East Anglia Hub Wind Farms

ACP-2023-079

Design Principles Evaluation

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1 Project Overview

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.

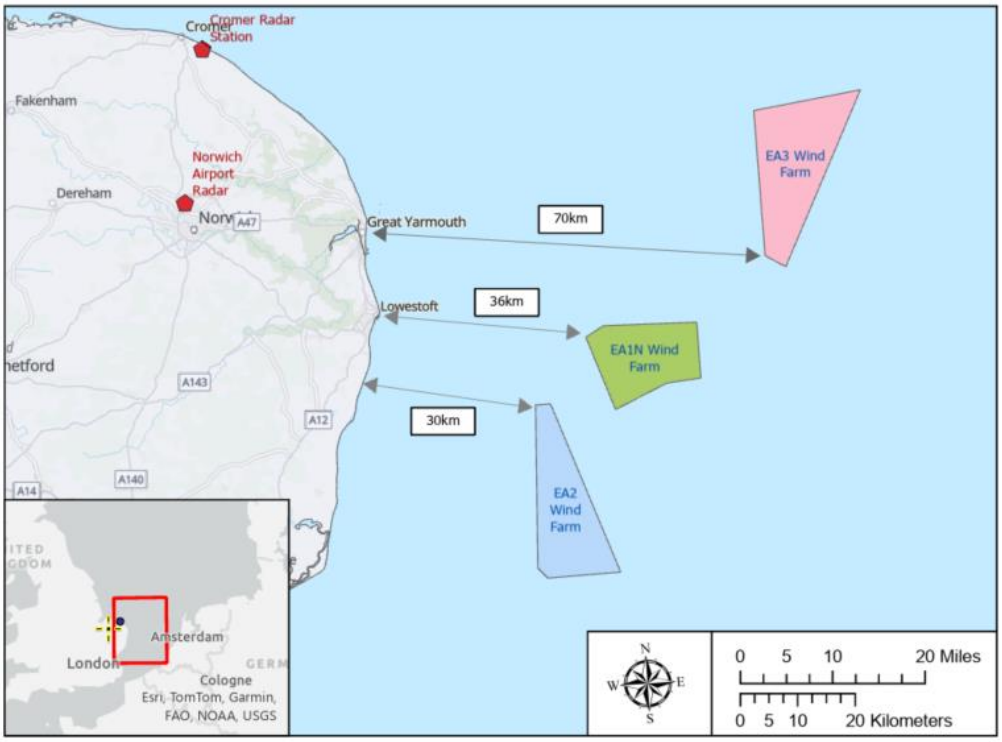


Figure 1 - EA Hub Proximity to UK Coastline

1.2 Project Overview

This report has been produced in accordance with the requirements set out in CAP 1616 - Airspace Change Process (Version 5). As part of the Airspace Change Proposal (ACP), Stage 1 requires Scottish Power as the Change Sponsor (CS) to provide a current-day scenario (CDS[1]), which captures a clear description of the current impacts and sets the context for all stakeholders. This ACP has been pre-scaled to a Level 3 by the Civil Aviation Authority (CAA)[2], meaning its implementation has the potential for only a low impact on both aviation and non-aviation stakeholders.

[1] Current-Day Scenario, CAA Airspace Change Portal (ID: ACP-2023-079) Airspace change proposal public view (caa.co.uk).
[2] Post CAA ACP Assessment Meeting – 16th January 2024

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) Offshore Wind Farm (OSWF).

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

1.3 Design Principles

Stage 1 of CAP 1616 requires that the CS of the ACP engages with its stakeholders in a two-way dialogue to establish a set of Design Principles (DPs) which will subsequently guide the development of the design options (DOs). SPR have successfully completed Stage 1 and the finalised DPs have already passed the CAP 1616 Stage 1 (DEFINE) Gateway.

Draft Design Principles (DP) were developed and distributed amongst the identified stakeholders to gain their feedback and comment. These principles were accompanied by supporting documentation to provide context around the location of each site and explain what the design principles aimed to achieve. All engagement with stakeholders took place via email and the exercise concluded with no changes necessary to the DPs presented in the tables below.

1.3.1 Mandatory Design Principles (MDP)

Design Principle Area	Mandatory Design Principles
MDP 1 - Safety	*The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.*
MDP 2 - Policy	*The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.*
MDP 3 - Environment	*The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.*

Table 1 - Mandatory Design Principles

1.3.2 Discretionary Design Principles (DDP)

Design Principle Area	Initial Discretionary Design Principles (DDP)
DDP 1 – Technical 1 (Other aviation stakeholders)	*The airspace change proposal should consider the impacts on Air Navigation Service Providers (ANSP) and other aviation stakeholders, such as nearby airport operators.*
DDP 2 – Technical 2 (Ministry of Defence requirements)	*The airspace change proposal should be compatible with the requirements of the Ministry of Defence.*
DDP 3 – Technical 3 (Accessibility for all airspace users)	*The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users*

Table 2 - Discretionary Design Principles

1.3.3 Bespoke Design Principles (BDP)

Design Principle Area	Initial Bespoke Design Principles (BDP)
BDP 1 – BDP Policy	*The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy[3].*
BDP 2 – Technical 3 (Airspace)	*The airspace change should be designed to fit with existing background airspace classification and any known planned changes.*
BDP 3 – Technical 4 (Airspace)	*The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.*

Table 3 - Bespoke Design Principles

1.4 Design Option Development

The CS has considered a variety of DOs that provide sufficient mitigation against the operational effects radar detectable wind turbines are anticipated to have on the Cromer Primary Surveillance Radar (PSR). The DOs are expected to successfully support operation of the EA Hub and allow further testing of technical mitigation solutions at the impacted surveillance radar systems.

This section includes a list of the DOs which have been developed to align with the finalised DPs. It is worth highlighting that Option 0 (below) reflects a scenario where the EA Hub wind farm is not constructed. This option is unviable because the purpose of the ACP is to support the construction of the wind farms. Nevertheless, Option 0 will be carried forward to subsequent stages of the CAP 1616 process for

[3] SARG Policy Statement 123: Policy for Radio Mandatory Zones and Transponder Mandatory Zones (13 Jan 2022). Ref 002.

comparative purposes where it will be used as the baseline reference for any future environmental assessments, if required.

The following comprehensive list of DOs were proposed for further consideration:

Option 0: Baseline (Do nothing).

Option 1: Temporary wind turbine suspension of operation.

Option 2: SSR Only operations.

Option 3: The use of an In-fill radar solution.

Option 4: Introduction of Class D or E Controlled Airspace.

Option5: Class E+ Transponder Mandatory Zone (TMZ) Airspace.

Option 6: Radio Mandatory Zone (RMZ).

Option 7: RAG Blanking Only.

Option 8: TMZ (x3) Only.

Option 9: TMZ (x3) and RAG Blanking with no Buffers.

Option 10: TMZ (x3) and RAG Blanking with Norfolk TMZ Overlap.

Option 11: TMZ (x3) and RAG Blanking with Norfolk TMZ Adjoined.

Option 12: TMZ (x3) and RAG Blanking with Extended Norfolk TMZ Boundary.

Option 13: TMZ (x2) and RAG Blanking with Norfolk TMZ Overlap.

Option 14: TMZ (x2) and RAG Blanking with Norfolk TMZ Adjoined.

Option 15: TMZ (x2) and RAG Blanking, FIR Aligned and with Norfolk TMZ Overlap.

Option 16: TMZ (x2) and RAG Blanking, FIR Aligned and with Norfolk TMZ Adjoined.

Option 17: TMZ (x1) and RAG Blanking with Norfolk TMZ Overlap.

1.5 Technical Criteria

Please note that the option which is eventually chosen for implementation will be compliant with the appropriate technical criteria defined in CAP 1616H, Appendix B and will form the basis for the CS's formal ACP submission.

2 Design Principles Evaluation Assessment

2.1 Options Development

The CS developed a list of design options (DOs), from comprehensive options through to specific lateral options, which support the Statement of Need (SoN) and are aligned with the ACP's finalised DPs.

2.2 Options Assessment

CAP 1616H[4] provides a standardised format for the completion of the DPE; however this format can be expanded as necessary to take account of the CS's DPs. The degree to which the DPs align with the DOs is indicated by the colour coding listed in Table 1 below.

Colour	Code Meaning
Green	Met (M) – All the conditions within the DP are met or there is no change.
Yellow	Partial (P) – Some of the conditions within the DP are met or there is a minimal/limited change.
Red	Not Met (NM) – None of the conditions within the DP are met.
White	Not Applicable (NA) in this scenario

Table 4 - DP Colour Coded Evaluation

The CS has taken the view that any option with a DP assessed as Not Met (Red) should be rejected. The following sections include the detailed evaluations against each of the DOs.

The CAP 1616H pre-scale Level 3 ACP guidance states that there is no requirement for the CS to conduct a full DPE[5], and that only the minimum evaluation of the DOs against the mandatory DPs should be conducted. However, the CS's approach is to evaluate the DOs against all finalised DPs, including discretionary and bespoke DPs.

[4] CAP 1616H, Chapter 2, page 13. 2.18
[5] CAP 1616H, Chapter 2, page 13, 2.2.1.

