East Anglia Hub Wind Farms

ACP-2023-079

Current-day Scenario

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1 Introduction

1.1 Background

Iberdrola Group, through its UK subsidiary, ScottishPower Renewables Ltd (SPR) are proposing to develop the East Anglia (EA) Hub Wind Farm Development, a macro offshore complex to deliver a combined installed capacity of 3.1 gigawatts (GW). This development will consist of three Wind Farms, named EA1N, EA2 and EA3, and they will be located in the Southern North Sea, to the east of the Norfolk coastline.

1.2 Project Overview

This report forms part of the document set required in accordance with the requirements set out in the CAP 1616 - Airspace Change Process (Version 5). As part of the Airspace Change Proposal (ACP), Stage 1 requires the Change Sponsor (CS) to provide a current-day scenario (or baseline), which captures a clear description of the current impacts and sets the context for all stakeholders. As this ACP has been pre-scaled to a Level 3 by the Civil Aviation Authority (CAA)[1], meaning it has the potential for low impact on both aviation and non-aviation stakeholders.

The CS is currently undertaking the establishment of three wind farms in the Southern North Sea. These sites are collectively known as the East Anglia Hub (EA Hub).

This ACP aims to introduce new airspace measures and support a technical mitigation solution, such as Range Azimuth Gating (RAG) within the Cromer Radar, which is primary radar system likely to be affected by the East Anglia Hub Offshore Wind Farm wind turbine generators (WTGs).

This document should be used and referenced in conjunction with all stages of the ACP. This allows the Stakeholders to review the current-day scenario against the evolving ACP process.

1.3 The Process

Within the CAP 1616 guidance, Stage 1 consists of two elements. The first element is the Define element, where the change sponsor prepares a Statement of Need (SoN) which sets out what airspace issue or opportunity it is seeking to address. The SoN for East Anglia Hub can be read in conjunction with this document and can be found at the following link. the next step is the development of the Design Principles which encompass areas such as safety, environmental and operational criteria, and strategic policy objectives which the change sponsor is aiming for in the airspace change proposal.

[1] Post CAA ACP Assessment Meeting – 16th January 2024

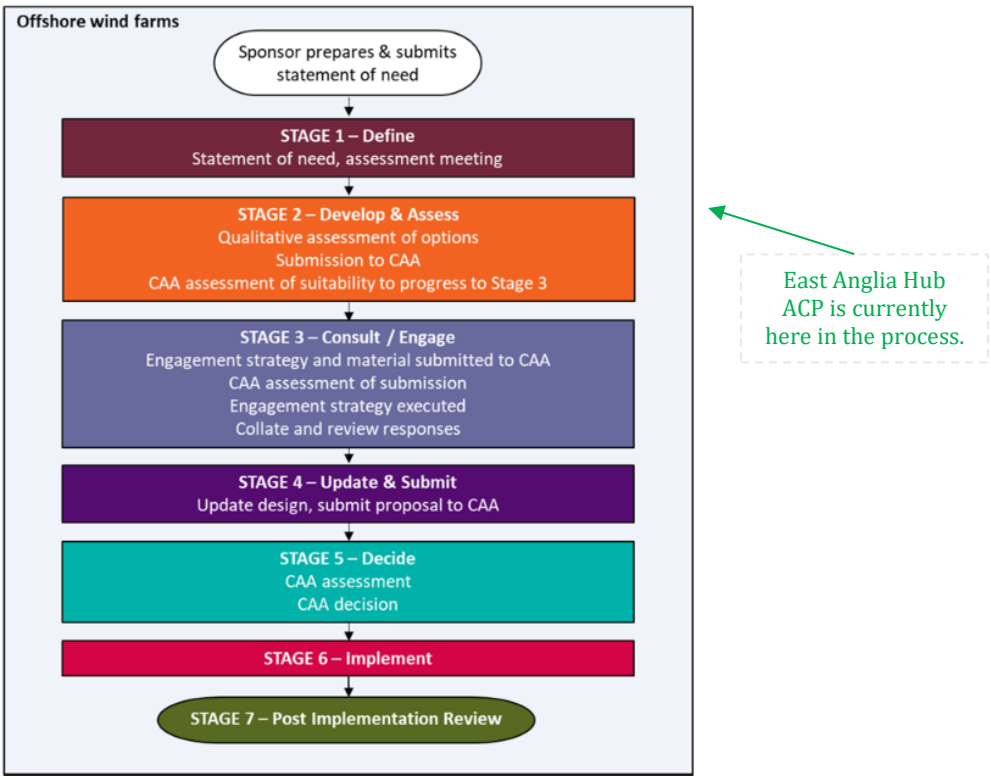

Figure 1 - CAP 1616 h Appendix B: OSWF mitigation airspace change process overview.

1.4 Structure of this Document

- Section 1 – Introduction
- Section 2 – Airspace Design
- Section 3 – Airspace Usage & Analysis
- Section 4 – Adjacent OSWF Capacity
- Section 5 – Other Considerations
- Section 6 – Any Potential Safety Risks
- Appendix A1 – Operational Diagrams
- Appendix A2 – Traffic Studies
- Appendix A3 - Acronyms
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1.5 The East Anglia Hub

The East Anglia Hub (EA Hub) is a ScottishPower Renewables (SPR) project representing a group of wind farm developments located in the Southern North Sea. The EA Hub consists of four Wind Farm sites in the North Sea region, East Anglia 1 North (EA1N), 2 (EA2), and 3 (EA3). East Anglia 1 is already a fully operational wind farm to the south of EA1N and is not part of this ACP process. Figure 2 below shows a representation of EA1N, EA2, and EA3 and their approximate distances from the UK coastline.

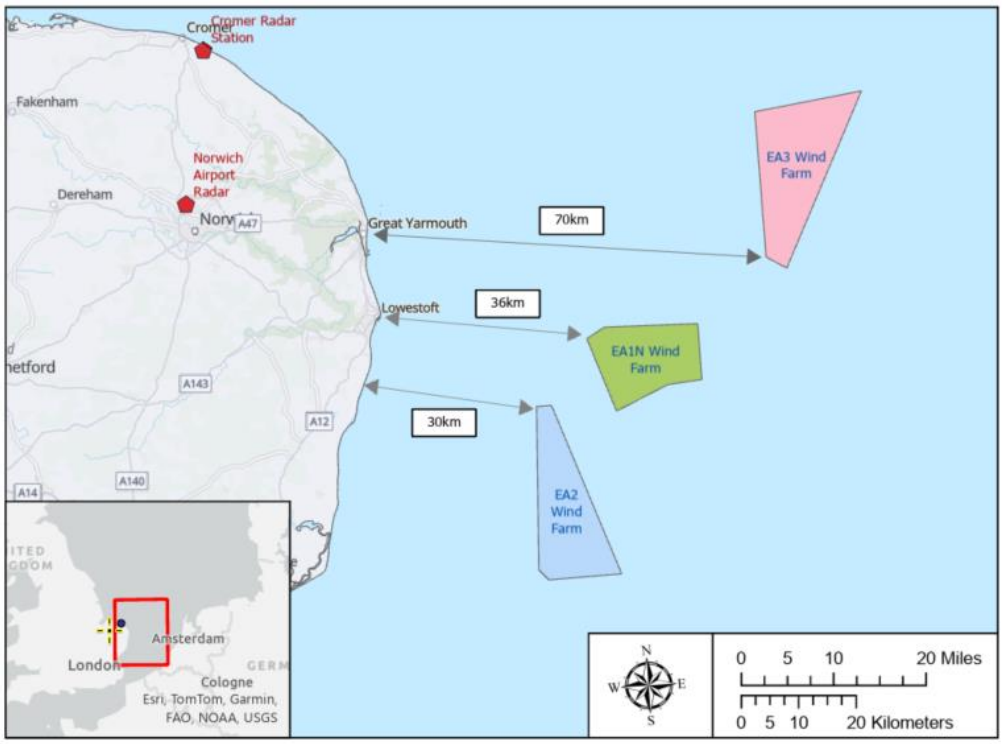

Figure 2 - EA Hub Proximity to UK Coastline

The EA1N site is situated 36 kilometers (km) east of the UK coastline and achieved UK planning consent in March 2022. The sites planned 67 WTGs are due to become operational in March 2028. EA1N have the potential to provide up to 800 megawatts (MW) of energy, powering over 650,000[2] homes per year.

The EA2 site is situated 30km south-west of EA1N and achieved UK planning consent at the same time as EA1N. As the closest of the EA Hub sites to the UK coastline, EA2 is scheduled to become active in March 2027. Once operational, EA2's 75 planned wind turbines have the potential to produce up to 900MW of energy which equates to powering nearly 800,000[3] homes per year.

The third and most developed of the EA Hub site is EA3 which is situated almost 70km east of Great Yarmouth. EA3 achieved UK planning consent in August 2017, and began wind farm construction in July 2022 for a March 2026 operational deadline. EA3 is the most northerly of the three EA Hub sites and the furthest from the UK mainland. Once operational, EA3 approximately 100 wind turbines have the potential to produce up to 1,400MW, powering over 1 million [4] homes per year.

The EA Hub is likely to be classified as Critical National Infrastructure (CNI) and play a major part in delivering the UK government's energy strategy.

[2] ScottishPower Renewables: East Anglia One North Web page.
[3] ScottishPower Renewables: East Anglia Two Web page
[4] ScottishPower Renewables: East Anglia Three Web page

1.6 Objections to East Anglia Hub – Primary Surveillance Radar

During the planning consent phase of SPR's EA Hub project, a series of Line of Sight (LoS) assessments were conducted by both the National Air Traffic Services (NATS) and SPR on what effects, if any, the EA Hub WTGs may have on the primary surveillance radar (PSR) at Cromer and NATS' associated air traffic (Surveillance and Control) service operations. Having consulted with the Secretary of State (SoS), NATS has raised an objection to the operational commencement of WTGs at all 3 EA Hub sites until appropriate mitigation to resolve the Cromer PSR issue is implemented and maintained.

A LoS assessment is a technical review that considers how a tall structure, such as a wind turbine, may affect the transmission and reception signals of a ground-based radar system, given the distance between each location and the curvature of the earth. If the WTGs are assessed as being within the 'Line of Sight' of the radar beam, the returning signal to the radar can cause severe interference that reduces the performance of the radar system. In some cases, similar ACPs have resulted in a technical mitigation that introduces Range Azimuth Gating (RAG) within the radar system across the affected azimuth and range sectors. The application of radar RAG, more commonly known as radar blanking, will prevent the display of potentially erroneous radar returns, or clutter, caused by the WTGs. This RAG blanking can be applied to any location on a radar display. However, this blanking will also remove any display of the primary radar return from aircraft within the blanked area.

This ACP seeks to introduce a RAG blanking area that will remove clutter from all of the EA Hub Wind Farms and, in order to mitigate the 'black hole' caused by the RAG blanking, the CS is aiming to introduce Transponder Mandatory Zones (TMZs). The zones will cover the blanked area from surface (SFC) to Flight Level (FL) 100. This will ensure that any aircraft entering the RAG blanked TMZ area will be operating a transponder Secondary Surveillance Radar (SSR) and will therefore still be displayed to Air Traffic Control (ATC).

Secondary Surveillance Radar works together with transponders which are installed on the aircraft. The ground based SSR radar interrogates the transponder which transmits a signal which is captured by the radar. The information transmitted by the transponder identifies the aircraft, along with details as to aircraft altitude (note that transponder equipage is mandatory for instrument flight, and flight above Flight Level (FL) 100.

2 Airspace Design

2.1 Current Airspace Structure

As part of the CAP 1616h requirement, the CS is required to inform the stakeholder community of a defined current scenario at the site of the proposed EA Hub Wind Farms. This section highlights and discusses the currently established airspace structures in the vicinity of the proposed EA Hub Wind Farms.

The CS conducted an analysis of the structure of the airspace surrounding EA1N from sea level up to FL660. Due to the breadth of area assessed across three distinct OSWF's, this section has been organized into sub-sections representing each EA site. Each EA sub-section is broken down into the following airspace sections:

- Air Traffic Service Airspace
- Navigational Warnings
- Routes
- Instrument Flight Procedures (IFP)
- Military Exercise & Training Areas

2.1.1 Airspace Classification

Airspace is denoted by a classification type; in the UK there are currently five classes of airspace: A, C, D, E and G (in descending order of restrictive complexity). The classification of the airspace determines the applicable flight rules and the minimum level of air traffic service provision. Classes A, C, D and E are areas of controlled airspace and Class G is a classification for any uncontrolled airspace within the UK. Controlled airspace is provided primarily to protect airspace users operating within its pre-defined boundaries and within this airspace users must be equipped to a certain standard and pilots must hold certain flying qualifications. Pilots must obtain clearance from ATC to enter controlled airspace and, except in an emergency, must follow ATC instructions implicitly.

The following are descriptors of identified airspace classifications relating to the EA Hub sites:

Class A. In class A airspace, only Instrument Flight Rules (IFR) flying is permitted. It is the most strictly regulated airspace where pilots must always comply with ATC instructions. Aircraft are separated by ATC from all other air traffic. Users of this airspace are mainly major airlines and business jets.

Class C. Class C airspace in the UK extends from Flight Level (FL) 195 to FL600. Both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) flying is permitted in this airspace, but pilots require a clearance to enter and must comply with ATC instructions.

Class G. Within this airspace aircraft may fly without any ATC clearance or control and are subject to a set of simple rules. Although there is no legal

requirement to do so, many pilots do notify ATC of their presence and can ask for help. In this airspace pilots take full responsibility for their own safety.

2.1.2 Airspace Type

The current-day scenario analysis identified several airspace types which interact or are situated in the vicinity of the East Anglia Hub OSWF complex. The airspace types are:

Control Area (CTA). A CTA is defined as a volume of controlled airspace extending upward from a specified lower level to a specified upper level. CTAs typically provide protection to aircraft climbing out from and inbound too an airport.

Transponder Mandatory Zone. The objective of a TMZ is to enhance the conspicuity of aircraft operating within, or in the vicinity of, complex, or otherwise busy airspace when the establishment of a more restrictive classification of airspace is not warranted, in order to maintain a balance between safe, efficient operations and fair, equitable access for all airspace users. Typically, a TMZ will be established using the least restrictive classification of airspace within which it is to sit, unless a more restrictive classification is required to satisfy a demonstrable safety need.

Temporary Reserved Area (TRA). A TRA is a defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily reserved, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit under an Air Traffic Services (ATS) authority. In compliance with the EC Regulation that lowers Class C Airspace to FL 195, TRAs between FL 195 and FL 245 have been established to accommodate the various VFR airspace users, including military autonomous operational requirements above FL 195.[5]

Aerial Tactics Area (ATA). ATA airspace is an area of defined dimensions designated for air combat training within which high energy manoeuvres are regularly practiced by aircraft formations.

2.1.3 Routes

This section of the current-day scenario includes the analysis of the Navigational Routes above the EA Hub complex and identifies those that may have an influence on this ACP development. These exclude airport approach and departure routes to airports (see 2.2.4 for Instrument Flight Procedures).

Helicopter Main Routing Indicators (HMRI). HMRI's[6] are expressed as linear routes which are commonly flown by helicopters to and from offshore destinations. The purpose of HMRI is to indicate areas of dense helicopter activity to other airspace users. HMRIs hold no airspace status and assume the airspace classification in which they reside. HMRIs also have no defined lateral limits. However, the HMRIs in the Southern North Sea extend vertically from 1,500ft AMSL to FL60.

Tactical Air Navigation Routes (TACAN). The TACAN system is a navigation system used by military aircraft.

[5] The Single European Sky (SES) Airspace Classification Regulation Commission (Regulation (EC) No 730/2006)
[6] UK Civil AIP - ENR 1.6 ATS Surveillance Services & Procedures / 4 Other Relevant Information & Procedures (25 Jan 2024)

ATS Routes. An ATS Route is a specified navigational route designed for channelling the flow of air traffic as necessary for the management of air traffic operations. An ATS Route is made up of a designator (name), a series of waypoints, and an upper and lower vertical limit. A section between two waypoints on an ATS Route is referred to as an ATS segment.

2.1.4 Instrument Flight Procedures

An IFP is used by aircraft flying in accordance with instrument flight rules and are designed to facilitate safe and efficient operations around the world whilst undertaking (instrument) departures, arrivals, and/or approaches to and from airports. In the UK, NATS publish all civil licensed CAP1732[7] aerodrome IFPs in the UK Civil Aeronautical Information Publication (AIP).[8] If an ACP is likely to affect any aerodrome IFPs, then the CS is to work closely with the Aerodrome Operator to resolve any safety issues concerning their existing IFPs.

2.1.5 Military Exercise & Training Areas

The current-day scenario analysis identified the following types of military exercise and training areas which interact or are situated in the vicinity of the East Anglia Hub OSWF complex. These are:

Low Flying Areas (LFA). The Ministry of Defence (MOD) has an enduring requirement to low fly within the UK to remain current and competent to meet government directed tasks. To ensure that military requirements are met, whilst managing safety risks and mindful of the need to minimise any disturbance to the public, military low flying takes place within the UK Low Flying System, known as Low Flying Areas, which utilise Class G airspace from the surface to 2000ft above ground level (AGL).

Air to Air Refuelling Areas (AARA). The UK and other European nations have established a series of dedicated areas to safely conduct military air to air refuelling. Figure 16 (Annex 1.3) shows the UK's Air to Air Refuelling Areas in the vicinity of the EA Hub complex. AARAs area controlled by a military authority, such as Swanwick Mil or Control and Reporting Centre (CRC) Boulmer[9]. The AARA holds no specific airspace classification and will adopt the airspace classification in which they reside.

