East Anglia
Offshore Wind

VATTENFALL

SCOTTISHPOWER RENEWABLES

East Anglia THREE

Chapter 16

Aviation and MOD

Environmental Statement
Volume 1
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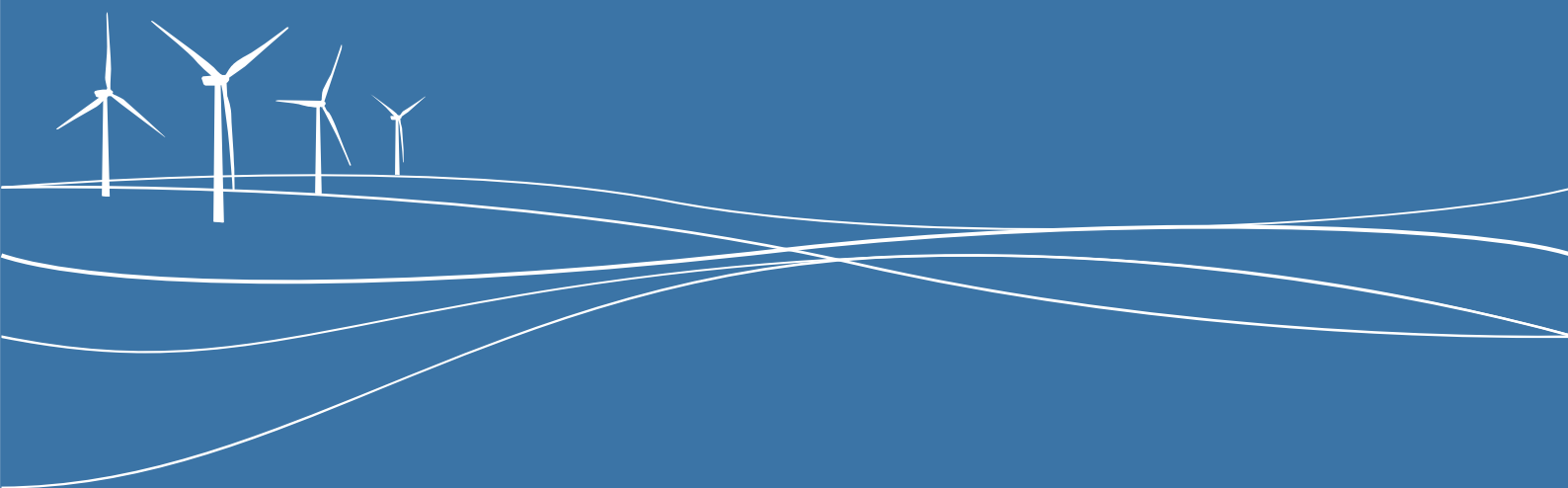

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Table of Contents

Chapter 16 Aviation and MOD Chapter figures are presented in **Volume 2: Figures** and listed in the table below.

Figure number	Title
16.1	East Anglia THREE site and relevant civil airspace designations
16.2	East Anglia THREE site and relevant military airspace designations
16.3	East Anglia THREE site: Windfarm Locations

Chapter 16 Aviation and MOD Chapter appendices are presented in **Volume 3: Appendices** and listed in the table below.

Appendix number	Title
16.1	Aviation Radar

16 AVIATION AND MOD

16.1 Introduction

1. This chapter of the Environmental Statement (ES) addresses the potential impact that the proposed East Anglia THREE project could have on aviation interests, including those of the United Kingdom (UK) Civil Aviation Authority (CAA), Ministry of Defence (MOD), regional airports, local aerodromes and NATS (that currently comprises NATS (En-Route) plc [NERL] and NATS (Services) Limited [NSL]), other UK aviation stakeholders and, where necessary, overseas authorities. The Chapter includes a description of the potential effects on aviation activities with respect to effects on radar and physical effects in both UK and overseas airspace predicted as a result of the construction, operation and decommissioning phases of the proposed East Anglia THREE project. An assessment of these effects is undertaken and, where applicable, details are provided of proposed mitigation measures.

2. This Chapter is supported by a Technical Appendix (Volume 3: Aviation and MOD - Technical Appendix 16.1 – hereafter *Appendix 16.1*), which identifies the radars liable to detect the East Anglia THREE site and details of the radar Line of Sight (LoS) analyses, including a technical analysis of those radars subject to assessment. The Chapter's content then goes on to outline the modus operandi of Air Navigation Service Providers (ANSPs) in the area, the consultation engagement to date and summarises the effects that the East Anglia THREE site is likely to have on aviation activities in the vicinity.

3. This Chapter has been prepared by Cyrrus Limited. A list of acronyms used in this Chapter and the appendices are set out in the East Anglia THREE Environmental Statement Acronyms and Glossary of Terms document.

4. Guidance on the issues to be assessed for potential effects on aviation interests from offshore renewable energy developments in general have been obtained through reference to National Policy Statements (NPS) EN-1 and EN-3; summarised in *Table 16.3.*

16.2 Consultation

5. Consultation with potentially affected stakeholders was initiated at the scoping stage of the proposed East Anglia THREE project. During summer 2014, Section 42 consultation was undertaken with NATS, the MOD, the National Air Traffic Management Advisory Committee (NATMAC), transboundary stakeholders and offshore helicopter operators supporting the oil, gas and renewable energy

industries and search and rescue operations, using the Aviation and MOD Preliminary Environmental Information Report (PEIR) chapter.

6. NATMAC is a non-statutory advisory body sponsored by the UK CAA, with membership drawn from the whole spectrum of the UK aviation community. The Committee is consulted for advice and views on any major matters concerned with airspace management and provides a common conduit to conduct comprehensive and effective consultation. NATMAC assists in the development of airspace policies, configurations and procedures in order that due attention is given to the various requirements of all users of UK airspace, civil and military.

7. Where potential objections have been or could be raised, methods of mitigation are proposed. Dialogue is on-going with those stakeholders concerned, specifically the MOD.

8. The main issue identified is associated with potential wind turbine interference to Primary Surveillance Radars (PSRs). An additional consideration that has been investigated is that, due to the physical size of the wind turbines proposed, there is potential for the wind turbines to become aviation obstacles or obstructions to aircraft operations in their vicinity, particularly helicopters engaged in offshore operations. This is also addressed within this Chapter.

9. *CAP 764 - Policy and Guidelines on Wind Turbines, Issue 5, June 2013*, (CAP 764) advises that wind turbine effects on Secondary Surveillance Radars (SSRs) could be caused due to the physical blanking and diffracting effects of the wind turbine towers depending on the size of the wind turbines and the windfarm. However, CAP 764 goes on to say that these effects are only a consideration when the wind turbines are located very close to the SSR i.e. less than 10km. As all known SSRs are outside the East Anglia THREE site by a significant margin, no SSR site would be affected and the potential effect of wind turbine interference on SSR is therefore not considered further.

10. Similarly there would be no measureable effects upon terrestrial based aviation Communication, Navigation and (other) Surveillance (CNS) systems as the East Anglia THREE site is considerably outside applicable safeguarding limits pertaining to such CNS infrastructure. Therefore, terrestrial CNS infrastructure (other than PSR) is also not considered further, as no sites would be affected.

11. The infringement of coastal airports' Obstacle Limitation Surfaces (OLS) could render operations at those affected airports' unsafe, for example, if the transportation of wind turbine towers from onshore facilities to the East Anglia THREE site were to

infringe the OLS. The OLS routinely extend to only 15km from a licensed airport. Due to the considerable distance from nearby airports to the nearest port and to the East Anglia THREE site, there would be no impact on any OLS. Therefore, impacts upon airports' OLS are not considered further in this Chapter.

12. The consultation responses received to date in relation to the East Anglia THREE project are summarised in *Table 16.1.*

Table 16.1 - Consultation Responses

Consultee	Date /Details	Comment	Response / where addressed in the ES
Ministry of Defence	4 December 2012 DE/C/SUT/43/10/1/17608 (Scoping Opinion Response)	Objection based on concerns with East Anglia THREE being in LoS to the TPS-77 AD Radar and obstacle lighting requirement	See sections 16.1, 16.6 and 16.10, together with *Appendix 16.1*
NATS	December 2012 (Scoping Opinion Response)	Initial 'No comment'. Requested confirmation of the number, tip height and location of the wind turbines once these become known due to the East Anglia THREE site area being borderline with respect to PSR cover from the Cromer PSR	Following EATL modelling NATS confirmed that the Cromer radar would not be affected – See paragraph 16 and *Appendix 16.1*
Civil Aviation Authority	December 2012 (Scoping Opinion Response)	Consultation should occur with the offshore helicopter operators who may be contracted to operate in the area. Lighting/marking and charting of the turbines and any anemometer/meteorological masts: There a requirement to provide aviation lighting on all offshore obstacles over 60m above sea level (paragraphs 5.7 - 5.10 of CAP764 provide more information) and to inform the UK Hydrographic Office for charting purposes prior to construction/installation.	Section 42 consultation undertaken with offshore helicopter operators – responses reported below Lighting, marking and notification requirements addressed at sections 16.3.3.2 and 16.3.3.3
Ministerie van Defensie (Netherlands MOD)	7 December 2011 (ZEA consultation response)	"I can inform you that the Dutch MoD has no radar issues with the projected wind turbines in this area [the East Anglia Zone]".	Noted
Inspectie Leefomgeving en Transport (ILT) (Netherlands CAA)	2 December 2011 (ZEA consultation response)	No issues with any turbines placed anywhere within the East Anglia Zone. While turbine lighting requirements differ between the UK and NL, NL CAA recommends lighting on East Anglia wind farms which fall in part within the Amsterdam FIR in accordance with the UK requirements so there is	Noted

