From: Victoria Lane (Brodies Solicitors)
To: Hornsea Project Three
Cc: Karen Hamilton (Brodies Solicitors)
Subject: Spirit Energy ISH 1 Submission - Appendices List and Appendix ZD - ZO [BRO-D.FID4510105]
Date: 14 December 2018 23:26:32
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image008.png
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image012.png
SE ISH 1 - Appendix ZN - Comprehensive analysis of flying conditions (percentage frequency outcome) based on 3-hourly weather date for J6A (1 October 2017 – 29 September 2018)_44088947_1.PDF
SE ISH 1 - Appendix ZM - Expert assessment of flying conditions for ARA – Sample of weather forecasts at Block J-West (1 October 2017 – 29 September 2018)_44088940_1.PDF
SE ISH 1 - Appendices List - 14 December 2018_44089241_1.PDF
SE ISH 1 - Appendix ZO - Issue Specific Hearing 1 (4 December 2018) - Summary of Evidence_44089235_1.PDF
SE ISH 1 - Appendix ZL - Composite of SE and Orsted Maps (including nautical miles diameter and air or surface)_44088926_1.PDF
SE ISH 1 - Appendix ZK - Map of Hornsea and 7.5nm radius (including nautical miles diameter and air or surface)_44088925_1.PDF
SE ISH 1 - Appendix ZJ - Map of Hornsea and 5nm radius (including nautical miles diameter and air or surface)_44088923_1.PDF
SE ISH 1 - Appendix ZI - Map of Hornsea and 2nm radius (including nautical miles diameter and air or surface)_44088922_1.PDF
SE ISH 1 – Appendix ZH - Map of Hornsea and all radii (including nautical miles diameter and air or surface)_44088915_1.PDF
SE ISH 1 - Appendix ZG - Spirit Energy Technical Note_44089234_1.PDF
SE ISH 1 - Appendix ZF - Legislative Framework Summary - 14 December 2018_44089227_1.PDF
SE ISH 1 - Appendix ZE - Addendum to AviateQ International Limited Report (December 2018)_44089225_1.PDF
SE ISH 1 - Appendix ZD - Addendum to Noble Denton Marine Services Report to Spirit Energy Report Review of Marine Hazards (December 2018)_44089055_1.PDF

CONFIDENTIAL MESSAGE - INTENDED RECIPIENT ONLY

Please find attached Appendix ZD – ZO

Kind regards

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APPENDIX ZE

ADDENDUM TO AVIATEQ INTERNATIONAL LIMITED REPORT (DECEMBER 2018)

AviateQ International Limited

CONFIDENTIAL

Proposed Hornsea Three Offshore Wind Farm
Addendum

Date: December 2018

By: Ray Reynolds / Alan Cuttler / Neil Mackay

Distribution:

- Spirit Energy

AVIATEQ INTERNATIONAL LIMITED, UK 14TH DECEMBER 2018

TABLE OF CONTENTS

1 INTRODUCTION

1.1 This document is to be read as an addendum to the AviateQ "Proposed Hornsea Three Offshore Wind Farm" report, date 31st October 2018.

1.2 An Issue Specific Hearing relating to the Orsted Hornsea Three project was held at the Mercure Hotel in Norwich on the 4th December 2018. Various interested parties voiced their concerns about the proposed Hornsea Three project and these were responded to by a number of respective specialists representing Orsted.

2 AVIATION INPUT

2.1 With regard to matters concerning aviation and helicopter operations in particular, Orsted engaged the services of three individuals, one of whom had experience as an offshore helicopter pilot and who provided advice the Issue Specific Hearing covering helicopter Search and Rescue (SAR). The other two individuals were an ex-RAF fast jet pilot and an Environmental Assessment Methodology and Social Advisor, both of whom it is believed, did not have any helicopter operational experience.

2.2 Spirit Energy engaged the services of AviateQ who assigned three Senior Aviation Advisors to the project. Two of the Advisors were experienced helicopter pilots (Airline Transport Pilot (Helicopters) including North Sea offshore operations involving Commercial Air Transport (CAT) for the transportation of passengers with one also experienced in the SAR role. The third Senior Aviation Advisor had over 50 years' experience in aviation including as a fixed wing pilot, an aircraft maintenance engineer and as a Flight Engineer.

3 PROCEDURES

3.1 Aircraft operating procedures, including those used for Airborne Radar Approaches, are included in operator Operations Manuals. The procedures, approved by the relevant Government regulator, the Civil Aviation Authority (CAA) and trained by the operator, are to be followed by all pilots and form the basis of Standard Operating Procedures (SOPs).

The SOPs are derived from the Operations Manual (OM) which generally comprises four parts:

1. Part A (OMA): comprises all non type-related operational policies, instructions and procedures needed for a safe operation.
2. Part B (OMB): comprises all specific type-related instructions and procedures needed for a safe operation. Any differences between types, variants or individual aeroplanes used by the operator are taken into account.
3. Part C (OMC): comprises all instructions and information needed, including route and aerodrome Instructions and Information for the area of operation.
4. Part D (OMD): comprises all training instructions for personnel required for a safe operation.

An Operations Manual may include additional parts covering specialist operations such as SAR.

4 HELICOPTER PERFORMANCE DATA

4.1 The helicopter performance data used for the flight trials, detailed in Section 9 of the AviateQ Proposed Hornsea Three Offshore Windfarm Report (Hornsea3 Spirit Energy AQSR 1018) was obtained from EASA approved manufactures' Rotorcraft Flight Manuals.

5 STABILISED APPROACH

5.1 A helicopter approaching a landing point must make a stabilised approach. The purpose of a stabilised approach is to ensure the helicopter is in the correct configuration and on the correct flight path for landing, with gear down, and groundspeed at the correct value for the conditions. The aim is to minimise pilot workload in the final approach segment down to the approach termination point resulting in a safe landing.

