

14 Aviation

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14 Aviation

14.1 Executive Summary

14.1.1 An aviation assessment has been conducted by Wind Power Aviation Consultants Ltd in accordance with the relevant policy and guidance as detailed below. The assessment has concluded that the Proposed Development will have no effect on aviation stakeholders and that no mitigation will be required.

14.2 Introduction

14.2.1 Wind turbines have the potential to affect civil and military aviation. This chapter explains the methodology used to undertake the aviation safeguarding assessment, lists the aviation references used and describes the aviation baseline condition, consultation requirements and mitigations to be applied if required.

14.2.2 The Aviation Chapter has been written by Cdr John Taylor RN (Ret) of Wind Power Aviation Consultants Ltd (WPAC). He has over 35 years' experience as an Air Traffic Controller, Fighter Controller and Aviation Regulator and was head of Air Traffic Control for the Royal Navy. His responsibilities included responding to wind farm consultations on and offshore. Since 2008 his company has provided advice on the interaction between wind turbines and aviation including assessing over 3000 wind turbine proposals and giving evidence at over 20 Inquiries and Appeals in England and Scotland. He has also advised a number of Local Authorities on this issue. His team includes experts on radar propagation and modelling and low flying operations.

14.2.3 This assessment has assessed the design which includes turbine layout F and infrastructure layout 4 as described in Chapter 2. For the purpose of this assessment, it has been assumed that the Proposed Development turbines will not exceed 135 m to blade tip. In addition, the candidate turbine that has been used to inform the assessment has a hub height of 77.8 m and rotor diameter of 117 m. It is recognised that turbine selection will be subject to commercial tendering and availability and the specific parameters of hub height and rotor diameter may therefore vary; it is however unlikely that a change to the hub height or rotor diameter from that assessed would result in a material change in the findings of the assessment.

14.3 Legislation, Policy and Guidance

14.3.1 There are a number of aviation publications, relevant to the interaction of wind turbines and aviation matters, which contain guidance and legislation and cover the complete spectrum of aviation activity in the UK, as listed here.

- Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016 (CAA, 2016);
- CAP 168 Licensing of Aerodromes, Version 11 March 2019 (CAA, 2019);
- CAP 670 ATS Safety Requirements Version 3 June 2019 (CAA, 2019);
- CAP 774 UK Flight Information Services, Edition 3 May 2017 (CAA, 2017);
- CAP 738 Safeguarding of Aerodromes Version 2 Dec 2006 (CAA, 2006);
- CAP 793 Safe Operating Practices at Unlicensed Aerodromes Edition 1 July 2010 (CAA, 2010);
- CAP 493 Manual of Air Traffic Services Part 1 Edition 7.0 2017 (CAA, 2017);
- CAP 393 The Air Navigation Order 2016 and Regulations (CAA,2016)
- CAP 660 Parachuting Edition 5 March 2020 (CAA, 2020);

- Military Aviation Authority Regulatory Article 2330 (Low Flying) (MOD MAA, 2019);
- UK Military Aeronautical Information Publication (MIL AIP) (MOD, 2020);
- UK Aeronautical Information Publications (AIP) (NATS, 2020);
- CAA 1:250,000 and 1:500,000 VFR Charts (NATS 2019, 2020); and
- CAA Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines 01 April 2010 (CAA, 2010).

14.4 Consultation

14.4.1 Consultation should be carried out in accordance with the guidance laid down in 14.3.1.

14.4.2 As shown below there is no requirement to consult with aviation stakeholders except for the Ministry of Defence (MOD) Defence Infrastructure Organisation (DIO) , who will be consulted once the application has been lodged as explained below, 14.5.12.

