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MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Annex 3.1 to the Applicant's response to Rule 17 Letter: Warton Aerodrome CNS Safeguarding Assessment Report (Offshore Substation Platforms)

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Image of an offshore wind farm

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Warton Aerodrome CNS Safeguarding Assessment Report (Offshore Substation Platforms)

Date: 10th March 2025
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Revision: Issue 1.2
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Executive Summary

Introduction

Warton Aerodrome ("the Aerodrome") is responsible for the technical safeguarding of their Communications Navigation and Surveillance (CNS) systems in accordance with the Civil Aviation Authority (CAA) requirements.

Morgan Offshore Wind Farm Limited ("the Client") has commissioned Osprey to conduct a Line of Sight (LOS) assessment to determine potential aviation impacts against the In-Scope CNS systems at the Aerodrome, that could be impacted by the Client's proposed Offshore Substation Platforms (OSP) ("the Development").

Scope

In-Scope CNS

For the purposes of this report and the scope of work undertaken, the In-Scope CNS systems being considered are defined as the Aerodrome's:

- Very High Frequency (VHF) Communications (Comms) Transmitter (TX)/ Receiver (RX) Site

The Development

For the purposes of this report and the scope of work undertaken in the assessment contained within, the Development is defined as the proposed OSPs located approximately 35 Nautical Miles (NM) from the Aerodrome's, Aerodrome Reference Point (ARP).

As the final position of the OSPs within the wind farm has yet to be confirmed, four locations have been selected (within the array area) that are closest to the Aerodrome have been selected as 'test points' for the Assessment. Clearly this is not a realistic scenario as they all lie at the extremity of the array area, which would not be the case in reality.

The Requirement

A specific technical safeguarding assessment has been conducted as follows:

- **Line of Site Assessment**
  Line of Sight (LOS) assessment using industry standard Radio Frequency (RF) Planning tools, of the OPSs of the Development against the Aerodrome's following In-Scope CNS:
  - VHF Comms TX/ RX Site

Purpose

This report details the approach and presents the results of the technical safeguarding assessment commissioned and identifies any potential impacts on the In-Scope CNS systems at the Aerodrome.

The results and conclusions of the assessment conducted are summarised below:

LOS Assessment

- **Conclusions**
  The LOS assessment conducted concludes that the Development will not have direct LOS to the Aerodrome's In-Scope CNS systems and also lies in the Non-Line of Sight (NLOS) region where the transmitter/ receiver signal strength is already reduced.
- **Recommendations**
  None.

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1 Introduction

1.1 Introduction

Warton Aerodrome ("the Aerodrome") is responsible for the technical safeguarding of their Communications Navigation and Surveillance (CNS) systems in accordance with the Civil Aviation Authority (CAA) requirements.

Morgan Offshore Wind Farm Limited ("the Client") has commissioned Osprey to conduct a Line of Sight (LOS) assessment to determine potential aviation impacts against the In-Scope CNS systems at the Aerodrome, that could be impacted by the Client's proposed Offshore Substation Platforms (OSP) ("the Development").

1.2 Purpose

This report details the approach and presents the results of the technical safeguarding assessment commissioned and identifies any potential impacts on the In-Scope CNS systems at the Aerodrome.

1.3 Scope

1.3.1 The Development

For the purposes of this report and the scope of work undertaken in the assessment contained within, the Development is defined as the four nominal locations for OSPs located approximately 35 Nautical Miles (NM) from the Aerodrome's, Aerodrome Reference Point (ARP).

As the final position of the OSPs within the wind farm has yet to be confirmed, four locations have been selected (within the array area) that are closest to the Aerodrome have been selected as 'test points' for the Assessment. Clearly this is not a realistic scenario as they all lie at the extremity of the array area, which would not be the case in reality. Figure 1 depicts the localisation of the OSPs to the Aerodrome.