Consultee	Date /Details	Comment	Response / where addressed in the ES
		consistency of lighting throughout the wind farm.	
Luchtverkeersleiding Nederland (LVNL)	16 June 2014 (Section 42 Consultation)	PEIR: LVNL has not changed its original position (from ZEA consultation, email dated 12 December 2011), which is: "We don't expect radar issues with the wind turbines planned in the East Anglia Offshore Wind zone. The primary radars used by LVNL (including NATS radar Debden) are too far away to have line of sight with wind turbines in this area. Our Northsea Wide Area Multilateration and ADSB system will not be affected either as there are no WAM/ADSB field units close enough to the wind zone."	LVNL was considered for potential transboundary impacts. However, the LVNL has confirmed the proposed East Anglia THREE project would not affect their systems. See section 16.8.
UKFSC (UK Flight Safety committee)	16 July 2014 (Section 42 Consultation)	PEIR: "Blade heights in the EA3 development *(sic East Anglia THREE site)* should be restricted in the areas closest to the Trimingham and Cromer radars such that there is no forecast interference. Infra-red lighting should be available on all masts and collection stations. The HMR should be separated by 5 miles from the EA3 *(sic East Anglia THREE site)* boundary."	NATS confirmed that the Cromer radar would not be affected – See paragraph 16. MOD has been engaged regards potential interference and mitigation thereof, as presented in the appertaining row of this Table. See sections 16.1, 16.6 and 16.10 refer, together with *Appendix 16.1.* Separation of the East Anglia THREE site from Helicopter Main Routes (HMRs) by 5 miles is not a regulatory requirement;

Consultee	Date /Details	Comment	Response / where addressed in the ES
			rather a 2NM separation between the centre of the HMR and a windfarm is recommended. See section 16.5.2.3.
NATS	30 July 2014 (Section 42 Consultation)	PEIR: NATS undertook a preliminary assessment of East Anglia THREE site and established on a non-binding, pre-planning basis that it anticipated the East Anglia THREE site having no impact on NATS' radar, navigation or radio communications infrastructure.	NATS confirmed that the Cromer radar would not be affected – See paragraph 16 and *Appendix 16.1*.
Ministry of Defence	Email of 10 July 2014. meeting on 20 August 2014 and supporting email 8 December 2014	MOD provided EATL with 4 radar LoS plots by email on 10 July 2014 (based on test scenarios provided to MOD by EATL) for discussion at the 20 August meeting. Further to 20 August 2014 section 42 meeting, MOD emailed EATL on 8 December 2014: "Further to item 4 – Technical Matters on the attached draft minutes of the East Anglia 3 meeting on 20th August 2014, Steve Speke has completed an assessment to determine the maximum acceptable RLOS height at boundary point 4 above turbine 79 to the MOD at RRH Trimingham. "Steve has determined that the maximum acceptable height to the MOD would be 193 metres AMSL. I trust that this information will assist you when considering the layout of the development."	MOD has been engaged regards potential interference and mitigation thereof. See sections 16.1, 16.6 and 16.10, together with *Appendix 16.1.*

Consultee	Date /Details	Comment	Response / where addressed in the ES
CHC	31 July 2014 (Section 42 Consultation)	"CHC Helicopters Service Ltd offer[s] no objection to the East Anglia THREE Offshore Wind proposal."	Noted. Helicopter operations would not be significantly impacted, as addressed in sections 16.3, 16.5 and 16.6.

16.3 Scope

16.3.1 Study Area

13. The proposed East Anglia THREE project would consist of between 100 and 172 wind turbines within the East Anglia THREE site, each having a rated capacity of between 7MW and 12MW, with a total installed capacity of up to 1,200MW in a 305km² area. The East Anglia THREE site is located within the Round 3 Offshore Wind Zone called the East Anglia Zone, which is itself located in the southern North Sea. The East Anglia THREE site is approximately 69km from the closest point to Lowestoft and is the focus of this Chapter.

14. The nearest airport is at Norwich, approximately 100km from the East Anglia THREE site. Amsterdam Schiphol Airport is approximately 120km from the eastern boundary of the East Anglia THREE site. There are five Royal Air Force (RAF) stations located in the East Anglian region, all of which are located more than 100km from the East Anglia THREE site.

15. The aviation stakeholders' assessment was based upon a desktop study of the available information and its impact on international and national aviation Standards and Recommended Practices (SARPs) followed by subsequent consultation with the relevant statutory bodies and interested organisations. A logical and proven methodology detailed in *Appendix 16.1,* based on the requirements of CAP 764, was used to assess the potential effects of the establishment of the East Anglia THREE site in respect of PSRs. This chapter addresses the consequences of any radar impacts on the airspace in the vicinity of the East Anglia THREE site.

16. Following radar LoS modelling of two potentially affected PSRs (*Appendix 16.1* refers), it was determined that the Cromer PSR would not be affected by the East Anglia THREE site. NATS, (2014) Technical and Operational Assessment (TOPA) for East Anglia Zone 3, NATS Reference SG09269, 30 July 2014, concurred with this assessment. Therefore, the Cromer PSR is not considered further within this chapter.

16.3.2 Worst Case

17. EATL is currently considering constructing the project in either a Single Phase or in a Two Phased approach. Construction activities within the East Anglia THREE site would last 32 months under the Single Phase approach (in one single build period) and 42 months under the Two Phased approach (please refer to Chapter 5 Description of Development *Table 5.34* and *Table 5.37*).

18. The definitions of the worst case assumptions take into consideration content from Chapter 5 Description of the Development.

19. Radar LoS modelling has been undertaken based on a maximum wind turbine tip height of 247m Above Mean Sea Level (AMSL). Taking into consideration any potential differences that could be presented during the Single Phase and Two Phased approaches, worst case scenarios have been identified and assessed for their impact based on 247m AMSL tip heights. Table 16.2 presents details of these.

Table 16.2 - Worst Case Assumptions

Impact	Key design parameters forming realistic worst case scenario	Rationale
Construction		
Impact 1: Creation of aviation obstacle environment	**Single Phase** 100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL, or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL Maximum of five offshore electrical platforms 70.54m / 231.43ft AMSL in height Maximum of two meteorological masts 150.54m / 493.90ft AMSL in height Maximum of one accommodation platform 60.54m / 198.62ft AMSL in height **Two Phased** Under the Two Phased approach there would be an additional offshore electrical platform and the construction programme for above sea level infrastructure would be over a 42 month period compared with a 32 month period for the Single Phase approach.	Maximum number of the tallest wind turbines; or Maximum number of wind turbines in the East Anglia THREE site Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the East Anglia THREE site Impact starting from a point of zero infrastructure present to full presence
Impact 2: Wind turbines causing permanent interference on military radar	**Single Phase** 100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL; or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL Wind turbines installed over a 18 month period **Two Phased** Wind turbines installed over two 10 month periods with a gap of eight months between each period	Maximum number of the tallest wind turbines; or Maximum number of wind turbines in the East Anglia THREE site UK AD detection capability and therefore national security could be compromised Impact starting from a point of zero infrastructure present to full presence

Impact	Key design parameters forming realistic worst case scenario	Rationale
Impact 3: Increased air traffic in the area related to windfarm activities	Seven return helicopter trips per week (14 individual movements)	Maximum number of helicopter trips as a result of being engaged on works for East Anglia THREE Limited, causing increased likelihood of aircraft to aircraft collision
Operation		
Impact 1: Creation of aviation obstacle environment	100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL, or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL Maximum of five offshore electrical platforms 70.54m / 231.43ft AMSL in height Maximum of two meteorological masts 150.54m / 493.90ft AMSL in height Maximum of one accommodation platform 60.54m / 198.62ft AMSL in height **Two Phased** Under the Two Phased approach there would be an additional offshore electrical platform and the construction programme for above sea level infrastructure would be over a 42 month period compared with a 32 month period for the Single Phase approach.	Maximum number of the tallest wind turbines, or Maximum number of wind turbines in the East Anglia THREE site Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the East Anglia THREE site Impact duration present during 25 year operational period
Impact 2: Wind turbines causing permanent interference on military radar	100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL; or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL	Maximum number of the tallest wind turbines; or Maximum number of wind turbines in the East Anglia THREE site UK AD detection capability and therefore national security could be compromised Impact present during 25 year operational period

Impact	Key design parameters forming realistic worst case scenario	Rationale
Impact 3: Increased air traffic in the area related to windfarm activities	Seven return helicopter trips per week (14 individual movements)	Maximum number of helicopter trips as a result of being engaged on works for East Anglia THREE Limited, causing increased likelihood of aircraft to aircraft collision
Decommissioning		
Impact 1: Removal of aviation obstacle environment	100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL, or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL Maximum of five offshore electrical platforms 70.54m / 231.43ft AMSL in height Maximum of two meteorological masts 150.54m / 493.90ft AMSL in height Maximum of one accommodation platform 60.54m / 198.62ft AMSL in height	Maximum number of the tallest wind turbines; or Maximum number of wind turbines in the East Anglia THREE site Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the East Anglia THREE site Impact starting from a point of full presence of infrastructure to zero presence over a two year period
Impact 2: Removal of wind turbines causing interference on military radar	100 wind turbines with a maximum blade tip height of 247m / 811ft AMSL or 172 wind turbines with a maximum tip height of 181m / 594ft AMSL	Maximum number of the tallest wind turbines; or Maximum number of wind turbines in the East Anglia THREE site UK AD detection capability and therefore national security could be compromised Impact starting from a point of full presence to zero presence over a two year period
Impact 3: Increased air traffic in the area related to windfarm activities	Seven return helicopter trips per week (14 individual movements)	Maximum number of helicopter trips as a result of being engaged on works for East Anglia THREE Limited, causing increased likelihood of aircraft to aircraft collision

16.3.3 Embedded Mitigation

16.3.3.1 Site Selection and Design

20. The East Anglia THREE site was identified within the East Anglia Zone following completion of a Zone Appraisal and Planning process (ZAP), further details of which are presented in section 4.3 and section 4.4 of Chapter 4 Site Selection and Alternatives.

21. In summary, the ZAP involved the collection and assessment of environmental and technical data on a strategic level to identify suitable sites within the East Anglia Zone which could be taken forward for development.

22. Civil and military radar coverage and helicopter main routes were a key consideration of the ZAP and the CAA was a key consultee. Through the ZAP, the East Anglia THREE site was identified as one of the least constrained sites with regard to aviation receptors.

23. The infrastructure within the East Anglia THREE site would be configured to minimise conflicts with other users. In cases where conflict has been highlighted during consultation, EATL has, where appropriate, proposed mitigation measures to reduce or negate impacts.

