12 AVIATION AND RADAR

12.1 Introduction

12.1.1 This chapter considers the potential effects of the Proposed Development on existing and planned military and civil aviation activities, including those resulting from impacts to radar. Other potential effects result from the physical presence of the turbines as obstacles, and effects on navigational aids ('Navaids') and radio communication stations.

12.1.2 The chapter includes a description of the assessment methodology that has been adopted, the consultations conducted, relevant policy and legislation, the overall baseline conditions, and measures that will be taken to mitigate any significant effects. It concludes with a summary of the effects and mitigation requirements.

12.1.3 Radio waves are used in a variety of Navaids, radio communication systems and radar; any large structure has the potential to interfere with their propagation and reception. Radars are designed to detect movement, hence a turbine's rotating blades can be interpreted as an aircraft and as a consequence have the potential to affect air traffic management.

12.1.4 Wind turbines can also have an impact on flying simply due to their physical presence. In this respect, they are no different to any other tall obstacles such as pylons or television masts, with recognised criteria for safeguarding the airspace around airfields. Away from airfields, such obstacles are a normal part of the aviation scenery and measures are in place to enable aircraft to safely navigate around them.

12.1.5 The potential effects are highly dependent on the location of the wind farm and on the positions of the individual turbines. In some cases, there are no significant consequences, and no mitigation is required. In other cases, the turbine specification or layout must be designed to accommodate local infrastructure. Mitigation is often available and appropriate to manage effects that cannot be overcome through design, including effects on radar.

12.2 Statutory and Planning Context

12.2.1 The aviation related sections of key legislation, policy and guidance are described below. These place a responsibility on the Scottish Ministers and the Applicant to assess potential impacts on aviation.

Legislation

12.2.2 The Civil Aviation Act 1982 is the primary legislation passed by Parliament. It provides the overall legal framework and grants powers to the Civil Aviation Authority (CAA) and the government to regulate civil aviation in the UK.

12.2.3 This Act includes broad provisions covering areas such as airspace management, aviation safety, and the establishment of regulations for air navigation. The Act gives the Secretary of State the authority to make orders (secondary legislation) regarding various aspects of aviation, including safety, aircraft operations, and obstacles like wind turbines.

12.2.4 The Air Navigation Order 2016 (the ANO) is a form of secondary legislation created under the authority granted by the Civil Aviation Act 1982. The ANO contains detailed regulations that govern air navigation, including specific rules for the marking, lighting, and management of obstacles. This legislation is part of the UK-wide framework governing aviation safety and applies to all obstacles that might affect air traffic, such as tall buildings, towers, masts, and wind turbines.

Article 222 of the Air Navigation Order (2016)

12.2.5 The **ANO,** under the authority of the CAA, is the UK-wide legislation that governs air navigation, including the treatment of obstacles to aviation. This order sets the legal framework for how obstacles on the ground must be marked, lit, and assessed to ensure they do not pose a hazard to aviation.

12.2.6 Article 222 of the ANO deals with the lighting of en-route obstacles, which includes tall structures such as wind turbines, that may pose a hazard to aircraft. It establishes requirements for lighting obstacles to ensure their visibility to pilots, especially during night-time or in poor weather conditions.

12.2.7 The ANO and the International Civil Aviation Organisation regulations (ICAO Annex 14, Volume I. Aerodrome Design and Operations) require that structures away from the immediate vicinity of an aerodrome which are 150 m (492 ft) or more above ground level (AGL) are:

a) *Fitted with medium intensity steady red lights, positioned as close as possible to the top of the obstacle, and also equally spaced at intermediate levels, so far as practicable, between the top lights and ground level with an interval not exceeding 52 m; and*

b) *Illuminated at night, visible in all directions and any lighting failure is rectified as soon as is reasonably practicable.*

12.2.8 This requirement typically applies to wind turbines exceeding 150 meters in height, but turbines of any height could be subject to lighting requirements if located in safeguarded areas around civil or military aerodromes.

12.2.9 Under article 222 of the ANO, the lighting requirements can be changed under provisions given in section 6 which states, *"A permission may be granted for the purposes of this article for a particular case or class of cases or generally".* This allows the CAA to approve a reduced lighting scheme.