[7] CAP 1732- Aerodrome Survey Guidance (Ed 1, Dec 2028)
[8] The MOD publish the UK Military AIP on the MilFLIP Website
[9] UK Military AIP – ENR 5.2 Military Exercise & Training Areas & ADIZ

2.2 Current East Anglia 1N Interacting Airspace

2.2.1 ATS Airspace

The CS conducted an analysis of the structured ATS Airspace[10] above the EA1N Offshore Wind Farm (OSWF) site. The analysis shows that no ATS Airspace sits wholly or partially above EA1N. Refer to Annex 1 - Operational Diagrams for a visual appraisal of the ATS Airspace in the vicinity of the EA Hub complex.

2.2.2 Navigational Warnings

This section contains the analysis conducted against navigational warnings airspace in the vicinity over the EA Hub complex. A navigational warning can include airspace of a prohibited, restricted and or dangerous nature which could pose an immediate hazard to air navigation. Refer to Annex A1.1 - Operational Diagrams for a visual appraisal of the Navigational Warnings identified in Table 1.

ATA Lakenheath South. The ATA identified in Table 1, Lakenheath South, is Class G airspace. However, the AIP does notify this as an avoidance for all airspace users. Also, the ATA's vertical lower limit extends upwards from FL60 and potentially affects the TMZ airspace design options for all three EA Hub sites. This ATA, along with ATA Lakenheath North, are likely to influence the Design Options and require specific stakeholder engagement during this ACP process with the Lakenheath ATA (North & South) controlling authority.

2.2.3 Routes

ATS Routes. Table 1 below lists the ATS Segments which overfly EA1N and are shown pictorially in Figure 3. From the Lower Limit Column in Table 1**Error! Reference source not found.**, none of these ATS segments are low enough in altitude to impact a potential TMZ ACP solution (FL100) over the EA1N site.

[10] Reference the UK Civil AIP – Section ENR 2 for a full listing of UK ATS Airspace.

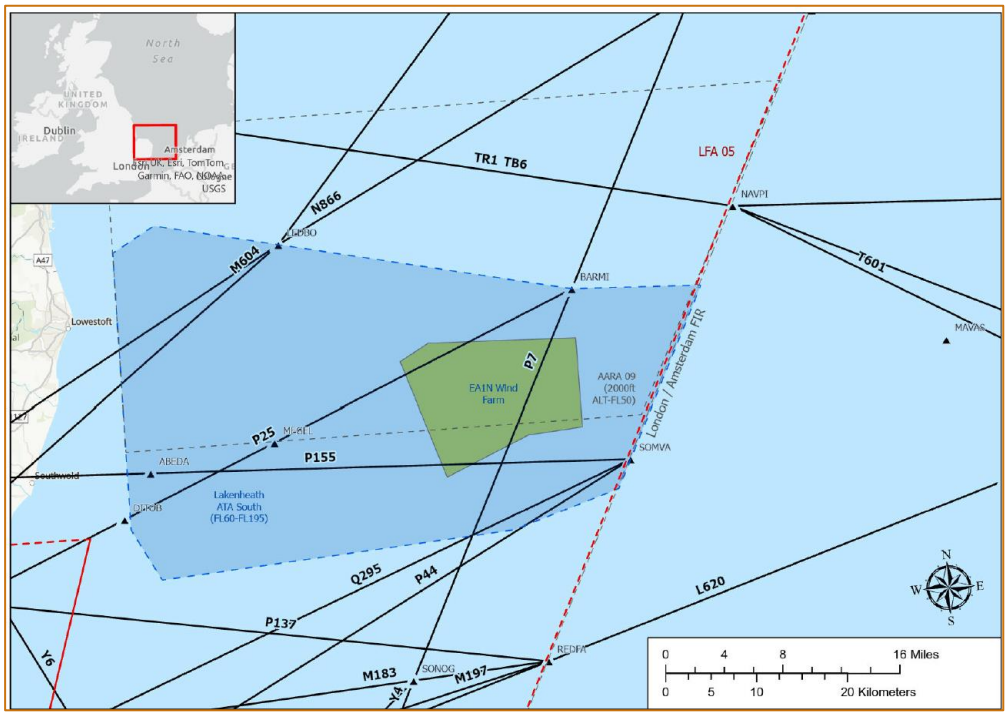

Figure 3 – Airspace and ATS Routing structure above EA1N OSWF

2.2.4 Instrument Flight Procedures (IFP)

The current-day scenario requires the CS to assess where the ACP may impact on an aerodrome Instrument Flight Procedure (IFP).

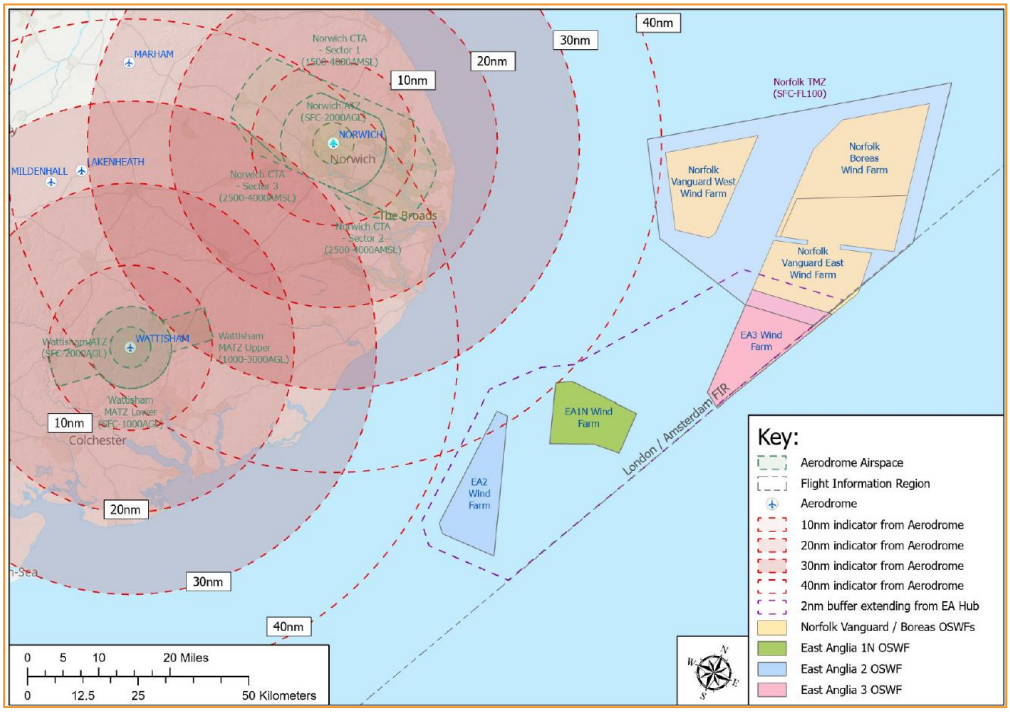

Figure 4 – IFP Aerodrome Proximity to EA Hub complex.

The EA Hub OSWF complex is within the vicinity of two aerodromes with IFPs, Norwich Airport and Wattisham Airfield (See Figure 4). Norwich Airport is located approximately 74km west of EA1N, 70km from EA2 and over 100km from EA3's OSWF perimeters. All of Norwich Airports four IFP approach procedures are contained within a 10nm circumference of their respective runways (09/27). Wattisham, which is further away from the EA Hub OSWF than Norwich, has two runways (05/23) and eleven published terminal approach procedures[11]. Each of Wattisham Aerodrome's published IFP's initiate their initial approach fix (IAF) within a 10nm radius of the airfield and remain over the UK mainland.

Figure 4 above depicts the two closest IFP UK aerodromes to the EA Hub complex. Figure 4 further denotes that should this ACP hypothetically establish a block TMZ above the EA Hub (purple checkered line), the closest aerodrome (Norwich) to the block TMZ would still exceed a 30nm distance to the hypothetical airspace perimeter.

The CS believes that due to the EA Hub's remote distance from the UK mainland, and by association its lack of proximity to any IFP aerodromes, that this ACP and any design options will have no impact on any aerodromes current or future IFPs.

2.2.5 Military Exercise & Training Areas

This section of the document assesses the airspace structure orientated toward military exercise and training areas[12]. Table 1 below shows two key identified types of airspace which are situated immediately above the EA Hub OSWF complex. The table shows that Air-to-Air Refuelling Area (AARA) 9 is situated in part over the EA1 and EA3 OSWF sites (3 & 6), whilst Low Flying Area (LFA)5 encompasses all three EA Hub sites (Figures 3, 5 & 6).

[11] UK Military AIP – Wattisham Aeronautical Information

[12] ENR 5.2 Military Exercise & Training Areas & Air Defence Identification Zone (Civil & Military AIPs)

Name	Segment (if app)	Lower	Upper	Class	Potential Impact with EA1N
Navigational Warnings					
Aerial Tactics Area (ATA) Lakenheath South	-	FL60	FL195	G	Yes
Routes					
P7	SONOG to BARMI	FL215	FL460	-	No
P25	MEGEL to BARMI	FL195	FL460	-	No
P155	ABEDA to SOMVA	FL245	FL460	-	No
Military Exercise & Training Areas					
AARA 9	-	2000ft ALT	FL50	G	No
Low Flying Area 5	-	Surface	2,000ft AGL	G	No

Table 1 - Table of Potential Impacts with EA1N

2.3 Current East Anglia 2 Interacting Airspace

2.3.1 ATS Airspace

The CS conducted an analysis of the structured ATS Airspace[13] above the EA2 OSWF site. Table 2 below lists the identified ATS Airspace, whether it resides wholly or partially above the Wind Farm, their upper and lower limits, and their allocated airspace classification. Refer to Annex A1.1 - Operational Diagrams for a visual appraisal of the ATS Airspace identified in Table 2.

Clacton Control Area – Sectors 5 & 6. Analysis identified two CTAs which are sited over 2 different EA Hub sites, Clacton CTA (sectors 5 & 6). As the maximum upper limit of a TMZ is FL100 the Clacton CTA Sector 5, which extends upwards from FL85 interacts directly with a potential TMZ Design option. However, as the carriage and operation of a transponder in Class A airspace is mandatory, the addition of a TMZ will have no impact on current-day operations within that specific section/portion of Clacton CTA 5[14].

2.3.2 Navigational Warnings

This section contains the analysis conducted against navigational warnings airspace in the vicinity over the EA Hub complex. A navigational warning can include airspace of a prohibited, restricted and or dangerous nature which could pose an immediate hazard to air navigation. Refer to Annex A1.1 - Operational Diagrams for a visual appraisal of the Navigational Warnings identified in Table 2.

ATA Lakenheath South. The ATA identified in Table 2, Lakenheath South, is designated Class G airspace. However, the AIP does state this area is an avoidance notification for all airspace users. Also, both of the ATAs vertical lower limit extend upwards from FL60 and could potentially influence any TMZ design options for all three EA Hub sites. These ATAs are likely to influence the Design Options and require specific stakeholder engagement during this ACP process with the Lakenheath ATA (North & South) Controlling Authority.

2.3.3 Routes

ATS Routes. Error! Reference source not found. below lists the ATS Segments which overfly EA2; also shown pictorially in Figure 21. From the Lower Limit column in Table 2 ATS Route Segment L620, M197, P7and Y4 may directly interact with a potential TMZ ACP solution (FL100) over the EA2 site.

[13] Reference the UK Civil AIP – Section ENR 2 for a full listing of UK ATS Airspace.
[14] UK Civil AIP - Gen 1.5 - Section 5.3.1.3

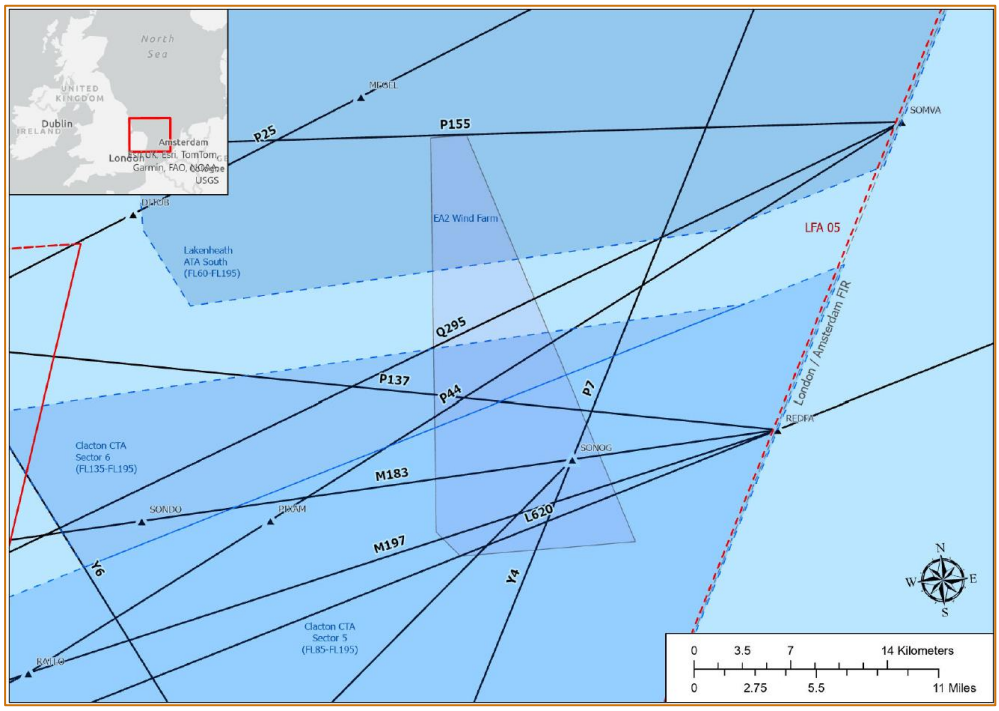

Figure 5 - Airspace and ATS Routing structure above EA2 OSWF

2.3.4 Instrument Flight Procedures (IFP)

As described in para 2.2.4, there will be no impact between the nearest IFPs and the anticipated ACP Design Options.

2.3.5 Military Exercise & Training Areas

As described in para 2.2.5, there will be no impact between the exercise and training areas and the anticipated ACP Design Options.

Name	Segment (if app)	Lower	Upper	Class	Potential Impact with EA2
ATS Airspace					
Clacton Control Area (CTA) 5	-	FL85	FL195	A	Yes
Clacton Control Area (CTA) 6	-	FL135	FL195	A	No
Navigational Warnings					
Aerial Tactics Area (ATA) Lakenheath South		FL60	FL195	G	Yes

Name	Segment (if app)	Lower	Upper	Class	Potential Impact with EA2
Routes					
L620	CLN (CLACTON) to REDFA	FL85	FL460	L620	**Yes**
M183	SONOG to REDFA	FL135	FL460	M183	**No**
M183	SONDO to SONOG	FL135	FL460	M183	**No**
M197	RATLO to REDFA	FL85	FL460	M197	**Yes**
P7	LOGAN to IDESI	FL85	FL460	P7	**Yes**
P7	IDESI to SONOG	FL85	FL460	P7	**Yes**
P7	SONOG to BARMI	FL215	FL460	P7	**No**
P25	MEGEL to BARMI	FL195	FL460	P25	**No**
P44	PIXAM to SOMVA	FL195	FL460	P44	**No**
P137	SIVDA To REDFA	FL205	FL460	P137	**No**
P155	ABEDA to SOMVA	FL245	FL460	P155	**No**
Q295	PAAVO to SOMVA	FL195	FL460	Q295	**No**
Y4	ODROB to SONOG	FL95	FL460	Y4	**Yes**
Military Exercise & Training Areas					
AARA 9	-	2000ft ALT	FL50	G	No
Low Flying Area 5	-	Surface	2,000ft AGL	G	No

Table 2 - Table of Potential Impacts with EA2

2.4 Current East Anglia 3 Interacting Airspace

2.4.1 ATS Airspace

The CS conducted an analysis of the structured ATS Airspace[15] above the EA3 OSWF site. Table 3 below lists the identified ATS Airspace whether it resides wholly or partially above the Wind Farm, their upper and lower limits, their allocated airspace classification. Refer to Annex A1.3 - Operational Diagrams for a visual appraisal of the ATS Airspace identified in Table 3.

North Sea Control Area 3 (MOLIX). Analysis identified 1 CTA sited over EA2 the North Sea CTA 3 (known as Molix). As the maximum upper limit of a TMZ is FL100 the Clacton CTA Sector 5, which extends upwards from FL85, is the only portion of airspace which interacts directly with the TMZ design around EA2. However, as the carriage and operation of a transponder in Class A airspace is mandatory, the addition of a TMZ will have no impact on current-day operations within that specific section/portion of the Clacton CTA 5[16].

Amsterdam Transponder Mandatory Zone. From the analysis, two significant TMZs were identified. The first TMZ is the Amsterdam TMZ (SFC-FL55) which is established from the London/Amsterdam Flight Information Region (FIR) to the Netherlands coastline. Although likely not to directly affect this ACP outcome, consideration is given to the impact this TMZ or any newly established UK adjacent TMZs may have on non-transponding general aviation (GA) airspace users wishing to cross the North Sea between the Netherlands and the UK.

Norfolk Transponder Mandatory Zone. Adjacent to the EA3 development site, Vattenfall Wind Power Ltd (VWP) has successfully gained approval from the CAA (June 2021) for the establishment of a TMZ. VWP have sought to develop two wind farm developments (Norfolk Vanguard & Norfolk Boreas) containing up to 360 WTGs to the height of 350 meters (m).

Although not operational yet, VWP had the same challenges to overcome as SPR are required to address with the EA Hub complex; notably the impact of WTGs on PSRs. The VWP ACP was initially intended to implement the TMZ on 30 Dec 2021 (13/2021), however due to alterations to the WTG build schedule the airspace implementation has paused and will now await the future wind farm commencement date (year 2024/2025).

