Hornsea Project Four: Environmental Statement (ES)

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Glossary

Term	Definition
Anomalous Propagation (Anaprop)	Anaprop is an effect to radar which can occur by changes in atmospheric temperature, air pressure or air water vapor content.
Commitment	A term used interchangeably with mitigation and enhancement measures. The purpose of the Commitments is to reduce and/or eliminate Likely Significant Effects (LSE's) in EIA (Environmental Impact Assessment) terms. Primary (Design) or Tertiary (Inherent) commitments are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or ES). Secondary commitments are incorporated to reduce LSE to acceptable levels following initial assessment i.e. so that residual effects are acceptable.
Controlled Airspace (CAS)	Airspace in which Air Traffic Control exercises authority. In the UK, Class A, C, D and E airspace is controlled.
Cumulative effects	The combined effect of Hornsea Four in combination with the effects from a number of different projects, on the same single receptor/resource. Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with Hornsea Four
Design Envelope	A description of the range of possible elements that make up the Hornsea Four design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea Four for EIA purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Export Cable Corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
Flight Level	A standard nominal altitude of an aircraft, in hundreds of feet, based upon a standardized air pressure at sea-level.
Helicopter Main Route (HMR)	Helicopter Main Routes are routes typically and routinely flown by helicopters operating to and from offshore destinations and are promulgated for the purpose of signposting concentrations of helicopter traffic to other airspace users. HMR promulgation does not predicate the flow of helicopter traffic. Whilst HMRs have no airspace status and assume the background airspace classification within which they lie (in the case of the Southern North Sea, Class G), they are used by the air navigation service provider and helicopter operators for flight planning and management purposes.
Hornsea Project Four Offshore Wind Farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection

Term	Definition
	to the electricity transmission network. Hereafter referred to as Hornsea Four.
Instrument Flight Rules (IFR)	The rules governing procedures for flights conducted with the crew making reference to aircraft cockpit instruments for situation awareness and navigation.
Instrument Meteorological Conditions (IMC)	Weather conditions which would preclude flight by the Visual Flight Rules, i.e. conditions where the aircraft is in or close to cloud or flying in visibility less than a specified minimum.
Maximum Design Scenario (MDS)	The maximum design parameters of each Hornsea Four asset (both on and offshore) considered to be a worst case for any given assessment.
Minimum Safe Altitude (MSA)	Under aviation flight rules, the altitude below which it is unsafe to fly in IMC owing to presence of terrain or obstacles within a specified area.
Mitigation	A term used interchangeably with Commitment(s) by Hornsea Four. Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, PEIR, or ES).
Onshore infrastructure	The combined name for all infrastructure located onshore that is associated with the project from landfall (mean low water springs (MLWS)) to grid connection.
Order Limits	The limits within which Hornsea Four (the 'authorised project') may be carried out.
Orsted Hornsea Project Four Ltd	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm DCO.
Uncontrolled Airspace	Airspace in which Air Traffic Control does not exercise any executive authority but may provide flight information services to aircraft in radio contact. In the UK, Class G airspace is uncontrolled.
Visual Flight Rules (VFR)	The rules governing flight conducted visually i.e. with the crew maintaining separation from obstacles, terrain and other aircraft visually.
Visual Metrological Conditions (VMC)	A flight category which allows flight to be conducted under VFR defined by in flight visibility and clearance from cloud.

Acronyms

Acronym	Definition
ACC	Area Control Centre
ADR	Air Defence Radar
AfL	Agreement for Lease
agl	above ground level
AIP	Aeronautical Information Publication
amsl	above mean sea level
ANO	The Air Navigation Order (ANO) 2021 and Regulations
ASACS	Air Surveillance and Control System
ATC	Air Traffic Control
ATS	Air Traffic Service
° C	° Centigrade
CAA	Civil Aviation Authority

Acronym	Definition
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CCS	Carbon Capture and Storage
CEA	Cumulative Effects Assessment
CNS	Communications, Navigation or Surveillance
DCO	Development Consent Order
DE&S	Defence Equipment and Support
DIO	Defence Infrastructure Organisation
DMRB	Design Manual Roads and Bridges
DVOF	Digital Vertical Obstruction File
ECC	Export Cable Corridor
EEA	European Economic Area
EIA	Environmental Impact Assessment
ES	Environmental Statement
FIR	Flight Information Region
FL	Flight Level
HMR	Helicopter Main Route
HMRI	Helicopter Main Route Indicator
HVAC	High Voltage Alternating Current
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
Indra	Indian Doppler Radar
IPC	Infrastructure Planning Commission
LAT	Lowest Astronomical Tide
LOS	Line of Sight
LSE	Likely Significant Effect
MCA	Maritime Coastguard Agency
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
Mil AIP	Military Aeronautical Information Publication
MLWS	Mean Low Water Springs
MOD	Ministry of Defence
MSA	Minimum Safe Altitude
NERL	NATS En Route Limited
NOTAM	Notice to Airmen
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NVG	Night Vision Goggles
OGA	Oil and Gas Authority
OWIC	Offshore Wind Industry Council
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PINS	Planning Inspectorate
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RAP	Recognised Air Picture

Acronym	Definition
RDDS	Radar Data Display Screen
SAR	Search and Rescue
SAT	Site Acceptance Test
SoS	Secretary of State
SSR	Secondary Surveillance Radar
TOPA	Technical and Operational Assessment
UKCS	UK Continental Shelf
UKIAIP	United Kingdom Integrated Aeronautical Information Publication
UKLFS	United Kingdom Low Flying System
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WTG	Wind Turbine Generator

Units

Unit	Definition
bcm	billion cubic metres
ft	feet
m	metre
km	kilometre
NM	nautical mile

8.1 Introduction

8.1.1.1 Orsted Hornsea Project Four Limited (hereafter the 'Applicant') is proposing to develop Hornsea Project Four Offshore Wind Farm (hereafter 'Hornsea Four') which will be located approximately 69 kilometres (km) from the East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone (please see **Volume A1, Chapter 1: Introduction** for further details on the Hornsea Zone). Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and connection to the electricity transmission network (please see **Volume A1, Chapter 4: Project Description** for full details on the Project Design).

8.1.1.2 The Hornsea Four Agreement for Lease (AfL) area was 846 km^2 at the Scoping phase of project development. In the spirit of keeping with Hornsea Four's approach to Proportionate Environmental Impact Assessment (EIA), the project has due consideration to the size and location (within the existing AfL area) of the final project that is being taken forward to Development Consent Order (DCO) application. This consideration is captured internally as the "Developable Area Process", which includes Physical, Biological and Human constraints in refining the developable area, balancing consenting and commercial considerations with technical feasibility for construction.

8.1.1.3 The combination of Hornsea Four's Proportionality in EIA and Developable Area process has resulted in a marked reduction in the array area taken forward at the point of DCO application. Hornsea Four adopted a major site reduction from the array area presented at Scoping (846 km^2) to the Preliminary Environmental Information Report (PEIR) boundary (600 km^2), with a further reduction adopted for the Environmental Statement (ES) and DCO application (468 km^2) due to the results of the PEIR, technical considerations and stakeholder feedback. The evolution of the Hornsea Four Order Limits is detailed in **Volume A1, Chapter 3: Site Selection and Consideration of Alternatives** and **Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure**.

8.1.1.4 This chapter of the ES presents the results of the EIA for the potential impacts of Hornsea Four on Aviation and Radar. Specifically, this chapter considers the potential impact of Hornsea Four during its construction, operation and maintenance, and decommissioning phases.

8.1.1.5 This chapter summarises information contained within **Volume A5, Annex 8.1: Aviation and Radar Technical Report**.

8.2 Purpose

8.2.1.1 The primary purpose of the ES is to support the DCO application for Hornsea Four under the Planning Act 2008 (the 2008 Act).

8.2.1.2 The ES has been finalised following completion of pre-application consultation (see **B1.1: Consultation Report** and **Table 8.3**) and will accompany the application to the Planning Inspectorate (PINS) for Development Consent.

8.2.1.3 This ES chapter:

- Summarises the existing environmental baseline established from desk studies and consultation;
- Presents the potential effects on Aviation and Radar arising from Hornsea Four, based on the information gathered and the analysis and assessments undertaken;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible effects identified in the EIA process.

8.3 Planning and policy context

8.3.1.1 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to aviation and radar, is contained in the overarching National Policy Statement (NPS) for Energy (EN-1, DECC, 2011a).

8.3.1.2 NPS EN-1 includes guidance on what matters are to be considered in the assessment. These are summarised in **Table 8.1** below.

Table 8.1: Summary of NPS EN-1 provisions relevant to Aviation and Radar.

Summary of NPS EN-1 provisions	How and where considered in the ES
Civil and Military Aviation	
"Where the proposed development may have an effect on civil and military aviation and/or other defence assets an assessment of potential effects should be set out in the ES" (Paragraph 5.4.10 of EN-1).	Construction, operation and decommissioning phases of Hornsea Four have been assessed within the impact assessment at **Section 8.11**.
"The applicant should consult with the MOD [Ministry of Defence], CAA [the Civil Aviation Authority], NATS and any aerodrome - licensed or otherwise – likely to be affected by the proposed development in preparing an assessment of the proposal on aviation or other defence interests" (Paragraph 5.4.11 of NPS EN-1).	**Section 8.4** provides the results of consultation activity.
"Any assessment of aviation or other defence interests should include potential impacts of the project upon the operation of CNS [Communication, Navigation or Surveillance] infrastructure, flight patterns (both civil and military), other defence assets and aerodrome operational procedures. It should also assess the cumulative effects of the project with other relevant projects in relation to aviation and defence" (Paragraph 5.4.12 of NPS EN-1).	The assessment of civil and military aviation flight patterns and infrastructure is provided in **Section 8.11** and cumulative effects within **Section 8.12**.

8.3.1.3 NPS EN-1 highlights several factors relating to the determination of an application and in relation to mitigation. These are summarised in **Table 8.2** below.

Table 8.2: Summary of NPS EN-1 policy on decision making relevant to Aviation and Radar.

Summary of NPS EN-1 provisions	How and where considered in the ES
Civil and Military Aviation	
"The Infrastructure Planning Commission (IPC) [hereafter the Secretary of State (SoS)] should be satisfied that the effects on civil and military aerodromes, aviation technical sites and other defence assets have been addressed by the applicant and that any necessary assessment of the proposal on aviation or defence interests has been carried out. In particular, it should be satisfied that the proposal has been designed to minimise adverse impacts on the operation and safety of aerodromes and that reasonable mitigation is carried out. It may also be appropriate to expect operators of the aerodrome to consider making reasonable changes to operational procedures. When assessing the necessity, acceptability and reasonableness of operational changes to aerodromes, the SoS should satisfy itself that it has the necessary information regarding the operational procedures along with any demonstrable risks or harm of such changes, taking into account the cases put forward by all parties. When making such a judgement in the case of military aerodromes, the SoS should have regard to interests of defence and national security" (Paragraph 5.4.14 of EN-1).	Civil and military aviation and technical sites have been considered within **Section 8.4** in relation to consultation and **Section 8.11** in relation to the assessment of impacts.
"If there are conflicts between the Government's energy and transport policies and military interests in relation to the application, the SoS should expect the relevant parties to have made appropriate efforts to work together to identify realistic and pragmatic solutions to the conflicts. In doing so, the parties should seek to protect the aims and interests of the other parties as far as possible" (Paragraph 5.4.15 of EN-1).	Mitigation solutions have been provided with **paragraphs 8.11.2.22** to **8.11.2.23**.
"There are statutory requirements concerning lighting to tall structures. Where lighting is requested on structures that goes beyond statutory requirements by any of the relevant aviation and defence consultees, the SoS should satisfy itself of the necessity of such lighting taking into account the case put forward by the consultees. The effect of such lighting on the landscape and ecology may be a relevant consideration" (Paragraph 5.4.16 of EN-1).	Aviation lighting specifications are provided in **Section 8.8.3** and will satisfy the requirements of Article 223 of Civil Aviation Publication (CAP) 393.
"Where after reasonable mitigation, operational changes, obligations and requirements have been proposed, the decision maker considers that: • *A development would prevent a licensed aerodrome from maintaining its licence;* • *The benefits of the proposed development are outweighed by the harm to aerodromes serving business, training or emergency service needs, taking into account the relevant importance and needs for such aviation infrastructure; or the development would significantly impede or compromise the safe and effective use of defence assets or significantly limit military training; and the development would have an impact on the safe and efficient provision of en route Air Traffic Control (ATC) services for civil aviation, in particular through an adverse effect on the infrastructure required to support CNS systems; consent should not be granted" (Paragraph 5.4.17 of EN-1).*	Construction, operation and decommissioning phase of Hornsea Four have been considered in **Section 8.11**.

Summary of NPS EN-1 provisions	How and where considered in the ES
"Where a proposed energy infrastructure development would significantly impede or compromise the safe and effective use of civil or military aviation or defence assets and or significantly limit military training, the SoS may consider the use of 'Grampian', or other forms of condition which relate to the use of future technological solutions, to mitigate impacts. Where technological solutions have not yet been developed or proven, the SoS will need to consider the likelihood of a solution becoming available within the time limit for implementation of the development consent. In this context, where new technologies to mitigate the adverse effects of wind farms on radar are concerned, the SoS should have regard to any Government guidance which emerges from the joint Government/Industry Aviation Plan" (Paragraph 5.4.18 of EN-1).	Mitigation solutions have been provided with **paragraphs 8.11.2.22** to **8.11.2.23** and will be secured via the DCO where appropriate.
"Mitigation for effects on radar, communications and navigational systems may include reducing the scale of a project, although in some cases it is likely to be unreasonable for the SoS to require mitigation by way of a reduction in the scale of development, for example, where reducing the tip height of wind turbines in a wind farm would result in a material reduction in electricity generating capacity or operation would be severely constrained. However, there may be exceptional circumstances where a small reduction in such function will result in proportionately greater mitigation. In these cases, the SoS may consider that the benefits of the mitigation outweighs the marginal loss of function" (Paragraph 5.4.21 of EN-1).	Mitigation of the Maximum Design Scenario (MDS) is detailed in **Section 8.11**.

8.4 Consultation

8.4.1.1 Consultation is a key part of the DCO application process. Consultation regarding Aviation and Radar has been conducted through stakeholder meetings, the EIA scoping process (Ørsted 2018), and formal consultation on the PEIR (Ørsted 2019). An overview of the project consultation process is presented within **Volume A1, Chapter 6: Consultation**.

8.4.1.2 The key issues raised during consultation specific to Aviation and Radar are outlined below in **Table 8.3**, together with how these issues have been considered in the production of this ES. Details of consultation undertaken with oil and gas operators are presented in Section 12.4 of **Chapter 11: Infrastructure and Other Users**.