16.3.3.2 Information, Notifications and Charting

24. The East Anglia THREE site would create an obstacle environment, which could be effectively mitigated by compliance with appropriate international and national requirements for the promulgation the locations of the obstacles on charts and in aeronautical documentation, together with the permanent marking and lighting of obstacles.

25. Measures would be adopted at the commencement of works at the East Anglia THREE site to ensure that the aviation sector is made aware of the creation of a further aviation obstacle environment in the East Anglia Zone, namely the East Anglia THREE site. These measures would include issuing permanent short-term Notices to Airmen (NOTAMs) and Aeronautical Information Circulars (AICs), warning of the establishment of obstacles within the East Anglia THREE site and publicity in such aviation publications as Safety Sense and General Aviation Safety Information Leaflet (GASIL).

26. At various points during the project, details of the position, height (AMSL) and lighting of each of the completed permanent structures in the project would be forwarded to the CAA Aeronautical Information Service (AIS) for inclusion in Aeronautical Information Publications (AIPs) and on relevant aeronautical charts, as

notifiable permanent obstructions. This permanent information would replace the short-term NOTAMs that would continue to be issued to cover the project until construction has been completed.

27. En-route navigation charts would be updated as the site construction proceeds. All obstacles over 300ft AMSL must be notified to the CAA for inclusion in the UK AIP (section ENR5.4) and aeronautical maps and to Defence Geographic Centre for inclusion in MOD databases.

16.3.3.3 Marking and Lighting

28. The mandated requirements for the lighting of wind turbines in UK territorial waters are set out (in order of primacy) in the following documentation:

- ICAO *Annex 14 - Aerodrome Design and Operations* - Chapter 6 paragraph 6.4.3.
- CAA *CAP 393 - Air Navigation: The Order and the Regulations, Fourth Edition 2015 (CAP 393), Section 1: Air Navigation Order (ANO) Articles 219 and 220.* Article 220 requires that offshore wind turbine obstacles have to be lit when they exceed 60m/197ft above highest astronomical tide (HAT).
- CAA *CAP 764 - Policy and Guidelines on Wind Turbines* - 5rd Edition, June 2013, Chapter 3 paragraph 5.8.
- CAA Directorate of Airspace Policy - *Policy Statement –The Lighting and Marking of Wind Turbine Generators and Meteorological Masts in United Kingdom Territorial Waters,* 22 November 2012.
- Maritime and Coastguard Agency (MCA) Marine Guidance Notice (MGN) 371 - *Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues*, 2008.
- UK MOD *MOD Obstruction Lighting Guidance*, issued by Low Flying Operations Squadron, 21 November 2014.
- Civil Aviation Authority (CAA), (2013) *CAP 437 - Offshore Helicopter Landing Areas – Guidance on Standards – 7th Edition – amendment 1/2013.*

29. The international marking and lighting requirement, set out in ICAO Annex 14, specifies that (emphasis added):

- "a wind turbine *shall* be marked and/or lighted if it is determined to be an obstacle" and that

- "the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines *should* be painted white, unless otherwise indicated by an aeronautical study".

30. UK regulations adopt ICAO Annex 14's requirements as to lighting of wind turbines but do not require that wind turbines follow the ICAO recommendation as to paint colour although CAP 764 does set out the ICAO recommendation by way of guidance. In terms of marking the wind turbines, in keeping with recent practice for offshore windfarms, it is anticipated that Trinity House would require all structures to be painted yellow from the level of HAT to a height directed by Trinity House and above the yellow section, all wind turbines would be painted submarine grey (colour code RAL7035).

31. EATL would light the East Anglia THREE site in accordance with CAP 393. ANO Article 219 defines an 'en-route obstacle' as any building, structure or erection, the height of which is 150 m or more above ground level (AGL) and requires these to be lit. Article 220 modifies the Article 219 requirement with respect to offshore wind turbines, requiring these to be lit where they exceed 60m HAT with a medium intensity (2000 candela) steady red lighting mounted on the top of each nacelle and requires for limited downward spillage of light. Article 220 allows for the CAA to permit that not all wind turbines are so lit. The CAA would require that all wind turbines on the periphery of any windfarm need to be equipped with aviation warning lighting and such lighting, where achievable, shall be spaced at longitudinal intervals not exceeding 900 metres. There is no routine requirement for offshore obstacles to be fitted with intermediate vertically spaced aviation lighting.

32. The most recent additional guidance on the lighting of offshore windfarms is detailed in CAA Policy Statement - Lighting of Wind Turbine Generators in United Kingdom Territorial Waters - dated 22 November 2012. This guidance has recently been subject to coordination with maritime agencies to ensure that confusing and contradictory light patterns are not displayed and, to that end, the UK CAA has indicated that the use of a flashing red Morse Code letter 'W' is likely to be acceptable to resolve the potential issues for the maritime community.

33. The MCA is seeking that wind turbine tips are marked in red, together with markings down the blade, to safeguard Search and Rescue (SAR) helicopter operations as set out in MGN 371. EATL would consider reasonable proposals from SAR operators for a lighting scheme and wind turbine shutdown protocol to be applied during rescue situations. An Emergency Response and Cooperation Plan (ERCoP) would be developed and implemented for all phases of the proposed project, based upon the MCA's standard template. EATL anticipates that appropriate lighting would be

utilised to facilitate heli-hoisting if undertaken within the East Anglia THREE site, as outlined in CAP 437.

34. To satisfy MOD requirements, the wind turbines would also be required to be fitted with infra-red lighting in combination with the ANO Article 220 lights. MOD lighting guidance indicates that provided combination infra-red / 2000cd visible red lights are used to light the wind turbines required to be lit under ANO Article 220, this would satisfy the MOD operational requirement.

16.3.3.4 Regulatory Requirements

35. When construction is complete, given that the East Anglia THREE site occupies uncontrolled (Class G) airspace, the responsibility for avoiding other traffic and obstacles rests with captains of civilian and military aircraft. Thus, logically a pilot would avoid the charted areas, and individually lit wind turbines, meteorological masts and any other obstacles, laterally or vertically, by the legislated standard minimum separation distance. This is outlined in CAP 393 Section 2: the Rules of the Air Regulations 2007 (Rule 5) which sets out that to avoid persons, vessels, vehicles and structures, pilots must give clearance of a minimum distance of 500ft; this applies equally to the avoidance of wind turbines and any other structure.

36. Military operations are subject to separate rules sponsored by the MOD. Pilots of military aircraft would be required to ensure that a Minimum Separation Distance (MSD) of 250ft from any person, vessel, vehicle or structure existed whilst operating in the vicinity of the East Anglia THREE site. The charting and lighting of the East Anglia THREE site should also be taken into account by MOD low flying units and SAR operators.

37. EATL assumes that the aviation stakeholders would adhere to all relevant CAA and MOD safety guidance in the conduct of their specific operations to ensure safe operations for all users of the airspace above the East Anglia THREE site.

16.4 Assessment Methodology

16.4.1 Legislation, Policy and Guidance

38. The assessment of potential impacts on aviation and MOD has been undertaken with specific reference to the relevant NPS. Those relevant to the proposed East Anglia THREE project are as follows:

- Department of Energy and Climate Change (DECC) (2011) *National Policy Statement for Renewable Energy Infrastructure (EN-3); and,*
- DECC (2011) *Overarching National Policy Statement for Energy EN-1.*

39. *Table 16.3* provides a summary of the relevant guidance for the decision maker from NPS EN-1 and NPS EN-3 which EATL would give due consideration during the development of the proposed East Anglia THREE project.

Table 16.3 - NPS Assessment Requirements

NPS requirements	NPS Reference	Section Reference
If the proposed development could have an effect on civil and military aviation then the assessment should: • Consult the MOD, UK CAA, NATS and any aerodrome – licensed or otherwise – likely to be affected by the proposed project in preparing an assessment of the proposal on aviation or other defence interests. • Include potential impacts of the project upon the operation of CNS [Communications, Navigation & Surveillance] infrastructure, flight patterns (both civil and military), other defence assets and aerodrome operational procedures. • Assess the cumulative effects of the project with other relevant projects in relation to aviation and defence.	NPS EN-1 Paragraph 5.4.13	Section 16.2 Section 16.6 Section 16.7
If there are conflicts between the Government's energy and transport policies and military interests in relation to the application, the decision maker should expect the relevant parties to have made appropriate efforts to work together to identify realistic and pragmatic solutions to the conflicts. In so doing, the parties should seek to protect the aims and interests of the other parties as far as possible.	NPS EN-1 Paragraph 5.4.15	Section 16.6 and *Appendix 16.1.*
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 decision maker 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.	NPS EN-1 Paragraph 5.4.16	Section 16.3.3.3
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 need for such aviation infrastructure, or • The development would significantly impede or	NPS EN-1 Paragraph 5.4.17	Section 16.10

NPS requirements	NPS Reference	Section Reference
compromise the safe and effective use of defence assets or significantly limit military training. • The development would have an impact on the safe and efficient provision of enroute air traffic control services for civil aviation, in particular through an adverse effect on the infrastructure required to support communications, navigation or surveillance systems. consent should not be granted.		
Where a windfarm potentially affects other infrastructure or activity, a pragmatic approach should be employed by the decision maker. The decision maker should expect the applicant to minimise negative impacts and reduce risks to as low as reasonably practicable (ALARP).	NPS EN-3 Paragraph 2.6.183	Sections 16.6, 16.7 and 16.8.
The decision maker should be satisfied that the site selection and design of the windfarm has avoided or minimised adverse effects on other offshore industries. The decision maker should not consent applications which pose unacceptable risks to safety after mitigation measures have been considered.	NPS EN-3 Paragraph 2.6.184	Section 16.3.3
Where schemes have been carefully designed and the necessary consultation has been undertaken at an early stage, mitigation measures may be found that could negate or reduce effects on other offshore infrastructure to a level sufficient to enable the decision maker to grant consent.	NPS EN-3 Paragraph 2.6.186	Sections 16.3.3 and 16.6
Detailed discussions between the applicant and the relevant consultees should have progressed as far as reasonably possible prior to the submission of an application. As such, appropriate mitigation should be included in any application and ideally agreed between relevant parties. In some circumstances, the decision maker may wish to consider the potential to use conditions involving arbitration as a means of resolving how adverse impacts on other commercial activities would be addressed.	NPS EN-3 Paragraph 2.6.187	Sections 16.2, 16.5 and 16.6.2.
Aviation and navigation lighting should be minimised to avoid attracting birds, taking into account impacts on safety.	NPS EN-3 Paragraph 2.6.107	Section 16.3.3.3 for proposed lighting and discussed in Chapter 13 Offshore Ornithology.

