

MICEDD

DEEPWATER DEVELOPMENT

28 - 30 March 2023 | Millennium Gloucester Hotel | London, UK

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Quest Offshore

World Oil®

Experience of testing CP and Leak Detection functionality integrated into a fully autonomous AUV

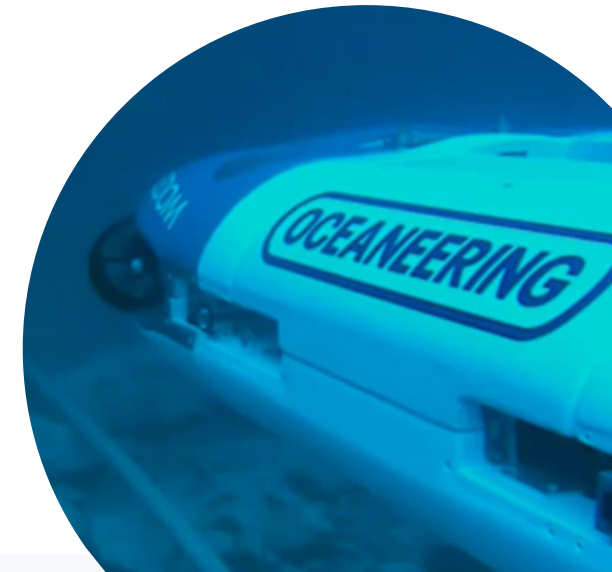
Andy Gower (Total Energies), Bill Gilmour, Damian Ling (Chevron ETC), Tom Glancy, Thomas Johansen, Anders Hermansen (Equinor), Erwan Diler (French Corrosion Institute)

Overview

- Challenges of testing the functionality of a fully autonomous AUV
- Use of the Design of Experiment methodology
- Assessment of Results
- Lessons Learned

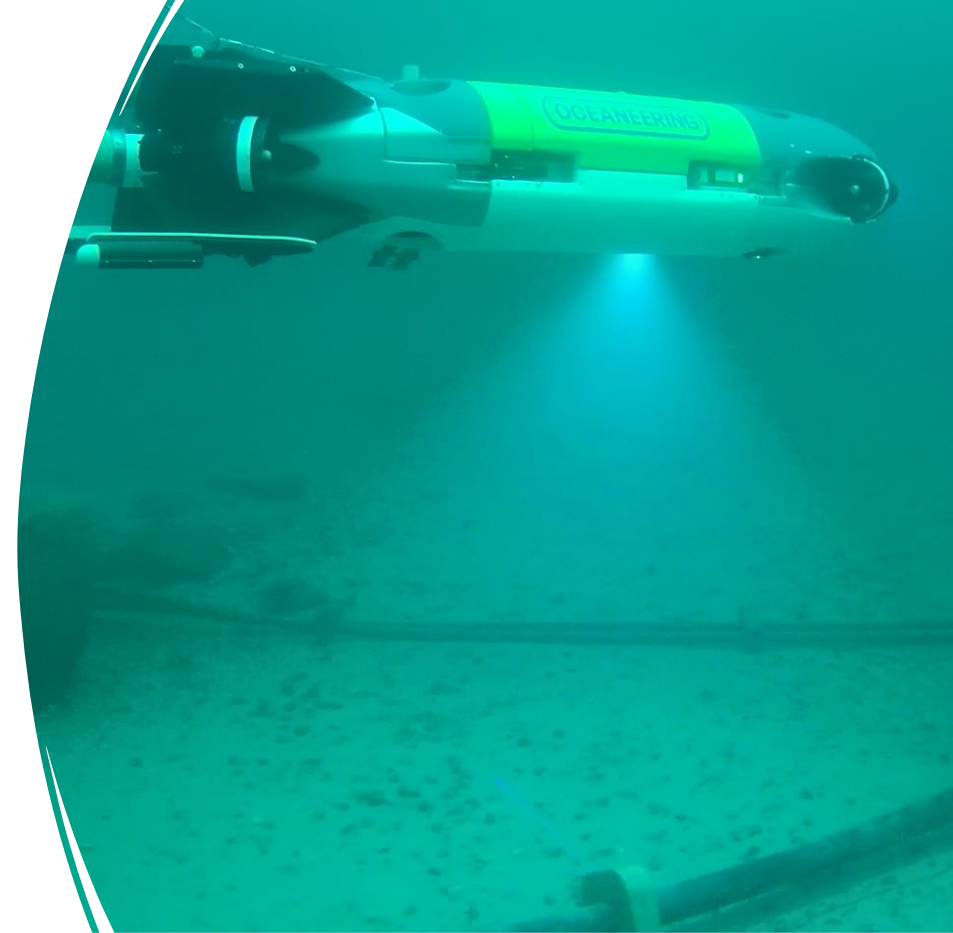
The need for Autonomous Pipeline Inspection AUVs