Table 8.3: Consultation responses.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
NATS	31 October 2018, Scoping Opinion	NATS stated that it has been unable to assess effects fully; however, NATS indicated that Hornsea Four would conflict with NATS safeguarding criteria and it would object to the proposal.	Impact to NATS radar systems are considered in **paragraph 8.11.2.18** *et seq*. Mitigation is discussed in **paragraph 8.11.2.22** to **8.11.2.23**. The Applicant has commenced and will continue to engage with NATS on an appropriate mitigation

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
			solution where significant impacts are identified.
MOD	13 November 2018, Scoping Opinion	On behalf of the MOD, the Defence Infrastructure Organisation (DIO) stated that subject to confirmation of the specification of aviation lighting to be used; the obstruction effect to military low flying activities created by Hornsea Four would be appropriately addressed. The onshore cable route as provided at Scoping does not affect MOD statutory safeguarded zones, however any amendment should consider the technical safeguarding zone surrounding the MOD Leconfield radio transmitter and receiver installations. The MOD stated that the Scoping Report identified the ADR sites at RAF Brizlee Wood and RAF Trimingham as relevant receptors but evaluation also now needed to include the site at RAF Staxton Wold and noted that the potential need for mitigation to address the impacts on ADR was recognised. Should this be confirmed as necessary, it will be for the Applicant to provide appropriate technical mitigation(s) in relation to the relevant ADR sites.	Aviation lighting specifications are provided in **Table 8.8** and **Section 8.8.3** and will satisfy the requirements of Article 223 of Civil Aviation Publication (CAP) 393. It is important to note that there have been no significant changes to the onshore Export Cable Corridor (ECC) route since Scoping. Conclusions of the potential impacts on Staxton Wold ADR are presented in **Section 8.7.6.8** and **8.7.6.9.**
PINS	26 November 2018, Scoping Opinion	The Planning Inspectorate highlights the MOD recommendation that the assessment should consider the Royal Air Force (RAF) Staxton Wold Air Defence Radar (ADR) as a relevant receptor for the assessment of effects on radar systems during operation, in addition to the RAF Brizlee Wood and RAF Trimingham ADRs.	Conclusions of the potential impacts on Staxton Wold ADR are presented in **Section 8.7.6.8** and **8.7.6.9.** Consideration and line of sight (LOS) analysis of ADR is provided in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**.
MOD	7 June 2019, Telephone	Discussion in relation to ADR mitigation.	N/A
NATS	5 April 2019, Telephone	NATS stated that subject to feedback from their engineers, the NATS preferred mitigation solution to address the impact that Hornsea Four would create on the NATS radar systems would likely comprise blanking of the affected radar systems, together with a proposal to change	Impact to NATS radar systems are considered in **paragraph 8.11.2.18** *et seq.* Mitigation is discussed in **paragraph 8.11.2.22** to **8.11.2.23**. The Applicant has commenced and will continue to engage with

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		airspace[1] (through an airspace change proposal) above the array area.	NATS on an appropriate mitigation solution where significant impacts are identified.
	11 June 2019, Email	Confirmation from NATS was provided that the preferred mitigation solution would be that outlined by telephone on the 5 April 2019; however, this would only be applied to the Claxby Primary Surveillance Radar (PSR).	
	14 August 2019, Section 42 consultation	NATS confirmed that Hornsea Four would degrade the performance of installed radar infrastructure. NATS believe that a 'two phase' mitigation is possible consisting of an approval of an airspace change proposal by the CAA and radar blanking of the Claxby PSR (see NATS update 13 October 2020 below).	
CAA	19 September 2019, Section 42 consultation	The CAA requested that specific studies are undertaken to determine what additional marking and lighting might be required to ensure that the turbines remain conspicuous to aviation activities, while not causing confusion or difficulties for maritime users. In addition and in order to facilitate situational awareness, the CAA requests that a study is undertaken into a form of electronic conspicuity/identification of the towers that might be suitable for use by airspace users which will assist to minimise operational impacts during poor weather conditions. Information of the development wind turbines will be required to inform the UK's database of tall structures (the Digital Vertical Obstruction File (DVOF)).	Details of notification of the development is provided in **paragraph 8.11.2.8**. In order to satisfy the CAA comments, aviation stakeholders were consulted on these specific points and results of consultation have been received and the CAA have been informed of the outcome of consultation; details are presented in **paragraph 8.11.2.9** *et seq*. Any additional requirement for marking and lighting will be agreed in consultation with the CAA. Search and Rescue (SAR) helicopter bases will be supplied with accurate information on wind turbine positions once wind turbine construction starts. This information will also inform the DVOF to ensure the positions are reflected on aeronautical charts. This commitment (Co102) is detailed in **Table 8.8** and

[1] The airspace change process ensures that when the CAA decides whether or not to approve a proposal to change UK airspace, it does so in an impartial and evidence-based way that takes proper account of the needs and interests of all affected in which all options will be considered within the application.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
			Volume A4, Annex 5.2: Commitment Register.
MOD	20 September 2019, Section 42 Response	The MOD stated that it has concerns with the development. The MOD has completed an assessment and has identified that the Hornsea Four wind turbines will be detectable to the Trimingham and Staxton Wold ADRs, but not detectable by the Brizlee Wood ADR. The MOD stated that the Staxton Wold ADR is a relevant consideration for assessment, with any modelling using the TPS-77 ADR criteria. A radar LOS analysis has predicted theoretical detectability by a replacement TPS-77 Staxton Wold ADR. Portions of the southern array area would be detectable to the Trimingham ADR (see MOD update 22 January 2021 below). The Brizlee Wood ADR would not theoretically detect the array area at a Wind Turbine Generator (WTG) blade tip height of 370 m Lowest Astronomical Tide (LAT). The MOD requested Hornsea Four is fitted with MOD accredited aviation safety lighting in accordance with The Air Navigation Order (ANO) 2021 and Regulations.	Consideration and ADR LOS analysis is provided in Volume A5, Annex 8.1: Aviation and Radar Technical Report. The MOD has subsequently stated that the Brizlee Wood and Trimingham ADR systems would not be affected by Hornsea Four and therefore both the Brizlee Wood and Trimingham ADR are not considered further in the ES. Discussion with the MOD is ongoing in relation to relevant mitigation required to address significant impacts. Consideration of aviation warning lighting is detailed within Section 8.8.3 *et seq.* Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Trinity House, Maritime Coastguard Agency (MCA) and CAA and MOD as appropriate. This commitment (Co93) is detailed in Table 8.8 and Volume A4, Annex 5.2: Commitment Register. Aviation lighting specifications are provided in Section 8.8.3 and will satisfy the requirements of Article 223 of CAP 393.
MOD	25 October 2019	The MOD confirmed that Staxton Wold needs to be included in evaluations and any modelling should be based on the TPS 77 ADR.	Conclusions of the potential impacts on Staxton Wold ADR are presented in Section 8.7.6.8 and 8.7.6.9.
Perenco, Alpha Petroleum, Bristow Norwich	9 January 2020, Aviation Workshop	In relation to aviation and platform based radar early warning systems (REWS), discussions focussed on SAR requirements and impacts on aviation radar.	SAR helicopter operations are discussed in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report). Impacts on aviation radar are

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
			considered in Section 8.11.2.15 *et seq.*
NATS	5 February 2020	Meeting to discuss proposed mitigation for NATS radar. NATS agreed that a proposed mitigation solution need only apply to the Claxby PSR.	Impact to NATS radar systems are considered in paragraph 8.11.2.18 *et seq.* Mitigation is discussed in paragraph 8.11.2.22 to 8.11.2.23. The Applicant has commenced and will continue to engage with NATS on an appropriate mitigation solution where significant impacts are identified.
CAA	24 March 2020, Teleconference	To address the CAA Section 42 comments (above), it was agreed with the CAA that those airspace users potentially impacted by Hornsea Four would be consulted on lighting and marking requirements. Results of the consultation have been provided to the CAA.	Results of the consultation activity are provided in paragraph 8.11.2.8.
MOD	26 March 2020, Teleconference	A discussion was held with the MOD's Defence Equipment and Support (DE&S) team, DIO and the RAF related to ADR mitigation options and related wording of DCO requirements. MOD acknowledged the unprecedented nature of assessing a receptor that does not exist at the time the EIA is conducted.	Conclusions of the potential impacts on Staxton Wold ADR are presented in Section 8.7.6.8 and 8.7.6.9.
Bristow Helicopters	1 July 2020, Email	Information on the development was provided to Bristow Helicopters. A response was received on the 29 July informing that Bristow would engage with the Applicant and MCA directly for SAR requirements.	SAR helicopter operations are discussed in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report).
MOD	30 July 2020, Teleconference	The MOD (DIO) gave an update on Staxton Wold, stating that an Indra Lanza Long Range Tactical ADR (LR-25) was due to be deployed during September 2020 on a temporary basis for testing of the ADR's in-built capability to mitigate the effects of wind farm generated clutter. The MOD confirmed that the Hornsea Four EIA should proceed based on an assessment of the effect of the project on a theoretical TPS-77 located at Staxton Wold.	Volume A5, Annex 8.1: Aviation and Radar Technical Report provides the radar LOS assessment conclusions for a theoretical TPS-77 ADR located at Staxton Wold.
MCA	30 July 2020 Email	No additional comments to make at this stage of the Project. Confirmation from the MCA that they will liaise with the Applicant	Aviation lighting specifications are provided in Section 8.8.3 and will satisfy the requirements of Article 223 of CAP 393.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		and the CAA for the requirements for the fitment of aviation lighting.	
Wiking Helicopters	30 July 2020 Email	Wiking Helicopters stated that in their opinion, each WTG should be fitted with aviation obstruction lighting. Wiking Helicopters would support the use of additional lighting for Night Vison Goggles (NVG) operations	Aviation lighting specifications are provided in **Section 8.8.3** and will satisfy the requirements of Article 223 of CAP 393. NVG lighting requirements are provided in **paragraph 8.11.2.8**.
NATS	13 October 2020 Email	The Applicant contacted NATS after the publication of a note (by NATS Safeguarding Office) which detailed instances of anomalous propagation being experienced by NATS ATC in the Southern North Sea (NATS 2020). Anomalous propagation can create unexpected radar clutter; this clutter has been observed on radar data provided by the Cromer and Claxby PSRs at the location of Hornsea Project One. NATS responded by email on the 21 October 2020, stating that the Cromer PSR would not theoretically detect the array area through direct LOS; however, experience has shown that previously for 'other developments' out of direct radar LOS that under specific meteorological conditions WTGs beyond radar horizon can 'appear on radar'. Therefore, NATS stated an updated position from that received during Section 42 consultation in that NATS seek mitigation to be applied to both the Cromer and Claxby PSR systems.	The Applicant has agreed that the Claxby PSR requires mitigation to reduce the effect to an acceptable level. Mitigation of the radar systems is discussed in **paragraphs 8.11.2.21** and **8.11.2.23**. The Applicant is continuing its dialogue with NATS and is aiming to ascertain the validity of a requirement to mitigate potential effects on the Cromer PSR, given that the Hornsea Four WTGs will not be within radar LOS of the Cromer PSR.
MOD	22 January 2021 Email	The MOD (DIO) stated that none of the Hornsea Four WTGs will be within radar LOS to the Trimingham ADR and that the MOD have no concerns in respect of Hornsea Four impacting the Trimingham ADR and that, as such, the Trimingham ADR does not need to be mitigated and a DCO requirement is not necessary for the Trimingham ADR.	Consideration and ADR LOS analysis is provided in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**. The Trimingham ADR is not considered within the assessment of effects in the ES.
MOD	28 January 2021 Teleconference	It was agreed with the MOD (DIO) that the Hornsea Four DCO Application, including this Aviation Chapter and the supporting Technical Report in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**, would be updated to reflect the absence of	Conclusion of ADR assessment are provided in **paragraph 8.11.2.6**.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		an impact on the Trimingham ADR. It was also agreed that this Aviation Chapter would reflect the presence of the Indra LR-25 ADR at Staxton Wold, but that the significance of the impact upon the LR-25 ADR would not be concluded, given that the LR-25 was not yet installed at Staxton Wold. It was noted that input acquired by the MOD later in 2021 might become available that would facilitate the conclusion of an impact assessment for the LR-25 ADR. Hornsea Four are working with and alongside the MOD to identify, develop and implement an ADR mitigation solution for Staxton Wold, however, it was agreed that it is not necessary to detail the specifics of this work within this Aviation Chapter .	
NATS	10 February 2021 Email	Ørsted followed-up on call with NATS reiterating Ørsted's understanding that a mitigation requirement should not apply to the Cromer PSR, given that (a) the Hornsea Four WTG's will not be within radar LOS of the Cromer PSR - as confirmed by radar LOS modelling, including NATS's Technical and Operational Assessment (TOPA), that (b) the Hornsea Four array area is understood to be beyond the instrumented (operational) range of the Cromer PSR, and that (c) a requirement for mitigation linked to Anoprop effects would need to be preceded by a wider cross-project and cross-sector debate.	There is a low probability that the Cromer PSR will be affected by Anaprop created by the Hornsea Four array area. **Table 8.6** provides information that the applicant will continue its dialogue with NATS to ascertain the validity of a requirement to mitigate potential effects on the Cromer PSR.
MOD	19 March 2021 Email	The MOD (DIO) confirmed that the Indra LR-25, ADR has arrived at Staxton Wold and is undergoing initial testing and optimisation work, prior to Site Acceptance Testing (SAT) and wind farm trials, and ahead of the radar going into active service from November 2021. MOD (DIO) shared the wording for a draft DCO requirement covering the Staxton Wold ADR.	Inclusion of the Indra LR-25 radar is provided in **paragraph 8.6.1.2**.
MOD	25 June 2021 Email	The MOD (DIO) confirmed that: SAT for the Indra LR-25 ADR is ongoing and with the wind farm testing element due imminently; and that, subject to SAT, the LR-25 will be handed over to the MOD later this year with	Inclusion of the Indra LR-25 radar is provided in **paragraph 8.6.1.2**.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		release into service expected late October 2021; and that, it's unlikely that there will be an update on the results of the wind farm testing of the LR-25 before it's handed over.	
MOD	February 2020 to August 2021 Teleconferences and Emails.	In addition to the above-referenced teleconference on 26/03/2020, a series of five separate teleconferences have been held with the MOD's DE&S team in support of ongoing efforts to identify, trial, develop and implement an ADR mitigation solution for Staxton Wold. In addition to this, Ørsted are a member of the MOD-Offshore Wind Industry Council (OWIC) Joint Task Force which will be leading the evaluation of ADR mitigation concepts in 2021 and delivering an ADR Strategy & Implementation Plan.	N/A
MOD	30 July 2021	Hornsea Four provided the MOD (DIO) amendments to the proposed ADR (Staxton Wold) DCO wording for comment ahead of DCO application.	N/A
MOD	26 August 2021	MOD (DIO) confirmed they had not managed to look at the amendments to the ADR requirement wording ahead of DCO application.	N/A

8.5 Study area

8.5.1.1 The aviation and radar study area is shown in **Figure 8.1**. This includes the Hornsea Four array area, offshore ECC, HVAC booster stations, the onshore ECC, and the airspace between the Hornsea Four array area, the UK mainland from Norwich Airport to the south and RAF Brizlee Wood to the north. The Hornsea Four aviation and radar study area for undertaking the assessment of cumulative effects is the same, except for the assessment of radar cumulative effects which includes other offshore wind farms in the southern North Sea that could have potential cumulative effects on identified radar receptors through the radar detection of WTGs. Specifically, the Hornsea Four aviation and radar study area covers:

- Aviation radar systems that potentially detect 370 metre (m) high (blade tip) wind turbines within the array area;
- Helicopter Main Routes[2] (HMRs) that are located within the proximity of the study area;
- Airborne SAR flight operations;

[2] HMR are to be renamed Helicopter Main Route Indicators (HMRI) which has no relevance to the conclusions of the assessment.

