Environmental Impact Assessment Report

Teindland Wind Farm

Volume 3

TA A13.1: The Initial Aviation Assessment (WFAS) and Addendum

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WFAS Ltd

Wind Farm Aviation Safeguarding Ltd

Aviation Wind, Solar & Physical Safeguarding

Envams

Aviation Baseline Assessment

Teindland

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Reference Documents

A. Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines.
B. CAP 774 UK Flight Information Services.
C. CAP 168 Licensing of Aerodromes
D. CAP 493 Manual of Air Traffic Services Part 1.
E. CAP 670 Air Traffic Services Safety Requirements.
F. CAP 774 UK Flight Information Services
G. CAP 777 ATC Surveillance Minimum Altitude charts
H. CAP 738 Safeguarding of Aerodromes
I. CAP 793 Safe Operating Practices at Unlicensed Aerodromes
J. CAA Policy Statement of Lighting of Onshore Wind Turbine Generators
K. Military Aviation Authority Traffic Management (3000 series) Instructions.
L. Military Aviation Authority Regulatory Article 2330 (Low Flying)
M. UK Military Aeronautical Information Publication (MIL AIP).
N. UK Aeronautical Information Publications (AIP).
O. CAA 1:250,000 and 1:500,000 VFR Charts.

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Figures

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Tables

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Issue

WFAS Ltd has been tasked with conducting an assessment of the aviation baseline and any associated radar issues/constraints relating to the construction and operation of a wind turbine generator (WTG) development at Teindland in accordance with the consultation criteria specified within this report.

This aviation baseline assessment is to address the direction given within the Scoping Opinion[1] and, as an Aviation Baseline Assessment, is to inform the future strategy for the project in regards of aviation rather than seeking to address any perceived omissions within the original Scoping work.

It is a condition of this report that WFAS Ltd cannot, and will not, be held liable for any loss or damage resulting from any use of the information contained herein. Whilst all reasonable endeavours have been made to ensure the accuracy of the content of this report its accuracy is not warranted. Any information provided by third parties and referred to herein is assumed correct at the time of writing but is subject to constant amendment and is not being continually checked or verified by WFAS after completion of the assessment. The commissioning party agrees to indemnify and hold the author and associates harmless against any losses arising from any use or misuse of the information contained within the document. No third party may rely upon this document, or any information contained therein, without the prior and express written agreement of WFAS.

[1] Teindland Wind Farm proposal, Scoping Opinion on behalf of the Scottish Ministers under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, 16 September 2022.

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Introduction

The development of wind turbines has the potential to cause a variety of adverse effects on aviation during turbine operation. These include (but are not limited to): physical obstructions, the generation of unwanted returns on Primary Surveillance Radar (PSR) and adverse effects on the overall performance of Communications, Navigation and Surveillance (CNS) equipment. A full aviation assessment of the Proposed Development will be undertaken to identify and assess the likely aviation issues associated with the Teindland wind turbine development.

Since there are many issues that need to be considered when assessing the potential impact of proposed developments, the local Air Navigation and Air Traffic Services Providers are best placed to provide expert interpretation of what those impacts might be and how they might affect safety, efficiency and flexibility of their operations. There is a well-established regulatory and policy framework that has been in force for a number of years, but which has been the subject of constant amendment and updating and there are a number of regulatory and guidance documents that have been taken into account and complied with in the preparation of this assessment.

Where there is line-of-sight between turbines and air traffic control radars it is possible that the turbines may be detected by the radar, dependant on atmospheric conditions, and appear as clutter on the controllers' screens; such clutter can have a direct operational impact on air traffic control operations. Similarly, turbines when constructed can act as a physical obstruction either to aviation operations at aerodromes in the vicinity of the development or aircraft transiting the area.

This report presents an assessment of the potential impacts upon aviation arising from the proposed development and focusses largely, but not solely, on radar potential effects. The assessment is based on an extensive experience in assessing wind turbine development proposals, radar and UK airspace together with understanding of the potential for effects and impacts on aviation stakeholders. The report is a result of desk-based consideration of extant regulation, guidance and the evaluation of existing data sources combined with radar modelling.

Taken collectively the reference and guidance sources establish that:

- Officially safeguarded aerodromes and aerodromes with a surveillance radar facility need to be consulted if the proposed wind turbines are within 30km;
- Within airspace coincidental with any published Instrument Flight Procedure (IFP) to take into account the aerodrome's requirement to protect its IFPs;

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- Consultation with the operators of officially safeguarded technical sites is required if the proposed wind turbines are within 10km;
- Further assessment and/or consultation will be required if turbines are planned within:
    - 17km of a licensed aerodrome within a runway of 1100m or more;
    - 5km of a licensed aerodrome with a runway of less than 1100m;
    - 4km of an unlicensed aerodrome with a runway of more than 800m; and/or
    - 3km of an unlicensed aerodrome with a runway of less than 800m.

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

Ministry of Defence

Furthermore, it is necessary to take into account the aviation and air defence activities of the Ministry of Defence (MoD). The types of issues that will be addressed include:

- Ministry of Defence Airfields (radar and non-radar equipped)
- Ministry of Defence Remote Air Traffic Control Radars
- Ministry of Defence Air Defence Radars
- Ministry of Defence Low Flying
- Ministry of Defence Meteorological Radars.

The Ministry of Defence does not stipulate consultation distances for their radars.

National Air Traffic Services Facilities

It will also be necessary to take into account the possible effects of wind turbines upon the National Air Traffic Services (NATS) radar systems – a network of primary and secondary radars and navigation facilities around the country.

