Norfolk Vanguard and Norfolk Boreas Windfarms

Vanguard and Boreas Windfarms

Gateway documentation:

Stage 2 Develop and Assess

2B: Options Appraisal

(Phase 1 Initial)

Including Safety Assessment

VATTENFALL

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Issue 1.0	July 2020	First issue submitted to SARG.

Contents

1. Introduction

1.1 This document forms part of the document set required in accordance with the requirements of the Civil Aviation Publication (CAP)1616 airspace change process.

1.2 This document aims to provide adequate evidence to satisfy Stage 2 Develop and Assess Gateway, Step 2B Options Appraisal (Phase 1 Initial), including Safety Assessment.

1.3 It is advised to read alongside the Stage 2A(i) Design Options Document which gives diagrams and descriptions of each option and the Stage 2A(ii) Design Principle Evaluation, Options Assessment which evaluates each of the design options against the Design Principles described in the Stage 1B Design Principle document.

2. Change Level

2.1 At the assessment meeting it was stated that this Airspace Change Proposal (ACP) was anticipated to be a Level 1 change owing to the potential to affect low level routes in the vicinity. However, as the design options have developed, it has become apparent that the change being proposed will have minimal impact on these routes. Only aircraft without an operating transponder operating over the high sea (47 km off the Norfolk coast), above the Development array areas will be impacted. Hence in accordance with the Levels as defined in CAP1616, it is now expected that this proposal is categorised as a Level 2B change.

2.2 In line with the requirements for a Level 2B change the environmental impact assessment has been conducted on the basis of CO_2 emissions. Owing to the location of this airspace change, there would be no perceptible change to noise impacts to stakeholders on the ground; hence no noise analysis has been undertaken.

3. Options Appraisal

3.1 The Wind Turbines Generators (WTGs) comprising the Norfolk Vanguard and Boreas windfarms could be detectable by the Cromer Primary Surveillance Radar (PSR) and would result in significant 'clutter' on radar displays. This would affect an air traffic controller's ability to identify aircraft via primary radar returns and hence introduce the risk of failing to detect a potential conflict between aircraft. A large number of WTGs, up to 180 in each development in this case, could also interfere with radar tracking and lead to a saturation of the radar processing systems.

3.2 Previous offshore windfarms have required Primary Radar Mitigation Schemes (PRMSs) to be in place prior to construction. Radar Range Azimuth Gating (RAG), commonly known as radar blanking, complemented with a Transponder Mandatory Zone (TMZ) is a commonly used and suitable mitigation scheme.

3.3 This ACP is proposing a Radar Blanking mitigation solution with corresponding TMZ for the Norfolk Vanguard and Boreas windfarms. Deployment of RAG, over the wind farm array area prior to construction commencing will remove the interference caused by the WTGs from the radar display. However, radar blanking will also remove primary radar returns of aircraft within the blanked area. As such, a TMZ will need to be established in the same area, restricting access to non-transponder equipped aircraft. Aircraft transiting the windfarm, will require an operating transponder and will remain detectable to ATC using Secondary Surveillance Radar (SSR).

3.4 The Do Nothing option does not provide any mitigation against radar clutter. It assumes that the wind farm would be built but there would be no changes implemented to prevent radar clutter and radar interference. The evaluation of the Do Nothing option against each Design Principle (DP) concluded that four DPs would not be met due to the anticipated clutter/ interference. This included the high priority safety DP, DP1-Maintain or enhance current levels of safety.

3.5 This ACP has proposed four alternative options which could be used to provide appropriate mitigation against the impacts of WTGs associated with Norfolk Vanguard and Boreas windfarms:

1. Option A: RAG Blanking and TMZ over the proposed windfarm locations.
2. Option B: RAG Blanking over the proposed windfarm locations with the TMZ extended to include a 2 NM buffer.
3. Option C: RAG Blanking over the proposed windfarm locations. Simplified polygon TMZ rubber banded around proposed windfarm locations with no buffer.
4. Option D: RAG Blanking over the proposed windfarm locations. Simplified polygon TMZ rubber banded around the proposed windfarm locations extended to include a 2 NM buffer. (**Preferred**)

3.6 The detailed makeup of the above options is described in the Norfolk Vanguard and Norfolk Boreas windfarms Gateway documentation: Stage 2 Develop and Assess Stage 2A(i): Airspace Change Design Options.

3.7 Evaluation of the design options is detailed in the Stage 2 Develop and Assess Stage 2A(ii): Design Principle Evaluation, Options Assessment.