- Military low flying areas and Practice and Exercise Areas (PEXA) that intersect or are adjacent to the Hornsea Four study area; and
- Aviation activities and aviation safeguarded areas that are adjacent to the onshore ECC.

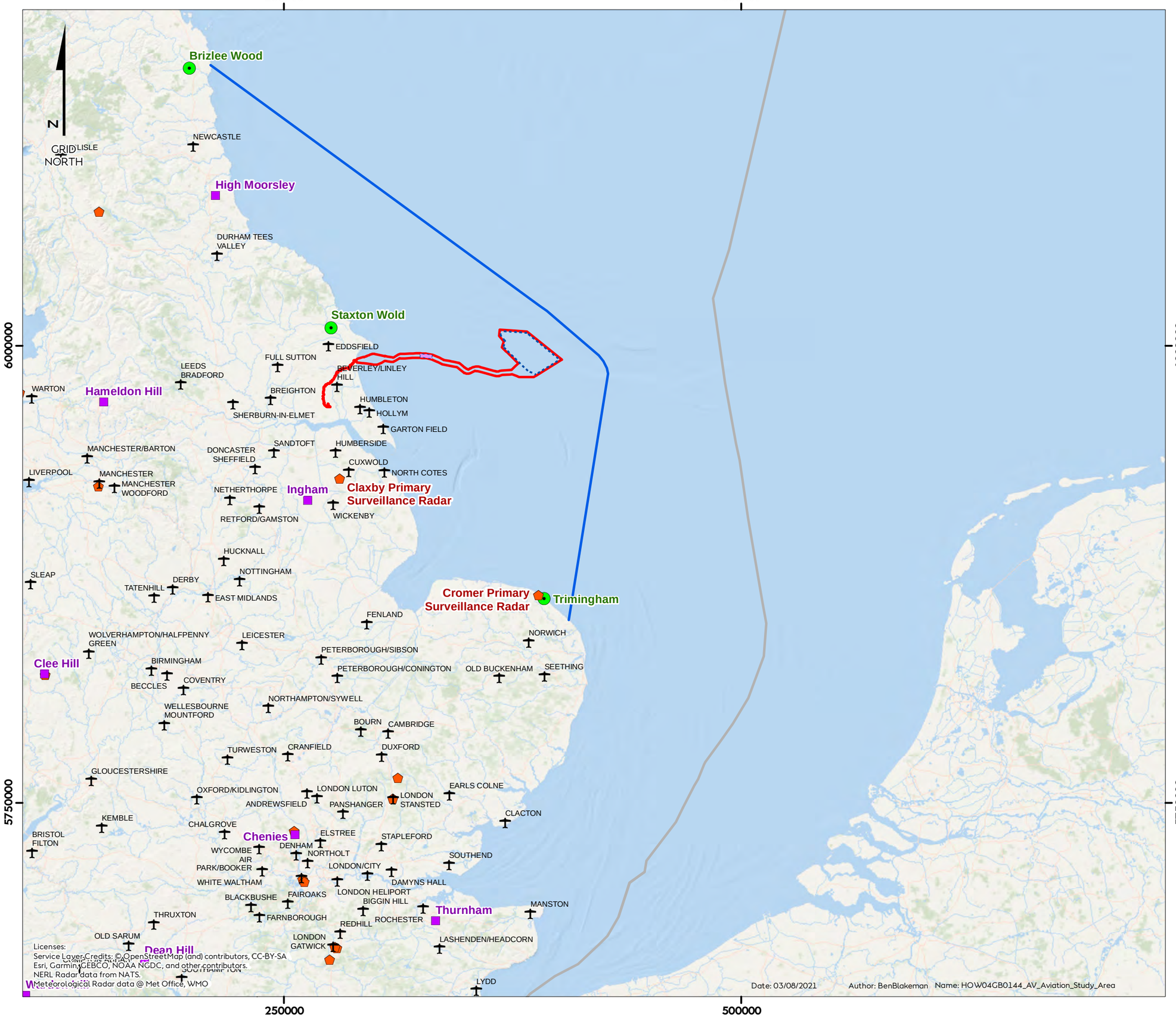
8.5.1.2 Detailed assessment of the potential to impact helicopter operations to helideck operated oil and gas platforms is provided in Appendix A of **Volume A5, Annex 11:1: Offshore Installation Interfaces** (Helicopter Access Report).

8.5.1.3 As all offshore electrical cables associated with Hornsea Four will be buried below the seabed, they will not have an impact on aviation interests and therefore are not assessed in this chapter. Up to three HVAC booster stations with a maximum height of 100 m LAT may be positioned within the HVAC Booster Station Search Area within the offshore ECC (see **Figure 8.1**). HMR 8, 9 and 10 cross the route of the offshore ECC (see **Figure 8.2**), HMR 8 crosses the offshore array area. Assessment of the use of HMRs in the region of Hornsea Four is provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report). The locations, heights and lighting status of the HVAC booster stations will be reported to the DIO as part of notification procedures - this commitment (Co102) is detailed in **Table 8.8** and **Volume A4, Annex 5.2: Commitment Register**. Stationary offshore infrastructure associated with Hornsea Four including the HVAC booster stations, accommodation platform and substations do not pose any issue to radar systems as radar processing techniques remove stationary objects from the radar display.

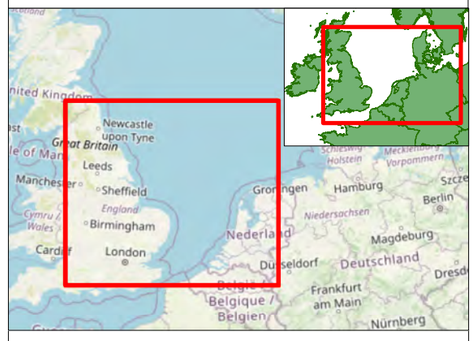
Hornsea Four

Figure 8.1

Aviation and Radar Study Area



- Order Limits
- HVAC Booster Station Works Area
- Array Area
- Jurisdictional Boundary
- Hornsea Four Aviation & Radar Study Area
- Airports and Airfields
- MoD Air Defence Radar Site
- NERL Radar
- Meteorological Radar Station



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2,000,000

0 50 100 Kilometres

0 25 50 Nautical Miles

REV	REMARK	DATE
---	First Issue for PEIR	20/06/2019
A	Updated following PEIR consultation, for DCO	03/08/2021

Aviation Study Area
Document no: HOW04GB0144
Created by: RM
Checked by: BPHB
Approved by: LK

GoBe

Ørsted

Hornsea Four

Figure 8.2

Oil and Gas Platforms and Helicopter Main Routes

250000 300000 350000 400000

6050000 6000000 5950000

GRID NORTH

D323G ↑FL660 ↓FL150

D323B ↑FL660 ↓FL50

ANGLIA RADAR AREA OF RESPONSIBILITY FL65 SFC

D323C ↑FL660 ↓FL50

D323H ↑FL660 ↓FL150

D323J ↑FL660 ↓FL150

D323D ↑FL660 ↓FL50

GARROW

KILMAR

TRENT

BOULT

RAVENSPURN

HMR 8

SCHOONER

CLEETON

HUMBER GATEWAY TMZ G FL100 SFC

NEPTUNE

HMR 9

HMR 8

HMR 10

R315 2000 SFC

D323K ↑FL660 ↓FL150

ROUGH

HOTON

HMR 4

HMR 3

HMR 8

HMR 7

HYDE

WEST SOLE

SATURN

AMETHYST

BARQUE

AUDRE

ATZ 2000 SFC

LAGER

HUMBERSIDE

HMR 6

GALAHAD

SOLE PIT

HMR 6

D307 20000 (OCNL 23000) SFC

PICKERILL

EXCALIBUR

CLIPPER

LANCELOT

GALLEON

LOGGS

GUINEVERE

GREATER WASH TMZ G FL100

WASH ATA NORTH FL245

VALIANT N

WAVENEY

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Basemap Source @ UK Integrated Aeronautical Information Publication

Date: 03/08/2021 Author: BenBlakeman Name: HOW04GB0201_AV_Oil_and_Gas_Platforms_Helicopter_Main_Routes

- Order Limits
- Array Area
- HVAC Booster Station Works Area
- 9 Nautical Mile Buffer from Array Area
- Oil and Gas Platform
- Heliport
- Reporting Point
- Aerodrome (Civil)
- Helicopter Main Route Indicators (HMRIs)
- Helicopter Transit Zones (HTZ)
- Transponder Mandatory Zone (TMZ)

AIRSPACE RESTRICTIONS

Prohibited 'P', Restricted 'R' and Danger Areas 'D' are shown with identification number/ effective altitude (in thousands of feet AMSL) or a Flight Level. Areas activated by Notam are shown with a broken boundary line

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:600,000

0 10 20 Kilometres

0 5 10 Nautical Miles

REV	REMARK	DATE
...	First Issue	03/08/2021

Oil and Gas Platforms and Helicopter Main Routes
Document no: HOW04GB0201
Created by: RM
Checked by: BPHB
Approved by: LK

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8.6 Methodology to inform baseline

8.6.1 Desktop Study

8.6.1.1 A desktop study was undertaken to obtain information on aviation and radar receptors. A variety of aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. The following documents informed the desktop study as listed in Table 8.4.

Table 8.4: Key sources of aviation and radar data.

Source	Summary	Coverage of Hornsea Four aviation and radar study area
CAA CAP 168: Licensing of Aerodromes.	Sets out the standards required at UK licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.	Onshore ECC.
CAA CAP 393: The Air Navigation Order (ANO) 2016 and Regulations.	Sets out the provisions of the ANO as amended together with regulations made under the Order. It is prepared for those concerned with day to day matters relating to air navigation that require an up to date version of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. CAP 393 also includes application of aviation obstruction lighting to wind turbines in UK territorial waters.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 437: Standards for Offshore Helicopter Landing Areas.	Guidance on Standards provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on wind turbine platforms to represent current best practice.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 764 Policy and Guidelines on Wind Turbines.	Provides assistance to aviation stakeholders to help understand and address wind energy related issues thereby ensuring greater consistency in the consideration of the potential impact of proposed wind farm developments.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 670: Air Traffic Services Safety Requirements.	Sets out the safety regulatory framework and requirements associated with the provision of an Air Traffic Service (ATS).	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 1434: UK Flight Information Services	Sets out the regulatory framework for the provision of ATS that are available to all flights operating within Class G airspace	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 1616: Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements.	Sets out the regulatory framework for the conduct of an Airspace Change Project.	Full coverage of the Hornsea Four aviation and radar study area.

Source	Summary	Coverage of Hornsea Four aviation and radar study area
CAA Visual Flight Rules Charts.	Topographical air chart providing information on aerodrome, airspace and areas of air traffic control responsibilities.	Full coverage of the Hornsea Four aviation and radar study area.
MOD Military Aeronautical Information Publication (Mil AIP).	The main resource for information and flight procedures at all military aerodromes as well as airspace, en-route procedures, charts and other air navigation information.	Full coverage of the Hornsea Four aviation and radar study area.
MOD Obstruction Lighting Guidance	Provides guidance to developers of the likely lighting to be required by the MOD for onshore and offshore developments.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 032: UK Integrated Aeronautical Information Package (UKIAIP).	The main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.	Full coverage of the Hornsea Four aviation and radar study area.

8.6.1.2 No technical limitations or difficulties were encountered in compiling the information required for the completion of the aviation and radar baseline study. The MOD have recently acquired an Indra Lanza Long Tactical Range-25 (LR-25) ADR. The LR-25 ADR is undergoing a series of Site Acceptance Tests (SAT) at Staxton Wold and upon acceptance (expected October 2021), will be utilised as a deployable resource by the MOD in support of worldwide operations; the 'home' base of the LR-25 is expected to be at Staxton Wold. However, there is no radar that's currently in operational service at the MOD Staxton Wold site. The MOD have confirmed that the Hornsea Four EIA should proceed based on an assessment of the potential effect of the project on a theoretical TPS-77 ADR located at Staxton Wold.

8.7 Baseline environment

8.7.1 Airspace designations

8.7.1.1 Hornsea Four will be situated in an area of Class G uncontrolled airspace, which is established from the surface up to Flight Level (FL) 195 (approximately 19,500 feet (ft)). Class C Controlled Airspace (CAS) is established above FL 195. Under these classifications of airspace, the following applies:

- Class G uncontrolled airspace; any aircraft can operate in this area of uncontrolled airspace without any mandatory requirement to be in communication with ATC. Pilots of aircraft operating under Visual Flight Rules[3] (VFR) in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions; and
- Class C controlled airspace; all aircraft operating in this airspace must be in receipt of an ATS.

[3] A set of regulations under which a pilot operates an aircraft in weather conditions clear enough to allow the pilot to see where the aircraft is going; the pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other flying machines.

8.7.1.2 Above and surrounding the Hornsea Four array area, the Class G uncontrolled airspace below FL 195 is subdivided into areas with the following aviation stakeholder responsibility:

- Anglia Radar, based at Aberdeen Airport and employing NATS PSR systems, has its area of responsibility established for the provision of ATC services to helicopter operations that support the offshore oil & gas industry and other aircraft, from the surface up to FL 65 (approximately 6,500 ft). Appendix A of **Volume A5, Annex 11.1 Offshore Installation Interfaces** (Helicopter Access Report) provides an assessment of helicopter operations to oil and gas platforms;
- Military En-Route Area Control, military air traffic controllers located at the Swanwick Area Control Centre (ACC) utilise NATS radar for the provision of ATS to aircraft flying outside of CAS above FL 100 within radar and radio coverage; and
- MOD Air Surveillance and Control System (ASACS), uses its ADR resources in support of operational flights in the protection of UK airspace and for military training exercises.

8.7.1.3 In aviation and airspace terms, the world is divided into Flight Information Regions (FIRs) for the responsibility of the provision of ATS to aircraft. Above FL 195 NATS En-route Limited (NERL) (which is a subsidiary of NATS) are the main ATS provider utilising several long-range PSR and Secondary Surveillance Radar (SSR) systems positioned to provide maximum coverage of UK airspace. Additionally, NATS has a licence obligation to provide radar data to other remote aviation stakeholders to a high quality and performance standard for the benefit of UK aviation. Any effect that Hornsea Four might have on NATS radar systems must be considered both in terms of effect on the civilian en-route services and in the context of its remote users such as Anglia Radar and the MOD.