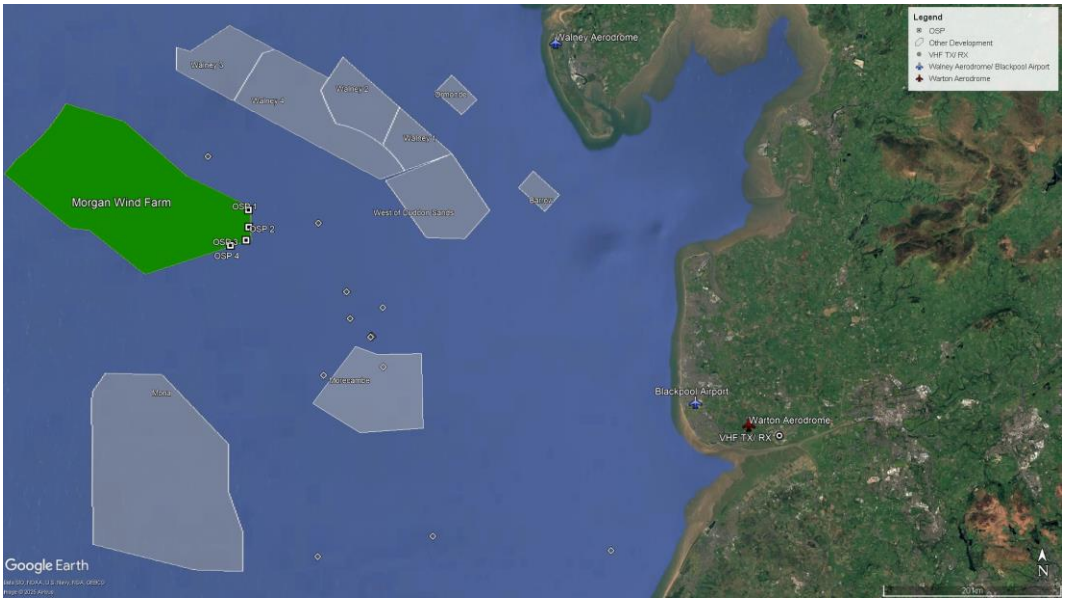

Figure 1 - Localisation

Similar to the worst-case location of the OSPs, a worst-case assumption of height has been assumed, with a maximum topside height of 74 meters (m) Above Mean Sea Level (AMSL) (i.e., 70m above Lowest Astronomical Tide (LAT). It is noted that if four OSP are selected then the topsides will be lower than 74 meters, and this assessment is therefore, overly precautionary in considering four OSP in the worst-case locations with the worst-case height. Specific OSP parameters and geolocations used in the assessment are detailed in Table 1 below.

OSP	Coordinates (4NGR[1])		Tip Height (m AMSL)	Tip Height (m LAT)	Label
	East/ West	North/ South			
1	53.973464°	-3.791074°	74	70	OSP1
2	53.956257°	-3.790352°	74	70	OSP2
3	53.943077°	-3.794948°	74	70	OSP3
4	53.937908°	-3.821660°	74	70	OSP4

Table 1 - Development Parameters

1.3.2 Requirements

The Client has commissioned the following specific technical assessment, detailed in Section 2 of this document, with summary conclusions and recommendations also being provided.

- **Section 2** - Line of Sight (LOS) assessment

1.3.3 In-Scope CNS

For the purposes of this report and the scope of work contained within, the Aerodrome CNS being considered, and the respective technical assessment conducted, is defined in Table 2 below. Table 3 includes the CNS parameters used for the assessment.

Warton CNS	Section 2 LOS Assessment
Very High Frequency (VHF) Communications (Comms) Transmitter (TX)/ Receiver (RX) Site	✓

Table 2 - CNS Assessment Scope

Warton CNS	Coordinates	Antenna Electrical Centre Height (m AGL)	Peak Power (kW)	Frequency (MHz)	Antenna Gain (dBi)	DOC[2] (NM)
VHF Comms TX/RX Site	53°44'44.30"N 002°53'20.11"W	26.2	0.005	127.00	2.1	40

Table 3 - CNS Parameters

[1] National Grid Reference.
[2] As published in the UK Aeronautical Information Publication (AIP) AD 2.EGNO-1 dated 23rd January 2025).

