MARINE POWER SYSTEMS
WAVESUB

EMEC Billia Croo Test Site

Navigational Risk Assessment Addendum

August 2021

Purpose

This document is provided as an addendum to and should be read in conjunction with the document 'Billia Croo Navigation Risk Assessment (NRA) – REP522'. 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 Billia Croo, Orkney Islands, together with proposed mitigation for reduction/elimination of these risks. Site location navigational risks are covered in the site-wide Billia Croo NRA produced by EMEC.

This document has been prepared to support a marine licence application for the Marine Power Systems (MPS) WaveSub deployment. 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	16/08/21	For submission	DL (EMEC)		

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1 Introduction

From its 2007 inception by Dr Gareth Stockman and Dr Graham Foster, Marine Power Systems (MPS) has followed a structured development pathway, delivered by its ever expanding strong team of engineers, scientists, managers and support staff to deliver clean energy ocean technology. MPS's technology portfolio can extract wave energy, wind energy and wind and wave combined; making best use of a marine area with minimal spatial impact whilst delivering maximum energy yield.

MPS's technology ethos uses a common platform system to host its proprietary ocean energy extraction technology and is able to accommodate the largest commercially available offshore wind turbine. This approach provides a set of shared advantages suitable to the demands of offshore energy production. These unique features of MPS's platform technology are: Manufacturable, Transportable, Deployable, Stable, Maintainable, Survivable.

MPS is nearing the completion of its research and development pathway and moving towards commercial demonstration. This next phase will see the long term deployment of a small array of MPS energy systems. EMEC's Billia Croo grid connected site is the premium choice to host this next key milestone with the site being UKAS accredited, this verification will add a thorough level of credibility to the project and bridge the closing of R&D testing to commercial delivery.

This assessment has been produced as an addendum to the site-wide Navigational Risk Assessment for the Billia Croo 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

WaveSub consists of a floating platform moored using a tension leg system. The platform accommodates a number of WEC floats. Once the device is deployed as shown in figure 1, the absorber floats are undocked and are excited by the subsurface orbital energy carried by the ocean waves. This excitation actuates the floats which capture and transfer this from mechanical energy to electrical energy using the onboard power take off system (PTO). This generated electrical energy is delivered to the grid network via a subsea cable.

In its deployed position WaveSub is always visible for marine navigation and is accessible for offshore maintenance and repair.

Shown in figure 1, is a commercial scale WaveSub. Two commercial scale WaveSub wave energy converters (WEC) are to be deployed, each device will have 3MW name plate capacity.