Planning Policy

12.2.10 The most relevant sections of National Planning Framework 4 (NPF4) and the Scottish Onshore Wind Policy Statement (OWPS) are highlighted below, with further details provided in **Chapter 5: Landscape and Visual Impact Assessment** of the EIA Report.

12.2.11 Under the Town and Country Planning (Scotland) Act 1997, local planning authorities are responsible for consulting with relevant aviation bodies when considering applications for wind turbine developments.

National Planning Framework 4 (February 2023)

12.2.12 Policy 11 of NPF4 concerns development proposals for all forms of renewables, and states that project design and mitigation will demonstrate how *"impacts on aviation and defence interests and seismological recording"* are addressed.

Scottish Onshore Wind Policy Statement (2022)

12.2.13 Under Chapter 6, Onshore Wind and Aviation Considerations of the Onshore Wind Policy Statement (OWPS), it is noted wind turbines have the potential to impact aviation operations, including, but not limited to, impact on aviation radar.

12.2.14 The OWPS recognises recent progress stating that

> *"Bespoke solutions which alleviated specific, individual objections have been deployed successfully over the last decade or more, releasing significant volumes of renewable generation. However, the pace of deployment necessitated by the climate emergency means we must find a way to alleviate these impacts in an effective, efficient and timely manner. It is also important that solutions are cognisant of the cost of deploying renewable energy, particularly given the need to focus on both security of supply and low-cost generation, given the current international and economic situation*."

12.2.15 Beyond the above statement of need, the OPWS sets out the structure and aims of Industry and Government groups set up to address the issues of radar impacts and aviation lighting; specifically the Onshore Wind Aviation Radar Delivery 2030 group and the Aviation Lighting Working Group. The Aviation Lighting Working Group has developed draft guidance focussed on delivering consistent methods, practices and recommendations to aid in assessing aviation obstacle lighting impacts. The draft guidance is out to consultation with relevant stakeholders.

Planning Circular 2/03: Safeguarding of Aerodromes, Technical Sites and Military Explosives Storage Areas (revised March 2016)

12.2.16 This Circular summarises the Scottish Ministers' understanding of the general effect of the relevant primary or secondary legislation. It contains four annexes. Annexes 1 and 2 describe the formal process by which planning authorities should take into account safeguarding, including in relation to wind energy developments. Annex 3 lists officially safeguarded civil aerodromes and Annex 4 lists planning authority areas containing civil en route technical sites for which separate official safeguarding maps have been issued.

12.2.17 The Circular also refers planning authorities, statutory consultees, developers and others to Civil Aviation Authority (CAA) CAP 764 (CAA Policy and Guidance on Wind Turbines), and Met Office guidelines.

CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level (June 2017)

12.2.18 This policy statement highlights and clarifies the requirements set out in the ANO for the lighting of onshore turbines. Lights should be operated by an acceptable control device (e.g.,

photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX. The control device should turn the lights off when the illuminance rises to a level of 500 LUX or more.

12.2.19 If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.

12.2.20 In practice, the CAA considers every proposed development on a case-by-case basis, taking into account the specific environment, including the existing developments and lighting as well as the benefits of reduced lighting schemes where light pollution is an issue. Where supported by appropriate studies and consultations the CAA may agree to a variation to the lighting requirements specified in the ANO, under the provisions of the ANO article 222 section 6.

Guidance

12.2.21 Cognisance has been taken of the following best practice guidance.

CAP 764: CAA Policy and Guidance on Wind Turbines (Feb 2016)

12.2.22 CAA guidance within CAP 764, sets out recommended consultation and assessment criteria for the impacts of wind turbines on all aspects of civil aviation.

12.2.23 The CAA involvement in the Wind Farm Pre-Planning Consultation Process ceased on 25 December 2010. CAP 764 now states that *"developers are required to undertake their own pre-planning assessment of potential civil aviation related issues."*

12.2.24 Within CAP 764, the CAA provides a chapter describing the *"wind turbine development planning process"*, within which the main civil aviation stakeholders and their interests are listed and described in brief. Table 1 within the guidance document provides an overview of considerations and the following paragraphs detail what developers will need to consider, conducting associated consultations as appropriate.