8.7.2 Military Low Flying Operations

8.7.2.1 The UK Low Flying System (UKLFS) used for Military Low Flying activity covers the open airspace over the entire UK land mass (excluding specific areas) and surrounding sea areas generally out to 2 NM from the coastline (however, military low flying does take place further offshore), from the surface to 2,000 ft. agl (above ground level) or amsl (above mean sea level).

8.7.3 Military Practice and Exercise Areas (PEXA)

8.7.3.1 Military PEXAs are areas available for training use primarily by the UK armed forces but also those of overseas nations. They can be over land or water, or both, and may involve the firing of live ammunition.

8.7.4 Helicopter Main Routes (HMR)

8.7.4.1 A network of HMRs is established in the vicinity of the array area to support the transport of personnel and material to offshore oil and gas installations. HMR 8 crosses the array area (**Figure 8.2**).

8.7.5 Evolution of the Baseline

8.7.5.1 The baseline description above provides an accurate reflection of the current state of the existing environment. The earliest possible date for the start of construction is August 2026, with an expected operational life of 35 years, and therefore there exists the potential for the baseline to evolve between the time of assessment and point of impact. Outside of short-term or seasonal fluctuations, changes to the baseline in relation to Aviation and Radar usually occur over an extended period of time (considered in the paragraphs below). Based on current information regarding reasonably foreseeable events over the next six years, the baseline is not anticipated to have fundamentally changed from its current state at the point in time when impacts occur. The baseline environment for operational/decommissioning impacts is expected to evolve as described below, with the additional consideration that any changes during the construction phase will have altered the baseline environment to a degree (as set out in this chapter).

8.7.5.2 The Infrastructure Planning EIA Regulations 2017 require that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the ES (EIA Regulations, Schedule 4, Paragraph 3). From the point of assessment, over the course of the development and operational lifetime of Hornsea Four (operational lifetime anticipated to be 35 years), long-term trends mean that the condition of the baseline environment is expected to evolve. This section provides a qualitative description of the evolution of the baseline environment, on the assumption that Hornsea Four is not constructed, using available information and scientific knowledge of Aviation and Radar.

8.7.5.3 It is difficult to define what the likely evolution of the aviation interests in the southern North Sea will be either with, or in the absence of, Hornsea Four. In 2019, the Oil and Gas Authority (OGA) Annual Report reported predicted a decline in gas production in the UK Continental Shelf (UKCS) (continuing a gradual decline seen since the year 2000). Operators continue to find it difficult to predict production accurately as older fields mature and their reliability reduces. "*The OGA have studied energy integration in which a range of opportunities* in the *UKCS which have the potential to make a very significant 30%+ contribution towards the UK's overall net zero target, both through Carbon Capture and Storage (CCS) and through CCS plus hydrogen. Offshore renewables (wind, wave and tidal) could well contribute a further 30%+ to the abatement required in 2050".* It is predicted that while estimates predict that gas demand will decline slightly, UK gas production will fall at a faster rate from 35 (billion cubic metres) bcm in 2019 to 16 bcm in 2035.

8.7.5.4 A significant share of future oil and gas production is expected to come from new fields and major projects in existing fields. As old fields are decommissioned helicopter use will decline however future offshore renewable energy leasing rounds are likely to increase helicopter activity in the support of offshore developments. New marine technology using marine service and accommodation vessels equipped with walk-to-work systems is also offering an alternative to helicopters for the oil and gas and wind industries.

8.7.5.5 Helicopter operations are being used and being planned in the offshore wind industry both for construction and for operation and maintenance purposes. It is considered a reasonable assumption that helicopter numbers will remain fairly constant but that the providers may gradually shift from servicing one offshore industry (oil and gas) to another

(offshore wind) and that helicopter use may, in time, be reduced due to a shift to walk-to-work systems. An assessment of future helicopter operations offshore is provided in Appendix A of **Volume A5, Annex 11.1 Offshore Installation Interfaces** (Helicopter Access Report).

8.7.5.6 Other fixed and rotary wing aviation activities (military low flying, airborne SAR, fisheries protection) are not expected to change. The use of satellite based surveillance and navigation may replace traditional primary surveillance radar systems in the future.

8.7.5.7 The MOD has stated in its response to PEIR (MOD 2019a), and again in an email dated 22/01/2021, that the Staxton Wold ADR is a relevant consideration and will need to be taken account of and mitigated, furthermore the MOD stated that the basis for any modelling relating to Staxton Wold should use the TPS-77 ADR criteria. **Volume A5, Annex 8.1: Aviation and Radar Technical Report** and this Chapter provide the radar LOS assessment conclusions for a theoretical TPS-77 ADR located at Staxton Wold.

8.7.6 Data Limitations

8.7.6.1 The data used in this chapter are the most up to date publicly available information which can be obtained from the data sources as cited. Data have also been provided through consultation as detailed in **Section 8.4** above.

8.7.6.2 Given the scale of consultation undertaken on behalf of the former Hornsea Zone in general, for Hornsea Project One, Hornsea Project Two and for Hornsea Three, it is considered that the data employed in the assessment are of a robust nature and are of a standard equal to, and in areas greater than, that drawn for previous projects. It is assessed that data gathered is sufficient for this assessment.

8.7.6.3 As stated in **paragraph 8.6.1.2**, there is no specific radar specification data available to baseline Staxton Wold, apart from generic TPS-77 radar information. A radar LOS analysis from the Indra LR-25 ADR to Hornsea Four has not been possible as the operating parameters and specific radar technical information applicable to the LR-25 and which is required to complete the analysis, has not been released. With this exception, all required data has been available.

8.7.6.4 A radar LOS analysis has been completed; methods and details are provided in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**. The results of the analysis for those radar systems for which Hornsea Four WTGs are theoretically detectable are also included within this section.

8.7.6.5 The radar LOS assessment is a theoretical desk-based study which provides theoretical results of the potential for radar detectability of WTGs. Signal diffraction and attenuation within a given radar environment can influence the probability of a WTG being detected. Although the maximum number of WTGs will be 180 (the MDS); the layout of WTGs for Hornsea Four has not yet been finalised. Therefore, to facilitate the radar LOS analysis, an evenly spread, indicative grid placement of the 370 m amsl blade tip WTGs within the Hornsea Four array area has been assumed for LOS analysis. It is important to note that 370 m amsl represents a higher elevation than the MDS for Hornsea Four blade tip height which is 370 m LAT. As such, the LOS analysis is considered suitably precautionary. The analysis undertaken gives an indication of the likelihood of WTGs being theoretically

detected such that the operational significance of the turbine relative to nearby aviation radar assets can be assessed. The radar LOS analysis was undertaken on a slightly larger array area than the array area within the Hornsea Four Order Limits at DCO application; the reduction in size of the northern part of the array area does not influence the results of the radar analysis.

8.7.6.6 The qualitative definitions used in the LOS assessment are defined in **Table 8.5.**

Table 8.5: Radar LOS Qualitative Definitions.

Result	Definition
Yes	*The WTG is highly likely to be detected by the radar: Direct LOS exists between the radar and the turbine.*
Likely	*The WTG is likely to be detected by the radar at least intermittently.*
Unlikely	*The WTG is unlikely to be detected by the radar but cannot rule out occasional detection.*
No	*The WTG is unlikely to be detected by the radar as significant intervening terrain exists.*

8.7.6.7 The theoretical results of the radar LOS analysis from the NATS Claxby PSR across the indicative grid pattern of WTGs placed within the Hornsea Four array area is provided in **Figure 8.3**.

Hornsea Four

Figure 8.3

LOS results Claxby PSR at a blade tip height of 370 m amsl.

360000 380000 400000

6000000

5980000

N

GRID NORTH

B2 T1 T2 T3 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 B6

Array Area

Definitions of LOS Results

Yes

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:150,000

0 4 8 Kilometres

0 2 4 Nautical Miles

REV	REMARK	DATE
....	First Issue	13/08/2021

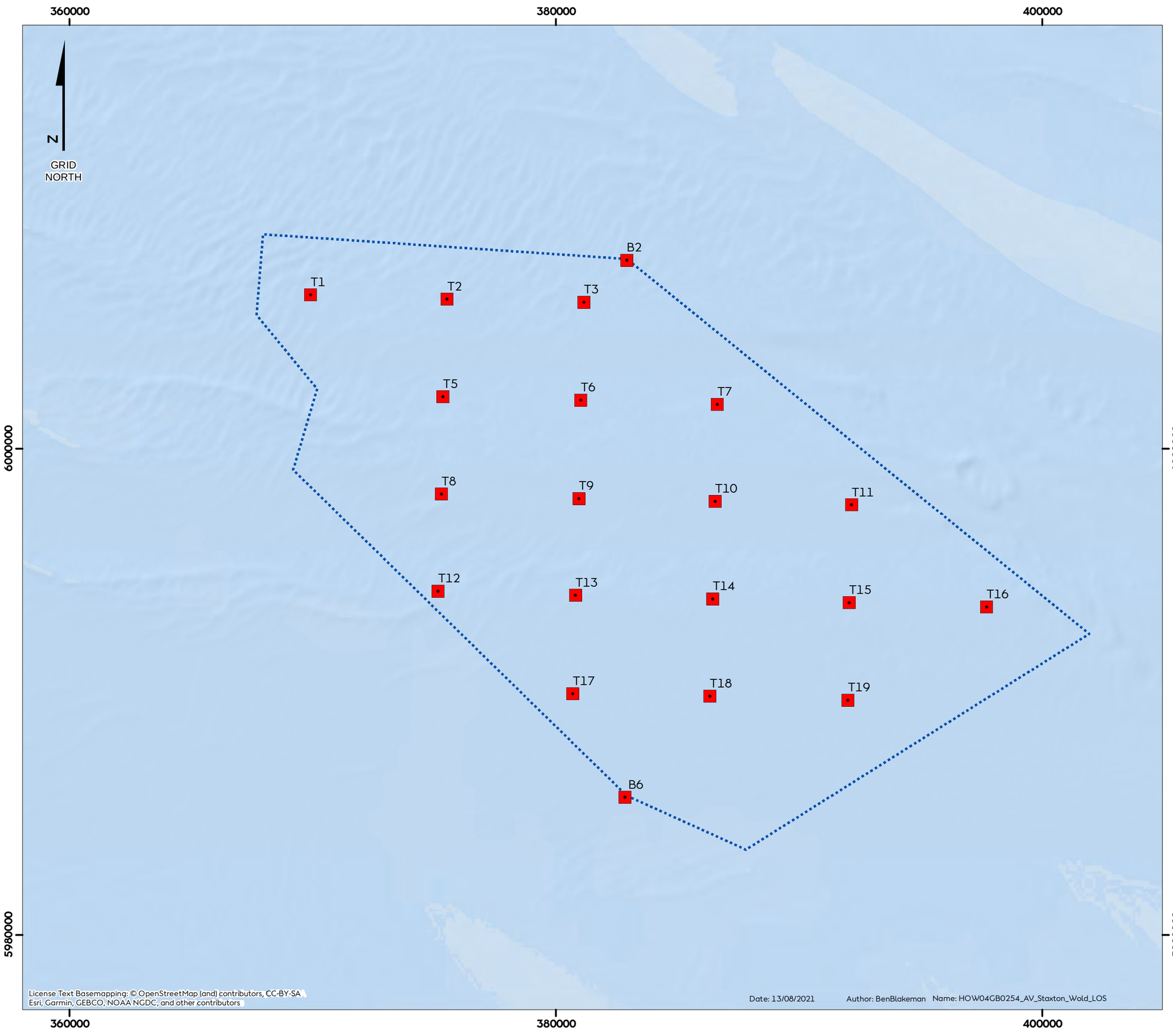
LOS Results
Claxby
Document no: HOW04GB0253
Created by: BPHB
Checked by: RM
Approved by: LK

GoBe Ørsted

Date: 13/08/2021 Author: BenBlakeman Name: HOW04GB0253_AV_Claxby_LOS

8.7.6.8 The results of the LOS analysis indicate that WTGs of 370 m within the Hornsea Four array area are, theoretically, highly likely (definition as stated in **Table 8.5**) to be detectable by the Claxby PSR system with the potential to create unacceptable radar clutter on NATS (and other users of the Claxby radar data) radar screen displays. The NATS TOPA agrees with the conclusions of the analysis.

8.7.6.9 As the recently procured Indra LR-25 ADR is not yet fully operational at Staxton Wold, the radar LOS assessment has been completed on known TPS-77 radar parameters utilising the previous location of the ADR at Staxton Wold. **Figure 8.4** provides the results of the radar LOS analysis from the TPS-77 that was previously situated at RAF Staxton Wold.



Hornsea Four

Figure 8.4

LOS results Staxton Wold (TPS-77) at a blade tip height of 370 m amsl.

Array Area

Definitions of LOS Results

Yes

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:150,000

0 4 8 Kilometres

0 2 4 Nautical Miles

REV	REMARK	DATE
....	First Issue	13/08/2021

LOS Results
Staxton Wold
Document no: HOW04GB0254
Created by: BPHB
Checked by: RM
Approved by: LK

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8.7.6.10 Figure 8.4 indicates that if a TPS-77 ADR (or similar) was installed at Staxton Wold, the WTGs in the Hornsea Four array area would theoretically be detectable by the radar system and would therefore have the potential to create radar clutter on MOD monitoring systems. It is assumed that the LR-25 ADR would be installed in the same position with similar antenna height as the TPS-77. Its coastal location, the lack of terrain shielding and the height of the Hornsea Four WTGs leads to the assumption that it will similarly detect the Hornsea Four WTGs.

8.8 Project basis for assessment

8.8.1 Aviation Stakeholders and Receptors

8.8.1.1 Table 8.6 provides the conclusions of the baseline study, identifying the key aviation receptors and stakeholders. Volume A5, Annex 8.1: Aviation and Radar Technical Report provides further details.

