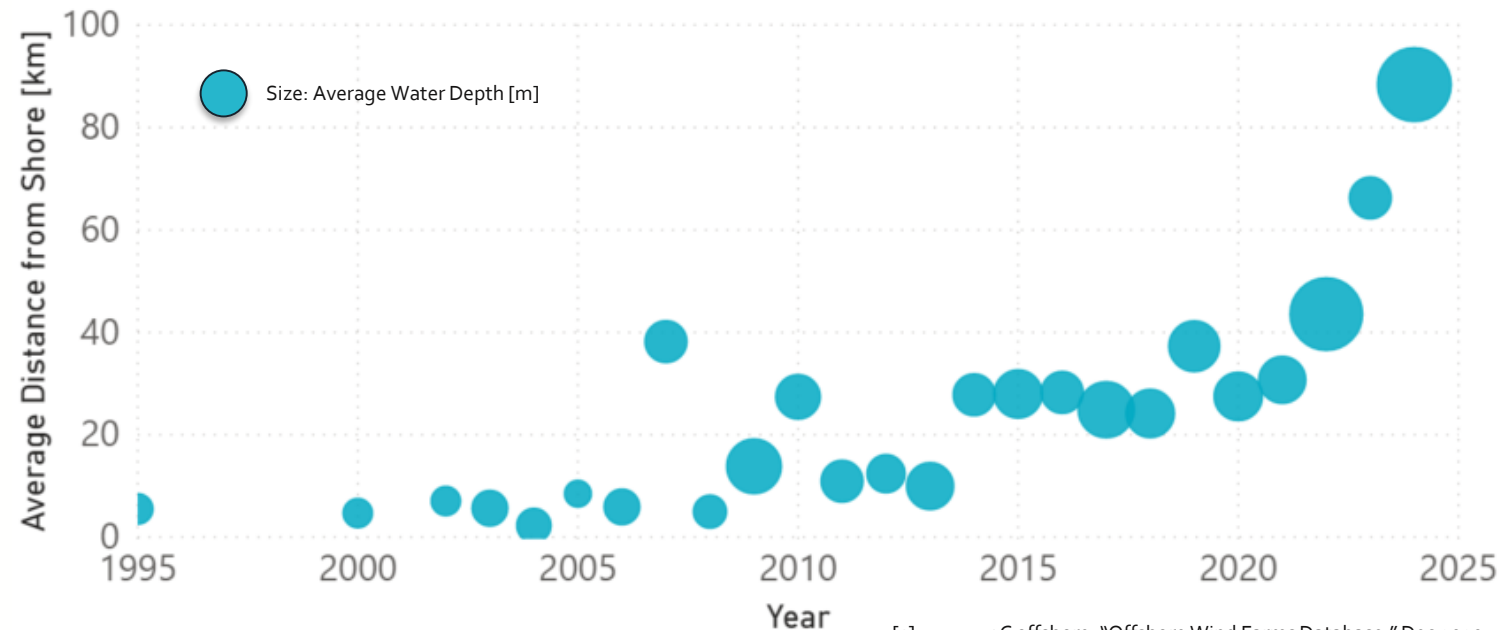
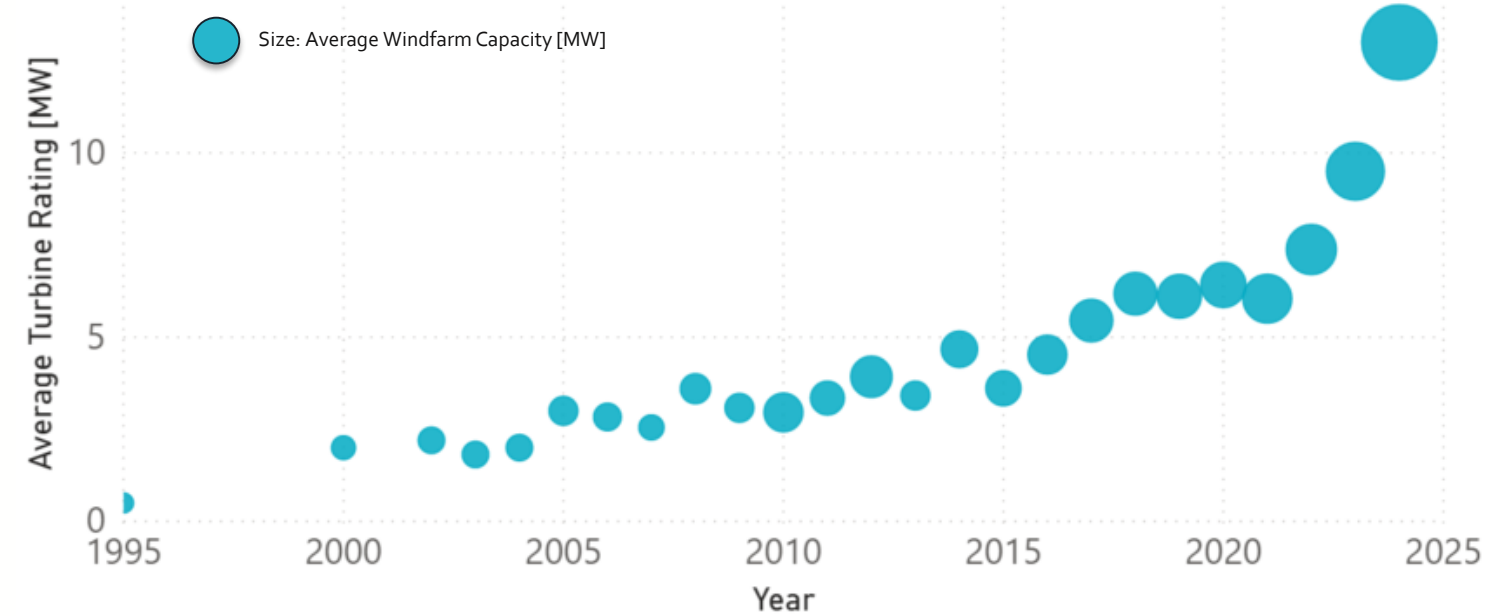


