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Marine Characterisation Research Project (MCRP)

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Menter Môn

Marine Characterisation Research Project (MCRP)

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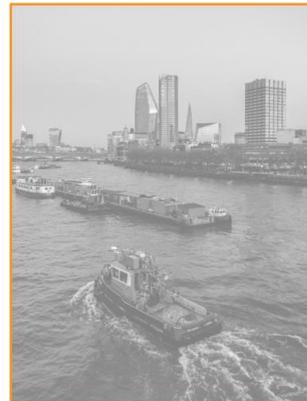
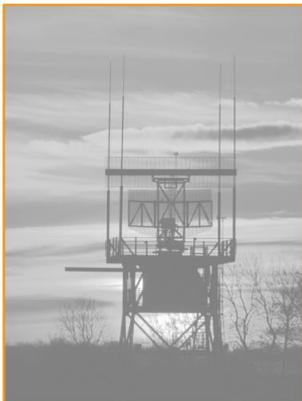
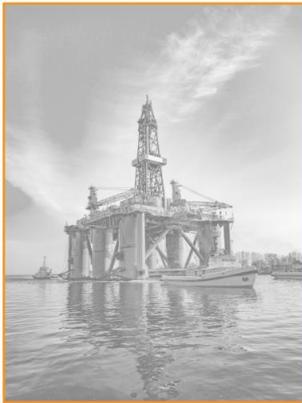
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MORLAIS DEMONSTRATION ZONE NAVIGATION
MONITORING SPECIFICATION



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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid
MAIB	Marine Accident Investigation Branch
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MDZ	Morlais Demonstration Zone
MGN	Marine Guidance Note
nm	Nautical Mile
NMS	Navigation Monitoring Specification
NRA	Navigation Risk Assessment
NRW	Natural Resources Wales
NtM	Notice to Mariners
OREI	Offshore Renewable Energy Installation
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
UKC	Under-Keel Clearance
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic Study

1 INTRODUCTION

Following the successful consenting of the Morlais tidal Demonstration Zone (MDZ) in December 2021, this Navigation Monitoring Specification (NMS) has been prepared by Marine and Risk Consultants Limited (Marico Marine) in response to marine licence (ORML 1938) conditions to detail the marine traffic monitoring methodology for pre-, post- and construction phases of the project (see **Figure 1**). It should be noted that this document is a “living document”, the contents, of which are up to date at the time of release.

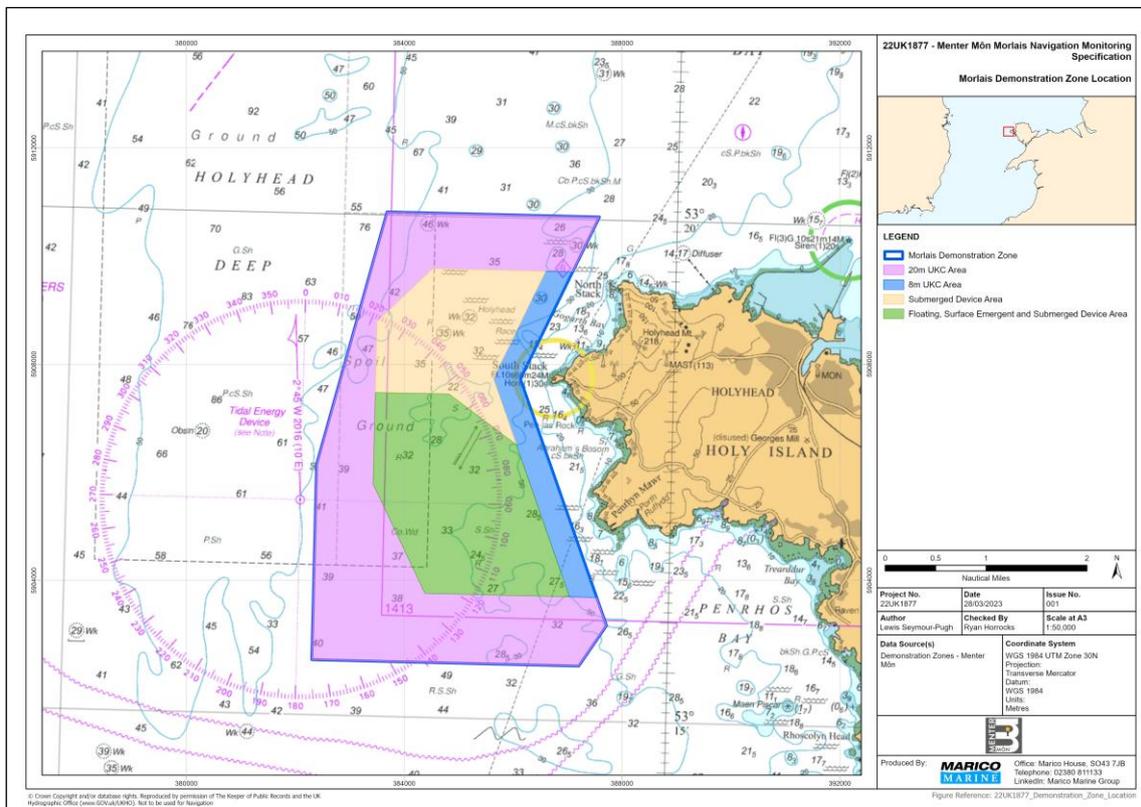


Figure 1: Location and zoning of the Morlais Demonstration Zone as of June 2023

Initially, two vessel traffic surveys (VTS) are scheduled to take place in the summer and winter of 2023 to inform the first bi-annual Navigation Risk Assessment (NRA). Following this, one VTS is to be undertaken every year thereafter and the data collected used to inform the bi-annual and device-specific NRAs required by the Morlais marine licence. Further monitoring will be undertaken for the construction to post-construction phases of the project.

The purpose of the NMS is to provide a specification for vessel traffic monitoring throughout the lifetime of the MDZ to meet the requirements of the Maritime and Coastguard Agency (MCA)

Marine Guidance Note 654¹. The VTSs will be conducted by Marico Marine specialists on behalf of Menter Môn and will ensure that the data captured throughout the survey remains accurate, fit for purpose and compliant with the prescribed standards, frequency and quality required to support all phases of the MDZ and supporting NRAs. The results of the vessel traffic monitoring will be reviewed against the anticipated traffic composition and patterns. Any implemented mitigation measures will be monitored, and their cumulative effectiveness analysed to feed into any future variations and additional mitigation that may be required in due course.

The MCA Marine Guidance Note (MGN) 654 (M+F) - *Offshore Renewable Energy Installations (OREI) safety response, Guidance on UK Navigational Practice, Safety and Emergency Response* - contains the current UK guidance on navigational monitoring. This NMS will inform the navigation monitoring of the MDZ in compliance with the recommendations made therein.

Annex 3 of MGN 654 contains details regarding the mitigation measures and factors to be considered for OREIs - specifically underwater turbines - and that the data captured must include draught information to correctly assess the minimum under-keel clearance (UKC) of the vessels transiting through the study area.

2 SCOPE OF WORKS

The scope of monitoring suitable for the MDZ has been determined in accordance with the marine licence and the recommendations made in MGN 654. See **Table 1**.

A navigation monitoring survey of the MDZ planned device-specific deployment area is required by the licence in support of the construction and post-construction phases. The surveys will be required to capture every form of craft and vessel present in the region and will last at least 28 days. The 28-day periods can be split into two 14-day periods (one winter period and one summer period) to capture indicative seasonal variations. This is the approach that will be followed.

To accurately capture seasonal variations, changes during peak hours, fishing operations and movements of small craft, it is well understood that AIS data alone does not constitute an appropriate traffic survey. AIS data acquisition will therefore be supplemented by radar data and visual observations via video surveillance CCTV.

¹ [MGN 654 \(M+F\) Offshore Renewable Energy Installations \(OREI\) safety response - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614242/MGN_654_M_F_Offshore_Renewable_Energy_Installations_OREI_safety_response.pdf)

Feedback from stakeholder consultation reinforced this approach; specifically, to capture those vessels not required to carry and operate AIS, and to provide a means of ensuring that vessels such as fishing boats, kayakers and paddleboarders were monitored during the survey.

To that end, and in addition to Marico Marine’s site-wide video monitoring, local stakeholders such as the National Coastwatch Institute (NCI) and the Angelsey kayaking community have agreed to support the project by crowd-sourcing visual and digital sea-user data in a format that can be utilised and incorporated into the NRA. This will help to ensure a faithful representation of the baseline marine traffic profile for small vessels and recreational users across the MDZ.

Table 1: Navigation Monitoring Scope

Data Types	AIS, radar, visual and crowd-sourced data
Survey Duration	28 days, split into two 14-day periods (one winter period and one summer period)
Location	Morlais Demonstration Zone, Equipment located on South Stack Lighthouse, Capture all movement data within the MDZ shapefile area and movements in the surrounding area.
Survey Frequency	As required by the Morlais marine licence during and post-construction.

2.1 VTS PROGRAMME

To facilitate VTS data acquisition, Marico Marine have invested in the procurement and development of a bespoke VTS equipment spread tailored to the monitoring requirements of the MDZ. See **Section 3**. Mindful of the need to collect contemporary vessel traffic data to underpin the first bi-annual NRA, the following survey plan is being progressed through 2023:

- **Survey equipment testing:** 14th March to 31st March.
- **14-day summer VTS:** 16th August to 07th September.
- **14-day winter VTS:** October 2023 (Dates TBC).

Follow-up surveys will be conducted to satisfy bi-annual and device specific NRAs throughout the life of the development, and to ensure MCA guidance is followed to only consider data less than 2-years old.

3 VTS METHOD STATEMENT

The VTS method statement provides a summary description of the works to be undertaken and specifications of the equipment and software to be used. The monitoring equipment being installed is capable of capturing data in a format suitable for the NRA.

3.1 EQUIPMENT OPERATION

The survey monitoring equipment shall be tested and configured off-site and will be reconfigured and calibrated during installation on-site. Once the equipment is operational, it will be set up to be operated and monitored remotely using a SpaceX StarLink broadband connection, by a team of Marico Marine operatives.

All the equipment proposed and utilised here is currently used extensively for vessel traffic monitoring by ports and coastguards to international standards. The equipment is designed to be set up and used in offshore maritime environments such as onboard the bridge of a ship and can deliver Safety of Life at Sea regulation (SOLAS)-required levels of data, providing evidence in line with the requirements of the project. The data will be collected and archived locally, with remote user access, and transferred from the equipment using the low-latency Star Link communications system.

An engineer or operative will undertake a remote login daily (and as required) to ensure that all systems are functioning correctly. Automated processes will include:

- sectored, automatic panning of the CCTV of all areas within the study area;
- automatic acquisition of targets by the radar; and
- fusing, recording and logging of AIS.

Marico operatives will monitor all the instruments, including the CCTV camera sweeps and will have the ability to manually intervene and override the CCTV sweep sequence if required.

Radar targets will be automatically acquired using the ARPA (automatic radar plotting aid) functionality of the SIMRAD software. Targets that are not automatically acquired by ARPA will be manually acquired by the operatives. All movements will be recorded in a digital data log including any manual observations. A methodology can be found in **Annex D**.

3.2 EQUIPMENT LOCATION

3.2.1 South Stack

The South Stack Foghorn Building (**Figure 2**) has been identified as being the most suitable terrestrial station to fully survey and capture activity across the MDZ and surrounding area of interest for navigation monitoring. This location provides the ability to fully monitor and capture all inshore traffic and the key areas identified by the local stakeholders. It also best enables the

setup of the VTS equipment for visual observations and capturing non-AIS/radar targets. Once set up, the VTS equipment will be left in position at South Stack for the remainder of the survey.

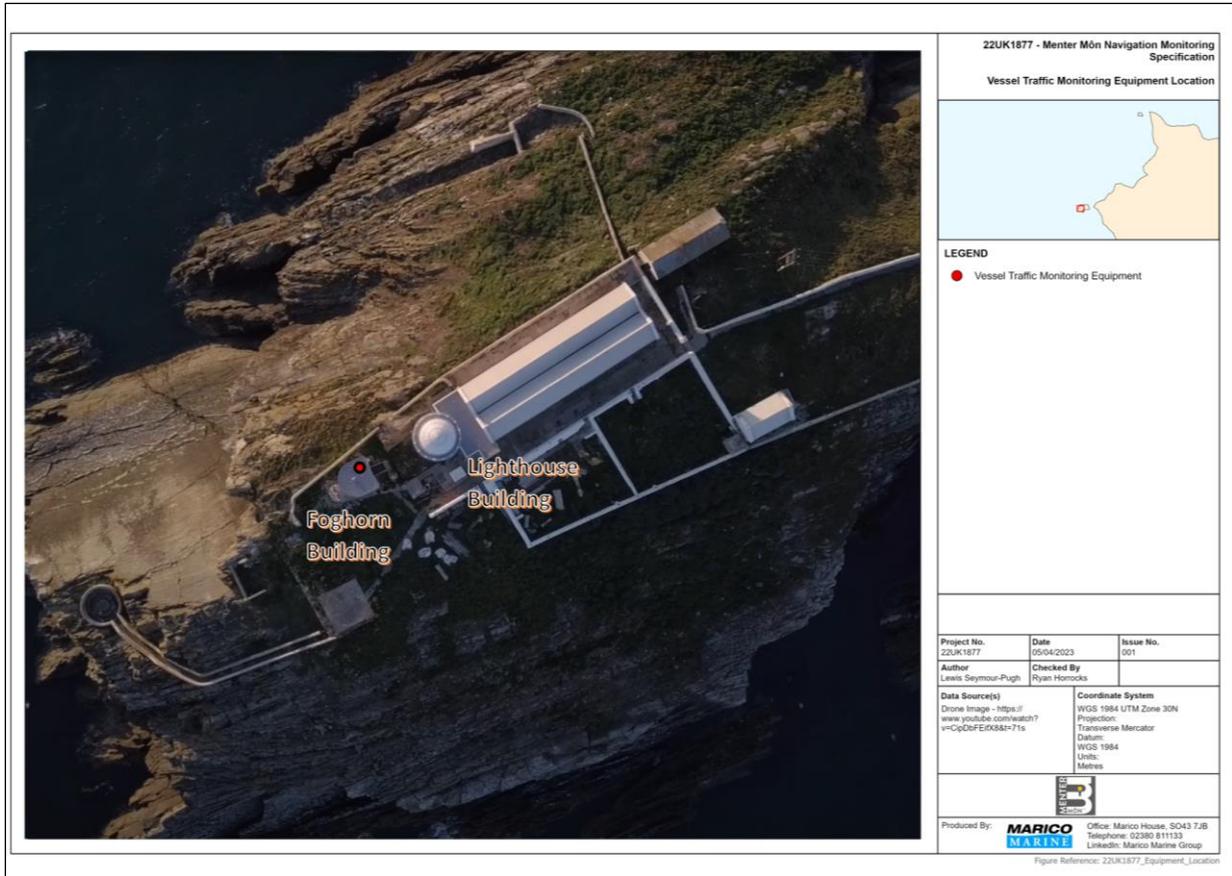


Figure 2: VTS Equipment Location

3.3 ON-SITE EQUIPMENT

The monitoring equipment will be positioned on top of the South Stack Foghorn Building. The mobilisation and installation will be undertaken following the methodology detailed in the Traffic Survey RAMS document. The function and indicative make and models of the equipment intended to be used are detailed with further technical specifications in **Annex A**.