2.3 DPE Option 0 – Do Nothing

Do Nothing Option	**Reject (Retained for comparative purposes only)**
East Anglia Hub OSWF is not constructed (EA1N, EA2 & EA3).	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	This option does not alter the existing airspace and reflects the current arrangements which are assessed to be safe.	Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	As the airspace will not be changing, there will be no impact to any legislation caused, and the CDS will remain unchanged.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	As the airspace will not be changing, there will be no environmental impact caused, and users can operate as they do currently.	Met
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	As the airspace will not be changing, there will be no impact to any aviation stakeholders caused, and users can operate as they do currently.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be	As the airspace will not be changing, there will be no impact to the MOD and can operate as they do currently.	Met

Design Principle		Summary of Assessment	Evaluation
	compatible with the requirements of the Ministry of Defence.		
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	As the airspace will not be changing, there will be no impact to any aviation stakeholders caused, and users can operate as they do currently.	Met
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	As the airspace will not be changing, and therefore there is no requirement to implement CAA airspace policy.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	As the airspace will not be changing, and therefore there is no requirement to implement CAA airspace policy.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	There is no additional airspace being affected as no changes are being made, and therefore no volume of airspace is affected.	Met

Table 5 – Option 0.

2.3.1 Do Nothing Option Conclusion

Although at first glance, Option 0 may appear to be an attractive option in terms of meeting the DPs, it is unviable as it does not consist of any airspace solution and therefore negates the requirement for any change under the CAP 1616 process. Each of the DPs have been assessed as Met (green) for this option, simply because there is no airspace solution (and therefore no change to extant circumstances).

This option has therefore been rejected but will be taken forward into subsequent stages of the process for comparative purposes only.

2.4 DPE Option 1 – Temporary Suspension

Temporary Wind Farm Suspension of Operation	**Reject**
Intermittent mitigation against radar clutter. ANSPs would tactically request the suspension of the wind farm operation subject to aircraft traffic levels and routings.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Any instruction to stop the EA Hub wind turbines is unlikely to be immediate. Also, there is uncertainty over the time it then takes for the wind turbines to stop turning. Therefore, the removal of any radar clutter is also unlikely to be immediate. This might lead to confusion, ATC delays and increased workload in the effort to maintain safe operation of air traffic. During this unspecified period, there could be a decrease in aircraft safety to an unacceptable level.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	Due to the requirement to request the wind turbine generators are switched off, this option is practically not a simple change and does not improve the efficient use of airspace. The option therefore does not provide a suitably safe solution.	Not Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Dependent on the time taken for the wind turbines to stop turning, there is possibility that aircraft would be rerouted around radar clutter because they cannot wait for the wind turbines to stop rotating. Rerouting may increase the environmental impact if track distances increase. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impacts on communities below 7,000ft or 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):**	This option provides no airspace change solution and would not impact	Not Applicable

Design Principle		Summary of Assessment	Evaluation
	The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	'other aviation stakeholders', therefore this DP is not relevant for this design.	
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	Dependent on the time taken for the wind turbines to stop turning, there is possibility that MOD aircraft would be rerouted around radar clutter because they cannot wait for the wind turbines to stop rotating. Rerouting may increase the environmental impact if track distances increase.	Not Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	This option does not change the airspace design and would therefore not impact 'other aviation stakeholders'. This option is a technical solution rather than a change to the airspace design. This option might redirect aircraft whilst WTG are shut down, depending upon the flight conditions and level of control provided (see MDP3 Environmental).	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	This DP is not relevant for this design.	Not Applicable
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Control of the wind turbines would remain with the respective developer, and the time taken in initiating the request and the cessation of wind turbine operations would introduce delay and increased workload at a time when speed is of the essence to ATC. Due to the unpredictable nature	Not Met

Design Principle		Summary of Assessment	Evaluation
		of operations within uncontrolled airspace, in which the wind turbines are located, this option is unviable, as it would be unable to be sufficiently robust for the dynamic ATC operational environment.	

Table 6 – Option 1.

2.4.1 Temporary Wind Farm Suspension of Operation Conclusion

This option would not be acceptable to the OSWF developer; furthermore, in the fast moving, dynamic world of ATC operations, this option would be operationally unmanageable, and unacceptable to the ANSPs because it provides insufficient mitigation for the anticipated effects on the Cromer PSR systems.

This option has therefore been rejected.

2.5 DPE Option 2 – SSR Only Operations

SSR Only Operations	**Reject**
With SSR Only Operations, the PSR would be deselected to remove wind turbine induced clutter. Non-transponding[6] aircraft would therefore remain undetectable throughout the entire area of coverage of the Cromer PSR system.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	As non-transponding aircraft would not be tracked by the PSR, ATC would be unaware of their position. This could lead to an unacceptable decrease in the level of aircraft safety.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	The UK AIP states that ATC Separation cannot be provided in Class G due to the nature of the unknown Class G traffic environment. As this option affects the Cromer PSR entire area of operations, it is likely that increased safety risks could result due to the potential presence of non-transponding (unseen) aircraft also operating in this area. This would be contrary to CAA policy and guidance.	Partial
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	It is unlikely that airspace users would alter their routings when compared to current day operations. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impacts on communities below 7,000ft or 4,000ft.	Met
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such	NATs ATC are capable of utilising SSR Only as a means of operation when their Cromer PSR is not working. However, they would not be able to provide any level of service against non-participating aircraft.	Partial

[6] A non-transponding aircraft is also known as a non-participating aircraft in the context of the use of SSR.

Design Principle		Summary of Assessment	Evaluation
	as nearby airports operators.		
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	The Military Aviation Authority (MAA) provide Regulatory Articles (RA) to provide a framework of policy, rules, directives, standards, processes and the associated direction, advice, and guidance, which governs military aviation activity and against which air safety is assessed. RA 3241 covers contingency arrangements for the continued provision of ATS utilising SSR Only by military ATC. Although it is possible to operate in this fashion, this would be associated with an increased level of risk to aircraft and crews.	Partial
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	Aircraft unable to provide SSR information to ATC will not be provided with any radar-based ATC service. A limitation in the radar service being provided to participating aircraft by ATC may be acceptable to aircraft captains. Whilst it is assumed the vast majority of MOD, Coastguard and Search And Rescue (SAR) aircraft operate SSR, there may be limitations on General Aviation (GA) aircraft operating in certain weather conditions.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Not relevant in this situation.	Not Applicable
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to	Whilst the use of SSR Only would not change any airspace volumes, it would mitigate the clutter problem in the vicinity of the wind turbine generators. However, it would also	Not Met

Design Principle		Summary of Assessment	Evaluation
	counter the effects of wind turbine generators on ATC surveillance infrastructure.	affect the wider area of PSR coverage with a potential impact for airspace users.	

Table 7 – Option 2.

2.5.1 SSR Only Operations Conclusion

Within SSR Only operations (and without radar blanking), the PSR would be deselected to remove wind turbine induced clutter. Since it is not possible to deselect PSR for a specific area, this would mean the entire area of operations for the air traffic controller would be without displayed PSR data. Consequently, it would be impossible to detect any aircraft operating without SSR when entering the airspace above the Development Area or within the coverage of the effected radar system. This would lead to an unacceptable loss of situational awareness for the controller and an inability to provide an effective radar service.

This option has therefore been rejected.

2.6 DPE Option 3 – Radar Infill

Use of Infill Radar Solution	**Reject**
An infill radar solution, provides radar data from an existing or new source located in an area that does not detect the East Anglia Hub OSWF turbines. This radar would still ensure effective low-level coverage in the area of development. This approach would be categorised as a technical solution because it maintains the current airspace configuration and does not introduce any airspace design change.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	An infill radar solution would ensure the removal of any displayed radar clutter caused by the detection of the EA Hub Wind Farm. The use of infill radar solutions has been a successful alternative in the civilian ATC environment and may be appropriate for mitigation of the Cromer PSR. To date, no infill solution has been used in the military ATC radar environment. However, the solution would need to be accepted, provide the required range and radar coverage, be appropriately safety assessed and flight checked, and attract the required regulatory approvals.	Partial
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This is a creative and simplified approach to the airspace mitigation. It would maintain levels of safety that are currently experienced today, and its implementation could be planned for full compliance against existing regulations and policies.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	It is unlikely that airspace users would alter their routings when compared to current day operations. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impacts on communities below 7,000ft or 4,000ft.	Met

Design Principle		Summary of Assessment	Evaluation
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	The introduction of a new radar source that provides an infill solution would ensure the provision of services to aviation stakeholders. However, whilst it is understood that this has been acceptable solution for some civilian ANSPs, it is not believed to be fully accepted by the MOD.	Partial
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	The introduction of a new radar source that provides an infill solution is not believed to be fully accepted by the MOD.	Not Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The successful addition of infill radar either as a standalone/replacement or radar infill option has seen success in the mitigation of wind farm effects to radar in civilian ATC environments. Airspace users would see no difference in the service provided to them. However, the mitigation principle requires further research to determine acceptability by each ANSP. As such, the change sponsor is unable to fully determine what impact this option may have at this stage.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	This DO does not include the implementation of TMZ airspace solution and is therefore not relevant in this situation.	Not Applicable
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace	As the use of an infill radar solution would be used to mitigate against the	Met

Design Principle		Summary of Assessment	Evaluation
	affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	clutter that wind turbine generators in a specific location have on radar displays. As a technical solution, the various radars operating together would provide a solution across only the affected area.	

Table 8 – Option 3.

2.6.1 Use of Infill Radar Conclusion

This option requires a suitable site or infill radar solution to be identified that includes provision of suitable power and telecommunications links. A new radar will itself require planning consent which may not be granted. The EA Hub sites are located a minimum of 30km or more from land and require offshore siting planning consent activity. Furthermore, it is estimated that the upfront cost of a suitable infill radar solution would be at least £10.5m; not including any land lease or necessary utilities.