Table 8.6: Aviation receptors and stakeholders identified from the baseline study

Stakeholder	Operation
NATS	The NATS Claxby PSR, which is located in North Lincolnshire, and the Cromer PSR, which is located in North Norfolk, provide radar coverage in the airspace above and surrounding the Hornsea Four array area which enables the provision of radar-based ATS to those aircraft operating within and overflying the London FIR. Radar detectability of operational wind turbines will create a detrimental effect to operations utilising the subject radar system. A NATS TOPA concluded there will be an impact created to the Claxby PSR; however, no operational impact is predicted on the north Norfolk located Cromer PSR. NATS Safeguarding has published a note (NATS 2020), in which it states periodic observations of unexpected radar clutter has been observed on radar data provided by the Cromer and Claxby PSRs at the location of Hornsea Project One. NERL concludes that more work is required to fully understand the implications of the unexpected detection of Hornsea Project One by the Claxby and Cromer PSRs. The Applicant is continuing a dialogue with NATS aimed at ascertaining the validity of a mitigation requirement that's linked to the potential for the i the Cromer PSR to intermittently detect the Hornsea Four WTGs, given that the Hornsea Four WTGs will not be within direct LOS to the Cromer PSR and given that the Hornsea Four array area is understood to be located beyond the declared operational coverage (instrumented range) of the Cromer PSR.
MOD	Military Low-Level Operations take place over the sea from the surface to 2,000 ft amsl in the airspace surrounding the Hornsea Four array area. Above FL 50 (approximately 5,000 ft) military aircraft engage in air exercise operations in established PEXA. ADR systems (such as Staxton Wold) provide radar coverage of the airspace above and surrounding the Hornsea Four array area for the protection of UK airspace and for the provision of radar services to aircraft operating in PEXAs. The onshore ECC route passes close to MOD communication facilities established for MOD Leconfield, no effect is predicted.
Offshore Helicopter Operators	A network of HMRs is established in the vicinity of the Hornsea Four array area to support the transport of personnel and material to offshore oil and gas installations. Assessment of helicopter operations to oil and gas helideck platforms is contained in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report).

Stakeholder	Operation
Offshore Oil and Gas Platform Operators	A consultation zone of nine NM radius exists around offshore helicopter destinations. A number of oil and gas helideck equipped platforms are located within the defined consultation zone as shown in Figure 8.2 and Volume A5, Annex 8.1: Aviation and Radar Technical Report. Assessment of helicopter operations to oil and gas helideck platforms is contained in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report).
Airborne SAR Operations	The SAR force provides 24-hour aeronautical SAR cover in the UK which is provided from ten strategically located bases across the UK. The bases are positioned close to SAR hotspots so that aircraft can provide support as quickly and efficiently as possible. Bristow Helicopters were awarded the contract to provide SAR helicopter services for the UK in 2013; the closest SAR helicopter base is located at Humberside Airport. SAR helicopter operations are discussed in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report).

8.8.1.2 The radar receptors (NATS Claxby, and the MOD Staxton Wold ADR) for each impact are described within the text for each assessment and have been identified in Table 8.6. Those receptors which are not considered to have any potential to be impacted by Hornsea Four have not been presented within the assessment.

8.8.1.3 Aviation receptors were identified in accordance with CAP 764 (CAA 2016). This assessment considers all radar systems within operational range of Hornsea Four, as well as military areas of operation. For each identified receptor, the physical obstruction and/or radar effect, and subsequently the operational impacts were considered with any other potential impacts.

8.8.1.4 The operational range of a radar system is dependent on the type of radar used and its operational requirement. CAP 764 provides a guide of 30 km for assessment of civil aerodrome radar impact; however, impact is dependent on radar detectability of operational wind turbines, the radars operational range and the use of airspace in which the development sits. The operational impact considers the approach and departure flight paths, physical safeguarding of flight, airspace characteristics and flight procedures as published in the UKIAIP (NATS 2021) and the Mil AIP (MOD 2021). This assessment has been informed by the results of baseline studies and consultation, with reference to the existing evidence base regarding the effects of offshore wind farm development.

8.8.1.5 Volume A5, Annex 8.1: Aviation and Radar Technical Report provides details of the radar LOS analysis completed to provide a predicted theoretical indication of those radar systems that could theoretically be impacted by the operation of Hornsea Four. The response to scoping from the MOD indicates the onshore ECC does not impact safeguarding criteria; however, the route passes close to MOD Leconfield, and any amendment to the onshore ECC route should consider the technical safeguarding zone surrounding the MOD Leconfield radio transmitter and receiver installations. Since there has been no significant change to the route the onshore ECC is not considered further in this assessment.

8.8.2 Impact register and impacts not considered in detail in this ES

8.8.2.1 Upon consideration of the baseline environment, the project description outlined in Volume A1, Chapter 4: Project Description, and the Hornsea Four Commitments detailed within Volume A4, Annex 5.2: Commitments Register, and in response to formal

consultation on the PEIR, a number of Hornsea Four impacts across all topics are "not considered in detail in the ES". All impacts assessed within the PEIR for aviation and radar have been further considered in the ES, with no impacts falling into the category "not considered in detail in the ES". Table 8.7 details impacts that were agreed to be scoped out during the Scoping phase. Further detail is provided in Volume A4, Annex 5.1: Impacts Register.

Table 8.7: Impacts scoped out of assessment and justification.

Project activity and impact	Likely significance of effect	Approach to assessment	Justification
Construction: Wind turbine effects on aviation radar systems during the construction process (AV-C-1).	No likely significant effect.	Scoped Out	Scoped out based on PINS Scoping Opinion (PINS Scoping Opinion, November 2018, ID: 4.10.1). During construction, and prior to commissioning WTG blades will not be rotational. As a result, the infrastructure will not be processed and presented onto Radar Data Display Screens (RDDS) by the radar system. Therefore, there will be no impacts on radar systems during the construction phase of the project.

Notes:
Grey - Potential impact is scoped out at EIA Scoping and both PINS and Hornsea Four agree.

8.8.2.2 Please note that the term "scoped out" in Table 8.7 relates to the (LSE in EIA terms and not "scoped out" of the EIA process *per se*. All impacts "scoped out" of LSE are assessed for magnitude, sensitivity of the receiving receptor and conclude an EIA significance in the Impacts Register (see Volume A4, Annex 5.1: Impacts Register).

8.8.3 Commitments

8.8.3.1 Hornsea Four has adopted commitments (primary design principles inherent as part of Hornsea Four, installation techniques and engineering designs/modifications) as part of the pre-application phase, to eliminate and/or reduce the likely significant effect (LSE) arising from a number of impacts. These are outlined in Volume A4, Annex 5.2 Commitments Register. Further commitments (adoption of best practice guidance), referred to as tertiary commitments are embedded as an inherent aspect of the EIA process. Secondary commitments are incorporated to reduce LSE to acceptable levels following initial assessment i.e., so that residual effects are reduced to acceptable levels.

8.8.3.2 The commitments adopted by Hornsea Four in relation to aviation and radar are presented in Table 8.8. The full list of Commitments can be found in Volume A4, Annex 5.2: Commitments Register.

Table 8.8: Relevant aviation and radar commitments.

Commitment ID	Measure Proposed	How the measure will be secured
Co93	Tertiary: Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Trinity House, MCA, CAA and MOD as appropriate. This will include a buoyed construction area around the array area and the HVAC booster station in consultation with Trinity House.	DCO Schedule 11, Part 2 - Condition 8 and; DCO Schedule 12, Part 2 - Condition 8 (Aids to navigation) DCO Schedule 11, Part 2 - Condition 13(1)(j) and; DCO Schedule 12, Part 2 - Condition 13(1)(j) (Aid to navigation management plan)
Co99	Tertiary: Hornsea Four will ensure compliance with MGN654 and its annexes where appropriate.	DCO Schedule 11, Part 2 - Condition 15 and; DCO Schedule 12, Part 2 - Condition 15 (Offshore safety management)
Co102	Tertiary: The DIO and the CAA will be informed of the locations, heights and lighting status of the wind turbines, including estimated and actual dates of construction and the maximum height of any construction equipment to be used, prior to the start of construction, to allow inclusion on Aviation Charts.	DCO Schedule 11, Part 2 - Condition 10 and; DCO Schedule 12, Part 2 - Condition 10 (Aviation Safety)
Co181	Tertiary: An Offshore Decommissioning Plan will be developed prior to decommissioning.	DCO Schedule 11, Part 1(6) and; DCO Schedule 12, Part 1(6) (General Provisions)
Co200	Secondary: Lighting at the HVAC Booster Station(s) will accord with the design set out in the HVAC Booster Station Lighting Plan to ensure that the night-time effects of the HVAC Booster Station lighting on the special characteristics of the Flamborough Head Heritage Coast will be not significant.	DCO Schedule 12, Part 2 - Condition 22 (HVAC Booster Station Lighting Plan)

8.9 Maximum Design Scenario (MDS)

8.9.1.1 This section describes the MDS parameters on which the aviation and radar assessment has been based. These are the parameters which are judged to give rise to the maximum levels of effect for the assessment undertaken, as set out in **Volume A1, Chapter 4: Project Description**. Should Hornsea Four be constructed to different parameters within the design envelope, then impacts would not be any greater than those set out in this ES using the MDS presented in **Table 8.9**.

8.9.1.2 The MDS for impacts on aviation radar services assumes that the entirety of the Hornsea Four array area will be populated with WTGs (up to 180) with a maximum blade tip height of 370 m above LAT. This is because the largest area of the highest WTGs will create the largest impact from a physical obstruction and radar interference perspective, leading to a greater effect on aviation services and air defence systems. Any aspects of the

infrastructure that are non-rotating, fixed and lower in height than the wind turbines (i.e., 10 electrical infrastructure positions for offshore substations and accommodation platforms within the array area and the three HVAC booster stations within the HVAC Booster Station Search Area) and less than the extent of the Hornsea Four array area will not create an incremental effect on aviation and radar interests. **Table 8.9** provides the MDS for impacts to aviation and radar.

Table 8.9: MDS for impacts on aviation and radar.

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
Construction			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2).	Tertiary: Co93 Co99 Co102	**Array:** • 180 WTGs with a maximum tip height of 370 m LAT; • Installation vessels – maximum of eight vessels in a given 5 km^2 area and associated construction activity; and • Impact starting from a point of zero infrastructure present to full presence over a single phase of construction over approximately three years.	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.
Increased air traffic in the area related to wind farm activities in the construction phase may affect the available airspace for other users (AV-C-3).	Secondary: Co200 Tertiary: Co93 Co99 Co102	• 180 WTGs with a maximum tip height of 370 m LAT; • Up to 135 helicopter return trips for WTG installation; • Up to 180 helicopter return trips for WTG foundation installation; • Up to 63 helicopter return trips for OSS and accommodation platform installation; • Up to 42 helicopter return trips for OSS and accommodation platform foundation installation; • Up to 396 helicopter return trips for array and interconnector cable installation; • Up to 800 helicopter return trips for export cable installation; and • Impact starting from a point of zero infrastructure present to full presence over a single phase of construction over approximately three years.	Maximum number of helicopter trips as a result of being engaged on works for Hornsea Four causing an increased possibility of aircraft to aircraft collision.
Operation			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1).	Secondary: Co200 Tertiary: Co93 Co99 Co102	• 180 WTGs with a maximum tip height of 370 m LAT; • Up to three HVAC Booster Stations along the ECC; and • Impact throughout the operation and maintenance phase of 35 years.	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area and HVAC Booster Station Search Area.
Wind turbines causing permanent interference on	None	**Array:** • 180 WTGs with a maximum tip height of 370 m LAT; and	These parameters represent the MDS for height of infrastructure within the array which has the

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
civil and military radar systems (AV-O-2).		• Impact throughout the operation and maintenance phase of 35 years.	greatest potential for interference with radar systems. Impact present during operational period.
Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3).	None	**Array:** • 180 WTGs with a maximum blade tip height of 370 m above LAT; and • Impact throughout the operation and maintenance phase of 35 years.	Wind turbines with the maximum possible blade tip height creating a physical obstruction to aviation operations due to size of above sea level infrastructure.
Disruption to aircraft using HMRs (AV-O-4).	Tertiary: Co102	**Array:** • 180 WTGs with a maximum tip height of 370 m LAT; and • Impact throughout the operation and maintenance phase of 35 years.	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.
Decommissioning			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1).	Tertiary: Co93 Co99 Co102 Co181	**Array:** • 180 WTGs with a maximum tip height of 370 m LAT; • Decommissioning vessels - maximum of eight vessels in a given 5 km^2 area; and • Impact starting from a point of full presence of infrastructure to zero presence over a decommissioning period of approximately three years.	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.
Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-D-2).	Secondary: Co200 Tertiary: Co93 Co99 Co102 Co181	MDS is identical (or less) to that of the construction phase (AC-C-3).	Maximum number of helicopter trips as a result of being engaged on works for Hornsea Four causing an increased possibility of aircraft to aircraft collision.

8.10 Assessment methodology

8.10.1.1 The assessment methodology for aviation and radar is consistent with that presented in **Volume A1, Chapter 5: Environmental Impact Assessment Methodology**.

8.10.2 Impact assessment criteria

8.10.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on those used in the Design Manual for Roads and Bridges (DMRB) methodology, which is described in further detail in **Volume A1, Chapter 5: Environmental Impact Assessment Methodology**.

8.10.2.2 The criteria for defining sensitivity in this chapter are outlined in **Table 8.10.**

Table 8.10: Definition of terms relating to receptor sensitivity.

Sensitivity	Definition used in this chapter
Very High	Receptor or the activities of the receptor, is of critical importance to the local, regional or national economy and/or the receptor or the activities of the receptor, is highly vulnerable to impacts that may arise from the project and/or recoverability is long term or not possible.
High	Receptor or the activities of the receptor, is of high value to the local, regional or national economy and/or the receptor or the activities of the receptor, is generally vulnerable to impacts that may arise from the project and/or recoverability is slow and/or costly.
Medium	Receptor or the activities of the receptor, is of moderate value to the local, regional or national economy and/or the receptor or the activities of the receptor, is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high levels of recoverability.
Low	Receptor or the activities of the receptor, is of low value to the local, regional or national economy and/or the receptor or the activities of the receptor, is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.

8.10.2.3 The criteria for defining magnitude in this chapter are outlined in **Table 8.11**.

Table 8.11: Definition of terms relating to magnitude of an impact.

Magnitude of impact	Definition used in this chapter
Major	Total loss of ability to carry on activities and/or impact is of extended physical extent and/or long-term duration (i.e. total life of project and/or frequency of repetition is continuous and/or effect is not reversible for project).
Moderate	Loss or alteration to significant portions of key components of current activity and/or physical extent of impact is moderate and/or medium-term duration (i.e. operational period) and /or frequency of repetition is medium to continuous and/or effect is not reversible for project phase.
Minor	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/or physical extent of impact is low and/or short to medium-term duration (i.e. construction period) and/or frequency of repetition is low to continuous and/or effect is not reversible for project phase.

Magnitude of impact	Definition used in this chapter
Negligible	Very slight change from baseline condition and/or physical extent of impact is negligible and/or short-term duration (i.e. less than two years) and/or frequency of repetition is negligible to continuous and/or effect is reversible.

8.10.2.4 The significance of the effect upon aviation and radar is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for this assessment is presented in **Table 8.12**. Where a range of significance of effect is presented in **Table 8.12**, the final assessment for each effect is based upon expert professional judgement.

8.10.2.5 For the purposes of this assessment, any effects with a significance level of slight or less have been concluded to be not significant in terms of the EIA Regulations.

Table 8.12: Matrix used for the assessment of the significance of the effect.