No consultation with any affected stakeholder has been undertaken by WFAS at this stage.

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Radar and Wind Turbine Effects on Radar Performance

For the purposes of this assessment it might be useful to have an understanding of the nature of radar propagation, how a radar works and the nature of the interference effects that turbines can have on radars when the turbines are operating.

Radars fall into 2 main categories, Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR).

Primary Surveillance Radar

A PSR has a transmitter which emits a pulse of electromagnetic radiation which is then used to identify the range, direction, or speed of objects such as aircraft, ships, weather formations etc. The radar system measures the time elapsed between the emission of the pulse and the receipt of the reflected energy. If the time period does not alter the algorithms within the system will determine that the reflecting object is not moving (terrain, buildings etc) and the resultant radar return can be "erased" and not presented on the controllers' screen.

When emitted the pulses, or waves, are in phase and when they come into contact with an object are scattered in all directions. The pulse is partly reflected back with a change of wavelength and frequency when the target is moving. Radar returns can be amplified within the algorithms within the radar system which enables radar to detect objects at ranges where other emissions would be too weak to detect. In the case of most ATC radars the main constraint is line-of-sight between the radar and the object being targeted although with some high-powered radars such as Air Defence Radars, it is possible for the radar to detect targets over the horizon.

PSR is susceptible to anomalous propagations i.e. the radar will detect and display reflected radar signals as if they were aircraft and, depending on the type of radar being used, anomalous propagations can prevent a radar controller tracking real aircraft, thus impairing the provision of effective air traffic control services.

Wind turbines have the potential to create 2 adverse effects on primary radar systems:

- Wind turbines act as a reflector presenting a static target to the radar system similar to other reflective surfaces (buildings, electricity pylons etc) except that wind turbines reflect an amount of energy which can be much larger than that caused by an aircraft, especially relatively small military fats jets and light General Aviation (GA) aircraft. With a larger development of turbines the amount of

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reflected energy can "swamp" the receiver rendering it incapable of detecting legitimate targets.

- PSRs will "see" any reflecting object that the radar energy illuminates and this can cause "clutter" on the radar screen and this is especially so with wind turbines. To discriminate between the required targets (aircraft) and the unwanted clutter, the radar ignores static objects and only displays moving targets. However, whilst the turbine mast is static and can be processed as such, the rotating blades of a wind turbine are reflected as a changed radar pulse which the radar receiver detects as a moving target. These reflected returns from the rotating blades are then presented on the controllers' display as primary radar returns and are indistinguishable from those genuine returns originating from aircraft.

The consequences of the effects are that the radar may not be able to distinguish a real aircraft amongst the returns originated by the wind turbines and/or false targets are presented to the ATCO which may appear in conflict with other aircraft, resulting in the issuance of unnecessary avoiding action.

The operational effects/significance of any unwanted clutter on ATC radar displays varies depending on where this clutter is in relation to the aviation operations/flight paths of aircraft. If the area of turbine-induced clutter is in an area of aviation operations (civil or military) or close to a flight path, then this can be problematic for the ATCO. Within aviation the Statutory Consultees are the CAA, NATS and MoD and if there is potential interference as a result of line-of-sight between the development and surveillance radars/radios it can be expected that the MoD or NATS, or both, are very likely to assess the proposal in detail and to raise objections based on their respective base-line assessment processes if they consider that interference effects from any development will impact on aviation operations.

Secondary Surveillance Radar

Secondary Surveillance Radar (SSR) works by the radar, normally (but not always) co-located with the PSR, transmitting an interrogation signal which is received by a transponder (if the aircraft is equipped with one). The aircraft transponder replies with coded information concerning the aircraft identification and height and, very much as with PSR, derives azimuth and range of the aircraft, relative to the radar, based on the time delay between interrogation and reply. As an active "interrogate and respond" system SSR is much less susceptible to interference from wind turbines than PSRs. There can be some effects but these are range dependent between the radar head and the turbines and in this instance are not considered relevant against the provided boundary positions.

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Operational Use of Radar

The operational use of radars within Air Navigations Services provision can be considered in three areas.

- **ATC in the Terminal Environment** - The radar is used to improve the efficiency and safety of aircraft operations for aircraft arriving at, or departing from, an airport. PSR and SSR radar are used to enhance a controller's "situational awareness" within the assigned airspace, normally out from the airport to between 25 – 50nm (approximately 56 to 93km). The boundaries of the volume of airspace for which the controller is responsible will depend on other neighbouring airports, traffic patterns, approach and departure paths etc. As aircraft leave the airspace associated with a particular airport, they are handed to an adjacent radar unit or to an En-Route control facility.

- **ATC in the En-Route or Area Environment** - Provision of radar services in an En-Route, or Area, Environment is conducted in facilities called Area Control Centres (ACC). Each centre has a designated area of airspace, or Flight Information Region (FIR) and is responsible for aircraft routing to or from airports within that FIR and utilising radars capable of longer-range operations, typically 180 to 250nm.

Military Operations/Applications - The UK MoD provides Terminal ATC services at military airfields and En-route, or Area, service in much the same way and together with the Air Defence (AD) role. In the instance of the Proposed Development the controllers provide a combination of all service types as well as providing control of aircraft operating within the Danger Area complexes.

Other radars

There are other radars in operation in the UK, e.g. Air Defence Radars and MET Office radars. The role of those facilities may differ, but the basic principles of radar theory/technology apply, and those radars are included within this assessment.