Catapult Network

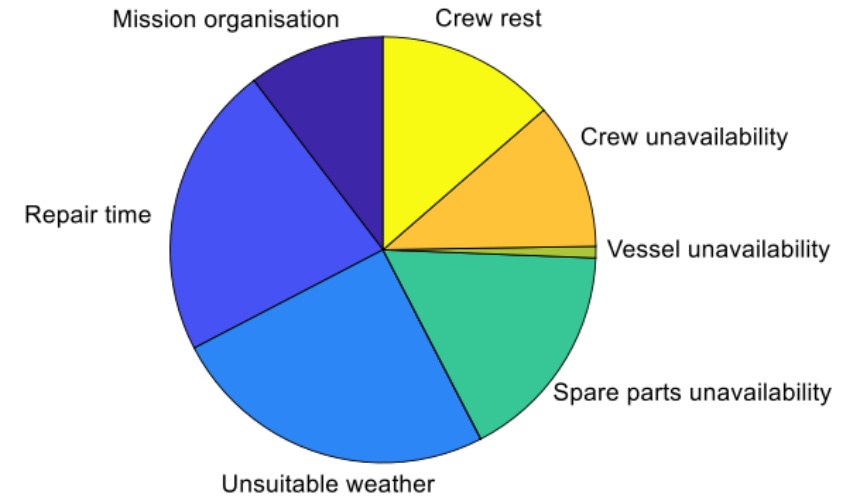


Key Worldwide Trends

- Current worldwide installation [1]
 - Fully commissioned ~30.5 GW
 - Incl. construction phase ~67.7 GW
 - Incl. consent authorised ~122 GW
- Larger turbines
 - Increased energy capture
- Further from Shore
 - A number of sites already exploited.
 - Enhanced wind profile
- Challenges
 - Distance from Shore
 - Increased water depths
 - Harsher Environment
 - Seabed variation
 - Other infrastructure