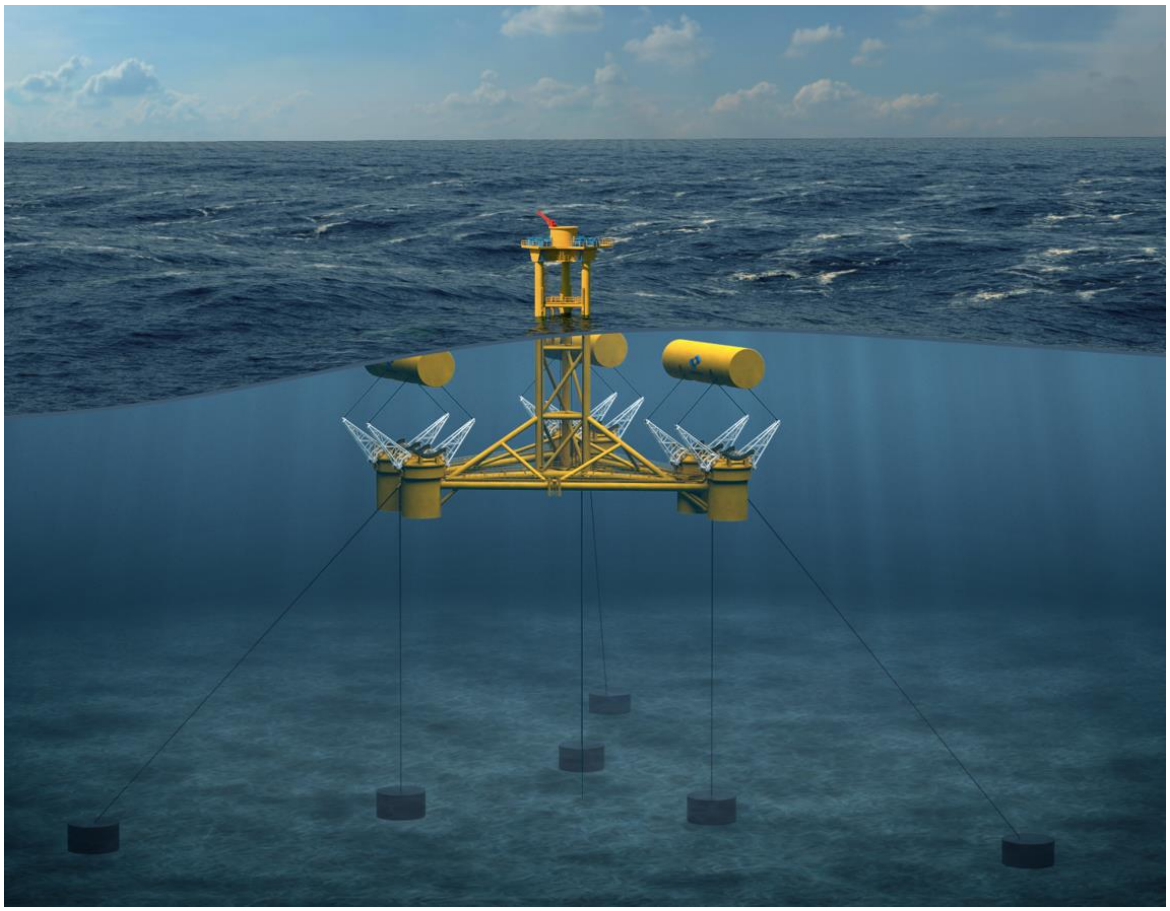

Figure 1. Commercial Scale WaveSub (Concept Image subject to change)