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Assessment Methodology

Wind Farm Aviation Safeguarding Limited has an established methodology of considering the potential impact of wind turbines established at any given potential wind farm development site. The methodology is based on assessing the airspace infrastructure and aviation operations arrangements that exist in the area of the proposed development, be they technical or physical, and within a study area based on the ranges of all radars with the capability to provide surveillance over the area.

- Analysis of the airspace structure in the area of the proposal
- Analysis using specialised radar modelling software
- Assessment of Communication, Navigation and Surveillance (CNS) systems
- Operational ATC implications
- Assessment of physical safeguarding constraints against any airport/airfield Obstacle Limitation Surfaces
- Assessment of Visual Flight Rules flight (including military low flying, unlicensed aerodromes and airstrips)
- Consultation with affected aviation stakeholders.

The radar projections shown in this report have been produced using specialist propagation prediction software (RView) which 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 and models terrain using the Ordnance Survey (OS) Landform Panorama digital terrain model, which has a post spacing of 50 metres and has a root mean square (RMS) error of 3 metres. 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. 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 and models the trajectory of radar signals at different elevations permitting the 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.

The radar line-of-sight illustrations used in this report show the radar on the left and the turbine location on the right. The purple line illustrates radar line-of-sight (the lowest point at which there will be any radar coverage). Under some specific circumstances turbines can be located slightly above radar line-of-sight and still not be visible to the radar due to increased attenuation of the radar signal close to the ground or the shape of the terrain within the first Fresnel Zone for the radar, but as an initial assessment tool, radar line-of-sight is a very good indicator.

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It should also be noted, however, that with some high-powered radars such as those used for air defence, it is also possible for diffraction effects to occur particularly where the 'terrain blocking point' is close to the radar, which can in some circumstances lead to a radar being able to detect a turbine that is just below radar line-of-sight. Although every care is taken during the line-of-sight modelling and analysis process, modelling limitations and assumptions obviously lead the conclusions in this report to be based on theoretical results. The results are therefore indicative, and actual radar performance may differ from this analysis. Similarly, different Air Navigation Service Providers may use differing terrain data models which might produce slightly different results. Once a site layout has been designed, if radar visibility in marginal situations becomes a key issue, detailed and extensive modelling can be undertaken, usually in cooperation with the aviation consultee to determine the extent of any technical impact on a radar.

For the purposes of radar modelling 230m tip heights were used for the illustration, which in all projections, is for Turbine 1, but this height parameter makes no difference to the line-of-sight (LoS) results but is just a value for modelling and for the diagrams of projections.

It should be noted that the radar modelling software used to compile this report does not model against a fixed point in space, namely it does not measure against a fixed tip height. In our opinion modelling on such a basis is misleading in that, for example, such models will show if a 230m tip height is visible to any, each and all of the radars with the operational range over the turbine position but will not indicate if a 229m tip would not be visible. RView measures against a geographical point on the earth's surface and determines the lowest level that any, each and all of the radars with the operational range over that position can detect contacts at both the theoretical base of radar cover and the lowest level of solid radar cover.

Radar LoS varies significantly from position to position depending on the topography between the position and the radar head. In the radar projections below the purple line (the radar line-of-sight) originates on the left-hand side at the radar antenna height and radiates towards the right hand side position of the turbine; the green line represents the terrain. Furthermore, when the bottom of the lowest radar beam (Hf0.6magl Fresnel line – the light blue line) is plotted, the base of solid radar cover above the turbine position can be determined; the base of solid radar coverage can be assumed to be where the Fresnel Zone (the bottom radar lobe) intercepts the Free Space line above the turbine.

For assessment purposes it can be assumed that the respective radar operators will look at their value for the radar Line-of-Sight (HLos) which will be below the base of solid radar cover (Hf06) as the basis for any objection. In any subsequent discussion on specific locations the Hf06 figure could be introduced in determining the radar's ability to detect and present the turbine return on the radar screen. Simplistically, it can be viewed as the height when the radar might see it (HLos) and the height when it can be considered that the radar will, in all probability, detect the turbine (Hf06).

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The values are measured in metres (m) above ground level (agl); for the turbine not to be visible to the radar the values have to be greater than the turbine tip height (230m).

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The Aviation Environment

This is a fifteen-turbine proposal, with tip height of 230m, situated as shown in Figure 1.