		Magnitude of impact (degree of change)			
		Negligible	*Minor*	*Moderate*	*Major*
Environmental value (sensitivity)	*Low*	Neutral or Slight (Not Significant)	Neutral or Slight (Not Significant)	Slight (Not Significant)	Slight (Not Significant) or Moderate (Significant)
	Medium	Neutral or Slight (Not Significant)	Slight (Not Significant) or Moderate (Significant)	Moderate or Large (Significant)	Moderate or Large (Significant)
	High	Slight (Not Significant)	Slight (Not Significant) or Moderate (Significant)	Moderate or Large (Significant)	Large or Very Large (Significant)
	Very High	Slight (Not Significant)	Moderate or Large (Significant)	Large or Very Large (Significant)	Very Large (Significant)

8.11 Impact assessment

8.11.1 Construction Phase

8.11.1.1 The potential impacts of the offshore construction of Hornsea Four have been assessed on aviation and radar. These impacts arising from the construction of Hornsea Four are listed in **Table 8.9** along with the MDS against which each construction phase impact has been assessed. A description of the potential effect on aviation and radar receptors caused by each identified impact is given below.

8.11.1.2 It is good practice to notify aviation stakeholders of the location and dimension of a wind energy development and the associated construction activities. Information regarding construction will be passed to DIO and the CAA at least ten weeks in advance of the erection of the first wind turbine and will be followed up on the day with a confirmation that the activity has taken place. The data will include:

- Location, height (of all structures over 150 ft), dates of erection, dates of removal and lighting type (none, infra-red or lighting brightness); and

- Local aerodromes identified during consultation should be notified, particularly any police helicopter or air ambulance unit.

Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2)

Magnitude of impact

8.11.1.3 Wind turbine construction infrastructure above LAT could pose a physical obstruction to flight operations in the vicinity and specifically to low flying aircraft. Construction infrastructure such as installation vessels and erected (non-operational) wind turbines can be difficult to see from the air, particularly in poor meteorological conditions leading to potential increased obstacle collision risk.

8.11.1.4 Aviation stakeholders have been consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of construction infrastructure. The CAA highlighted the requirement for all structures of 300 ft or more to be charted on aeronautical charts and that the individual locations of the wind turbines are provided for inclusion in the DVOF.

8.11.1.5 A range of mitigation measures, in the form of appropriate notification to aviation stakeholders (Co102) and lighting and marking to minimise effects to aviation flight operations (Co93) would apply to the development of Hornsea Four. These will comply with current guidelines and will be agreed with the appropriate stakeholders and are outlined in Section 8.8.3. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In Visual Meteorological Conditions (VMC) conditions, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware of the location of these through the notification procedures for Hornsea Four. Furthermore, when flying in Instrument Meteorological Conditions (IMC), pilots will be utilising on-board radar which detects obstructions, will be flying above the Minimum Safe Altitude (MSA) and will be under the control of ATC with an appropriate level of ATS which may include the provision of an ATC radar service.

8.11.1.6 The impact is predicted to be of regional spatial extent and of short-term duration and intermittent. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be **minor**.

Sensitivity of the receptor

8.11.1.7 Embedded mitigation and notification of construction, operation and decommissioning of the wind farm; the lighting of structures (Co93) and promulgation on aviation charts (Co102) will reduce any physical obstruction effect to aviation activities in the region of Hornsea Four. The Applicant will complete appropriate liaison to ensure information on the construction and decommissioning of the wind farm is circulated in a Notice to Airmen (NOTAM) and other appropriate media.

8.11.1.8 The UK's database of tall structures (the DVOF) will be notified of all structures of 300 feet or more in order to ensure they are charted on aeronautical charts. This commitment (Co102) is detailed in Volume A4, Annex 5.2: Commitments Register. The ability of

aviation stakeholders to continue using the Southern North Sea airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

8.11.1.9 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be **slight** (not significant) or **moderate** (significant). It is considered that the effect will be **slight** (not significant) as aircrews are responsible for avoiding obstructions; situational awareness will be provided by prior notification of the development to aviation stakeholders, the fitment of appropriate lighting and the inclusion on the DVOF and appropriate aviation charts and publications.

8.11.1.10 A detailed assessment of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) has been completed with further details provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).

Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-C-3)

Magnitude of impact

8.11.1.11 The CAA, in the response to the Hornsea Four PEIR stated that Hornsea Four may impinge on standard routing heights of helicopters operating offshore and may require a change to the MSA. Under aviation flight rules, the MSA is the altitude below which it is unsafe to fly in IMC (i.e. in poor visibility/cloud) owing to presence of terrain or obstacles within a specified area. This could result in an increase in helicopters operating in a confined block of airspace above the array; any increase in helicopter offshore operations, could impact on existing aviation activities and air traffic operating in the area. Details of the assessment completed are included in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).

8.11.1.12 When helicopters are operating offshore in support of Hornsea Four, aircraft can be in receipt of an ATS and may be provided with traffic information on other aircraft, but ultimately pilots are responsible for their own separation from other aircraft, obstacles and terrain irrespective of in-flight weather conditions. Due to the localised area of operation of support helicopter activities in one area of the Southern North Sea, the procedures existing for ATC radar provision and the availability of existing ATS; the impact is expected to be of medium-term duration and continuous. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of the receptor

8.11.1.13 The ATS provided in the Southern North Sea, observation of the MSA by aircrews in poor weather conditions and standard operating procedures of aircraft operation ensure a continued safe separation distance to be maintained between aircraft, obstacles and terrain. Improvements in radar surveillance and radio coverage infrastructure have enhanced the offshore ATC service provided. The same rules of the air and ATC services

will continue to apply to helicopter operators operating aircraft within the Southern North Sea. The provision of an ATS to helicopters completing activities in support of Hornsea Four is not considered to affect the provision of a service to another user of the airspace. Best practice offshore aviation guidance has been developed for the offshore wind energy sector which will be taken into consideration by the Applicant.

8.11.1.14 The ability of the support helicopter operator and other airspace users to continue to safely operate in the available airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of the effect

8.11.1.15 The sensitivity of the receptor is considered to be **low** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be **neutral** (not significant) or **slight** (not significant).The effect has been concluded to be **slight** (not significant).

8.11.1.16 A detailed assessment of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) has been completed and further details are provided in Appendix A of Volume A5, Annex 11.1: Offshore Installation Interfaces (Helicopter Access Report).

8.11.2 Operation and Maintenance

8.11.2.1 The potential impacts of the offshore operation and maintenance of Hornsea Four have been assessed on aviation and radar. These impacts arising from the operation and maintenance of Hornsea Four are listed in Table 8.9 along with the MDS against which each operation and maintenance phase impact has been assessed. A description of the potential effect on aviation and radar receptors caused by each identified impact is given below.

Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1)

8.11.2.2 As is the case for construction and decommissioning activities; information will be circulated to relevant aviation stakeholders including DIO and the CAA (Co102). Information on potential aviation obstructions will be promulgated within the UKIAIP (NATS 2021) and notified to DIO for marking on aeronautical related charts and documentation including the DVOF.

Magnitude of impact

8.11.2.3 During the operational phase of Hornsea Four, wind turbines and the HVAC booster stations along the ECC could pose a physical obstruction to the flight of aircraft operating in the vicinity of the Hornsea Four array area, specifically to low flying aircraft. Aviation stakeholders have been consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of the wind turbines and the HVAC booster stations.

8.11.2.4 The CAA response to the Hornsea Four PEIR highlighted a potential for additional lighting and marking requirements to be fitted to the wind turbines to ensure that the offshore array remain conspicuous to offshore low flying operations whilst not causing confusion to maritime users. Furthermore, the CAA stated that an addition of a form of electronic conspicuity/identification of the wind turbines might assist airspace users in the reduction of operational impact during poor weather conditions.

8.11.2.5 Electronic conspicuity on a fixed ground obstacle would be a new development in the UK and could be confused with airborne flight deck transponder equipment. The use of 'in-cockpit' traffic alert and collision avoidance systems which are designed to reduce the incidence of mid-air collisions between aircraft may also be impacted in the increased electronic environment.

8.11.2.6 The MOD requested that Hornsea Four be fitted with MOD accredited aviation safety lighting in accordance with the ANO and this has been included as a Hornsea Four commitment (Co93).

8.11.2.7 A range of mitigation measures, in the form of appropriate notification to aviation stakeholders (Co102), and the lighting and marking to minimise effects to aviation flight operations (Co93) would apply to the development of Hornsea Four, as included in the commitments set out under **Section 8.8.3**. These commitments will comply with current guidelines and be agreed with the appropriate stakeholders. Provisions of notification to the CAA and DIO and following the regulations provided in the ANO for aviation warning lighting of offshore wind farms is a project commitment as detailed in **Volume A4, Annex 5.2: Commitments Register**.

8.11.2.8 In order to satisfy the CAA's comments in relation to lighting, aviation stakeholders who may be directly impacted by operating in the vicinity of the offshore array area were asked to provide confirmation regarding the adequacy of the current UK marking and lighting for Hornsea Four. Of the stakeholders consulted, only the MCA and Wiking Helicopters responded to the consultation request. The MCA stated that they had no additional comments to make and would discuss the requirements of the Lighting and Marking Plan with the Applicant and the CAA. Wiking Helicopters stated that in their opinion, each WTG should be fitted with aviation obstruction lighting. Wiking Helicopters also stated that they would support the use of additional lighting for NVG operations. The MOD have provided guidance regarding their requirements for offshore lighting of wind turbines of which the minimum standard is both visible and IR lighting. The MOD state that in the majority of cases, the MOD requirement is exceeded by the CAA, MCA and Trinity House statutory requirements however, the MOD minimum specification for offshore lighting is a 'combi light' of visible and infra-red lighting. Consultation is now complete with no requests for additional marking and lighting or electronic conspicuity be utilised to assist users in poor weather conditions (excluding the use of NVG). Based on the evidence presented, the Applicant considers that this issue is now closed. The CAA were informed of the results of the consultation and acknowledged receipt of the outcome. Any additional requirement for marking and lighting will be agreed in consultation with the CAA and the MOD, which is included as a Hornsea Four commitment (Co93).

8.11.2.9 Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In VMC conditions, pilots

are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification procedures of Hornsea Four (Co102). When operating, IMC pilots will be utilising on board radar which detects obstructions, will be operating above the MSA and be under the control of ATC with an appropriate level of radar service. The impact is predicted to be of regional spatial extent and of permanent duration however, the physical extent of the impact is low. It is predicted that the impact will affect the receptor directly however, the magnitude is considered to be **minor**.

8.11.2.10 A detailed assessment of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) has been completed, with further details provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installations Interfaces** (Helicopter Access Report).

Sensitivity of the receptor

8.11.2.11 Aviation receptors who operate in area of the array have been consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of the operational wind turbines.

8.11.2.12 The ability of aviation stakeholders to continue to safely operate in the airspace available is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

8.11.2.13 The CAA have published regulations for the lighting and marking of offshore wind turbines to which the Applicant has committed to adhere (Co93). Aviation stakeholders have been requested to provide information to the Applicant if they consider the extant regulations for the lighting of UK offshore wind turbines is sufficient for Hornsea Four. The request resulted in only one specific response from Wiking Helicopters requesting every WTG to be fitted with aviation lighting, contrary to CAA guidance and ANO regulation, rather than periphery lighting being fitted to wind turbines within the same group. The consideration of lighting and marking following additional aviation stakeholder engagement, and the prior notification of Hornsea Four activities along with inclusion of appropriate aviation charts and publications will mitigate the effect. The sensitivity of the receptors is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be **slight** (not significant) or **moderate** (significant). It is considered that due to the fitment of aviation lighting as per extant regulations (Co93), together with prior notification of Hornsea Four activities and inclusion of the development on aviation charts and publications (Co102) will mitigate the effect to **slight** (not significant).

Wind turbines causing permanent interference on civil and military radar systems (AV-O-2)

8.11.2.14 The operational WTGs would be theoretically detectable by the NATS Claxby PSR. WTG detectable by a PSR might degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the WTGs and saturate the radar receiver leading to clutter potentially concealing real aircraft targets.

Magnitude of impact

8.11.2.15 **Volume A5, Annex 8.1: Aviation and Radar Technical Report** provides details of the radar LOS analysis which has been completed across an indicative grid pattern against the MDS of wind turbines located in the Hornsea Four array area. **Volume A5, Annex 8.1: Aviation and Radar Technical Report** concluded that Hornsea Four WTGs would not be detectable by the NATS Cromer PSR, and both Trimingham and Brizlee Wood ADRs. As such, these systems are not considered further.

8.11.2.16 The operational wind turbines of the Hornsea Four array would be theoretically detectable by the NATS Claxby PSR. Although a fully operational ADR is not currently *in situ* at Staxton Wold, an evaluation has been completed using the legacy Staxton Wold TPS-77 ADR parameters[4]. The results of the evaluation, provided in **Volume A5, Annex 8.1: Aviation and Radar Technical Report** and this document, indicate that, if a TPS-77 ADR or similar, were installed at Staxton Wold, wind turbines within the Hornsea Four array area would theoretically be detectable by the radar system. It's understood that information regarding the level of impact created by existing offshore wind turbines upon the MoD's recently procured Indra LR-25 ADR will become available in Q4 2021. It is anticipated that the information gathered through the 2021 performance-testing of the LR-25 ADR will inform an understanding of expected Hornsea Four effects. However, given that, at the time of the Hornsea Four DCO Application, a fully operational ADR system is not *in situ* at Staxton Wold , this impact is not evaluated further in this chapter. Further information is available in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**.

8.11.2.17 Wind turbines detectable by a PSR system might degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the wind turbines and saturate the radar receiver leading to clutter potentially concealing real aircraft targets.

8.11.2.18 The Hornsea Four array area is within the operational range (370 km) of the NATS Claxby PSR (located in North Lincolnshire). Radar LOS analysis, provided in **Volume A5, Annex 8.1: Aviation and Radar Technical Report**) and in this ES Chapter, which assessed a blade tip height of 370 m above LAT, concluded that the operational wind turbines of Hornsea Four will be theoretically detectable by the Claxby PSR system, leading to a degradation of the system and the presentation of radar clutter. The impact is predicted to be of regional spatial extent and of medium term duration. It is predicted that the impact will affect the receptors directly, the magnitude is considered to be **moderate**.

Sensitivity of the receptor

8.11.2.19 The ability of NATS to accurately use the Claxby PSR for the provision of an ATS could be impacted in the presence of wind turbine interference and the production of radar clutter onto radar displays.

[4] Results are indicative, given that, at the time of this EIA, the MoD's recently procured Indra LR-25 ADR has not been handed over into operational service at Staxton Wold; furthermore, confirmation regarding specific radar parameters (inc. location, and antenna height remain outstanding).

8.11.2.20 NATS aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS. The radar stakeholder is considered to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

8.11.2.21 Overall, the sensitivity of NATS is considered to be **high** and the magnitude of the impact is deemed to be **moderate**. The effect considered will, therefore, be **moderate** or **large** (significant) as Air Traffic Controllers will require an uncluttered radar display to provide a safe and efficient ATS to aircraft under their control. Unmitigated, the radar clutter created will appear at or near the array area however, there will not be a total loss of radar utility and therefore it is considered the effect will be **moderate** (significant).