14.5 Assessment Methodology and Significance Criteria

Study Area

14.5.1 The assessment of effects of the Proposed Development is based upon the guidance laid down in CAA Publication CAP 764 Policy and Guidelines on Wind Turbines Version 6, dated February 2016 with the consultation criteria for aviation stakeholders defined in Chapter 4 of CAP 764. These distances inform the size of the study area and include:

- airfield with a surveillance radar – within 30km;
- non radar licensed aerodrome with a runway of more than 1,100 metres – within 17km;
- non radar licensed aerodrome with a runway of less than 1,100 metres – within 5km;
- licensed aerodromes where the turbines would lie within airspace coincidental with any published instrument flight procedure (ifp);
- unlicensed aerodromes with runways of more than 800 metres – within 4km;
- unlicensed aerodromes with runways of less than 800 metres – within 3km;
- gliding sites – within 10km; and
- other aviation activity such as parachute sites and microlight sites within 3km – in such instance’s developers are referred to appropriate organisations.

14.5.2 CAP 764 goes on to state that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved or within which they will always be objected to. These ranges are intended as a prompt for further discussion between developers and aviation stakeholders.

14.5.3 It is also necessary to take into account the aviation and air defence activities of the MOD as safeguarded by the Defence Infrastructure Organisation (DIO). The types of issues that are addressed in this chapter include:

- Ministry of Defence Airfields, both radar and non-radar equipped;
- Ministry of Defence Air Defence Radars;
- Ministry of Defence Meteorological Radars; and
- Military Low Flying.

14.5.4 It is necessary to take into account the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance systems – a network of primary and secondary radars and navigation facilities around the country.

14.5.5 As well as examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168, Licensing of Aerodromes, to determine whether a proposed development will breach obstacle clearance criteria.

Desk Study

14.5.6 The radar calculation results shown in this Chapter have been produced using specialist propagation prediction software (RView Version 5¹). Developed over a number of years, it has been designed and refined specifically for the task. RView uses a comprehensive systems database which incorporates the safeguarding criteria for a wide range of radar and radio navigation systems. Rview models terrain using the Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50m and has a root mean square (RMS) error of 4m. The results are verified using the Shuttle Radar Topography Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds. By using two separate and independently generated digital terrain models, anomalies are identified and consistent results assured. Rview models the refractive effects of the atmosphere on radio waves and the First Fresnel Zone. A feature of RView is that as well as performing calculations in the manner believed to be most appropriate it also allows comparison with results from simpler models. For example, RView can perform calculations using the true Earth Radius at the midpoint between the radar and the wind turbine or the simplified 4/3 Earth Radius model. If needed, RView is also capable of modelling a range of atmospheric refractive conditions. RView models the trajectory of radar signals at different elevations enabling modelling of both volume surveillance and pencil beam radars as well as the effects of angular sterilisation as applied, for example, in Met Office radars.

Site Visit

14.5.7 No site visit has been required, because a desk based study was more than sufficient.

Assessment of Potential Effects

14.5.8 Assessment of potential effects has been undertaken by identifying whether impacts are anticipated upon aviation and radar infrastructure, and therefore whether aviation stakeholders are anticipated to object to the Proposed Development.

14.5.9 The assessment does not determine significant or non-significant effects, but whether there is a potential effect or no potential effect.

Requirement for Mitigation

14.5.10 Should effects upon aviation and radar infrastructure from the Proposed Development be determined, mitigation measures will be identified and reported.

Assessment of Residual Effects

14.5.11 As per the assessment of potential effects, the assessment will not determine significance but whether the Proposed Development will give rise to a residual effect or not.

Limitations to the Assessment

14.5.12 It is MOD policy not to provide substantive or detailed responses at the pre-application stage and therefore the MOD has not been consulted pre-application.

¹ Rview is WPAC's own bespoke programme produced in house

14.6 Baseline

14.6.1 The Proposed Development is located in an area relatively remote from any aviation facilities. Figure 14.1 shows airspace features up to 5000ft above mean sea level (AMSL) and 14.2 shows a wider area up to 19500ft. in order to show the site location in an aviation context. The Proposed Development is underneath Class G unregulated airspace which extends upwards from ground level to Flight Level 195 (approximately 19,500ft). The closest regulated airspace at low level is Class E regulated airspace designated N560 which takes traffic from Inverness to Wick and beyond. The Proposed Development is 10 km to the north-west of the boundary of that airspace. The Proposed Development is located within restricted airspace designated as R610A, also known as the Highlands Restricted Area (HRA). The boundary is marked by hashed purple lines as shown in Figures 14.1 and 14.2. The HRA covers most of Northern Scotland and is used by the MOD for tactical low flying training.

