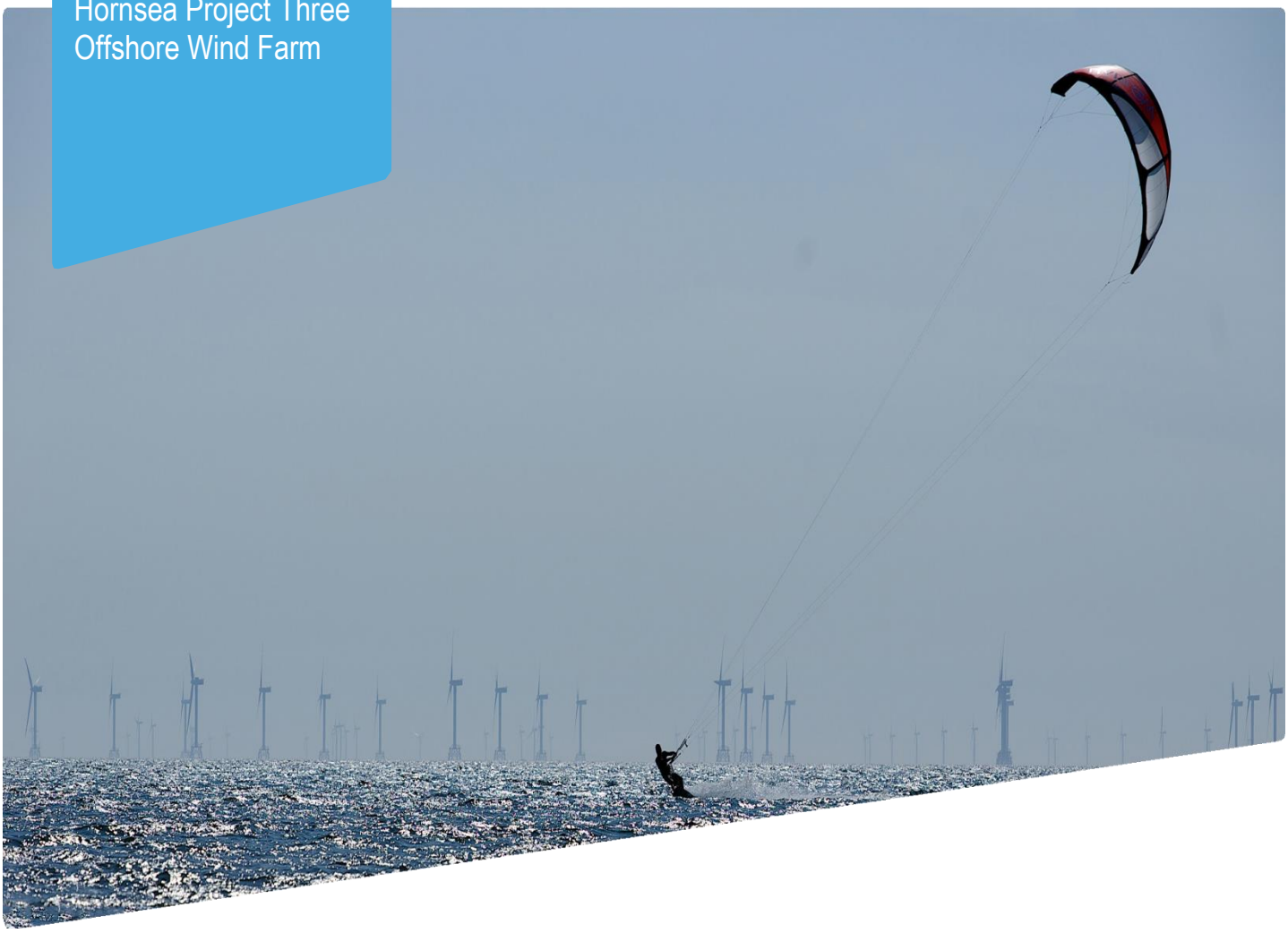
Hornsea Project Three
Offshore Wind Farm



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Appendix 42 to Dealine 7 submission - Position statement in relation to the Radar Early Warning System at J6A platform

Date: 14th March 2019

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Document Control			
Document Properties			
Organisation	Ørsted Hornsea Project Three		
Author	RPS		
Checked by	Karma Leyland		
Approved by	Andrew Guyton		
Title	Appendix 42 to Dealine 7 submission - Position statement in relation to the Radar Early Warning System at J6A platform		
PINS Document Number	n/a		
Version History			
Date	Version	Status	Description / Changes
14/03/2019	A	Final	Submitted at Deadline 7 (14th Mar 2019)

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.

