AWS OCEAN ENERGY LTD |
PARTIAL SCALE WAVESWING DEMONSTRATOR

EMEC Scapa Flow Test Site

Navigational Risk Assessment Addendum

December 2020

Purpose

This document is provided as an addendum to and should be read in conjunction with the document 'Scapa Flow Scale Wave Site Navigational Risk Assessment (NRA) – REP299'. It describes the key project-specific navigational risks to be addressed in relation to proposed activities at the European Marine Energy Centre test site at Scapa Flow, Orkney Islands, together with proposed mitigation for reduction/elimination of these risks. Site location navigational risks are covered in the site-wide Scapa Flow NRA produced by EMEC.

This document has been prepared to support a marine licence application for the AWS Partial Scale Waveswing Demonstrator. For further information regarding the project, please refer to the Project Information Summary.

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
1.0	15/12/20	Originate	DL (EMEC)	JM (AWS)	

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1 Introduction

AWS Ocean Energy Ltd is a technology development company aiming to provide marine energy solutions to customers and partners worldwide. Established in 2004, AWS has developed a range of technologies and services to meet customer needs from isolated off-grid power supplies to utility scale offshore power production.

This assessment has been produced as an addendum to the site-wide Navigational Risk Assessment for the Scapa Flow test site. This document identifies and assesses any project-specific navigational risks and discusses the proposed risk control measures to be implemented in order to reduce the risk associated with the project.

2 Project overview

Further information regarding the project is available in the Project Information Summary.

2.1 Asset information

The Archimedes Waveswing is a submerged point absorber that changes volume in response to pressure variations caused by ocean waves. Nominal rating for a full-scale device is 195kW although this is capable of being scaled up as the technology becomes further developed.

Overall, the partial-scale device will measure 4.5m diameter and have an approximate height of approx 7.5mm. The PTO will have a continuous rating of 16kW. The device will be designed for full onshore commissioning and extended dry testing.

The device uses a single-point tension tether mooring attached to a tidal compensation winch mounted within the device. The tether is attached by means of a quick release ‘Rocksteady’ connector to a gravity-base anchor comprised of a fabricated steel frame and concrete ballast blocks. The device is submerged, and the tidal compensation system ensures that the minimum submergence from the floater crown to the mean water level is 1.5m.

Anchor and device deployment are scheduled for April 2021 with device recovery to storage October 2021.

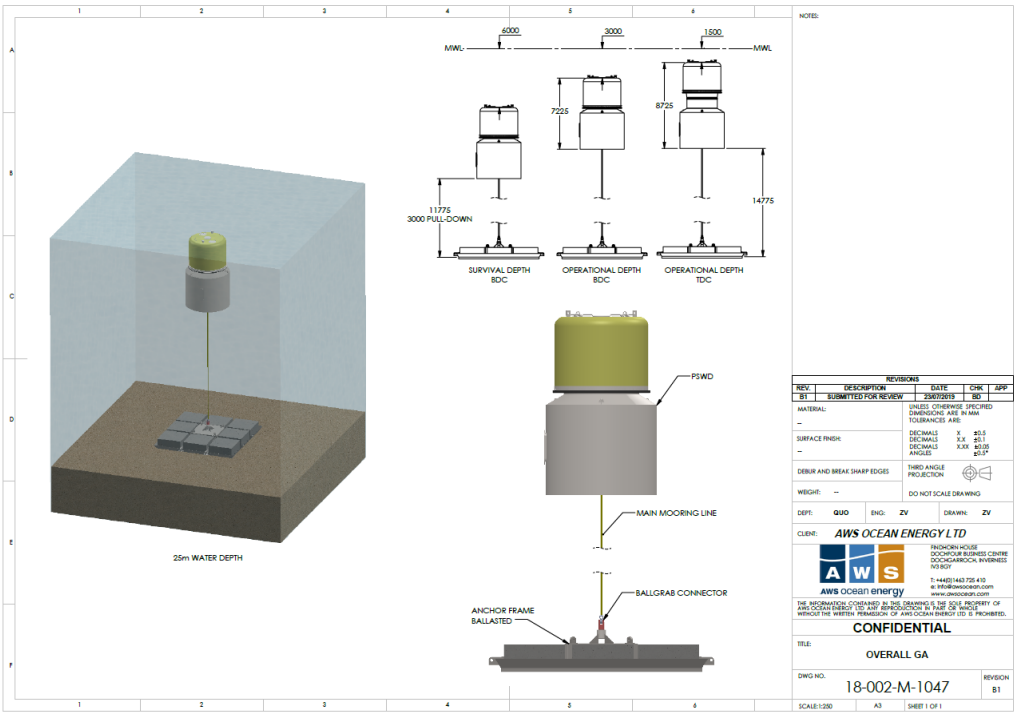

Figure 1. General architecture of device

2.2 Schedule and test plan

In summary, the process envisages the device being transported from the fabrication yard to Stromness in a horizontal tow configuration using a multicat as the towing vessel.