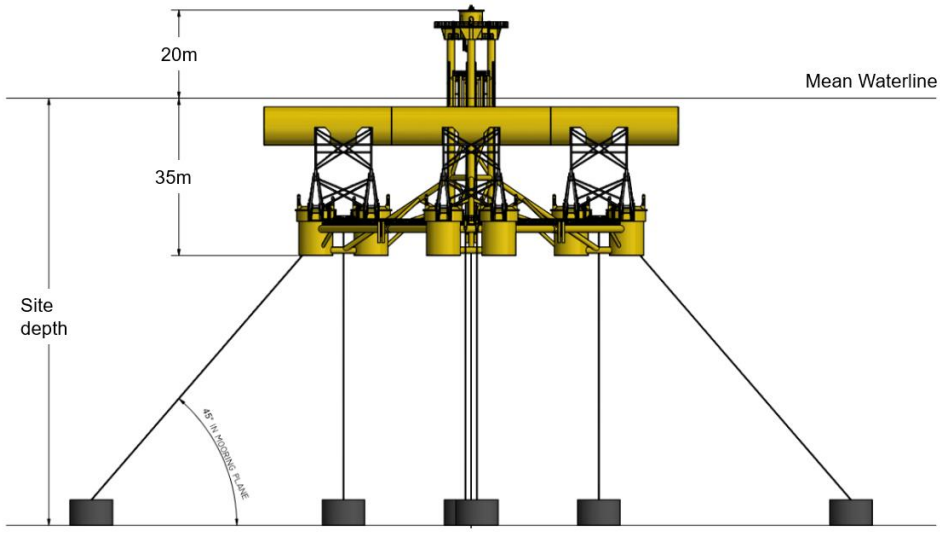

Figure 2. WaveSub concept mooring layout

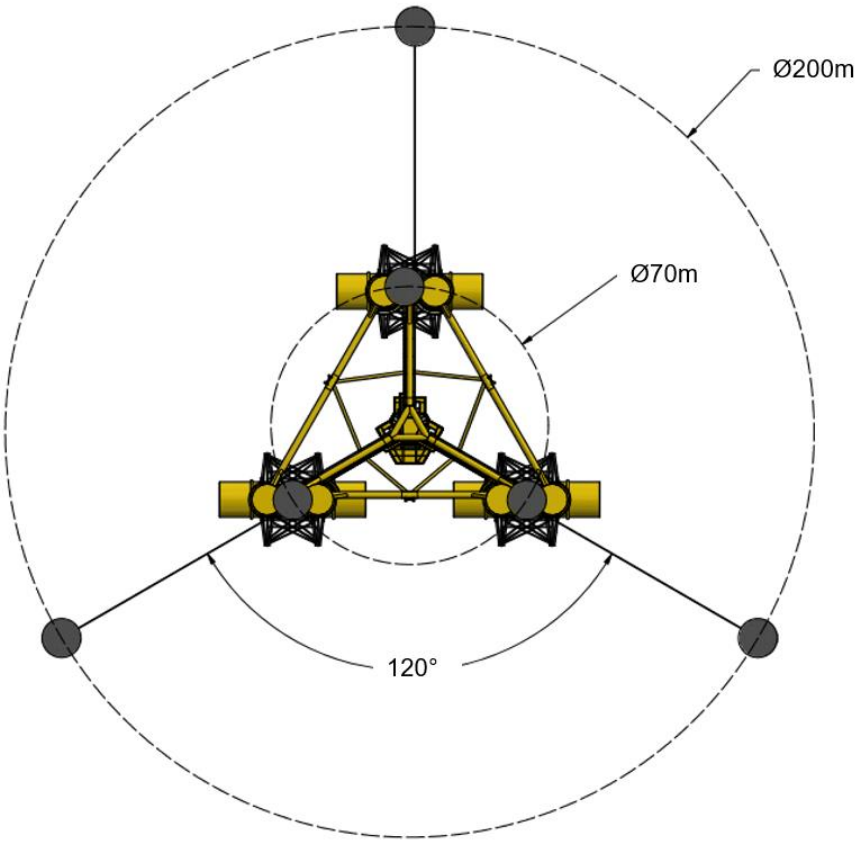

Figure 3. WaveSub concept mooring layout.

2.2 Schedule and test plan

The project operational target is 2025. Ahead of this a geophysical survey has been conducted (July 2021).

Table 1. Gantt chart of schedule

STAGE	YEAR			
	2021	2025	2026	2035
SITE SURVEY				
PRE-CONSTRUCTION WORKS (ANCHORS)				
DEVICE INSTALLATION				
DEVICE COMMISSIONING				
OPERATIONAL				
DECOMISSIONNING				

2.3 Deployment location

The device will be deployed within the EMEC Billia Croo test site.