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1. Executive Summary

1.1 Within the Application, consideration was given to the potential for Hornsea Three to impact on the Radar Early Warning System (REWS) located on the Spirit Energy operated J6A platform and providing radar coverage for the J6A, the Chiswick and the Grove platforms (all Spirit Energy operated) (Volume 2, Chapter 11: Infrastructure and Other Users of the Environmental Statement).

1.2 Following submission of the Application, there have been a number of iterations refining the understanding and definition of the system that is in operation on the J6A platform. These iterations, and the corresponding updates to the assessment of potential impact, have been reported to the Examining Authority by the Applicant and Spirit Energy through various Deadline submissions during Examination.

1.3 On the 1st March 2019, a meeting was held between the Applicant, Spirit Energy and Spirit Energy's radar operator and vendor. This meeting verified the details of the system in operation on the J6A platform. The meeting also enabled discussion to be held between relevant experts from both parties with regards to the potential implications of the operational presence of Hornsea Three on the radar system.

1.4 Via this meeting, the radar on the J6A platform has been verified as being a REWS, which includes both Radar and AIS vessel tracking and alarming. The radar specifications are very similar to those originally assessed within the Application. The original assessment concluded that the presence of Hornsea Three may cause the REWS to lose tracks of the vessels and fail in raising TCPA alarms in a timely manner. As a result, the Application proposed 'designed in mitigation' to ensure that the effects on the radar would be reduced to a level that is not significant.

1.5 From the outcome of the consultation meeting held on the 1st March 2019, the Applicant understands that whilst specifications of the radar are similar to those originally assessed within the Application, the capabilities of the software are better and more capable than anticipated during the Application assessment. The existing J6A platform system employs advanced tracking and thresholding algorithms which are anticipated to be sufficient to deal with any potential wind farm related shadowing and thresholding effects.

1.6 It was therefore agreed during the meeting on the 1st March 2019 that trials could be conducted on the J6A radar, following completion of construction of Hornsea Three, i.e. when the project is operational. These trials would verify whether or not the REWS is operating within its acceptable limits. If not, it was agreed that mitigation, most likely in the form of software upgrades to that REWS could be undertaken to remove those effects of Hornsea Three.

1.7 As such, the Applicant has included proposed Protective Provisions (as submitted at Deadline 7) in relation to the REWS at J6A. These proposed Protective Provisions allow for a REWS mitigation proposal to be agreed between the parties in the event that an adverse impact on the REWS is caused by the operation of Hornsea Three. Such mitigation would be implemented and maintained at the Applicant's expense. The Applicant remains committed to working with Spirit Energy to ensure that the J6A REWS is able to continue to operate effectively post construction of Hornsea Three.

2. Introduction

2.1 The Applicant submitted an assessment of the potential for an impact, due to the operational presence of Hornsea Three, on a Radar Early Warning System (REWS) located on the Spirit Energy operated J6A platform (Volume 5, Annex 11.1: Radar Early Warning System Technical Report of the Environmental Statement; APP-119).

2.2 The Applicant has since received conflicting information in regard to the radar system used on the J6A platform (see the Applicants response to section 6.4 of Sprit Energy's Written response at the Applicants comments on written representations and responses submitted at Deadline 4 (REP4-011)).

2.3 The Applicant therefore sought to verify the details of the REWS on the J6A platform through a meeting with the Spirit Energy operator of the radar and the radar vendor, as set out in the Applicants response at Deadline 5.

2.4 This verification was completed through a consultation meeting which took place on 1 March 2019. The meeting was attended by representatives from The Applicant and Spirit Energy, as well as the Spirit Energy radar operator and the radar vendor.

2.5 This position statement outlines the present understanding of the Applicant in regard to the REWS on the J6A platform. The statement presents the proposed method for the mitigation of any potential effects on the REWS arising as a result of Hornsea Three.

3. Background

3.1 A REWS is primarily used to detect and track vessels navigating within the vicinity of offshore oil and gas assets and provide collision warning and evacuation alarms when vessels meet defined Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) parameters.

3.2 There is the potential for Hornsea Three to have an effect on the REWS on the J6A platform due to the distance of Hornsea Three from the J6A platform (6.9nm) which is within the operational range of the radar. As noted, the Applicant submitted an assessment of potential impact on the J6A platform REWS in the Environmental Statement (Volume 5, Annex 11.1: Radar Early Warning System Technical Report of the Environmental Statement; APP-119).

