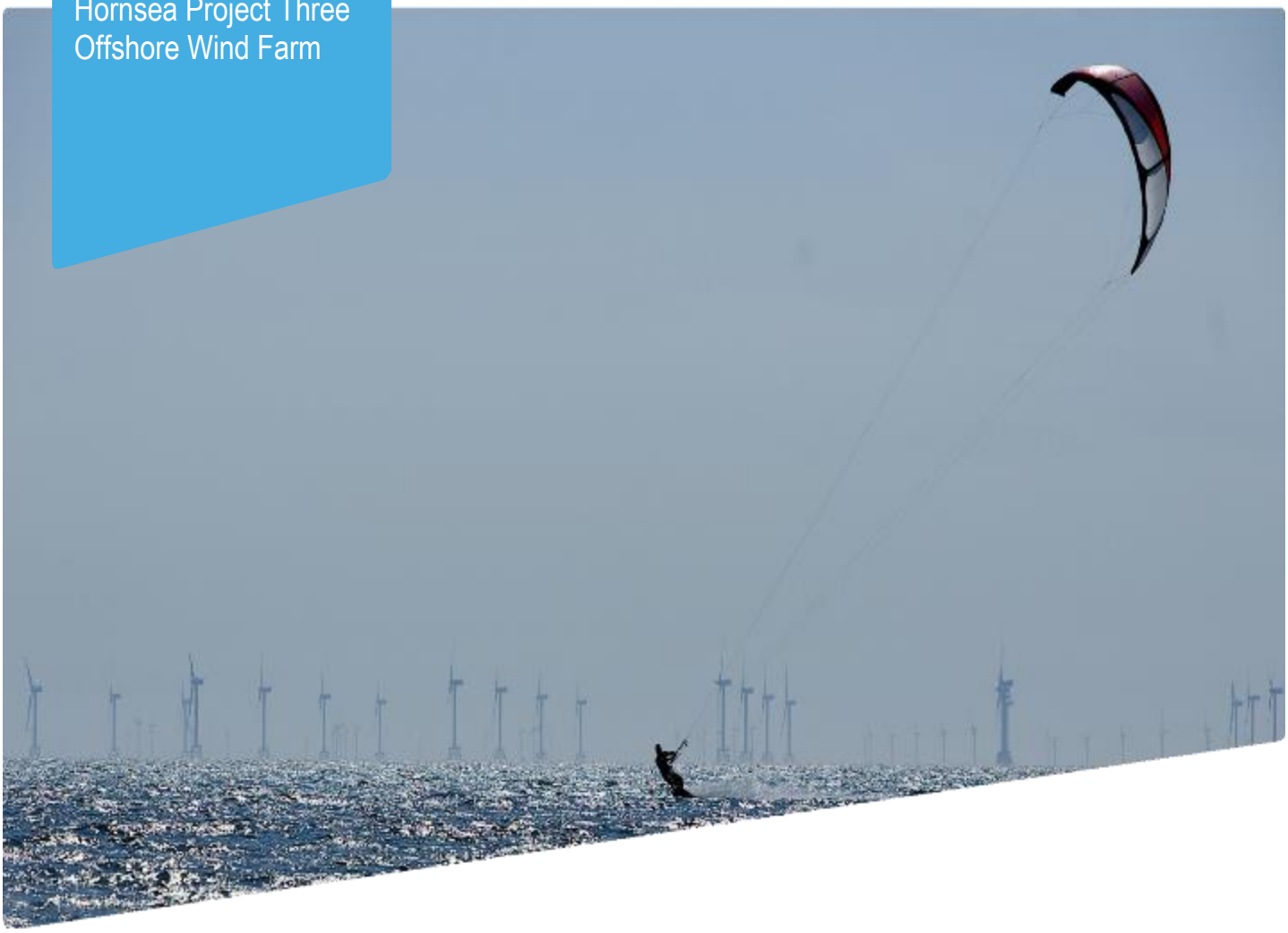
Hornsea Project Three
Offshore Wind Farm



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Appendix 22 to Deadline 7 submission - Position Statement on Turbulence

Date: 14th March 2019

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Ørsted

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5 Howick Place,

London, SW1P 1WG

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2018.