The CS considers this option is a technical solution that lies outside the scope of CAP 1616; it could potentially be an option in the future.

For now, this option is considered unviable and has therefore been rejected.

2.7 DPE Option 4 – Class D or E Controlled Airspace

Introduction of Controlled Airspace (Class D or E)	**Reject**
The introduction of Class D controlled airspace provides a known traffic environment which allows aircraft to operate under both under Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). Class E controlled airspace enables flight under both IFR and VFR. IFR flights must obtain an ATC clearance before entering Class E airspace and comply with ATC instructions.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Safety will be compromised as radar clutter presented by the detection of the EA Hub wind turbines will still be generated on Cromer PSR ATC radar displays. This will lead to a loss of situational awareness for controllers with a consequent detrimental impact on safety.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	The introduction of controlled airspace would increase the complexity of the local airspace design and would act as a barrier to some classes of airspace user. This runs contrary to the objectives of airspace modernisation and CAA policies.	Not Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	If controlled airspace was introduced, rerouting of aircraft not able to comply with requirements is likely to take place, increasing the environmental impact of additional track mileage for the small number of aircraft that operate in the area. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service	The creation of controlled airspace does not include any blanking of the Cromer PSR system. The wind turbine induced radar clutter will still be received and lead to a lack of situational awareness, seduction of	Not Met

Design Principle		Summary of Assessment	Evaluation
	providers and other aviation stakeholders such as nearby airports operators.	radar tracks and other radar effects. The creation of controlled airspace would also add complexity for local ANSPs and affect all stakeholders.	
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	The introduction of different classes of airspace would be compatible with both civil and military regulations. However, there may well be impacts that might affect MOD requirements.	Partial
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	Those airspace users unable or unwilling to comply with the rules required to operate in the various classes of controlled airspace would need to route around it. This might create displacement and funnelling of aircraft leading to an increased risk of the loss of safe separation. However, due to the low numbers of aircraft involved, it is unlikely there would be a much-heightened risk compared to today.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Not relevant in this situation.	Not Applicable
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option could co-exist with the existing background airspace classifications but would require a portion of controlled airspace to be established where currently there is uncontrolled airspace.	Partial
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	The volume of airspace that it would be necessary to re-configure as controlled airspace would probably not align well with this 'minimum' requirement; for that reason it has not been designed in detail at this point in the ACP process.	Partial

Table 9 – Option 4.

2.7.1 Introduction of Controlled Airspace (Class D or E) Conclusion

This option introduces Class D controlled airspace which allows aircraft to operate under both under Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). Class E controlled airspace enables flight under both IFR and VFR. IFR flights must obtain an ATC clearance before entering Class E airspace and comply with ATC instructions.

With this option, safety would be comprised due to the continued detection of radar clutter which could lead to a loss of SA for controllers. The introduction of classified airspace would increase the complexity of the current airspace and limit its use by other air users. Other air users needing to route around the area would generate increased emissions. From a safety and policy perspective this DO would therefore not be compliant.

This option has therefore been rejected.

2.8 DPE Option 5 – Class E Controlled Airspace and TMZ

Introduction of Class E Controlled Airspace + TMZ	**Reject**
Class E controlled airspace including a TMZ has already been deployed in the UK (for example to replace Class F airways).	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Safety will be compromised as radar clutter presented by the detection of the EA Hub wind turbines will still be generated on Cromer PSR ATC radar displays. This will lead to a loss of situational awareness for controllers with a consequent detrimental impact on safety.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	The introduction of controlled airspace would increase the complexity of the local airspace design and would act as a barrier to some classes of airspace user. This runs contrary to the objectives of airspace modernisation and CAA policies.	Not Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	If controlled airspace was introduced, rerouting of aircraft not able to comply with requirements is likely to take place, increasing the environmental impact of additional track mileage for the small number of aircraft that operate in the area. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such	The creation of controlled airspace does not include any blanking of the Cromer PSR system. The wind turbine induced radar clutter will still be received and lead to a lack of situational awareness, seduction of radar tracks and other radar effects. The creation of controlled airspace	Not Met

Design Principle		Summary of Assessment	Evaluation
	as nearby airports operators.	would also add complexity for local ANSPs and affect all stakeholders.	
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	The introduction of different classes of airspace would be compatible with both civil and military regulations. However, there may well be impacts that might affect MOD requirements.	Not Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	Those airspace users unable or unwilling to comply with the rules required to operate in the various classes of controlled airspace would need to route around it. This might create displacement and funnelling of aircraft leading to an increased risk of the loss of safe separation. However, due to the low numbers of aircraft involved, it is unlikely there would be a much-heightened risk compared to today.	Not Met
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	This DO includes the implementation of TMZ airspace solution; therefore, the necessary CAA policy can be complied with.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option could co-exist with the existing background airspace classifications but would require a portion of controlled airspace to be established where currently there is uncontrolled airspace.	Partial
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	The portion of airspace required to be controlled would probably not fit with the minimum requirement to deliver the solution and has not been designed at this time.	Not Met

Table 10 – Option 5.

2.8.1 Introduction of Controlled Airspace (Class E+) Conclusion

This option provides the introduction of Class E airspace plus a TMZ. However, there is currently no provision to deploy Class E down to surface level in the UK. Although the conspicuity element would be enhanced by a TMZ, safety would be comprised because the radar clutter would still be detected leaving no real mitigation against the risk of loss of controller SA. Establishing controlled airspace would increase complexity and restrict the free flow of aircraft, causing diversions that would potentially increase emissions.

This option has therefore been rejected.

2.9 DPE Option 6 – Radio Mandatory Zone

Radio Mandatory Zone	**Reject**
A Radio Mandatory Zone (RMZ) would require aircraft to be in two-way communication with ATC and provide information pertinent to the flight prior to entering the designated airspace.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Safety will be compromised as radar clutter presented by the detection of the EA Hub wind turbines will still be generated on Cromer PSR ATC radar displays. This will lead to a loss of situational awareness for controllers with a consequent detrimental impact on safety.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	Although the addition of a RMZ would not help to mitigate the effects of the clutter, it would help to offset the negative effects by partially improving safety through the establishment of 2-way communication between the aircraft and the control agency. However, for those unable to comply with the RMZ requirements it would present a barrier to the integration of some airspace users; this would be against current policy.	Partial
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	If the aircraft user did not have the required RT licence or radio equipment then they may have to route around the RMZ airspace, increasing track mileage and emissions, causing a greater environmental impact. additional track mileage and be less expeditious. Due to the location of the Wind farms (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change	A RMZ created in the airspace above the EA Hub Wind Farm would provide a degree of situational awareness to	Not Met

Design Principle		Summary of Assessment	Evaluation
	proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	the controller about the nature of the aviation within the airspace. However, it would not prevent the generation and display of false tracks with the associated loss of situational awareness.	
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option is expected to have little impact on the MOD traffic, but a formal agreement would be to brokered with MOD if they were to pick up the task of controlling authority.	Partial
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	MOD aircraft would be suitably equipped to transit a RMZ, as would the Coastguard and SAR users. A small number of GA users may not be able to comply due to either aircraft fit or the lack of a Radio Telephony (RT) licence.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Not relevant in this situation, however the SARG Policy 123 (TMZ Policy) also refers to the establishment of RMZs.	Partial
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	The airspace required for the solution would be the minimum required.	Met

Table 11 – Option 6.

2.9.1 Radio Mandatory Zone Conclusion

A RMZ is an area of defined dimensions within which a pilot must be in two-way communication with the airspace owner, prior to entry. On entering this area, pilots must provide information pertinent to their flight, but does not require an aircraft to operate a transponder. An RMZ would provide a better level of situational awareness for a controller. However, it would not prevent the generation and display of false tracks/clutter created from the radar detection of East Anglia Hub OSWFs with the associated loss of situational awareness to air traffic controllers. This mitigation does not go far enough to reduce the risk of collision, as ATC would potentially not detect all aircraft within the clutter and would not be able to provide any prescribed separation between aircraft.

Due to the overriding safety concerns this option is rejected.

2.10 DPE Option 7 – RAG Blanking Only

RAG Blanking Only - *'Do Minimum Option'*	**Reject**
Introduction of RAG blanking onto the Cromer PSR in the area of the radar above the EA Hub complex which would remove the EA Hub wind turbine induced radar clutter from showing on radar displays.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Radar clutter would be removed in the radar range gates subject to RAG blanking as well as all radar contacts from aircraft operating in the blanked area. This would have a detrimental impact on ATC surveillance and aviation safety as a full 'air picture' would not be provided to air traffic controllers.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	The use of a RAG blanking without other safeguards in place reduces the safety of the airspace against current operations and therefore does not meet the aims of the AMS.	Not Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Aircraft requiring a continuous radar service may have to re-route or be vectored around the blanked area because there would be unidentified and/or unknown traffic operating inside the blanked area. A re-route would increase the environmental impact because of increased track mileage. Aircraft not under a radar service would be able to transit with no restrictions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change	The presence of a RAG blanked area over the wind farm areas would affect the resilience of the ATC network, as	Not Met

Design Principle		Summary of Assessment	Evaluation
	proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	several airways (See CDS) which route overhead could be affected by the lack of situational awareness if aircraft were operating above it without a transponder. This may also affect the operation within Air-to Air Refuelling Area 9, Low Flying Area 5 and Lakenheath Aerial Tactics Area's North and South as non-military aircraft inside the RAG blanked area without SSR could become a hazard to other airspace users.	
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option is unlikely to meet the requirements of MOD who may be concerned by the lack of radar coverage in the area that would create a 'black hole' leading to safety concerns.	Not Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The use of RAG blanking over the wind farm may not suit certain airspace users who rely on ATC being able to 'see' them on radar to provide relevant traffic information, particularly when operating in marginal weather conditions.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy[1].	This DO does not include the implementation of TMZ airspace solution; therefore, the necessary CAA policy cannot be complied with.	Not Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to	The portion of airspace that needed to have the RAG blanking applied would be the minimum required.	Met

[1] SARG Policy Statement: Policy for Radio Mandatory Zones and Transponder Mandatory Zones (13 Jan 2022).