2.4.2 Navigational Warnings

This section contains the analysis conducted against navigational warnings airspace in the vicinity over the EA Hub complex. A navigational warning can include airspace of a prohibited, restricted and or dangerous nature which could pose an immediate hazard to air navigation. Refer to Annex A0 - Operational Diagrams for a visual appraisal of the Navigational Warnings identified in Table 3.

Aerial Tactics Area Lakenheath North. The ATA identified in Table 3 Lakenheath North; is allotted as Class G airspace, and not restricted, however the AIP does state an avoidance notification to all airspace users. Also, both of the Lakenheath ATAs (North & South) vertical lower limit extend upwards from

[15] Reference the UK Civil AIP – Section ENR 2 for a full listing of UK ATS Airspace.
[16] UK Civil AIP - Gen 1.5 - Section 5.3.1.3

FL60, and potentially affecting the TMZ Design Options for all three EA Hub sites. These ATAs are likely to influence the Design Options and require specific stakeholder engagement for this ACP process, such as the Lakenheath ATA (North & South) Controlling Authority.

Temporary Reserved Area 003. TRA 003 has no published details on its dedicated operational purpose beyond a reserved area for dedicated military operations[17]. However, According to Regulation (EC) No 730/2006, TRAs may be used simultaneously by both civil and military aircraft, including aircraft in en-route transit through a TRA. Military air systems are permitted to operate anomalously during the TRA hours of operations, denoting civil air users should adhere to cautionary avoidance warnings due to the Unusual Aerial Activities conducted within a TRA. As the lower limit of a TRA (Class C) is FL195, there will be no interactions or impacts with this ACP's proposed TMZ solution, which has an upper limit of FL100. It is understood there is a low probability of VFR operations being conducted at TRA altitudes[18].

2.4.3 Routes

The following navigational route is situated above the EA3 OSWF site.

Tactical Air Navigation Routes (TACAN). Analysis of the TACAN routes[19] has shown that the TACAN routing structure only overflies the EA3 site. Table 3 and Figure 6 have captured this information.

Helicopter Main Route Indicators. The most southerly established HMRI routes in the North Sea are Routes 450 and 447. Figure 14 (Annex A1.1) depicts these routes immediately north of EA3 and intersecting with the reporting point 'LUVOR' on the London/Amsterdam FIR boundary. Although not necessarily an immediate airspace interaction with EA3, should this ACP select airspace options which extends in a northerly direction, then HMRI route interaction may be a consideration.

ATS Routes. Table 3 below lists the ATS Segments which overfly EA3 and are shown pictorially in Figure 6. From the Lower Limit Column in Table 3 none of these ATS segments or TACAN Routes are low enough in altitude to impact a potential TMZ ACP solution (FL100) over the EA3 site.

[17] UK Military AIP – ENR 5.2, 5.2.2 TRA 001-008
[18] UK Civil AIP – ENR 1.1, 5.1.5 Temporary Reserved Areas
[19] UK Military AIP – ENR 6-1-1 UK TACAN Routes Diagram (10Aug 23)

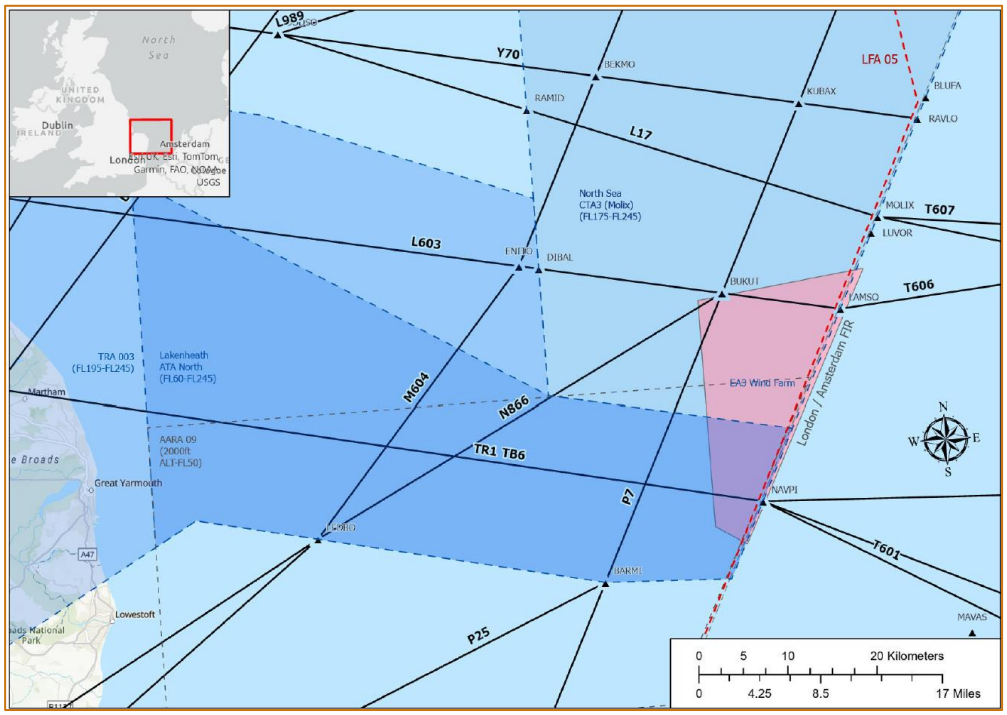

Figure 6 - Airspace and ATS Routing structure above EA3 OSWF

2.4.4 Instrument Flight Procedures (IFP)

As described in para 2.2.4, there will be no impact between the nearest IFPs and the anticipated ACP Design Options.

2.4.5 Military Exercise & Training Areas

As described in para 2.2.5, there will be no impact between the exercise and training areas and the anticipated ACP Design Options.

Name	Segment (if app)	Lower	Upper	Class	Potential Impact with EA3
ATS Airspace					
North Sea Control Area (CTA) 3 (MOLIX)	-	FL175	FL195	A	No
North Sea Area – Amsterdam Transponder Mandatory Zone (TMZ)	-	Surface	FL55	G	No
Vanguard / Boreas Transponder Mandatory Zone (TMZ)[20]	-	Surface	FL100[21]	G	No

[20] Airspace Portal – Norfolk Vanguard & Norfolk Boreas Windfarms (ACP-2018-03)
[21] Assumed. Not yet published in the UK Civil AIP by Change Sponsor, However it is expected to be FL100 to address the radar RAG for non-transponding aircraft.

Name	Segment (if app)	Lower	Upper	Class	Potential Impact with EA3
Navigational Warnings					
Aerial Tactics Area (ATA) Lakenheath South	-	FL60	FL195	G	Yes
Temporary Reserved Area (TRA) 003	-	FL195	FL245	C	No
ATS Routes					
L603	BUKUT to LAMSO	FL175	FL460	-	No
N866	LEDBO to BUKUT	FL245	FL460	-	No
P7	BARMI to BUKUT	FL245	FL460	-	No
TACAN Routes					
TR1	EA1 to NAVPI	Minimum Altitude FL250		-	No
TR1 (NL)	NAVPI to MC2	Minimum Altitude FL210		-	No
TB6	EA1 to NAVPI	Minimum Altitude FL250		-	No
TB6 (NL)	NAVPI to VKL (TACAN)	Minimum Altitude FL210		-	No
T601 (NL)	NAVPI to OKIDU	Minimum Altitude FL210		-	No
T606 (NL)	LAMSO to MONIL	Minimum Altitude FL150		-	No
Military Exercise & Training Areas					
AARA 9	-	2000ft ALT	FL50	G	No
Low Flying Area 5	-	Surface	2,000ft AGL	G	No

Table 3 - Table of Potential Impacts with EA3

2.5 Other Airspace Factors for Consideration

To provide stakeholders with a broader understanding of the EA Hub complex development area, this section highlights several other current day aviation-based factors which have been considered but are evaluated to have no / or minimal impact at this stage of the ACP process.

2.5.1 Controlling Authority - Area of Responsibilities

A Flight Information Services (FIS) provide assistance to General Aviation (GA), Military and Commercial aircraft within Class G Airspace, outside of controlled airspace, and covers the whole of the UK. A FIS can also be allocated, amongst other established units, the role as a controlling authority for Class G airspace, such as RMZ or TMZs. In certain circumstance a controlling authority may require a co-located radar capability, such as Anglia Radar.

Due to the location of the EA Hub the question of controlling authority for the proposed airspace solution is acknowledged as a work stream which requires addressing at the necessary stakeholder engagement stage of this ACP process. In the likely event of an established TMZ over the EA Hub OSWF, the CS has an early awareness to ensure engagement with regional units such as Anglia Radar, London Information, and / or Swanick Mil (but not limited to) are undertaken to achieve an appropriate attributed controlling authority for the proposed airspace outcome of this ACP.

2.5.2 Helicopter Traffic Zone

Helicopter Traffic Zones (HTZ) are established in the Southern North Sea as notification of helicopters engaged in platform approaches, departures and extensive uncoordinated inter-platform transit flying. Inter-platform flying by civil helicopters within HTZs contained within the Anglia Offshore Safety Area (OSA) will be conducted on the company or field discrete frequency. HTZs consist of the airspace from sea level to 2,000ft AMSL contained within tangential lines, not exceeding 5nm in length, joining the neighbouring circumferences of circles 1.5nm radius around each individual platform helideck.

Figure 7 (below) shows the proximity of the closest HTZs to the EA Hub complex. Although airspace users utilising these HTZs are likely to operate in the area North of the EA Hub complex, the consideration of HTZ proximity to the EA Hub complex has been included to provide situational awareness.

2.5.3 Anglia Offshore Safety Areas

The Anglia OSA consists of the airspace from surface to 3,500 ft AMSL and is classified as Class G airspace. Helicopters operating within the Anglia OSA are not normally operating below 1,500 ft ASML unless forced to fly beneath by weather or for essential operating reasons. Pilots of helicopters entering the OSA must establish 2-way radiotelephony (RTF) communication with the appropriate Air Traffic Services Unit (ATSU).

The OSA operates within Class G airspace from SFC to 3,500ft and only intersects with the EA3 OSWF site.

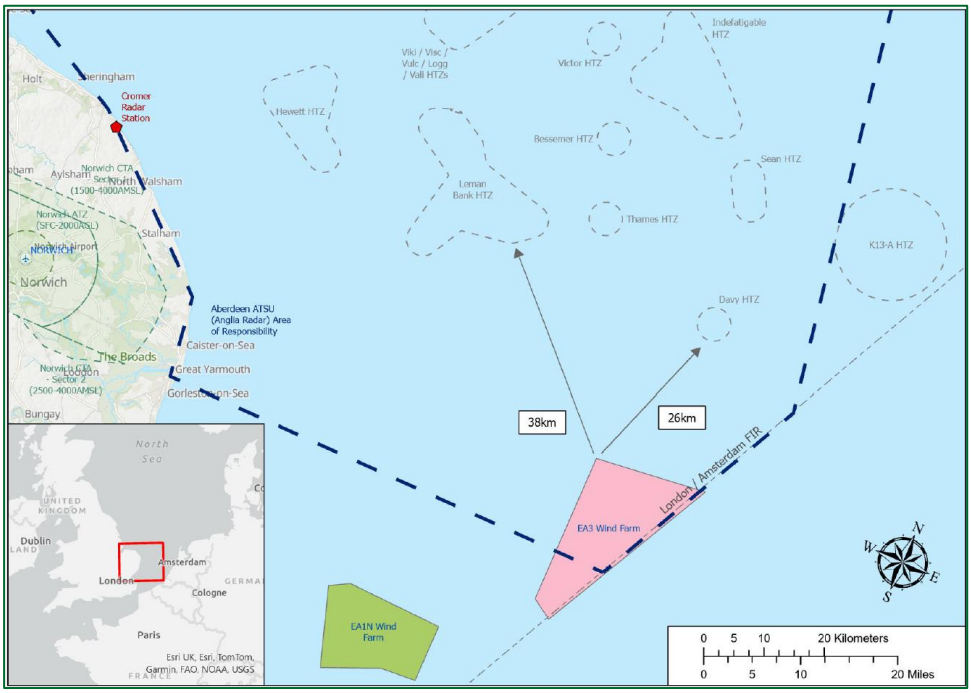

Figure 7 - EA3 OSWF proximity to North Sea HTZs

3 Airspace Usage & Analysis

3.1 Introduction

The CAA CAP1616 (Version 5) requires the CS to provide information on the usage of the airspace in the vicinity of the EA Hub developments. The intent of this section is to support the stakeholders' understanding of the current usage of adjacent volumes of airspace in and around the development sites by highlighting the pertinent organisations and airspace users operating within the Southern North Sea region, and below FL100.

3.2 Air Users

3.2.1 ATS Routing Structure

Unlike Glass G airspace, the defined ATS Routing structure above the EA Hub complex, as collated in Section 2 (Airspace Structure), shows that the lowest limit of all the assessed ATS segments is FL85. This segment may affect future airspace design options for this ACP, however all aircraft utilising this ATS route segment are required to operate a transponder as they transition through Class A airspace (Clacton CTA (Figure 5)) and are therefore unaffected by routing through the planned EA Hub complex TMZ up to FL100.

3.2.2 Fast Jets

Fast jet aircraft from the MOD and USAF operating in both the established LFA 5 (SFC-2,000ft AMSL), and Lakenheath ATA's (FL55- FL195) are highly likely to interact with the EA Hub development areas. However, fast jet air users are likely to be transponding and would not be affected by establishment of a TMZ.

3.2.3 Oil & Gas fields in the North Sea

As detailed earlier in this document, oil companies such as Shell, BP, and Total Energies operate in the North Sea. These companies drill for oil in the North Sea on oil platforms (or oil rigs) which are, in some cases, supported by an integrated helicopter landing platform. These helicopter landing platforms support the oil rig operations, via transport of workers, stores, and logistics etc, to and from the UK mainland (see HMRI). The frequency of oil & gas field associated helicopter activity is infrequent and private company specific. Figure 7 shows the Southern North Sea HTZ locations (north of the EA Hub complex) which indicate the locations of the helicopter landing platforms on the oil and gas rigs.

3.2.4 Offshore Windfarm Installation and Maintenance

Over the last decade, the wind industry has developed many OSWFs in the Southern North Sea in support of the UK's renewable energy strategy. These OSFW companies utilise helicopters as an integral part of their operational tasking in support of critical activities such as site surveys, transfer of personnel, maintenance, and inspection.

3.2.5 Search & Rescue

The Southern North Sea is part of the UK Region for Maritime, Aeronautical and Land Search and Rescue (SAR)[22] and is regionally supported by the Coastguard Helicopter and SAR operations bases at Lydd and Humberside from where they operate S92 and AW189 helicopters, respectively. It is highly likely that SAR helicopters, operated by Bristow[23], will be operating in the vicinity of all three EA Hub sites in an operational capacity, or when conducting training exercises.

3.2.6 General Aviation

The North Sea area between the UK and mainland Europe at the latitudes of the EA Hub complex holds a distinct challenge for general aviation (GA) users. It is acknowledged that in airspace classes A-E (including TMZs) it is mandated for air users to operate a transponder. However, it is impossible, outside a radar control room, to track non-transponding air users in Class G airspace and provide a quantitative assessment of their traffic patterns.

Several studies have been collated to understand the GA Non-SSR activity in the North Sea (Annex 2). The first two studies (Supporting previously completed ACPs) examined the GA activity off the coast of East Scotland, whilst a third is a short study assessment of the GA non-SSR activity over the EA Hub complex and in between the Norfolk and Dutch coastlines.

Using the data from these airspace studies (Annex 2), the CS advocates that within the Stage 2 Full Options Appraisal (FOA) and subsequent documentation, it should be acknowledged that Noise, Air Quality, Greenhouse Gas Impact, and Fuel Burn are unlikely to undergo substantial changes with the implementation of a TMZ airspace solution, assuming it is the preferred option. Therefore, the CS proposes that later stages of the ACP need not entail a quantitative assessment of these areas. Additionally, it is asserted that attempting a quantitative assessment at later stages could prove costly and disproportionate to the ACP pre-scaled level.

3.3 East Anglia Hub Analysis

This section provides an initial analyse of each of the EA Hub sites (EA1N, EA2, & EA3) evaluated against the current day airspace infrastructure. Each OSFW section below will be supported by a profile view representing the airspace and ATS structure (ft ASML) immediately above the respective OSWF boundary perimeters. The profile view depicts a red checkered line which represents the altitude of a TMZ's upper limit (FL100). Readers of this document should consult Annex A0- Figure 14 and Figure 17 for a current day view of airspace and ATS routing above the EA Hub OSWF complex.

3.3.1 EA1N Airspace Analysis

The latitude of the EA1N OSWF places it between EA3 to the northeast and EA2 to the southwest. From the airspace and routing structure assessment, EA1N resides within Class G airspace (Figure 8 below). Three areas of designated airspace have been identified that overlap TMZ airspace around EA1N. However,

[22] Strategic Overview of SAR in the UK and Ireland (Jan 2017)
[23] Bristow- Search and Rescue

these three airspace structures (AARA 9, LFA 5 and Lakenheath ATA South) are also all designated as Class G airspace.

The ATA Lakenheath South (Class G) is notified with an advisory measure requesting pilots to avoid the area due to intense military flying activity. However, the existing airspace structures are not incompatible with a proposed TMZ airspace option around the EA1N development area.