Figure 1 - proposed wind turbine locations

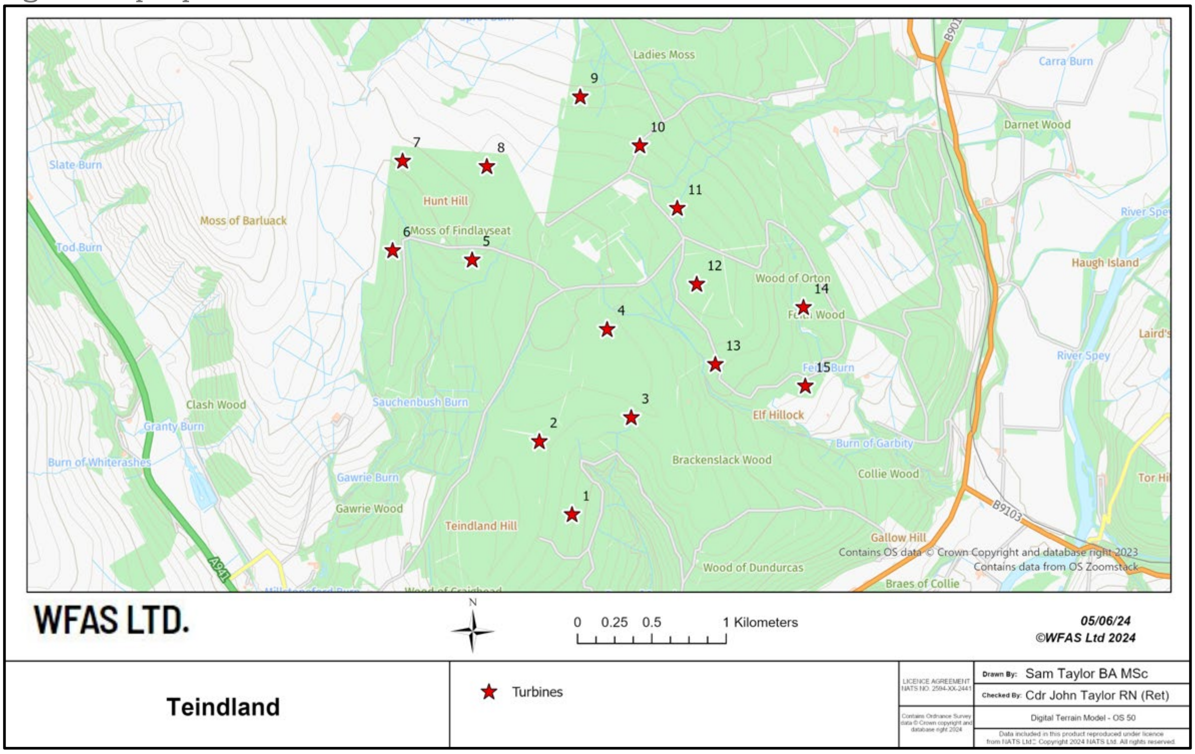

Table 1 – modelled positions

Turbine	E/NGR	N	Tip (magl)
1	328446	851968	230
2	328226	852459	230
3	328844	852620	230
4	328682	853213	230
5	327774	853680	230
6	327239	853743	230
7	327306	854345	230
8	327873	854309	230
9	328501	854777	230
10	328902	854448	230
11	329154	854028	230
12	329285	853517	230
13	329410	852978	230
14	330003	853361	230
15	330015	852832	230

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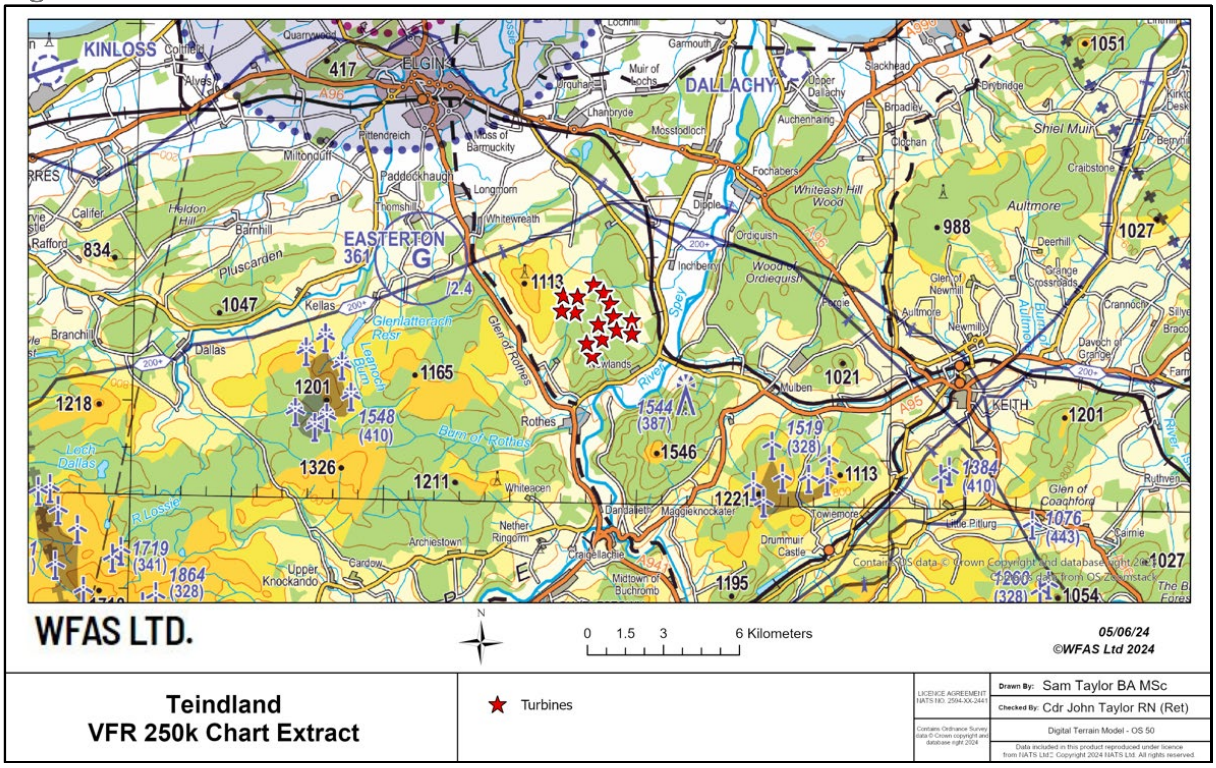
These map extracts show features below 5000ft (Figure 2) and 10,000ft (Figure 3). The aviation environment in the vicinity of the proposed Teindland development is relatively benign with relatively few significant areas of aviation infrastructure but with some key radars covering and overlapping the area. The proposed turbines are located in airspace which is uncontrolled (Class G) from surface level up to Flight Level (FL) 195 (approximately 19,500 feet)