40. As well as the NPS guidance, and in addition to the guidance outlined in the embedded mitigation section, the requirements and recommendations in the following documentation have also been considered in the completion of the assessment:

- CAA, (2015) CAP 032 - UK Aeronautical Information Publication;
- CAA, (2014) CAP 168 – Licensing of Aerodromes;
- CAA, (2013) CAP 437 - Offshore Helicopter Landing Areas – Guidance on Standards;
- CAA, (2013) CAP 670 - Air Traffic Services Safety Requirements;
- CAA, (2012) CAP 724 – Airspace Charter;
- CAA, (2007) CAP 725 - Guidance on the Application of the Airspace Change Process;
- MOD, (2015) UK Military AIP;
- MOD, (2015) UK Military Low Flying – An Essential Skill;
- MCA, (2008) MGN 371 - OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response Issues; and
- Netherlands (NL) Luchtverkeersleiding Nederland (LVNL), (2015) Integrated Aeronautical Information Package, the Netherlands (NL AIP).

16.4.2 Data Sources

41. In addition to the specific guidance documents referred to in sections 16.3.3 and 16.4.1, the following data sources used in the undertaking of the desk based assessment, and for the remainder of the chapter, are presented in *Table 16.4*.

Table 16.4 - Data Sources Features

Data	Year	Source	Confidence	Notes
Raytheon SS-10 PSR	2007	Raytheon Equipment Brochure	High	
Lockheed Martin TPS-77 PSR	2014	Lockheed Martin Equipment Brochure	Medium	Detailed performance data covered by International Traffic in Arms Regulations (ITAR) restrictions and therefore not

Data	Year	Source	Confidence	Notes
				available
AIP	Current as of 1st July 2015	UK and Netherlands	High	

16.4.3 Impact Assessment Methodology

42. In assessing the significance of the effects from the proposed East Anglia THREE project, it was necessary to identify whether or not there would be an impact on aviation operations. The aviation industry is highly regulated and subject to numerous mandatory standards, checks and safety requirements (e.g. CAP 670), many international in nature and requiring the issue of operating licenses. In all cases, the sensitivity or magnitude of the impact on operations could only be identified by the appropriate aviation organisation conforming to the Risk Classification Scheme used to quantify and qualify the severity and likelihood of a hazard occurring. The Risk Classification Scheme is a fundamental element of an aviation organisation's Safety Management System (SMS), which must be acceptable to, and approved by, the UK CAA or the Military Aviation Authority (MAA), as appropriate. As such, for the purposes of this assessment, no detailed grading has been made of the magnitude of the impact or sensitivity of the receptor on the basis that any potential reduction in aviation safety cannot be tolerated. Instead the following definitions of basic significance have been used as defined in *Table* 16.5 - Impact Significance Definitions. This represents a deviation from the standard methodology presented within Chapter 6 Environmental Impact Assessment Methodology.

Table 16.5 - Impact Significance Definitions

Potential Significance	Definition
Major Significant	Receptor unable to continue safe operations or safe provision of air navigation services (radar) or effective air defence surveillance in the presence of the wind turbines. Technical or operational mitigation of the impact is required.
Moderate Significant	Receptor able to continue safe operations but with some restrictions or non-standard mitigation measures in place.
Not Significant	The proposed development would have little impact on the aviation stakeholder or the level of impact would be acceptable to the aviation stakeholder.
No Change	The proposed development would have no impact on the aviation stakeholder and would be acceptable to the aviation stakeholder

16.4.4 Cumulative Impact Assessment

43. Cumulative impacts in relation to the operation of other offshore and onshore windfarms have been considered for aviation and radar receptors within this Chapter. Cumulative impacts have been considered with respect to obstacles and increase in air traffic, and with regards to the extent of radar visibility at wind turbine heights.

16.4.5 Transboundary Impact Assessment

44. Similar to the cumulative impacts this section considers transboundary offshore wind developments with regards to obstacles to flight, increase in air traffic, radar visibility and airspace management.

16.5 Existing Environment

45. An initial desktop study was undertaken to determine those aviation stakeholders that were likely to be affected by the proposed East Anglia THREE project. This exercise was to establish the scope of any areas that could fundamentally preclude the development going ahead, prior to undertaking any consultation.

46. EATL and Cyrrus identified the following major aviation stakeholders as key organisations that would have a particular interest in the East Anglia THREE site:

- CAA Safety and Airspace Regulation Group (SARG).
- The Netherlands aviation authorities: The Netherlands equivalent of the UK CAA, Inspectie Leefomgeving en Transport (ILT), the Netherlands equivalent of NATS, Luchtverkeersleiding Nederland (LVNL), and the Netherlands MOD, Ministerie van Defensie. (These authorities are covered under the transboundary section in section 16.8.)
- NATS - specifically the NATS Raytheon SS-10 Air Traffic Control (ATC) PSR facility at Cromer and the air traffic services provided utilising the Cromer PSR by NERL (by both civil en-route and embedded MOD off-route controllers) and NSL's Anglia Radar unit.
- UK MOD - specifically the MOD TPS-77 Air Defence (AD) PSR at Trimingham.
- Offshore helicopter operators (including SAR operators) in the immediate vicinity of the proposed East Anglia THREE site would be consulted via NATMAC.

47. The conclusion reached was that none of the above stakeholders would have fundamental issues that were incapable of resolution, as is summarised in the remainder of this chapter.

16.5.1 Radar Modelling

48. An aviation stakeholders' assessment was undertaken based on a desktop review of the available information and data listed in *Table 16.4,* together with consultations with relevant organisations.

49. Computer modelling using a contemporary software modelling tool (ICS Designer™) has been undertaken to predict if radar LoS exists between PSRs in the region of the East Anglia THREE site and the likely Probability of Detection (Pd) of the rotating wind turbine blades. This exercise identifies those PSRs that could detect the wind turbines and has been based on wind turbines with a maximum tip height of 247m AMSL. The data obtained from the modelling has been analysed and provides a key input into establishing the degree to which aviation and operations in the area of the East Anglia THREE site could be affected and what additional mitigation processes could be employed.

50. The LoS / Pd modelling conducted for the MOD TPS-77 Air Defence PSR had to be based on generic data as the specific characteristics for this PSR are considered security sensitive by the MOD. Therefore, Cyrrus has used contemporary ATC PSR performance characteristics and publicly available TPS-77 data in lieu. It has to be acknowledged that modelling by MOD sources with detailed configuration data may reveal differing Pd results for the TPS-77 PSR. However, confidence is high that the PSR performance characteristics used have a high level of compatibility with the AD PSR performance.

51. *Appendix 16.1* takes into consideration the outputs from the computer modelling. This has been used to determine potential mitigation strategies for inclusion in this document, where appropriate. As necessitated, final mitigations would be agreed and implemented with aviation and radar stakeholders. Ongoing consultation with stakeholders would continue as part of the design process for the East Anglia THREE site.

52. Only PSRs potentially in LoS of the East Anglia THREE site were subjected to detailed impact assessment. Additionally, statutory and technical aviation safeguarding issues in the area surrounding the East Anglia THREE site have been addressed using UK CAA standards detailed in CAP 670.

16.5.2 Airspace

16.5.2.1. Civil Airspace Designations

53. Information on airspace classifications can be found at UK AIP: ENR 1.4 ATS (Air Traffic Services) Airspace Classification.

54. The airspace above the East Anglia THREE site from sea level to Flight Level (FL) 175 (circa 17,500ft AMSL) is uncontrolled and classified as Class G airspace. The uncontrolled airspace immediately above the East Anglia THREE site is transited by most types of civilian aircraft operating, quite legitimately, 'off-route' and is also used by military aircraft for general training and exercise purposes. Additionally, the broad area is crossed by a number of Helicopter Main Routes (HMRs) that serve the offshore oil and gas industry platforms in the southern North Sea. NSL's Anglia Radar unit provides an Air Traffic Service (ATS) within its area of responsibility (between the surface and FL65 (circa 6,500ft AMSL)) over the northern two-thirds of the East Anglia THREE site, as depicted in *Figure 16.1*.

55. To the west, Class D Controlled Airspace (CAS) is established around Norwich International Airport. Class D CAS is established in order to provide protection to aircraft arriving and departing from aerodromes and from other aircraft operations; the Class D CAS is shown around Norwich Airport in a grey pecked line in *Diagram 16.1*. Norwich International Airport and the nearest military airfields, together with the associated PSRs located at them, are too far to the west of the East Anglia THREE site to be impacted by it and need not be considered further.

56. Class A CAS is established in the vicinity of the East Anglia THREE site protecting lower airspace airways L603, P7, P25 and M604. However, these airways have base levels not below FL175 (circa 17,500ft AMSL) and only L603 directly overlays the East Anglia THREE site – see *Diagram 16.1.* This airspace is delegated to the Netherlands ATC authorities and is known as MOLIX CTAIII; see *Figure 16.1*. Above FL175 (circa 17,500ft AMSL) all airspace is either Class C or A CAS. Within this airspace there exist Upper Air Routes (UARs). The latest UAR structure is shown at *Diagram 16.2*.