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1. Introduction

1.1 Spirit Energy raised a concern at Deadline 4 (REP4-138) that the effects of turbine induced turbulence have not been considered by the Applicant. The Applicant submitted at Deadline 5 that turbulence was considered in Volume 2, Chapter 8: Aviation, Military and Communication of the Environmental Statement (APP-068) and that it was screened out of the assessments. This was based on guidance provided in CAP 764, that there were no Mandatory Occurrence Reports (MOR) of such incidents (paragraph 2.54 of CAP 764), and the fact that the Hornsea Three array area would not be in the vicinity of an aerodrome and at a distance offshore not to anticipate light sport aviation (paragraph 2.57 of CAP 764) (see Table 8.9 of Volume 2, Chapter 8: Aviation, Military and Communications of the Environmental Statement.

1.2 The Applicant advised that they were seeking guidance on turbulence from their internal aviation specialists who have considerable experience of operating in and around wind farms. In addition, and in order to provide further assurance to Spirit Energy in this regard, the Applicant advised they would progress a meeting with a leading academic on this subject and will provide further assurance following this meeting.

1.3 This position statement presents the outcome of consultation in this regard.

Ørsted internal position on turbulence

1.4 Ørsted is the market leader in the offshore wind industry with 18 operational wind farms and 6 offshore wind farms under construction. As such Ørsted has an internal aviation group within the company which is managed by a team of 4 aviation experts who manage the aviation contracts serving these wind farms.

1.5 Helicopters are used during both the construction and operation and maintenance phase of wind farms in the UK and overseas. Ørsted uses helicopters to transport equipment and personnel during construction and operational and maintenance activities, both to the transformer substations with the array and to the turbines themselves where they undertake hoist operations during maintenance activities.

1.6 Ørsted are in the process of constructing Hornsea Project One which will have their first offshore accommodation platform equipped with a helideck located within the Hornsea Project One array. Ørsted are currently in the process of developing flight plans for helicopter access to this platform for personnel transfer.

1.7 The largest scale wind turbines that Ørsted presently operate are 8 MW with a rotor diameter of 164 m.

1.8 Ørsted pilots and contracted helicopter operators have unparalleled experience operating within and around wind farms. The Ørsted aviation group have not had any reports of the wind turbine induced turbulence having a significant effect on any of their flights. The pilots report that in some instances when operation within a wind farm the effect of turbulence can be felt, and in certain winds it can be bumpy, but that the effects have not been significant enough to interfere with the stability of flight or the ability to conduct stable approaches, so as not to require reporting

1.9 The Applicant discussed turbulence with the helicopter operator CHC and they advised that they had not encountered wind turbine induced turbulence as a problem when flying in proximity to wind turbines.

Mandatory Occurrence Reports

1.10 CAP 764 advises that there have been no Mandatory Occurrence Reports (MOR) or aircraft accident reports related to wind turbines in the UK (paragraph 2.54 of CAP 764) with the statement verified up to June 2015. The Applicant is presently seeking to obtain an update on this report.

CAA Guidance and further research

1.11 CAA provide guidance on turbulence in CAP 764. They conducted a literature survey with the University of Liverpool to establish the scale and the advances of current research on this front (paragraph 2.52 CAP764).

1.12 The CAA reported in CAP 764 that they have investigated the effects of small wind turbine wakes on General Aviation (GA) aircraft with the University of Liverpool (paragraph 2.55 of CAP 746). The results of this study show that wind turbines of rotor diameter (RD) of less than 30m should be treated like an obstacle and GA aircraft should maintain a 500ft clearance. The report advises that as the wind turbine wake is dependent on many parameters (the thrust generated by the rotor, the blade tip velocity ratio, wind direction and speed, turbulence level in free stream, weather conditions and the geometry of wind turbine), it is therefore difficult to scale wake results from a small to a large wind turbine.

1.13 The report goes on to discuss the results of a study conducted using LIDAR field measurements on a WTN250 wind turbine at East Midlands Airport, UK (paragraph 2.60 of CAP 764), which indicated that statistically, the wake velocities recovered to 90% of the free stream velocity at the downstream distance of 5 RD. Consideration should be given to the type and stability of the helicopter used in the trials and how this compares to the current helicopter fleet and stability capabilities used in the North Sea. CAP 764 cites that further work will be conducted by University of Liverpool in this regard.