3.3.1 X-Band Radar

SIMRAD HALO-6 Pulse compression RADAR

X-Band radar delivers high-resolution coverage with optimal target separation. The images produced by radar include hard targets such as ships and coastlines. X band radar also presents reflections from the sea surface, known as 'sea clutter'. Given a wind speed of more than

approximately 6 knots, the backscatter from the sea surface becomes visible in radar images which can contain valuable information on the actual sea state. X-band radar systems scan the ocean surface in real-time at high temporal (1–2 s) and spatial (5–10 m) resolution. An area of sea surface of several square kilometres can therefore be continuously monitored. X-band radar systems are designed to be installed on moving vessels or, as in this case, on fixed platforms.

The main limitations of X-band radar are the limited range, and the requirement for sufficient sea clutter (and associated significant wave height) to allow clear imaging. Due to the limited range of X-band radar, a fixed platform will be installed reasonably close to the area of interest.

Coverage of the X-Band radar has been modelled using the Cambridge Pixel SPX Tool and indicative radar coverage is shown in **Figure 3**.

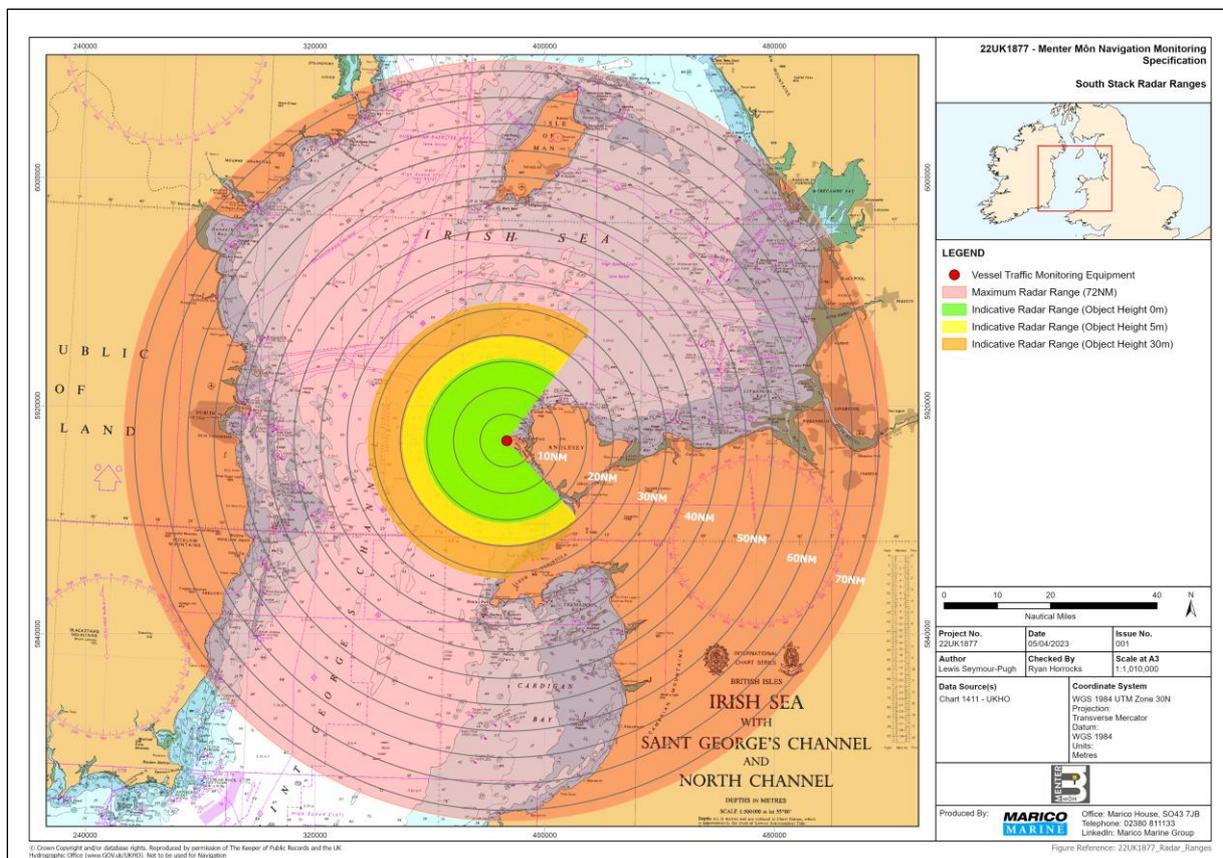


Figure 3: South Stack Modelled Radar Ranges

3.3.2 AIS Receiver

SR162 Professional AIS Receiver

Operating in the VHF maritime band, AIS (Automatic Identification System) systems enable the wireless exchange of navigation status between vessels and shore-side traffic monitoring centres.

Commercial ships, ocean-going vessels and recreational boats equipped with AIS transceivers broadcast AIS messages that include the vessel's name, course, speed, and current navigation status.

The AIS data captured is NMEA data, which will be stored locally. GIS data analysts process AIS vessel tracks into a raster output, enabling analysis and visualisation of vessel traffic movement patterns. Using an in-house gate analysis tool the frequency, direction and percentiles of traffic through a linear channel can be calculated and visualised, to be used in an NRA.

3.3.3 Remote Access Controllable CCTV

Predator PTZ Camera PRED60-28-G-W 28 x Optical Zoom 360Vision CCTV With Wiper.

Pan, tilt, and zoom (PTZ) cameras are robotic video cameras that allow an operator to control the camera remotely. PTZ cameras can pan horizontally, tilt vertically and zoom in on a subject to enhance the image quality without digital pixelation. The ability to pan, tilt, and zoom to a pre-set location, ensures an efficient workflow for the operator. Camera pre-sets will be stored on the camera and then recalled to robotically move the camera to a specific location. In this way, PTZ camera operators can quickly view multiple locations within the MDZ. All images will be recorded.

3.3.4 Satellite Broadband

Star Link High-speed, low-latency broadband internet receiver and app.

Satellite broadband is a satellite internet service for locations where fixed-line broadband cannot be accessed. Satellite broadband is transmitted using a wireless connection via a satellite dish, capable of both sending and receiving information. The satellite dish will be deployed with a clear line of sight. This will enable a low-latency, high-bandwidth, exchange of information from the on-site equipment to the remote operators.

3.3.5 Uninterruptible Power Supply Unit

RS PRO 110- 300V, 2000VA (1.6kW).

Uninterruptible Power Supply (UPS) is an electrical unit that provides power backup and protection for devices like computers that are susceptible to variations and cut out of power supply. The UPS will be plugged in between the mains wall socket and the devices being powered. It has a rechargeable battery that can provide power until the mains electricity is restored. The UPS will

ensure that there are no periods where data is not collected, providing redundancy in the event of a blackout.

3.4 OFF-SITE/REMOTE EQUIPMENT

This equipment will be used by remote operatives, responsible for monitoring and recording vessel traffic movements and ensuring that the equipment is properly functioning and working as required. The survey operatives will be working on PCs, with additional PC monitor screens to facilitate the continuous monitoring of all equipment outputs. The key function of the operatives will be to ensure that all movements are captured and that any movements not automatically picked up are manually acquired and collated with any corresponding information from the same source.

3.4.1 Desktop PC with Data Recording Software

Windows-based PC running Wartsila's NaviHarbour Software.

Throughout the navigation monitoring, Marico operatives will be located at either Marico Marine's offices in Southampton or the Menter-Mon offices in Llangefni. The vessel traffic survey will be undertaken using remote access to the on-site equipment via the SpaceX StarLink broadband connection.

4 SAFETY

Marico Marine personnel will be trained and experienced in undertaking the work that will be carried out to mobilise, demobilise and undertake the monitoring. Staff will hold the necessary qualifications for their tasks and will have received a full pre-deployment safety briefing.

The safety and well-being of operatives/staff and third parties in the vicinity of work being undertaken are of paramount importance.

No work will be undertaken on-site until risk-assessed and deemed to be safe. If minor variations in the methodology are required, then the work will stop until trained staff have assessed the new requirements and the work is re-assessed and a new methodology is agreed upon and approved by management and those working on-site.

Environmental conditions and personnel performance will be monitored throughout the tasks alongside the operational status and operability of the equipment. Work will be stopped and/or

may be delayed as appropriate if any dangerous conditions arise, any conditions exceed the pre-determined parameters of the risk assessment or if the equipment is found to be faulty, damaged, or not fit for purpose on-site. All equipment will be assessed, and training undertaken in operation before deployment and setup (mobilisation).

The latest version of the MDZ VTS Risk Assessment & Method Statement (RAMS) document is presented in **Annex B**.

5 DATA REQUIREMENTS

5.1 CAPTURE

All AIS, Radar, and visual observations data that is to be included in the NRA will have been collected using the equipment and approach outlined in **Sections 2 and 2.1**, following the guidance from the MCAs MGN 654. A desk-based study will also be undertaken to obtain any other relevant data sets including admiralty charts, incidents data and ocean uses. All data acquired will cover a 10nm buffer of the proposed development. This is a standard buffer that is considered appropriate for assessing the potential impacts to vessel traffic and routeing for maritime risk assessments. Digital data collected during the desk study will be GIS software compatible. Data may be sourced in various formats, including both static files and cloud-based services. All data collected for the project will be stored and managed in line with required GIS standards and guidelines (subject to data licensing terms and conditions).

5.2 ANALYSIS

The data gathered will be input into Esri GIS software, ArcGIS Pro. Data will be analysed using our bespoke in-house geoprocessing toolkit and the ArcGIS Pros geoprocessing toolkit. Analysing the traffic survey and corresponding data will allow characterisation of the baseline traffic profile and determine how the proposed development may impact traffic flow and navigation risk. The process will determine:

- Numbers, types, sizes, frequency and distribution of vessels presently using the study area;
- Non-transit uses of the areas (fishing, recreational/racing craft, dredging);
- Popular transit routes used by coastal or deep-draught vessels; and
- Alignment and proximity of the site relative to adjacent shipping lanes.

90th percentile analysis (as per requirements of MGN 654), gate analysis and density analysis will be assessed using practical mariner expertise and undertaken with the use of an in-house geoprocessing toolkit. Outputs will be assessed utilising in-house analytical tools to determine the traffic profile of the site and establish future case scenarios, for example, vessel type, length, frequency, or distribution. These outputs will be formatted into supporting figures which can be produced and incorporated into GIS templates and will be used to inform the navigation risk assessment process.

6 HYDROGRAPHIC SURVEYS

Guidance in the form of a hydrographic survey specification to meet the International Hydrographic Organisation (IHO) Order 1a survey standard is presented in **Annex C**.

The collection of multibeam echosounder bathymetry using this specification ought to ensure that the international standards are being met. This will allow for that data to be of a suitable quality to be used for the update of nautical charts by the UK Hydrographic Office (UKHO). Furthermore, data collected to this standard will be suitable for a range of other engineering uses, following the ethos of 'gather once, use many times'. This ought to introduce survey cost savings for Menter Mon, whilst helping to maintain navigation safety within the proximity of the MDZ.

Please note, this specification is supplied for guidance only. Experienced survey contractors are likely to have their own survey specification and workflows to meet IHO standards. This specification is based on the specification used by the UK's Maritime and Coastguard Agency to map UK home waters under the auspices of the UK Civil Hydrography Programme.

7 CABLE ROUTES

For phase one of the development, four devices are due to be deployed. These devices are to be installed in 2026 and their positions are shown in **Figure 4**. An indicative cable route and cable route corridor are also shown in **Figure 4**. The cable route corridor, cable route, and inshore cable area will all be considered and observed when conducting future vessel traffic surveys.