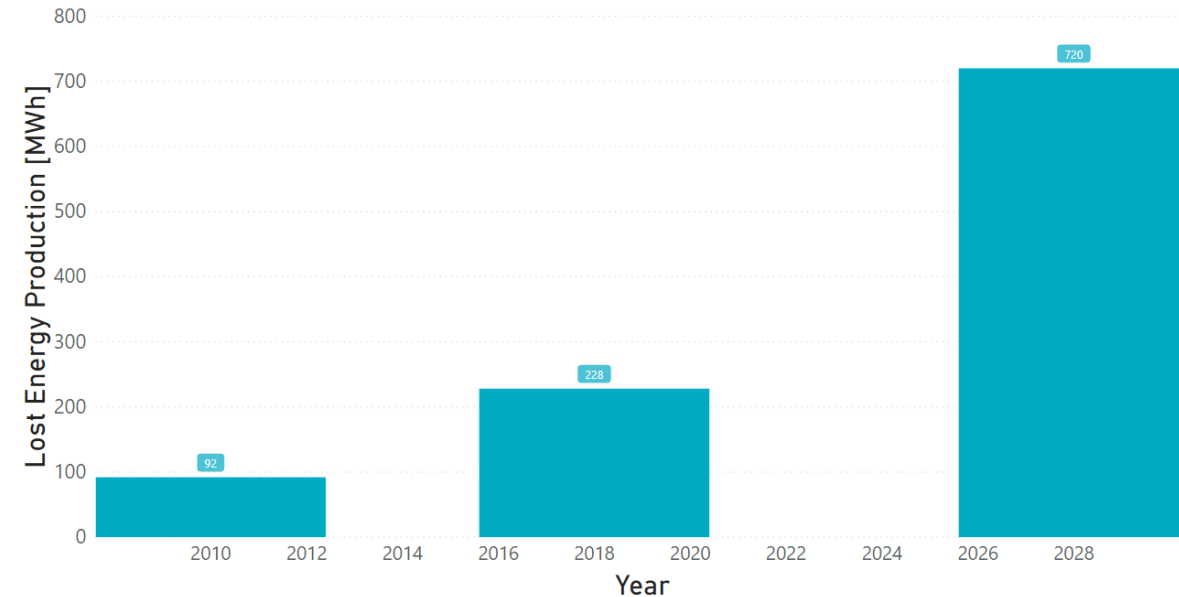


- Windfarm outlook
 - New generation
 - Colossal turbines - downtime more significant
 - Older generation
 - *"By 2028 20% of the 69GW operational fleet [in Europe] will be more than 10 years old"*
- Moving away from a reactive philosophy - status quo not sustainable for LCoE
 - Condition monitoring / structural health monitoring
 - Increased frequency of inspection and intervention



[1] K. Athanasios and F. Brennan, "ROMEO - Deliverable Report - D8.1: Development of a high-fidelity cost/revenue model for impact assessment -," 2018.

Impacts of a 1% reduction in availability per turbine



[3] Wood Mackenzie, "Offshore Wind Operations and Maintenance Trends," 2019.

- Commercially realised technologies across multiple environmental domains.
 - Wind turbine blade drone inspection
 - ROV substructure surveys
 - Hydrographic surveys
- Other opportunities approaching commercialisation
 - Contact Robotics