3.3.2 EA1N Route Analysis

Segments of the following ATS Routes overfly the EA1N OSWF boundary perimeter: P7, P25, and P155. An ATS route will typically adopt the airspace classification of the surrounding airspace through which it passes (per segment). From the diagram below (Figure 8), all identified ATS segments reside inside of controlled airspace, therefore are deemed as Class A or C. The lowest ATS lateral limit (P25) for the segment MEGEL to BARMI (See **Error! Reference source not found.**) starts at FL195 up to the upper lateral limit of ATS Route Segment P155 of FL460. This indicates that the current established ATS routing over EA1N will have no impact on the proposed development of a TMZ over EA1N.

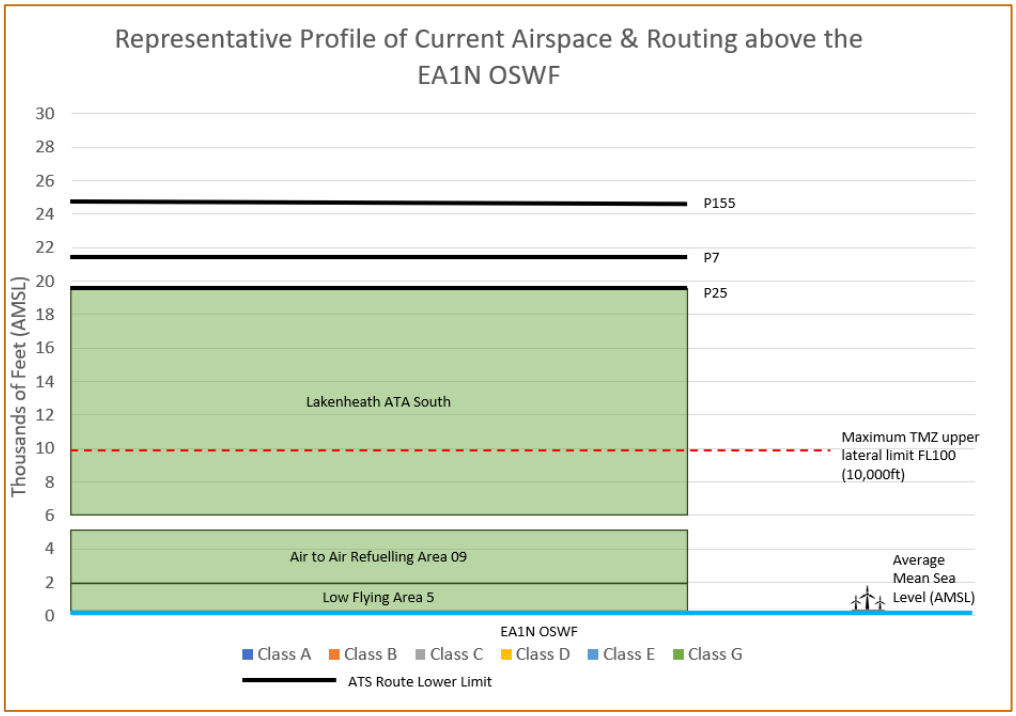

Figure 8 - Profile of interacting airspace above EA1N OSWF[24]

3.3.3 EA2 Airspace Analysis

As the most southerly situated OSWF of the EA Hub complex, the site resides within Class G airspace and below other Class A and G airspace (Figure 9). Four areas of designated airspace have been identified that could interact with an airspace option related to EA2. Two of these airspace reservations (LFA 5 and

[24] Used in conjunction with *Figure 3 – Airspace and ATS Routing structure above EA1N OSWF*

Lakenheath ATA South) are designated as Class G airspace, whilst the remaining two (Clacton CTA sector 5 & 6) are designated Class A airspace. Of the four identified airspace reservations, Clacton Sector 5 is the only restrictive airspace type with a vertical lower limit below FL100, indicating that Clacton is likely to influence the airspace development of a TMZ solution above EA2. EA2's interaction analysis with the Lakenheath South ATA is the same as EA1N though not a restricted area it does publishing advisory avoidance measures to air users.

3.3.4 EA2 Route Analysis

Segments of the following ATS Routes overfly EA2 OSWF boundary perimeter: L620, M183, M197, P7, P25, P44, P137, Q295 and Y4. From the diagram below (Figure 9), all identified ATS segments reside inside of controlled airspace and are deemed either Class A or Class C. From the nine ATS segments identified, three of the ATS segments have lateral limits that extend below FL100; these are L620, M197, and P7 (see Table 2 for ATS Segment details) which start at FL85 upwards to FL460. This indicates that these three ATS routes are likely to interact with a TMZ solution above the EA2 OSWF.

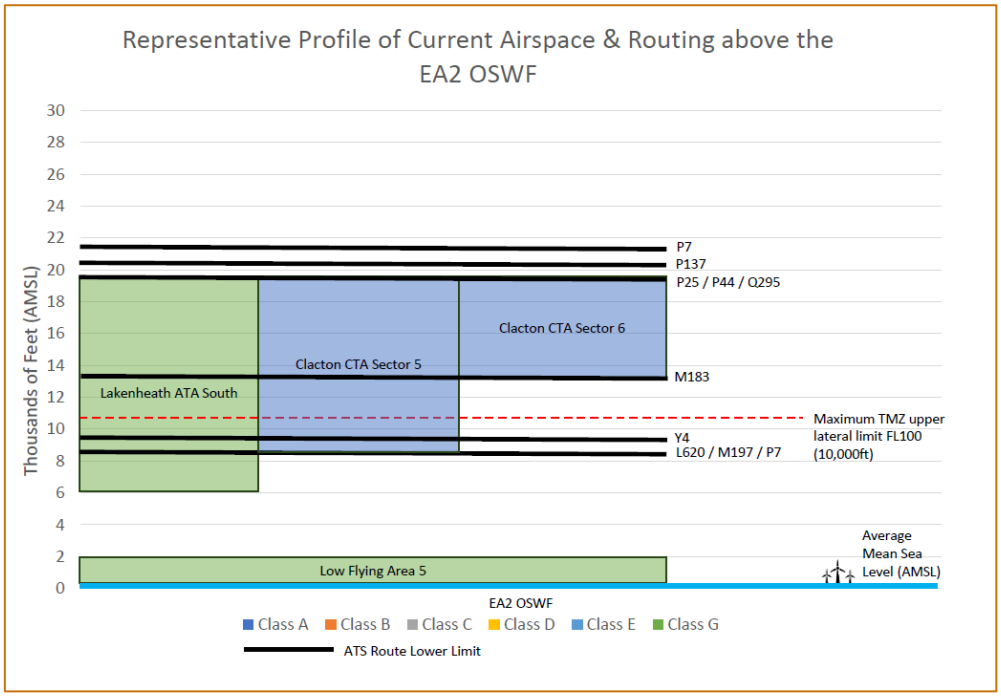

Figure 9 - Profile of interacting airspace above EA2 OSWF[25]

3.3.5 EA3 Airspace Analysis

EA3 is the most northerly of the EA Hub OSWF sites and resides in Class G airspace and below Classes A, C, and G airspace (Figure 10). Five areas of designated airspace have been identified that could interact with airspace design options relating to EA3. Three of these airspace reservations (AARA 9, LFA 5, and Lakenheath ATA North) are designated as Class G airspace, whilst the remaining

[25] Used in conjunction with *Figure 5 - Airspace and ATS Routing structure above EA2 OSWF*

two are Class A and Class C; North Sea CTA 3 & TRA 003 respectively. From the five identified airspace reservations only Lakenheath North ATA, AARA 09 and LFA5 extend below FL100, and are all Class G airspace; only the Lakenheath North ATA holds air user entry warnings and that are likely to influence any TMZ airspace design options for EA3. EA3's interaction analysis with the Lakenheath North ATA is the same as Lakenheath South ATA which although not a restricted area it does publishing advisory avoidance measures to air users.

The EA3 OSWF is located in close proximity to the London/Amsterdam Flight Information Region (FIR). Although the airspace design options from this ACP will not infringe this international boundary, it should be noted that the Netherlands have an established TMZ (SFC to FL55) which may be a factor for consideration when selecting future airspace design options. The Dutch AIS will be requested to contribute at the ENGAGE phase of this ACP, particularly concerning the EA3 airspace options.

3.3.6 EA3 Route Analysis

Segments of the following ATS Routes overfly EA3 OSWF boundary perimeter: L601, L603, N866, P7, TR1, and TB6 (see Table 3 for ATS Segment details). From the diagram below (Figure 10), of the eight ATS segments identified none of the lateral limits extend below FL100. This indicates that an EA3 TMZ airspace design solution will not be influenced by the current ATS structure above EA3.

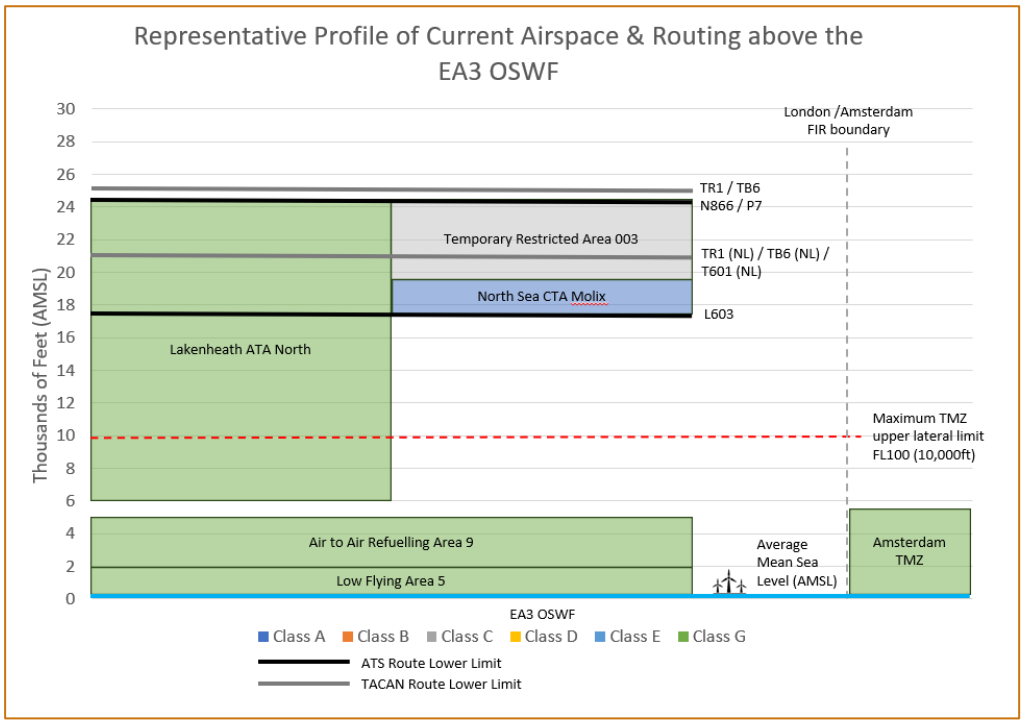

Figure 10 - Profile of interacting airspace above EA3 OSWF[26]

[26] Used in conjunction with *Figure 6 - Airspace and ATS Routing structure above EA3 OSWF*

4 Adjacent OSWF Capacity

4.1 Introduction

This section of the current-day scenario document typically references key local features below 7,000ft, such as large urban and/or densely populated areas. The remote geographic position of the OSWFs are clear of such areas, but this section provides details of other features that surround the development area.

4.1.1 The Southern North Sea

The North Sea borders Great Britain to the west, Scandinavia and Denmark to the northeast and France and Germany to the south. The southern most point of the North Sea ends when it meets the English Channel (the nearest point between England and France). The EA Hub is situated approximately 30 km east of the Norfolk coastline and to the west of the Dutch Coastline.

4.1.2 The Crown Estate Offshore Wind Activity

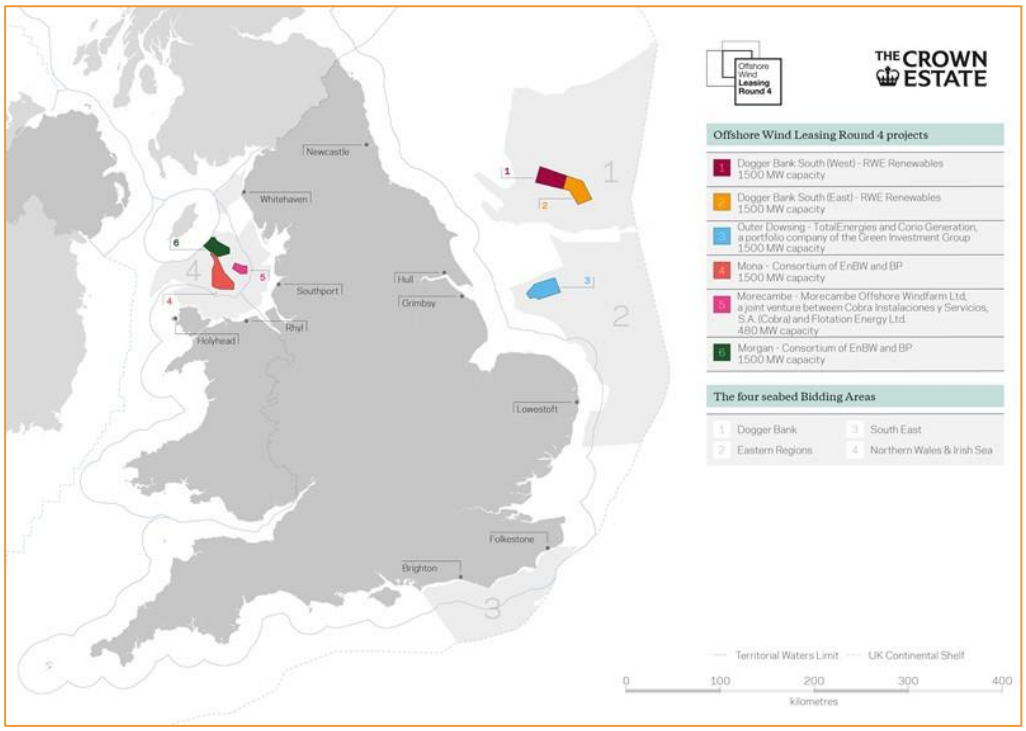

Figure 11 - Round 4 OSWF Projects (Source: The Crown Estate)

The UK coastal regions are being continually assessed by The Crown Estate[27] (TCE) to evaluate and develop natural and renewable UK resources. One particular area under development is the Southern North Sea key resource areas (KRA) which has assessed the North Sea for potential seabed fixed wind installations. Specific areas are then identified as locations for offshore wind

[27] The Crown Estate Website

exploitation through a government leasing mechanism, in support of the British Energy Security Strategy.

The Offshore Wind Leasing Round 4 Agreements for Lease signing concluded in January 2023, meaning six new projects could begin to generate renewable electricity by the end of the decade. Figure 11 shows three of the six projects are located off the North Wales, Cumbria, and Lancashire coast, and three are located in the North Sea off the Yorkshire and Lincolnshire coast.

4.1.3 East Anglia One Offshore Wind Farm

East Anglia One (EA1) is a pre-existing and operational wind farm located immediately south of the planned EA1N site. Planning consent for EA1 was given in July 2014[28] and the OSWF became operational in July 2020. At the time of its development, it was acknowledged that the EA1 OSWF would have no impact on flying operations and due to its distance from UK radar installations this project was not subject to an ACP requirement.

Figure 12 below depicts the EA1 Wind Turbine Generators in proximity to EA1N, EA2 and the UK coastline.

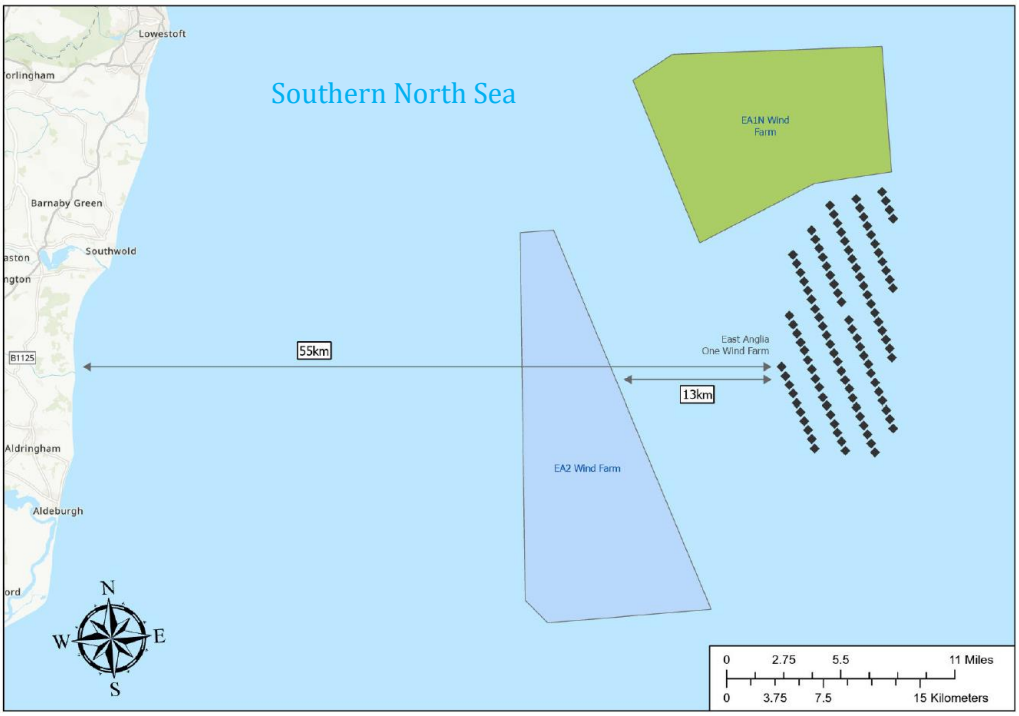

Figure 12 - East Anglia One OSWF in proximity to EA1N & EA2

4.1.4 Norfolk Vanguard / Boreas Offshore Wind Farms

Vattenfall Wind Power Ltd are establishing a TMZ (Norfolk TMZ) above two OSWF developments, Norfolk Vanguard & Norfolk Boreas (immediately North of EA3 OSWF) containing up to 360 WTGs to the height of 350m.