1.4 Abbreviations

The following abbreviations are used within this document:

Abbreviation	Meaning
AGL	Above Ground Level
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
ARP	Aerodrome Reference Point
ASL	Above Sea Level
ATS	Air Traffic Services
CAA	Civil Aviation Authority
CAP	CAA Publication
CNS	Communications Navigation and Surveillance
Comms	Communications
DOC	Declared Operational Coverage
ft	feet
G	Gain
kW	kilowatt
LAT	Lowest Astronomical Tide
LOS	Line of Sight
m	Meters
MHz	megahertz
NGR	National Grid Reference
NLOS	Non-Line of Sight
NM	Nautical Miles
Osprey	Osprey Consulting Services Limited
OSP	Offshore Substation Platform
RF	Radio Frequency
RX	Receiver
SME	Subject Matter Expert
TX	Transceiver
VHF	Very High Frequency

Table 4 - Abbreviations

2 LOS Assessment

2.1 Introduction

This section presents the LOS Assessment for the Aerodrome In-Scope CNS systems. Using composite optical line of site functions, coupled with Radio Frequency (RF) propagation and Fresnel zone calculations in ATDI HTZ Communications (HTZ Comms) which is an industry standard RF network planning toolset with extensive RF Propagation analysis and modelling capabilities. Analysis has been conducted of point-to-point (optical) and RF (Fresnel) visibility between the In-Scope CNS and the OSP of the Development.

2.2 Overview

LOS in its most simplistic form is a calculation to determine whether one object can see another in a direct path. Many factors may influence VHF radio propagation especially the terrain profile and atmospheric conditions. However, tall and dense objects may also affect the radio waves (i.e. reflect, refract, diffract, scatter etc).

VHF radio waves travel a bit further than the optical horizon (this is referred to as the LOS region), where signals remain strong and direct. VHF radio waves do not stop directly at the end of the LOS region but continue to propagate beyond the radio horizon into what is known as the Non-Line of Sight region (NLOS), in the NLOS region the transmitter/ receiver signal strength is already reduced.

Osprey has extensive experience of modelling VHF radio waves LOS using HTZ Comms. Our assessment considers optical line of site, the upper Fresnel zone, the Earth's curvature and terrain.

2.3 Scope

As detailed in Section 1.3.3, the Aerodrome's In-Scope CNS considered in the LOS Assessment is as follows:

- VHF Comms TX/RX Site

2.4 Methodology

2.4.1 CNS Modelling

The In-Scope CNS was modelled as an RF emitter with specific parameters as detailed in Table 3.

2.4.2 Development Model

A model of the OSP was created in HTZ Comms using the data detailed in Table 1; specifically:

- The OSP was created as a target point in space by using x, y and z as location and the maximum height parameters.

2.4.3 LOS Assessment

The OSP was assessed for visibility against the In-Scope CNS. An example of a resultant profile path is depicted in Figure 2 below.