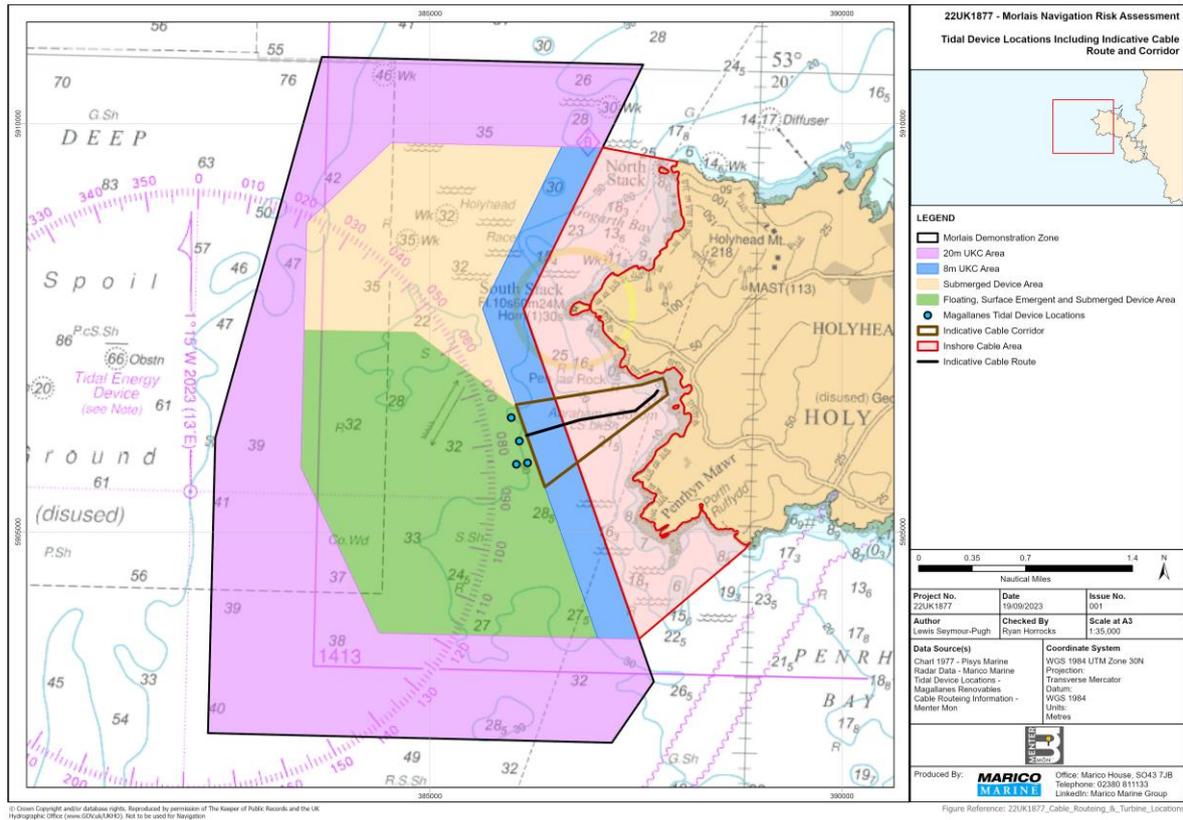


Figure 4: Cable Routing and Turbine Locations for Phase 1 (2026).

8 SUBMISSION

The navigational monitoring specification along with all captured data will be submitted and made available to the client, Menter Mon, for onward submission to the MCA via NRW at the relevant time.

Annex A Survey Equipment and Software

1 SIMRAD HALO-6 PULSE COMPRESSION RADAR



True 72nm range with 6-foot open array antenna

Beam Sharpening for enhanced target separation

Simultaneous Dual Range operation

Dedicated Harbour, Offshore, Weather, and Bird modes

High-speed 48 RPM operation for rapid updates

Ready instantly from standby, and in 16-25 seconds from power-on

MARPA target tracking (up to 10 targets, 20 in dual range)

VelocityTrack™ Doppler technology for collision avoidance

Specifications:

Physical

- Compass Safe: STD 1.0 m (3.3 ft) Steer 0.5 m 1.6 ft)
- Dimensions: W x H x D 324 mm x 427 x 339 mm (12.76" x 16.81" x 13.35)
- Weight Pedestal: 18.75 Kg (41.3lb) Antenna: 6.5 Kg (14.3 lb)

Electrical

- Power Consumption max: 180 W (peak) at maximum wind velocity
- Power Consumption typical: 40 W (average) at zero wind velocity 6.5 W (average) for Scanner + RI-12 in Standby mode
- Recommended Fuse Rating: 25 A for 12 V systems or 15 A for 24 V
- Supply Voltage: 12 V Systems 10.8 - 15 V DC 24 V Systems 20 - 31.2 V DC

Environment

- Humidity: IEC60945 Exposed product
- Operating Temperature Range: -25°C to +55°C (-13°F - 131°F)
- Shock Vibration: IEC60945 Exposed product and 20G, 100,000 cycle
- Waterproof rating: IPX6

Connectivity

- Ethernet Ports: RI-12, 1 x 100 Mbit RJ45 Adapter to 5 pin yellow supplied)
- N2K PG Ns: 127250 - Vessel Heading, 127251 - Rate of Turn, 129025 - Position, Rapid Update, 129026 - COG & SOG, Rapid Update, 129029 - GNSS Position Data, 130818 - Proprietary
- NMEA 0183 Sentences supported: Sentences used by the radar application. HDG, HDT, HDM, GGA, GLL, RMC, VTG. Baud rate: Auto sense 4800, 9600, 19200 or 38400
- NMEA 2000 Connectivity: RI-12, 1 x NMEA2000, Micro-C, 1 LEN

Approvals

- Approvals Compliance: FCC/IC/R&TTE Type Certified cation FCC ID: RAYHALOIC ID: 4697A-HALOR&TTE: Emissions compliant to SM1541-4 (including -40dB/dec future design objectives)

Radar

- Beam width: 1.2° +/- 10% (-3 dB width) - 0.8 deg with Beamsharpening mode
ON: Vertical: 25° +/- 20 % (-3 dB width)
- Max Range, scale: 72 nm
- Max Wind Speed: 70 kn
- Min Range, scale: 75 m (300 ft)
- Radar Modes: Head Up, North Up
- Radar Technology: Pulse Compression
- SART Racon: Yes - trigger distance: about 1nm max - weather, sea state, and SART position dependent

2 SR162 PROFESSIONAL AIS RECEIVER



Electrical data

Power: 9 -15 volt DC

Power consumption: 1.5 watts

Data output

Data Speed: 38400 baud(default)

Format: NMEA 0183 version 3

NMEA output data format: VDM, standard GPS sentences (SR162G only)

Receiver

Frequency: AIS1 161.975 MHz, AIS2 162.025 MHz

Sensitivity: -112dBm

Antenna impedance: 50 ohm

GPS: 12-channel integrated GPS receiver (SR162G only)

Physical data

L x W x H: 115 x 75 x 28 (mm)

Weight: 400g

Antenna Connectors: VHF BNC, GPS antenna port(SR162G only)

Data output port: 9-pin D-sub connectors-232 serial

3 PREDATOR PTZ CAMERA PRED60-28-G-W



The Predator PTZ (Pan Tilt Zoom) Camera is designed and manufactured in the UK by 360 Vision Technology, the market leader in advanced CCTV dome camera technology and control. The predator PRED60-28-G-W is a high-speed motorized PTZ camera, engineered and field-proven to perform the harshest environments and most demanding applications.

The Predator is:

- rated IP68 for effective protection against rain or dust
- built to withstand hurricane-force winds (190+ mph)
- designed to withstand environmental temperatures of -50 to +70°C

The predator is perfectly suited to field deployment for traffic surveys as it is an ideal solution for installations in hostile, marine environments.

4 STARLINK



Star Link high-speed, low-latency broadband internet antennae, router and app.

ANTENNAE

Antenna	Electronic Phased Array
Orientation	Motorized Self Orienting
Environmental Rating	IP54
Snow Melt Capability	Up to 40 mm/hour (1.5in / hour)
Operating Temperature	-30°C to 50°C (-22°F to 122°F)
Field of View	100°
Average Power Usage	50-75W

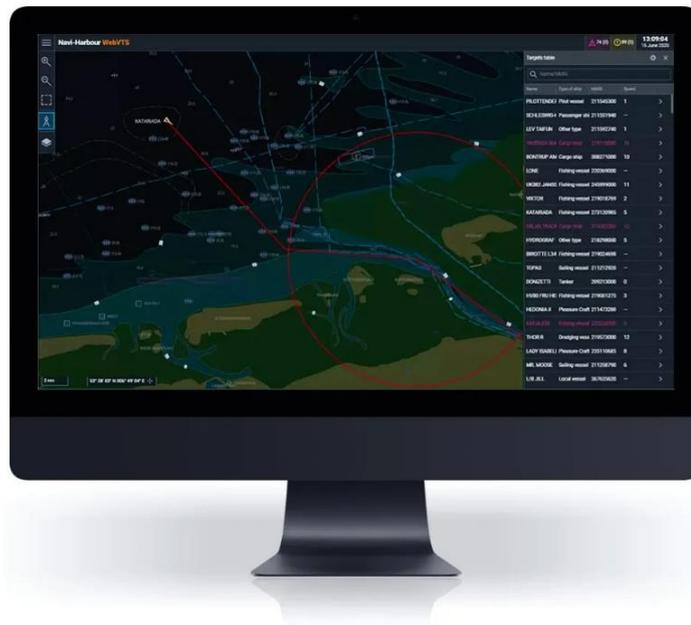
STAR LINK WIFI ROUTER

Wi-Fi Technology	IEEE 802.11a/b/g/n/ac standards
Chipset	Wi-Fi 5
Radio	Dual Band - 3 x 3 MIMO
Security	WPA2
Environmental Rating	IP54, configured for indoor use
Range	Up to 185m ² (2000sqft)
Operating Temperature	-30°C to 50°C (-22°F to 122°F)
Mesh	Compatible with up to 12 Star Link Mesh nodes
Ethernet Adapter	Available

APP

iOS or Android Smartphone

5 WÄRTSILÄ NAVI-HARBOUR WEB VTS



Wärtsilä Navi-Harbour WebVTS 5.0 system provides a fully integrated view of the traffic situation in any area covered by the existing VTS (Vessel Traffic System) or AIS (Automatic Identification System) monitoring system. The Navi-Harbour VTS comes with an interactive and user-friendly interface, making it effortless to use for the system's operator. Uninterruptable power supply

Naviharbour Software:

- Displays navigational situation in the VTS operating area.
- Generates alerts for operators based on the set criteria and restrictions.
- Provides display and control of data from sensors.
- Records navigational situations and audio exchanges.
- Monitors the VTS elements operation using the VTS database.
- Multiple data and information sources: The system uses AIS data sources, Navi-Monitor and AIS-Monitor target and alert data.
- Has no special network requirement: WebVTS works with any standard internet browser.
- Accurately detects, tracks, and identifies even small and high-speed targets with advanced monitoring systems.

6 UNINTERRUPTED POWER SUPPLY RS PRO 110- 300V, 2000VA (1.6KW).



The uninterruptible power supply (UPS) is designed to give the computers and equipment power in the case of any unexpected energy cut-off or similar applications. The power supply device contains a battery that guarantees power for a certain period. This enables the user time to save the current task and shut down the software. Uninterruptible power supplies ensure mission-critical data loss can be prevented.

Specifications:

True double-conversion

Microprocessor control optimises reliability

Input power factor correction

Output power factor 0.9

Wide input voltage (110 V – 300 V)

Converter mode

ECO mode for energy saving

Generator compatible

Adjustable charging current via LCD or software(1A-6A)

Smart SNMP with either USB or RS-232

The comprehensive display allows easy monitoring and access to UPS status

Annex B MDZ VTS RAMS Document

MENTER MÔN

RISK ASSESSMENT AND METHOD STATEMENT (RAMS) FOR
MORLAIS VESSEL TRAFFIC SURVEY



Report Number: 22UK1877
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Author(s): Martin Harvey; Ryan Horrocks

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
CPA	Closest Point of Approach
CMR	Construction Monitoring Report
DML	Deemed Marine Licence
DWR	Deep-Water Route
EAOL	East Anglia ONE Limited
EAOW	Est Anglia ONE Windfarm
KWh	Kilowatt-hour
IMO	International Maritime Organisation
LOA	Length Over-All
m	Metre
MAIB	Marine Accident Investigation Branch
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MMO	Marine Management Organisation
nm	Nautical Mile
NRA	Navigation Risk Assessment
NtM	Notice to Mariners
OREI	Offshore Renewable Energy Installation
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SOLAS	Safety Of Life At Sea
TSS	Traffic Separation Scheme
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic Study

1 INTRODUCTION

This Risk Assessment and Method Statement (RAMS) has been prepared by Marine and Risk Consultants Limited (Marico Marine) for two Vessel Traffic Surveys of the Morlais Demonstration Zone (See **Figure 1**). The surveys will cover a summer and winter period within 2023. Mobilisation will take place across 19th June to 21st June 2023 (TBC), with surveys commencing between 10th – 25th August 2023 (summer) and 22nd November – 7th December 2023 (winter). The installation will be the same of that which was installed during the previous licence dated 28th February 2023. It is Marico Marine's preference that equipment is left on site plugged in for the duration of the granted licence to avoid equipment failures. This is at the discretion of Trinity House and will require their approval.

The survey will be undertaken for Menter Mon and will meet the requirements of the Maritime and Coastguard Agency's (MCA) Marine Guidance Note 654.

Survey equipment is proposed to be located at South Stack Lighthouse – Holy Island, Isle of Anglesey (See **Figure 2**).