5.2 A stabilised approach is conducted for all approaches as it provides the optimum safety configuration and follows a standard procedure for which both crew members are trained.

5.3 When carrying out a stabilised approach in low cloud or poor visibility, the helicopter needs to be established on the final approach track and within 30º of the wind direction when at a distance of 5 to 7 nautical miles from the intended offshore landing site.

5.4 An approach is stabilised when the following criteria are met:

- The helicopter is in the correct landing configuration and the indicated airspeed is stable at the briefed approach speed +/- 10 KIAS.
- The helicopter is on the correct briefed flight path.
- Only small changes in heading and power are required to maintain the flight path.

5.5 In good weather conditions the helicopter will be established on finals at least 1 nautical mile from the landing site to ensure that it is correctly configured at the 0.5 nautical mile 'gate'.

- All IFR approaches should be stabilised by 1000ft above the point of landing.
- All IFR approaches shall be stabilised by 500 feet above the point of landing.

5.6 Providing crews with repeatable operating practices designed to manage flightpath control effectively and maintain awareness of the helicopter's state offers strong mitigation against any potential loss of control.

5.7 During the past 5-7 years, systems and programmes such as Helicopter Flight Data Monitoring (HFDM) have been put in place by the offshore helicopter industry. HFDM programmes are still being fine-tuned by offshore industry working groups such as HeliOffshore to monitor the helicopter flight profiles flown and to measure the accuracy of flight. This work is delivering excellent results.

5.8 Reference Appendix 1 to this Addendum. The HeliOffshore "Proposals for Offshore Helicopter Safety Enhancements" (24th March 2017) relies on data to include operational safety issues. See Figure 1. In Figure 2, the four categories with the highest level of fatalities include "Collision with obstacle(s) during take-off and landing" and records a number of fatalities and non-fatal injuries in the occurrence categories assigned to offshore helicopter occurrences.

6 DESCENDING EN-ROUTE

6.1 In IMC the option to descend below 2,100ft whilst en-route and over the windfarm array area to remain clear of icing conditions or to attain VFR is not be possible since this would penetrate the en-route MSA.

6.2 In IMC when clear of the windfarm array, a descent may be made to the revised MSA of 1,500ft. To descend below 1,500 feet, pilots follow a prescribed and trained procedure to achieve visual meteorological conditions whether this is at 1,000 feet or as low as 200 feet during an ARA.

6.3 In IMC and routing along an HMR the MSA will be 1,500 feet. The Hornsea Three report refers to CAP 764 *"CAP 764 recommends HMRs should ideally be free of obstacles 2 nm either side of the centre line due to the requirement for helicopters to transit below the 0° isotherm level during conditions which pose an icing risk."*

It continues "*Helicopters may choose to fly as low as 500 ft. in such conditions when they are within the HMR*". Descending down to 500 feet would not be possible with, for example, vessels or jack-ups in transit/in a shipping lane or any structure such as a platform in the HMR area. While VMC may not be a requirement at 500 feet day or night when shedding ice, the obstacle clearance distance when using the weather radar would be increased to 10nm.

7 TURBINE INDUCED TURBULENCE

7.1 Turbine induced turbulence, caused by the wake of a wind turbine which extends down-wind behind the wind turbine blades and the tower, needs further consideration. CAP 764 Section 2.51 through to Section 2.61 cover the issue of turbulence also stating that, due to different parameters that need to be taken into consideration, it is difficult to scale up wake results from a small to large wind turbine. Work carried out by Liverpool University referenced in CAP 764 was based on small wind turbines of less than 30m rotor diameter (RD).

7.2 CAP 764 2.60 states that *LIDAR field measurements on a WTN250 wind turbine at East Midlands Airport, UK, indicated that statistically, the wake velocities recovered to 90% of the free stream velocity at the downstream distance of 5 RD.*

7.3 CAP 764 2.60 states *Based on the models described in the Liverpool University Research Paper, schematics of the wake region for small wind turbines are given in the following figures. The figures show the zone where wake encounter has potential to cause severe impact on the encountering GA aircraft.*

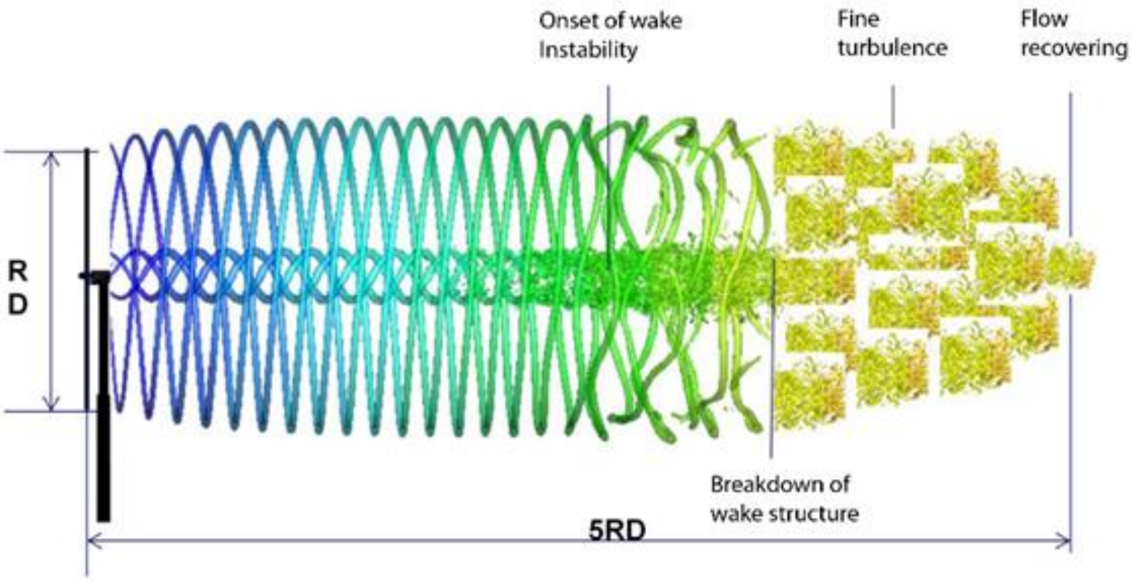


Figure 1: Schematic of the wind turbine wake. The effect of wake is weaker beyond 5-RD downwind for the wind turbines of diameter < 30m.