- Develop a method to carry out pipeline inspection, with an ambition to remove a crewed surface support vessel
- Reduce the time at sea acquiring data relating to integrity threats, contributing to decarbonisation
- Capture all data in a single mission
 - Adaptive Behaviours
 - Eliminate the need for follow up ROV inspections
 - Payload sensors to support the necessary data



Testing Challenges

- How do we control the test environment
 - Requirements and Criteria, External factors, Cost
- How do we control the execution of the test
 - Dynamic, Uncontrolled, Variables
- How do we assess the results to determine suitability
 - Criteria, Repeatability, Acceptance of Failure, Acceptance of inconclusive results

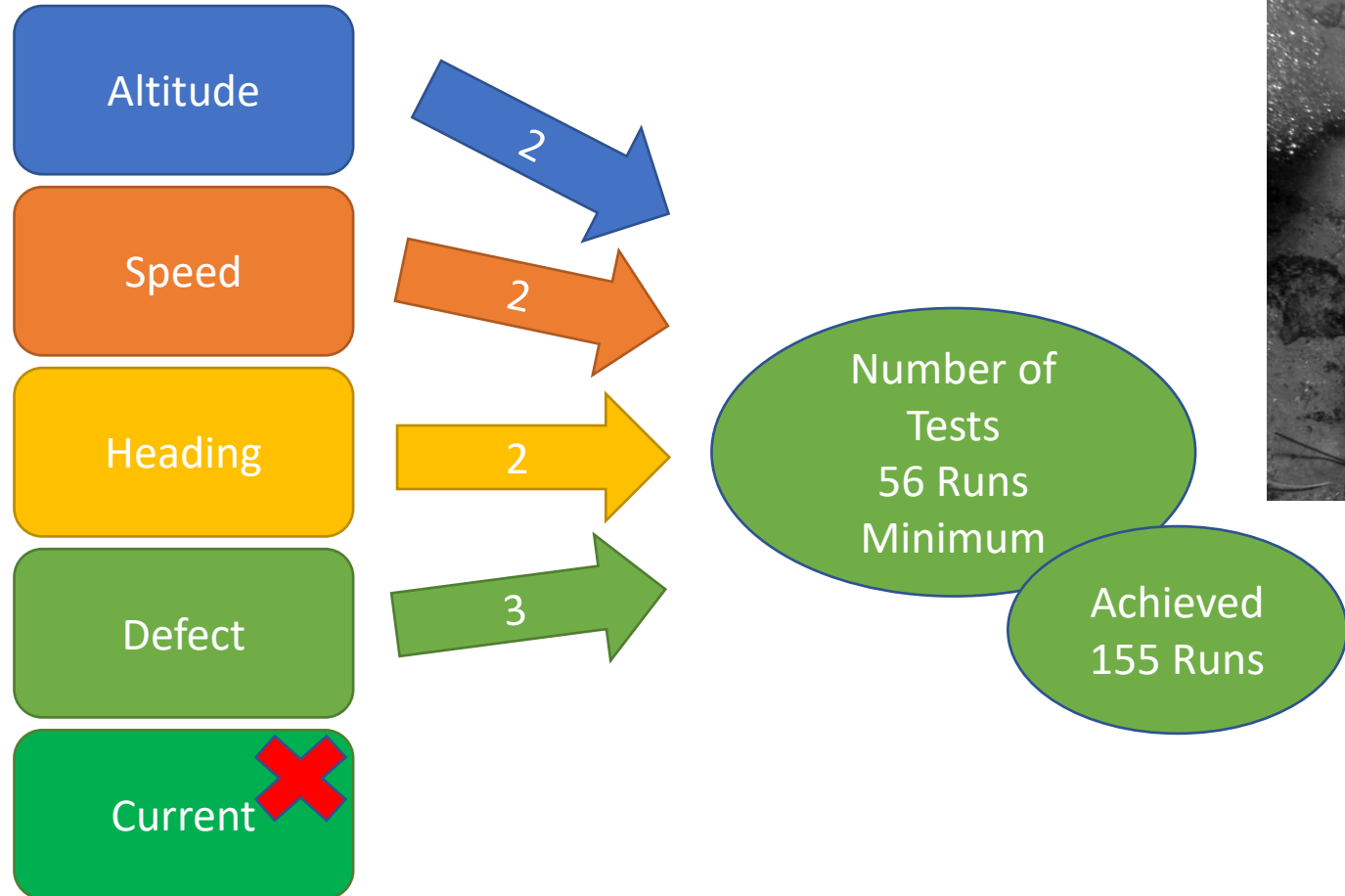