3.8 Do Nothing (Baseline) Option

3.8.1 The Do Nothing option assumes that the Norfolk Vanguard and Boreas windfarms are constructed, and the changes proposed in the ACP are not implemented. Table 1 indicates the effects on communities and stakeholders should this be the case.

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	There are no proposed changes to air traffic patterns so there will be no impact on noise. The designated area is approx. 47 km off the Norfolk coast.
Communities	Air quality	Qualitative	No change to aircraft trajectories below 1,000 ft.
Wider society	Greenhouse gas impact	Monetise and quantify	With no mitigation scheme there will be no change in aviation greenhouse gas emissions due to trajectory changes. However, the wind farm is anticipated to provide CO_2e benefits of c. 6.3 million tonnes per annum, over its 25 year life. [1] This benefit will only be realised if the airspace change is implemented. (note: with no mitigation solution, under Condition 34[2] the wind farm would be unable to progress. As such the expected CO_2e benefits of c. 6.3 million tonnes per annum would **not** be realised.)
Wider society	Capacity/ resilience	Qualitative	Radar clutter could increase ATC workload and impact ATC capacity, leading to a reduction in ATC resilience.
General Aviation	Access	Qualitative	There would be no change in access for GA aircraft from today.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Qualitative	There would be no increase in effective capacity.
General Aviation / commercial airlines	Fuel burn	Qualitative	No change from today
Commercial airlines	Training cost	Qualitative	N/A – There are no associated airline training costs with the Do Nothing option.
Commercial airlines	Other costs	Qualitative	N/A – There are no associated airline costs with the Do Nothing option.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	N/A – There are no associated infrastructure costs with the Do Nothing option.
Airport/ Air navigation service provider	Operational costs	Qualitative	N/A – The Do Nothing option would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	N/A – There are no deployment costs associated with the Do Nothing option.

Table 1: Options Appraisal (CAP1616 E2) – Do Nothing Option

3.9 Design Options: implementation of a TMZ

3.9.1 The design proposal is for the implementation of RAG blanking, alongside a TMZ. There are four options identified with varying possibilities for the size and parameters of the blanked area and TMZ. Most of the impacts are the same for all four options. The only difference between the options in Table

[1] Calculated using https://www.renewableuk.com/page/UKWEDhome and https://group.vattenfall.com/uk

[2] Condition 34 is a Suspensive condition that prohibits the construction of the windfarm without first putting in place a suitable PRMS.

2 below is regarding the capacity/resilience. This is identified by the grey shading in Table 2 which identifies the expected impact of the design proposal for all four options:

Group	Impact	Level of Analysis	Evidence
Communities	Noise impact on health and quality of life	Qualitative	There are no proposed changes to air traffic patterns so there will be no impact for noise. The designated area is approx. 47 km from the Norfolk coast.
Communities	Air quality	Qualitative	No changes to aircraft trajectories below 1,000 ft.
Wider society	Greenhouse gas impact	Monetise and quantify	The introduction of a RAG Blanking and TMZ PRMS will have no impact on transponder equipped aircraft. All commercial aircraft and the majority >99% of GA aircraft are transponder equipped and will remain unaffected. The introduction of the wind farm is anticipated to provide CO_2e benefits of c. 6.3 million tonnes per annum[3], which is a benefit of this project. This environmental benefit negates any disbenefit caused by increased track millage of any non-transponder equipped aircraft avoiding the proposed TMZ and will only be realised if the airspace change is implemented.
Wider society	Capacity/ resilience	Qualitative	Options A and C will increase ATC workload and impact ATC capacity, leading to a reduction in ATC resilience. Options B & D will have no anticipated impact.
General Aviation	Access	Qualitative	For GA aircraft equipped with an operating transponder there would be no change in access due to the proposed TMZ. Aircraft without an operational transponder would be restricted from entering the TMZ and would be required to fly a route avoiding the TMZ. GA users without an operating transponder wanting to access the TMZ will have a one-off cost implication (approx. £2,000) to purchase a transponder. Given the offshore location (47 km from the Norfolk coastline), the demand for GA aircraft without a transponder wanting to fly over this area is minimal. The vast majority of GA aircraft, >99%, are transponder equipped and will not be impacted by this airspace change.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	There would be no increase in effective capacity. Relative difference in capacity between each of the options is small and would not be likely to affect ATC sector monitor values[4].
General Aviation/ commercial airlines	Fuel burn	Monetise	No expected change to fuel burn for commercial airlines as flight plannable routes will remain unchanged and they will be able to route through the TMZ as currently. GA users may incur increased fuel burn if they are forced to reroute around the TMZ if they do not have the relevant equipage. However, the likely volume of non-transponder equipped aircraft which may pass through this area and any potential increase in fuel burn as a result would be negligible (estimate <2 per week).
Commercial airlines	Training cost	Qualitative	N/A – There are no associated airline training costs with with any Design Option.