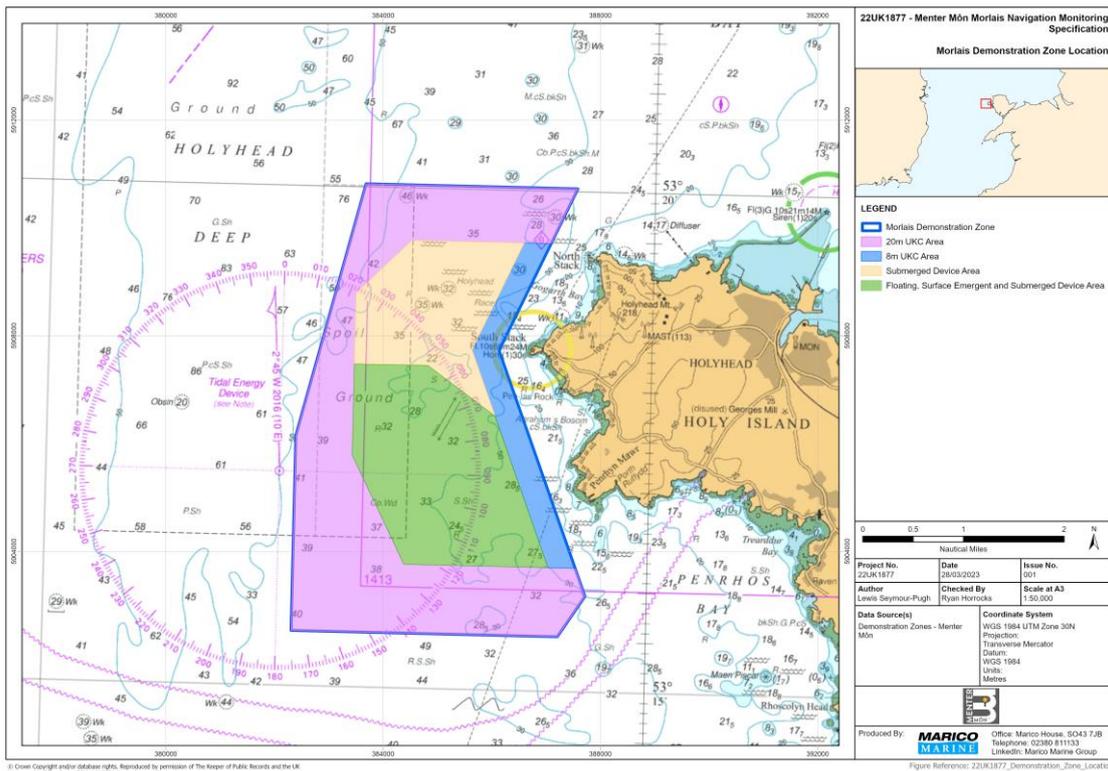


Figure 1: Morlais Demonstration Zone, off Holy Island

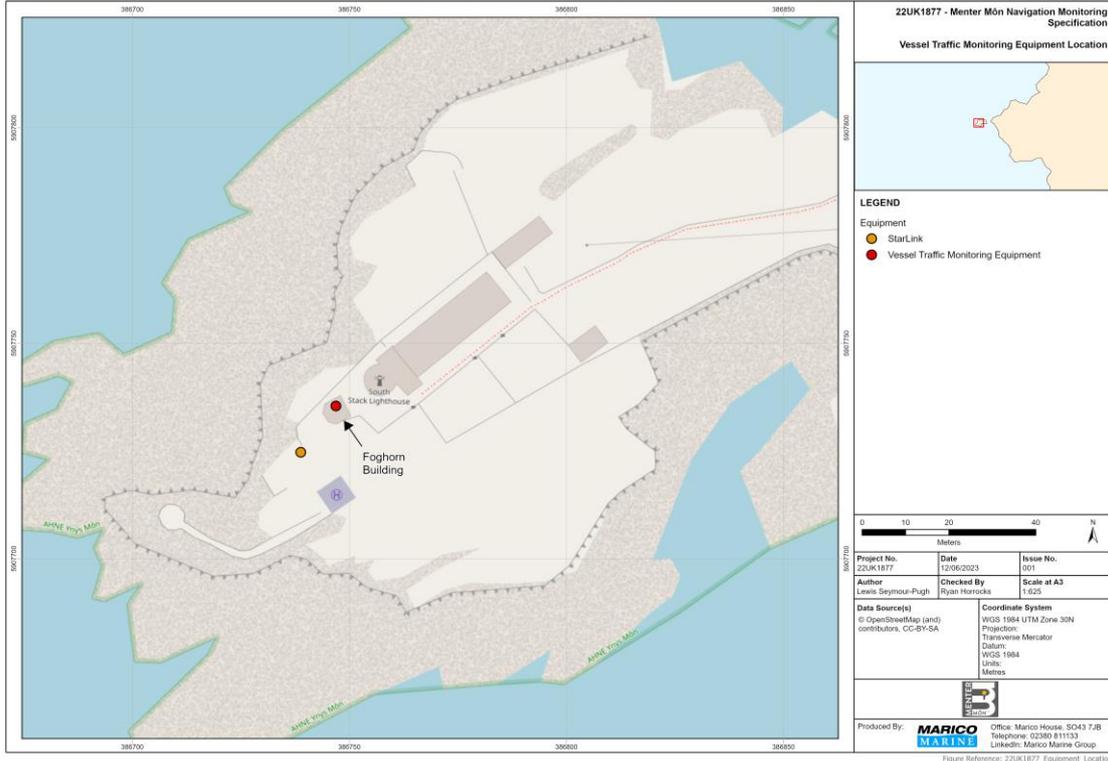


Figure 2: Location of Equipment on South Stack

1.1 MARICO PERSONNEL INVOLVED

Table 1: Marico Personnel Involved

Name	Role	Mobile No	Days on site
Martin Harvey	Principal (Lead) Engineer	07475 067830	Up to 4 (dates TBC)
Ryan Horrocks	Maritime Consultant	07733 029641	Up to 14 (dates TBC)
Lewis Seymour-Pugh	Graduate Analyst	07799 088257	Up to 14 days (TBC)
Sophie Buck	Technical Assistant	N/A	Up to 14 (dates TBC)
André Cocuccio	UK Director	07881 627113	Emergency Contact

2 METHOD STATEMENT

This section provides a summary of the work to be undertaken by Marico personnel. Note that all Marico personnel are trained and have experience in undertaking this kind of work and where necessary hold the relevant qualifications. On this occasion, a newly joined Graduate Analyst will support our survey team as a training/development opportunity.

The safety and wellbeing of our employees and third parties in the vicinity of work being undertaken by Marico personnel (including the public) is of paramount importance to the management and owners of Marico Marine.

No work will be undertaken onsite until risk assessed and deemed to be safe, for example cable routeing in relation to trip hazards etc. If minor variations in the methodology are required, then the work will stop until the principal (Lead) Engineer has assessed the new requirement in order to determine:

- If it is safe for the work to proceed as planned; or
- If any additional risk control measures are required.

2.1 ACCESS AND SAFETY

Access to and from the site will be provided by the lighthouse attendee. When on site, all members of staff will follow Marico Marines standard operation procedures and will have been briefed and provided with the risk assessment for the site. To access the Fog House Roof for the installation of the radar, AIS and CCTV, only trained personnel with the "Working at Height" qualification will be permitted to access the roof. All equipment will be secured to an existing railing on the roof or will be fixed to a weighted platform and weighed down using sandbags. The equipment will be monitored remotely frequently by Marico Marine staff, and Marico Marine will have correspondence with the lighthouse attendee to ensure that the equipment is fixed and secure while Marico Marine employees are not on site. All cables will be zip tied together and fixed to the side of the existing ladder to ensure they are out of the way (See **Figure 3, please note that this image was taken before the cables were fully secured**). No cables will obstruct the ladder or encroach the stairs leading into the fog house. These will then enter the building through an air vent in the door before being plugged into a standard 3-pin plug.

The Starlink unit is to be positioned west of the fog house (See **Figure 4**). This unit will be weighed down using sandbags and bricks. The cable (which leads to a connection within the fog house) will be positioned across an existing stone wall and run under the building to enter through the same air vent as the other cables. The cable is positioned off the floor where it does not run under the building and will not obstruct the ladder or encroach the stairs leading into the fog house.

2.2 MOBILISATION AND INSTALLATION OF EQUIPMENT

The work to be undertaken is standard operation for Marico Marine engineers/personnel. This is planned to be undertaken across 19th June to 21st June 2023 (TBC). It will include:

- Arrive and report to TH Site Representative;
- Visual inspection of the installation site and update this RAMS document if required;
- Unload all survey equipment and transport (by hand) to site;
- Deploy radar on the roof of the Fog Signal Building:
 - Lift radar into place and secure;
 - Run cables (power and data) and secure.
- Deploy CCTV and AIS roof of the Fog Signal Building:
 - Lift CCTV and AIS into place and secure;
 - Run cables (power and data) and secure.
- Deploy Equipment Box on the ground adjacent the roof of the Fog Signal Building.
- Set-up ethernet link to remote Operator workstation located offsite.
- Connect power supply and test.

Approximate duration of installation works 4-5 hours.

2.3 DURATION OF THE SURVEY

For the duration of each two-week survey, it is envisaged that Marico Marine staff members will remain off site. All survey work will be conducted remotely via internet communication and access to and from the site will remain tentative in case of an equipment failure. If access to the site is required, all of Marico Marines standard operation procedures will be adhered to and staff will be accompanied by the lighthouse attendant.



Figure 3: Installation of equipment at the Fog House (prior to tidying of cables).



Figure 4: Installation of the Starlink unit.

2.4 DE-MOBILISATION AND REMOVAL OF EQUIPMENT

It is Marico Marine's preference that equipment is left on site plugged in for the duration of the granted licence to avoid equipment failures. This is at the discretion of Trinity House and will require their approval. If the equipment can be left on site, it could be unplugged between survey periods. If the equipment needs to be removed or once the licence has expired, then the work to be undertaken is standard operation for Marico Marine engineers/personnel and will include:

- Removal of radar from the roof of the Fog Signal Building:
 - Disconnect radar and lower to ground;
 - Remove cables (power and data).
- Removal of CCTV and AIS from roof of the Fog Signal Building:
 - Disconnect CCTV and AIS and lower to ground;
 - Remove cables (power and data).
- Remove Equipment Box and onsite workstation;
- Check site is tidy and nothing is left behind (remove any litter from site).
- Contact TH Site Representative to confirm completion of survey.

Approximate duration of demobilisation works 2-3 hours.

2.5 SURVEY EQUIPMENT

The following equipment will be used. All equipment has been tested prior to deployment on survey to ensure it is fully functional. The equipment specification is as follows:

- a Simrad HALO-6 Pulse compression RADAR:
 - Antenna size: 6 ft. (1.8 m);
- CCTV Camera:
 - a Predator PTZ Camera PRED60-28-G-W 28 x Optical Zoom 360Vision CCTV With Wiper;
- Marine VHF Antenna (for AIS);
- StarLink equipment;
- Equipment Box comprising:
 - Desktop PC with data recording software;
 - SR162 Professional AIS receiver;
 - Uninterruptible Power Supply Unit;
- Installation Materials.

2.6 VESSEL TRAFFIC SURVEY

Acquisition of the vessel traffic survey will be undertaken remotely from Menter Mon offices on Anglesey.

The remote survey will:

- Be for a period of 14 days ;
 - During daylight hours only;
 - Comprise up to 2 members of Marico staff sat at a Marico workstation, operating the survey equipment remotely using a desk, power and internet connection (to be made available by Menter Mon).
 - If our Graduate Analyst is not available, 'lone working' may be required from what we understand to be a manned Menter Mon office. In this case, our operative will be required to check in with Menter Mon and Marico HQ at the beginning of their day (via mobile or Teams for Marico). A similar 'check out' will be completed on the cessation of manned survey each day. Daily comms will be maintained with Marico HQ and Marico Chepstow via mobile or Teams as needed throughout each day.
 - It is our intention to swap survey operatives out at the end of the first week and have them each supported by one of our Graduate Analysts (availability allowing).
 - In the even of an emergency, our operatives have a direct dial number for Marico's UK Director.
-

2.7 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Table 2: Personal Protective Equipment

Standard PPE	Required	Other details
Head Protection	✓	3 x Helmet
Hi-Vis	✓	3 x High Vis Jackets
Protective Clothing	x	Unless required under site rules
Eye Protection	x	Unless required under site rules
Gloves	✓	3 x Pair Gloves
Protective Footwear	✓	3x Pair Suitable Footwear
Ear Protection	✓	Unless required under site rules
Dust Mask	✓	Unless required under site rules

Table 3: Additional PPE

Additional PPE	Required	Other Details
Working at Height	✓	1 x Full Safety Harness 1 x Adjustable Restraint
Life Jacket	N/A	Not required
Other	N/A	Not Applicable

2.8 OTHER CONSIDERATIONS

Table 4: Other Considerations

Ref	Other Considerations	Details
1	Tools/Equipment required:	1. Basic Hand Tools 2. Cable Ties/Tape 3. High Gain VHF Aerial 4. AIS-2-USB Receiver 5. 12V Power Supply
2	Access to the place of work (Marico personnel will):	1. Attend any site induction required; 2. Register on arrival/departure as required; 3. Follow ALL site rules; and 4. Use correct route when accessing and egressing the site. Marico personnel will comply with site rules in wearing the required PPE.
3	Access to equipment to be used:	Marico personnel will strictly adhered to all applicable site rules, regulations and conditions. Any