[28] SI 2014 No.1599 – The East Anglia ONE Offshore Wind Farm Order 2014

5 Other Considerations

5.1 Planning / Consent Agreements and Conditions

ScottishPower Renewables, under their subsidiary companies, submitted planning applications to the UK government for the construction of the East Anglia Hub Offshore Wind Farms (OSWF).

5.1.1 Secretary of States (SoS) Consent for the EA Hub OSWFs

- The EA1N OSWF planning application received UK government building consent in April 2022 through the Statutory Instrument (SI) Infrastructure Planning Order 2022 No.432[29]. The activation of the EA1N OSWF WTGs are planned to commence in early 2029.
- The EA2 OSWF planning application received UK government building consent in April 2022 through the SI Infrastructure Planning Order 2022 No.433[30]. The activation of the EA2 OSWF WTGs are planned to commence in early 2028.
- The EA3 OSWF planning application received UK government building consent on October 2017 through the SI Infrastructure Planning Order 2017 No.826[31]. The activation of the EA3 OSWF WTGs are planned to commence in early 2026.

5.1.2 Conditions for Mitigation

The two main aviation-based objections which were initially raised during the planning application phase, were from the MOD (Item 34) who were concerned on the effects of the WTGs on the Remote Radar Head Trimingham and their Air Surveillance and Control Operations. The second objection came from NATS (Item 35) who are concerned with the OSWF WTG effects on the Cromer PSR.

Consequently, the MOD has withdrawn their objections to RRH Trimingham and the MOD's Air Surveillance and Control Operations [32]. Although the MOD will be continually engaged as a stakeholder throughout the stages of this ACP, the mitigation of the NATS's Cromer PSR remains the only aviation SI condition concerning this ACP process.

5.2 Biodiversity and Habitat Regulations Assessment Requirements

5.2.1 European Sites Overflown below 3,000ft.

Contained within the publication of version 5 of CAP 1616, is a set of new and existing environmental assessment requirements[33] to be met for every ACP. One of the new requirements sets out the need for a Habitats Regulations

[29] SI 2022 No.432 The East Anglia ONE North Offshore Wind Farm Order 2022.
[30] SI 2022 No.433 The East Anglia TWO Offshore Wind Farm Order 2022.
[31] SI 2017 No.826 The East Anglia THREE Offshore Wind Farm Order 2017.
[32] Order 2017 (Amendment) – Discharge of Requirement 33, MOD Surveillance Operations (EA3).
[33] CAP1616i: Environmental Assessment Requirements and Guidance for ACPs (Ed1, Nov 2023)

Assessment[34] (Early Screening Criteria). The Habitats Regulations Assessment (HRA) is a legal requirement to assess the likely impact of an airspace change proposal on biodiversity. CAP 1616i – Environmental Assessment Requirements and Guidance for Airspace Change Proposals states that a biodiversity receptor includes, but is not limited to:

- Special Areas of Conservation (SAC), and possible SACs
- Special Protected Areas (SPA), and potential SPAs
- Ramsar sites and proposed Ramsar sites
- Compensatory habitats[35]

5.2.2 The HRA legal framework

The legal framework established to protect biodiversity receptors are listed below:

- The Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters).
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) in Scotland.
- The Conservation (Natural Habitats &c.) (Northern Ireland) Regulations 1995 (as amended) in Northern Ireland.
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in the UK offshore area.

5.2.3 Special Areas of Conservation[36] (SAC)

SAC are protected areas in which the UK Government and devolved administrations are required to establish a network of important high-quality conservation sites that will make a significant contribution to conserving the habitats and species identified in the Habitats Directive[37] (Annex I and II). The listed habitat types and species are those considered to be most in need of conservation at a European level (exc. birds). In the UK SACs currently constitute an area approximately 13.5 million hectares (ha).

5.2.4 Special Protected Areas[38] (SPAs)

SPAs are designated areas for the protection of birds, as classified by the aforementioned legal requirements. SPAs together with SAC form part of the UK's national site network. In the UK SPAs constitute an area approximately 5.5 million ha.

[34] UK Gov – Habitats regulations Assessment: protecting a European site
[35] Convention on Biological Diversity (1992), Art.2
[36] https://jncc.gov.uk/our-work/special-areas-of-conservation/
[37] European Council Directive 91/43/EEC
[38] https://jncc.gov.uk/our-work/special-protection-areas/

5.2.5 Ramsar sites[39]

Ramsar sites are wetlands of international importance under the Ramsar convention. Emphasis was taken on selecting qualifying Ramsar sites which held importance to waterbirds with the UK. However, non-bird features of potential sites are also considered. Due to the avian link, Ramsar and SPA sites are intrinsically co-operative in nature.

5.2.6 Compensatory Habitats

Compensatory Habitats are designated areas secured to compensate for potential damages to SACs, SPAs and Ramsar sites.

5.3 UK Government's Initial HRA of the EA Hub Project

The UK government's Department for Business, Energy & Industrial Strategy (BEIS) conducted HRA's on the planning applications of EA3 (2015), and EA1N & EA2 (March 2022) concerning the effects of the proposed construction and operation the OSWF WTGs. These assessments included offshore electrical platforms, onshore construction and maintenance platforms, meteorological masts, inter-array cables (linking WTGs), and additional cabling to link energy production to the mainland and their effects on the HRA framework [40] [41] [42].

The SoS concluded that although the project would have an adverse effect on certain habitats, satisfactory compensatory measures were secured by the OSWF developer to address these issues. The SoS further highlighted that the benefit of the EA Hub project is an imperative to the public interest which outweighs these impacts.

5.4 East Anglia Hub ACP HRA

5.4.1 ACP requirements – Stage 2 Pre-scaled Level 3

As a requirement within CAP1616, at Stage 2 of the pre-scaled Level 3 East Anglia Hub ACP, a Habitats Regulations Assessment - Early Screening Criteria (HRA-ESC) must be conducted and submitted for CAA review. Figure 13 below is a list of the HRA-ESC questions which must be addressed and submitted to the CAA to compete stage 2 of this ACP.

Due to the OSWF locations the Ramsar sites, land, and coastline-based protection areas, have not been included in this or any further assessment for this ACP.

It must be highlighted that although the department of BEIS has conducted initial HRA's for the EA Hub, the HRA for this ACP will only focus will be on the implementation of potential airspace and their likely impacts.

When an HRA-ESC form is completed and it results in one or more of the European sites being overflown, consideration shall be given by the CS & CAA as

[39] https://jncc.gov.uk/our-work/ramsar-sites/
[40] BEIS – EA2 Habitat Regulations Assessment (March 2022)
[41] BEIS – EA1N Habitats Regulations Assessment (March 2022)
[42] UK Gov Planning Inspectorate – Review of EA3 OSWF HRA Report (August 2015)

to whether or not the ACP changes are positive, remain the same or result in a negative outcome to each of the affected sites.

An initial assessment has been conducted of the EA Hub OSWF perimeter boundaries against the qualifying environment considerations commented above. An operational diagram (OD) has been created (Figure 15 (Annex A0.2)) depicting the current locations of the EA Hub OSWF perimeters and any SPA and SACs in close proximity to them.

Habitats Regulations Assessment – Early Screening Criteria

Q1. Are there any changes to air traffic patterns or number of movements expected below 3,000 feet due to the airspace change proposal?

If the answer to Q1 is 'no' then habitats regulations assessment is no longer required.
If the answer to Q1 is 'yes' then proceed to Q2 below.

Q2A. Are there any European sites within a radius of 18 km of each runway end?

Q2B. Are any European sites identified in Q2A overflown (i.e. plane passing directly overhead or within 2,655 feet of the boundary of a European site at 3,000 feet or below) by proposed flight routes?[10]

If the answer to Q2A and Q2B are both 'no' then habitats regulations assessment is no longer required.
If the answer to Q2A or Q2B is 'yes' then proceed to Q3 below.

Q3A Will the airspace change proposal reduce the number of movements overflying one or more European sites, while not increasing them over another?[11]

Q3B Will the airspace change proposal increase the altitude of aircraft overflying one or more European sites, whilst not decreasing altitude over another?

If the answer to Q3A and Q3B are both 'yes' then habitats regulations assessment is no longer required.
If the answer to Q3A or Q3B is 'no' then secondary screening will be required.

Figure 13 - CAP1616i - HRA-Early Screening Criteria

5.5 Omitted Current-day Scenario Requirements

The CS having evaluated the requirements for CAP1616 (version 5) and in particular the requirements for CAP1616H (Level 3 Pre-scaled ACPs) pertaining to the Current-day Scenario documentation. Due to the EA Hub complex's remote locations, the offshore status of the project, the geographic absence of dense population areas, and the current airspace classification in the areas of interest, the CS has concluded that the following requirements are not applicable and will not be assessed as part of this ACP.

The omitted requirements are as follows:

5.5.1 Current-day Noise

CAP 1616i (Chapter 5) refers to the requirement of an airport to model noise[43] at the vicinity of an airport and the number of people exposed to it. Due to the remote location of this ACP and its offshore (see Figure 1) status, the CS believes that this CAP 1616h requirement is not applicable.

5.5.2 Green House Gas Emissions

CAP 1616i (Chapter 6) requires the CS to consider and demonstrate the continuous climb operations (CCO), continuous descent operations (CDO) and low power/low drag effects may have throughout the course of the ACP development. As these requirements refer to airport activities (arrival/departure), the CS believes this requirement is not applicable to this ACP.

The CS acknowledges that there may be an occasional non-SSR equipped aircraft that routes around the TMZ. This would result in an increase in track miles and an increase in GHG emissions. However, these dis-benefits would be offset by the operation of the OSWF. See Annex 2 Aviation Studies on the likelihood of non-SSR aircraft operating in the North Sea and the CS's concluding applicability of associated quantitative assessments at later stages of this prescale Level 3 ACP.

5.5.3 Local Air Quality

CAP1616i (Chapter 7) refers to the analysis of the potential noise impacts below 7,000ft and the associated impact on local air quality (LAQ) caused by the emissions generated from aircraft taking off, landing or whilst on the ground. As this is an aerodrome/airport-based requirement assessing LAQ impacts on surrounding communities, the CS believes that this requirement is not-applicable to this ACP due to the site's offshore location.

5.5.4 Tranquillity

CAP 1616i (Chapter 8) refers to the consideration of the impacts this ACP may have on areas of tranquillity. These areas include National Parks, Areas of National Beauty (AONB), National Scenic Areas (NSA), the Norfolk and Suffolk Broads, plus any additional areas identified during stakeholder engagement. The CS must regard the potential impacts, by statutory requirement, on these areas and avoid overflight below 7,000ft. As this ACP's location is situated a minimum of 30km offshore (Figure 1) and the proposed outcome for this ACP would be a TMZ solution (Class G airspace), the CS considers that the CAP1616 tranquillity requirement does not apply to this ACP. The CS is mindful that the requirement for the HRA (biodiversity) is mandatory and is to be completed for the Stage 2 submission (see Section 5.2).

5.5.5 Noise Action Plans

A Noise Action Plan (NPA) provides a framework to manage any environmental noise (from roads, rail, aviation, and industry) and its effects. NPAs aim to protect areas in large urban areas where the noise quality is good. As the EA Hub complex location resides in the middle of the South North Sea and approximately

[43] CAP 2091, CAA Policy on Minimum Standards of Noise Modelling.

30km from the UK coastline (Figure 2), the CS deems this requirement is non-applicable to this ACP.

6 Any Potential Safety Risks

6.1 Operating in Class G Airspace Away from the Coastline in the UK

The Southern North Sea, in the vicinity of the proposed EA Hub Wind Farm Development, offers a unique operating environment for aviators. While General Aviation (GA) activity in this area is lower compared to other parts of the UK, the very nature of Class G airspace in this region presents its own set of challenges.

The hazard in Class G airspace is reliance the "See and Avoid" principle, particularly when other in-cockpit or external distractions materialise. Unlike controlled airspace, where Air Traffic Control (ATC) maintains separation between aircraft, pilots in Class G airspace are solely responsible for maintaining visual contact with other traffic to avoid collisions. To mitigate this hazard, pilots undergo rigorous training in visual scanning techniques and, if equipped, utilise Automatic Dependent Surveillance-Broadcast (ADS-B) technology to enhance their situational awareness.

An additional hazard is introduced by the proximity of the Lakenheath Aerial Training Area (ATA). Fast jets operating with unpredictable flight paths within the ATA pose a potential collision risk. Here, strict adherence to published procedures and airspace restrictions outlined in the UK Civil Aviation Information Publication (AIP) becomes paramount. Fortunately, the ATA is clearly marked on aviation charts.

The development of the wind farms themselves introduces another consideration: wildlife hazards. Bird strikes are a significant threat in these areas, and pilots must be aware of bird migration patterns to minimise this hazard. Additionally, during the construction and maintenance phases of the wind farms, helicopter traffic might increase, requiring heightened vigilance from all airspace users to avoid potential conflicts. This increase in traffic levels during the installation phase of any wind farm can be managed by a Notice to Aviation (NOTAM) being disseminated throughout the flying community to draw attention to this increased hazard.

Whilst not a current hazard, thought will need to be given during the design stage to ensure the likely airspace mitigation solutions do not create choke points or force a funnelling effect for GA aircraft not suitably equipped who route around the airspace new airspace structures. Designs will seek to ensure that any hazard in this regard is kept as low as reasonably practicable (ALARP).

In conclusion, while operating in Class G airspace near the EA Hub Wind Farms presents some hazards, the aviation community prioritises safety through a combination of factors and any hazards will be appropriately mitigated. Rigorous pilot training, coupled with technological advancements like ADS-B, helps mitigate the hazards inherent when operating in uncontrolled airspace. Ultimately, a pilot's proactive approach to flight planning, accurate navigation, and maintaining high levels of situational awareness will ensure the safety of all airspace users in the airspace surrounding the EA Hub Wind Farm developments.