Design Principle		Summary of Assessment	Evaluation
	counter the effects of wind turbine generators on ATC surveillance infrastructure.		

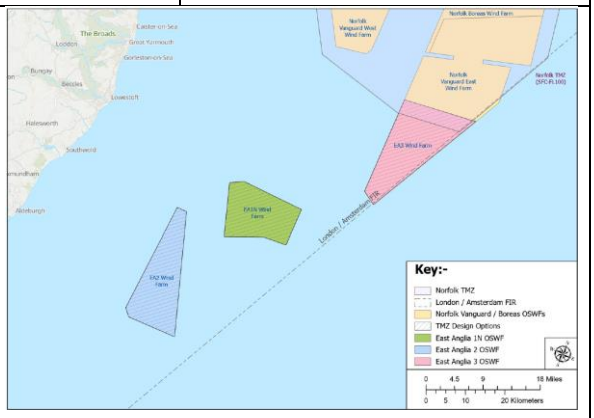
Table 12 – Option 7.

2.10.1 RAG Blanking Only Conclusion

RAG blanking involves removing received radar clutter from the ATC Radar Data Display Screen (RDDS) to avoid any confusion for a controller. However, this also means that within the area of the RAG the PSR will also not display any primary radar aircraft returns. RAG blanking effectively creates a 'black hole' in the radar coverage overhead the wind farm location. Therefore the use of RAG blanking in isolation will not provide a suitable mitigation.

Blanking of the Cromer PSR systems without an associated TMZ is not a viable option and is rejected.

2.11 DPE Option 8 – TMZ (3) Only

TMZ Only (without RAG blanking)	**Reject**
This option provides the placement of a TMZ over the proposed EA OSWF sites perimeter without the use of RAG blanking. This would not remove the EA Hub wind turbine induced radar clutter from showing on the Cromer PSR displays.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	Without the use of RAG blanking applied to the TMZ area, wind turbine induced primary radar clutter will negatively affect the degree, accuracy and timeliness of the instructions, advice, and information a controller is able to provide to pilots within (and adjacent to) the TMZ, with consequent impacts on safety.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents, however, the presence of clutter will not maintain or enhance levels of safety.	Not Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Aircraft requiring a continuous radar service may have to re-route or be vectored around the area of clutter, increasing the environmental impact of additional track mileage. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial

Design Principle		Summary of Assessment	Evaluation
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	The network would be affected by the application of a TMZ with no associated RAG blanking as there may be a requirement to avoid the clutter in order to continue to prove a radar service; this could increase ATC workload and delay transits.	Partial
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option assumes that a formal agreement would be agreed with MOD for them to operate as the controlling authority. The option would not impact MOD air users who will have the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The use of RAG blanking over the wind farm may not suit certain airspace users who rely on ATC being able to 'see' them on radar to provide relevant traffic information, particularly when operating in marginal weather conditions.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to	The portion of airspace that needed to have the TMZ applied would be the minimum required.	Met

Design Principle		Summary of Assessment	Evaluation
	counter the effects of wind turbine generators on ATC surveillance infrastructure.		

Table 13 – Option 8.

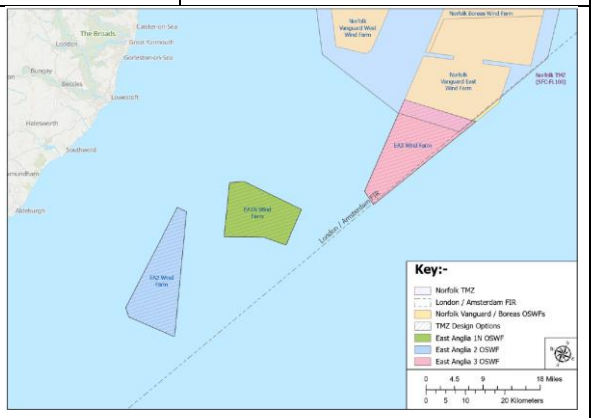
2.11.1 TMZ Only Conclusion

The objective of establishing a TMZ, is not to prevent aircraft from operating near the wind turbines, merely to require that they operate a transponder when entering the TMZ. The TMZ area would be the minimum required to restrict non-transponder equipped aircraft overflying the EA OSWF sites.

A TMZ only option, without the removal of wind turbine clutter through blanking, will not provide sufficient mitigation against clutter generated by the wind turbine generators.

A TMZ only option without RAG blanking is therefore rejected.

2.12 DPE Option 9 – TMZ (3), RAG Blanking, No Buffers

TMZ and RAG Blanking Variant Option 9	**Reject**
This option involves the placement of a TMZ over the OSWF locations in addition to the use of RAG blanking to remove associated wind turbine induced radar clutter from the Cromer PSR ATC displays. This option does not introduce any safety buffers.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. However, there is no 2nm TMZ buffer which reduces any chance of a controller identifying pop-up traffic and taking the necessary action when aircraft appear in close proximity to the TMZ, and before blanking takes effect. There is therefore a risk that non-transponding aircraft could stray into the TMZ, reducing safety in the area.	Not Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This solution does meet the aims of the AMS and associated Government Policy Documents. It maintains levels of safety and allows for future integration of future users.	Met
MDP3	**Environment:** The airspace change proposal should deliver the	There could still be aircraft that do not operate a transponder that need to route around the proposed TMZ	Partial

Design Principle		Summary of Assessment	Evaluation
	Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	area, increasing the environmental impact of additional track mileage. If a controlling authority were to be nominated, then this would reduce the likelihood of a re-route for non-transponding aircraft but would not eliminate it. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The provision of a TMZ with a RAG blanking solution in place would mean that, assuming participating aircraft are equipped with a transponder, no change would be expected against current day operations to aircraft operators. Some GA aircraft may not have the required transponder, but these aircraft, operating at these ranges from the coastline are expected to be of limited numbers.	Partial
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed	Adherence to SARG Policy 123 requirements would ensure the	Met

Design Principle		Summary of Assessment	Evaluation
	TMZ complies with the CAA TMZ Policy.	establishment of a TMZ complies with CAA policy and regulation.	
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution.	Met

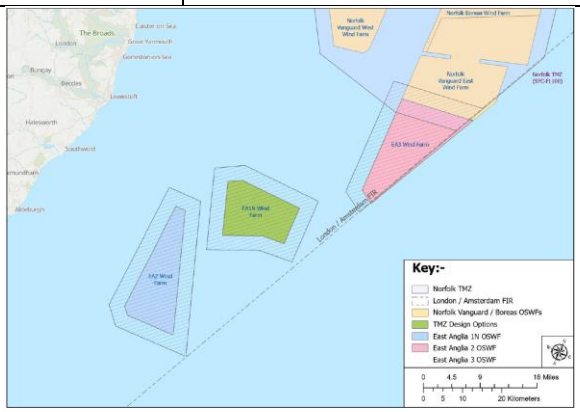
Table 14 – Option 9.

2.12.1 TMZ with RAG Blanking and No Buffers Conclusion

The combination of a TMZ and RAG blanking means this solution reduces the amount of primary radar clutter visible to controllers using the Cromer PSR. The main objective of this option is to provide a known traffic environment within the immediate vicinity of the OSWF through the use of aircraft SSR transponders. Additional procedural mitigation may be developed by the controlling authority (if one is nominated) to allow aircraft that are not fitted with a transponder to transit through the airspace. However, the lack of a 2nm safety buffer leaves an identified safety risk without appropriate mitigation.

A TMZ with RAG Blanking but no safety buffer therefore rejected on safety grounds.

2.13 DPE Option 10 – TMZ (3), RAG Blanking, Norfolk TMZ Overlap

TMZ and RAG Blanking Variant Option 10	**Reject**
This option provides three distinct TMZs and RAG blanking airspace solution. Each TMZs perimeter is extended to include a 2nm buffer within established UK airspace. In this option, the EA3 TMZ overlaps the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. However, due to the OSWF proximities to each other this design option does establish two distinct funnelling areas between the proposed TMZs. These funnels could increase the risk of mid-air collision (MAC) or TMZ infringement.	Not met

Design Principle		Summary of Assessment	Evaluation
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. However, it does introduce a further safety concern associated with funnelling.	Partial
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft may elect to route around the group of TMZ's avoiding the funnelling between EA1N and EA2. This would increase track mileage and increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The provision of a TMZ with a RAG blanking solution in place would mean that, assuming participating aircraft are equipped with a transponder, no change would be expected against current day operations to aircraft operators. Some GA aircraft may not have the	Met

Design Principle		Summary of Assessment	Evaluation
		required transponder, but these aircraft, operating at these ranges from the coastline are expected to be of limited numbers. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft; it does however introduce the funnelling described earlier that may offset the advantage gained by any buffer.	Partial

Table 15 – Option 10.