https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=5609

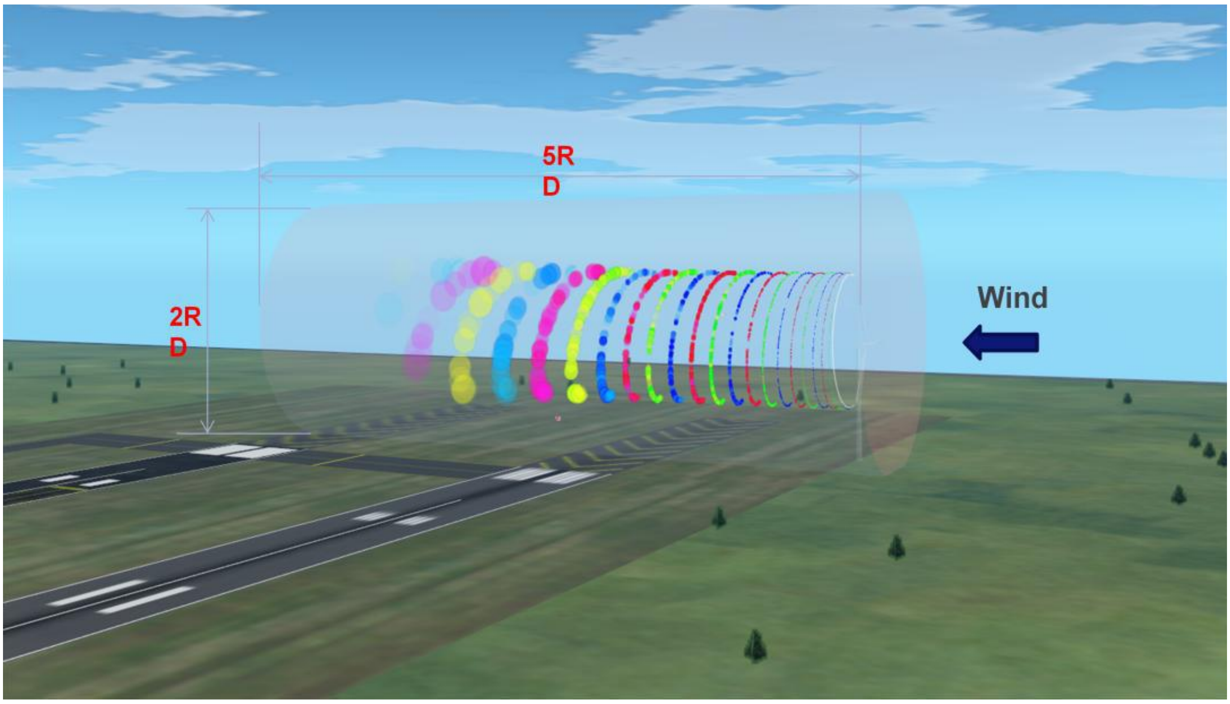


Figure 2: The cylindrical region downwind the rotor should be avoided. Its size is 5RD (downwind) by 2RD (vertical). Coloured helices indicate wake vortices and decay.

7.4 While it is difficult to scale up wake results from small to large wind turbines, based on a rotor diameter of 265m (Environmental Statement, Volume 5, Annex 8.1 Aviation (PINS Reference A6.5.8.1) (May 2018) Table 4.1, the cylindrical region downwind the rotor that should be avoided could well equate to 1,325 meters and 530 meters vertically applying the small turbine 5 RD and 2 RD guidance.

7.5 A study covering Turbine Wake Dynamics by Philip McKay, Rupp Carriveau, David S-K Ting and Timothy Newson (HTTP://DX.DOI.ORG/10.5772/53968) provides additional information in the following summary:

> *The study of wind turbine wakes is broken into two parts: near wake and far wake. The near wake region is concerned with power extraction from the wind by a single turbine, whereas the far wake is more concerned with the effect on the downstream turbines and the environment [7]. Opinions on near wake length have varied, but can be considered to fall in the range of 1 to 5 rotor diameters (1D to 5D) downstream from the rotor disc [5-6], with far wake regions dependent on terrain and environmental conditions. The full extent of far wake length is currently still under study, but may range from up to 15D for onshore sites [8]* ***and up to 14 km for offshore*** *[9]. The 5D to 15D wake region has been defined as an intermediate wake region by some [10], with the far wake pertaining to distances farther than 15D.*