A1 Operational Diagrams

A1.1 Aviation Situational Awareness Diagram

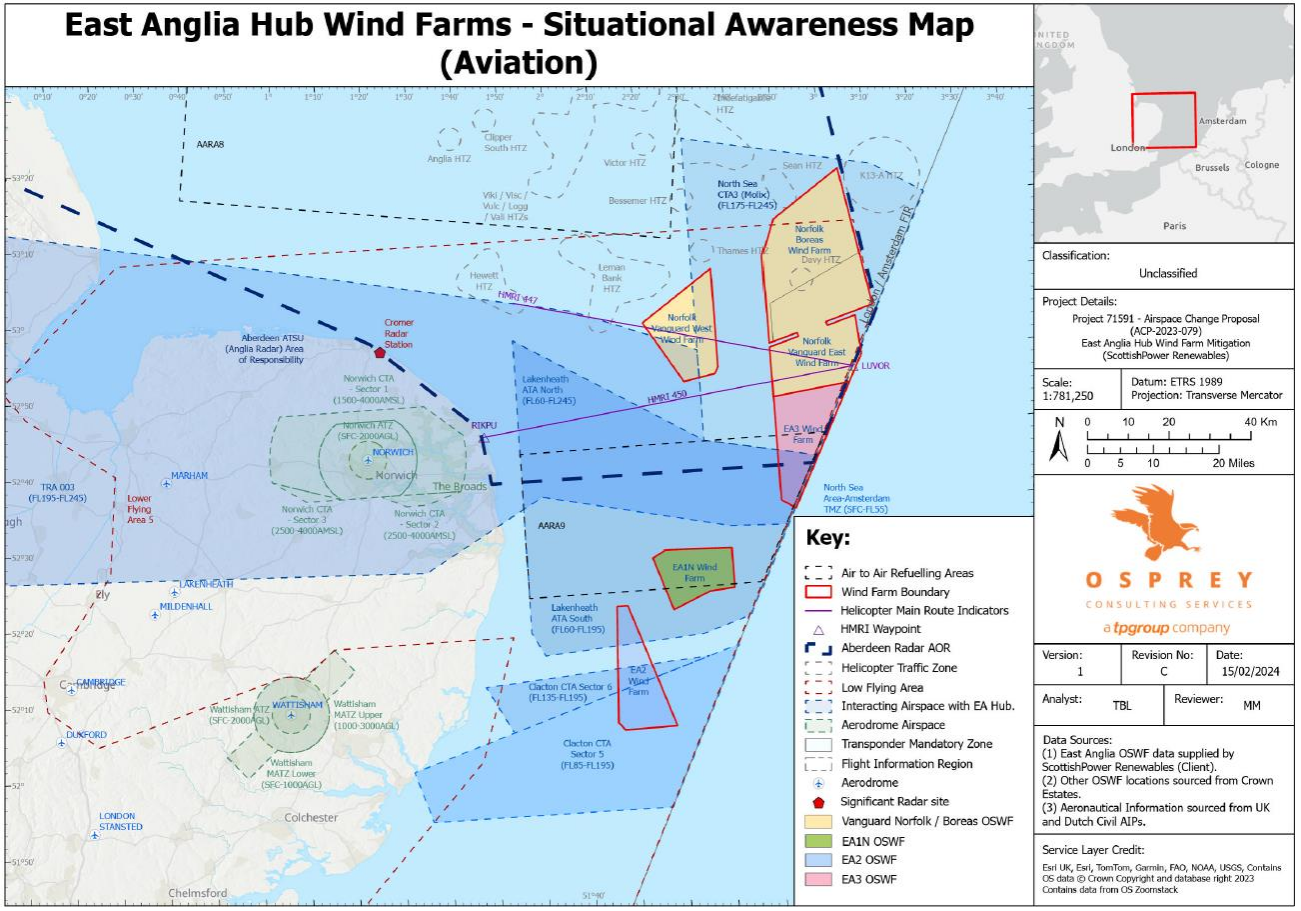

Figure 14 - Operational Diagram - Aviation Situational Awareness

A1.2 Habitat Regulation Assessment Diagram

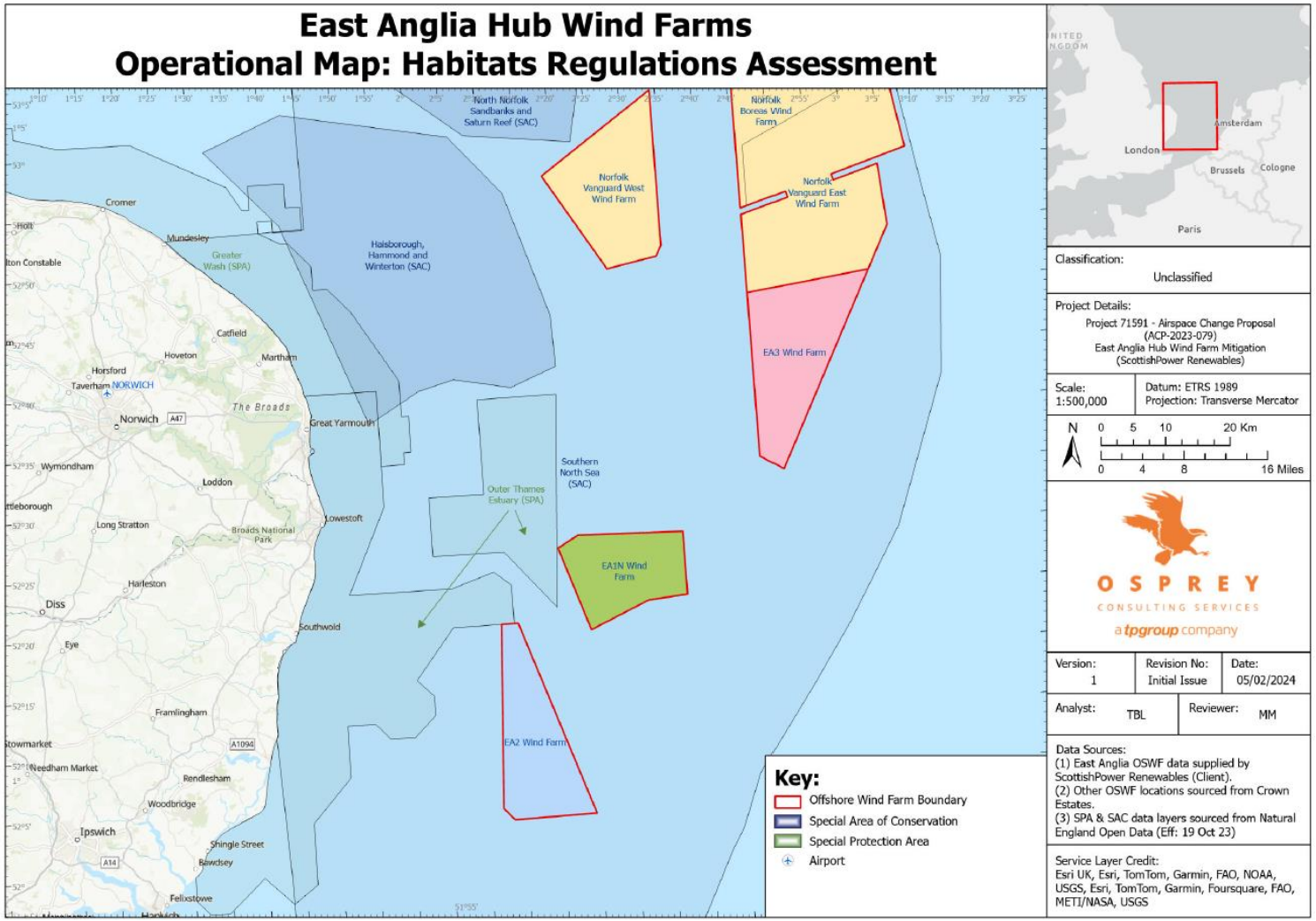

Figure 15 - Operational Diagram - Habitats Regulations Assessment

A1.3 Air to Air Refuelling Location Diagram

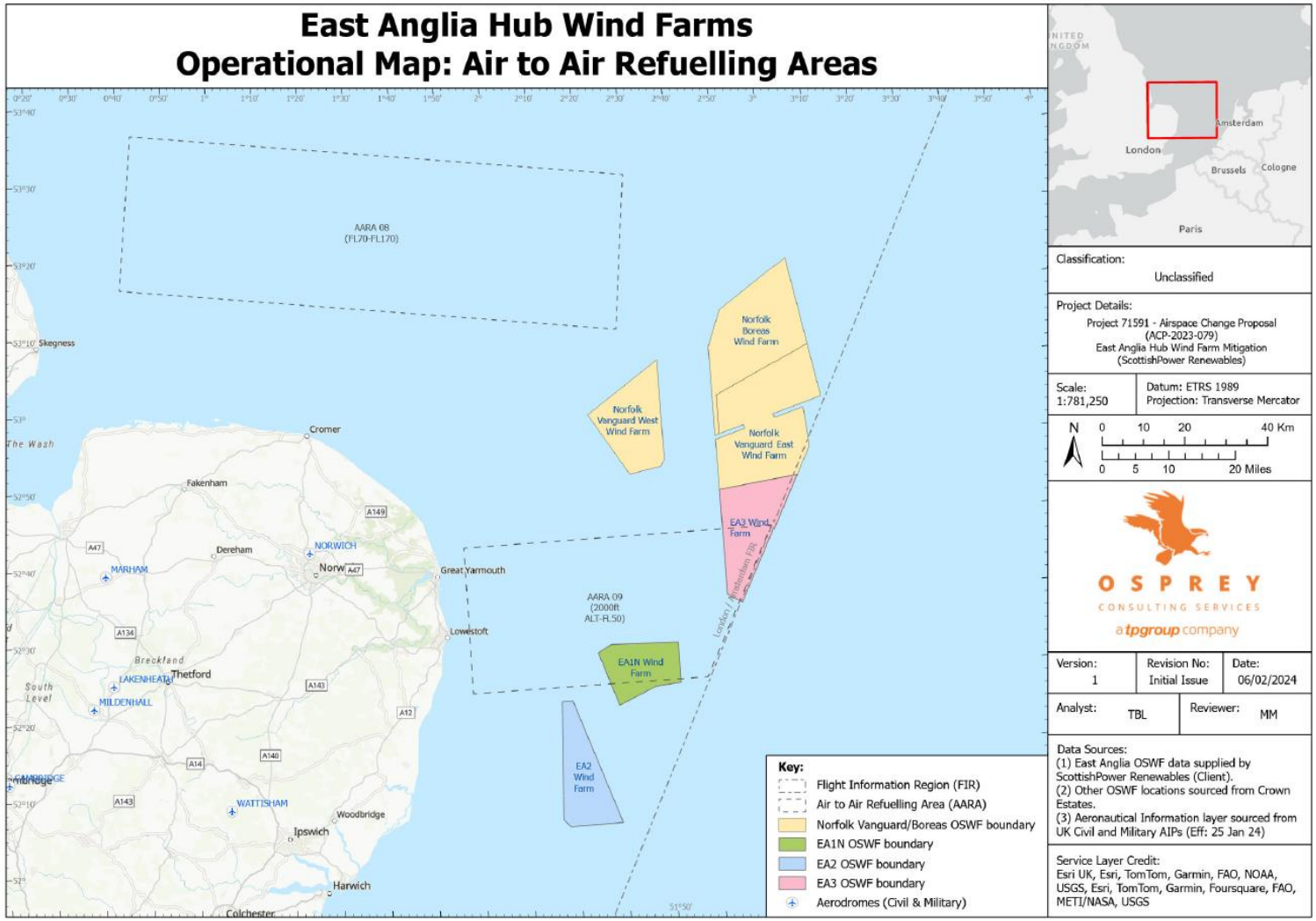

Figure 16 - Operational Diagram - Air to Air Refuelling Areas

A1.4 Air Traffic Service Routes Diagram

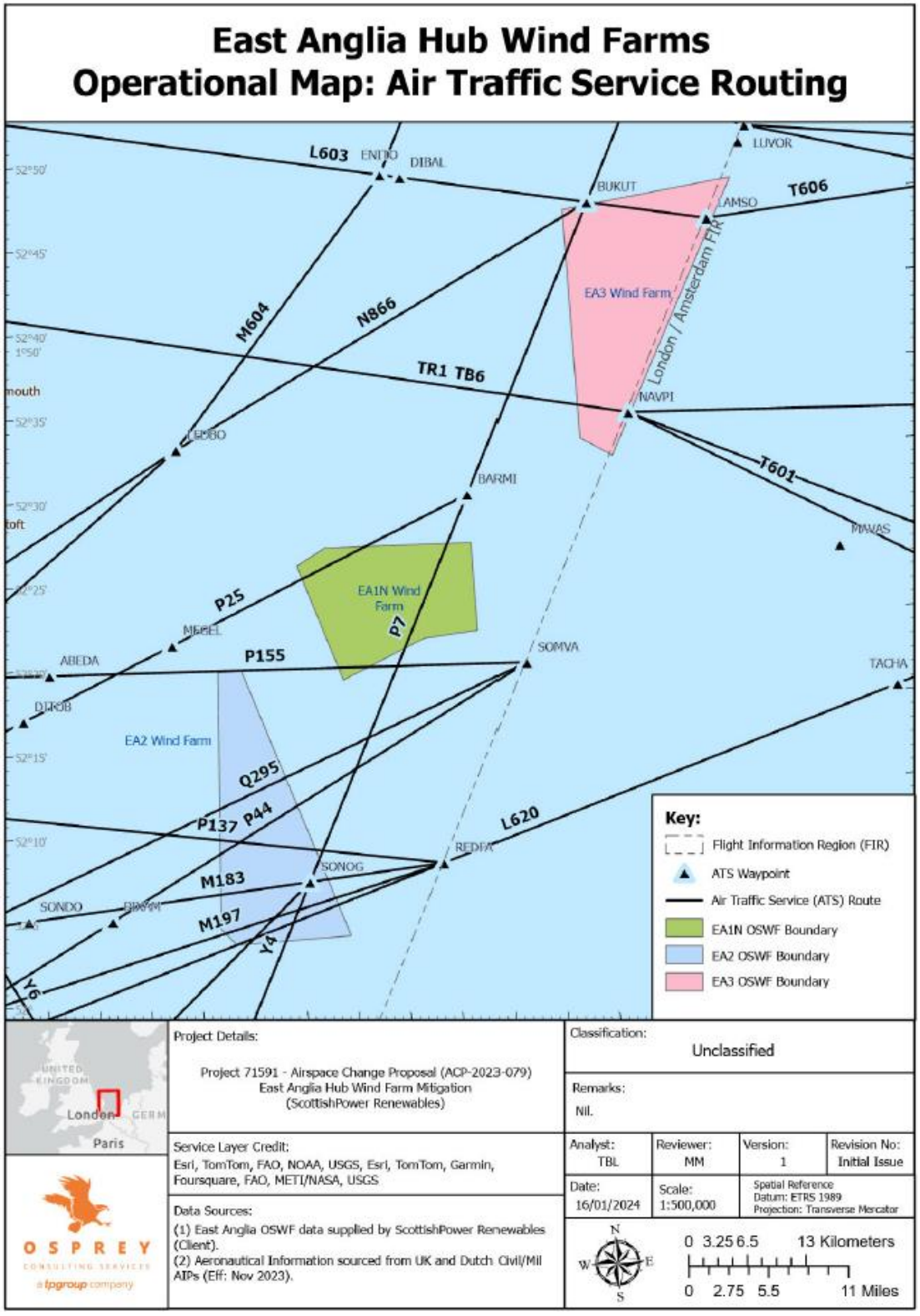

Figure 17 - Operational Diagram - ATS Routing

A1.5 Low Flying System Diagram

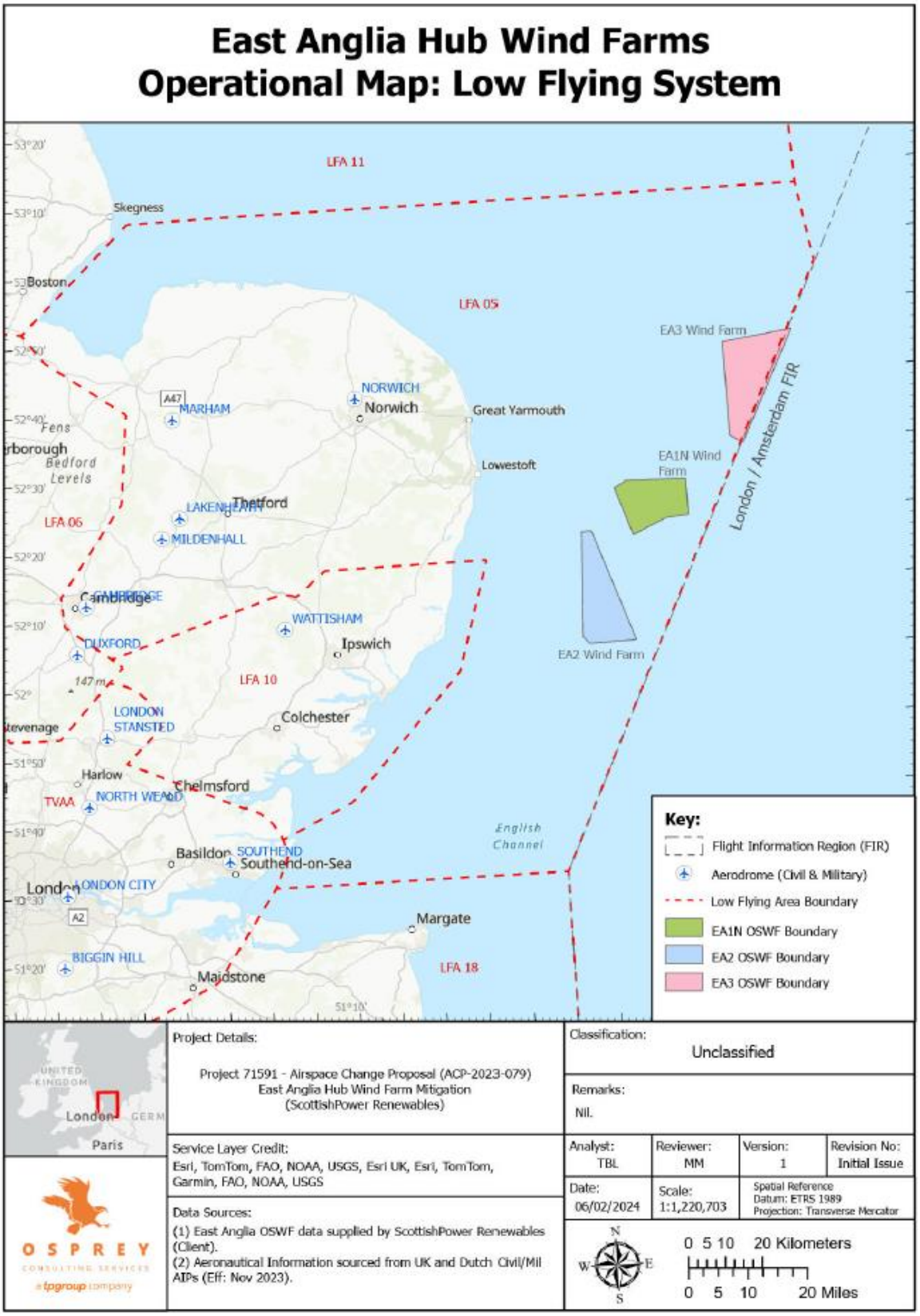

Figure 18 - Low Flying System

A1.6 Norwich Airport – ILS/DME/NDB(L) Rwy 17 Approach Procedure

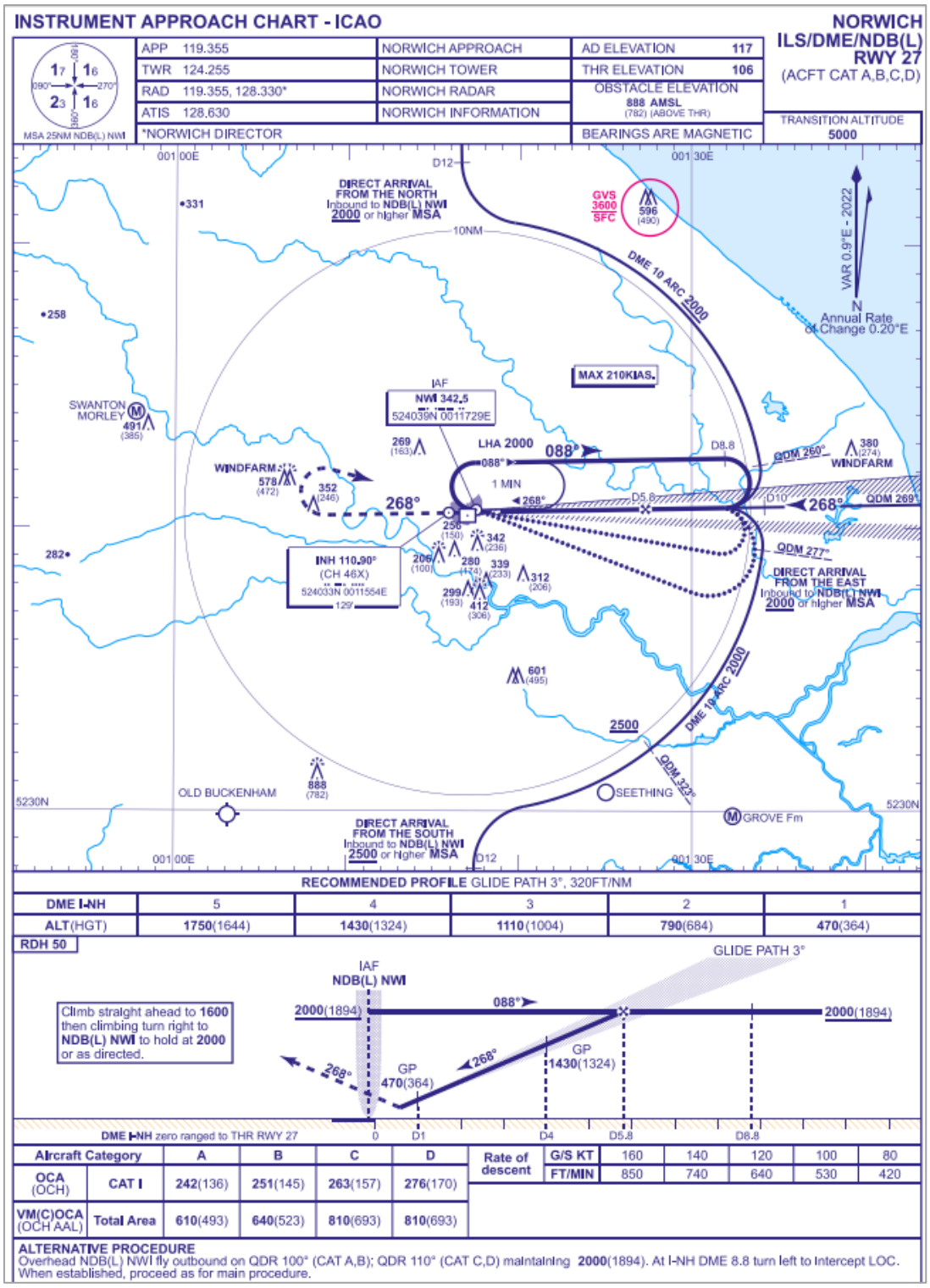

Figure 19 - AD 2-EGSH-8-2: Norwich ILS/DME/NDB Rwy 27 Approach Chart

A1.7 South North Sea – Aberdeen ATSU (Anglia Radar) AOR

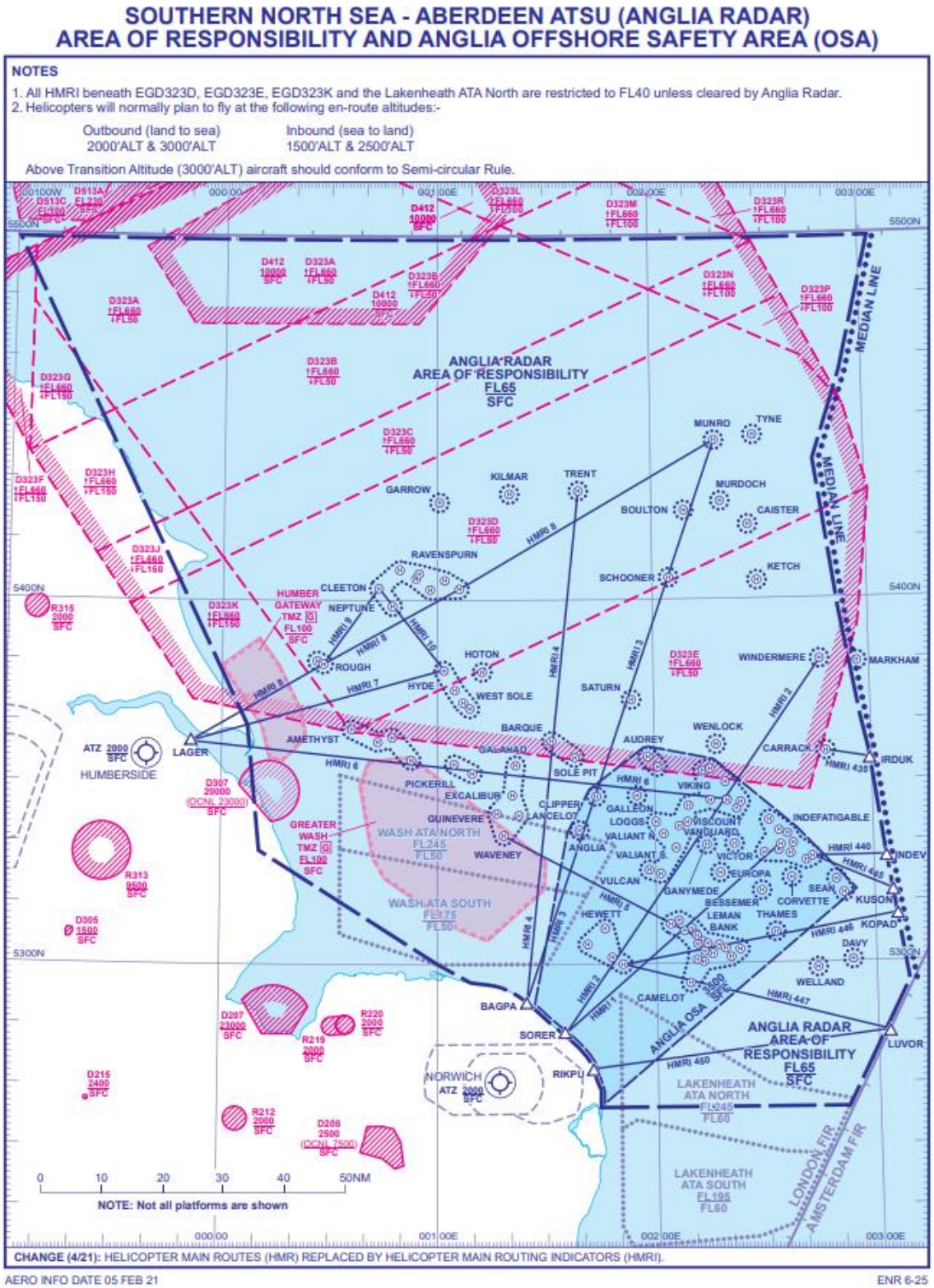

Figure 20 – UK Civil AIP Chart: South North Sea Anglia OSA (ENR 6.25 (Eff: 05 Feb 21)

A1.8 Norfolk Vanguard / Boreas OSWF & TMZ Location

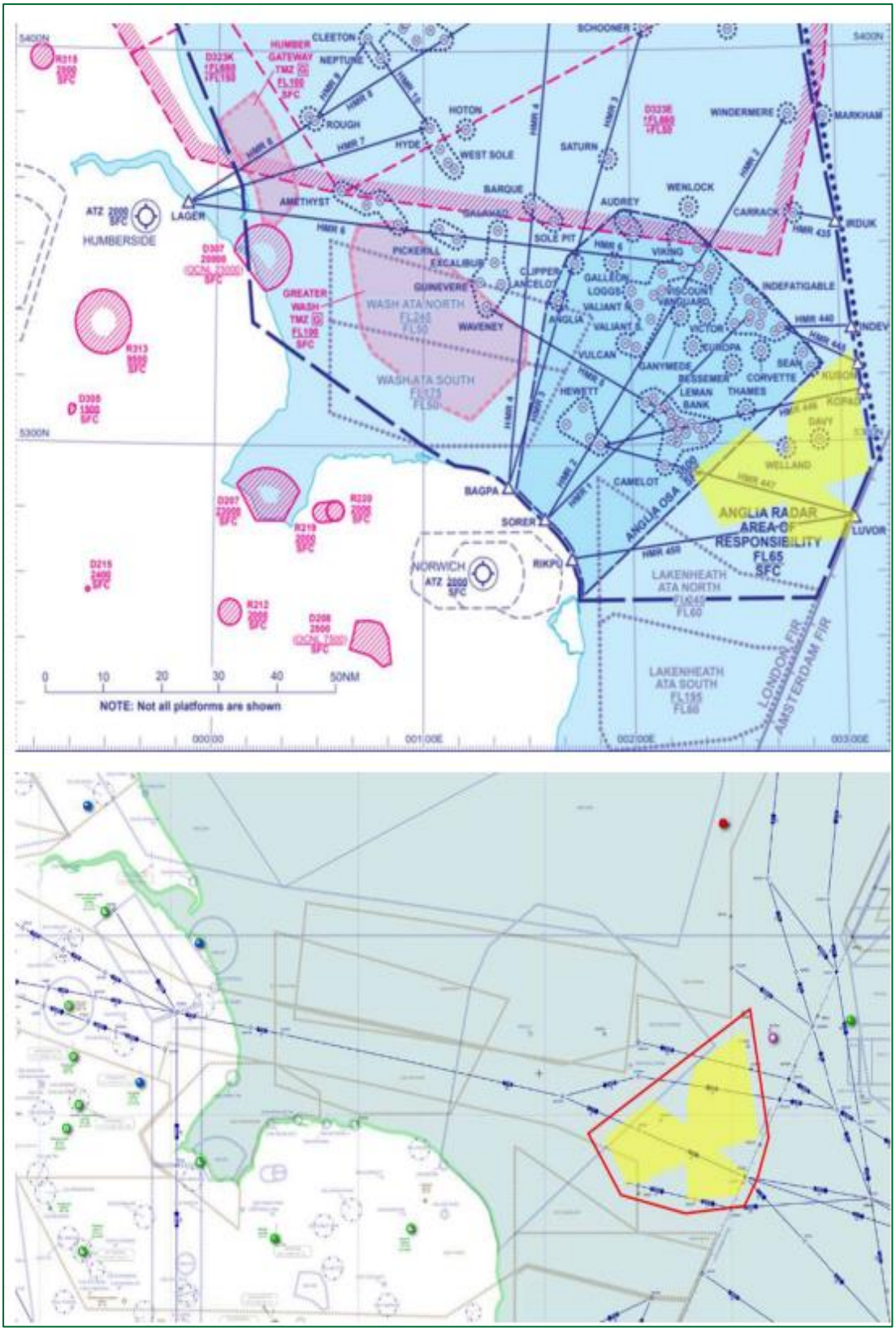

Figure 21 - (Top) VWP Wind Farm location. (Bottom) VWP Wind Farms with CAA approved TMZ boundary (Red line)

A2 Traffic Studies

A2.1 Introduction

This section aims to discuss the frequency of traffic activity for non-Transponding aircraft (Non-SSR) in the North Sea and conclude the likelihood of non-SSR GA aircraft operating in the Vicinity of the EA Hub OSWF complex. This section analyses two previous studies/surveys undertaken in support of previous ACP submission in the North Sea, whilst a third study assessment applies the rationale and findings from the first two studies and applies them to the EA Hub region of the North Sea.

A2.2 2015 Aviation Traffic Survey

Background

In 2015, an aviation study was concluded to support an ACP, focusing on the establishment of a TMZ in the Firth of Forth. This particular aviation study was utilised in the ACP submissions for Neart Na Gaoithe (NNG) and Inch Cape (IC). At the time of commissioning the traffic study, the projected location of the NNG and IC TMZ was anticipated to align with the details outlined in Figure 22 below.

Figure 22 - NNG and IC TMZ Area (Circa 2015) *Reproduced from CAA digital map data © Crown copyright 2015. UK AIP ENR.*

Traffic Survey Results - General Aviation (GA)

The first of the two data collection exercises was completed during the week beginning the 16th March 2015. During the weeklong collection of data, which utilised the radar picture from the Leuchars primary and secondary surveillance radar, no GA aircraft were seen to transit the proposed area of the TMZ. A further air traffic study took place during the first week of July 2015 over a five-

day period, using the same method as previously; the results from this second study mirrored those of the first in that no GA aircraft were seen to transit the area. Upon commencement of the study, there was an initial assumption that the presence of non-Secondary Surveillance Radar (SSR) equipped aircraft near the development area would be minimal. This assumption was corroborated by discussions with controlling staff at RAF Leuchars (now MOD Leuchars Station). The subsequent results of the study validated this assumption, affirming that the likelihood of non-SSR equipped aircraft operating in the designated TMZ location was indeed extremely remote.

Traffic Survey Results - Other Traffic

Commercial civil aircraft were observed operating in a north to south, south to north transit to the east of RAF Leuchars mainly following the track of airway P18 (which has restricted opening hours). All aircraft were transponding and were operating above Flight Level 100 under the control of the Scottish Area Control Centre. The incidence of military and civil aircraft transit traffic operating below FL 100 in the area of the proposed developments was restricted to a formation of four typhoon aircraft operating on a northerly transit through the developable area at low level. All four aircraft were in R/T contact with RAF Leuchars air traffic control (ATC) prior to transit through the area of the proposed developments with the lead and last aircraft displaying a Mode A/C transponder code.