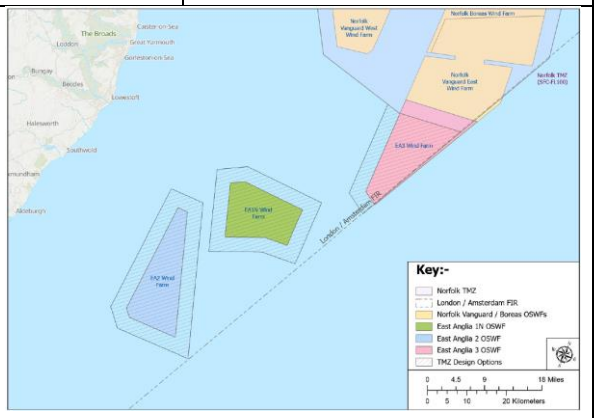
2.13.1 TMZ with RAG Blanking and Norfolk Overlap Conclusion.

This option provides three distinct TMZs and RAG blanking airspace solution. Each TMZs perimeter is extended to include a 2nm buffer around the consented area within established UK airspace. This option also overlaps the Norfolk TMZ perimeter.

A TMZ buffer zone aims to increase safety. However, due to the proximity of the southerly wind farms EA1N and EA2, an adequate buffer zone reduces the gap between the two TMZ's to only 1.6nm, leading to an increased risk of TMZ infringement by a non-transponding aircraft. In addition, the TMZ's various shapes would be unsympathetic to controllers and pilots which would unnecessarily increase their workloads.

This option is therefore rejected because of the safety concern associated with MAC and/or TMZ infringement.

2.14 DPE Option 11 – TMZ (3), RAG Blanking, Norfolk TMZ Adjoined

TMZ and RAG Blanking Variant Option 11	**Reject**
This option provides three distinct TMZs and RAG blanking solution. Each TMZs perimeter is extended to include a 2nm buffer within established UK airspace. The EA3 windfarm <u>does not</u> overlap the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. However, due to the OSWF proximities to each other this design option does establish two distinct funnelling areas between the proposed TMZs. These funnels could increase the risk of MAC or TMZ infringement.	Not met

Design Principle		Summary of Assessment	Evaluation
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. However, it does introduce a further safety concern associated with funnelling.	Partial
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft may elect to route around the group of TMZ's avoiding the funnelling between EA1N and EA2. This would increase track mileage and increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The provision of a TMZ with a RAG blanking solution in place would mean that, assuming participating aircraft are equipped with a transponder, no change would be expected against current day operations to aircraft operators. Some GA aircraft may not have the	Met

Design Principle		Summary of Assessment	Evaluation
		required transponder, but these aircraft, operating at these ranges from the coastline are expected to be of limited numbers. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification. However, it is vulnerable to the outcome of the planned Norfolk TMZ to the north of EA3. If this does not come to fruition, part of the EA3 TMZ will not be completed.	Partial
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft; it does however introduce the funnelling described earlier that may offset the advantage gained by any buffer. This option does not overlap the Norfolk TMZ.	Partial

Table 16 - Option 11.

2.14.1 TMZ with RAG Blanking and Norfolk TMZ Adjoined Conclusion

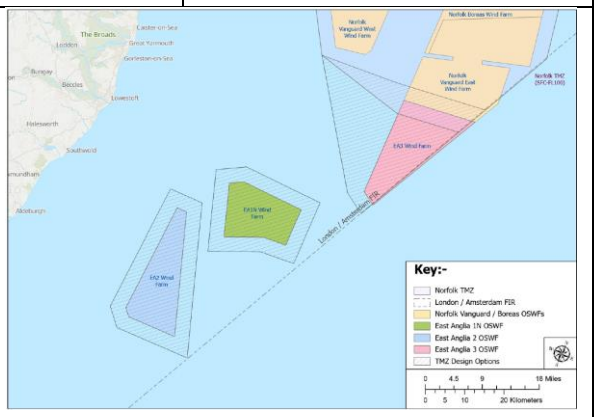
This option provides three distinct TMZs with a buffer zone and RAG blanking. The perimeters of EA1N and EA2 TMZs are extended to include a 2nm buffer around the consented area within established UK airspace. However, this is not extended along the northern edge of the EA3 TMZ as this option does not overlap the Norfolk TMZ.

The addition of a TMZ buffer zone aims to increase safety, but the reduced gap between EA1N and EA2 may offset this advantage. The risk of TMZ infringement is

therefore increased compared to other options and the TMZ areas would be unsympathetic to controllers and pilots, unnecessarily increasing their workloads. The lack of a TMZ buffer on the Northern edge of EA3 means that this option is not future proofed should the Norfolk TMZ not go ahead as planned.

Due to the safety concerns and vulnerability against the Norfolk TMZ this option is rejected.

2.15 DPE Option 12 – TMZ (3), RAG Blanking, Extended Norfolk TMZ Boundary

TMZ and RAG Blanking Variant Option 12	**Reject**
This option provides three distinct TMZs and RAG blanking solution. The EA1N and EA2 TMZs perimeter is extended to include a 2nm buffer. However, the EA3 TMZ provides an extended shape to simplify the perimeter boundary between the proposed EA3 TMZ and the Norfolk TMZ. This option also includes an overlap into the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. However, due to the OSWF proximities to each other this design option does establish two distinct funnelling areas between the proposed TMZs. These funnels could increase	Not Met

Design Principle		Summary of Assessment	Evaluation
		the risk of MAC or TMZ infringement.	
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. However, it does introduce a further safety concern associated with funnelling.	Partial
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft may elect to route around the group of TMZ's avoiding the funnelling between EA1N and EA2. This would increase track mileage and increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft,	The provision of a TMZ with a RAG blanking solution in place would mean that, assuming participating aircraft are equipped with a transponder, no change would be expected	Partial

Design Principle		Summary of Assessment	Evaluation
	including general aviation and other civilian airspace users.	against current day operations to aircraft operators. Some GA aircraft may not have the required transponder, but these aircraft, operating at these ranges from the coastline are expected to be of limited numbers. The addition of a safety buffer mitigates further risk as highlighted in MDP1 above. However, in order to simplify the shape of the TMZ and buffer, this option has utilised a larger volume of airspace.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft; it does however introduce the funnelling described earlier that may offset the advantage gained by any buffer. An additional volume of airspace is allocated to the EA3 TMZ/Norfolk TMZ join to provide a more sympathetic shape in this area for airspace users.	Partial

Table 17 - Option 12.

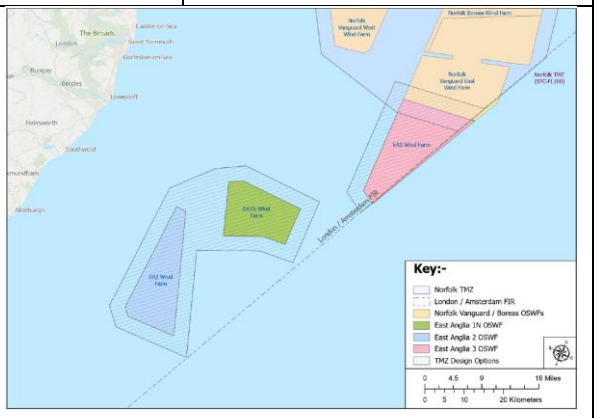
2.15.1 TMZ with RAG Blanking and Extended Norfolk TMZ Boundary Conclusion

This option provides three distinct TMZs with a buffer zone and RAG blanking. The perimeters of EA1N and EA2 TMZs are extended to include a 2nm buffer around the consented area within established UK airspace. This option also includes the use of an extended volume of airspace next to EA3 to simplify the shape for controllers and pilots. This option overlaps the Norfolk TMZ.

The addition of a TMZ buffer zone aims to increase safety, but the reduced gap between EA1N and EA2 may offset this advantage. The risk of TMZ infringement is therefore increased compared to other options and the TMZ areas would be unsympathetic to controllers and pilots, unnecessarily increasing their workloads. The airspace included as EA3's TMZ has been increased to facilitate a more user-friendly shape.

This option is rejected because of the safety concern associated with MAC and/or TMZ infringement.

2.16 DPE Option 13 – TMZ (2), RAG Blanking, Norfolk TMZ Overlap

TMZ and RAG Blanking Variant Option 13	**Accept**
This option provides two distinct TMZs and RAG blanking airspace solution, by combining the previously separate EA1N and EA2 TMZs in earlier options. Each TMZ's perimeter is extended to include a 2nm buffer within established UK airspace. This option also overlaps the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. The gap between the EA1N and EA2's TMZ and RAG blanking areas has been closed, providing a simpler, joint TMZ and eliminating the narrow corridor between EA1N and EA2. A transit	Met

Design Principle		Summary of Assessment	Evaluation
		corridor between EA1N and EA3 is maintained.	
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. It maintains safety and allows for future integration of future users.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft will have to route around the grouped EA1N and EA2 TMZ's. This will increase their track milage and thus increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution. To reduce the risk to other airspace users, the funnel between EA1N and EA2 has been closed whilst access is maintained through the gap between EA1N and EA3.	Met

Design Principle		Summary of Assessment	Evaluation
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft. The funnelling corridor between EA1N and EA2 has been closed to mitigate the associated safety risk.	Met

Table 18 – Option 13.