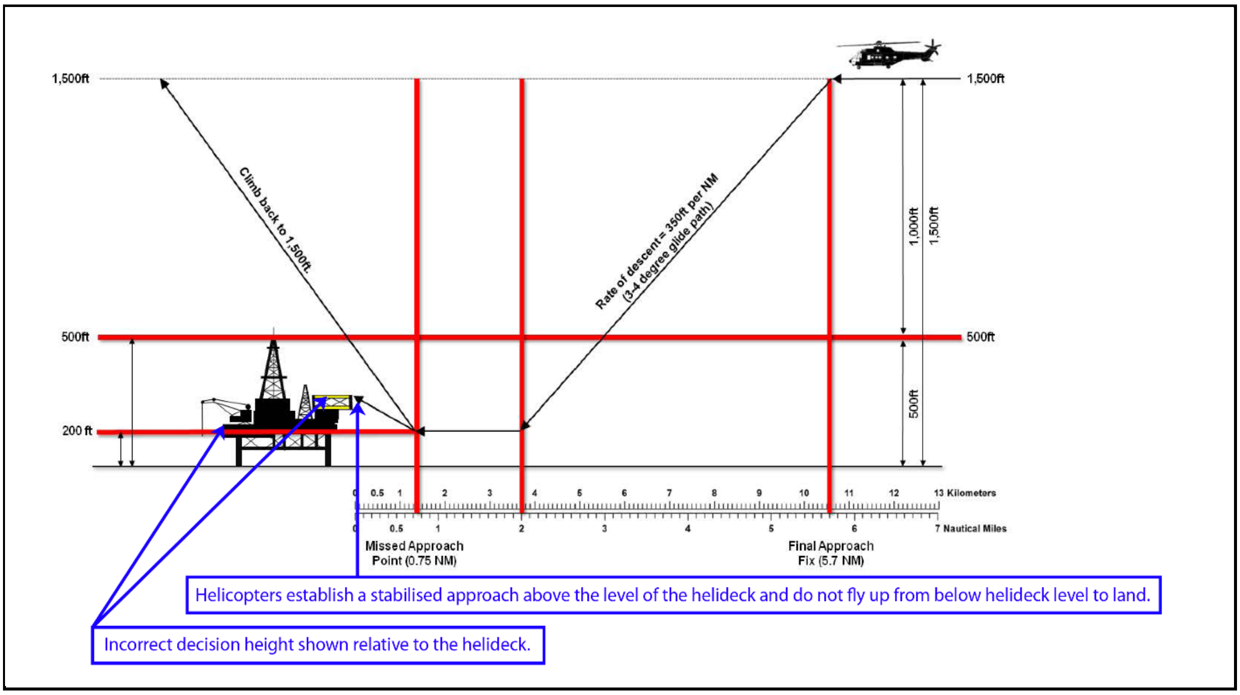
8 ORSTED APPROACH PROFILES

8.1 The diagrams, Figures Nos. 7.4 (page 22) and 7.5 (page 23) in the Environmental Statement: Volume 5, Annex 8.1 Aviation (PINS Reference A6.5.8.1) (May 2018) are in fact not correct, because they show that the MDH is 200ft which is below the height of the helideck shown on the diagrams. The Minimum Descent Height (MDH) when carrying out an ARA during the day is 200ft or 50ft above the helideck height, whichever is the higher. ARAs conducted at night require an MDH of 300ft or 50ft above the helideck height, whichever is the higher. This is addressed in paragraph 3.31(2) of CAP 764 which states:

> "Approach. Routinely, helicopters making manually flown radar/GPS approaches and, in the future, autopilot-coupled approaches, to offshore installations will commence the approach from not below 1500 ft Above Mean Sea Level (AMSL) or 1000 ft above obstacles, whichever the higher. As helicopters approaching offshore installations must make the final approach substantially into wind, the approach could be from any direction. **The obstacle-free zone must, therefore, extend throughout 360° around the installation to prevent restrictions being placed on the direction of low visibility approaches and departures**. Additionally, during the approach, all radar contacts have to be avoided by at least 1 NM which could interfere with the necessary stable approach path if manoeuvring is required. The approach sequence and descent below 1500 ft routinely commences from about 8 NM downwind of the destination installation and the final approach starts at around 5–6 NM and 1000–1500 ft. The helicopter descends to a minimum descent height (**at least 200 ft by day and 300 ft at night**), which is commonly achieved within 2 NM of the helideck having descended on a 'glide path' of between 3–4°. Thereafter, it flies level at that height towards the Missed Approach Point (MAPt). As the helicopter approaches the MAPt, a minimum of 0.75 NM from the offshore destination, the pilot must decide whether or not he has the required the necessary visual references to proceed to land or, if not, conduct a go-around following a missed approach procedure."

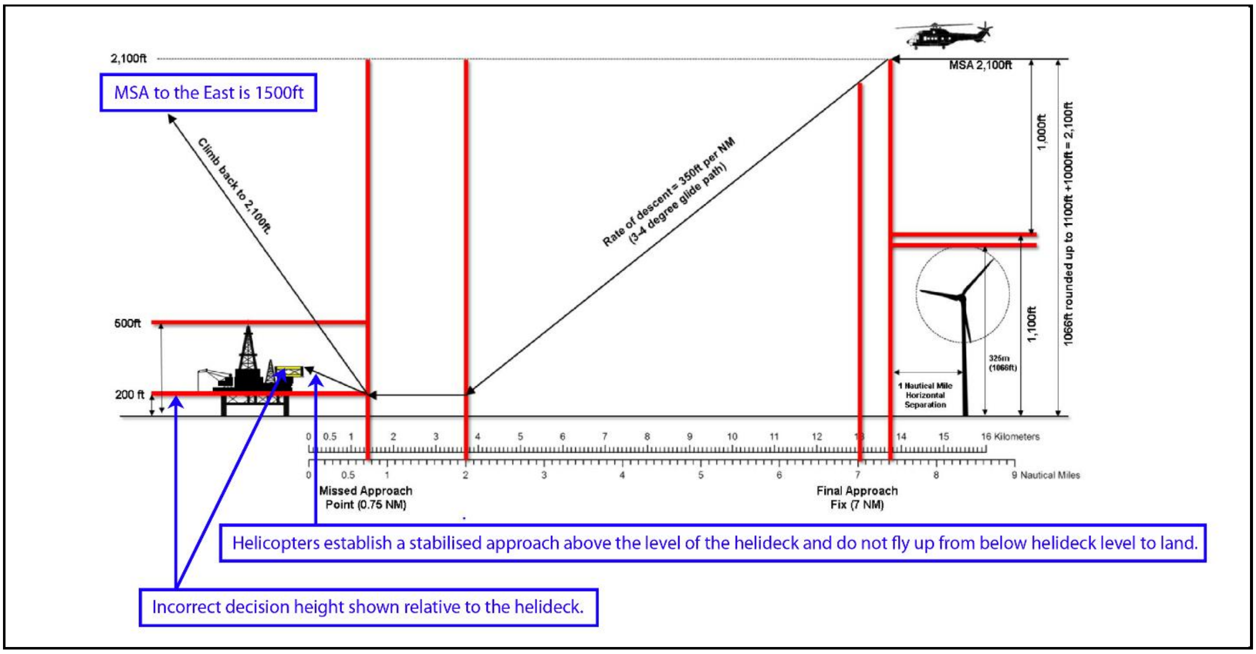
Operations to the Chiswick and Grove platforms are permitted at night.