A wet tow to the deployment site follows using a multicat to tow the device to Berth 1 at the Scapa Flow test site. The anchor will have been pre-installed, again using the multicat or potentially the multicat and GM700 crane barge. The device mooring tether is connected to the anchor using a messenger line to guide a rocksteady connector into its receptacle. The power and controls umbilical is connected to the TSB using a deck-mate connector allowing control of the on-board mooring line winch. The final installation stage is to winch the device down to the intended operational depth using the on-boards pull-down system.

During the first month of deployment, the anchor frame and concrete blocks will be installed using a multicat vessel or GM700 barge.

Table 1. Project proposed schedule

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Anchor deployment						
WEC deployment						
WEC mid-test recovery						
WEC re-deployment						

WEC recovery to storage						

2.3 Deployment location

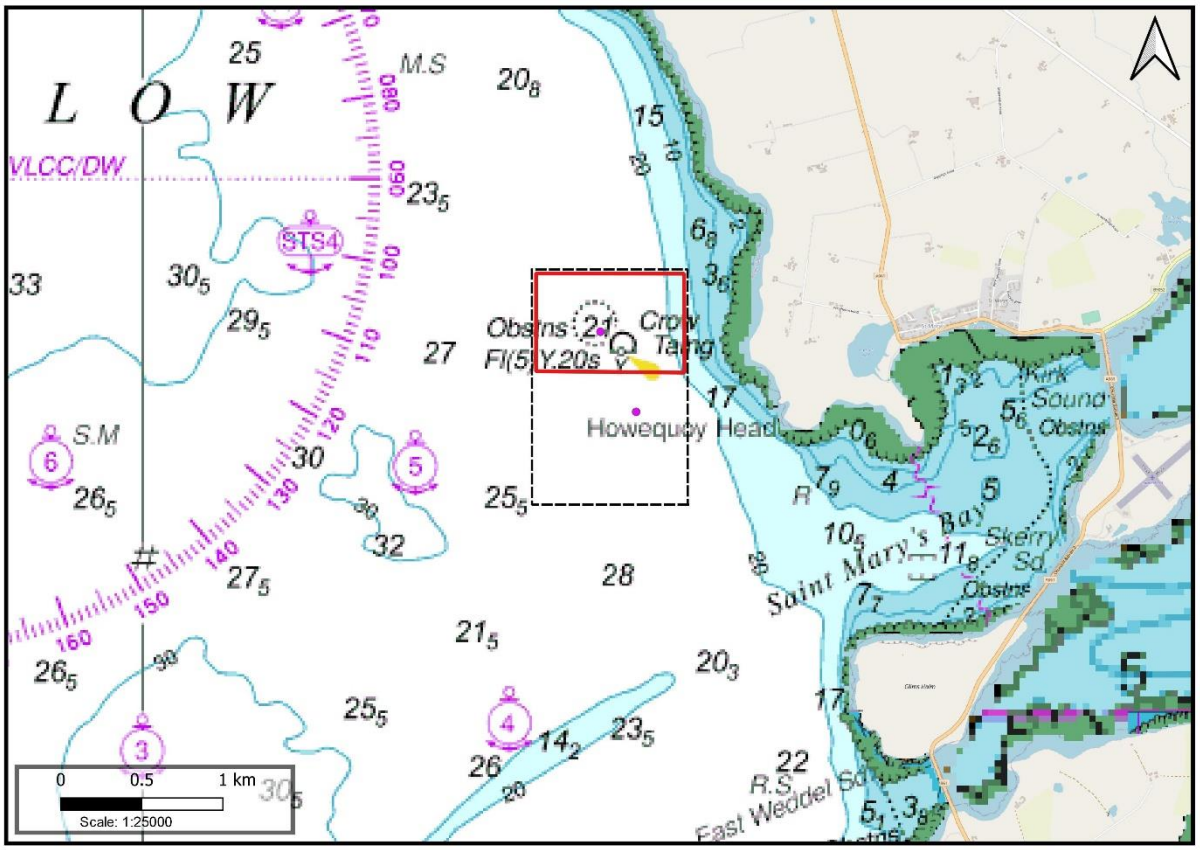

Figure 2. Marine licence boundary (red line), site boundary (black dashed line), and berths (purple dots)