- The CAA observes in section 2.36 that impact on communications, navigation and surveillance infrastructure alone is not sufficient to support an objection; rather those impacts need to have a negative impact on the provision of an air traffic service.
- The CAA notes in section 5.25 of CAP 764 that *"it is incumbent upon the developer to liaise with the appropriate aviation stakeholder to discuss – and hopefully resolve or mitigate – aviation related concerns without requiring further CAA input. However, if these discussions break down or an impasse is reached, the CAA can be asked to provide objective comment".*
- Section 5.26 of CAP 764 states that *"the CAA will not provide comment on MOD [Ministry of Defence] objections or arguments unless such comments have been requested by the MOD."*

12.3 Consultation Undertaken

12.3.1 Consultation was conducted during the scoping process and more recently for feedback on the proposed aviation obstacle lighting scheme.

12.3.2 There were no objections received within the scoping responses. The MOD identified a lighting requirement, NATS stated no objection and Glasgow, Aberdeen, Edinburgh and Prestwick Airports stated that the site was out-with their safeguarding zones.

12.3.3 Aviation lighting scheme responses have been received from HIAL, the MOD, Police Scotland, the Scottish Air Ambulance Service and the CAA.

12.3.4 **Table 12.1** summarises the consultation responses regarding aviation matters and provides information on where and/or how they have been addressed in this assessment.

Table 12.1: Aviation Consultation Summary

Consultee and Date received	Summary of key comments	Action Taken
MOD; Scoping response by letter to ECU dated 27th Feb 2024	To address low flying it would be necessary for the development to be fitted with MOD accredited lighting in accordance with the requirements of the Civil Aviation Authority, Air Navigation Order 2016. In addition to CAA requirements, the MOD will require the submission, approval, and implementation of an aviation safety lighting specification that details the installation of MOD accredited aviation safety lighting.	The aviation lighting scheme meets the requirements set out in the MOD response. More details on the lighting are provided in 'Aviation Obstruction Lighting' within section 12.8 below. The MOD was sent an aviation lighting design document for review in November 24, which it approved subject to the addition of IR (Infrared) lighting, see below.
NATS; Scoping response by email to ECU of 6th February 2024	The Proposed Development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal.	No action required.
Aberdeen Airport; Scoping response by email to ECU of 21st February 2024	This proposal is located outwith the consultation area for Aberdeen Airport. As such we have no comment to make and need not be consulted further.	No action required.

Consultee and Date received	Summary of key comments	Action Taken
Edinburgh Airport; Scoping response by email to ECU of 16th February 2024	I can confirm the location of this development falls out with our Aerodrome Safeguarding zone for Edinburgh Airport therefore we have no objection/comment.	No action required.
Glasgow Airport: Scoping response by email to ECU of 19th February 2024	This proposal is located outwith our consultation area. As such we have no comment to make and need not be consulted further.	No action required.
Glasgow Prestwick Airport: Scoping response by email to ECU of 31st January 2024	The proposed development lies outwith the GPA safeguarding area and consequently we would have no comment or valid objection to make.	No action required.
AVIATION LIGHTING CONSULTATIONS		
HIAL; By email to Wind Business Support dated 15th November 2024	I can confirm that we are content with the proposed lighting design for Millenium East Windfarm.	Implement the proposed aviation lighting scheme.
MOD; By email to Wind Business Support dated 22nd November 2024	It is acknowledged MOD requirements have changed slightly since the initial consultation and that MOD did not specify IR lighting in the scoping response. However, following review the MOD Low Flying SME has now requested that the turbines are fitted with MOD accredited IR lighting and is content for the developer to light the same turbines that will have the visible spectrum lighting as per the wording in the document.	Implement the proposed aviation lighting scheme, with the addition of IR lighting as requested.
Police Scotland; By email to Wind Business Support dated 16th December 2024	I don't see any issues with the proposal from our side.	Implement the proposed aviation lighting scheme.
Scottish Air Ambulance; By email to Wind Business Support dated 5th November 2024	The proposed cardinal lighting scheme with turbines 1,5,7,8 lit, with the most elevated turbine also being lit would be acceptable from a	Implement the proposed aviation lighting scheme.

