Performance Review of Maritime Support Services for Orkney

Performance Review of Maritime Support Services for Orkney (PRoMSSO).

This project was conceived to explore and characterise the performance of Orkney based vessels and associated services in carrying out operations required for the marine energy industry.

Results obtained from the performance review will help project developers to select fit-for-purpose and cost-effective vessel combinations for their future projects.

This project was funded by the Scottish Government through the European Marine Energy Centre (EMEC) and was undertaken by Orkney based Aquatera Ltd, acting as principal contractor to EMEC, with Orcades Marine providing vessel management consultancy. This was further supported by a group of operations management, service and vessel supply companies.

aquatera environmental services and products

EMEC ORKNEY THE EUROPEAN MARINE ENERGY CENTRE LTD

The Scottish Government

THE PROJECT INVOLVED:

20 organisations
120+ individuals
60+ vessel operations
30 days at sea

The aims set out by the Scottish Government were to:

- Investigate and trial ways to reduce the costs of operations required for the marine energy industry
- Demonstrate how a project involving many companies, vessels and people can be carried out to high safety standards using a project-wide safety management system
- Demonstrate how vessels used in Orkney waters can carry out complex marine operations cost effectively with cooperation and good coordination

The project was delivered on time and within budget, following high safety standards

The results have been published to assist in the further development of the industry

The following Guiding Principles were adopted:

- Trials should not interfere with commercial operations
- Vessels used must have worked in Orkney waters
- Vessels must reach agreed standards set by the project partners
- Fixed budget and finite timescales were set. Project partners agreed to support the project by reducing rates by at least 25%
- Instrumentation was deployed on vessels to monitor and validate performance
- Trials were designed to investigate validity and future potential of computer modelling
- All participants were encouraged to share in a project culture of openness, engagement and learning
- All parties worked on the project collectively, with a high degree of interchangeability and sharing of expertise to achieve set targets
- There were three inputs to overall results:
  - Mariners Observations
  - Data Analysis
  - Computer Modelling
- Results obtained should benefit the whole industry. Although the trials were based in Orkney, the outcomes are transferable to other localities with similar marine opportunities and challenges

The trials set out to investigate the performance of a gantry barge spread of vessels carrying out marine operations.

This included an assessment of various position-keeping, towing and mooring techniques. Exploring the capability of transporting a large payload to site and accurately positioning it on a target. Novel ways to rotate the payload through 90 degrees underwater were also investigated.