Figure 2 – CAA VFR 1:250,000 Chart extract



The main feature of the airspace environment is the Military Air Traffic Zone (MATZ) at the military airfield at RAF Lossiemouth approximately 19 km to the northwest. In Figure 2 the edge of the MATZ is shown by the partial circle of blue dots encompassing a lightly shaded blue area. Closer to the site and again to the northwest is the glider site at Easterton shown by the blue circle with a letter "G"

That airspace is expanded upon in Figure 3 which shows the airspace over a much wider area with the whole of the MATZ at RAF Lossiemouth shown together with the Moray Control Area (CTA) as the corridors edged in purple to the west and splitting over the civil airport at Inverness. This is an airway of Controlled Airpsace (CAS), for the use of commercial air traffic routing to/from Inverness, and beyond, and under the control of National Air Traffic Services En-Route (NERL). Inverness Airport is shown by the ring of purple dots of the border of the Air Traffic Zone (ATZ) and the larger compass rose delineating the VOR/DME navigational beacon at the airport.

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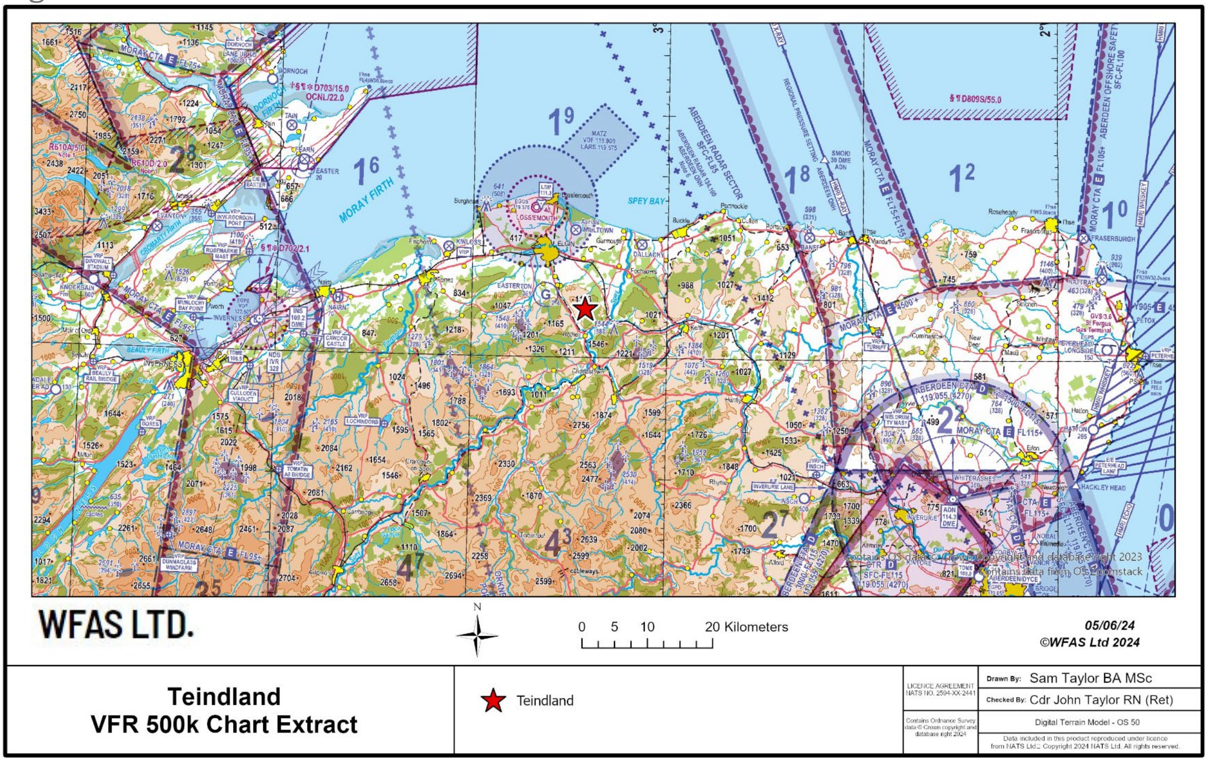
To the southeast the CTA surrounding Aberdeen Airport is similarly marked with thick purple lines and with further sectors of the Moray CTA routing to the north either side of the military Danger Area (D809) shown by red hashed lines; another Danger Area (D703) is shown similarly marked to the northwest of the proposed development.

Figure 3 – CAA VFR 1:500,000 Chart extract



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Air Traffic Control Radars

The nearest MoD ATC radar is at RAF Lossiemouth located on the western edge of the town of Lossiemouth, Morayshire and is located approximately 19km from the centre of the proposed development. The airfield operates ATC radar for the provision of ATC radar services to aircraft operating in the vicinity of the proposed development.

The radar projection at Figure 4 is based on T1 and is representative of all of the tubine positions. The radar is at the bottom left and with the radar beam then extending to the right and upwards towards the turbine position. The terrain is indicated by the thin green line.