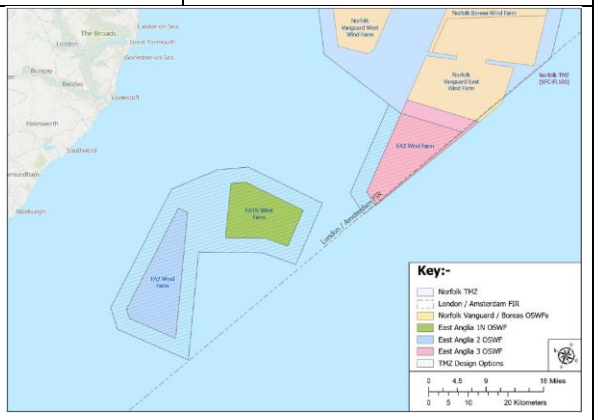
2.16.1 TMZs Combined with RAG Blanking and Norfolk TMZ Overlap Conclusion

This option provides two distinct TMZs with a buffer zone and RAG blanking. Each TMZs perimeter is extended to include a 2nm buffer around the consented area within established UK airspace. This option overlaps the Norfolk TMZ perimeter. The safety benefits of the buffer zone are further complimented by the closure of the funnel between EA1N and EA2. The TMZ's areas are more sympathetic to controllers and pilots than in earlier options.

However, to the south and east of the joint EA1N and EA2 TMZ, up to and along the FIR boundary, an area of airspace has been created that would be unusable by non-transponding aircraft who would need to route around the combined TMZ.

This option eliminates any safety concerns and provides an acceptable solution.

2.17 DPE Option 14 – TMZ (2), RAG Blanking, Norfolk TMZ Adjoined

TMZ and RAG Blanking Variant Option 14	**Reject**
This option provides two distinct TMZs and RAG blanking airspace solution, combining the previously separate EA1N and EA2 TMZs in earlier options. Each TMZ's perimeter is extended to include a 2nm buffer within established UK airspace. This option does not overlap the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. It should be noted that for this DO, there is no overlap into the Norfolk TMZ. The gap between the EA1N and EA2's TMZ and RAG blanking areas has been closed, providing a simpler, joint TMZ and eliminating the	Met

Design Principle		Summary of Assessment	Evaluation
		narrow corridor between EA1N and EA2. A transit corridor between EA1N and EA3 is maintained.	
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. It maintains safety and allows for future integration of future users.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft will have to route around the grouped EA1N and EA2 TMZ's. This will increase their track milage and thus increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution. To reduce the risk to other airspace users, the funnel between EA1N and EA2 has been closed whilst access	Met

Design Principle		Summary of Assessment	Evaluation
		is maintained through the gap between EA1N and EA3.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification. However, it is vulnerable to the outcome of the planned Norfolk TMZ to the north of EA3. If this does not come to fruition, part of the EA3 TMZ will not be completed.	Partial
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft. The funnelling corridor between EA1N and EA2 has been closed to mitigate the associated safety risk. This option does not extend over the Norfolk TMZ.	Met

Table 19 – Option 14.

2.17.1 TMZs Combined with RAG Blanking and Norfolk TMZ Adjoined Conclusion

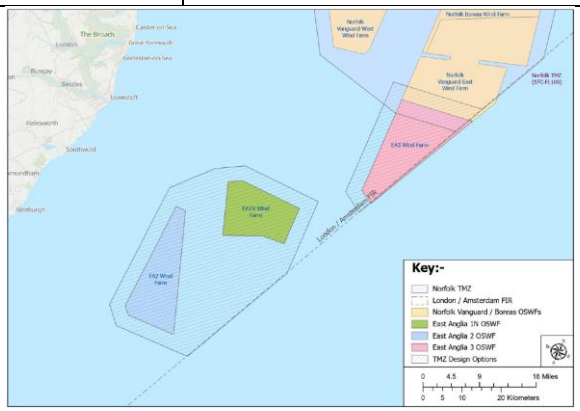
This option provides two distinct TMZs with a buffer zone and RAG blanking. Each TMZs perimeter is extended to include a 2nm buffer around the consented area within established UK airspace. However, this is not extended along the northern edge of the EA3 TMZ as this option does not overlap the Norfolk TMZ. The safety benefits of the buffer zone are further complimented by the closure of the funnel between EA1N and EA2. The TMZ's areas are more sympathetic to controllers and pilots than in earlier options.

However, to the south and east of the joint EA1N and EA2 TMZ, up to and along the FIR boundary, an area of airspace has been created that could be judged unusable for non-transponding aircraft who would need to route around the combined TMZ.

The lack of a TMZ buffer on the Northern edge of EA3 means that this option is not future proofed should the Norfolk TMZ not go ahead as planned.

This option is rejected due to its vulnerability should changes relating to the Norfolk TMZ not progress as planned.

2.18 DPE Option 15 – TMZ (2), RAG Blanking, FIR, Norfolk TMZ Overlap

TMZ and RAG Blanking Variant Option 15	**Accept**
This option provides two distinct TMZs and RAG blanking airspace solution, combining the previously separate EA1N and EA2 TMZs in earlier options, but into a single large TMZ that runs along the London/Amsterdam Flight Information Regions (FIR). Each TMZ's perimeter is extended to include a 2nm buffer within established UK airspace. This option also overlaps the Norfolk TMZ perimeter.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. It should be noted that for this DO, there is an overlap into the Norfolk TMZ. The gap between the EA1N and EA2's TMZ and RAG blanking areas has been closed, providing a simpler, joint TMZ and eliminating the	Met

Design Principle		Summary of Assessment	Evaluation
		narrow corridor between EA1N and EA2. A transit corridor between EA1N and EA3 is maintained.EA1N and EA3 is maintained.	
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. It maintains safety and allows for future integration of future users.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft will have to route around the grouped EA1N and EA2 TMZ's. This will increase their track milage and thus increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ, and RAG blanking would mitigate primary radar clutter appearing on controller's radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution. To reduce the risk to other airspace users, the funnel between EA1N and EA2 has been closed whilst access	Met

Design Principle		Summary of Assessment	Evaluation
		is maintained through the gap between EA1N and EA3. The unusable gap between EA1N, EA2 and the Amsterdam FIR boundary has also been closed with this option.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft. The funnelling corridor between EA1N and EA2 has been closed to mitigate the associated safety risk. Lastly, the unusable airspace Southeast of EA1N and EA2 has been incorporated into this option. Although the combined TMZ uses a larger volume of airspace, as described in para 2.16.1 this airspace would be denied to non-transponding aircraft only and would not therefore be used in either case. This design also creates a more sympathetic shape for airspace users and controllers alike.	Met

Table 20 – Option 15.

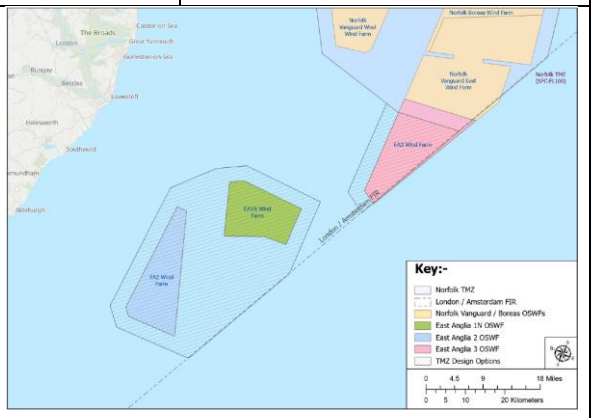
2.18.1 TMZs Combined with RAG Blanking and Norfolk TMZ Overlap Conclusion

This option provides two distinct TMZs with a buffer zone and RAG blanking. Each TMZs perimeter is extended to include a 2nm buffer around the consented area within established UK airspace. The safety benefits of the buffer zone are further complimented by the closure of the funnel between EA1N and EA2. The TMZ's areas are more sympathetic to controllers and pilots than in earlier options. This option overlaps the Norfolk TMZ.

The 'unusable' airspace to the south and east of EA1N and EA2 has been incorporated into the TMZ creating a simpler solution for controllers and pilots alike.

This option eliminates any safety concerns and provides the most acceptable solution.

2.19 DPE Option 16 – TMZ (2), RAG Blanking, FIR, Norfolk TMZ Adjoined

TMZ and RAG Blanking Variant Option 16	**Reject**
This option provides two distinct TMZs and RAG blanking airspace solution, combining the previously separate EA1N and EA2 TMZs in earlier options, but into a single large TMZ that runs along the London/Amsterdam Flight Information Regions (FIR). Each TMZ's perimeter is extended to include a 2nm buffer within established UK airspace. This option does not overlap the Norfolk TMZ perimeter.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. It should be noted that for this DO, there is an overlap into the Norfolk TMZ. The gap between the EA1N and EA2's TMZ and RAG blanking areas has been closed, providing a simpler, joint TMZ and eliminating the narrow corridor between EA1N and EA2. A transit corridor between EA1N and EA3 is	Met

Design Principle		Summary of Assessment	Evaluation
		maintained.EA1N and EA3 is maintained.	
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization strategy or Secretary of State and CAA's policy and guidance.	This meets the aims of the AMS and associated Government Policy Documents. It maintains safety and allows for future integration of future users.	Met
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	Non-transponding aircraft will have to route around the grouped EA1N and EA2 TMZ's. This will increase their track milage and thus increase emissions. Due to the location of the wind farm (over the sea) and the specifics of this option, it is expected that there will be no noise impact to communities below 7,000ft and 4,000ft.	Partial
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	This meets the aims of the AMS and associated Government Policy Documents. It maintains safety and allows for future integration of future users.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general aviation and other civilian airspace users.	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution. To reduce the risk to other airspace users, the funnel between EA1N and EA2 has been closed whilst access is maintained through the gap between EA1N and EA3.	Met

Design Principle		Summary of Assessment	Evaluation
		The unusable gap between EA1N, EA2 and the Amsterdam FIR boundary has also been closed with this option.	
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification. However, it is vulnerable to the outcome of the planned Norfolk TMZ to the north of EA3. If this does not come to fruition, part of the EA3 TMZ will not be completed.	Partial
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	Including the TMZ buffer zone, the amount of airspace used is slightly greater than the minimum required. However, this TMZ buffer provides a safer solution by mitigating the risk of infringement by non-transponding aircraft. The funnelling corridor between EA1N and EA2 has been closed to mitigate the associated safety risk. Lastly, the unusable airspace Southeast of EA1N and EA2 has been incorporated into this option. Although the combined TMZ uses a larger volume of airspace, as described in para 2.16.1 this airspace would be denied to non-transponding aircraft only and would not therefore be used in either case. This design also creates a more sympathetic shape for airspace users and controllers alike. Because there is an overlap into the Norfolk TMZ, there is some uncertainty as to whether or not this option meets the BDP3 requirement; it may not be the minimum necessary volume of	Partial

Design Principle		Summary of Assessment	Evaluation
		airspace that is required if the Norfolk TMZ does not progress.	