1.14 The Applicant consulted with the leading experts at the University of Liverpool to ascertain if further modelling on larger wind turbines had been carried out. The Applicant undertook a consultation meeting with Dr White of Liverpool University and Professor Barakos of University of Glasgow (20 February 2019). They reported that there are two research groups which have been established to study the wake effect from wind turbines on helicopters. These are the NITROS (Engineering for Rotorcraft Safety) Research and GARTEUR (Group for Aeronautical Research in Europe) research. This research has enabled further modelling to be undertaken on wake effects however these models have still not been validated. The experts advised that it is not possible at the present time to define what is the exact distance that helicopters may be affected from a turbine as consideration must be given to the turbine size, geometry and proximity to other turbines, and the size and type of helicopters to be flown.

1.15 The wake effect may be measurable down wind of a wind turbine, however what is of importance is the effect of this on a helicopter's stability, i.e. the level at which the turbulence has an effect. To be able to provide an accurate assessment of this distance, the models will need to be verified against the actual wind turbines (specific size and geometry) to be installed and the specific helicopters to be flown.

1.16 A report by NLR (2016) has been published as part of the GARTEUR research. The report modelled a single 8MW turbine and presented a literature research for multiple turbine (wind farm) effect. The report advises that the results require real time validation.

1.17 The report concluded that at a distance of nearly 6 wind turbine RD is required to ensure that a gust limit to sudden lateral speed change for all wind directions is not higher than 6 kts.

1.18 The gust limit of 6kts is the maximum allowable sudden reduction in wind speed for a fixed wing aircraft. This is reported as a conservative approach because helicopters will generally be less sensitive to crosswind disturbances than fixed wing aircraft. The report therefore also considers gust limits of 10.5 kt and 15 kts. Whilst 6RD distance is given for 6 kts, the report goes on to say that if the criteria for 10.5 kts and 15 kts is used the safety separation distance for helicopters is reduced to 2RD.

1.19 The report advises that for a wind farm (multiple turbines) the results of a literature review (on modelled data again not verified) could increase the value (6RD based on 6kt limit) to a worst case of 8 RD.

1.20 The Netherlands Enterprise Agency contracted a desktop study to look at the accessibility of oil and gas platforms near the offshore wind farm zones Hanndse Kust (zuid and Noord) by helicopter (To70, 2017). This study assumes wind farm generated turbulence is not critical for safe helicopter flight operation beyond a distance equal to 8RD (worst case condition) and cites the NRL (2016) report.

1.21 It can be seen from the review of the NRL information that this may actually be a misleading value and is dependant not only on the turbine size, geometry and array layout, but also on the helicopter stability limits of the CAT and SAR helicopters used in the North Sea. It is important to distinguish between safety distances that should be applied for very light sport aviation such as gliding, parachuting, hang-gliding, paragliding or microlight operations from stabilised CAT helicopters.

Summary position

1.22 The Applicant is not aware of wind turbine induced turbulence having a noticeable effect on the stability of helicopters from consultation with the internal aviation group, or with the helicopter operators CHC or as reported by CAA in regard to there being no Mandatory Occurrence Reports (MOR) of such incidents (paragraph 2.54 of CAP 764). CAP 764 is the only UK Government Guidance on turbulence and it does not provide for a safety separation distance to be applied.

1.23 The Applicant therefore maintains its position that the effect of turbulence from the wind turbines on helicopter operations is not a significant issue. Whilst there is considerable modelling work now ongoing in this regard the data presented has to date not been verified against Round 3 offshore wind farms and using Civilian Air Transport (CAT) and Search and Rescue (SAR) North Sea helicopter stability capabilities. The Applicant supports the validation of current modelling work such that applicable distances can be established cogniscent of aircraft type and stability capabilities.

References

CAA (2016) CAP 764 Policy and Guidelines on Wind Turbines

NLR (2016) NLR-CR-2016-266 Offshore windturbine zog en veilige helikopteroperaties

To70 (2017) Helicopter accessibility of oil & gas platforms near the offshore wind farm sites Hollandse Kust (zuid and noord) Desk study report. April 2017.