Figure 4 – radar projection RAF Lossiemouth PSR

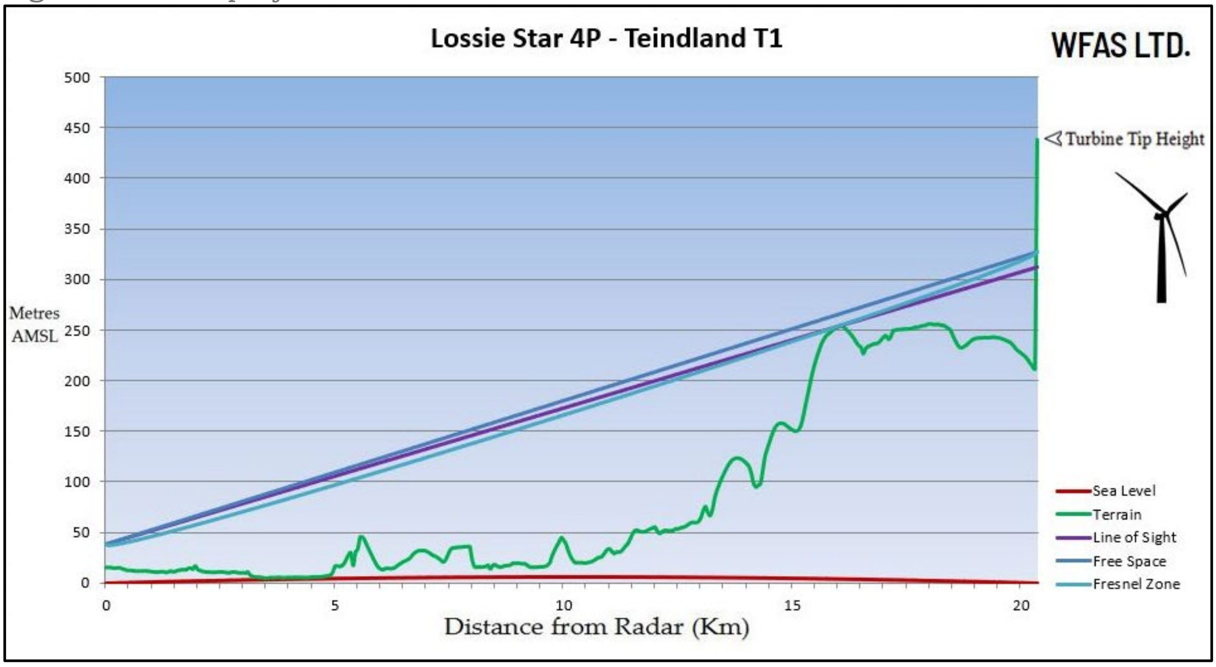

Table 2 – RAF Lossiemouth PSR radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	20.44	119.0	104.5		9	17.944	0.0	0.0
2	19.902	82.4	68.9		10	18.425	0.2	0.0
3	20.02	48.7	41.3		11	18.914	1.1	0.0
4	19.417	24.4	19.1		12	19.426	9.7	4.7
5	18.603	43.3	32.8		13	19.959	49.0	42.0
6	18.329	87.8	77.8		14	19.913	25.4	19.3
7	17.804	39.0	30.5		15	20.378	68.4	61.5
8	18.076	1.1	0.0					

All of the proposed turbines will show, and with some to ground level, in an area key to the MoD operations and training.

Where turbines create radar 'clutter', controllers cannot always distinguish turbine returns from low, slow aircraft. Under a Deconfliction Service, an agreement between the pilots and the air traffic controller regarding the minimum separation that the pilot requires to have from other aircraft, the controller will have to assume that the clutter could be concealing an unknown aircraft and will be required to attempt to avoid the clutter (or unknown aircraft) by at least 5 nautical miles (nm).

Having established that the turbines will show on the radar, the MoD will need to assess the operational impact of the resultant clutter on their procedures. Defence Infrastructure Organization (DIO) who conduct aerodrome safeguarding on behalf of military aviation tend to object to everything that they anticipate will impact on their operations, including the provision of a Lower Airspace Radar Service (LARS), a radar service that can be provided, not just to military aircraft, but to anything else that might be flying within 40nm of the airfield.

RAF Lossiemouth Watchman radar

The Star 4P radar at Lossiemouth is a new installation at the airfield and which replaced an obsolete Watchman which had been in place for some decades. However, although decommissioned, the removal date for that old radar has yet to be confirmed and, for completeness, it has been included within the radar modelling assessment.