Table 21 – Option 16.

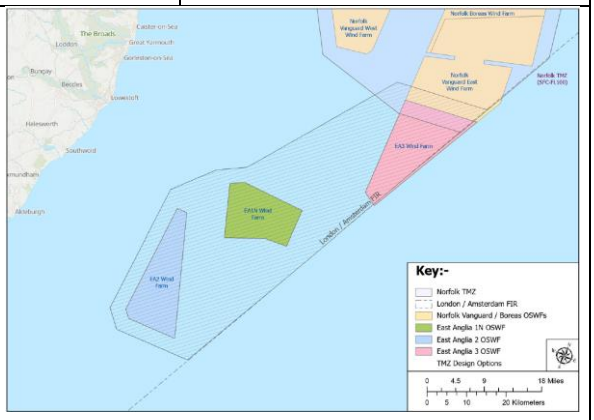
2.19.1 TMZs Combined with RAG Blanking and Norfolk TMZ Adjoined Conclusion

This option provides two distinct TMZs with a buffer zone and RAG blanking. Each TMZs perimeter is extended to include a 2nm buffer around the consented area within established UK airspace. However, this is not extended along the northern edge of the EA3 TMZ as this option does not overlap the Norfolk TMZ. The safety benefits of the buffer zone are further complimented by the closure of the funnel between EA1N and EA2. The TMZ's areas are more sympathetic to controllers and pilots than in earlier options.

The 'unusable' airspace to the south and east of EA1N and EA2 has been incorporated into the TMZ creating a simpler solution for controllers and pilots alike. The lack of a TMZ buffer on the Northern edge of EA3 means that this option is not future proofed should the Norfolk TMZ not go ahead as planned.

This option is rejected due to its vulnerability should changes relating to the Norfolk TMZ not progress as planned.

2.20 DPE Option 17 –TMZ (1), RAG Blanking, Norfolk TMZ Overlap

TMZ and RAG Blanking Variant Option 17	**Reject**
This option provides a single TMZ and RAG blanking airspace solution. The TMZ perimeter is extended, outward from the OSWF boundary, to include a 2nm buffer within established UK airspace. The TMZ perimeter buffers are joined in a direct line ensuring the buffer to each OSWF, then continued along the London/Amsterdam Flight Information Regions (FIR). This option overlaps the Norfolk TMZ.	

Design Principle		**Summary of Assessment**	**Evaluation**
Mandatory Design Principles (MDP)			
MDP1	**Safety:** The airspace change proposal must maintain a high standard of safety and should seek to enhance current levels of safety.	The provision of RAG blanking applied to the TMZ area reduces the impact of any wind turbine induced primary radar clutter. This helps to minimise any effects on the instructions, advice, and information a controller can provide to pilots operating within the TMZ. The addition of a 2nm TMZ buffer improves the time available for a controller to identify pop-up traffic and take the necessary action before blanking takes effect, should an aircraft appear in the buffer area in close proximity to the TMZ. This reduces the chance of a non-transponding aircraft straying into the TMZ and reducing safety in the area. This option is the simplest and safest solution as it provides an easily identifiable single TMZ and buffer to protect EA1N, EA2, and EA3. It also provides resilience against speculative future Norfolk TMZ issues should that development not go ahead as planned.	Met
MDP2	**Policy:** The airspace change proposal should not be inconsistent with relevant legislation, the CAA's airspace modernization	This option utilises an excessive amount of airspace beyond that required to practicably provide the	Not Met

Design Principle		Summary of Assessment	Evaluation
	strategy or Secretary of State and CAA's policy and guidance.	ACP's safety requirements[7]; this would not be consistent with the CAA's airspace modernisation strategy; in particular the requirement for 'simplification, reducing complexity and improving efficiency'.[8]	
MDP3	**Environment:** The airspace change proposal should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance 2017.	This TMZ option will be a significant barrier for any non-SSR equipped GA users that transit between the UK and mainland Europe (and vice versa). Although the numbers are likely to be small, they would now need to navigate either north of the Norfolk TMZ or south of this TMZ option, with a consequent increase in track mileage and CO2 emissions.	Not met
Discretionary Design Principles (DDP)			
DDP1	**Technical 1 (Other aviation stakeholders):** The airspace change proposal should consider the impacts on air navigation service providers and other aviation stakeholders such as nearby airports operators.	It is anticipated that a solution involving a TMZ and RAG blanking would mitigate primary radar clutter appearing on controllers' radar screens, which is expected to maintain the level of flexibility experienced by ANSPs today.	Met
DDP2	**Technical 2 (Ministry of Defence requirements):** The airspace change proposal should be compatible with the requirements of the Ministry of Defence.	This option would not impact the MOD air users who have a high likelihood of having the required equipment and licence.	Met
DDP3	**Technical 3 (Accessibility for all airspace users):** The airspace change proposal should satisfy the requirements of operators and owners of all classes of aircraft, including general	The required size of the RAG blanking area and the TMZ is expected to be the minimum required to deliver a safe solution. The size of the volume associated with this option means that it may not satisfy the requirements of GA and other classes of aviation.	Not Met

[7] SARG Policy 123 – Policy for RMZ & TMZs, Page 3, item 4.3.
[8] CAA CAP 1711 - Airspace Modernisation Strategy 2023–2040 Part 1: Strategic objectives and enablers (Objectives Page 5).

Design Principle		Summary of Assessment	Evaluation
	aviation and other civilian airspace users.		
Bespoke Design Principles			
BDP1	**Policy:** The airspace change proposal should ensure that the design of the proposed TMZ complies with the CAA TMZ Policy.	Adherence to SARG Policy 123 requirements would ensure the establishment of a TMZ complies with CAA policy and regulation.	Met
BDP2	**Technical 3 (Airspace):** The airspace change should be designed to fit with existing background airspace classification and any known planned changes.	This option does not alter the respective airspace classification.	Met
BDP3	**Technical 4 (Airspace):** The volume of airspace affected should be the minimum necessary to deliver a safe solution to counter the effects of wind turbine generators on ATC surveillance infrastructure.	This option utilises an excessive amount of airspace, beyond that required to provide the safe solution to counter the effects of the wind turbine generators.	Not Met

Table 22 – Option 17.

2.20.1 TMZ (1), RAG Blanking and Norfolk TMZ Overlap Conclusion

This option provides a single TMZ and RAG blanking airspace solution around all three windfarm developments. The TMZ perimeter south eastern perimeter aligns with the London/Amsterdam Flight Information Regions (FIR). This option also overlaps the Norfolk TMZ. Whilst arguably the safest and simplest option, the sheer volume of airspace used is beyond what is required and the size imposes a non-compliance with policy and other design principles, and notably may have the most significant effect from an environmental perspective.

This option is therefore rejected.

3 Design Principle Evaluation – Outcome

3.1 Summary of Options

Each of the proposed DOs within the Suitable List has been assessed against the DPs produced during Stage 2 of the CAP 1616 process. A summary of the assessment is shown below in Table 23 below. This table aligns with the required format detailed in CAP 1616H.

Design Options[9]	MDP1	MDP2	MDP3	DDP1	DDP2	DDP3	BDP1	BDP2	BDP3	DPE Outcome
Option 0 (*'Do Nothing Option'*)	M	M	M	M	M	M	M	M	M	**Reject** – To be carried forward for comparison purposes only.
Option 1	NM	NM	P	NA	NM	P	NA	M	NM	**Reject**
Option 2	NM	NM	M	P	P	P	NA	M	NM	**Reject**
Option 3	P	M	M	P	NM	P	NA	M	M	**Reject**
Option 4	NM	NM	P	NM	P	P	NA	P	P	**Reject**
Option 5	NM	NM	P	NM	NM	NM	M	P	NM	**Reject**
Option 6	NM	P	P	NM	P	P	P	M	M	**Reject**
Option 7 (*'Do Minimum Option'*)	NM	NM	P	NM	NM	P	NM	M	M	**Reject**
Option 8	NM	NM	P	P	M	P	M	M	M	**Reject**
Option 9	NM	M	P	M	M	P	M	M	M	**Reject**

[9] Key: NM = Not Met, M = Met, P = Partial, NA = Not Applicable.