Location Description	Latitude and longitude (WGS 84)				UTM (Eastings and Northings)			
Berth 1	58°53.07'N, 002°57.02'W				502820E, 6528441N			
Test site boundary points	Corner A	Corner B	Corner C	Corner D	Corner A	Corner B	Corner C	Corner D
	58° 53.950' N	58° 53.170' N	58° 53.170' N	58° 53.950' N	652882 6E	652737 8E	652737 7E	652882 6E
	002° 56.500' W	002° 56.500' W	002° 57.500' W	002° 56.500' W	503361 N	503362 N	502402 N	503361 N
Marine Licence Boundary	Corner A	Corner B	Corner C	Corner D	Corner A	Corner B	Corner C	Corner D
					652880 6E	652819 4E	652819 5E	652880 7E

	58° 53.94'N 002° 57.47' W	58° 53.61' N 002° 57.4'W	58° 53.61'N 002° 56.52' W	58° 53.94'N 002° 56.52' W	502430 N	502497 N	503343 N	503342 N

3 Key navigational themes

In order to complete this project-specific assessment, a review of the site-wide NRA for EMEC's Scapa Flow test site was conducted. The following navigational themes have been considered during the assessment.

3.1 Vessel routing

The Scapa Flow test site is not in close proximity to any shipping routes. Any vessels that do transit the site or in waters adjacent to the site will be aware of the test site presence as it is marked on United Kingdom Hydrographic Office charts. Also, a notice to mariners will be issued by Orkney Harbours Authority before any works relating to this project are undertaken.

3.2 Contact / allision risk

A notice to mariners and uses of appropriate marking and lighting to alert other mariners to the device should mitigate the risk of contact. The test site is charted on the United Kingdom Hydrographic Office charts.

3.3 Effects of tide / tidal streams and weather

The location of the Scapa Flow scale site was initially selected due to the benign conditions that characterise the site. As the device will be deployed within a sheltered scale site, there is no significant risk associated with tide, tidal streams, and weather.

3.4 Collision risk and visual navigation

The device is submerged below the surface of the water and the scale of the assets to be installed during this project are not expected to hinder visual navigation. The exception may be small craft such as open top RIBs, workboats, or multicat vessels that will periodically perform maintenance tasks.

3.5 Communication, radar and positioning system

The scale of the assets to be installed during this project are not likely to impact on electronic communication or positioning systems. Given that no generating infrastructure exists above the surface, there is no anticipated impact upon communications, radar and positioning systems.

3.6 Moorings

A single point mooring will be installed at the Scapa Flow test site prior to WEC installation. The mooring will be marked by a site surface buoy when not in use.

3.7 Station keeping

The device control system will alarm should the device lose mooring tension or communications, indicating a station keeping failure.

3.8 Fishing activity

Fishermen would generally be expected to take precautions in order to avoid any underwater assets that may be present at the test site, especially if devices or vessels were onsite.

3.9 Recreational activity

There is minimal racing or small boat sailing at the test site, and few recreational vessels are recorded in the vicinity.

3.10 Subsea cables

There is no evidence of anchoring or gear snagging at Scapa Flow historically.

3.11 Search and rescue

The device will not alter the capability of search and rescue operations in the area all will not interfere with RNLI and helicopter operations.

3.12 Cumulative and in-combination

The closest anchorage to the test site is approximately 0.7nm to the south-west. Commercial vessels on transit are at least 1 nm west of the site. No significant impact is expected to arise from the presence of this anchorage.

4 Risk controls

4.1 Site-wide risk controls

A number of risk controls are embedded by the processes EMEC has implemented in order to operate the site and the layout of the Scapa Flow test site. The embedded risk control measures are detailed in Table 2, along with any project-specific actions which include any divergence from the specified control discussed.

Table 2. EMEC embedded risk controls for Shapinsay Sound test site

ID	Embedded risk control	Description	Project-specific actions
1.	PPE Requirement	Maintenance teams to wear suitable PPE when working on the assets, including life jackets.	
2.	Training of staff	Staff to be trained to the required standards for their work and have suitable local knowledge of regulations and operations in the Orkney Islands.	
3.	Emergency Risk and Cooperation Plan (ERCoP)	ERCoP for site developed and agreed with the MCA and SAR bodies to be consulted.	