3.3 However, the Applicant was then advised by Spirit Energy (email of April 2018) that there was in fact no REWS on the J6A platform and that there was a RACON and AIS system on the platform. Further information was provided by Spirit Energy (July 2018) which included the specifications of the equipment on board the J6A platform and a document regarding ship collision. The equipment specifications only included the RACON system and no additional radar or ARPA definitions. The ship collision study advised that the J6A platform had an ARPA provided by DECCA, which is a display and data processing technology. No specifications of the radar were provided, however it stated that the ARPA alarm range was limited to 4 nm, and so not within the range of potential effect from Hornsea Three. Based on this information the Applicant conducted an additional assessment of the potential impact of the operational presence of Hornsea Three on the RACON and AIS system, as specified, which was submitted at Deadline 1 (REP1-117).

3.4 The Applicant notes that Spirit Energy submitted new information at Deadline 3 (section 9.2 of Appendix ZG of Spirit Energy submission at Deadline 3; REP3-063). This information provided a revised definition of the relevant systems in place on the J6A platform.

3.5 The Applicant progressed a comparison of this revised definition and operational coverage with that of the REWS originally assessed (in Volume 5, Annex 11.1: Radar Early Warning Technical Report of the Environmental Statement) and concluded the specifications of the radar provided by Spirit Energy at Deadline 3 are very similar to those originally assessed (See Applicants response at Deadline 5).

3.6 The Applicant advised at Deadline 5 that whilst progress had been made in understanding the system being used, uncertainty remained in regard to its operational use. The Applicant therefore sought to verify the radar through a consultation meeting. As noted, this meeting was held on the 1st March between the Applicant, Spirit Energy (including the operator of the radar), and the radar vendor.

4. Radar specifications

4.1 The radar on the J6A platform has been verified as being a REWS and is used in the same manner as a REWS. The radar specifications are very similar to those originally assessed within the ES, as shown in the Table below.

Radar specifications and comparison with ES

Parameters	Modelled REWS (as presented in Application)	J6A REWS (as confirmed at 1st March 2019 meeting)
Gain	30 dB	31 dB
Transmitter Power	25 kW	10 or 25 kW
Frequency	9.411 GHz	9.411 GHz
Pulse Width	250 ns	250 ns
Rotation Rate	25 RPM	28 RPM
Pulse Repletion Frequency	2.0 KHz	1.8 or 3.0 KHz
Noise Figure	5.5 dB	5.0 dB
Dissipative Losses	1.0 dB	-
Beam-shape Losses	0.6 dB	-
Azimuth beam width	0.7° (nominal)	1° (maximum)
Elevation beam width	23.0°	24.0°
Antenna Height	50 m (AMSL)	Approx 44m

4.2 The radar uses a megnetron transceiver and does not employ Doppler processing.. The azimuth beam is less than 1 degree which is a narrow beam width enabling high azimuth resolution. The elevation beam height is around 20 - 25 degrees.

Thresholding Algorithms

4.3 The thresholding algorithms used in the radar are commercially sensitive, proprietary information of the radar vendor.

4.4 The vendor receives the raw radar video and then uses their proprietary algorithms that consider clutter levels and adjust the threshold according to the local environment and Spirit Energy requirements. The algorithms are able to consider objects that are causing large radar returns and will adapt to avoid loss of targets within close proximity.

Tracker

4.5 The algorithms can track a radar target in a shadow (course and speed) enabling a vessel to be followed as it routes through radar shadow. The tracker is also well equipped with the ability to track objects that may fall within a shadow region for a defined number of radar rotations. This will enable the system to maintain track of vessels travelling through shadow regions even if they lose detection momentarily.

Display

4.6 The radar typically takes 210 azimuth cuts. Additionally the radar images are not transferred to other facilities through radio links but always stay on the J6A platform.

AIS and radar communication

4.7 The AIS output is NMEA data format and has a text based type of output which is simple and effective. Encrypted AIS data is sent out which can be inputted into J6A Radar/AIS system, which is standard for nearly all AIS transponders.

5. Potential effect of Hornsea Three on the radar

5.1 The radar system can handle about 2000 targets at a time. However it was noted that for a large number of tracked targets, the computer processing power is at times not good enough to keep up with algorithms calculating the alarm criteria. In the presence of a wind farm, the system can be configured to set up each turbine as a static target/zone and it would not be included in the calculations.

5.2 The system on the J6A platform is reported to have advanced thresholding capabilities. The system can be configured to track/identify different vessels which may otherwise fall out of detection. The tracker is able to compensate for temporary loss of detection.

5.3 Once Hornsea Three has been constructed thresholding settings may require adjustment to account for the presence of the large radar echoes generated by turbines. The most likely worst case scenario will be looking directly onto the turbine blades as they might occupy more cells and have large radar signature. Turbine blades can use up multiple threshold cells but the effect is very small and is expected to be manageable with the advanced thresholding algorithms used. For the tracker to register a trackable target, the object must be successfully detected on two or four consecutive rotations, at the same speed and the same size, before these radar echoes are qualified to become a viable target.