Note that the following Figures 7.4 and 7.5 do not refer to the shallow climb rate which is addressed later.



Orsted Annex 8.1: Figure 7.4
Indicative Instrument Approach Procedure as Existing (without Turbines Present)

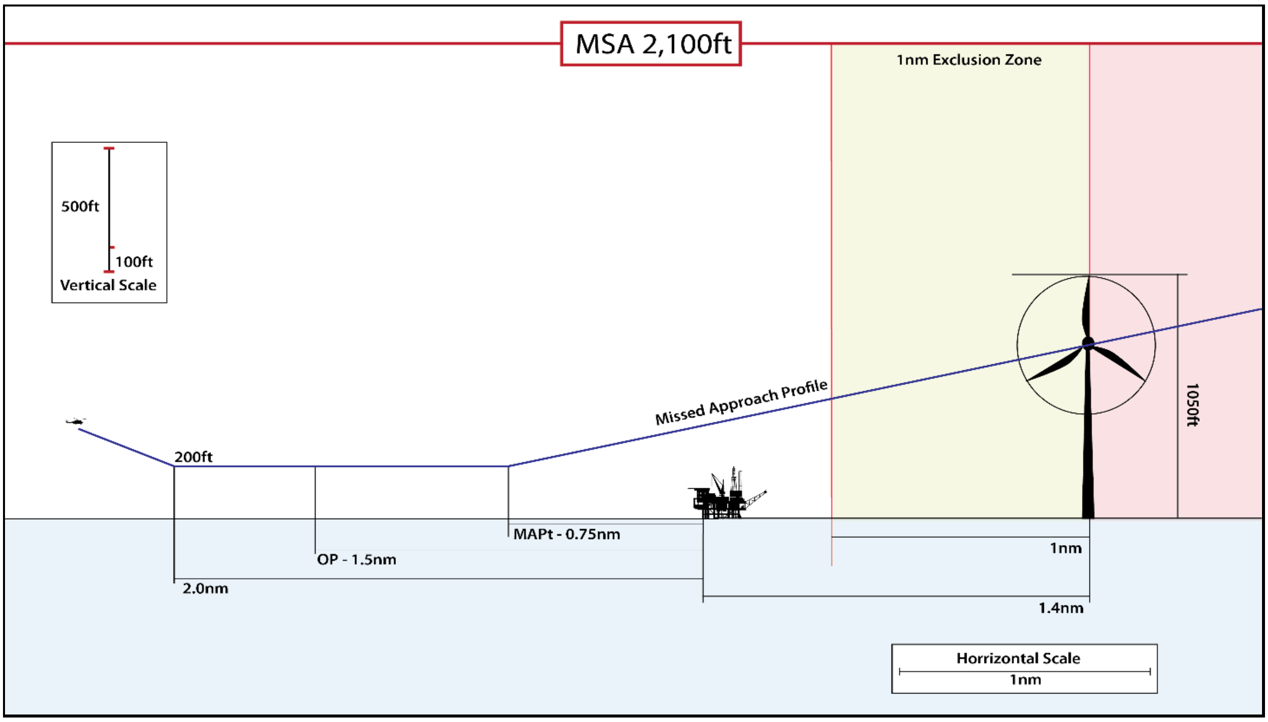
8.2 Furthermore, diagram Figure No. 7.5 in the same Environmental Statement: Volume 5, Annex 8.1, does not show the correct climb profile in the event of a missed approach. The diagram shows a helicopter approaching from over the windfarm at the MSA of 2100ft. A missed approach from this direction would be away from the windfarm and require a climb to 1500ft, which would be the MSA in that sector.



Orsted Annex 8.1: Figure 7.5
Indicative Instrument Approach Procedure as Proposed (with Turbines Present)

9 MISSED APPROACH and DEPARTURE PROFILES

9.1 An important diagram missing from the Environmental Statement, Volume 5, Annex 8.1 is a diagram showing an approach from the east and the go-around and missed approach procedure profile based on the anticipated rate of climb during the missed approach phase based on one engine inoperative shallow climb performance criteria. Any missed approach procedure executed westwards towards the windfarm array would require a climb to a minimum altitude of 2,100ft, the MSA in that sector. As can be seen from the diagram below, the aircraft would impact the turbine before reaching MSA.