Further Mitigation

8.11.2.22 Suitable mitigation of the effects on the NATS Claxby PSR has been identified by NATS during the consultation completed to date (see **Table 8.3**).

8.11.2.23 The NATS preferred mitigation solution will be implemented in two stages. The first stage will require an application to the UK regulator (the CAA) under an airspace change proposal detailed in CAP 1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements (CAA 2018a). Secondly, on approval of the airspace change proposal, radar blanking of the NATS Claxby PSR will remove all wind turbine radar returns. On implementation of the NATS preferred mitigation solution and with the mitigation in place, the residual effect to the NATS Claxby PSR is considered to reduce to **slight** (not significant).

Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3)

Magnitude of impact

8.11.2.24 In order to help achieve a safe operating environment, a consultation zone of 9 NM radius (CAA 2016) exists around offshore helicopter installations. This consultation zone is not considered a prohibition on wind turbine development within a 9 NM radius of offshore operations, but a trigger for consultation between the offshore helicopter operators, the operators of existing installations and wind developers to maintain a safe coexistence between wind turbines and offshore helicopter operations. A detailed assessment of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) has been completed; further details are provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report) which considers that the receptor will be affected directly during limited occasions of poor inflight visibility and therefore the magnitude is considered to be **minor**.

Sensitivity of the receptor

8.11.2.25 The sensitivity of the operator is dependent on the frequency and dependency to which helicopter access to the existing oil and gas platform is affected, and this assessment has been informed through consultation with applicable helicopter platform operators. Helicopter operators will require efficient access/egress arrangements in the presence of obstructions to continue operations and therefore sensitivity of the receptor is **medium**.

Significance of the effect

8.11.2.26 Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report) provides details of the assessment of helicopter access to oil and gas platforms potentially impacted by Hornsea Four. Using Ravenspurn North as a case study, the results of the assessment indicate that it is unlikely that there will be any long periods of time when oil and gas platform helicopter operations are inhibited. The sensitivity of the receptor is deemed to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect is **slight** (not significant) or **moderate** (significant). Based on the conclusions of Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report), the significance of effect is considered to be **slight** (not significant).

Disruption to aircraft using HMRs (AV-O-4)

Magnitude of impact

8.11.2.27 Offshore oil and gas platforms in the North Sea are supported by a number of helicopter operators who ferry crews and supplies to and from the mainland. The routes taken by helicopters on such flights may follow HMRs which form a network of corridors between offshore platforms and the main support bases at Norwich Airport and Humberside Airport. HMR's are not a mandatory routing for helicopter operators offshore but are promulgated for the purpose of signposting concentrations of helicopter traffic.

8.11.2.28 **Figure 8.2** provides an illustration of the HMR structure surrounding the Hornsea Four array area. HMR 8 which routes from the Lincolnshire coast to the Munro Platform, bisects the Hornsea Four array area. HMRs are established to both provide an identification of common flight paths and to assist safe helicopter flights when flying in IMC (i.e. when flight cannot be completed in visual conditions). CAP 764 recommends HMRs should ideally be free of obstacles 2 NM either side of the centre line but where planned, should be consulted upon with the helicopter operators and the air navigation service provider (Anglia Radar).

8.11.2.29 It should be noted that the Offshore Renewables Aviation Guidance (ORAG) (RenewableUK, 2016) advises that the HMR routes in the southern North Sea are rarely followed and Hornsea Three pre-application consultation has advised that they are not routinely used but are used more as a point of reference (Orsted 20218a).. **Figure 8.2** illustrates that HMR 8 crosses the Hornsea Four array area, and the presence of the turbines below HMR 8 would preclude the use of this route when the weather requires flight at a lower altitude which would not provide the required obstacle clearance of 1,000 ft. The altitude that the helicopter can fly is based on obstacle clearance criteria and may also be dictated by the icing level or 0° Centigrade (C) isotherm (the level at

which the air temperature reaches freezing). Flight into known icing conditions can be prohibiting, and is generally time-limited, depending upon the aircraft type. Thus, a low freezing level can pose problems for helicopter operations. As the helicopters are Instrument Flight Rules (IFR) equipped, the only weather factor which could preclude use of the HMR is an icing level below 2000 ft. The impact is predicted to be of regional spatial extent and of short to medium term duration. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be **moderate**.

Sensitivity of the receptor

8.11.2.30 Helicopter flights offshore can be flown in visual conditions (i.e. in weather conditions in which pilots will be able to see and avoid obstructions) or in IMC when the icing level is high enough. In these weather conditions, due to the presence of Hornsea Four wind turbines, helicopters would be required to transit at a higher MSA over the Hornsea Four array area. UK SAR helicopters have a full icing clearance (icing protection capability) and therefore an icing level <2,000 ft will not restrict a transit by a SAR helicopter.

8.11.2.31 With regards to the use of HMR 8, the helicopter operator has low vulnerability as it is able to adapt (climb) to an increased MSA which will provide the required separation from obstacles below. Furthermore, the helicopter may also have a certain level of icing protection and there are alternative routes that can be flown avoiding the Hornsea Four array area albeit there may be, as a consequence of the raised MSA, an increased journey time due to the requirement to fly at a greater height or to deviate around the Hornsea Four array area.

8.11.2.32 A HMR does not predicate the flow of helicopter traffic. Where ATC coverage is less comprehensive (as in the Northern North Sea, northeast of Aberdeen), flights are more likely to be conducted along HMRs. The region covered by the Hornsea Four array area is, however, served by radar coverage and provision of ATC services by Anglia Radar to aircraft operating offshore therefore helicopter flights are likely to be provided a direct routing to their offshore destination, i.e. a route that does not follow an HMR, whilst operating VFR, or IFR over the wind turbines at or above the specified MSA. Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report) states that during meetings with the helicopter operators, and during a helicopter operator workshop conducted during the Hornsea Three planning phase, it was stated that minimal use is made of the HMRs in the Southern North Sea. This is partly historical, as the small and medium helicopter types operated in the area had a limited client payload and so routeing on a direct track was the preferred option to maximise client payload by minimising the time of flight and hence fuel load required. This preference for direct routing has continued even though the more capable AW139 helicopter types have a larger payload and range than previous helicopter types operated in the area.

8.11.2.33 The sensitivity of the helicopter operator to be able to transit the Hornsea Four array area has therefore been assessed as low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore considered to be **low**.

Significance of the effect

8.11.2.34 Overall, the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **moderate** and the effect will be **slight** (not significant) as the use of HMR is not mandatory and when flying in poor weather conditions where in-flight visibility is reduced, aircrews will fly at or above the MSA.

8.11.2.35 Note that a detailed assessment of the potential impacts on helicopter operations and the use of HMRs have been completed as part of an overarching oil and gas assessment, with further details provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).

8.11.3 Decommissioning

8.11.3.1 The potential impacts of the offshore decommissioning of Hornsea Four have been assessed on aviation and radar. These impacts arising from the decommissioning of Hornsea Four are listed in **Table 8.9** along with MDS against which each decommissioning phase impact has been assessed. A description of the potential effect on aviation and radar receptors caused by each identified impact is given below.

Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1)

Magnitude of impact

8.11.3.2 During the decommissioning phase, the presence and movement of decommissioning vessels may present a potential collision risk to low flying aircraft operating in the vicinity of decommissioning infrastructure. A range of mitigation measures (notification (Co102), lighting and marking (Co93)) to minimise environmental effects would apply to the decommissioning of Hornsea Four. These will comply with current guidelines and be agreed with the appropriate stakeholders and are outlined in **Section 8.8.3**. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. Pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and decommissioning vessels and will be aware through notification procedures of Hornsea Four (Co102). Mitigation implemented will remain in place until the last wind turbine has been removed. The impact is predicted to be of regional spatial extent and of short-term duration and intermittent. It is predicted that the impact will affect the receptor directly, the magnitude is therefore, considered to be **minor**.

Sensitivity of the receptor

8.11.3.3 Aviation stakeholders have been consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities. The CAA highlighted the requirement for all structures of 300 ft or more to be charted on aeronautical charts and that the individual locations of the wind turbines are provided for inclusion in the DVOF which will inform aviation stakeholders. Embedded mitigation together with the notification of the decommissioning of the wind farm and promulgation on aviation charts and in appropriate publications will reduce any physical obstruction effect to aviation activities in the region of Hornsea Four. Appropriate liaison will be undertaken to ensure information on the

decommissioning of the wind farm is circulated in a NOTAM and other appropriate media (Co93 and Co102).

8.11.3.4 The ability of aviation stakeholders to continue to safely operate in the Southern North Sea airspace during decommissioning activities is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

8.11.3.5 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be **slight** (not significant)or **moderate** (significant). It is considered that due to prior notification of the decommissioning of the development to aviation stakeholders, the fitment of appropriate lighting and the inclusion on the DVOF and appropriate aviation charts will reduce the significance to **slight** (not significant).

Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-D-2)

Magnitude of Impact

8.11.3.6 The CAA, in the response to the Hornsea Four PEIR stated that Hornsea Four may impinge on standard routing heights of helicopters operating offshore and may require a change to the MSA. This could result in an increase in helicopters operating in a confined block of airspace above the array; any increase in helicopter offshore operations, could impact on existing aviation activities and air traffic operating in the area. Details of the assessment completed are included in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).

8.11.3.7 When helicopters are operating offshore in support of Hornsea Four, aircraft can be in receipt of an ATS and may be provided with traffic information on other aircraft, but ultimately pilots are responsible for their own separation from other aircraft, obstacles and terrain irrespective of in-flight weather conditions, this provision of an ATS and the requirement of pilot responsibility is not expected to change over the lifetime of Hornsea Four. Due to the localised area of operation of support helicopter activities in one area of the Southern North Sea, the procedures existing for ATC radar provision and the availability of existing ATS; the impact is expected to be of medium-term duration and continuous. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor.**

Sensitivity of the receptor

8.11.3.8 The ATS provided in the Southern North Sea, observation of the MSA by aircrews in poor weather conditions, and standard operating procedures of aircraft operation ensure a continued safe separation distance to be maintained between aircraft, obstacles and terrain. Improvements in radar surveillance and radio coverage infrastructure have enhanced the offshore ATC service provided and this enhancement is expected to continue with the increased use of GPS navigation. The same rules of the air and ATC services will continue to apply to helicopter operators operating aircraft within the

Southern North Sea. The provision of an ATS to helicopters completing activities in support of Hornsea Four is not considered to affect the provision of a service to another user of the airspace. Best practice offshore aviation guidance has been developed for the offshore wind energy sector which will be taken into consideration by the Applicant.

8.11.3.9 The ability of the support helicopter operator and other airspace users to continue to safely operate in the available airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of the effect

8.11.3.10 The sensitivity of the receptor is considered to be **low** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be **neutral** (not significant) or **slight** (not significant). The effect has been concluded to be **slight** (not significant).

8.11.3.11 A detailed assessment of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) has been completed and further details are provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).

8.12 Cumulative effect assessment (CEA)

8.12.1 Cumulative Effect Assessment Methodology

8.12.1.1 Cumulative effects can be defined as effects upon a single receptor from Hornsea Four when considered alongside other developments. This includes all projects that result in a comparative effect that is not intrinsically considered as part of the existing environment and is not limited to offshore wind projects.

8.12.1.2 A screening process has identified a number of reasonably foreseeable projects and developments which may act cumulatively with Hornsea Four. The full list of such projects that have been identified in relation to the offshore environment are set out in **Volume A4, Annex 5.3: Offshore Cumulative Effects** and are presented in a series of maps within **Volume A4, Annex 5.4: Location of Offshore Cumulative Schemes**.

8.12.1.3 In assessing the potential cumulative effects for Hornsea Four, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans, may not actually be taken forward, or fully built out as described within their MDS. There is therefore a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, those projects under construction are likely to contribute to cumulative effects (providing effect or spatial pathways exist), whereas those proposals not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

8.12.1.4 All projects and plans considered alongside Hornsea Four have been allocated into 'tiers' reflecting their current stage within the planning and development process. This allows the cumulative effect assessment to present several future development scenarios, each with a differing potential for being ultimately built out. This approach also allows

appropriate weight to be given to each scenario (tier) when considering the potential cumulative effect. The proposed tier structure is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the Hornsea Four ES. An explanation of each tier is included in **Table 8.13**.

Table 8.13: Description of tiers of other developments considered for CEA (adapted from PINS Advice Note 17).

Tier 1	Project under Construction.
	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented.
	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined.
Tier 2	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted.
Tier 3	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted.
	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

8.12.1.5 The plans and projects selected as relevant to the CEA of impacts to aviation and radar are based on an initial screening exercise undertaken on a long list (see **Volume A4, Annex 5.3: Offshore Cumulative Effects**). A consideration of effect-receptor pathways, data confidence and temporal and spatial scales has been undertaken to select projects for a topic-specific short-list. By virtue of its distance from centres of aviation activity, Hornsea Four will produce fewer direct adverse effects on aviation operations than an equivalent onshore developments. In the case of Hornsea Four, aviation cumulative effects are confined to the effect of wind turbine detection by the Claxby PSR and the creation of an aviation obstacle to aircraft operating at low level offshore.

8.12.1.6 The specific projects scoped into the CEA for aviation and radar, as well as the tiers into which they have been allocated are presented in **Table 8.14.** Note that this table only includes the projects screened into the assessment for aviation and radar based on the criteria outlined above. For the full list of projects considered, including those screened out; please see **Volume A4, Annex 5.3: Offshore Cumulative Effects**.

8.12.1.7 It is noted that offshore wind farms seek consent for a MDS and the 'as built' offshore wind farm will be selected from the range of consented scenarios. In addition, the MDS quoted in the application is often refined during the determination period of the application. For example, it is noted that the application for Hornsea Project One considered a maximum of 332 turbines within the ES but was awarded consent for 240 turbines. In addition, it is now known that Hornsea Project One 'as built' consists of 174 turbines. Similarly, Hornsea Project Two has gained consent for an overall maximum of 300 turbines, as opposed to 360 considered in the ES and the 'as built' number of turbines is likely to be 165. A similar pattern of reduction in the project envelope from that assessed in the ES, to the consented envelope and the 'as built' project is also seen across other offshore wind farms of relevance to this CEA. This process of refinement can result in a reduction to associated project parameters, for example the number and length of cables to be installed and the number of offshore substations.

8.12.1.8 The potential for cumulative effects created by the radar detection of Hornsea Four exists to those radar systems that will also detect the wind farm developments listed in **Table 8.14** below.

8.12.1.9 The CEA presented in this aviation and radar chapter has been undertaken on the basis of information presented in the ES for the other projects, plans and activities. Given that this broadly represents a MDS, the level of cumulative effects on aviation and radar would highly likely be reduced from those presented here. **Table 8.14** provides those projects screened into the aviation and radar cumulative assessment.

Table 8.14: Projects screened into the aviation and radar cumulative assessment.