Diagram 16.1 - Airspace –Southern North Sea – Lower ATS Routes (up to FL245) – extract from UK AIP ENR 6-3-1-1 Lower ATS Routes (South Sheet) (25 Jun 15). Chart reproduced with the permission of NATS (Services) Limited. Ordnance Survey © Crown copyright, All rights reserved 2015. Licence number 100050170

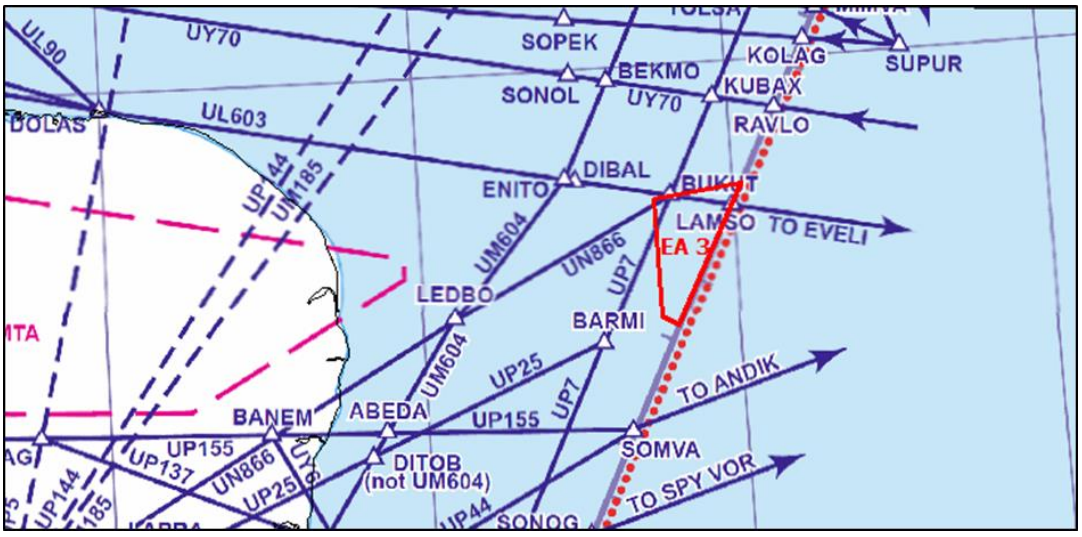

Diagram 16.2 - Airspace –Southern North Sea — Upper Airspace Control Area and Upper ATS Routes (FL245 and above) -extract from AIP ENR 6-3-2-1 Upper Airspace Control Area and Upper ATS Routes (South Sheet) (25 Jun 15) Chart reproduced with the permission of NATS (Services) Limited. Ordnance Survey © Crown copyright, All rights reserved 2015. Licence number 100050170.

57. The eastern boundary of the East Anglia THREE site lies almost along the London / Amsterdam airspace boundaries, known as Flight Information Regions (FIRs); see *Figure 16.1*.

58. Additionally, certain areas of UK airspace are delegated to the Netherlands ATC Authorities for operational convenience. This includes MOLIX CTAIII, the airspace from FL175 (circa 17,500ft AMSL) to FL245 (circa 24,500ft AMSL) above the northern two-thirds of the East Anglia THREE site. This airspace is shown at *Figure 16.1*.

Procedures and communications are as if this airspace was an integral part of the Amsterdam FIR.

59. The East Anglia THREE site could, therefore, have transboundary impacts on Netherlands aviation operations in the region. However, there is only one Class A and C airway in the Amsterdam FIR or delegated airspace that would traverse the East Anglia THREE site.

60. As part of the East Anglia ONE consultations, EAOW engaged with the ILT, LVNL and the Netherlands MOD, Ministerie van Defensie, to ensure that aviation operations in their own and delegated airspace are taken into account in connection with both East Anglia ONE and the entire East Anglia Zone. All indicated that these windfarms would not impact on their operations although the ILT did note that the HMR450/KZ50 would be subject to the 2NM separation guidance set out in CAP 764 (see section 16.5.2.3).

16.5.2.2. Military Airspace Designations

61. The southern portion of the East Anglia THREE site is also overlaid by the RAF Lakenheath Aerial Tactics Area (ATA) North in which, inter alia, Air Combat Training (ACT) takes place between FL60 (circa 6,000ft AMSL) to FL245 (circa 24,500ft AMSL). Further to the south, the RAF Lakenheath ATA South is established between FL60 and FL195 (circa 19,500ft AMSL); see *Figure 16.2*.

62. The southern part of the East Anglia THREE site lies below an Air to Air Refuelling Area (AARA 9); see the demarcated area in *Figure 16.2*. These activities take place between 2,000ft AMSL and FL50 (circa 5,000ft AMSL). Military aircraft utilising these areas would ordinarily be receiving ATS from military controllers working alongside their civilian counterparts stationed at NERL Swanwick (using NERL radar facilities, including the Cromer PSR).

16.5.2.3. Helicopter Main Routes

63. HMRs are routes typically and routinely flown by helicopters operating to and from offshore destinations and are promulgated for the purpose of highlighting 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 ANSP and helicopter operators for flight planning and management purposes. In summary, HMRs are simply recognised routes to assist in regularising routeings and effectively managing traffic safely and do not comprise CAS; see *Figure 16.1.*

64. HMRs have no promulgated lateral dimensions although CAA Policy (CAP 764) states that there should be no obstacles within 2NM either side of HMRs. The 2NM distance is based upon: operational experience; the accuracy of navigation systems; and, importantly, practicality. Such a distance would provide time and space for helicopter pilots to descend safely to an operating altitude below the icing level.

65. The ability of a helicopter to fly higher would be dependent upon the 0°C isotherm (icing level); this might preclude the aircraft from operating on days of low cloud base if the 0°C isotherm was at 2000ft AMSL or below as the aircraft must be able to descend to a clear area below cloud and with a positive temperature to safely de-ice if necessary.

66. Vertically, the HMRs over the southern North Sea extend from 1,500ft AMSL to FL60 (circa 6,000ft AMSL) inclusive. However, where helicopter icing conditions or other flight safety considerations dictate, helicopters could be forced to operate below 1,500ft AMSL. In these circumstances, where possible, pilots should endeavour to follow HMRs and advise the ATS provider of the new altitude giving the reason for operating below 1,500ft AMSL. Consequently, a large number of wind turbines beneath an HMR could result in significant difficulties by forcing the aircraft to fly higher in order to maintain a safe vertical separation from wind turbines. CAP 764 suggests that, for the purpose of transiting wind turbine developments under Visual Flight Rules (VFR) and facilitating construction or maintenance flights within the boundaries of the windfarm, 'flight corridors' may be introduced within the design of the site. An HMR has been promulgated through the area of the Greater Gabbard Offshore Wind Farm and the Galloper Wind Farm, presumably to allow helicopter traffic to access those sites. This suggests that in following CAP 764, windfarms and traffic using HMRs are expected to co-exist.

67. Compliance with the HMR structure is not compulsory. In the general interests of flight safety, however, civil helicopter pilots are strongly encouraged to plan their flights using HMRs wherever possible. Three HMRs – UK HMRs 447 and 450 and NL HMR KZ50 – are in the vicinity of, but do not transit, the East Anglia THREE site (see *Figure 16.1*). NL HMR KZ50 is located within airspace controlled by the Netherlands and is a continuation of where HMRs 447 and 450 converge. The closest HMR (HMR 450) does transit 2NM (3.7km), from, and parallel to, the northern boundary of the East Anglia THREE site and is therefore in compliance with the requirements of CAP 764, because the northern boundary of the East Anglia THREE site is 2NM away.

16.5.3 Flight Procedures and ATS provided

68. In Class G (uncontrolled) airspace, aircraft are not obliged to be in receipt of an ATS, although it is open to pilots to seek Air Traffic Services outside Controlled Airspace

(ATSOCAS) from the designated ATS provider: the extent of the ATSOCAS supplied would depend on the CNS capability of the ATS provider, its workload and any regulatory provisions relating to the carriage of CNS equipment by aircraft (e.g. transponders). All aircraft above FL100 (circa 10,000ft AMSL) in the London FIR are required to carry and operate transponders in accordance with national regulations.

69. To gain access to CAS, a pilot has to comply with various mandatory requirements. This includes establishing two-way radio communications with the designated ATC authority for the specified airspace and obtaining permission to enter it. The pilot then has to comply with instructions received. In this way, the controllers know of all the air traffic in the defined airspace. The controllers can then take appropriate measures to ensure that standard separation minima are maintained between all known aircraft by using various techniques that may or may not include the use of PSR.

70. The ATS providers in the vicinity of the East Anglia THREE site are:

- NSL from its Anglia Radar unit which provides an ATS to aircraft in its area of responsibility between the surface and FL65 (circa 6,500ft AMSL) – the Anglia, Radar Area of Responsibility covers the northern two-thirds of the East Anglia THREE site (see *Figure 16.1*).
- Civil controllers at NERL's Swanwick Control Centre who provide en-route ATS to aircraft within CAS following promulgated routes along airways and Upper Air Routes.
- MOD controllers embedded at NERL's Swanwick Control Centre who provide:
    - ATSOCAS to military and civil aircraft outside of CAS below FL195 (circa 19,500ft AMSL) – this would include any ATSOCAS provided to aircraft operating in the Lakenheath ATAs and AARA9.
    - ATS within CAS to aircraft flying diverse profiles not following the en-route structure, e.g. aircraft wishing to cross CAS or conducting special tasks, such as flight inspections or trials.
- LVNL which provides an en-route ATS to aircraft in all airspace delegated to it (e.g., above FL175 (circa 17,500ft AMSL) in the vicinity of the East Anglia THREE site).

71. Flight procedures in the study area are conducted in accordance with International and National UK CAA and MOD SARPs as promulgated in the UK AIP and the Netherlands equivalent.

72. Given that all aircraft operating above FL100 (circa 10,000ft AMSL) are required to be equipped with and operate transponders, the significance of primary radar for the provision of an ATS is more acute in the lower airspace outside of CAS, and is especially relevant to helicopter operators. EATL has therefore consulted with the MOD, NSL (Anglia Radar) and the helicopter operators via NATMAC to better understand their operations in and around the East Anglia THREE site.

16.6 Potential Impacts

73. The potential impacts that could occur during construction, operation and decommissioning of the proposed project are listed in *Table 16.2* for each impact.

74. The receptors for each impact are described within the text of each assessment and are identified in section 16.5. Those receptors which are not considered to have any potential to be impacted by the proposed East Anglia THREE project have not been presented within the baseline.

16.6.1 Potential Impacts during Construction

16.6.1.1. Impact 1: Creation of an Aviation Obstacle Environment

75. Construction of the windfarm would involve the installation of infrastructure above sea level which could pose a physical obstruction to aircraft utilising the airspace in the vicinity of the East Anglia THREE site.