Design Options[9]	MDP1	MDP2	MDP3	DDP1	DDP2	DDP3	BDP1	BDP2	BDP3	DPE Outcome
Option 10	NM	P	P	M	M	M	M	M	P	**Reject**
Option 11	NM	P	P	M	M	M	M	P	P	**Reject**
Option 12	NM	P	P	M	M	P	M	M	P	**Reject**
Option 13	M	M	P	M	M	M	M	M	M	**Accept**
Option 14	M	M	P	M	M	M	M	P	M	**Reject**
Option 15	M	M	P	M	M	M	M	M	M	**Accept**
Option 16	M	M	P	M	M	M	M	P	P	**Reject**
Option 17	M	NM	NM	M	M	NM	M	M	NM	**Reject**

Table 23 - DPE Outcome Matrix Summary

3.2 Conclusion

As you see from the table above, 17 Design Options were reviewed as part of this DPE. Options 1-6 will not be taken forward, primarily due to the lack of a TMZ and RAG blanking solution. Options 1-6 failed to meet at least one DP, with the majority failing to meet 2 of the MDPs.

Options 7-17 all included a TMZ and RAG blanking solution. Options 7-12 will not be carried forward, primarily due to failing MDP 1 (amongst other failures). Options 14 and 16 will not be carried forward due to their vulnerability relating to potential changes to the Norfolk TMZ not progressing as planned.

Therefore, the viable options below (options 13 and 15) will be carried forward for stakeholder engagement into the Stage 3 CONSULT/ENGAGE phase of the CAP 1616 ACP process:

- **Option 13** – This option provides two distinct TMZs and RAG blanking airspace solution. Each TMZs perimeter is extended to include a 2nm buffer within established UK airspace. This option overlaps the Norfolk TMZ perimeter.
- **Option 15** – This option provides two distinct TMZs and RAG blanking airspace solution. Each TMZs perimeter is extended to include a 2nm buffer within established UK airspace. The EA1N/EA2 combined TMZ is extended to the London/Amsterdam Flight Information Regions (FIR). This option overlaps the Norfolk TMZ perimeter.

In addition to the design option considerations for a TMZ solution, it must be noted that as per the CDS[10], and as seen in Figure 2 below, the TMZ above EA2 OSWF would require a sectored approach into two components (A & B). Sector B (southern sector) would be from SFC to FL85 to accommodate for the existing Clacton CTA Sector 5's lower limit (Class C airspace). Sector A remains a standard TMZ vertical upper limit (SFC-FL100). Examples of sectorisation can be found in both the London (Area A & B) and Burbo Bank (Areas A-C) TMZ[11].

Please note that although it has been rejected in the DPE, the 'Do-Nothing' option shall be taken forward into Stage 3 CONSULT/ENGAGE for comparative purposes only as the baseline scenario for stakeholders.

3.3 Next Steps

As part of a pre-scaled Level 3 ACP the CAP 1616H there is no requirement for the CS to conduct an Initial Options Appraisal (IOA)[12], unlike higher level assigned ACPs (1 & 2). The only exception to this requirement is if the CAA specifies a requirement to do so, which has not been requested.

The accepted options contained within the Comprehensive List of Viable Options (See 3.2) will progress into Stage 3, CONSULT/ENGAGE, of the CAP 1616H process.

[10] Current-Day Scenario, CAA Airspace Change Portal. Airspace change proposal public view (caa.co.uk) Current-Day Scenario, Issue 2, Figure 9.
[11] UK Civil AIP ENR 2.2 – Section 4, Enroute Transponder Mandatory Zones.
[12] CAP 1616H Chapter 2, page 14, 2.21

During consultation, all stakeholders will be given the opportunity to comment on the design options.

Additionally in Stage 2, the CS will complete a Habitat Regulations Assessment (HRA) early screening criteria laid out in CAP 1616i, Environmental Assessment Requirements and Guidance for ACPs.

4 References

Ref	Title (Link)	Origin
[Ref 001]	CAP1616H: Guidance on Airspace Change Process for Level 3 and Pre-Scaled Airspace Change Proposals V1 Issue date: 23 Nov 2023	CAA
[Ref 002]	ScottishPower Renewables (UK) Ltd East Anglia Hub Windfarms Mitigation Created November 2023 Ref ACP-2023-079 (Link)	Change Sponsor
[Ref 003]	East Anglia Hub ACP-2023-079 Design Principles: Stakeholder Engagement V1 Issued Date 24 May 2024 Ref ACP 2023-079 (Link)	Change Sponsor
[Ref 004]	East Anglia Hub ACP-2023-079 Design Options: V1 Issued Date 24 May 2024 Ref ACP-2023-079 (Link)	Change Sponsor
[Ref 005]	SARG Policy 123: Policy For Radio Mandatory Zones and Transponder Mandatory Zones (V2 - 13-Jan-2022)	CAA

Table 24 - References

A1 Operational Diagrams

A1.1 Aviation Situational Awareness Diagram

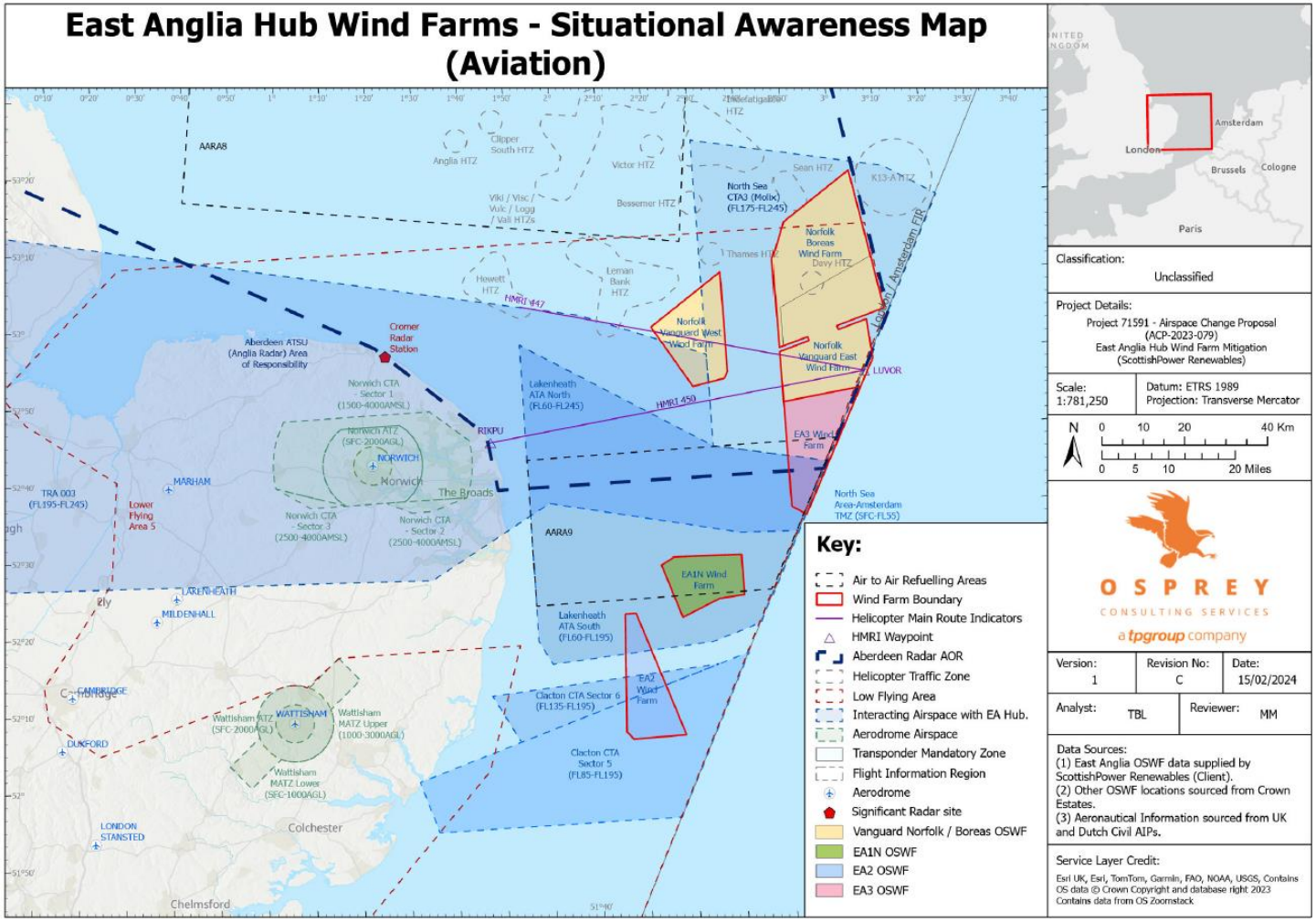


Figure 2 - Operational Diagram - Aviation Situational Awareness Diagram

A2 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
DPE	Design Principle Evaluation

Acronym	Meaning
EFIS	Electronic Flight Information Systems
FL	Flight Level
ft	feet
GA	General Aviation
GW	GigaWatt
HRA	Habitats Regulations Assessment
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
MAC	Mid-Air Collision
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.
NATS	National Air Traffic Service
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 25 - List of Acronyms

A3 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.
Project Records	Term used to describe any project specific record (technical queries, comment sheets, transmittals, calculations etc.). Records are

Term	Meaning
	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[13] (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 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.

[13] SERA 13001 Operation of an SSR transponder

Term	Meaning
'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 26 - List of Useful Terminology