Image Credit: ULC Robotics



Image Credit: ROVCO



Image Credit: IXBlue

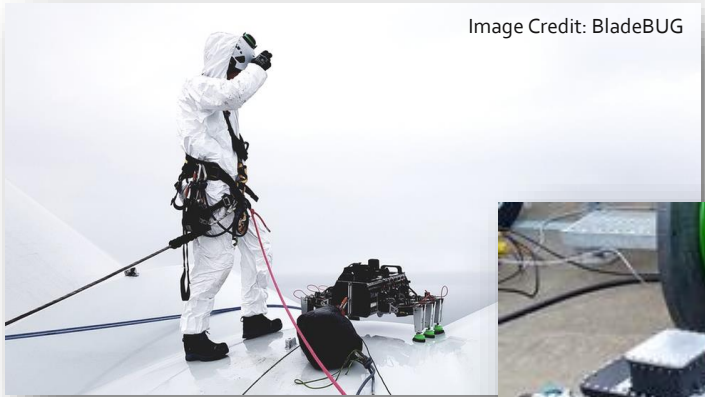
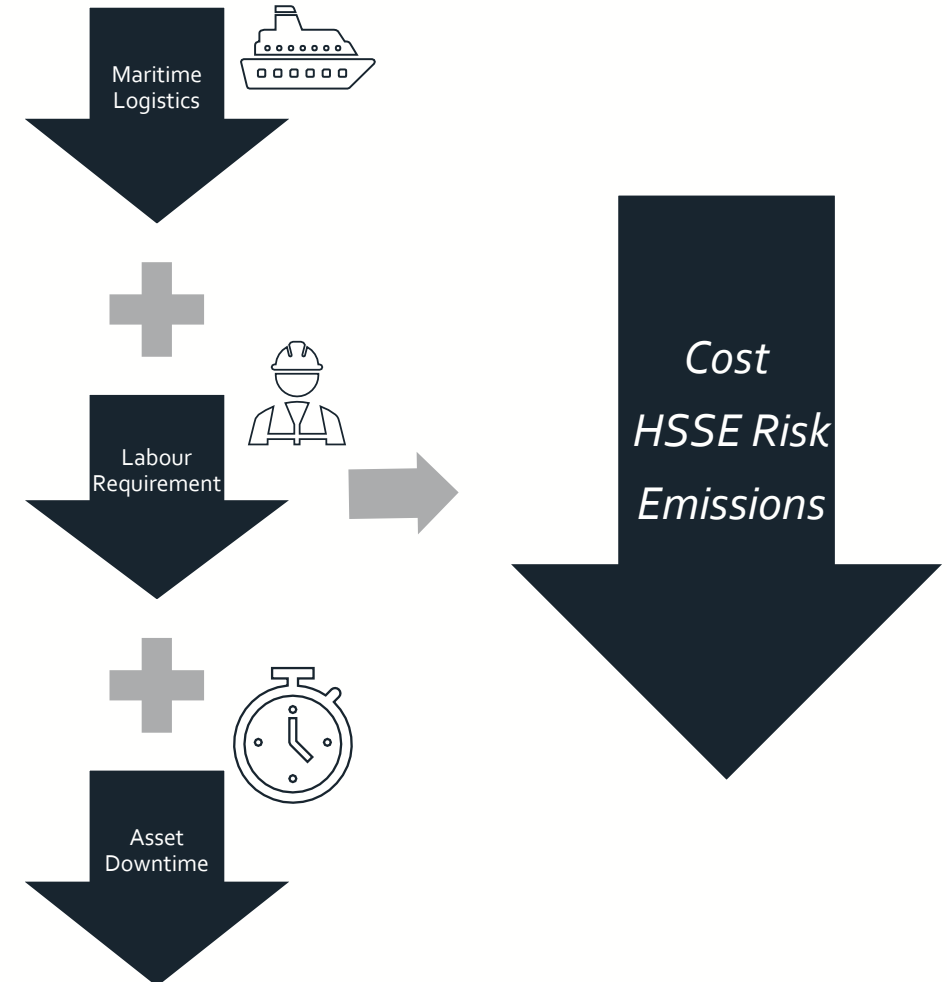