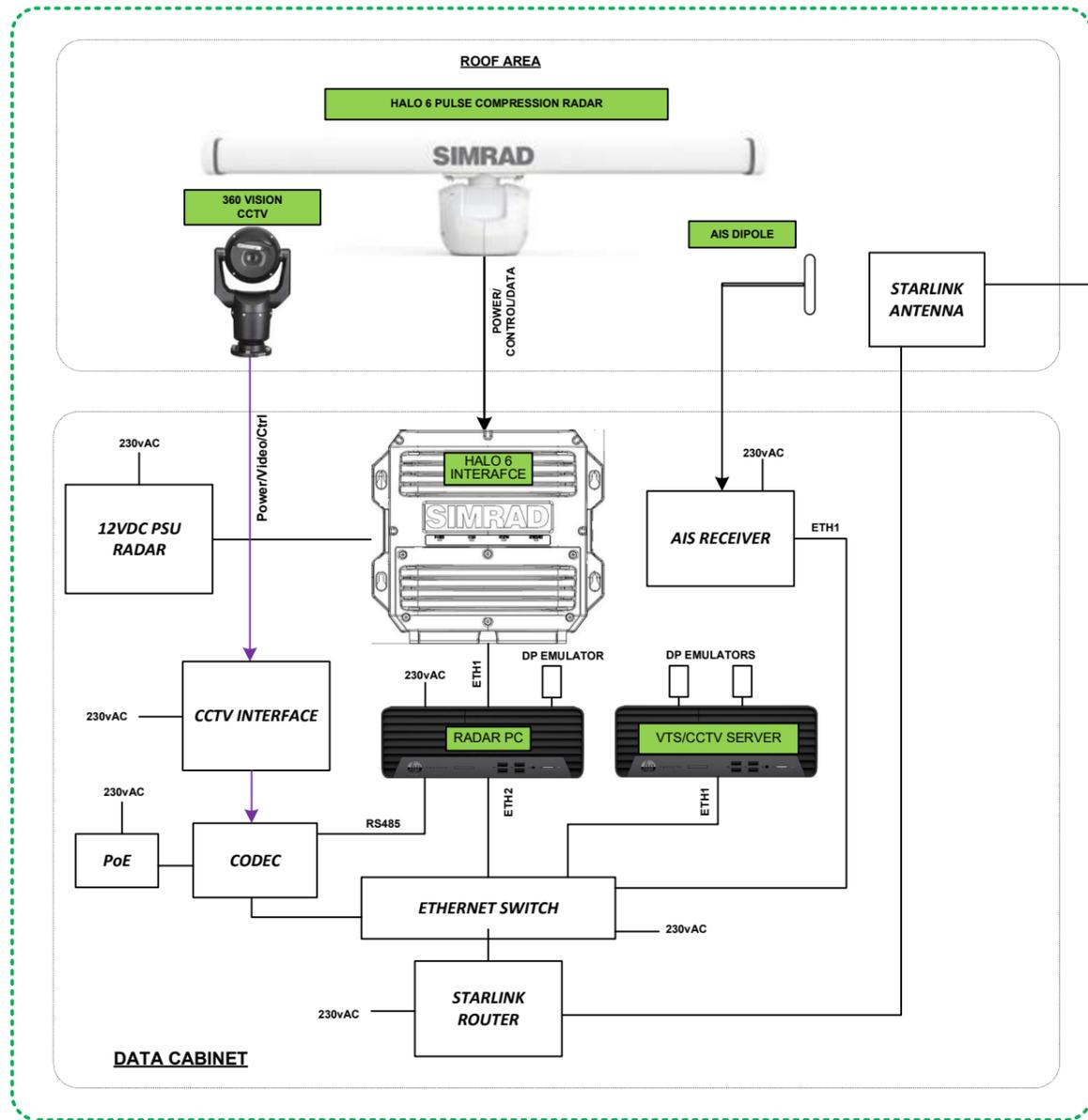
		<p>person failing to do so will be subject to Marico disciplinary action and will be removed from site. The company Site Manager will ensure that all working areas and means of access/egress are clear from obstruction.</p>
4	The workplace:	<p>1. Workplace area is to be kept clear of waste and the ground is to be sound and level with sufficient space for the easy passage of men and equipment.</p> <p>2. If required physical barriers will be positioned to control access to work.</p> <p>Access routes in and around the working area must be free from obstruction and will be subject to regular monitoring and cleaning.</p>
5	Working at Height:	<p>Some of the survey equipment will be installed on the flat roof of the Fog Signal Building. This will require 2 people to support working at a height of approximately 7 meters off the ground. Suitable harness and restraints are supplied and to be always used, in accordance with manufacturer's instructions.</p> <p>Marico personnel are fully trained in working at height and in the use of harnesses to support their work.</p> <p>With a harness correctly fitted, our Marico engineer will climb the ladder to the Fog Signal Building roof. As they climb the ladder, their harness will be clipped to the next available rung to support safe working. This will be repeated until they reach the roof.</p> <p>Roof based works will be undertaken only once the harness is clipped onto the topside end of the ladder, to support unhindered access and movement whilst working on the roof.</p>
6	Working near water:	<p>No work will be carried out within 5m of open water.</p>
7	Lone working:	<p>No lone working is envisaged for this workscope.</p> <p>Mobilisation and demobilisation is a two-man job.</p> <p>We intend to have two survey operators based at Menter Mon offices for survey acquisition (availability allowing). Should lone working be required, this will be mitigated for by remote location at manned Menter Mon offices. Our lone working comms protocol has been outlined elsewhere in this document.</p>

Annex A Risk Assessment

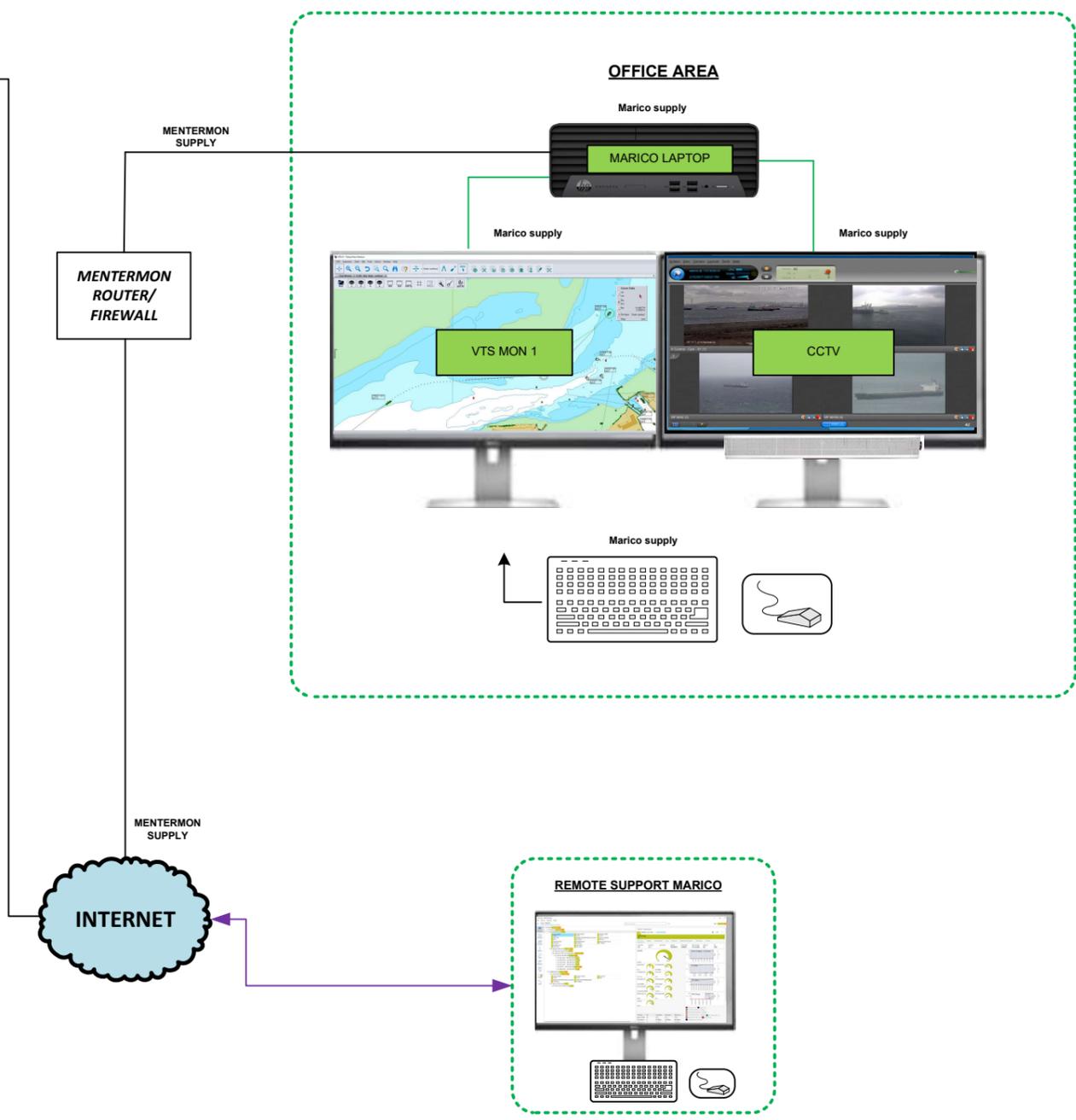
What are the Hazards?	Who might be harmed and how?	Precautions already in place	Risk Rating			What further action is necessary?	Residual Risk Rating		
			Probability	Severity	Risk		Probability	Severity	Risk
Falling from height	Serious or even fatal injury could occur if an operator falls from height. Others working below may also be at risk.	Sufficient and suitable steps or ladders to be made available. Where required platforms with guardrails are to be used. Marico personnel have attended Working at Heights Training.	Med	High	High	Suitable Harness and Restraints are provided and to be used at all times	Low	Med	Low/Med
Slips and trips	Staff members and public nearby may suffer sprains, bruising or fractures if they trip over objects, such as work debris, or slip on spillages.	Good housekeeping; debris such as packaging etc to be collected and stored in a safe manner until job completion; Safe route to work area agreed with site health and safety plan.	Med	Med	Med	Good housekeeping to be maintained at all times. Site induction undertaken before works commence. Suitable shoes to be worn.	Low	Low	Low
Entering Water	Any personnel falling into or inadvertently entering the water may incur serious injury or death through drowning. Hypothermia is also a distinct possibility.	Where possible, ensure that work is not undertaken close to the water edge. Where it does occur then suitable PPE equipment should be used – including (where appropriate) lifejackets, immersion suits.	Low	Low	Low	No work will be undertaken in the vicinity of open water	Low	Low	Low
Injury due to lifting heavy equipment	Any personnel lifting heavy equipment may incur serious back injury.	N/A	Low	Low	Low	No heavy equipment required	Low	Low	Low
Electric Shock	Electric Shock	Only to use existing domestic supply.	Low	Low	Low	No electrical work will be required except for plugging a standard 3pin mains plug into a socket.	Low	Low	Low

Annex B Additional Information

SOUTH STACK BUILDING



Mentermon office – Anglesey



EMERGENCY CONTACT DETAILS

In case of MARICO staff related emergency please contact:

Marico Marine

Tel. + 02380 811133

Out of Hours:

Tel. 07881 627 113

Marine and Risk Consultants Ltd

(Marico Marine)

Marico House

Lyndhurst

SO43 7JB

Hampshire

United Kingdom

Starlink



Starlink high-speed, low-latency broadband internet antennae, router and app.

ANTENNAE

Antenna	Electronic Phased Array
Orientation	Motorized Self Orienting
Environmental Rating	IP54
Snow Melt Capability	Up to 40 mm/hour (1.5in / hour)
Operating Temperature	-30°C to 50°C (-22°F to 122°F)
Field of View	100°
Average Power Usage	50-75W

STARLINK WIFI ROUTER

Wi-Fi Technology	IEEE 802.11 a/b/g/n/ac standards
Chipset	Wi-Fi 5
Radio	Dual Band - 3 x 3 MIMO
Security	WPA2
Environmental Rating	IP54, configured for indoor use
Range	Up to 185m ² (2000sqft)
Operating Temperature	-30°C to 50°C (-22°F to 122°F)
Mesh	Compatible with up to 12 Starlink Mesh nodes
Ethernet Adapter	Available

APP

iOS or Android Smartphone

HEALTH AND SAFETY & HSE TRAINING POLICY STATEMENT

Marico Marine believes that accidents and illness at work are preventable, and that high standards of health and safety management are of the utmost importance to the effectiveness, efficiency and reputation of the company. Marico Marine is committed to protecting the health and safety of employees, clients, contractors, visitors and the communities in which the company operates, both in the UK and overseas.

As part of its commitment to Health and Safety, Marico Marine adheres to a Health and Safety annual timetable which includes office equipment servicing, staff training and staff wellbeing – see Annex A.

In meeting these commitments, Marico Marine will:

- Comply with legal and other relevant requirements as pertinent to an office environment;
- Maintain safe and healthy working conditions by identifying and mitigating health and safety risks in the work place and arising from its work activities as pertinent to an office environment;
- Consult with employees on matters affecting their health and safety;
- Provide and maintain equipment in a safe condition;
- Provide appropriate information, instruction and supervision for employees;
- Ensure all employees are adequately trained and are competent to do their assigned tasks; and
- Review and revise this policy at regular intervals and following any significant changes in legislation or circumstances.

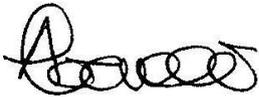
ENVIRONMENTAL POLICY STATEMENT

Marine and Risk Consultants Limited (Marico Marine) is committed to minimising the impact of its activities on the environment in which it operates, both on shore and afloat.

In meeting this commitment, Marico Marine will:

- Comply with legal and other relevant requirements as pertinent to an office environment;
- Assess its activities in order to establish and minimise any adverse consequences for the environment;
- Use appropriate machinery and power sources so as to minimise toxic and polluting emissions into the atmosphere or water, as pertinent to an office environment;
- Strictly control the handling and use of ozone-depleting gases so as to minimise adverse effects on the atmosphere as pertinent to an office environment;
- Minimise waste by evaluating operations and ensuring they are as efficient as possible;
- Actively promote and implement recycling internally (i.e. ink toners, computer equipment, packaging materials);

- Use environmentally friendly and biodegradable cleaning products;
- Provide information, instruction and supervision for employees;
- Ensure all employees are adequately trained and are competent to do their assigned tasks within the office and relating to environment issues such as recycling guidelines and minimising their carbon footprints;
- Encourage flexible working from home for part of the week to minimise car travel;
- Opt for electric cars for company use; and
- Review and revise this policy at regular intervals and following any significant changes in legislation or circumstances.