ID	Embedded risk control	Description	Project-specific actions
4.	NtM and Promulgation	In addition to NtM, EMEC's Maritime Safety Information Standard Operating Procedures (SOP) ensures that all key navigational consultees are informed prior to any works. Distribution could include HMCG, Orkney Harbours (available via Orkney Islands Council Marine Services website), Orkney Marina noticeboards (as necessary), Orkney Fisheries Association, Scottish Fisheries Federation and UKHO. Stakeholders are targeted with information about relevant assets based on their activities and location.	
5.	Incident monitoring and reporting	EMEC to encourage incident/near miss reporting and monitor any safety issues at the test site. If necessary, risk control to be reviewed. Risk assessments to be reviewed following any incidents.	
6.	EMEC Procedures	EMEC has a number of SOP and standards in place to reduce navigation risks, such as: • Task risk assessment; • Control of work (permit to access) • Hazard identification reporting; and • Maritime safety information.	
7.	Hydrography	Contractual responsibility for developer to return the site to the original condition post-decommissioning.	
8.	Charting	Site is marked on nautical charts.	
9.	Site Monitoring	EMEC's SCADA system provides real-time status information, trends, alarms and remote-control access to facilitate a safe working environment, comprehensive assessment and safe operation of the sites.	
10.	Liaison with local stakeholders	EMEC regularly liaises with key local stakeholders to identify any potential issues as soon as possible. Regular updates include information regarding upcoming deployments and significant operations at the site.	
11.	500m advisory ATBA	A 500m advisory ATBA exists around all test devices located at EMEC test sites.	

4.2 Project-specific risk controls

The following table provides a description of the risk controls that will be implemented during the project.

Table 3. Project-specific risk controls

ID	Project-specific risk control	Description
1.	Radar reflectors	Use of radar reflectors on TSB to improve marking during times of poor visibility.
2.	Heightened monitoring in adverse metocean conditions	During gale force winds, periodic monitoring of the devices is recommended to ensure excessive forces are not acting on the moorings which might cause a breakout.
3.	Inspection and maintenance programme	Regular maintenance regime by developer to check the asset, its fittings and any signs of wear and tear. This should identify any failings which might result in a mooring failure and breakout. Refer to TPV for further information. Device to be deployed for short period of time, likely inspection and maintenance to be minimal within this period.
4.	Remote shut down including feathering of blades	Devices to be fitted with ability to shut down in an emergency, such as feathering any blades or braking to allow access or prevent contact with a vessel.
6.	Marking and Lighting	Assets to be lit to the requirements of NLB and marked in line with IALA guidance, IALA Recommendation O-139 (2013)[1]. A small West cardinal will be placed within 100m of the device.

[1] All surface piercing structures should be marked as:

- Individual wave and tidal energy devices within a site that extend above the surface are painted yellow above the waterline;
- If marked, the individual devices should have flashing yellow lights. The flash character of such lights must be sufficiently different from those displaying on the boundary lights with a nominal range of not less than 2 nautical miles; and
- A single wave or tidal energy structure standing alone may be marked as either an isolated danger mark or a special mark.

It is also recommended that:

- Radar reflectors, retro-reflecting material, Racons and / or AIS transponders should be considered where the level of traffic and degree of risk requires it;
- The lit Aid to Navigation (AtoN) must be visible to the mariner from all relevant directions in the horizontal plane, by day and night;
- Any floating AtoNs should be located outside the moorings of the floating structures; and
- AtoNs should comply with IALA Recommendations and have an appropriate availability, normally not less than 99% (IALA Category 2).

ID	Project-specific risk control	Description
8.	Tow risk assessment and passage plan	As required under Orkney Harbours Pilotage Directions 4(3)[2], prior to conducting a towing operation, a risk assessment and passage plan for the move should be conducted. The plan should account for the size of the tow, maneuverability restrictions, tow arrangements and metocean conditions.
9.	Guard vessels	During major construction or maintenance activities, a guard vessel may be considered to assist in protecting the devices from contacts with passing vessel traffic. Due to the low density of traffic, this is not considered necessary except for extraordinary circumstances. If guard vessels are to be used onsite, it is important that such vessels employed to guard the site follow appropriate guidelines, with clear instructions on when to intervene in a potential incident.
10.	Liaison with local stakeholders	Consultation should be undertaken with Orkney Marine Services, the MCA and NLB prior to installation of device to confirm that adequate risk controls are in place. EMEC also conducts regular stakeholder consultation events to ensure that local marine users are aware of the pipeline of activity.
11.	Installation, maintenance and removal	All vessels undertaking activities on site should comply with EMEC standard operating procedures. Vessels should be mindful of other navigating vessels and avoid disrupting the activities of others.
12.	ERCoP	Project-specific annex to be incorporated into site-wide ERCoP.

5 Summary and conclusion

This document has been prepared to support a marine licence application for the AWS Partial Scale Waveswing Demonstrator and should be read in conjunction with the document 'Scapa Flow Scale Wave Site Navigational Risk Assessment (NRA) – REP299'.

In summary, the NRA has concluded that the deployment of the device is low risk with suitable risk controls in place. This conclusion has been emphasised by the scale of this deployment and short testing period.

[2] Orkney Islands Council Competent Harbour Authority (2016) The Orkney Pilotage Direction 1988 (as amended 2007, 2010 and 2016).