Further Study

In March 2015, a request was made to RAF Leuchars for statistical data on non-SSR equipped aircraft that had received any type of service from their ATC, including radar and non-radar services. Military units are obligated to retain flight strips for aircraft receiving any service, whether radar-assisted or not. Historical flight strips were analysed to fulfil the data request. Between April and July 2015, RAF Leuchars controllers noted that they had controlled several non-SSR equipped general aviation (GA) aircraft, mainly microlight aircraft, operating near the coastline or overland, away from the proposed TMZ. The collected data for this four-month period includes all aircraft under deconfliction service (DS), traffic service (TS), or basic service (BS). Details of the flight strip data are presented in Table 4 below.

Month	DS/TS/BS Provided	% non-SSR equipped	Number of non-SSR equipped
April 2015	673	2.7	19
May 2015	750	1.9	14
June 2015	891	1.7	15
July 2015	1,320	0.9	11
Combined Total	3,634	≈1.6	59

Table 4 - % of non-SSR aircraft provided with a service from RAF Leuchars.

Implication

As the data above highlights that zero non-SSR aircraft transited the anticipated TMZ during the surveyed two-week period, and the results from Table 5 which show that approximately 1.6% of all transits through the entire area of responsibility for RAF Leuchars do not have a transponder operational. If the data is extrapolated and averaged on a monthly basis, it would be reasonable to expect that RAF Leuchars provide DS/TS/BS to some 908 aircraft per month (but likely to be much lower during the winter months, and therefore overall average likely to be a lot lower) which means they control around 14 aircraft which are operating non-SSR per month. As highlighted in above, the majority of non-SSR aircraft remained close to the coastline or operated overland.

A2.3 2018 Aviation Traffic Study

Background

In 2018 a subsequent aviation study was completed in support of an ACP which involved the establishment of a TMZ in the Outer Firth of Forth. This aviation study was used by the change sponsors of the Seagreen ACP to highlight the low number of non-SSR aircraft operating close to their development site and request that from Stage 3 onwards in ACP process, that no quantitative analysis would be required. The location of the Seagreen TMZ at the time the traffic study was commissioned was expected to be as detailed in Figure 23 below.

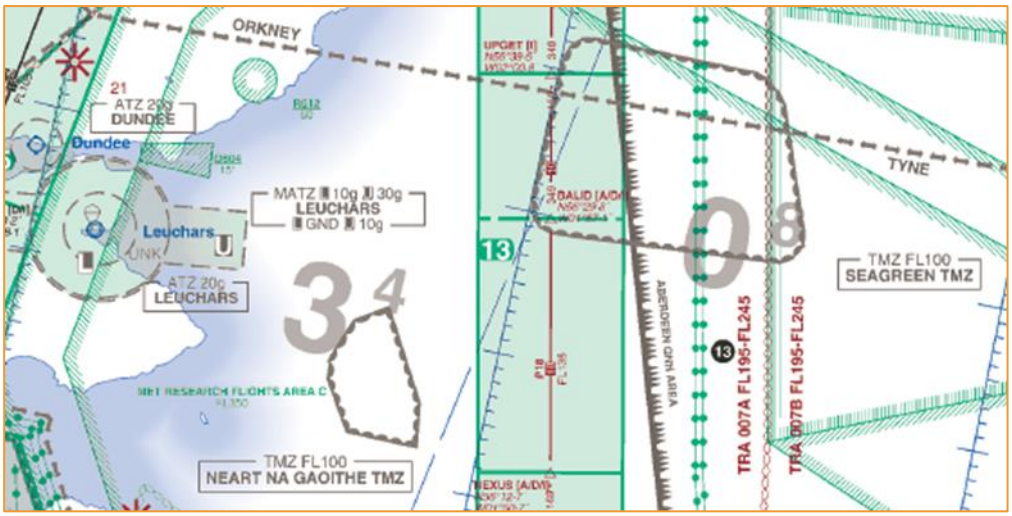

Figure 23 - Seagreen TMZ Location

Traffic Survey Results

As part of the Seagreen ACP, a similar traffic survey to that from 2015 was conducted over a 1-month period during September 2018. This study found that during the month, MOD Leuchars Station had 1,270 aircraft transit their area of responsibility, and of these just 2 were non-SSR aircraft. This equates to approximately 0.16% of all tracks. Unlike the 2015 study, there is no breakdown about the types of aircraft or the types of radar service they were under, however it would be safe to assume that there was no significant non-SSR activity around

the Seagreen development area, as no reference was made in the supporting documentation.

A2.4 2024 EA Hub Aviation Traffic Study

Introduction

A short study on the GA transponding traffic patterns transitioning the North Sea below FL100. The UK's Norfolk and Suffolk counties have several established non-licenced GA aerodromes along its North Sea coastline. It is considered by the CS that non-transponding (non-SSR) GA airspace users may wish to transit the North Sea in an easterly direction toward the Netherlands coastline.