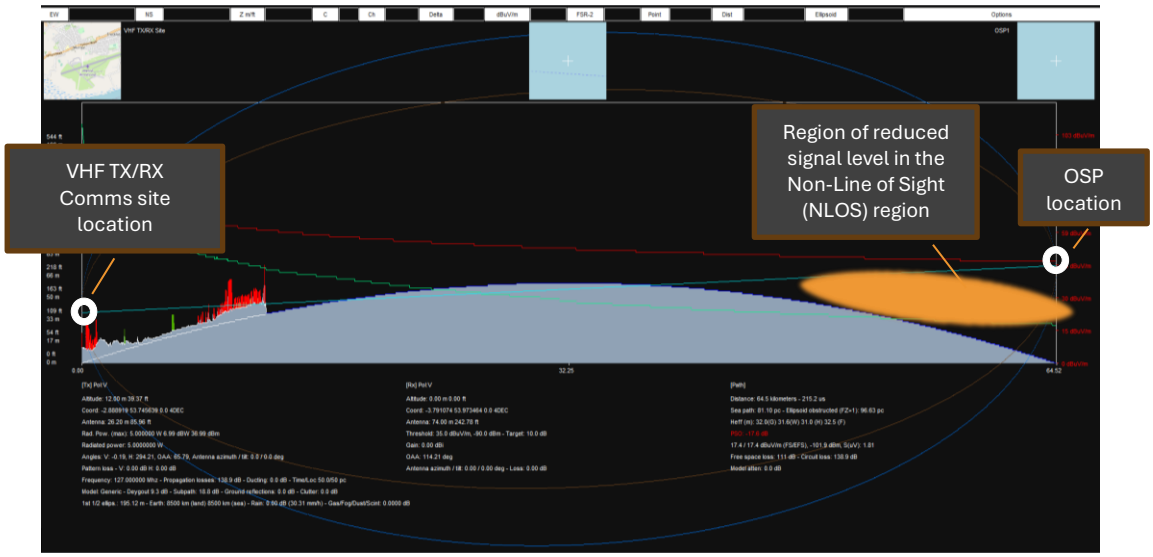

Figure 2 - Illustration of Region of Reduced Signal Level in the NLOS Region

The profile path was evaluated by a Subject Matter Expert (SME) who determined whether the OSP visibility is:

- Yes (Red) - Visible to the In-Scope CNS System (the OSP has direct optical LOS)
- No (Green) – Not visible to the In-Scope CNS System (the OSP does not have direct optical LOS due to the interlaying terrain and lies within the NLOS region of reduced signal strength).

2.5 Results

There is no direct optical line of sight between the VHF TX/RX comms site and the four OSP locations, as seen in the LOS profiles presented in Appendix 1. This is mainly due to the intervening terrain and curvature of the Earth. As illustrated in Figure 2 above, there is already a region of reduced comms in the vicinity of the OSPs (in the NLOS region), as discussed earlier. Irrespective of how many OSP are selected or where they are located within the array area, the proposed development will consequently not likely impact the Aerodrome's In-Scope CNS systems.

Summary results of the LOS assessment conducted against the Development are presented in Table 5 below:

OSP	Tip Height (m AMSL)	Tip Height (m LAT)	Distance to CNS (NM)	Visibility Result	Description	Appendix 1 Reference
OSP1	74	70	34.85	NO	Not visible to the In-Scope CNS System (the OSP does not have direct optical LOS due to the interlaying terrain and lies within the NLOS region of reduced signal strength)	Figure 3
OSP2	74	70	34.45	NO	Not visible to the In-Scope CNS System (the OSP does not have direct optical LOS due to the interlaying terrain and lies within the NLOS region of reduced signal strength)	Figure 4
OSP3	74	70	34.33	NO	Not visible to the In-Scope CNS System (the OSP does not have direct optical LOS due to the interlaying terrain and lies within the NLOS region of reduced signal strength)	Figure 5
OSP4	74	70	35.11	NO	Not visible to the In-Scope CNS System (the OSP does not have direct optical LOS due to the interlaying terrain and lies within the NLOS region of reduced signal strength)	Figure 6

Table 5 - Warton VHF TX/RX Comms LOS Results

2.6 Conclusion

Irrespective of the final design and layout scenario the LOS assessment conducted concludes that the Development will not have direct LOS to the Aerodrome's In-Scope CNS systems.

Given the nature of VHF signals and the manner in which they tend to propagate beyond the visual LOS and extending the comms coverage range, the OSPs will not likely impact the Aerodrome's in-Scope CNS in the development area. The proposed Development also lies in the NLOS region where the transmitted comms signal level is already reduced.

2.7 Recommendations

None.

Appendix 1 LOS Profiles

A1.1 Introduction

In conducting the Assessment, many technical artifacts are generated. A Profile Path image is produced for the point-to-point visibility between the In-Scope CNS and the OSP being considered.

For ease of readability of the main report, this image is contained within this Appendix.