André Cocuccio – UK Director

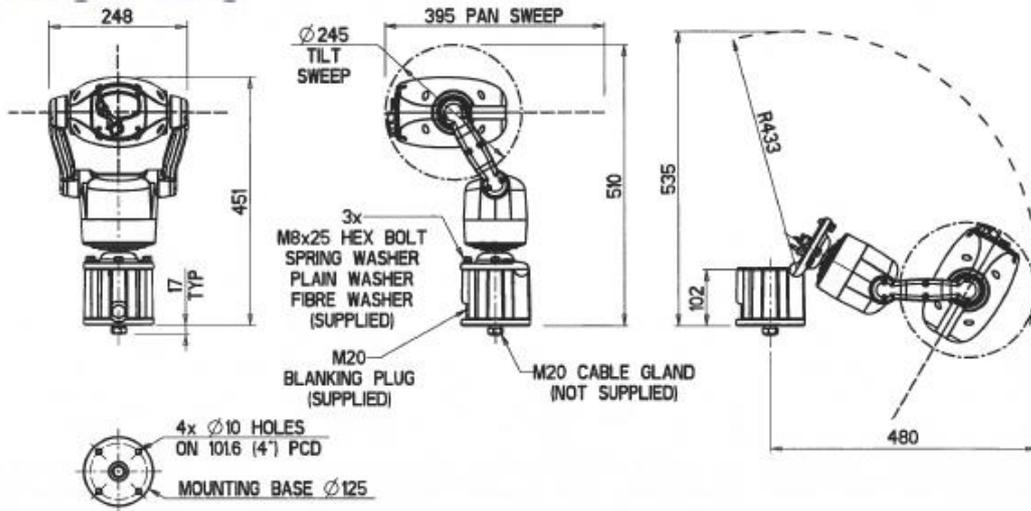
Date: 31 August 2022

Date to be reviewed: 30 April 2024

H S E CALENDAR 2023

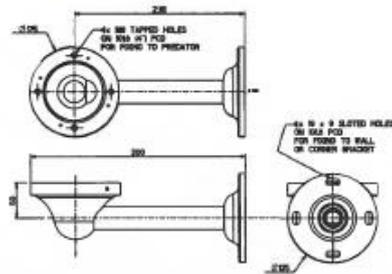
Due Date	Item	External Company if Applicable	In-House Owner	Completed
Weekly	Test fire alarm	/	Luke Kelly-Granger	Weekly (Mondays) ongoing
Quarterly	Environmental/recycling reminder/ refresher	/	Shirley Barnet	Quarterly (diarised: March, June, Sept, Dec ongoing)
Six monthly	HSE refresher training for office staff: office risk assessment, fire extinguishers	/	Luke Kelly-Granger	December/ June
Annually August 2023	DSE assessments for all staff	Vergo UK (for 2 staff with back problems)	Shirley Barnet (for rest of staff)	August 2022
June 2023	Fire Extinguisher Service / renewal	FireCare, Security & Electrical	Shirley Barnet	8/6/23
June 2024	Calor Gas boiler service	KMH	Shirley Barnet	29/6/23
August 2022 (every 4 years)	PAT testing	Andy Bonney Electrician	/	31/8/22
September 2023 (Annually)	PPE equipment annual check- Safety Harness/ hard hat	Arco Professional Safety Services	Martin Harvey	Sent for inspection 31/8/22
24/11/2024	First Aid	British Red Cross	Ryan Horrocks	24/11/21

HMA (Hinged Mount Adapter) no lamps
Weight: 9.5kg

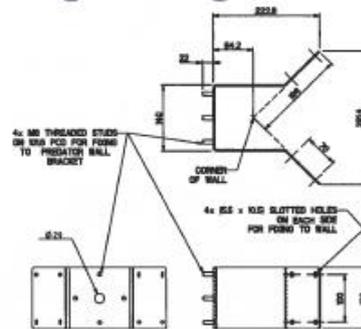


PREDATOR Bracketry

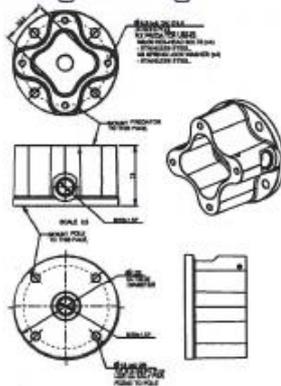
Wall Bracket
Weight: 1.2kg



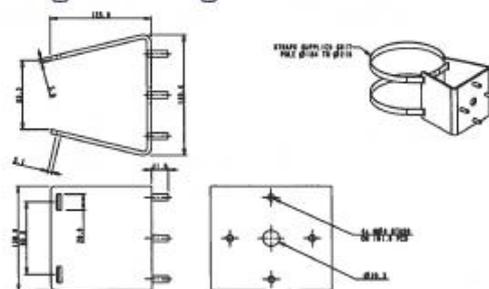
Corner Bracket
Weight: 2.2kg



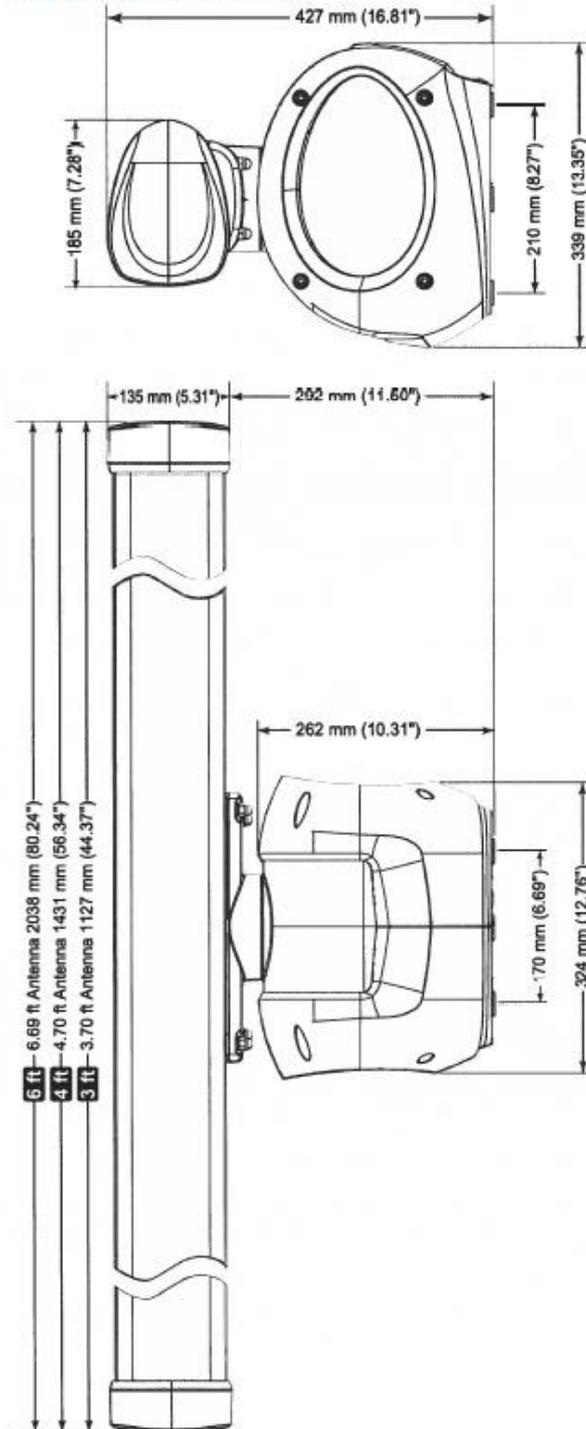
Pole Mount Adapter (PMA)
Weight: 1 kg



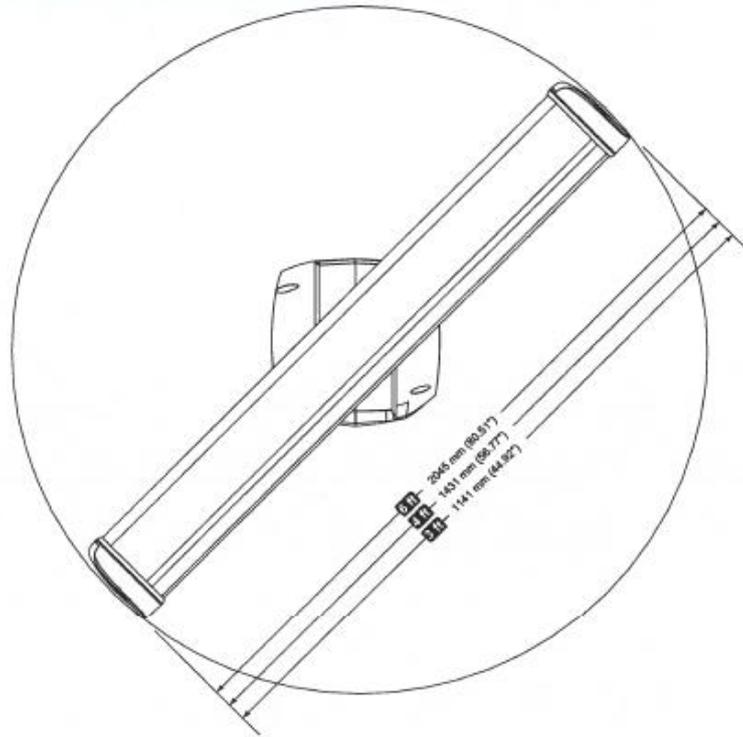
Pole Mount Bracket (PMB)
Weight: 2.5kg



Pedestal and antennas



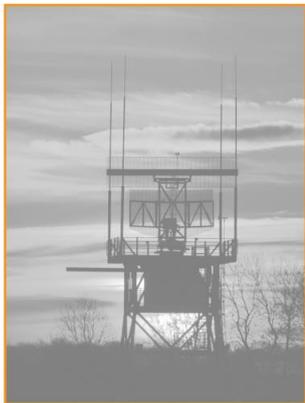
Antenna maximum rotation



Annex C Hydrographic Survey Specification

MENTER MÔN

MDZ HYDROGRAPHIC SURVEY SPECIFICATION



Report Number: 22UK1877
Issue: Draft A
Date: 24 June 2023

Prepared for: Menter Môn
Town Hall
Bulkley Square
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Anglesey
LL77 7LR

Author(s): André Cocuccio

QC:

Date	Release	Prepared	Authorised	Notes
24/06/23	Draft A	AVC		For client review

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FIGURES

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ABBREVIATIONS

Abbreviation	Detail
BM	Benchmark
CD	Chart Datum
CHP	Civil Hydrography Programme
DGPS	Differential Global Positioning System
ETRS98	European Terrestrial Reference System 1989
FIG	Fédération Internationale des Géomètres
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
IHO	International Hydrographic Organization
MBES	Multibeam Echosounder
MCA	Maritime & Coastguard Agency
MGN	Marine Guidance Note
OD	Ordnance Datum
RoS	Report of Survey
RTK	Real Time Kinematic
UKHO	United Kingdom Hydrographic Office
UTC	Universal Time Co-ordinated
UTM	Universal Transverse Mercator

1 INTRODUCTION

Following the successful consenting of the Morlais tidal Demonstration Zone (MDZ) in December 2021, Marine and Risk Consultants Ltd have been commissioned to prepare this navigation-focused Hydrographic Survey Specification in support of the Navigation Monitoring Specification (NMS) required by the MDZ marine licence (ORML 1938) (see Figure 1).

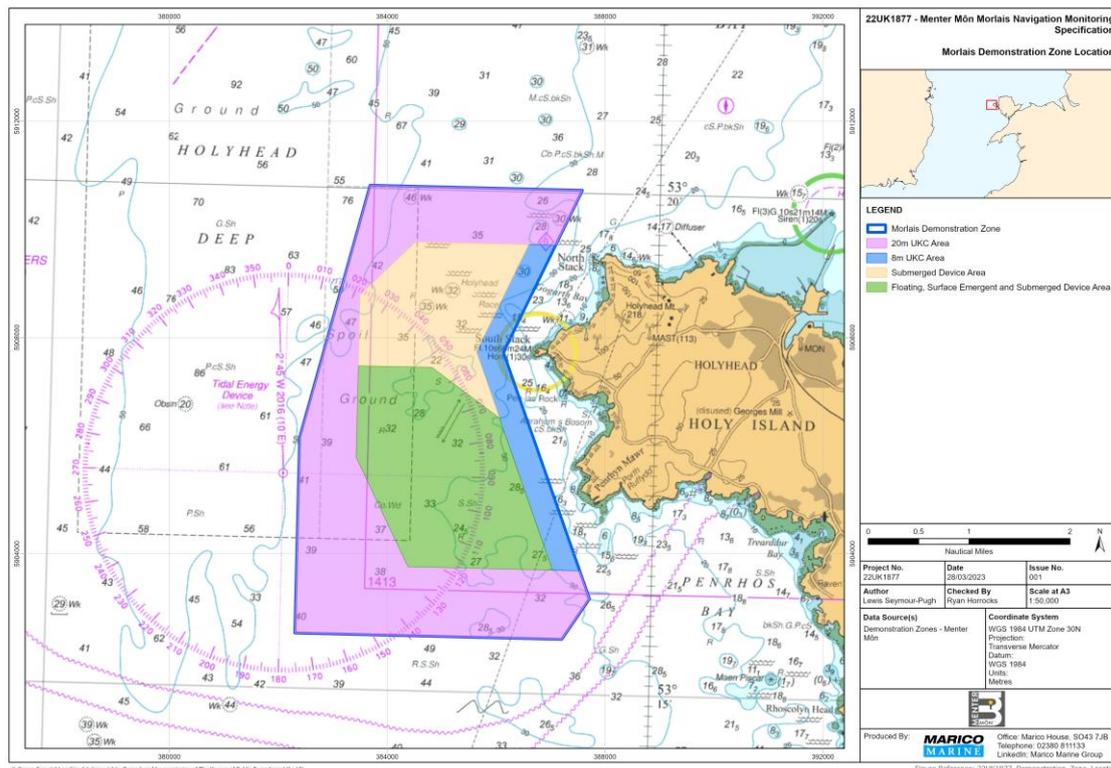


Figure 1: Location and zoning of the Morlais Demonstration Zone (as of June 2023)

Annex 4 of the MCA's Marine Guidance Note (MGN) 654 (M+F) - *Offshore Renewable Energy Installations (ORE) safety response, Guidance on UK Navigational Practice, Safety and Emergency Response* - contains the current UK guidance on conducting hydrographic surveys in support of safety of navigation within and around ORE installations.