Indicative ARA to Chiswick Platform - OEI Missed Approach Profile with Turbine Present: WV 270/17kts

9.2 The Missed Approach Procedure requires a volume of obstacle-free airspace of 7.5nm as a diameter around each of the Chiswick, Grove and J6A offshore platforms in which to safely execute the MAP. The Figure No. 7.10 of ES Volume 5, Annex 8.1, Aviation (PINS Reference A6.5.8.1) (May 2018) shows the area in green of a 7nm diameter volume of constrained airspace around each of those platforms. To comply with relevant CAA approved OM procedures for the relevant helicopter type, the diameter would be required to be increased to 7.5nm. In that situation, the available obstacle-free airspace would be provided in which to safely execute OM procedure for MAP. That would be in line also with CAP 764: *3.31*

9.3 *3.31 (2). Approach. Routinely, helicopters making manually flown radar/GPS approaches and, in the future, autopilot-coupled approaches, to offshore installations will commence the approach from not below 1500 ft Above Mean Sea Level (AMSL) or 1000 ft above obstacles, whichever the higher. As helicopters approaching offshore installations must make the final approach substantially into wind, the approach could be from any direction. The obstacle-free zone must, therefore, extend throughout 360° around the installation to prevent restrictions being placed on the direction of low visibility approaches and departures…*

9.4 *3.31(3). Go-Around and Missed Approach Procedure (MAP). Upon initiating a go-around, the pilot will follow a MAP whereby the helicopter is either turned away from the destination structure by up to 45° and climbs, or climbs straight ahead depending on the procedure being used. The anticipated rate of climb during the missed approach phase is based upon one engine inoperative performance criteria and could be quite shallow (1–2°). For obvious safety reasons, a go-around involving a climb from the minimum descent height needs to be conducted in an area free of obstructions as this procedure assures safe avoidance of the destination structure.*

9.5 *3.31(4). Departure Procedure. On departure from an offshore installation the aircraft will be climbed vertically over the deck to a height determined by its performance criteria and is committed to the take off once a nose down attitude is adopted. If during this phase an engine failure is experienced then the anticipated rate of climb will be the same as described above for the MAP; however, the climb could start from as low as 35 ft above sea level dependent on deck height. The distance to climb to a safe altitude by which either a turn can be carried out, or straight ahead, to reach separation from obstacles will be dependent on aircraft one engine inoperative performance criteria….*

9.6 *3.32. In summary, obstacles within 9 NM of an offshore destination would potentially impact upon the feasibility to conduct some helicopter operations (namely, low visibility or missed approach procedures) at the associated site. Owing to the obstruction avoidance criteria, inappropriately located wind turbines could delay the descent of a helicopter on approach such that the required rate of descent (at low level) would be excessive and impair the ability of a pilot to safely descend to 200/300 ft by the appropriate point of the approach (2 NM). If the zone is compromised by an obstruction, it should be appreciated that routine low visibility flight operations to an installation may be impaired with subsequent consequences for the platform operator or drilling unit charterer. One such consequence could be that the integrity of offshore platform or drilling unit safety cases, where emergency procedures are predicated on the use of helicopters to evacuate the installation, is threatened. Additionally, helicopter operations to wind farms may impact on oil and gas operations.*

9.7 Indicative turbine Layouts A and B in Figures 3.9 and 3.10 of Environmental Statement Chapter 3, Project Description (PINS Reference A6.1.3) (May 2018) read with the diagram in Environmental Statement Figure 7.10 of Volume 5, Annex 8.1 (PINS Reference A6.5.8.1) (May 2018) shows the envisaged presence of obstacles in the area of the 7.0nm diameters areas around the Chiswick, Grove and J6A platforms. There is no guarantee that a helicopter could execute safely relevant manoeuvres in such areas around the Chiswick, Grove and J6A platforms. The ensured provision of the diameters (at the correct distance of 7.5nm) around each of the Chiswick, Grove and J6A platforms (illustrated in ES Figure 7.10 of Volume 5, Annex 8.1) would enable the necessary safe execution of required relevant OM manoeuvres by helicopters in relation to those platforms. These 7.5nm diameters would also be within the CAP 765 consultation zone of 9nm.

10 COMPOUND TURNS

10.1 During the Issue Specific Hearing held at the Mercure Hotel in Norwich on the 4th December 2018, Orsted's aviation representatives referred to the ability of helicopters making "compound turns" to avoid the windfarm turbines. No such terminology could be found in aviation parlance. It is assumed Orsted's representatives were referring to circling approach procedures since Environmental Statement Volume 5, Annex 8.1 para 7.4.4.8 refers to circling approaches.

11 CIRCLING APPROACH PROCEDURE

11.1 The operating minima for a downwind ARA and a subsequent circling approach procedure is a MDH of 300ft or deck height plus 100ft during the day and 500ft or deck height plus 100ft during the night whichever is the greater. The decision range increases from 0.75nm to 1nm day and 1.5nm at night. If visual reference is lost while circling due to for example inadvertent entry into cloud, irrespective of the location of the aircraft in the circling area, the handling pilot must execute a missed approach, climbing until the MSA is reached.

11.2 A straight in ARA is the safest procedure that simultaneously brings the helicopter to a MAPt of 0.75nm at 200 feet with the aircraft in a stabilise approach configuration. However, placing the windfarm turbines near to the Chiswick and Grove production platforms would preclude an into wind ARA due to obstructions within 1 nautical mile of the missed approach segment as shown in the main report.

11.3 A straight in ARA to an intermediate structure provides the same level of safety (0.75nm at 200 feet) but a low level shuttle to the destination is unlikely since the operating minima stipulates a higher cloud base. See main report section 4.3.

11.4 The risks associated with a circling approach in poor visibility are much higher than that for other types of approach.

Note 1: Inadvertent flight into IMC occurs when an aircraft is operating in visual conditions and unexpectedly enters an area of low or zero visibility such as low cloud or snow showers. If the aircraft is at low level (below 500 feet) on an approach to land on an off-shore helideck, this has the potential to be a hazardous condition unless the aircraft is configured correctly and is following the stabilised approach procedures.