A1.2 Contents

The contents of this Appendix are as follows:

A1.3 Warton VHF TX/RX Communications Site - LOS Profile Paths

A1.3.1 OSP1

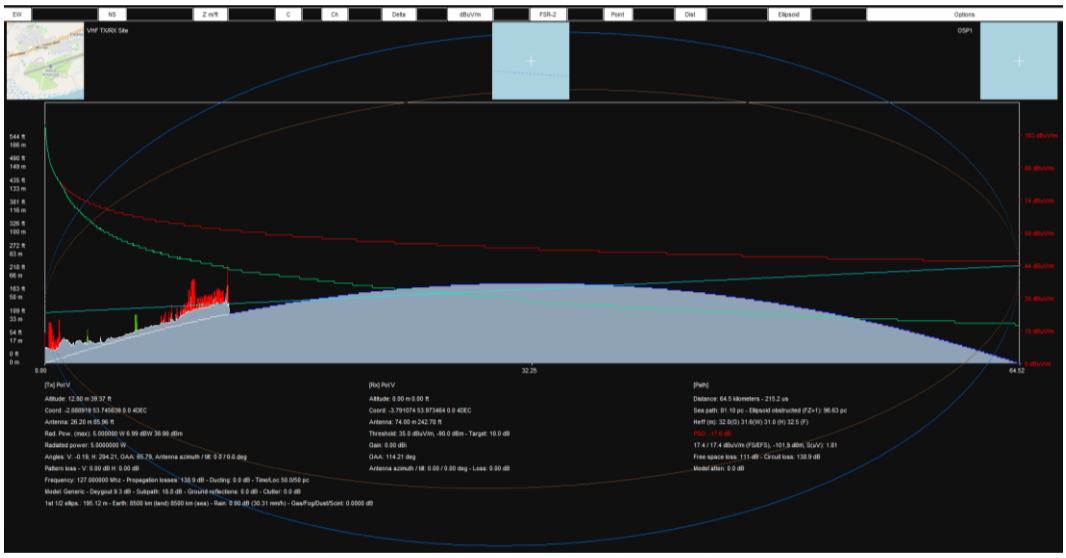

Figure 3 - OSP1 LOS Profile

A1.3.2 OSP2