Design of Experiment Methodology

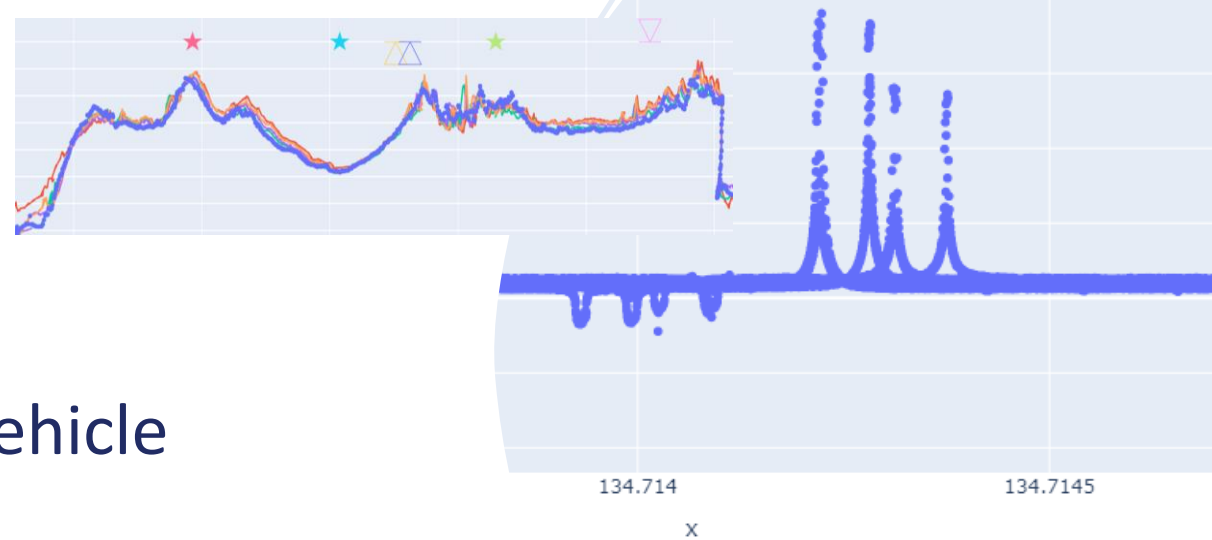
- Identify all possible variables that can affect the outcome of the test
 - Altitude, Speed, Defect, Current, Weather, Turbidity, Secondary Noise
- Exclude those that you have no control over
- Decide on testing method
 - Edge cases and interpolate, interim levels appropriate to Business Cases
- Decide on reliability required for the function
 - 90% at 50% confidence level
- This results in the number of tests to be performed
 - Also allows low level failure to meet criteria

Design of Experiment Methodology

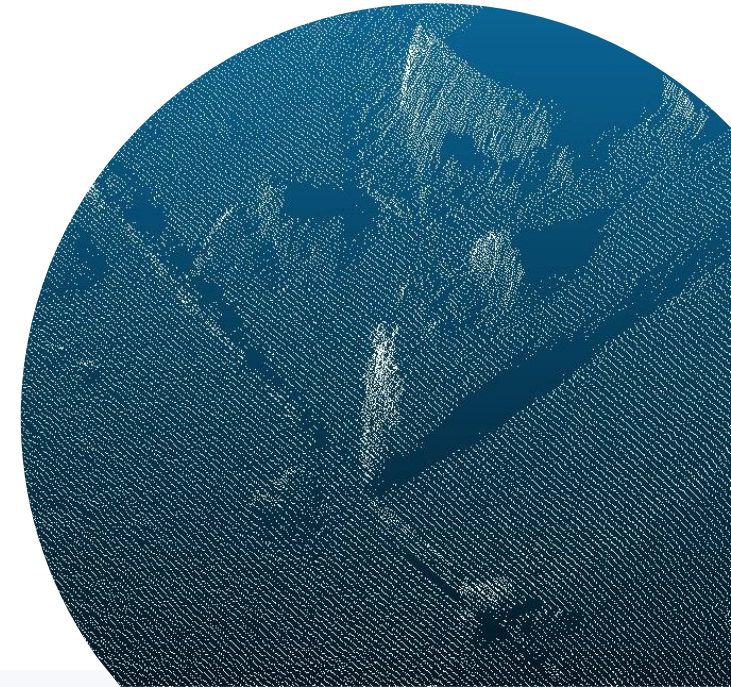
- Variables
- Levels
- Repeatability
- Reliability
- Test both vehicle and payload
- Statistics