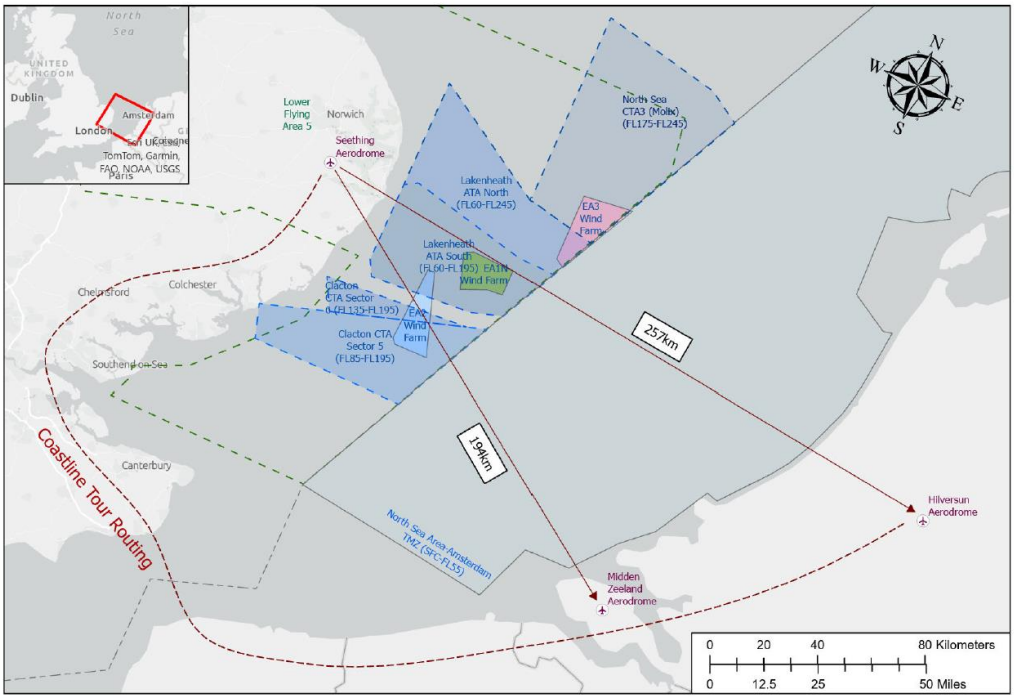

Figure 24 - Example Scenario of non-transponding GA crossing the North Sea

For example, a GA user departing Seething aerodrome (N52304020 E001250180) transiting in a southerly or easterly direction across the North Sea, into Dutch controlled airspace and on to either Midden Zeeland (N51304400 E003435200) or Hilversum Aerodromes (N52113100 E005084900), would likely experience a series of transitional considerations with the existing airspace structure. Figure 24 depicts two example scenarios of GA routes departing from

UK aerodromes and arriving in Holland. These scenarios assume the GA air users are non-transponding and remain below FL100 for their entire journey:

Scenario 1 – Seething to Hilversun:

- Sufficient fuel to reach destination (257km), as the breadth of the North Sea at this point exceeds 185km.
- Awareness of military Low Flying in LFA5 from SFC to 2,000ft AMSL.
- Avoid where practical or stay below the Lakenheath ATA South FL60.
- On crossing the London / Amsterdam FIR stay above the Amsterdam TMZ FL55.

Scenario 2 – Seething to Midden Zeeland:

- Sufficient fuel to reach destination (196km), as the breadth of the North Sea at this point exceeds 155km.
- Awareness of military Low Flying in LFA5 from SFC to 2,000ft AMSL.
- Avoid where practical or stay below the Lakenheath ATA South FL60.
- Avoid or stay below the Clacton CTA Sector 5 (Class A airspace) FL85.
- On crossing the London / Amsterdam FIR stay above the Amsterdam TMZ FL55.

Short-study Assessment

A 12-hour short traffic study was conducted to assess the type and volume of airspace users operating below FL100 and in the vicinity of EA Hub complex areas (see Annex A0, Operational Diagrams).

The study's aim was to simulate the effect of an established TMZ over the EA Hub complex and assess affected traffic patterns[44]. The study covered a two-day period in August 2023 on Saturday 26th and Sunday 27th. The supporting data was taken from flights between 0900 – 1500 hrs on each day. August was specifically chosen as it is in the summer period and improved weather conditions, and the weekend was also chosen as it is highly likely to experience a larger volume of airspace users.

It is acknowledged by the CS that this study is a small snapshot of the annual air operations in this area, and that there is no practical means, without incurring significant costs are disproportionate to the pre-scaling of this ACP, to assess non-SSR air user activity unless observing an actual radar screen. The study therefore uses only transponding data as an indicator of likely non-SSR activity patterns.

The table below shows the results of the two-day short traffic study into transponding aviation activity in the vicinity of the EA Hub complex below FL100.

[44] The assessment utilises mostly transponder-based data (FR24)

Date	Time	CallSign /Type	Owner	Dept	Arrival	ALT
26 Aug 2023 (SAT)	11:12	GDOGA / Diamond DA50 RG (DA50)	Private	OXFORD	ROTTERDAM	3,150ft
	11:12	GFIAT / Piper PA-28-140 (P28A)	Pilot Flight Training	N/A	ROTTERDAM	3,600ft
	12:08	LNELG / Cirrus SR22 (SR22)	Private	ROTTERDAM	DUXFORD	6,650ft
27 Aug 2023 (SUN)	15:00	LNELG / Cirrus SR22 (SR22)	Private	DUXFORD	ROTTERDAM	10,000ft

Table 5 - Air User short study results (Source: FR24).

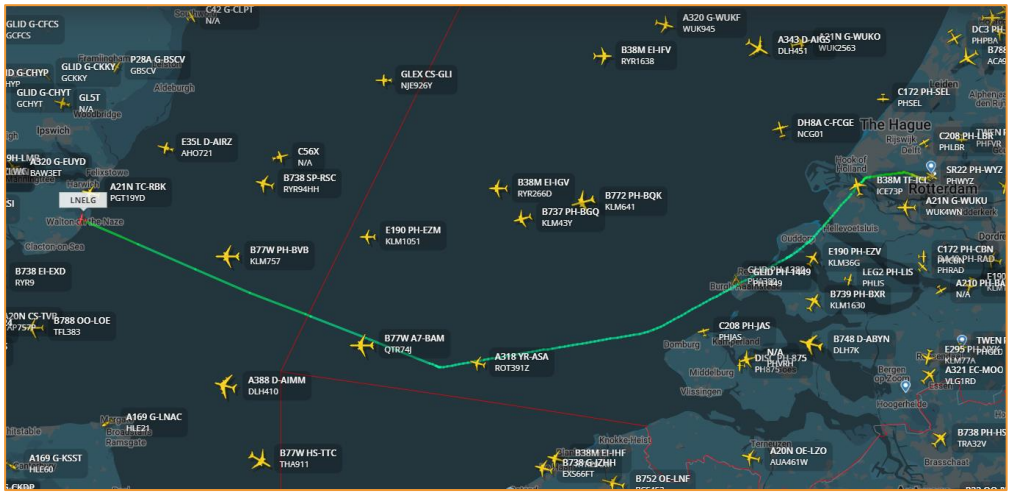

Figure 25 - Example of North Sea transition handle baring the coastline (Source: FR24)

Example of handlebar navigation

Figure 25 shows a route of a Cirrus SR22 light aircraft transiting from Rotterdam onwards to Duxford Aerodrome. The pilot has headed south along the Dutch coastline and then in a westerly direction before reaching the UK, near Walton on the Naze, for onward journey to Duxford Aerodrome. Although a longer journey than a direct line route from Rotterdam to Duxford, following the coastline increased their safety by minimising the oversea transit time and increasing options for additional diversion landing sites should an emergency arise.

Projected activity base on 2015 survey data

If the 2024 data was applied against the results of the 2015 survey non-SRR percentage (Table 4), this would suggest that of the 4 transponding flights 0.0064% of the total flights would be non-SSR aircraft. If this data is then expanded and applied across the year, the percentage of non-SSR flights in the vicinity of the EA Hub complex would be 1.168%. This result is obviously constrained by the study criteria (hours of study), the region of the North Sea, but it may also be overly inflated due to the data capture period (summer). The likelihood of the annual percentage of non-SSR aircraft operating in the development area is expected to drop at seasonal lows and the deteriorating weather conditions in the North Sea during autumn and winter periods.

A2.5 Conclusion

The points below summarise the following conclusions:

- **GA Activity Patterns:** The studies consistently indicate minimal GA activity in the development area, especially below FL100. This pattern remains consistent across both the 2015 and 2018 airspace surveys.
- **Seasonal Variations:** Seasonal variations on air traffic, in the North Sea during winter months likely reduce transits due to adverse weather conditions and decreased daylight hours. As the results collected were outside of the winter months, any extrapolation of data to provide a monthly average would have been artificially heightened.
- **Seagreen ACP Findings:** The 2018 Seagreen ACP study, highlighted the low incidence of non-SSR aircraft (0.16% of all tracks) operating in the RAF Leuchars' area of responsibility. This data supports the contention that the area near the Seagreen development experiences minimal non-SSR activity.
- **EA Hub ACP Findings:** The 2024 EA Hub ACP study demonstrates, when applying the rationale from the previous two studies with the two-day findings, that the GA non-SSR aircraft are highly unlikely to cross the North Sea in significant numbers across the region of the EA Hub OSWF complex.
- **Operational Characteristics:** The studies provided an insight into the operational characteristics of aircraft that operate non-SSR, and it can be seen that they operate close to the shoreline, or overland. By spotlighting these operational characteristics, this information enriches the comprehension of the dynamics surrounding non-SSR activity. These insights serve as an invaluable contextual layer, is highly suggestive that in the area of the development site, non-SSR aircraft venture no more than a few miles away from the coastline, and not to the excesses of 30km away to reach the East Anglia Hub development area.

Thus, the CS believes that the establishment of a TMZ airspace (Class G) solution[45] above the EA Hub complex will have very little impact to the GA non-SSR community.

These survey findings underscore a crucial point: the envisaged changes in the airspace are not anticipated to impart a significant impact on Noise, Air Quality, Greenhouse Gases, or Fuel Burn. Therefore, there is a strong basis for advocating against the necessity of a quantitative assessment in the subsequent stages of this ACP. This stance aligns with the practicality of the proposed airspace modifications and serves to mitigate the potential for unnecessary costs and resources associated with detailed quantitative analyses. In essence, the presented data lends credence to the assertion that the expected effects on various parameters make a quantitative assessment in later ACP stages unnecessary.

[45] TMZ designs will be identified in Stage 2 and the Design Option (DO) and Design Principle Evaluation (DPE) steps of this ACP.

A3 Acronyms

Acronym	Meaning
AARA	Air to Air Refuelling Area
ABP	Altitude Based Priorities
ACAS	Airborne Collision Avoidance Systems
ACP	Airspace Change Proposal
ADS-B	Automatic Dependent Surveillance-Broadcast
agl	above ground level
ALARP	As Low as Reasonably Practical
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
ATA	Aerial Tactics Area
ATC	Air Traffic Control
ATCRMS	Air Traffic Control Radar Mitigation Scheme
ATS	Air Traffic Service
CAA	Civil Aviation Authority – UK Airspace regulator
CAP	Civil Aviation Publication
CAP 1616	Guidance on the regulatory process for changing airspace design including community engagement requirements.
CDS	Current-day Scenario
CNI	Critical National Infrastructure
CO_2	Carbon Dioxide
CS	Change Sponsor
CTA	Control Area
DP	Design Principles

Acronym	Meaning
DPE	Design Principle Evaluation
EFIS	Electronic Flight Information Systems
FL	Flight Level
ft	feet
GA	General Aviation
GW	GigaWatt
IFP	Instrument Flight Procedures
IFR	Instrument Flight Rules
IOA	Initial Options Appraisal
IMC	Instrument Meteorological Conditions
LAT	Lowest Astronomical Tide
LFA	Low Flying Areas
m	metre
MAA	Military Aviation Authority
MOD	Ministry of Defence
MW	MegaWatt
NATMAC	National Air Traffic Management Advisory Committee - NATMAC is a non-statutory advisory body sponsored by the Directorate of Airspace Policy. The Committee is consulted for advice and views on any major matter concerned with airspace management.
nm	Nautical Mile
OSWF	Offshore Wind Farm
PSR	Primary Surveillance Radar
RA	Regulatory Article
RAF	Royal Air Force
RAG	Range Azimuth Gating

Acronym	Meaning
RCS	Radar Cross Section
RDDS	Radar Data Display Screen
RDP	Radar Data Processor
RMZ	Radio Mandatory Zone
RT	Radio Telephony
RW	Runway
SFC	Surface
SoN	Statement of Need: Sets out what airspace issue or opportunity this proposed change seeks to address
SSR	Secondary Surveillance Radar
TMZ	Transponder Mandatory Zone
TRA	Temporary Restricted Area
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WTG	Wind Turbine Generators

Table 6 - List of Acronyms

A4 Glossary of Terminology

Term	Meaning
Automatic Dependent Surveillance-Broadcast (ADS-B)	An ADS-B system is a hardware equipment installed onboard aircraft. It automatically transmits the location (latitude, longitude) of the aircraft and its movement data (speed, heading, altitude) via a digital data link. These transmissions are received and can be used by other aircraft and Air Traffic Control to display the aircraft's position.
Consultant	An external company employed to work with the project team to provide professional or expert advice in a particular field.
Development Area	The proposed geographic location of the East Anglia Hub Wind Farms.
External Providers (Suppliers, Contractors, Third Parties)	An organisation outside the Group charged with supplying goods and or services as well as carrying out complementary activities as part of the project.
Primary Surveillance Radar (PSR)	A conventional radar sensor that illuminates a large portion of space with an electromagnetic wave and receives back the reflected waves from targets within that space. Primary radar detects aircraft (and other objects, such as flocks of birds, weather phenomena, other environmental factors, and wind turbines) without selection, regardless of whether or not they possess a transponder. It can also detect and report the position of anything that reflects its transmitted radio signals, including the rotating blades of the wind turbines. It indicates the position of targets but does not identify them. Because wind turbines blades are moving targets, it is hard for a radar to distinguish them from aircraft. Radar data processing connects returns from successive sweeps of the radar, and from this infers speed. Multiple wind turbines in a wind farm create multiple radar returns and these can appear as stationary or rapidly moving primary returns on the radar display.
Primary Radar RAG Blanking	Range Azimuth Gate (RAG) radar blanking blocks any primary radar return within selected ranges and azimuth sectors. This can be mapped to suppress plots within wind turbine clutter regions. However, the primary blanking in any given area is complete, hence the primary return from any aircraft entering this area would also be suppressed. Thus, the aircraft would not appear on the radar unless they were operating with a transponder, and hence detected by the Secondary Surveillance Radar (SSR).
Project Document	Term used to describe any project specific deliverable documentation (procedures, drawings, specifications, reports etc.), including other means of describing and communicating operational controls and technical data, relevant for law compliance or legal purposes and for progress calculation.

Term	Meaning
Project Records	Term used to describe any project specific record (technical queries, comment sheets, transmittals, calculations etc.). Records are documents stating results achieved or providing evidence of activities performed.
Radar Mitigation Scheme	A scheme necessary and sufficient to prevent the operation of the East Anglia Hub wind turbines impacting adversely on the primary surveillance radar performance at Cromer. The scheme may be in combination, or individually and take the form of a hardware or software solution which will be implemented and maintained for the lifetime of the development or for such shorter period as may be agreed in consultation with the NATS and/or MOD as necessary to mitigate any such adverse impact.
Secondary Surveillance Radar (SSR)	A SSR, also known as a transponder, comprises of two interacting components, the first is a ground-based unit (the radar), known as the interrogator and the second is the aircraft known as the responder. The ground-based element interrogates an area of responsibility utilizing a 1030 MHz frequency, which is responded to by an aircraft with an electromagnetic pulse on a 1090 MHz frequency. SSRs have three modes, depending on the pulse intermission and the aircraft reporting capabilities. A, C and S. Civil aircraft may be equipped with different transponders modes: • Mode 3A – Transmits the aircraft identifier code. • Mode C (Also known as ALT) – The air traffic controller can observe the aircrafts altitude /flight Level (FL) • Mode S – Aircraft altitude and permits transmission of callsign and registration of the aircraft. Although not a formally required piece of aircraft equipment, air users wishing to operate in Class, B and C airspace and TMZs[46] (Class D, E, F & G), or at altitudes above FL100, will need a Mode S Elementary Surveillance transponder.
Transponder Mandatory Zone (TMZ)	A Transponder Mandatory Zone is an area of defined dimensions wherein the carriage and operation of aircraft transponder equipment is mandatory. All flights operating in airspace designated by the competent authority as a TMZ shall carry and operate SSR transponders capable of operating on Modes S or, in exceptional circumstances, SSR Modes A and C. However, the advent and increasing affordability of technology such as Automatic Dependent Surveillance – Broadcast (ADS-B) means that the concept of a TMZ may now evolve to utilise alternate types of electronic conspicuity systems. A pilot wishing to operate in a TMZ without serviceable transponder equipment may be granted access subject to specific

[46] SERA 13001 Operation of an SSR transponder

Term	Meaning
	arrangements agreed with the TMZ Controlling Authority via satisfactory 2-way communication.
'Will' or 'Must' (CAA)	Used by the CAA to refer to requirements that **must** be met in full unless it has been agreed in advance with the CAA that it would be disproportionate to do so.
'Should' (CAA)	Used by the CAA to refer to requirements that is expected to be met in full unless the change sponsor provides an acceptable rationale (within their submission) that it would be disproportionate to do so.
'May' (CAA)	Used by the CAA to refer to an action that the change sponsor is encouraged to consider taking. Given the unique circumstances of each airspace change proposal, there may be instances where the CAA might instruct the change sponsor to take specific action.

Table 7 - List of Useful Terminology