1.1 SCOPE

All hydrographic surveys conducted to support development consent or ongoing licence conditions should provide full seafloor coverage that meets the requirements of IHO S44 Edition 6 Order 1a.

This document presents guidance in the form of a hydrographic survey specification to meet these international survey standards, ensuring that data gathered is of a suitable quality to be used for the update of nautical charts by the UK Hydrographic Office (UKHO). Furthermore, data collected to this standard will be suitable for a range of other engineering uses, following the ethos of 'gather once, use many times'. This has the potential to introduce survey cost savings for Menter Môn, if adopted as the common survey standard across the MDZ.

This specification is supplied for guidance only. Experienced survey contractors are likely to have their own survey specification and workflows to meet IHO standards. This specification is adapted from technical requirements developed by the UK's Maritime and Coastguard Agency; to map UK home waters under the auspices of the UK Civil Hydrography Programme.

1.1.1 Proposed Survey Programme

In order to establish a baseline, confirm safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are required of active zones within the MDZ at the following stages:

- **Pre-construction:** the proposed generating assets area/zone and proposed cable route(s).
- **Post-construction:** deployed generating assets area/zone and cable route(s).
- **Post-decommissioning of all or part of the development:** the installed generating assets area and the cable route(s).

1.2 RELATED STANDARDS & PUBLICATIONS

- Standards for Hydrographic Surveys. Special Publication No. 44. Edition 6. International Hydrographic Organization.
- Civil Hydrography Programme Survey Specification, Maritime & Coastguard Agency.
- The Mariner's Handbook (NP100). United Kingdom Hydrographic Office.
- Admiralty Tidal Handbook NP122 No.2. United Kingdom Hydrographic Office.

2 SURVEY SPECIFICATION

2.1 PERSONNEL

2.1.1 Charge Surveyor

A Charge Surveyor (also termed as Party Chief or Surveyor in Charge) shall always have oversight during survey operations. The Charge Surveyor shall be a IHO/FIG Category A accredited hydrographic surveyor (or equivalent) and have a minimum of 5 years offshore surveying experience including surveying for nautical charting purposes. The Charge Surveyor shall have the authority and experience to make and implement operational decisions and will be available for Menter Môn's representative to contact in order to progress and modify the survey plan if necessary.

2.1.2 Survey Team

Survey teams shall include suitably qualified and experienced personnel capable of supporting all aspects of hydrographic survey in offshore areas for nautical charting purposes and office-based staff responsible for data compilation and quality assurance.

2.2 MULTIBEAM ECHOSOUNDER BATHYMETRY

2.2.1 Primary Depth Sensor

Depth will be measured throughout the survey area using a multibeam bathymetry system (MBES) capable of meeting all requirements stated below.

2.2.2 Uncertainty

Sounding uncertainty (in three dimensions) shall be in accordance with IHO Order 1A, as defined in IHO S44 Edition 6.

The Contractor shall provide a fully developed uncertainty model to Menter Môn prior to survey operations commencing. The model shall state all component uncertainties, as well as the combined Total Propagated Uncertainty (TPU).

2.2.3 Object Detection

For all parts of the survey area, the minimum size of object detected shall be:

- Cube with sides of 2m in depths < 40m
- Cube with sides of 10% of depth in depths >40m

2.2.4 Sounding Density

Each object is to be detected by at least 3 valid data points in the along-track direction and 3 valid data points in the across-track direction, forming a minimum 3x3 grid of 9 data points.

To monitor compliance with the Target Detection requirements for a given area, a minimum sounding density of 9 accepted soundings will be achieved in the following bin sizes:

- Bin with sides of 2m in depths < 40m
- Bin with sides of 10% of depth in depths >40m

2.2.5 Acoustic Coverage

Full seafloor coverage shall be achieved to the 2m depth contour where it is safe to do so.

2.2.6 Crosslines

A minimum of 4 bathymetric crosslines shall be run for each survey area, at approximately equal spacing, with an optimum of 4 crosslines for each survey block. These crosslines shall be approximately perpendicular to the typical mainline orientation in that block.

Crossline shall data should be cleaned as per 2.27.

2.2.7 Depth Data Precision

Soundings shall be logged to at least two decimal places of a metre and presented as depths below Chart Datum (CD).

2.2.8 Data Cleaning

All accepted soundings within the final bathymetric dataset shall fall within the IHO Order 1A uncertainty allowance. All systematic errors and obvious outliers shall be rejected from the bathymetric data. Data points falling within the Order 1a depth requirements but still numerically

distant from the main dataset will still be regarded as outliers and should be rejected, but not deleted, from the dataset.

2.3 TIDES AND REDUCTION OF SOUNDINGS

2.3.1 Reduction of Soundings to Chart Datum

Soundings are to be reduced to Chart Datum (CD) by using dual frequency carrier phase GNSS combined with the Ordnance Survey Active Networks i.e. Post Processed Kinematic (PPK) GNSS.

2.3.2 Establishment of Shore-Based and Offshore Tide Gauges

Coastal or offshore tidal stations may be required within the extents of the survey area. Supplementary tidal stations, and/or use of locally available permanently installed gauges, e.g. local Harbour Master, National Tidal and Sea Level Facility (NTSLF) or Regional Coastal Monitoring Programme tide gauges, may also be used.

Tidal heights will be measured throughout the survey period and for a minimum of 30 days using a temporary or permanent tide gauge capable of meeting all of the requirements stated below.

Automatic tide gauges (both onshore and offshore) should be capable of resolving water level measurement to $\pm 0.01\text{m}$ in height and ± 2 min in time.

Heights must be recorded to at least 2 decimal places of precision and at sample intervals no higher than 5-minute resolution.

Offshore (on non-vented) tide gauges shall be corrected for atmospheric pressure. Atmospheric pressure shall be recorded within 100km of the gauge location at a temporal resolution no greater than 6 hours.

2.3.3 Pole to Gauge Calibration

All temporary contractor-installed coastal tide gauges must be calibrated by reference to independent readings using a tide pole or 'top down air gap' measurements (e.g. by weighted tape measure from an appropriate reference mark which can be subsequently tied into the vertical control).

Readings are to be taken half-hourly as a minimum, with 10-minute interval readings taken for the duration of one hour before to one hour after high and low water. If observing at a location with a tide range more than 7m (or where the range is perceived to be changing rapidly) the

observations are to be taken every 10 minutes, and every 5 minutes for the duration of one hour before to one hour after high and low water. Automatic coastal tide gauges installed by the Contractor only require a minimum 13-hour period of manual observations.

When reading a pole in calm weather an accuracy of $\pm 0.03\text{m}$ should be attainable, with the time of each reading recorded to within ± 5 seconds of UTC; the same for a 'top down air gap' measurement technique.

2.4 POSITIONING

2.4.1 Survey Geodasy

Unless otherwise stated, each survey shall be rendered using the following geodetic parameters:

- Datum: ETRS89
- Spheroid: GRS '80
- Projection: UTM Grid Zone 30 North.

All rendered positions shall be quoted as geographical co-ordinates (i.e. in terms of Lat / Long) as degrees and decimal minutes.

2.4.2 Horizontal Accuracy

The Horizontal Accuracy of all depths and positions shall be in accordance with IHO S44 Order 1a (6th Edition).

2.4.3 Positioning

Soundings are to be positioned by using dual frequency carrier phase GNSS combined with the Ordnance Survey Active Networks i.e. Post Processed Kinematic (PPK) GNSS.

The Contractor will state methodologies for post-processed and real-time positioning within the report of survey.

2.5 SURVEY CONTROL

2.5.1 Establishment of Survey Control

Three-dimensional position of any existing or newly established survey control shall be determined by dual frequency carrier phase GNSS techniques, tied into the Ordnance Survey

Active Network. A minimum of six hours of observations are required per station. The six-hour observation period should be divided into two three-hour sessions. At the end of the first session the antenna should be physically moved away from the mark and then re-established over the mark before commencing the 2nd observation session. The height of the static GNSS antenna should be measured before each session and clearly recorded and reported. If the height measured is a slope distance from the edge of the antenna, this shall be appropriately corrected to obtain the true vertical offset. The static GNSS antenna shall be positioned directly over the control point using an optical plummet. The absolute uncertainty with respect to ETRS89 for any existing or newly established survey control shall not exceed 1cm in horizontal and 2 cm in vertical at the 95% confidence level.

Elevation masks should be selected appropriate for the surrounding site, but typically should be not less than 10°. The appropriate OD height and appropriate UTM coordinate for each station shall be computed. Where necessary, co-ordinate conversion shall be conducted using approved conversion programmes and an estimated final uncertainty stated.

2.5.2 Optical Levelling

To perform a redundant check on any control established and/or utilised, all control points shall be optically levelled from two pre-existing control points referred to the appropriate Ordnance Datum.

Levelling is to be conducted between the 2 control points established, the tide pole and any existing BM's in the vicinity of the survey area.

Levelling is to comprise a looped traverse – no inter-sights shall be taken. Levels should be read and recorded to a precision of 0.001m. Any levelling field records should also be supplied.

2.5.3 Station Marking & Documentation

All geodetic stations established during survey operations shall be described and photographed.

Descriptions of stations should include the coordinates and height of the station; a location description; a detailed description; list of other visible marks; visibility diagram and suitability for positioning fixing systems. Digital photographs, sketches, maps and/or chart extracts should be included to show views of the mark in situ and its immediate locality.

2.5.4 Vessel Dimensional Control

An appropriate dimensional control survey of each vessel to be utilised shall be conducted prior to commencement. Permanent and recoverable control points are to be established on each vessel utilised, coordinated to the vessel reference frame to within a tolerance $\pm 0.01\text{m}$ relative (at the 95% confidence level) in X, Y and Z.

All sensors shall be established within the vessel reference frame within a tolerance $\pm 0.02\text{m}$ relative (at the 95% confidence level) in X, Y and Z.

Where appropriate, the rotations of each sensor around the X, Y and Z axis shall be initially determined by the dimensional control survey to within ± 0.2 degrees (at the 95% confidence level). These values may be later adjusted during the sonar patch test, if required. The centre of gravity (rotation) should also be estimated and its location within the vessel reference frame and method of establishment clearly stated in the report of survey.

A copy of the dimensional control report for each vessel shall be annexed to the report of survey.

2.6 CALIBRATION

2.6.1 Multibeam Bathymetry Calibration

A calibration of the multibeam bathymetry system and associated sensors (i.e. "patch test") shall be performed at the start of each survey season or after changing out or significantly reconfiguring any survey sensor (methodology shall be detailed in tender). Final post calibration repeatability shall be proven by means of the repeatability test detailed below.

2.6.2 Static Positioning Check

A static positioning check shall be performed at the start of each survey season or after changing out or significantly reconfiguring any survey sensor. The check shall monitor the three-dimensional position of either the primary GNSS antenna or another appropriate point within the vessel reference frame, for a period of no less than 30 minutes at a 1-minute resolution.

The report of survey should separately state the computed statistical reliability of both the horizontal position and the height measured. The positioning data to be compared will have been derived using the same procedures used to obtain all positions associated with the bathymetric data (i.e. post processed kinematic).

Any local survey control utilised in this procedure shall be compliant with the requirements stated in Survey Control section.

2.6.3 Multibeam Bathymetry Repeatability Test

A multibeam bathymetry repeatability test shall be performed following calibration at the start of each survey or after changing out or significantly reconfiguring any survey sensor. This test should be conducted after the static position check as stated in the Static Positioning Check section.

The test shall monitor the three-dimensional position of a clearly defined small but easily detectable feature on the seabed. The feature should be first surveyed near nadir from multiple directions – as a minimum from north, south, east and west. Secondly the feature should be boxed in, so that it appears in the outer beams on port for 2 lines, and the outer beams on starboard for 2 lines.

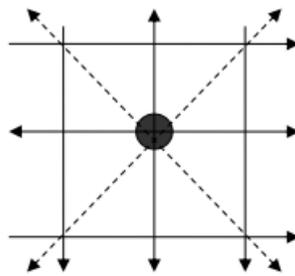


Figure 2: Illustration depicting survey lines required for an MBES Repeatability

The subsequent report should separately state the computed statistical reliability of both the horizontal position and the depth measured for the feature.

2.6.4 Vertical Offset Check

A vertical offset gross error check shall be performed at the start of each survey or after changing out or significantly reconfiguring any survey sensor (methodology shall be detailed in tender). The check shall compare the physical measurements of the distance from the primary and secondary GNSS antennas on the vessel to the seabed. This shall be performed in one location using a method entirely independent of the vessel's survey systems (e.g. level staff or leadline in a berth). These measurements shall be compared to data logged simultaneously in the same location using the vessel's survey system and software. The results should be compared and detailed in the report of survey.

2.6.5 Quality

The Contractor shall provide a real-time indication of the quality of the 3D position and received augmentation data.