Tier	Project/plan	Date of construction (if applicable)	Distance to Hornsea Four Array (km)	Distance to Hornsea Four ECC (km)	Distance to Hornsea Four HVAC Booster Area (km)	Reason for inclusion in CEA
1	Hornsea Project Two Offshore Wind Farm	2020 to 2022	3.46	10.61	67.23	Creation of an obstacle
	Hornsea Project One Offshore Wind Farm	2018-2020 (under construction)	16.84	26.56	83.33	Creation of an obstacle
	Westermost Rough Offshore Wind Farm	N/A (Operational)	62.94	22.07	26.38	Radar cumulative effect
	Hornsea Three Offshore Wind Farm	2024 to 2028	46.47	60.28	116.91	Creation of an obstacle
	Humber Gateway Offshore Wind Farm	N/A (Operational)	66.37	41.65	42.69	Radar cumulative effect
	Triton Knoll Offshore Wind Farm	2019 to 2021 (under construction	56.99	50.20	61.89	Radar cumulative effect
	Dudgeon Offshore Wind Farm	N/A (operational)	74.89	74.81	102.70	Radar cumulative effect
	Race Bank Offshore Wind Farm	N/A (operational)	78.83	72.90	83.60	Radar cumulative effect
	Lincs Offshore Wind Farm	N/A (operational)	96.62	84.15	90.07	Radar cumulative effect
	Teesside Offshore Wind Farm	N/A (operational)	140.61	86.99	109.28	Radar cumulative effect

Tier	Project/plan	Date of construction (if applicable)	Distance to Hornsea Four Array (km)	Distance to Hornsea Four ECC (km)	Distance to Hornsea Four HVAC Booster Area (km)	Reason for inclusion in CEA
	Inner Dowsing Offshore Wind Farm	N/A (operational)	101.69	88.57	93.77	Radar cumulative effect
	Sheringham Shoal Offshore Wind Farm	N/A (operational)	91.54	90.25	107.45	Radar cumulative effect
	Lynn Offshore Wind Farm	N/A (operational)	107.20	95.46	101.12	Radar cumulative effect
2	Dudgeon Extension Project	2024 to 2027	69.49	69.48	92.80	Radar cumulative effect
	Sheringham Shoal Extension	2024 to 2027	83.60	82.32	100.68	Radar cumulative effect

8.12.1.10 Certain effects assessed for the project alone are not considered in the cumulative assessment due to:

- The highly localised nature of the impacts (i.e. they occur entirely within the Hornsea Four Order Limits only);
- Management measures in place for Hornsea Four will also be in place on and be similar to other projects considered in the cumulative assessment reducing the risk so that significant effects are unlikely to occur; and/or
- Where the potential significance of the effect from Hornsea Four alone has been assessed as negligible.

8.12.1.11 The effects excluded from the CEA for the above reasons are:

- Increased air traffic in the area related to wind farm activities; and
- Disruption to aircraft using HMRs due to the highly localised nature of the impact.

8.12.1.12 Therefore, the effects that are considered in the CEA is as follows:

- Creation of an aviation obstacle to low flying aircraft operating offshore; and
- Wind turbines causing permanent interference on civil and military radar systems.

8.12.1.13 The cumulative MDS's described in **Table 8.15** have been selected as those having the potential to result in the greatest cumulative effect on an identified receptor group. The cumulative effects presented and assessed in this section have been selected from the details provided in the project description for Hornsea Four (summarised for aviation and radar in **Table 8.9**), as well as the information available on other projects and plans in order to inform a cumulative MDS. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project design envelope to that assessed here, be taken forward in the final design scheme.

Table 8.15: Cumulative MDS table.

Project Phase	Potential Impact	Maximum Design Scenario	Justification
Construction and Operation and Maintenance	Creation of an aviation obstacle to low flying aircraft operating offshore.	MDS for Hornsea Four plus the cumulative full development of the following projects within 40 km of Hornsea Four: **Tier 1:** • • Hornsea Project One; • Hornsea Project Two. **Tier 2:** • No Tier 2 projects identified. **Tier 3:** • No Tier 3 projects identified.	Inclusion of other developments which will have the potential to create a cumulative aviation obstacle and the creation of an obstacle for other users in the same region.
Operation and Maintenance	Wind turbines causing permanent interference on civil and military radar systems.	MDS for Hornsea Four plus the cumulative full development of the following projects within 100 km of Hornsea Four: **Tier 1:** • • Westermost Rough; • Humber Gateway; • Triton Knoll; • Dudgeon; • Lincs; • Teesside; • Inner Dowsing; • Race Bank • Sheringham Shoal and • Lynn. **Tier 2:** • Dudgeon and Sheringham Shoal Extension Projects **Tier 3:** • No Tier 3 projects identified.	Maximum aviation and radar cumulative effect is calculated within a representative 100 km buffer of Hornsea Four.

8.12.2 Cumulative Effect Assessment

8.12.2.1 A description of the significance of cumulative effects on aviation and radar arising from each identified impact is given below.

8.12.3 Construction and Operation and Maintenance Phase

Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore

Tier 1

8.12.3.1 There is potential for cumulative effect as a result of construction and operation and maintenance activities associated with Hornsea Four and other projects (Table 8.14). For the purposes of this ES, this additive effect has been assessed within 40 km from Hornsea Four, which is considered to be the maximum range where the creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore may occur although some impacts are likely to be localised to the Hornsea Four array area. The Tier 1 projects are listed in Table 8.15.

8.12.3.2 Other offshore projects that will contribute to increased helicopter flights in the region of Hornsea Four include Hornsea Project One and Hornsea Project Two. The cumulative increase in helicopter operations from the listed projects might be noticeable, particularly as flights will be concentrated in a regional area and may impact other users of the airspace including military low flying aircraft.

8.12.3.3 The effect is predicted to be of regional spatial extent, permanent and continuous however the physical extent of impact is low. It is predicted that the effect is direct on aviation receptors operating in the airspace. The magnitude is therefore, considered to be **moderate**.

8.12.3.4 Aviation operations in the UK are highly regulated. The Hornsea Four study area is located in airspace where the provision of an ATS is routine (subject to radio and radar coverage). The same rules of the air which maintain a safe operating environment in the current baseline will apply in the Southern North Sea during all phases of Hornsea Four and the provision of the ATS will not be affected.

8.12.3.5 The aviation receptors operating offshore are deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptors is therefore, considered to be **low**.

8.12.3.6 Overall, the sensitivity of the receptor is considered to be **low** and the magnitude of impact is deemed to be **moderate**. The effect will, therefore, be **slight** (not significant) due to prior notification of the development to aviation stakeholders, the fitment of appropriate lighting and the inclusion on the DVOF and appropriate aviation charts and publications.

8.12.4 Operation and Maintenance Phase

Wind turbines causing permanent interference on civil and military radar systems

8.12.4.1 There is potential for cumulative effect as a result of operational activities associated with Hornsea Four and other projects (Table 8.14). For the purposes of this ES, this additive impact has been assessed within 100 km from Hornsea Four and restricted to those Tier 1 and Tier 2 developments that are known to have attracted a DCO requirement that relates to ATC PSR. The range is considered to be the maximum range where aviation and

radar cumulative effect may occur due to radar performance characteristics although some impacts are likely to be localised to the Hornsea Four array area. The projects identified for this tier are listed at **Table 8.15**.

Tier 1/Tier 2

8.12.4.2 Theoretical radar LOS analysis for the NATS Claxby PSR (see **Volume A5, Annex 8.1: Aviation and Radar Technical Report**) indicates that Hornsea Four wind turbines with a tip height of 370 m, would be considered to be detectable to the radar system.

8.12.4.3 Other offshore wind farms that are considered likely to be detected by the radar systems include Westermost Rough, Humber Gateway, Triton Knoll, Dudgeon, Race Bank, Lincs, , Inner Dowsing, Sheringham Shoal Lynn and the Dudgeon and Sheringham Shoal Extension projects however, it has not been deemed necessary to undertake radar LOS analysis to each of these developments for the purposes of this CEA. The potential cumulative effect will be to add to the radar clutter and possibly an increase in the individual signal processing demands of the two radar systems dependent on radar detectability. However, it is presumed that the majority of the projects provided above have radar mitigation in place which will remove radar clutter and therefore any effect will be reduced to negligible.

8.12.4.4 The effect is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible for the lifetime of Hornsea Four. It is predicted that the impact will affect the receptor directly. However, on the basis that no wind farm which through its operation requires a radar technical mitigation solution to be in place will be permitted to operate without this necessary radar mitigation in place in agreement with key aviation stakeholders, it is considered that with radar mitigation in place, Hornsea Four will not contribute to adverse cumulative effects on aviation radar. With mitigation in place the magnitude is considered to be **minor**.

8.12.4.5 NATS aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS. The radar stakeholder is considered to be of high vulnerability, low recoverability and high value. The sensitivity of these receptor is therefore, considered to be **high**.

8.12.4.6 Overall, the sensitivity of the receptor considered is **high** and the magnitude of the impact is deemed to be **minor**. The effect for the receptor will, therefore, be **slight** (not significant) or **moderate** (significant) however as mitigation will be required for those radar systems which are affected, no radar cumulative effect will be apparent. It is considered the effect will be **slight** (not significant) due to the requirement for a technical solution to mitigate radar effect.

8.13 Transboundary effects

8.13.1.1 Transboundary effects are defined as those effects upon the receiving environment of other European Economic Area (EEA) states, whether occurring from Hornsea Four alone or cumulatively with other projects in the wider area. A transboundary screening exercise was undertaken at Scoping (Annex L of the Scoping Report (Orsted 2018), which identified that there was potential for transboundary effects to occur in relation to aviation and radar.

8.13.1.2 There is the potential for transboundary impacts to arise from the presence of the wind turbines during the operation and maintenance phase disrupting civil and military radar coverage from The Netherlands. The probability of impact (due to radar detectability of the Hornsea Four wind turbines) is extremely low due to the range of applicable Netherlands radar systems from the Hornsea Four array area and the low likelihood of detection of the Hornsea Four array by Netherlands radar systems.

8.13.1.3 The sensitivity of the receptor is considered to be **low** and the magnitude of the impact is deemed to be **negligible**.

8.13.1.4 Therefore, the potential transboundary effect of disruption of civil and military aviation radar coverage interference on aviation and radar is concluded to be **neutral** or **slight** (not significant). It is considered that the transboundary effect will be **neutral** (not significant) as Hornsea Four is likely to be outside of the effective range of Netherlands radar systems.

8.14 Inter-related effects

8.14.1.1 Inter-related effects consider impacts from the construction, operation or decommissioning of Hornsea Four on the same receptor (or group). The potential inter-related effects that could arise in relation to aviation and radar are presented in **Table 8.16**. Such inter-related effects include both:

- Project lifetime effects: i.e. those arising throughout more than one phase of the project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation; and
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

8.14.1.2 A description of the process to identify and assess these effects is presented in **Section 5.8** of **Volume A1, Chapter 5: Environmental Impact Assessment Methodology**.

Table 8.16: Inter-related effects assessment for aviation and radar.

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
Project-lifetime effects			
Construction, operation and decommissioning.	Creation of an aviation obstacle.	Slight (not significant)	Aircraft operating at a level to be in conflict with the Hornsea Four offshore array area will be impacted by construction and decommissioning infrastructure and wind turbines across all project phases. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter and will be notified of all project phases through notification procedures outlined in Section 8.7.3. Therefore, across the project lifetime, the effects on aviation and radar receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Construction and operation	Increased air traffic related to wind farm activities might affect the available airspace for other users.	Slight (not significant)	Helicopters will be used during the construction, operational and maintenance and decommissioning phases of Hornsea Four and these flights would be in addition to existing helicopter traffic levels in the Southern North Sea. The effect can be considered to be continuous across all project phases. Helicopter flights in the UK are highly regulated. The same rules of the air and ATC services will continue to apply to helicopter operators within the Southern North Sea and the provision of a service to Hornsea Four support helicopters is not considered to affect the provision of a service to another user of the airspace. Therefore, across the project lifetime, the effects on aviation and radar receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Receptor-led effects			
The interaction of other aircraft operating at low level with wind farm infrastructure and increased air traffic related to wind farm activities.		The greatest potential for spatial and temporal interactions is likely to occur due to interaction of an aviation obstacle and the reduction of airspace due to increased wind farm related air traffic for other users. The individual standalone impacts were assigned significance of minor. ATS provision and the rules of air, including the see and be seen principle, will mean reduced potential for interaction between inter-related effects. It is therefore anticipated the significance of these combined effects on airspace users will not be of any greater significance than the effects when assessed in isolation (i.e. slight (not significant).	

8.14.1.3 There are no inter-related effects that are of greater significance than those assessed in isolation.

8.15 Conclusion and summary

8.15.1.1 Table 8.17 presents a summary of the significant impacts assessed within this ES, any mitigation and residual effects.

Table 8.17: Summary of potential impacts assessed for aviation and radar.

Impact and Phase	Receptor and value/sensitivity	Magnitude and significance	Mitigation	Residual impact
Construction				
Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Slight (not significant)	None proposed beyond existing commitments.	Not significant
Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-C-3).	Helicopters operating in support of wind farm activities Low	Minor Slight (not significant)	None proposed beyond existing commitments.	Not significant
Operation				
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Slight (not significant)	None proposed beyond existing commitments.	Not significant
Wind turbines causing permanent interference on civil and military radar systems (AV-O-2).	NATS High	Moderate Moderate (significant)	NATS – Radar blanking and Airspace Change Proposal . With agreed mitigation in place impact will be reduced to not significant.	Not significant
Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3)	Helicopter operators Medium	Minor Slight (not significant)	A number of mitigations have been identified which will improve the access to each installation in poor weather as provided in Appendix A of **Volume A5, Annex 11.1: Offshore Installation Interfaces** (Helicopter Access Report).	Not significant
Disruption to aircraft using HMRs (AV-O-4).	Helicopter operators operating on HMRs Low	Moderate Slight (not significant)	None proposed beyond existing commitments.	Not significant

Impact and Phase	Receptor and value/sensitivity	Magnitude and significance	Mitigation	Residual impact
Decommissioning				
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Slight (not significant)	None proposed beyond existing commitments.	Not significant
Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-D-2)	Helicopters operating in support of wind farm activities Low	Minor Slight (not significant)	None proposed beyond existing commitments.	Not significant

8.16 References

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Orsted (2018a) Hornsea Project Three Offshore Wind Farm Environmental Statement. Volume 2, Chapter 8 – Aviation, Military and Communication. PINS Document Reference: A6.2.8

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NATS (2021) CAP 032 United Kingdom Integrated Aeronautical Information Publication

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CAA (2014) CAP 670 Air Traffic Services Safety Requirements

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MOD (2019) Air Defence Radar Mitigation Update including Annex A (August 2018 release)

MOD (2019a) Statutory Consultation under Section 42 of the Planning Act 2008 and Regulation 13 of Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

MCA (2021) Safety of Navigation: Offshore Renewable Energy Installations OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response