Note 2: Visual approaches in poor visibility increase pilot workload and increase the risk of pilot disorientation; this practise has resulted in several helicopter accidents in the North Sea.

12 WEATHER DATA

12.1 Orsted's assessment of meteorological conditions affecting flight operations to gas production platforms in close proximity to the wind farm eastern boundary (the Chiswick and Grove platforms) was provided in Volume 5, Annex 8.1, paragraph 7.4.4.8 of the Environmental Statement. The information was of a general nature and not specific concerning the percentage of time and number of days that an instrument approach (ARA) would be required.

12.2 The report assumed that low cloud and poor visibility may occur 15% of the time. A further assumption was made that during this 15% period, an instrument approach (ARA) would be required for 5% of the time with circling approaches made during the remaining 10% of the time. However, the report also states that an instrument approach procedure is conducted, due to low cloud or poor visibility in the platform facility, approximately 5% of the time. This appears to contradict with the first sentence above. Supporting evidence has not been made available but was apparently obtained in discussions with a helicopter operator. Spirit Energy challenges the accuracy of the information provided in the Environmental Statement: Volume 5, Annex 8.1 and recommends that the study data be sent for review /verification to all parties concerned.

No of Days Sampled	**200**	
No of Days ARA Required Annually	**88**	24% of the year*
No of Days ARA Required Annually on 60% Probability	**32**	8.5% of the year*
No of Days ARA Required Annually on 30% Probability	**22**	6% of the year *
Period Sampled 1st October 2017 through to 30th September 2018		
* **Signifies several flights may be required during the affected days**		

Explanation for the number of days per year resulting in an ARA to EACH of the facilities operated to:

- an ARA would be required to be conducted 88 days per year for any flight for that day.
- 60% of the time during a period of 32 days in the year may result in an ARA instrument approach due to weather conditions for a particular flight e.g. the first flight of the day affected due to slowly clearing patches of low cloud.
- 30% of the time during a period of 22 days in the year may result in an ARA instrument approach due to weather condition for a particular flight e.g. a flight affected at night due to low visibility resulting from temporary passing snow or rain showers.

13 SUMMARY

Aviation operations are complex. The Environmental Statement, Volume 5, Annex 8.1 contains various assumptions which are not 100% correct and which appear to have influenced the assessment work undertaken leading to Orsted's conclusions on aviation. Included in the assumptions are:

1. The ability for aircraft to descend to 500 feet while following a Helicopter Main Route (HMR); 4 mile corridor. This is not the case since consideration had not been given to obstructions such as shipping in the vicinity of the HMR and the need for a cleared area with no radar return within 10 nautical miles of the aircraft.
2. The report lacks a full appreciation of the challenges faced by CAT offshore helicopter operations in a hostile environment, overlooking the need for standardisation, consistency and repeatability when pilots are carrying out approaches and departures from offshore installations. The authors appear to be unaware of the recent progress in the industry with the introduction of Helicopter Flight Data Monitoring (HFDM) and helicopter stabilised approaches during visual approaches as well as during the instrument phase of an approach.
3. The practice of cloud breaks en-route over unobstructed areas of open seas have evolved with better and more restrictive defined parameters and would not be carried out in obstructed sea areas.
4. Based on Block J-West weather forecasts for the J6A area, covering the 12 month period between 1st October 2017 and 30th September 2018, it is clear that the proposed location of the windfarm would prevent helicopters from executing the standard procedures discussed in this addendum and the main report on a far greater number of days than stated in the Environmental Statement, Volume 5, Annex 8.1.
5. The effects of wind turbine induced turbulence requires further research.

Accordingly, the overall conclusions of the Environmental Statement, Volume 5, Annex 8.1 are not robust.

14 CONCLUSION:

The proposed location of the Hornsea Three wind turbines relative to the Chiswick and Grove offshore production platforms introduces obstructions that impact on the ability to safely conduct essential instrument flight procedures to these facilities in low visibility conditions. Access to these facilities is needed 365/24/7. Consequently, the resulting restrictions affect not only normal helicopter operations but also affect Sprit Energy on a commercial and safety basis with the latter impacting the integrity of each of the Chiswick and Grove offshore installation safety cases where emergency procedures are predicated on the use of helicopters to evacuate these installations when manned.

Appendix 1: Proposals for Offshore Helicopter Safety Enhancements

Extract from the HeliOffshore Safety Strategy.

The following data informs the HeliOffshore Safety Strategy, which is what we have used as the basis to agree which areas we should focus on to enhance safety performance. The following excerpt from the recent EASA accident report gives a good basis for discussion, for example, system failure, aircraft upset, and obstacle conflict have the highest percentage of accidents, so we have selected these as justification for our priority areas to focus on to improve safety.