Single Phase

76. Under a Single Phase approach, from a starting point of no infrastructure within the East Anglia THREE site boundary, the infrastructure outlined in *Table 16.2* would gradually be installed over a period of up to 32 months (See Chapter 5 Description of the Development *Table 5.34*).

77. Specifically for the East Anglia THREE site, permanent or temporary obstacles can also increase risk to:

- General military low-flying training and operations; and
- Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea.

78. In compliance with International and National SARPs with respect to notification, marking and lighting, as outlined in section 16.3.3.3, to make pilots aware of the addition of infrastructure to the site, the impact on the aviation sector during the construction of the East Anglia THREE site could be reduced to an acceptable level. The impact has been assessed to be **not significant**.

Two Phased

79. Under a Two Phased approach there would be an additional offshore electrical platform and all construction works within the East Anglia THREE site would be installed over a 42 month period (see Chapter 5 Description of the Development *Table 5.37*). Despite the additional offshore electrical platform and the increased build time construction of the East Anglia THREE site impact would remain at an acceptable level and therefore the impact has been assessed to be **not significant**.

16.6.1.2. Impact 2: Wind Turbines Causing Permanent Interference on Military Radar

80. Wind turbines have the potential to affect radar which would in turn affect the effectiveness of surveillance services due to interference on radar displays, as radar operators are unable to distinguish between those primary radar returns generated by wind turbines and aircraft. As a general rule, controllers are required to provide 5NM lateral separation between traffic receiving an ATS and 'unknown' primary radar returns in Class G airspace.

81. Despite the potential for LoS with PSR systems, the PSR would not detect the wind turbines comprising the East Anglia THREE site wind turbines until such time as blades are allowed to rotate at operational speeds.

Single Phase

82. As a result of non-detection during construction under a Single Phase approach, the impact is considered to be **no change**.

Two Phased

83. Under the Two Phased approach there would be no difference in the magnitude (other than a slightly increased build programme) of the impact and therefore the impact is considered to be **no change**.

16.6.1.3. Impact 3: Increased Air Traffic in the area Related to Windfarm Activities

84. The use of helicopters to support construction activities within the East Anglia THREE site could impact on existing air traffic in the area, and operations associated with HMRs. It is possible that helicopters could be used for transferring people and / or equipment to the East Anglia THREE site on a daily basis for the construction period.

Single Phase

85. The possible increase in air traffic associated with construction support activities brings with it a potential increased risk of aircraft collision in the area of the proposed East Anglia THREE project.

86. No HMRs are currently established within the East Anglia THREE site. Therefore, offshore helicopter operations using HMRs should be unaffected by the obstacle environment.

87. The proposed East Anglia THREE project is already well served by existing HMRs, procedures and ATC units providing the appropriate level of ATS. Therefore, the infrastructure is already extant to reduce the risk of collision to As Low As Reasonably Practicable (ALARP).

88. Due to the low number of movements predicted to be caused by the construction of the East Anglia THREE site, the absence of HMRs within the East Anglia THREE site, the availability of existing ATS and by complying with CAP 764 as outlined in section 16.3.3, the impact to aircraft operators in the vicinity of the East Anglia THREE site, including those using the HMRs, is considered to be **not significant**.

89. CAP 764 suggests that, for the purpose of transiting wind turbine developments under VFR and facilitating construction or maintenance flights within the boundaries of the windfarm, 'flight corridors' may be introduced within the design of the site. As the embedded mitigation is deemed sufficient to reduce the potential impact to **not significant**, no further regard to this additional mitigation is included within the chapter.

Two Phased

90. Under the Two Phased approach there would be no difference in the magnitude of the impact and therefore the impact is considered to be **not significant**.

16.6.2 Potential Impacts during Operation

16.6.2.1. Impact 1: Creation of an Aviation Obstacle Environment

91. During the operation of the proposed East Anglia THREE project, the infrastructure included within *Table 16.2* would be present within the East Anglia THREE site. This could pose a physical obstruction to aircraft utilising the airspace in the vicinity of the East Anglia THREE site.

92. Specifically for the East Anglia THREE site, permanent or temporary obstacles could also increase risk to:

- General military low-flying training and operations; and
- Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea.

93. In compliance with International and National SARPs with respect to notification, marking and lighting, as outlined in section 16.3.3.3, the impact on the aviation

sector during the operation of the East Anglia THREE site could be reduced to an acceptable level. The impact has been assessed to be **not significant**.

16.6.2.2. Impact 2: Wind Turbines Causing Permanent Interference on Military Radar

94. The East Anglia THREE site would be within the operational range of a single military radar system likely to detect wind turbines located within the East Anglia THREE site, as detailed in *Appendix 16.1*. Depending on the maximum tip height of the individual wind turbines and the detailed windfarm configuration selected, the wind turbines could be within radar LoS of the Trimingham AD PSR.

95. When operational (i.e. with blades fitted and rotating), wind turbines have the potential to generate 'clutter' (or false targets) upon radar displays, as PSRs are unable to differentiate between the moving blades of wind turbines and aircraft. As a consequence, radar operators can be unable to distinguish between those primary radar returns generated by wind turbines or by aircraft. This may produce an adverse impact on the ability of the MOD to undertake its AD role utilising the Trimingham AD PSR.

96. Mitigation would be required if the windfarm design, based upon parameters outlined in *Table 16.2*, shows a Pd of the wind turbines above the system threshold levels that would allow the wind turbine blades to be presented on PSR displays. This additional mitigation could involve one or more of the following:

- Designing the windfarm such that only wind turbines of a maximum tip height which is not detected by the Trimingham PSR are deployed in certain areas of the East Anglia THREE site.
- The application of a Non-Auto Initiation Zone (NAIZ) in the TPS-77's lowest beam over the footprint of any wind turbines that would be detected by the PSR. TPS-77 was acquired by the MOD on the basis that this type of AD PSR had enhanced or significantly improved resilience to wind turbine generated interference. In addition to the routine advanced processing of radar data that the TPS-77 is capable of, where areas of clutter and interference are deemed excessive, the system has an innovative means of removing radar returns that are distracting to system operator. A NAIZ can be configured within the radar system software which prevents newly detected radar tracks from being displayed within a specific 3-dimensional zone within the radar's coverage. Importantly for AD system operators, any moving radar tracks that enter a NAIZ would continue to be tracked through the zone, regardless of the surrounding clutter which has been suppressed by the TPS-77 software. In sum, any track which first appears in a selected area (such as a range-azimuth

cell(s) containing wind turbine(s)) would be suppressed but existing tracks which have entered that cell from elsewhere would be retained.

- Adjusting the specific optimisation of a PSR to 'engineer out' the Pd of the wind turbines whilst retaining safe and adequate coverage to fulfil the MOD's operational requirement.

- Providing infill radar cover for inclusion in the MOD AD air picture over the impacted areas of the East Anglia THREE site, where PSR optimisation or application of a NAIZ could be impracticable.

97. CAP 764 outlines other mitigation options which could be applied either singly or in combination to optimise the effectiveness of any mutually agreed solution. Due to the promising developments currently being advanced by industry in this area of technology, consultation on technical measures would continue as a development might emerge that proves to be more suitable for adoption and implementation while the proposed East Anglia THREE project advances and matures.

98. *Appendix 16.1* sets out the radar modelling findings in respect of both Cromer and Trimingham PSRs, identifying the areas in which wind turbines of specified heights should not be detected. *Appendix 16.1* concludes that in respect of the Trimingham AD PSR:

- The East Anglia THREE site could accommodate wind turbines up to 193m AMSL across the entire area and would require no further mitigation.

- If wind turbines taller than 193m AMSL were used, the areas shown in *Figure 16.2* are likely to require additional mitigation (most likely a NAIZ) – these areas assume the wind turbine heights shown were used across the entire East Anglia THREE site.

99. EATL understands that there is NAIZ capacity available although its availability is subject to detailed ITAR restricted modelling to be undertaken by SERCO, the MOD's subcontractor with regards to the TPS-77, and an operational assessment by the MOD based on the results of the results of the SERCO modelling. EATL anticipates further consultation with the MOD on this topic informed by the conclusions of *Appendix 16.1*. EATL has engaged with SERCO to procure this modelling. EATL has also had preliminary discussions with The Crown Estate [and the MOD] with regards to commercial terms pertaining to Trimingham TPS-77 mitigation.

100. Without additional mitigation, the impacts to these receptors receiving changes to their operational environment have been assessed to be **major significant**. However, it is anticipated that the potential risk posed to aviation and MOD

operations could be wholly and successfully mitigated through various windfarm design and technical solutions. Following the application of additional mitigation, the overall impact is considered to be **not significant**.

16.6.2.3. Impact 3: Increased air Traffic in the area related to Windfarm Activities

101. The operational phase of the East Anglia THREE site is likely to see increased helicopter air traffic over the current baseline levels engaged on support operations in the area of the East Anglia THREE site.

102. The effect of this is to create a greater potential risk of a mid-air collision between aircraft engaged in such operations and / or aircraft in transit across the study area. The potential for such risks occurring is reduced through the embedded mitigation (see section 16.3.3). The safety of aircraft operating in uncontrolled airspace ultimately resides with the aircrew, who may request the provision of an ATS that would be provided in accordance with national procedures. The infrastructure and provision of an appropriate level of ATS, as well as Search and Rescue services in times of emergency, are already in place to support the existing offshore oil and gas industries. In light of the measures to be adopted potential impacts are considered **not significant**.

103. The use of helicopters during the operational phase of the proposed East Anglia THREE project could impact on operations associated with HMRs. It is possible that helicopters could be used for transferring people and / or equipment to the East Anglia THREE site on a daily basis for the lifetime of the development.

104. Due to the low number of movements predicted during the operational period of the proposed East Anglia THREE project, the absence of HMRs within the East Anglia THREE site, the availability of existing ATS and by complying with CAP 764 as outlined in section 16.3.3, the impact to aircraft operators in the vicinity of the East Anglia THREE site, including those using the HMRs, is considered to be **not significant.**

16.6.3 Potential Impacts during Decommissioning

105. On expiry of the lease for the proposed East Anglia THREE project, EATL would remove all structures, except cables and pin piles deeper than 1 to 2m below the sea bed in accordance with the DECC decommissioning guidance (DECC 2011).