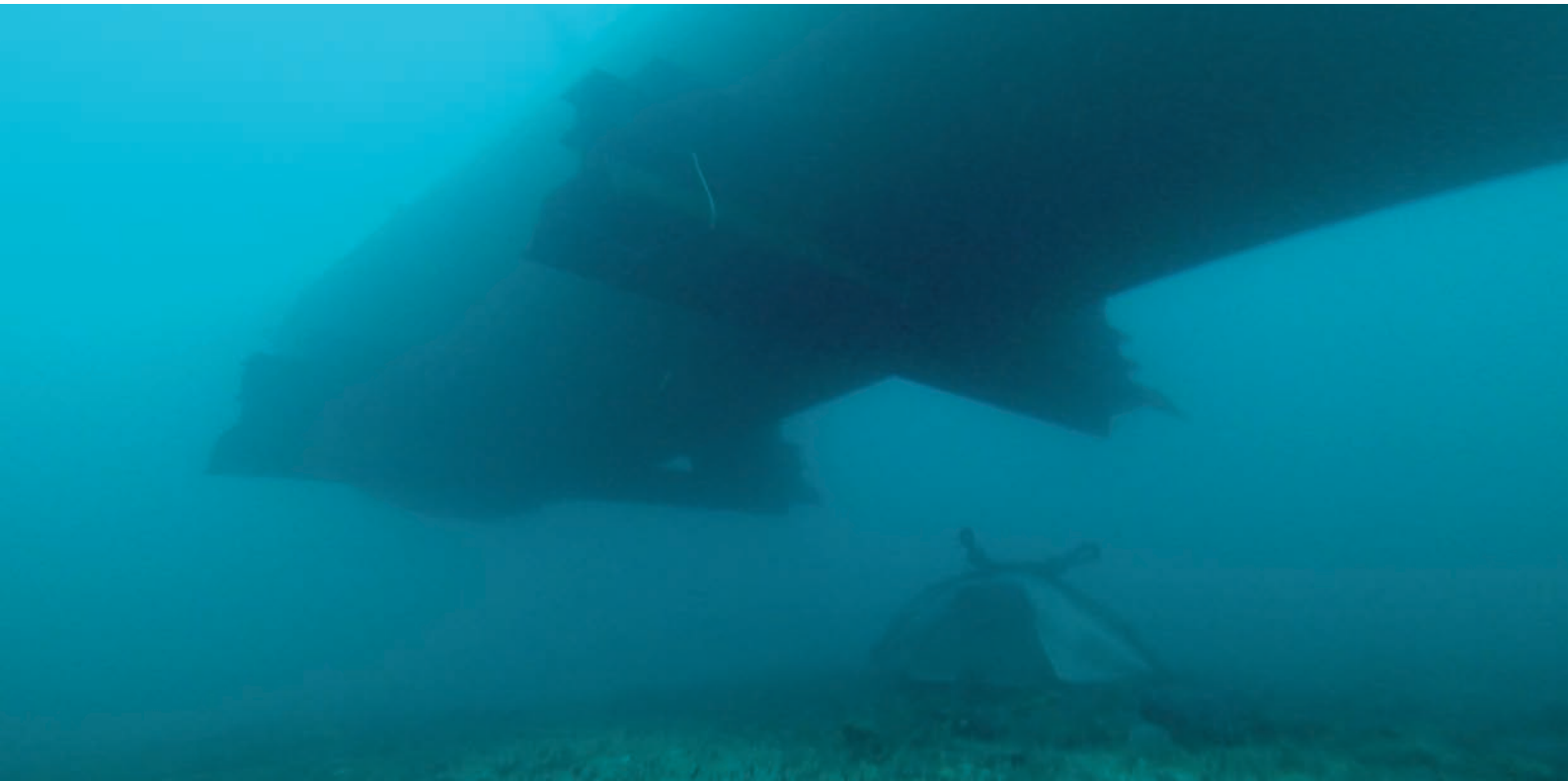
GANTRY BARGE

Outcomes:

- A towed barge can be held to within 10m of a set target in currents up to 2.25 m/s.
- This position keeping capacity enabled the pre-set moorings to be easily attached to the barge
- The moored barge held position to within 0.5m in tidal currents up to 2m/s
- The moored barge was manoeuvred around a box pattern and held position to an accuracy within 1m in 1.5 m/s currents
- The barge transported a full-scale dummy nacelle to site and held position on moorings within 1m accuracy
- The barge lowered the dummy nacelle onto a seabed target to within 0.5m
- A method was demonstrated to rotate the nacelle through +/- 45° under water using the barge

HOW DID WE ACHIEVE THIS?

- With full cooperation and coordination from a team of mariners, surveyors and onshore support
- Detailed method statements and risk assessments were prepared, with involvement of participants, in order to reduce safety and project risk
- Reviewing outcomes from previous operations and from each trial to continually improve operations
- Innovative use of a wide range of instrumentation and monitoring equipment



To investigate the performance of workboats as work horses for marine renewable projects.

Position keeping abilities were tested in a tidal stream with 3 and 4 point mooring systems. Position keeping tests were also carried out without moorings. Dynamic loadings were also examined when carrying payloads underslung and on vessel cranes.

WORK BOATS

Outcomes:

- Demonstrated the all-round capabilities of workboats as industry workhorses
- In tides up to 1.5m/s, workboats holding position directly into the tidal stream, can maintain position up to a deviation of 20°
- Heading into the tide workboats can hold position within a 10m circle in tides up to 2m/s (and possibly higher)
- On a four-point mooring in tidal stream up to 1.5m/s position keeping is within 1m
- On a three-point mooring in tidal stream up 2.2m/s position keeping is within 2m
- Gathered for first time, the dynamic load variation and snatch loads can be directly correlated to the vessels heave when heading into wave and swell

HOW DID WE ACHIEVE THIS?

- A range of different workboats were used during the trials
- Performance was measured to validate previous qualitative assessments
- Running line monitors and load cells were used to provide vessel skippers and crews new information on performance

To ascertain the coefficient of friction for different types of clump weights on different seabeds.

The baseline studies were conducted onshore within a quarry to inform further offshore trials. The offshore trials tested both a chain clump weight and a concrete clump using different lengths of tow wire. These trials were repeated on a range of different seabed types.

CLUMP WEIGHTS

Outcomes:

- A methodology was developed for determining the 'at sea' coefficient of friction between seabed and clump weight
- A methodology was also developed for more accurate at sea trials to provide enhanced data sets
- A third methodology was also produced for industry design curves

HOW DID WE ACHIEVE THIS?

- Designed a concrete clump weight as base load for trials
- A chain clump and concrete clump were pulled at different tow lengths until they started to move and loadings were recorded

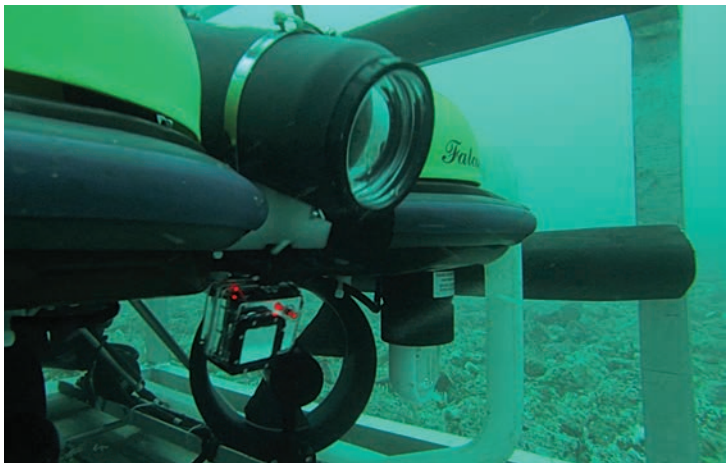
The trials set out to test the use of a newly designed and built garage system intended to increase the operating window of observation class ROVs.