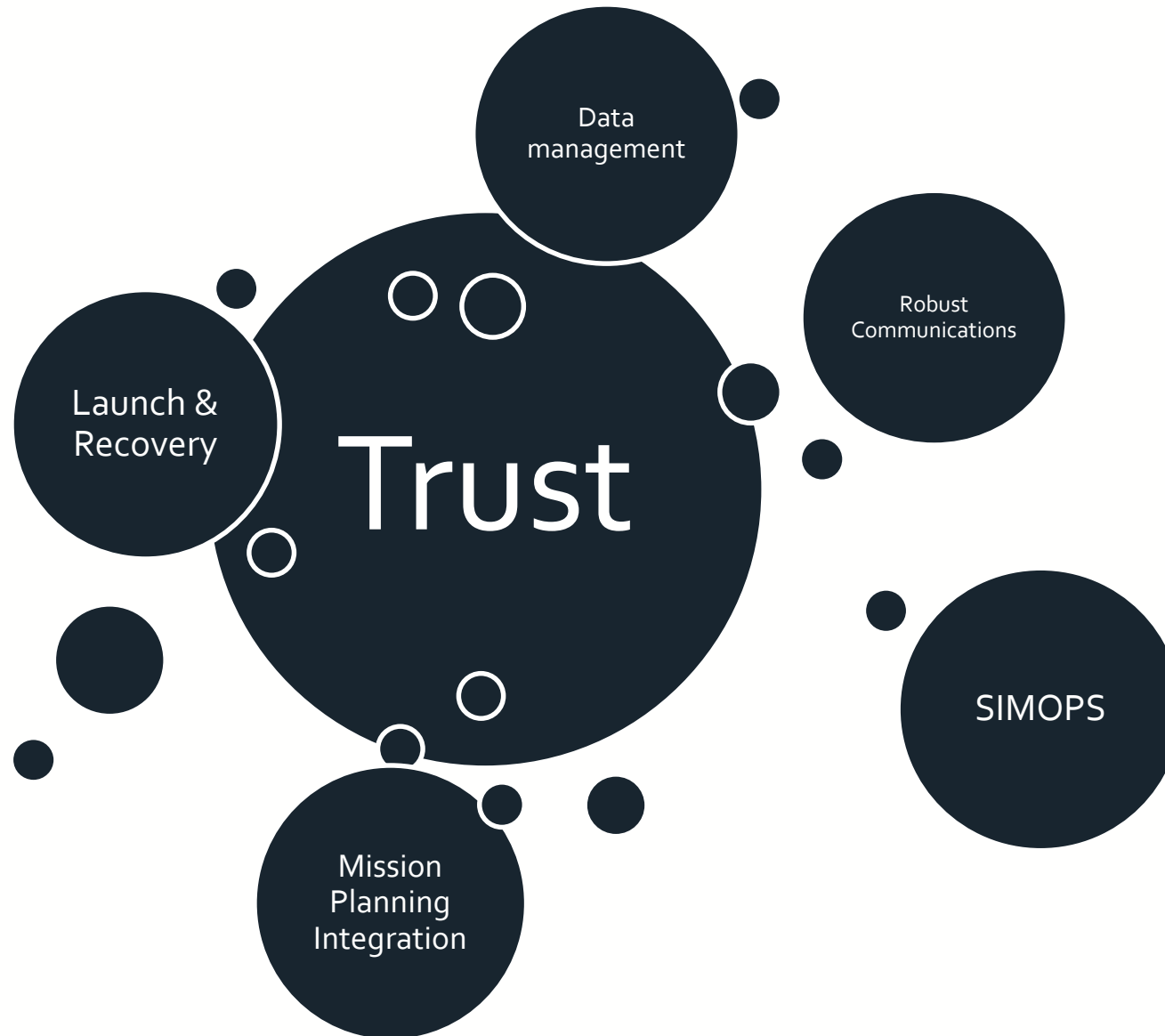
Image Credit: BladeBUG

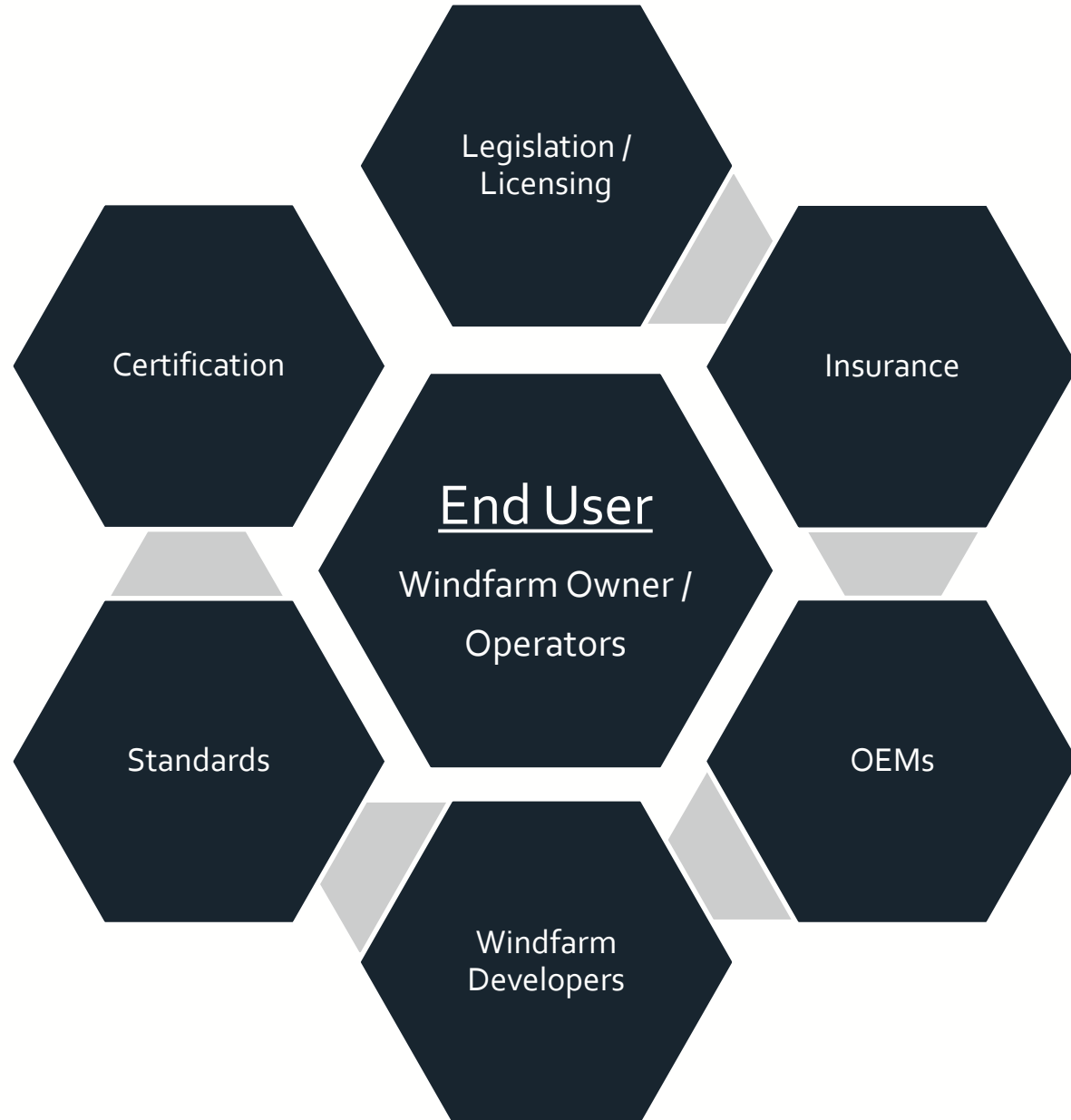


Image Credit: InnoTecUK

- Predominately piloted
 - Minor levels of automation.
- Require human supervision offshore.
 - Additional marine transport
- For full potential to be realised, these constraints will need to be alleviated
 - Roadmap of implementation
 - Specific to robotic application







- Automation
 - Gradual progression.
 - Aversion to fully autonomous operations
- Remote human supervision
 - Onshore
 - SOV
- Verification & Validation imperative for de-risking
 - Appropriate to the TRL
 - Controlled environment
 - Representative offshore environment
 - Demonstration commercial scale

PACT Level	Description
5b	System does everything autonomously
5a	System chooses action, performs it and informs operator
4b	System chooses action and performs it unless operator disapproves
4a	System chooses action and performs it only if operator approves
3	System suggests options to operator and proposes one of them
2	System suggests options to operator
1	Operator asks system to suggest options
0	Operator controls system



ORE Catapult Facilities for Robotics and Automation

- ORE Catapult – Blyth
 - Component Testing
 - Dock Facilities
 - Robotics and Autonomous Systems (RAS) Test & Validation Centre
 - Offshore robotics test site
 - Launch and recovery facility
- ORE Catapult – Levenmouth
 - 7 MW Turbine
- Vattenfall Technology Accelerator
 - EOWDC Windfarm



Contact us

Email us: info@ore.catapult.org.uk

Visit us: ore.catapult.org.uk

Engage with us:



GLASGOW | BLYTH | LEVENMOUTH | GRIMSBY | ABERDEEN | CORNWALL | LOWESTOFT | PEMBROKESHIRE | CHINA