Consultee and Date received	Summary of key comments	Action Taken
	Babcock Air Ambulance perspective.	
UK CAA; By letter to Wind Business Support dated 2nd January 2025	Under provisions given in the Air Navigation Order (ANO) Article 222 section 6, the CAA provides for the following variation: • medium intensity steady red (2000 candela) lights on the nacelles of turbines T01, T05, T07 and T08; • a second 2000 candela light on the nacelles of the above turbines to act as alternates in the event of a failure of the main light (note that both lights should not be lit at the same time); • the lights on these turbines to be capable of being dimmed to 10% of peak intensity when the lowest visibility as measured at suitable points around the wind farm by visibility measuring devices exceeds 5km; • infra-red lights to MoD requirements and specification (note that dimming permission is applicable only to visible lights, not infra-red lighting). Intermediate level 32 candela lights are not required to be fitted on the turbine towers.	Implement the proposed aviation lighting scheme.

12.4 Scope and Methodology

Scope of Assessment

12.4.1 The requirement is for the Proposed Development to have no significant residual impacts on aviation infrastructure and operators. This is addressed through consultation with all relevant stakeholders within the consenting process. The task of the Applicant is to independently assess the potential effects and, where significant effects are likely, to enter a dialogue with the relevant stakeholders, ideally in advance of submission of a consent application.

12.4.2 Whilst the aim of pre-submission dialogue is to elicit the approval of all stakeholders, typically solutions are identified but do not reach full maturity in terms of the assessment by the stakeholders and the contracting of mitigation where required. The stakeholders consider dialogue a higher priority and more meaningful once design iterations are completed and an application for consent is made.

12.4.3 An initial scoping assessment identified those stakeholders potentially affected by the Proposed Development. The assessment process involves considering all military and civil aerodromes in the wider area out to approximately 60 km; all radar installations out to the limit of their range; all navigational aids; air-ground-air communications stations and low flying activities. A key sensitivity is the visibility of the Proposed Development to those radars potentially affected. Because of this, radar line of sight modelling has been conducted prior to submission to assess the visibility of the Proposed Development to all relevant radars in the area.

12.4.4 As the Proposed Development includes turbines which are over 150 m in height, there is a statutory requirement for aviation obstacle lighting, meeting the requirements of the ANO. An aviation obstacle lighting scheme was generated, balancing the need for air safety and compliance with the ANO, with the need to minimise night time visual impacts. The scope of the aviation assessment included the design of suitable aviation lighting, and consultation with key aviation stakeholders to gain CAA approval for the proposed lighting scheme.

Baseline Methodology

Desk Study

12.4.5 The study area includes all potentially sensitive receptors. This covers assessment to the limit of range of relevant radars in the area, up to 200km in the case of NATS En-route primary radars and MOD air defence primary radars. Beyond this range the curvature of the earth prevents impacts. Broadly, the distances over which potential civil aviation conflicts have been assessed has been in accordance with the Civil Aviation Authority (CAA) guidance CAP 764 (CAA, 2016), as follows;

- Within 30 km of an aerodrome with a surveillance radar facility. The distance can be far greater than 30 km depending upon a number of factors including the type and coverage of the radar and the particular operation at the aerodrome (this is up to 111km for some aerodromes);
- Within airspace coincidental with any published Instrument Flight Procedure (IFP) to take into account the aerodrome's requirement to protect its IFPs (taken to be up to 60km);
- Within 17 km of a non-radar equipped licensed aerodrome with a runway of 1100 m or more;
- Within 5 km of a non-radar equipped licensed aerodrome with a runway of less than 1100 m;
- Within 4 km of a non-radar equipped unlicensed aerodrome with a runway of more than 800 m;

- Within 3 km of a non-radar equipped unlicensed aerodrome with a runway of less than 800 m.