Licensed Aerodromes

14.6.2 There are no licensed radar equipped aerodromes within 30 km. The closest is Inverness Airport, 65 km to the south, a busy regional airport operated by Highlands and Islands Airports Ltd (HIAL). Due to the lack of other radar facilities in the area, HIAL will often be consulted about proposed wind farm developments well beyond the standard 30 km. For completeness radar line of sight calculations have been undertaken to assess if any of the turbines would be likely to affect the radar.

Unlicensed Aerodromes

14.6.3 There are no unlicensed aerodromes within consultation distance. The closest shown on aviation charts is the microlight site at Rovie Farm, over 17 km to the south-east. Consultation is not required. An online search for private airfields has also been conducted and none identified within consultation distance, however, not all private strips are listed in publications or marked on charts.

Ministry of Defence

14.6.4 The closest military ATC radar facility is at RAF Lossiemouth, 74 km to the south-east. Lossiemouth is a high intensity military base operating Eurofighter Typhoons and Poseidon anti-submarine patrol aircraft. The base facilities are currently being upgraded and this includes the installation of a new primary surveillance radar (PSR). Currently the MOD are safeguarding both the existing Watchman PSR and the planned Thales Star 2000 NG radar due to be installed within the next 12 months.

Air Defence Radar

14.6.5 The closest Air Defence Radar is located at Buchan, near Peterhead, well over 150 km to the south-east.

Military Low Flying

14.6.6 The Proposed Development is located within the Highlands Restricted Area also known as Low Flying Area (LFA)14 (T). The area covers most of Northern Scotland and it is utilised for tactical low flying, however, since the demise of the Tornado, low flying by fast jets has decreased. The entire area is designated as a 'Red' area on the MOD Low Flying Areas Consultation Chart, which is described as: *'a high priority military low flying area likely to raise considerable and significant concerns'*.

NATS En Route Ltd (NERL)

14.6.7 An assessment has been conducted to determine any effect of the Proposed Development on NERL communications, navigation and surveillance infrastructure (CNS). The closest radars in the NERL network are at Alanshill and Perwinnes.

Met Office Radars

14.6.8 The Met Office safeguards its network of radars using a European methodology provided by the Operational Programme for the Exchange of Weather Radar Information known as OPERA. In general, they will object to any turbine within 5km in line of sight and will examine the impact of any turbines within 20km. Where a site is within 20 km, the Met Office will undertake an operational assessment based on three main criteria, having determined if there is a technical effect on the radar. The factors they will consider include the following:

- proximity to airports;
- river catchment response times; and
- population density

14.6.9 In this case the closest Met Office radar is at Hill of Dudwick, north of Aberdeen and well beyond 20 km. There will be no Met Office radar objection to the Proposed Development and consultation is not required.

14.7 Standard Mitigation

14.7.1 Aviation obstruction lighting requirements are laid down in CAA Policy Document at Reference M. In this case as the turbines are less than 150 m to tip and the Proposed Development is not in the vicinity of a licensed aerodrome, there is no requirement for any visible aviation lighting.

14.7.2 However, there will be a requirement for Infra-Red lights to satisfy MOD requirements.

14.8 Receptor Brought Forward for Assessment

14.8.1 The following receptors have been brought forward for assessment of potential effects from the Proposed Development:

- Licensed aerodromes;
- Ministry of Defence;
- Air defence Radar;
- Military Low Flying; and
- NERL.

14.9 Potential Effects

Licensed Aerodromes

14.9.1 Radar line of sight calculations have been undertaken for licenced aerodromes to assess if any of the turbines would be likely to affect the radar. The results are shown in Table 14.1 below. As the radar line of sight is far above the tip height of the Proposed Development (135 m) it is clear that there is no possibility of the turbines being visible to the radar at Inverness Airport. Therefore, at a distance of 65 km there is no requirement to consult with HIAL in relation to the Proposed Development.