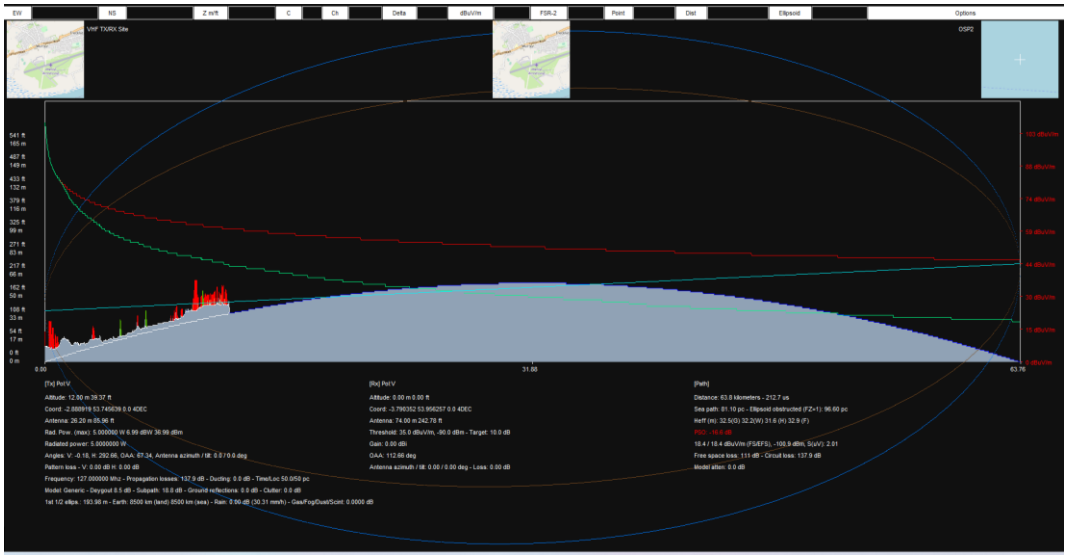

Figure 4 - OSP2 LOS Profile

A1.3.3 OSP3

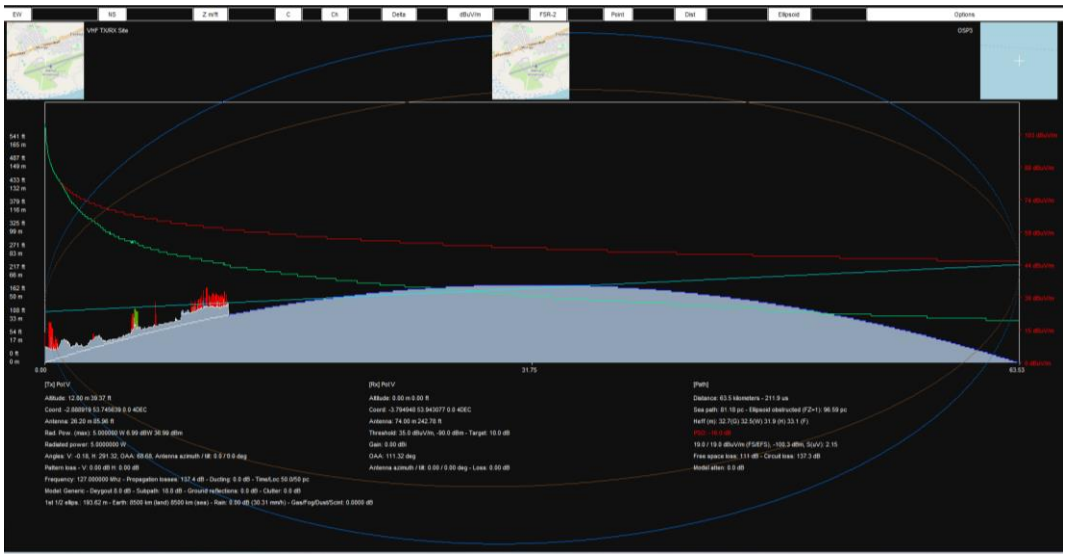

Figure 5 - OSP3 LOS Profile

A1.3.4 OSP4

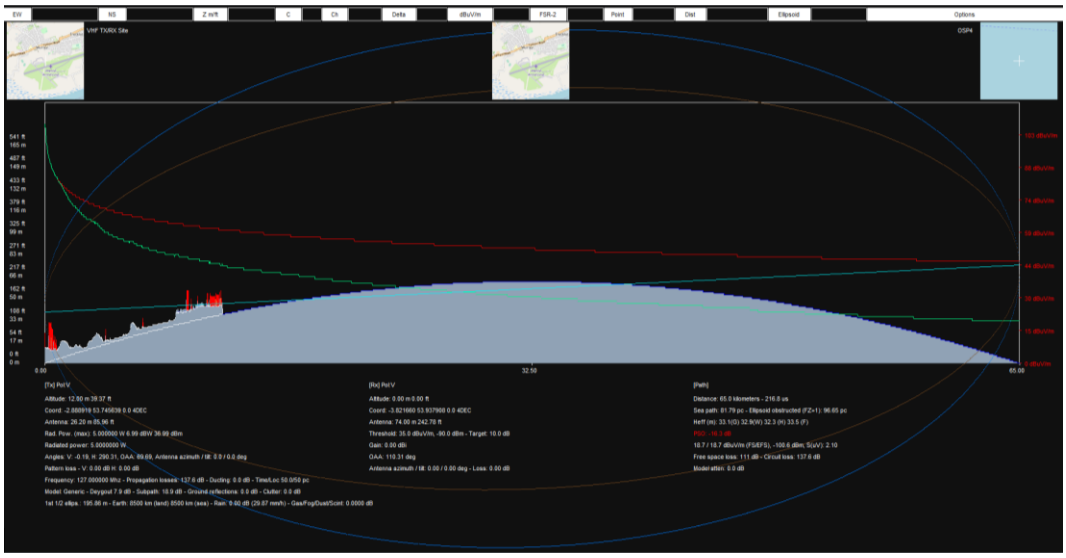

Figure 6 - OSP4 LOS Profile