12.4.6 In addition to which the following assessment distances have been applied;

- 200 km En-route and air defence primary surveillance radars;
- 60 nautical miles (nm), which is 111km, for military air traffic control primary surveillance radars;
- 20 nm, which is 37km, of military Precision Approach Radars;
- 30 km for Meteorological Office rainfall radars;
- 10 km for secondary surveillance radars, aeronautical navigation aids and radio communication stations;
- 30 km for military aerodromes with no radar;

12.4.7 An initial assessment was conducted to identify the assets and stakeholders potentially affected by the Proposed Development. This desk-based assessment included a review of the following:

- Airspace environment:
  - proximity to all aerodromes;
  - airspace class - Proximity to ATS routes;
  - TMZs, Areas of Intense Aerial Activity, Control Areas, restricted areas etc; and
  - proximity to military training areas.
- Checks for physical obstruction
  - through an infringement of obstacle limitation surfaces; and
  - potential for penetration of Instrument Flight Procedure safeguarding surfaces.
- Radar Line of Sight analysis for the following radars:
  - NATS En-route primary and secondary radar;
  - civil and military aerodrome air traffic control radar;
  - military precision approach radar;
  - military Air Defence radar; and
  - weather radar.
- Proximity to other technical sites:
  - navigational aids such as beacons; and
  - air-ground-air comms stations operated by NATS En-Route.

12.5 Existing Environment

12.5.1 The nearest significant aerodrome is Inverness Airport, approximately 62 km to the north-east. The site lies within an area identified as of low priority for military low flying. The

Proposed Development is well beyond the limits of safeguarding areas for any navigational aids or radio communication stations.

12.6 Future Baseline

12.6.1 The baseline is unlikely to change significantly over the life of the project.

12.6.2 There are no plans for additional military or civil radar in the area. Inverness Airport and RAF Lossiemouth are both important in the region and can be expected to remain in use. The Tactical Training Area to the west has not changed for many years and is also likely to remain, but extremely unlikely to expand.

12.7 Assessment of Effects

12.7.1 No aviation impacts are anticipated, reflected in the no objection responses to the scoping submission. Without impacts there are no cumulative issues and no residual impacts.

12.7.2 The above applies to all phases of the development; commissioning, operation and decommissioning.

12.8 Embedded Mitigation

Aviation Obstruction Lighting

12.8.1 As a form of standard mitigation, the turbines will be fitted with aviation obstacle lighting, to meet the requirements of both the CAA and the MOD.

12.8.2 A lighting design was proposed to all relevant aviation stakeholders for approval or comment. All parties, including the CAA and the MOD, have approved the reduced lighting design. Details of the approved design are as follows:

- Medium intensity steady red (2000 candela) lights on the nacelles of turbines 1, 5, 7 and 8 (4 in total);
- a second 2000 candela light on the nacelles of the above turbines would act as alternatives in the event of a failure of the main light;
- the lights on these turbines would be capable of being dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5km;
- IR lighting to MOD specification would be fitted to the nacelles of turbines 1, 5, 7 and 8; these lights would not be dimmed under conditions of good visibility; and
- the lights would operate from dusk until dawn.

12.8.3 There is no requirement for intermediate level lights to be fitted on the turbine towers.

12.9 Additional Mitigation and Residual Effects

12.9.1 There are no anticipated residual or cumulative effects upon aviation. No other mitigation is required.

12.10 Summary of Effects

12.10.1 No aviation impacts are anticipated for all phases of the development; commissioning, operation and decommissioning.

12.10.2 All the relevant consultees responded to the scoping submission with no concerns. This remains the anticipated response for this full submission. The Applicant has also independently assessed the potential effects, with no anticipated aviation impacts.

12.10.3 The CAA and all other aviation stakeholders have approved a lighting scheme consisting of visible spectrum plus infra-red lighting on four of the eight turbines.

12.11 References

Civil Aviation Authority (Feb 2016), 'CAP 764: CAA Policy and Guidelines on Wind Turbines'.

Civil Aviation Authority (Jun 2017), 'Policy Statement - Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level'.

Civil Aviation Authority (Feb 2021), 'CAP 393: The Air Navigation Order 2016 (ANO) and Regulations'.

Scottish Government (revised March 2016), 'Planning Circular 2/03: Safeguarding of Aerodromes, Technical Sites and Military Explosives Storage Areas'.

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