106. Decommissioning activities are anticipated to be undertaken over a period of approximately two years. For the decommissioning phase, it is therefore assumed that the wind turbines, offshore electrical platforms, accommodation platforms, met masts and their respective foundation infrastructure (to between 1m and 2m below the sea bed) would be removed. The implementation of standard aviation safety

management processes would be applicable and a risk assessment based on the appropriate aviation requirements pertinent at the time would be required.

16.6.3.1 Impact 1: Creation of an aviation obstacle environment

107. During the decommissioning of the proposed East Anglia THREE project, the above sea level infrastructure included within *Table 16.2* would be removed gradually over a period of up to two years. This would gradually reduce the physical obstruction to aircraft utilising the airspace in the vicinity of the East Anglia THREE site.

108. Specifically for the East Anglia THREE site, permanent or temporary obstacles can also increase risk to:

- General military low-flying training and operations; and
- Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea.

109. The embedded mitigation in the form of International and National SARPs with respect to notification, marking and lighting, as outlined in section 16.3.3.3, would be retained until decommissioning has been completed. The impact on the aviation sector during the construction in the East Anglia THREE site would be reduced to pre-development conditions. The impact has been assessed to be **no change**.

16.6.3.2 Impact 2: Wind turbines causing permanent interference on military radar

110. During the gradual decommissioning of above sea level infrastructure in the East Anglia THREE site over a period of two years, the impact on radar would be removed. Firstly, as wind turbines are made inoperative and the blades ceased turning, before being removed from the site. In addition, all mitigations applicable to the operational phase would remain in place during the decommissioning phase until such time as all wind turbine blades are removed. The impact on radar during decommissioning is therefore considered to be **no change**, as the site returned to pre-development conditions.

16.6.3.3 Impact 3: Increased air traffic in the area related to windfarm activities

111. The use of helicopters during the decommissioning phase of the proposed East Anglia THREE project could impact on operations associated with HMRs. It is possible that helicopters could be used for transferring people and equipment to the East Anglia THREE site on a daily basis during the decommissioning of site infrastructure.

112. The possible increase in air traffic associated with decommissioning support activities brings with it a potential risk of aircraft collision in the area of the proposed East Anglia THREE project.

113. Due to the low number of movements predicted during the decommissioning period of the proposed East Anglia THREE project, the absence of HMRs within the East Anglia THREE site, the availability of existing ATS and by complying with CAP 764 as outlined in section 16.3.3, the impact to aircraft operators in the vicinity of the East Anglia THREE site, including those using the HMRs, is considered to be **not significant**.

16.7 Cumulative Impacts

114. This section covers the anticipated cumulative impacts on aviation and MOD interests in the region of the East Anglia THREE site over the anticipated 25 year lifecycle of the proposed East Anglia THREE project.

115. By virtue of its distance from centres of aviation activity, the East Anglia THREE site produces fewer direct adverse effects on aviation operations than do onshore developments. In the case of the East Anglia THREE site, aviation impacts are confined to the introduction of a remote obstacle environment, the effect of wind turbine detection on the air defence PSR at Trimingham, and the increase of air traffic in the vicinity of the East Anglia THREE site. Consequently, the cumulative effects of the proposed East Anglia THREE project are also reduced in proportion to this reduced level of local impact.

116. In ATS terms, the establishment of the East Anglia THREE site in the southern North Sea provides for adequate airspace around the development in which aircraft can be operated to enable the prescribed separation standards to be achieved without incurring adverse impacts from other developments, either onshore or offshore.

117. The other windfarm developments with the potential to act cumulatively with the East Anglia THREE project are:

- Scroby Sands Offshore Wind Farm;
- Greater Gabbard Offshore Wind Farm;
- Galloper Wind Farm; and
- East Anglia ONE

118. *Table 16.6* sets out a summary of projects considered under the Cumulative Impact Assessment for the proposed East Anglia THREE project.

16.7.1 Impact 1: Creation of an Aviation Obstacle Environment

119. Aircraft captains have the responsibility for the safety of their aircraft and are required to avoid any obstacle by legislated minimum distances. There would be no

cumulative effects from the establishment of the proposed East Anglia THREE project, inclusive of the installation of wind turbines within the East Anglia THREE site.

120. The potential cumulative effect of maritime and aviation obstacle lighting creating confusing lighting configurations to both sectors has been recognised and lighting policy is currently under review to obviate this possibility as detailed in *UK CAA – Policy Statement –The Lighting and Marking of Wind Turbine Generators and Meteorological Masts in United Kingdom Territorial Waters,* dated 22 November 2012. Therefore, there should be no cumulative effects associated with the proposed East Anglia THREE project on the impact of surface obstacles on aviation operations as compliant markings and lighting would be provided.

121. Through the use of embedded mitigation such as effective lighting, reliance on pilot competence and consideration of charted obstacles, the cumulative effects from the creation of an obstacle environment is considered to be **not significant**.

16.7.2 Impact 2: Wind Turbines Causing Permanent Interference on Military radar

122. The East Anglia ONE site is located approximately 23km to the south of the East Anglia THREE site. Therefore, the potential for an adverse cumulative effect accruing between the two projects was considered.

123. The East Anglia ONE Environmental Statement indicates that no part of the East Anglia ONE site is likely to be detected by the TPS-77 PSR at Trimingham and the MOD did not object to that project. As no radar interference is predicted for East Anglia ONE, this presents no cumulative effect with the proposed East Anglia THREE site project and so the impact is considered to be **not significant.**

124. The East Anglia THREE site is approximately 66km, 75km, and 91km from the Scroby Sands, Galloper Wind Farm, and Greater Gabbard Offshore Wind Farm projects respectively. These three projects are at a sufficient distance in ATS terms that they would not create cumulative impacts on aviation operations in the area of the East Anglia THREE site. Therefore the cumulative impact for these three sites is considered to be **not significant**.

125. With respect to onshore windfarm sites, these would all be of a sufficient distance from the East Anglia THREE site that there would be no cumulative effects on aviation operations that arise from any combined adverse impacts. The cumulative impact with onshore windfarm sites is therefore identified to be **no change.**

16.7.3 Impact 3: Increased Air Traffic in the area related to Windfarm Activities

126. During the operational phase of the proposed East Anglia THREE project, the area in the vicinity of the site is likely to see increased helicopter air traffic over the current baseline levels due to the use of helicopters in the provision of operational support in the East Anglia THREE site.

127. The likely number of helicopter movements associated with day to day operations within the East Anglia THREE site is considered to be low. The cumulative effect of this activity in consideration of the four offshore windfarm projects assessed would create a greater potential risk of a mid-air collision between aircraft engaged in such operations and / or aircraft in transit across the study area.

128. The potential for such risks occurring is reduced through the distances between the East Anglia THREE site and Scroby Sands Offshore Windfarm, Galloper Wind Farm, Greater Gabbard offshore Windfarm and East Anglia ONE. The implementation of the embedded mitigation outlined in section 16.3.3, and the reliance on pilots not engaged in works in direct relation to the East Anglia THREE site to comply with civil aviation regulations, the cumulative impact to aircraft operators in the vicinity of the East Anglia THREE site, including those using the HMRs, is considered to be **not significant**.

Table 16.6 - Summary of Projects considered for the Cumulative Impact Assessment

Project	Status	[1]Distance from East Anglia THREE site (km)	[2]Distance from offshore cable route (km)	Project definition	Included in CIA	Rationale
East Anglia ONE	Consented	23km south	N/a	Consented information available	Yes	Proximity to proposed East Anglia THREE project
Scroby Sands Offshore Wind Farm	Operational	66km west	N/a	Built information	Yes	Proximity to proposed East Anglia THREE project
Galloper Wind Farm	Consented	75km south	N/a	Consented information available	Yes	Proximity to proposed East Anglia THREE project
Greater Gabbard Offshore Wind Farm	Operational	91km south	N/a	Built information	Yes	Proximity to proposed East Anglia THREE project

[1] Shortest distance to the East Anglia THREE site– unless specified otherwise.
[2] Shortest distance to the offshore cable corridor– unless specified otherwise.

16.8 Transboundary Impacts

129. Other EU member states that could be impacted by the proposed East Anglia THREE site project are detailed in *Table .*

Table 16.7 - List of Other EU Member States Retained in the Transboundary Impact Assessment in Relation to the Topic

EU member state	Commentary
Netherlands	The East Anglia THREE site would be situated adjacent to and abutting the London / Amsterdam FIR boundary. HMRs exist on the west side of the FIR Boundary but do not transit or otherwise impinge on the proposed East Anglia THREE site.

130. As aviation operations are predominantly regulated by international criteria, there would be little difference in the impacts perceived by receptors in the Netherlands over those experienced in the UK and the same mitigation strategies should be effective in both domains. This chapter assumes that helicopters originating from the Netherlands could routinely be required to fly low level in the vicinity of the proposed East Anglia THREE site. This would be undertaken using route NL HMR KZ50 which is located within the Amsterdam FIR and is a continuation of where HMRs originating from UK controlled airspace (HMR 447 and HMR 450) converge. Impacts to aircraft operators using HMR 450 as a result of the construction, operation and decommissioning of the project were considered to be not significant. Therefore it is assumed that impacts to aircraft operators using NL HMR KZ50 is considered to be **not significant.**

131. The nearest offshore windfarm development within Dutch territory lies some 27.5km from the north east point of the proposed East Anglia THREE site and lies under airspace that is the responsibility of the ITL – see *Figure 16.3*. As aviation objections have not been raised on these developments, it is reasonable to assess that there would be limited transboundary concerns with regards to aviation interests during the construction, operation and decommissioning stages of the proposed East Anglia THREE project. Therefore, the transboundary impact on aviation operations in the area of the London / Amsterdam FIR boundary is assessed as **not significant**.