The garage was designed and built by a local operator. During the trials the team tested its capabilities and operating windows compared to use without the system in place.

Outcomes:

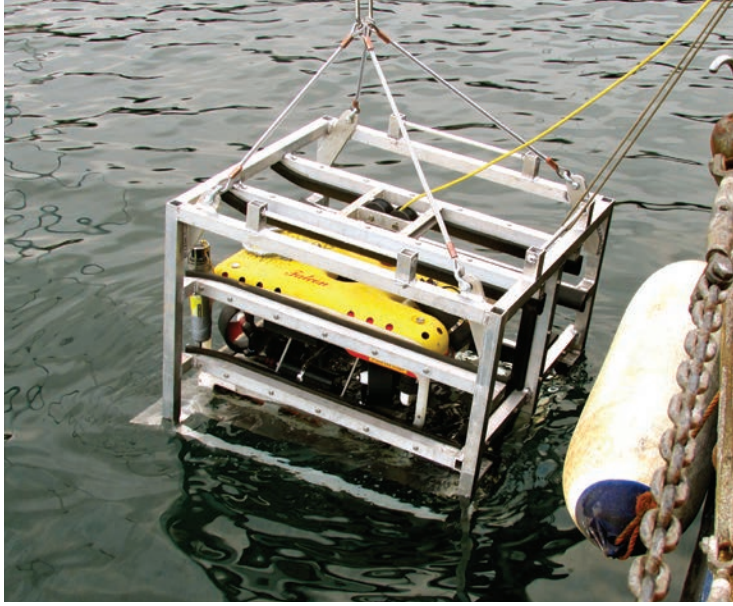
- The ROV increased its operating window in tidal currents of up to 1m/s
- The ROV garage worked well in deep water (60m)
- Deployment and recovery times were significantly reduced, cutting the travel to seabed time by almost half

ROV



HOW DID WE ACHIEVE THIS?

- Trialled new system in various locations with increasing tidal currents
- Filmed the movement of the ROV entering and exiting the garage
- Used the garage system to film a nacelle deployment on a tidal site



Investigating the effects of strong tidal currents on buoy behaviour.

Loadings on the mooring lines and submergence of a buoy were measured in relation to tidal velocity.

Outcomes:

- Modelled results for different types of buoy
- Loadings on the moorings were gauged
- Trialled newly developed underwater logging load cell

BUOY DRAG

HOW DID WE ACHIEVE THIS?

- Using Orcaflex modelling to produce baseline figures
- Comparison of modelled to measured results
- Using loadings and photographic evidence to gauge submergence potential

To investigate ‘man-overboard’ and life raft deployment to demonstrate the risks at strong tidal sites.

Tests were completed to simulate ‘man-overboard’ and life raft deployment to assess the value of risk control measures.

Outcomes:

- The dummy moved rapidly down-tide and was out of sight in 7 minutes, covering 2km in 20 minutes
- Visual tracking in good conditions was limited to around 500 – 750m
- Vessels could easily track personal locator beacons (PLBs) with AIS
- The life raft could be deployed in tidal conditions but deployment location requires careful consideration, particularly on moored vessels

HOW DID WE ACHIEVE THIS?

- Trialled two deployments of dummy, with and without PLB
- Trialled life raft deployment in strong tidal conditions
- Timed response from standby vessels and fast rescue craft

MAN OVERBOARD

A comprehensive safety management system was applied to cover all aspects of the trials.

- A hazard identification and risk analysis (HIRA) system was implemented to engage vessel owners, masters and crew in a detailed review of trials prior to operations
- The trials involved a high degree of strategic and operational preparation, which included the coordination of many separate elements
- Learning opportunities were maximised with the results disseminated to the renewables industry
- Flexibility and adaptability were key to the success of the trials due to challenging weather conditions and busy operational periods
- Local knowledge, expertise and fleet organisation ensured that all trials were completed successfully
- No accidents or incidents were reported over the 30 days of trials

SAFETY

PROJECT OUTCOMES

The precision installation of a large load, e.g. a tidal turbine nacelle, can be achieved by a gantry barge and accompanying spread of vessels at a cost saving of 70-80%, compared to using large DP (dynamically positioned) offshore construction vessels

The equivalent of three practice installations of a full-scale turbine nacelle were carried out during trials for under £400,000

More generally, installation, maintenance and decommissioning can all benefit from cost reductions by using a gantry barge spread of vessels for certain operations

ROV operations in tidal conditions are often a limiting factor in deployment. Using the launch and recovery garage apparatus the operational window increased by 25%

Better characterisation of the seabed coefficient of friction with respect to gravity anchors may allow future design optimisation

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The Scottish Government

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