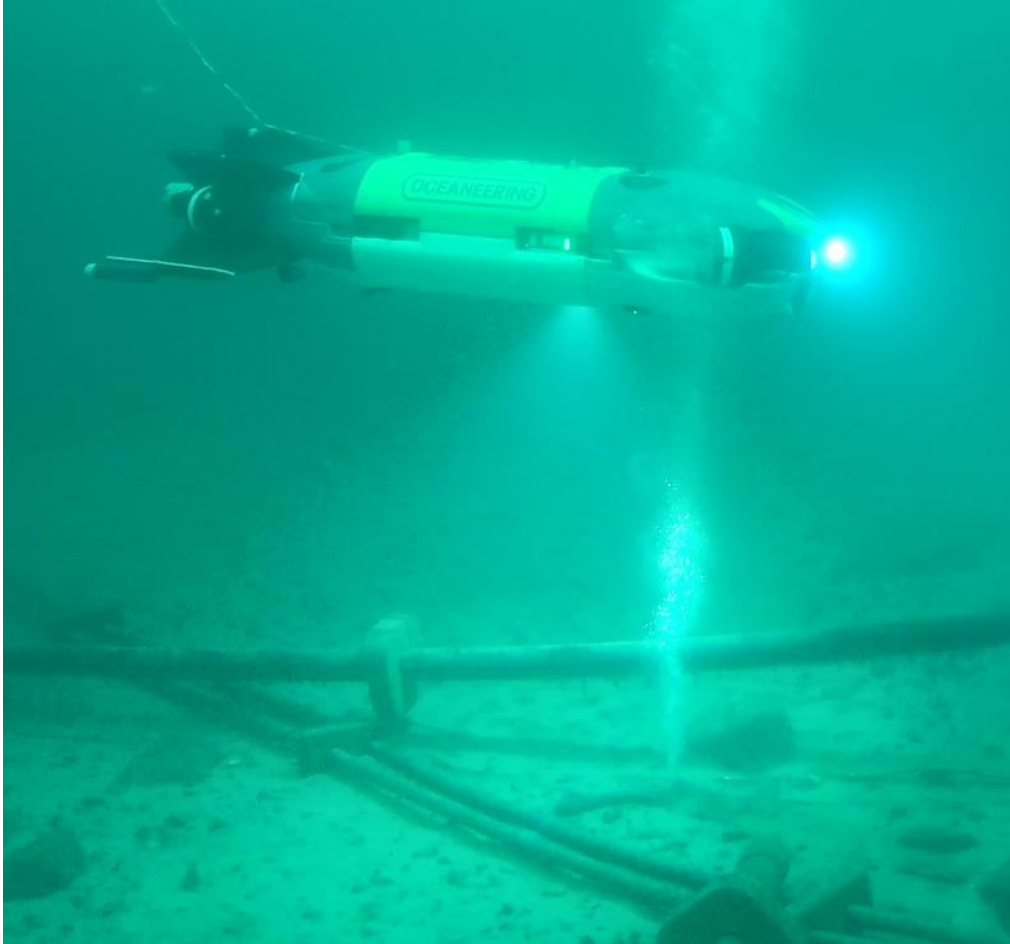
Assessment of Results



- Repeatability of Operation of Both Vehicle and Payload
 - Payload results can corroborate recorded vehicle behaviour
 - Electrical Field Gradient has altitude as a variable
 - Payload can be affected by vehicle behaviour
 - Altitude correction, speed correction
- What is the Ground Truth
 - Supporting method to measure defects
 - Challenged Ground Truth!
 - Unknowns are challenging – need to remove



Lessons Learned



Accept 'fault/failure/low criteria results'

Reliability and Repeatability are important

Test all variables

Experimental Design can reduce the number of test missions

Be prepared for the Ground Truth to be wrong!

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