Table 14.1 - Radar Line of Sight Results for Inverness Airport Radar

Turbine	Radar Line of Sight (metres AGL)
T1	1438.9

Turbine	Radar Line of Sight (metres AGL)
T2	1458.9
T3	1452.4
T4	1433.6

Ministry of Defence

- 14.9.2 Radar modelling has been conducted for both the existing Watchman PSR and the planned Thales Star 2000 NG radar with the results shown in Tables 14.2 and 14.3 below.

Table 14.2 - RAF Lossiemouth Star 2000 Radar

Turbine	Radar Line of Sight (metres AGL)
T1	309.2
T2	334.6
T3	346.5
T4	331.9

Table 14.3 - RAF Lossiemouth Watchman Radar

Turbine	Radar Line of Sight (metres AGL)
T1	822.8
T2	888.4
T3	896.8
T4	884.8

- 14.9.3 As the radar line of sight is far above the tip height of the Proposed Development (135 m) there is no possibility of the turbines being visible to either PSR at RAF Lossiemouth and there should be no MOD ATC objection.

Air Defence Radar

- 14.9.4 Radar modelling shows that there is no radar line of sight below 1,000 metres AGL and there will be no effect on the radar at Buchan. Therefore, there will be no MOD Air Defence objection to the Proposed Development.

Military Low Flying

- 14.9.5 Detailed examination of low flying charts covering the immediate area also show there are no flow arrows or restrictions in the vicinity of the Proposed Development and a low flying objection is therefore unlikely. The MOD will request that all four turbines be illuminated with MOD specification Infra-Red lights which are not visible to the naked eye.

NATS En Route Ltd (NERL)

- 14.9.6 Radar modelling from the closest radars at Alanshill and Perwinnes has been undertaken which has established that radar line of sight is in excess of 1,000 metres AGL. There is no possibility of any NATS systems being affected by the Proposed Development. NERL will be consulted and are expected to confirm this to be the case.

14.10 Additional Mitigation and Enhancement

- 14.10.1 No additional mitigation than that outlined in Section 14.7 is required.

14.11 Residual Effects

- 14.11.1 There will be no residual effects on aviation and radar receptors or operation.

14.12 Cumulative Assessment

- 14.12.1 As there are no aviation effects predicted to arise as a result of the development.

14.13 Summary

- 14.13.1 The aviation assessment has been conducted following the guidance and policy laid down in CAA CAP764. Radar modelling has also been undertaken which demonstrates that none of the turbines will be visible to any air traffic control, air defence or Met Office radars. The results are very clear and none are marginal. The assessment shows that the Proposed Development will have no effect on any aviation receptors or operations.

Table 14.4 – Summary of Effects

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction, Operation and Decommissioning					
Effects to aviation and radar receptors and operations	None	N/A	Infra-Red lights to satisfy MOD requirements	None	N/A

Table 14.5 – Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	Significance of Cumulative Effect	
			Significance	Beneficial/ Adverse
Effects to aviation and radar receptors and operations	None	N/A	None	N/A

14.14 References

Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016 (CAA, 2016)

CAP 168 Licensing of Aerodromes, Version 11 March 2019 (CAA 2019)

CAP 670 ATS Safety Requirements Version 3 June 2019 (CAA 2019)

CAP 774 UK Flight Information Services, Ed 3 May 2017 (CAA 2017)

CAP 738 Safeguarding of Aerodromes Version 2 Dec 2006 (CAA 2006)

CAP 793 Safe Operating Practices at Unlicensed Aerodromes Ed 1 July 2010 (CAA 2010)

CAP 493 Manual of Air Traffic Services Part 1 Ed 7.0 2017 (CAA 2017)

CAP393 The Air Navigation Order 2016 and Regulations (CAA 2016)

CAP 660 Parachuting Ed 5 March 2020 (CAA 2020)

Military Aviation Authority Regulatory Article 2330 (Low Flying) (MOD MAA 2019)

UK Military Aeronautical Information Publication (MIL AIP) (MOD 2020)

UK Aeronautical Information Publications (AIP) (NATS 2020)

CAA 1:250,000 and 1:500,000 VFR Charts (NATS 2019,2020)

CAA Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines 01 April 2010 (CAA 2010)