5.4 Rotation of the blades can affect the tracking software performance as described above also due to varying turbine returns which in theory may generate false tracks. However, no practical observations have been reported to date and most trackers are sufficiently advanced now for this not to be a problem.

5.5 Radar shadows from turbines are narrow and will improve with range due to diffraction effects. Radars should be able to detect vessels that are wider than the turbine shadow and should be able to detect vessels as they pass between shadows. Spirit Energy confirmed that as soon as the vessel appears between turbines, the radar would be able to detect it. This would apply to vessels passing to the south or north of the wind farm such that the radar could detect the vessel through the wind farm.

5.6 When the radar power coming from a vessel is higher than that of the surrounding clutter, (for two or four consecutive radar rotations), then it can be tracked. The radar has 25 nm range, so the radar can detect a vessel before it enters the shadow region to the north and south of Hornsea Three. Especially with pulse integration targets can be detected even if their radar echo is very small in the case of the vessel being in the shadow of a turbine (partially shadowed or otherwise). There is only a small time a vessel is completely behind any shadow and in such cases it is understood that is momentary loss of detection compensated by the tracker.

5.7 The potential shadowing appears to not be a significant issue as the existing radar system can deal with the temporary loss of detection and the system can rely on AIS in the event of radar coverage reduction.

6. Operational Coverage and TCPA/CPA alarms

6.1 The radar on the J6A platform provides radar coverage for the J6A, the Chiswick and the Grove platforms. Different scanning zones can be set up and individually named, such that the J6A, Chiswick and Grove platforms are monitored concurrently but discretely. Zones can be different sizes and shapes, but all managed from the J6A platform Radar.

6.2 The radar triggers various alarms including the TCPA and CPA alarms. The TCPA is set as a 20 minute vessel alarm warning and the CPA is set at 500 m. There are also other alarm settings. Examples were given in the meeting including entering the 500 m guard zone; a 2000 m pre-warning alarm (traffic zone) and one extending to 10nm. There was an action from the meeting for the details of these alarms to be confirmed. The alarms have different sounds for information warning, versus alarm warning. The alarm system is used to notify across a multitude of functions on the platform. Radar alarms (TCPA/CPA alarms) were not common. TCPA/CPA alarms did not rank in the top 10 alarms in the monthly reviews. There was reported to be potentially one ship-based alarm a day.

6.3 Alarm procedure is such that if the alarm is triggered contact is then made with the vessel by radio. If there is no response from the vessel, all people are then assembled at the lifeboat station. Guard vessels are not required in Dutch waters so there is not a permanent guard vessel in the Markham Field. A guard vessel is not needed for the Chiswick or Grove platforms unless a rig is present then a guard vessel is required.

6.4 The radar control room on the platform is manned 24/7 with no onshore support. The AIS is integrated with the radar and viewed on a single screen and only one alarm is generated per target.

6.5 Every alarm notifies through written text what it is; so if there is a ship-based Radar alarm then it will inform the platform what it is. For example a vessel can notify that it is entering the guard zone with details of the zone and the vessel tag. Algorithms can be used to fine-tune the alarm thresholds, e.g., alarm has to be present for more than 15 seconds to be considered "real". It is possible to change the configuration parameters to adapt the environment conditions, i.e., obstacles, vessel behaviour, etc.

6.6 In regard to vessel approaches to the platform Spirit Energy vessels are required to contact the platform to ask for permission to enter the 500 m zone. 3rd party supply vessels are tracked 10-12 miles of approach depending on the radar and AIS coverage.

7. Summary

7.1 From the outcome of the consultation meeting the Applicant is of the understanding that the technical parameters, and the operational coverage, are very similar to that assessed within the ES.

7.2 Also, from the outcome of the consultation meeting the Applicant is of the understanding that the capabilities of the software are more advanced than anticipated during the original radar modelling. The existing J6A platform system employs advanced tracking and thresholding algorithms which might be sufficient to deal with potential effects generated by wind farm shadowing and large radar reflections.

7.3 Trials on the radar can be conducted post construction to verify that the system is operating within its specified limits and adheres to the safety cases outlined by Spririt Energy's operations. This can be done utilising the service vessels in the area to take part in these trials

7.4 The Applicant has included proposed Protective Provisions (as submitted at Deadline 7) in relation to the REWS at J6A. These proposed Protective Provisions allow for a REWS mitigation proposal to be agreed between the parties in the event that an adverse impact on the REWS is caused by the operation of Hornsea Three. Such mitigation would be implemented and maintained at the Applicant's expense. The Applicant remains committed to working with Spirit Energy to ensure that the J6A REWS is able to continue to operate effectively post construction of Hornsea Three.