		Key Risk Areas (Outcomes)							
	Outcome Percentage of Fatal Accidents (Last 15 Years)	27.8%	16.7%	13.9%	8.3%	5.6%	0%	0%	0%
	Outcome Percentage of Non-Fatal Accidents (Last 15 Years)	34.4%	8.2%	9%	4.9%	4.9%	4.1%	1.6%	0.8%
Safety Area	Safety Issues	System Failure	Aircraft Upset	Obstacle Conflict	Terrain Conflict	Fire	Abnormal Runway (Landing Area) Contact and Excursions	Airborne Conflict	Incursions and Wrong Deck Landings
Operational	Detection, Recognition and Recovery of Deviation from Normal Operations		•	•	•	•	•	•	•
	Control of the Helicopter Flight Path and Optimal Operational Use of AFCS Capabilities		•	•	•		•	•	•
	Obstacle Clearance			•	•			•	
	Operation in Adverse Weather Conditions		•	•	•		•	•	•
	Fuel management	•	•						
	Flight Planning and Preparation		•	•	•	•	•	•	•
	Ground/ Helideck Operations	•	•	•		•	•		•
	Safe Landing Environment			•		•	•		•
	Helicopter Maintenance	•	•	•	•	•	•	•	•
Technical	Diagnosis of System Failures	•	•			•	•		
	Gearbox and Transmission System Reliability	•	•						
Consequences	Safe Forced Landings	•	•	•	•	•	•	•	•
	Safe Survival and Egress	•	•	•	•	•	•	•	•
Human Factors	Flight Crew Perception and Awareness		•	•	•		•	•	•
	CRM and Communication		•	•	•		•	•	•
	Knowledge and Competency of Individuals	•	•	•	•	•	•	•	•
	Personal Readiness	•	•	•	•	•	•	•	•
	Use of Rules and Procedures	•	•	•	•	•	•	•	•
Organisational	Crew Composition and Management		•	•	•		•	•	•
	SMS Implementation	•	•	•	•	•	•	•	•

Figure 1: Excerpts from EASA Report Offshore Helicopter Risk Portfolio from the last 15 years of global and offshore operations only

To enable an initial consideration of the Key Risk Areas (Outcomes) for the Offshore Helicopter Safety Risk Portfolio, the following chart provides details of the occurrence categories that were assigned to offshore helicopter occurrences.

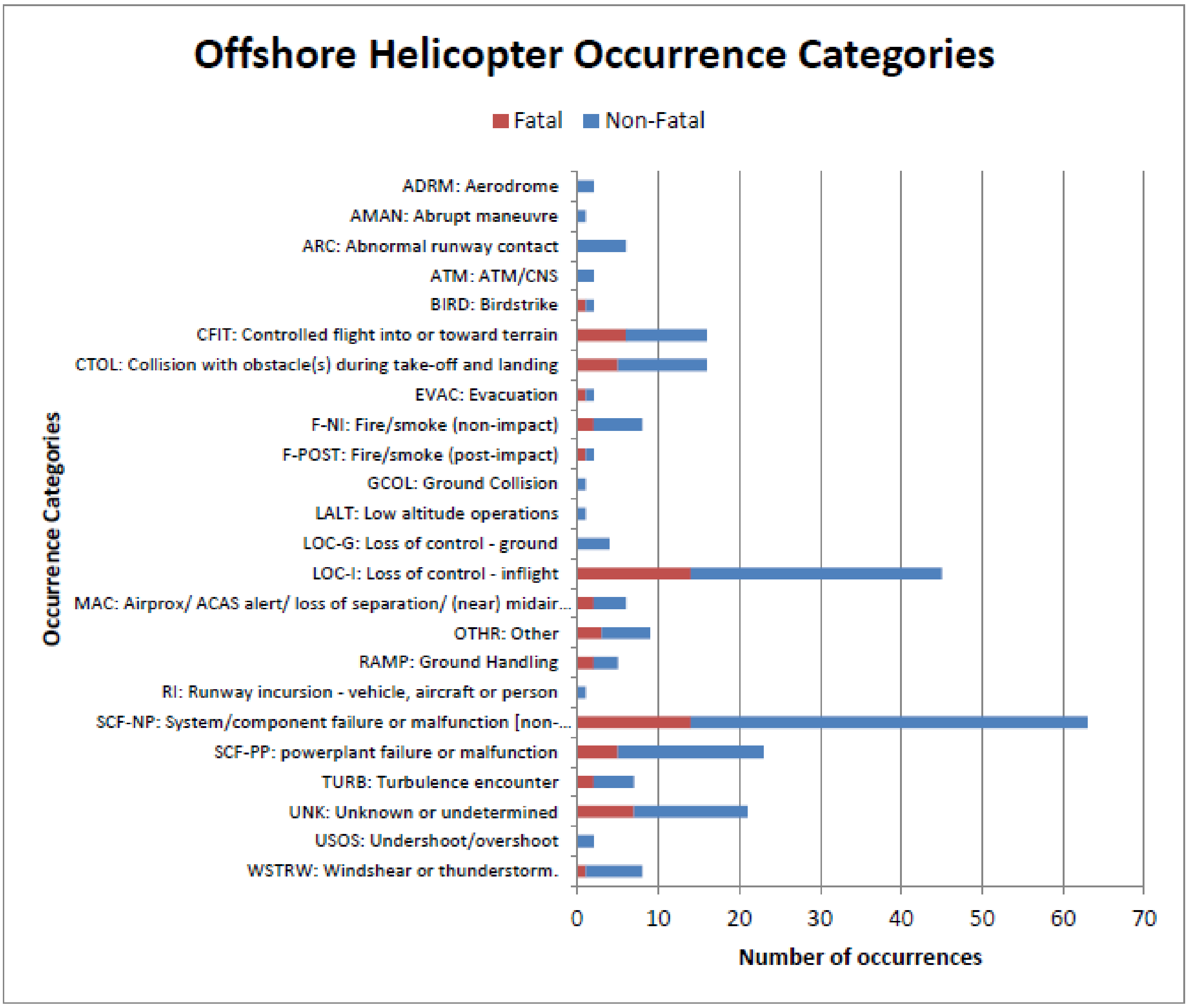


Figure 2: Offshore Helicopter Occurrence Categories from EASA Safety Risk Profile

The four categories with the highest level of fatal accidents are:

1. System/component failures or malfunction
2. Loss of control in-flight
3. Controlled flight into or toward terrain
4. Collision with obstacle(s) during take-off and landing

http://helioffshore.org/wp-content/uploads/2016/07/HeliOffshore-Safety-Proposals-v3.1.pdf