132. Consultation was undertaken in 2012 with relevant bodies as part of the East Anglia ONE and East Anglia Zone activities. A relatively small area of the East Anglia THREE site also lies inside the Netherlands FIR. The East Anglia ONE and East Anglia Zone consultation with the ILT indicated that the embedded mitigation proposed (i.e. charting, marking and lighting of all wind turbines consistent with UK regulations) would be acceptable to mitigate any potential impact by the creation of an obstacle

environment on low level transboundary flights. The same criteria would therefore be applied to the proposed East Anglia THREE project (to the extent that any of the East Anglia THREE site is within the Amsterdam FIR) to achieve the application of a consistent policy. At this time, the impact is considered to represent a limited effect and to be **not significant**.

133. *Diagram 16.1 and Diagram 16.2* show that some airways and upper air routes cross the area above the East Anglia THREE site. However, the routes impacted by the East Anglia THREE site are within airspace delegated to the Netherlands ATC Authorities. Traffic utilising these routes would be at or above FL175 (circa 17,500ft AMSL) and, by definition, operating within CAS where traffic operating within the protection of CAS can be deemed to be separated from non-transponding traffic Therefore, the potential impacts are assessed to be **not significant.**

16.9 Inter-relationships

134. The only inter-relationship with this chapter is Chapter 15 Shipping and Navigation. Aviation lighting fitted to offshore wind turbines could cause confusion to the maritime community as the specification for the lighting to be displayed below the horizontal plane of the light fitment itself could cause mariners some confusion. This confusion could result in wind turbines with conflicting warning lighting representing a collision risk to maritime surface vessels.

135. Work has been undertaken to develop an aviation warning lighting standard where, from the nature of the lighting, it would be apparent to mariners that the aviation lighting is clearly distinguishable from maritime lighting. Where it is evident that the default aviation warning lighting standard may generate issues for the maritime community a developer can make a case, that is likely to receive CAA approval, for the use of a flashing red Morse Code Letter 'W' to resolve potential issues for the maritime community. See *CAA Directorate of Airspace Policy - Policy Statement –The Lighting and Marking of Wind Turbine Generators and Meteorological Masts in United Kingdom Territorial Waters,* 22 November 2012.

Table 16.8 – Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Aviation lighting fitted to offshore wind turbines could cause confusion to mariners.	Chapter 15 Shipping and Navigation.	section 16.3.3.3

16.10 Summary

136. *Table* 16.9 presents a summary of the impact assessment undertaken with respect to the proposed East Anglia THREE project in relation to Aviation and MOD, which is discussed in section 16.6. *Table* 16.10 presents the summarised cumulative impacts, and *Table* 16.11 presents the summarised transboundary impacts with specific reference to the Netherlands as the only anticipated receptor of transboundary impacts.

Table 16.9 - Potential Impacts for Aviation and MOD receptors

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
Construction (Single Phase and Two Phased)				
Impact 1: Creation of aviation obstacle environment	Aviation – general Military Low flying Helicopter offshore operations Search and Rescue operations	Not significant	Embedded Mitigation sufficient	N/A
Impact 2: Wind turbines causing permanent interference on military radar	MOD - TPS-77 at Trimingham	No change	N/A	N/A
Impact 3: Increased air traffic in the area related to windfarm activities	Aviation – general Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea	Not significant	Embedded Mitigation sufficient	N/A
Operation				
Impact 1: Creation of aviation obstacle environment	Aviation – general Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea	Not significant	Embedded Mitigation sufficient	N/A

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
Impact 2: Wind turbines causing permanent interference on military radar	MOD - TPS-77 at Trimingham	Major significant	Radar technical solution at source Site design Site layout	Not significant
Impact 3: Increased air traffic in the area related to windfarm activities	Aviation – general Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea	Not significant	Embedded Mitigation sufficient	N/A
Decommissioning				
Impact 1: Creation of aviation obstacle environment	Aviation – general Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea	Not significant	Embedded Mitigation sufficient	N/A
Impact 2: Wind turbines causing permanent interference on military radar	MOD - TPS-77 at Trimingham	No change	N/A	N/A
Impact 3: Increased air traffic in the area related to windfarm activities	Aviation – general Military and civilian 'off-route' fixed-wing and helicopter operations – including those undertaking Search and Rescue missions – over the southern North Sea	Not significant	Embedded Mitigation sufficient	N/A

137. Potential cumulative impacts are summarised in *Table 16.10*

Table 16.10 - Potential Cumulative Impacts Identified for Aviation and MOD receptors

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
East Anglia ONE, Scroby Sands, Greater Gabbard Offshore Wind Farm, Galloper Wind Farm - creation of aviation obstacle environment	Aviation stakeholders in the vicinity of East Anglia THREE	Not significant	N/A	N/A
East Anglia ONE, Scroby Sands, Greater Gabbard Offshore Wind Farm, Galloper Wind Farm - wind turbines causing permanent interference on military radar	MOD - TPS-77 at Trimingham	Not significant	N/A	N/A
Onshore windfarms in the vicinity of radar stations - wind turbines causing permanent interference on military radar	MOD - TPS-77 at Trimingham	No change	N/A	N/A
East Anglia ONE, Scroby Sands, Greater Gabbard Offshore Wind Farm, Galloper Wind Farm - increased air traffic in the area related to windfarm activities	Aviation stakeholders in the vicinity of East Anglia THREE	Not significant	N/A	N/A

138. Potential Transboundary impacts are summarised in *Table 16.11*.

Table 16.11 - Potential Transboundary Impacts Identified for Aviation and MOD receptors

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
Impacts to aircraft operators using HMR KZ50	Helicopters using and nearby HMRs	Not significant	N/a	N/a
Impact on aviation operations in the area of the London / Amsterdam FIR boundary	Aircraft in transit through/using Netherlands airspace	Not significant	N/a	N/a
Impacts on Dutch PSR radar provision	Radar controllers	Not significant	N/a	N/a

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
Obstacle environment on low level transboundary flights	Aircraft in transit through Netherlands airspace	Not significant	N/a	N/a

16.11 References

Civil Aviation Authority (CAA), (2015) *CAP 393 - Air Navigation: The Order and The Regulations 4th Edition April 2015 Version 4.1*, London: CAA Publications.

Civil Aviation Authority (CAA), (2007) *CAP 725 - Guidance on the Application of the Airspace Change Process, 3rd Edition; March 2007*, London: CAA Publications.

Civil Aviation Authority (CAA), (2012) *CAP 724 – Airspace Charter 4th Issue August 2012*, London: CAA Publications.

Civil Aviation Authority (CAA), (2012) *Directorate of Airspace Policy - Policy Statement –The Lighting and Marking of Wind Turbine Generators and Meteorological Masts in United Kingdom Territorial Waters, 22 November 2012*, London: CAA Publications.

Civil Aviation Authority (CAA), (2013) *CAP 437 - Offshore Helicopter Landing Areas – Guidance on Standards – 7th Edition – amendment 1/2013*, London: CAA Publications.

Civil Aviation Authority (CAA), (2013) *CAP 670 - Air Traffic Services Safety Requirements, 3rd Edition, June 2013,* London: CAA Publications.

Civil Aviation Authority (CAA), (2013) *CAP 764 - Policy and Guidelines on Wind Turbines, Issue 5, June 2013*, London: CAA Publications.

Civil Aviation Authority (CAA), (2014) *CAP 168 – Licensing of Aerodromes, 10th Edition, March 2014,* London: CAA Publications.

Civil Aviation Authority (CAA), (2015) *CAP 032 - UK Aeronautical Information Publication* [Online], Available: http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=223 . Accessed 1/7/2015 .

Civil Aviation Authority (CAA), (2015) *ENR 1.4 - ATS Airspace Classification* [Online], Available at: http://www.ead.eurocontrol.int/eadbasic/pamslight-DD24FA042ECD51AC9A98C2F611AAF1B6/7FE5QZZF3FXUS/EN/AIP/ENR/EG_ENR_1_4_en_2015-05-28.pdf Accessed: 1/7/2015.

Department of Energy and Climate Change (DECC), (2011) *Decommissioning of offshore renewable energy installations under the Energy Act 2004,* [Online], Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/80786/orei_guide.pdf Accessed: 1/7/2015.

Department of Energy and Climate Change (DECC), (2011) *National Policy Statement for Renewable Energy Infrastructure (EN-3),* London. [Online], Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf Accessed: 1/7/2015.

Department of Energy and Climate Change (DECC), (2011) *Overarching National Policy Statement for Energy EN-1 (NPS EN-1),* London. [Online], Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf Accessed: 1/7/2015.

East Anglia ONE Limited (2012) *Environmental Statement for East Anglia ONE Offshore Windfarm*, East Anglia ONE Limited.

International Civil Aeronautical Organisation (ICAO), (2009) *Annex 14 Aerodromes Volume 1 - Aerodrome Design and Operations Sixth Edition, July 2013,* [Online], Available at: http://store1.icao.int/index.php/publications/annexes/14-aerodromes/annex-14-aerodromes-volume-i-aerodrome-design-and-operations-english-printed-12381.html Accessed: 1/7/2015.

Maritime and Coastguard Agency (MCA) Marine Guidance Notice (MGN) 371 - *Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues*, 2008, [Online], Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/441130/371.pdf Accessed: 1/7/2015.

Ministry of Defence (MOD) *MOD Obstruction Lighting Guidance*, issued by Low Flying Operations Squadron, 21 November 2014, [Online], Available at: http://www.renewableuk.com/download.cfm/docid/243606FF-735D-4C1B-A037572619727ACB Accessed: 1/7/2015.

Ministry of Defence (MOD), (2015) *UK Military Low Flying – An Essential Skill,* [Online], Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/27442/UK_Military_Low_Flying.pdf Accessed: 1/7/2015.

Ministry of Defence (MOD), (2015) *UK Military AIP,* [Online], Available at: https://www.aidu.mod.uk/Milflip/products/Current_AIRAC/UkMilaip/launch_aip.htm Accessed: 1/7/2015.

Netherlands (NL) Luchtverkeersleiding Nederland (LVNL), (2015) *Integrated Aeronautical Information Package, the Netherlands (NL AIP),* [Online], Available at: http://www.ais-netherlands.nl/aim/2015-05-14-AIRAC/eAIP/html/index-en-GB.html Accessed: 1/7/2015.

Chapter 16 ends here