[3] Calculated using https://www.renewableuk.com/page/UKWEDhome and https://group.vattenfall.com/uk

[4] Sector Monitor Values indicate the approximate number of aircraft per hour that an ATC sector can accommodate. If traffic demand rises above the monitor value, flow restrictions can be implemented to ensure that ATC are not overloaded to maintain safety. The imposition of flow restrictions can result in delays to aircraft.

Commercial airlines	Other costs	Qualitative	Updates to FMS and flight planning systems will by the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative and quantitative	N/A – There are no associated infrastructure costs with any Design Option
Airport/ Air navigation service provider	Operational costs	Qualitative	N/A – No Design Option will lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	N/A – There are no deployment costs associated with the deployment of a TMZ

Table 2: *Options Appraisal (CAP1616 E2) –Options A-C*
(note rows where there is a difference between options are coloured grey.)

4. Safety Assessment

4.1 Options Appraisal Safety Assessment – Do nothing

4.1.1 Construction of the wind farm without any mitigation against the resulting radar clutter/ interference in place would have the following impacts.

- WTGs will cause clutter on radar displays (~360 WTGs combined in the Norfolk Vanguard and Norfolk Boreas developments)
- This clutter will:
  - Make ATC tracking & identification of non-transponder equipped aircraft in the cluttered area impossible
  - Make ATC tracking & identification of transponder equipped aircraft in the cluttered area difficult due to obscuring.
- This clutter could cause interference & saturation of radar processing due to excessive radar returns which could degrade radar performance across the whole operating are of the radar.

4.1.2 Due to the above impacts, the suspensive Condition 34 requires that appropriate mitigation is put in place. Hence Do Nothing is not a viable option.

4.2 Options Appraisal Safety Assessment – Option D

4.2.1 The Option D– RAG Blanking over the proposed windfarm locations with a simplified polygon TMZ rubber banded around the proposed windfarm locations extended to include a 2 NM, is proposed as the optimum solution to mitigate the impact of the WTGs on the Cromer radar system.

4.2.2 This option will provide:

- RAG Blanking will give effective suppression of all primary radar clutter associated with the WTGs.
- The promulgation of a TMZ over the RAG blanked area will ensure that aircraft within the TMZ area must be transponder equipped and hence will remain visible to ATC via secondary radar.
- The dimensions of the TMZ will include a 2 NM buffer which is adequate to ensure that ATC have sufficient time to identify when an infringement of the TMZ has occurred and to take appropriate action.

4.2.3 Experience from previous wind farm developments has demonstrated that the implementation of radar RAG blanking coupled with an associated TMZ provides safe and effective mitigation against the radar issues associated with WTGs.

4.2.4 Initial qualitative assessment from NATS safeguarding has confirmed that the proposed Option D TMZ design will provide adequate mitigation to fulfil the requirements required of the NERL Cromer: PSR Mitigation Scheme.

4.2.5 Detailed safety analysis will be undertaken in due course by NATS based on the TMZ Option D proposed herein.

4.3 Safety Assessment Conclusion

4.3.1 The proposed Option D TMZ coupled with radar RAG blanking provides a safe and effective mitigation against the radar issues associated with WTGs.

5. Conclusion and Next Steps

5.1 All four options proposed would have the same impacts on communities and stakeholders, except with respect to the capacity/resilience as presented in Table 2 above. Options A and C would have a negative impact whereas Options B and D would have no anticipated impact. The CO_2e benefits which the proposed wind farm will enable annually far outweigh any potential fuel burn costs to non-transponder equipped GA aircraft, which will be negligible.

5.2 Both Option B (RAG Blanking over the proposed windfarm locations with the TMZ extended to include a 2 NM buffer) and Option D (RAG Blanking over the proposed windfarm locations with a simplified polygon TMZ rubber banded around the proposed windfarm locations extended to include a 2 NM) are suitable PRMSs for the Cromer PSR. However, only Option D fully met all the design principles. Option D is preferred due to its simpler TMZ shape. As such, Option D is the only option which will be carried forward to consultation.

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