Figure 5 – radar projection RAF Lossiemouth Watchman radar

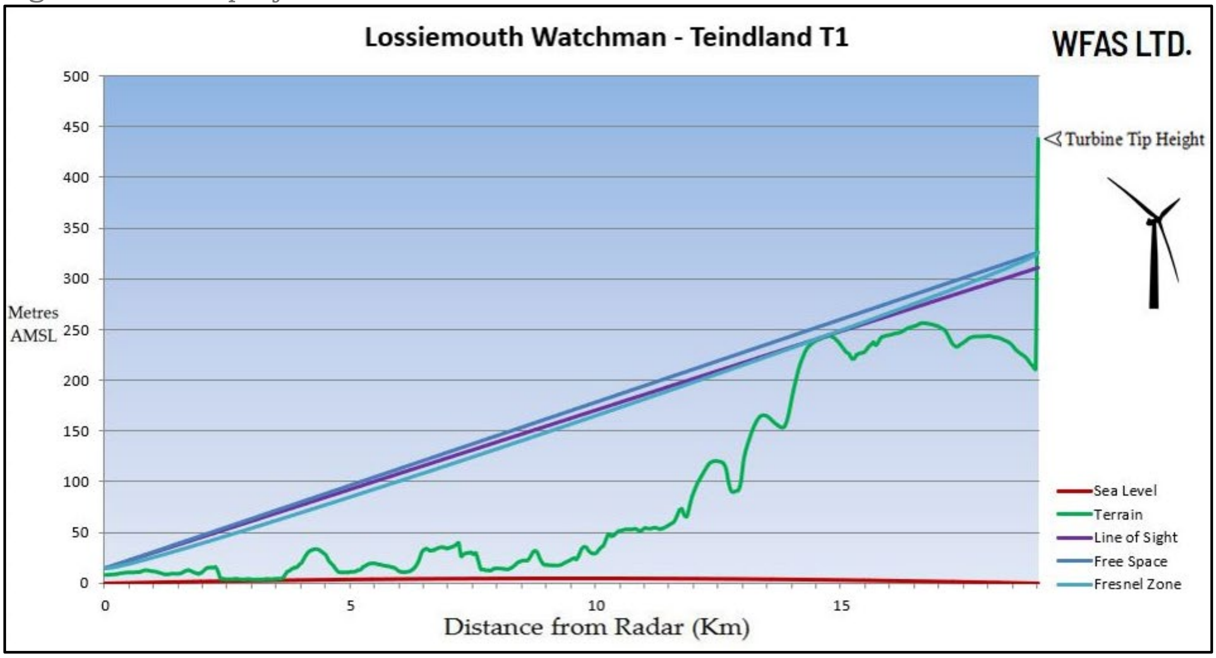

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Table 3 – RAF Lossiemouth Watchman radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	20.44	112.5	104.4		9	17.944	0.0	0.0
2	19.902	76.3	68.8		10	18.425	0.0	0.0
3	20.02	45.4	41.2		11	18.914	0.1	0.0
4	19.417	22.1	19.1		12	19.426	7.5	4.7
5	18.603	38.6	32.7		13	19.959	45.9	42.0
6	18.329	83.4	77.8		14	19.913	22.7	19.3
7	17.804	35.2	30.4		15	20.378	65.3	61.5
8	18.076	0.5	0.0					

It should be stressed that these results are included only for completeness and that, although the Watchman radar might be capable of detecting turbines at the proposed locations, any move by the MoD to object on the basis of this decommissioned radar would, in WFAS' opinion, not stand up to scrutiny.

In addition, and as part of ongoing radar trials there is a further TERMA radar positioned at Lossiemouth.

RAF Lossiemouth TERMA radar

Figure 6 – radar projection RAF Lossiemouth TERMA

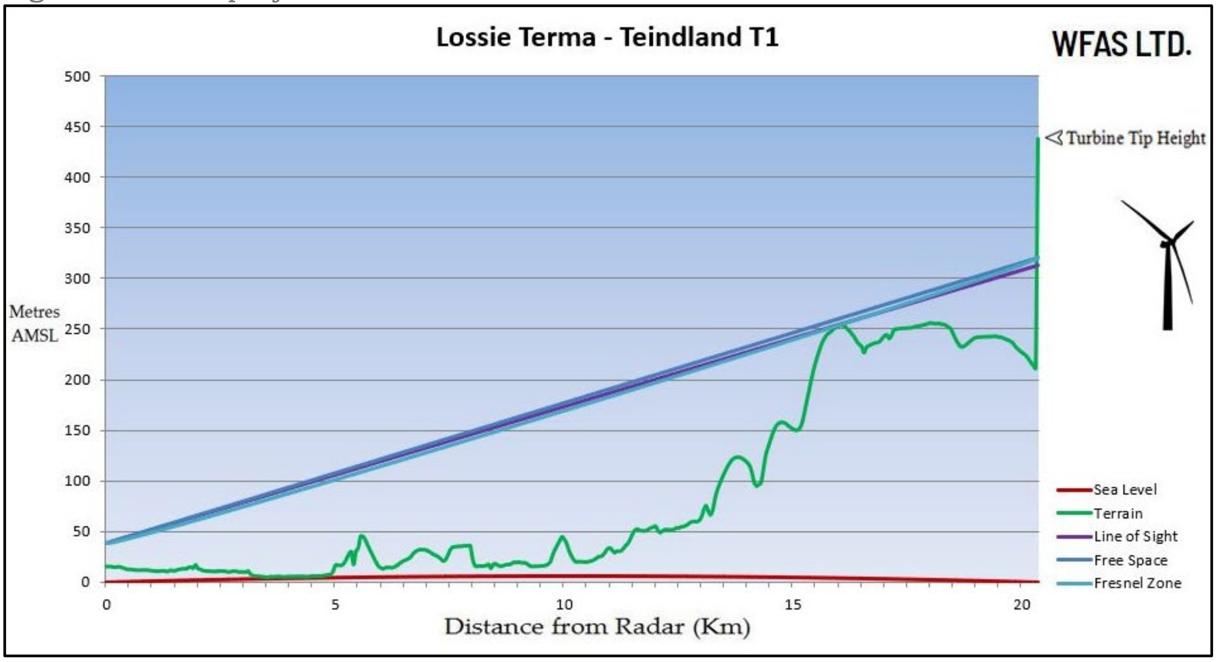

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Table 4 – RAF Lossiemouth TERMA radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	20.44	112.5	104.4		9	17.944	0.0	0.0
2	19.902	76.3	68.8		10	18.425	0.0	0.0
3	20.02	45.4	41.2		11	18.914	0.1	0.0
4	19.417	22.1	19.1		12	19.426	7.5	4.7
5	18.603	38.6	32.7		13	19.959	45.9	42.0
6	18.329	83.4	77.8		14	19.913	22.7	19.3
7	17.804	35.2	30.4		15	20.378	65.3	61.5
8	18.076	0.5	0.0					

Accepting that the TERMA radar is being trialled against other developments, and not necessarily in the Teindland area, the radar would still, potentially, be capable of detecting some of the turbines and is unlikely to be a suitable source of mitigation on the main PSR.