2.6.6 Calibration Report

The Contractor shall provide Menter Môn within an agreed timeframe, a draft report or summary of details following completion of each multibeam bathymetry calibration, static positioning checks, multibeam bathymetry repeatability, dimensional control and vertical offset checks. The full detailed calibration report(s) shall be included within the report of survey.

2.7 GENERAL REQUIREMENTS

2.7.1 Hydrographic Notes

Reports of significant differences to depths for a given area, particularly to the controlling depth, and any newly discovered dangers to surface or sub-surface navigation, shall be passed within 24 hours to the UKHO using the 'Hydrographic Note' (H102) form.

2.7.2 Sound Speed

The Contractor shall observe sound speed profiles at an interval consistent with the proposed error budget.

2.7.3 Licences, Consents & Permissions

The Contractor shall be responsible for arranging all licences, consents and permissions for access and frequency clearance for all survey operations whether ashore or afloat.

2.7.4 Daily & Weekly Progress Reports

Daily Progress Reports (DPRs) shall detail, survey operational progress, % of total survey coverage, planned activities, toolbox meetings, safety drills, etc., weather downtime and any problems encountered.

DPRs shall be completed and e-mailed to Menter Môn on a daily basis.

A brief Weekly Progress Report (WPR) shall summarise survey operations, milestone and completion and delivery dates, and include graphics of latest data coverage. WPRS shall be completed and e-mailed to Menter Môn on a weekly basis.

2.7.5 Quality Control

Robust quality control procedures shall be provided and adhered to during processing of all data. A copy of these procedures shall be provided to Menter Môn prior to survey operations commencing.

3 DELIVERABLES

3.1 LABELLING OF RECORDS & DELIVERABLES

Each rendered item of digital data shall bear a depiction of the Menter Môm logo, together with:

Project Name:

MORLAIS DEMONSTRATION ZONE

Hydrographic Survey Title:

[SURVEY DESCRIPTION]*

Survey Dates:

[SURVEY DATES]*

* To be completed.

3.2 MULTIBEAM ECHOSOUNDER DELIVERABLES

For supply to Menter Môm:

- All data should be rendered in digital form, in one of the following formats: CARIS Project Directory or GSF (Generic Sensor Format).
- Spurious data should be cleaned from the final, delivered dataset. Digital data should have rejected soundings included but flagged as deleted. The method used in any data cleaning (e.g. Shoal or Median Biased) should be clearly stated.
- Digital data should be full density i.e. prior to any gridding, binning or tinning being applied.
- If gridded datasets have been created, then these should also be included.
- Report of Survey.

3.3 REPORT OF SURVEY

For supply to Menter Môm:

A report of survey shall be prepared for each hydrographic survey that describes how the data was gathered and processed, including:

- A list of equipment and software used and the personnel employed.

- How the echosounder transducer and positioning equipment were set up, calibrated and used, together with all sensor offsets.
- Details of the horizontal datum to which the positions are referenced.
- Details of how the tides were measured, tide gauge was levelled and how the depths were reduced to Chart Datum (CD).

3.4 TIDAL DATA

For supply to Menter Môn:

Tide gauge records, including raw tide heights and metadata, are to be submitted either in text file format (ASCII) or Microsoft Excel format (.xls). Metadata pertinent to the deployment must include:

- Position of instrument
- Depth of water at the deployment site
- Start/ End of deployment time and date
- Units in metres

3.5 RETENTION OF DATA

All raw and processed digital records shall be retained and maintained by the Contractor for a period of 3 years from the date of deliverables submission. On completion of this 3-year period, the Contractor may seek permission from Menter Môn to dispose of the data as they so wish.

Annex D VTS Operators Methodology

MARICO MARINE

MORLAIS VESSEL TRAFFIC SURVEY METHODOLOGY AND GUIDELINES



Report Number: 22UK1877
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Prepared for: Marico Marine

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QC: Ryan Horrocks

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1 INTRODUCTION

Menter Môn has commissioned Marine and Risk Consultants (Marico Marine) to undertake the first of a two-yearly Navigation Risk Assessment (NRA) covering the Morlais Tidal Demonstration Zone as described within their marine license (**Figure 1**). The NRA being carried out by Marico Marine will also cover aspects of the device deployment in preparation for the first installation in 2026.

A requirement of the NRA is to undertake a Vessel Traffic Survey (VTS). This will satisfy the requirements of Menter Môn’s marine license and adhere to the guidance outlined within the Maritime and Coastguard Agencies (MCA) Marine Guidance Note (MGN) 654, which outlines the safety of navigation guidance for Offshore Renewable Energy Installations (OREI) in UK waters. The VTS uses Automatic Identification System (AIS), Radar and Visual Observation data to determine the traffic profile of the given OREI site. This data is then used in support of the NRA and will cover both summer and winter periods for seasonal variation. For more information on the VTS survey please refer to Marico Marine’s document entitled - *Morlais Demonstration Zone Navigation Monitoring Specification*.

This document outlines the methodology for operators of the survey and is designed to ensure that operators are cohesive in their approach.

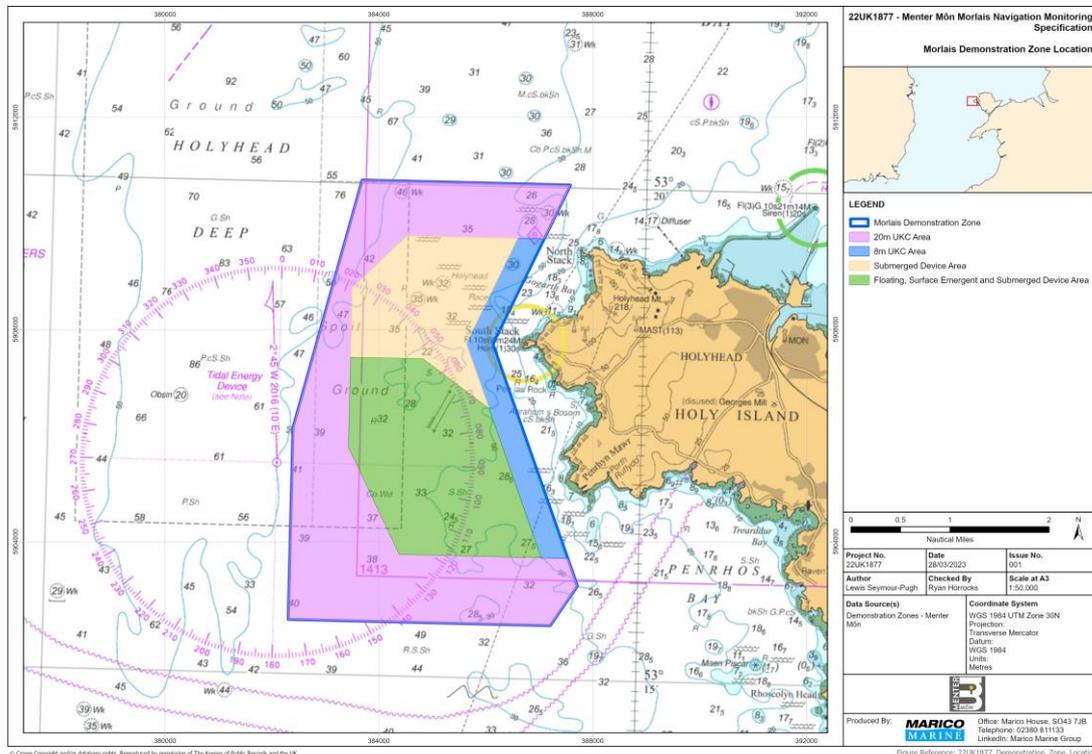


Figure 1 – Morlais Demonstration Zone as per the Marine License.

2 OPERATORS METHODOLOGY

2.1 SCOPE

The aim of the VTS is to record the number of vessels transiting within the vicinity of the MDZ. This will be undertaken using the equipment that was installed on South Stack on the 4th July 2023 (for more information on the VTS survey please refer to Marico Marines document entitled - *Morlais Demonstration Zone Navigation Monitoring Specification*). The data being recorded consists of AIS, Radar and Visual Observations. Two 2-week surveys to cover both summer and winter periods (16th – 29th Aug 2023 and TBC Exp. Nov 2023) will be undertaken for the NRA.

2.2 DESCRIPTION OF SOFTWARE

The system will be run using the Navi-Harbour Software. All operators will be trained on the system in advance and will have access to the Navi-Harbour user's manual for reference. All AIS, Radar, and CCTV data feeds have been integrated into the Navi-Harbour and operators will have the ability to control the CCTV Camera, identify radar targets and query AIS data within the software.

2.3 COLLECTION OF DATA

2.3.1 AIS

The AIS data being collected has enough range to cover the full extent of MDZ and most of the Irish Sea. This dataset will capture vessels carrying both Class A and Class B AIS receivers. All AIS data being recorded will be automatically saved locally on the PC situated at South Stack. This data can be queried on Navi-Harbour so that operators can determine a vessels destination, length etc. This data is to be extracted from the PC and saved on the Marico server at the end of every week.

2.3.2 Radar

The Radar installed at South Stack has been calibrated to detect vessels within an 8nm range. The radar is designed and has been calibrated to detect targets moving within that range. The Navi-Harbour software has been set up to self-identify targets that are moving. The software will only do this if the vessel has no AIS. Once the software has identified a target, a square box will appear with a line of direction. The operator will need to right click on the box and register the target to make it appear within the AIS dataset. The operator will need to use the CCTV to identify the vessel type. The radar data will be integrated into the AIS data and therefore will be extracted within that dataset at the end of every week.

2.3.3 Visual Observations

Visual observations will be conducted remotely from Marico Marines office. A control station will be set up within the office which operators will work from.

Visual observations data will be collected by the operators using the CCTV camera installed on South Stack and be controlled using Navi-Harbour. Observations are required to be taken during daylight hours and therefore operators will take shifts to cover the hours necessary. A camera sweep has been set on the Navi-Harbour software to capture areas of interest and undertake a periodic sweep of the MDZ (camera positions are set to 30 second intervals) (See **Figure 2**).

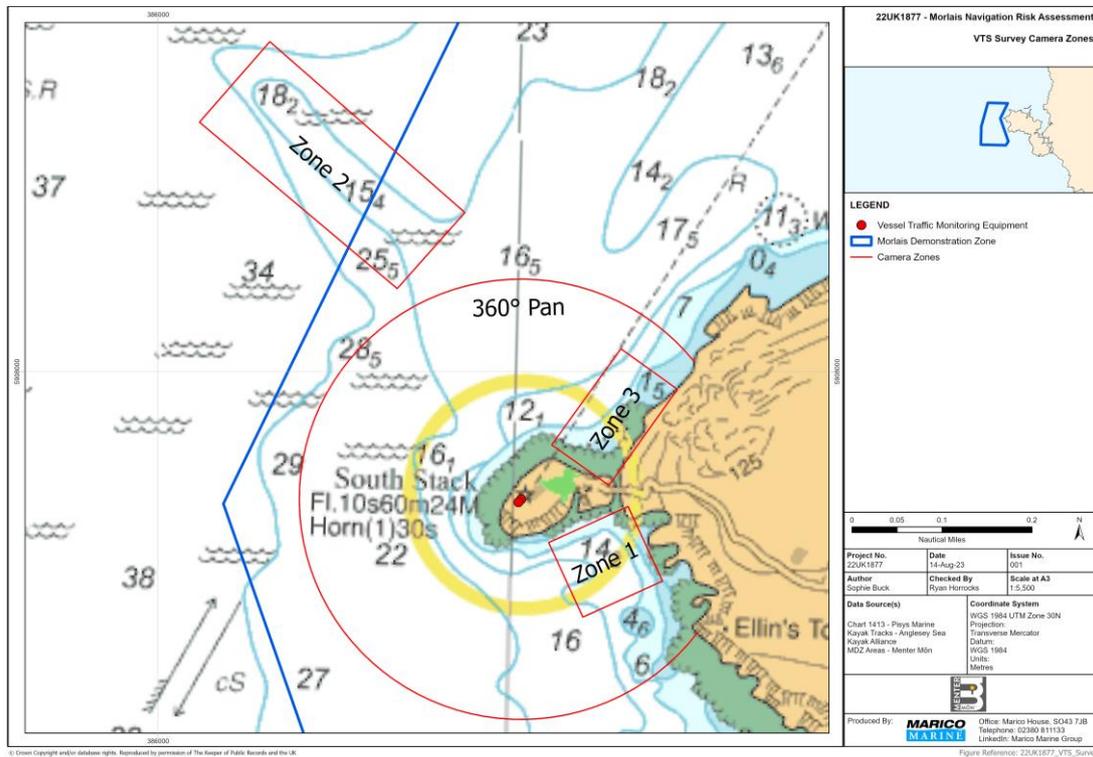


Figure 2 – Areas for Visual Survey.

Visual observations will be recorded for vessels passing through the MDZ, and the area between the MDZ and the coastline. If any vessel (both AIS and non-AIS) passes through either of these zones, it must be noted on the visual observation's spreadsheet and a screenshot of the vessel on the CCTV must also be taken and saved to the system. On the spreadsheet, vessel information must be noted; this can be obtained by using the AIS of a particular vessel. If a vessel does not have AIS (e.g. kayaker) then a rough description must be given including the vessel type (e.g. recreational) and location.

2.4 REQUIREMENT OF OPERATOR

As an operator, you are required to:

- Visually record any vessels that transit into the MDZ and coastal zone including small recreational vessels and take screenshots of the vessels;
- Extract AIS/Radar data at the end of every week;
- Take note of the weather within the weather log at the start of your shift using the MetOffice data for Holyhead;
- Check that all monitors on Navi-Harbour are green on the bottom extent of the software;
- Be present and online when your shift starts;
- Identify any issues that the system may have; and
- Report any issues or technical errors to the project manager/lead technician.

All resources that an operator will need can be found on the server within the VTS folder. A checklist will be available to operators during the survey.