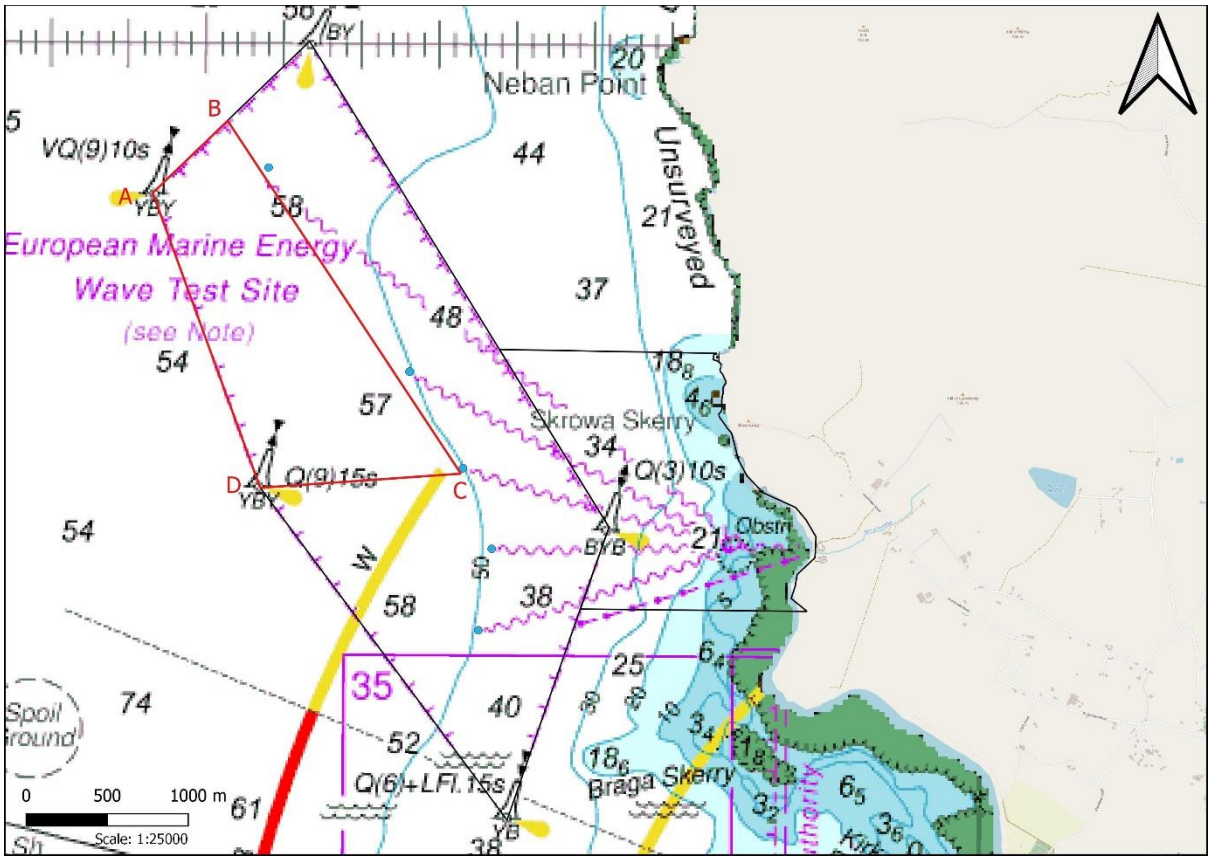

Figure 4. Marine licence boundary (red line)

Table 2. Coordinates of berth and test site boundary

Location Description	Latitude and longitude (WGS 84)				UTM (Eastings and Northings)			
	Corner A	Corner B	Corner C	Corner D	Corner A	Corner B	Corner C	Corner D
Marine Licence Boundary	58° 59.49' N	58° 59.73' N	58° 58.57' N	58° 58.52' N	318365E	318829E	320235E	318998E
	003° 25.34' W	003° 24.86' W	003° 23.35' W	003° 24.64' W	1012457 N	1012906 N	1010712 N	1010646 N

3 Key navigational themes

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

3.1 Vessel routing

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 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 Billia Croo site was initially selected due to the strong wave conditions. A device-specific TPV will be conducted which includes assessment on the moorings and takes into account the conditions found at the Billia Croo test site.

3.4 Collision risk and visual navigation

Part of the device is above 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

The moorings will be marked by a site surface buoy when not in use.

3.7 Station keeping

The device has AIS capabilities, therefore if moorings failed and the device became loose the relevant personnel would be notified immediately.

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 Billia Croo historically.

3.11 Search and rescue

The device will not alter the capability of search and rescue operations in the area or interfere with neither RNLI nor helicopter operations.

3.12 Cumulative and in-combination

There are no other developments within the area, thus no anticipated cumulative or in-combination effects are expected.

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 Billia Croo test site. The embedded risk control measures are detailed in Table 3.

Table 3. EMEC embedded risk controls for Billia Croo test site

ID	Embedded risk control	Description
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.
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.

ID	Embedded risk control	Description
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. Note – only relevant if test support buoy is deployed
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 4. Project-specific risk controls

ID	Project-specific risk control	Description
1.	Radar reflectors	The structure above sea level will provide a strong radar signal, If required a radar reflector can be fitted to improve marking during times of poor visibility.
2.	AIS	Use of AtoN AIS (or virtual AIS if permitted) fitted to all surface piercing devices to improve visibility to passing vessels. AIS should be Category 3 with at least 97% up time and use Message 21, or as directed by the Northern Lighthouse Board (NLB).
3.	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.
4.	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 the findings of your third party verification mitigation against device breakage.
5.	GPS alert system for asset moving	Remote monitoring of device to detect any major movements that might indicate a breakout for immediate response. Implement GPS excursion monitoring.
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]. The following is typically requested by the NLB:

[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;

ID	Project-specific risk control	Description
		• Yellow day marking/painting; • Flashing yellow special mark light (Category 1) (larger devices may require 2 lights at each end which are synchronised; light ranges should be at least 3 nautical miles); • Day top mark (if deemed necessary); • Radar reflector; and • AIS AtoN (mandatory for floating devices at EMEC). Appropriate statutory sanctions must be in place to exhibit, alter or discontinue lighting.
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.

- 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).

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

5 Summary and conclusion

This document has been prepared to support a marine licence application for the Marine Power Systems WaveSub deployment and should be read in conjunction with the document 'Billia Croo Navigational Risk Assessment (NRA) – REP522'.

In summary, the NRA has concluded that the deployment of the devices is low risk with suitable risk controls in place.