Although the airfield operates secondary surveillance radar (a numerical identification code that some aircraft are equipped to transmit) which might provide limited mitigation for the impact of the turbine development on the radar picture, the effect on the Primary Surveillance Radar is likely to be too significant. The DIO response, as articulated within the Scoping Opinion, would seem to state that the restrictions caused by the resultant clutter will be too much to accept. This is unfortunate and it is difficult to see how the MoD would accept this development without mitigation and, probably, at significant cost.

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Military Aviation - Air Defence

The MoD maintains a network of long-range radar providing a security and policing throughout UK airspace for which it is responsible under international agreements and for National security. The nearest of these is at RAF Buchan on the east coast at a distance of approximately 83km. The radar projection is at Figure 7.

Figure 7 – radar projection RAF Buchan Air Defence Radar

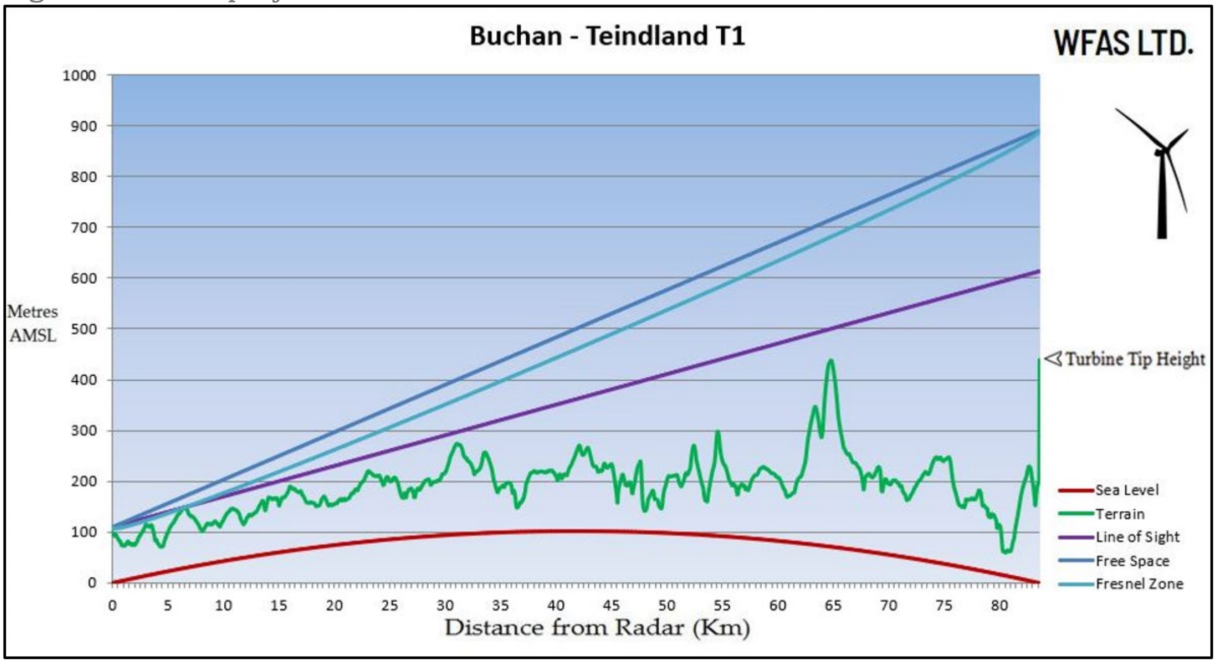

Table 5 – RAF Buchan radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	83.662	682.0	405.3		9	84.023	489.9	348.0
2	83.946	642.6	365.0		10	83.573	481.3	327.5
3	83.356	623.1	348.6		11	83.258	515.1	309.0
4	83.601	588.5	312.0		12	83.05	556.8	284.2
5	84.568	577.6	297.8		13	82.847	615.4	341.6
6	85.107	596.9	315.2		14	82.317	596.8	324.7
7	85.133	515.5	308.1		15	82.227	644.5	372.8
8	84.567	508.0	310.0					

The radar at RAF Buchan may not be capable of detecting the turbines of the proposed development. Accepting that the current development layout has altered in terms of number of turbines and possible maximum tip height, the DIO response to Scoping[2] states

[2] DIO letter, Ref No. DIO10055770, dated 09 August 2022.

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that there would be line-of-sight to, and unacceptable interference on, the RAF Buchan Air Defence radar ADR). The rationale for this approach is not clear. In the cases of some high-powered radars, such as ADR, it is possible for the radar beam to bend over the horizon and the line-of-sight results will depend on the parameters entered into the model. Some of those radar performance specifications/capabilities will be classified and it will not be known (or revealed) what specifications the MoD applied to the radar modelling and nor should they be expected to reveal those details. However, WFAS consider that diffraction/refraction of the magnitude required for the turbines to be visible to the radar would need to be significant and needs to be discussed with DIO. On the evidence of our radar assessment, there are several potential blocking points on the radar beam between Buchan and Teindland and it would appear that the Scoping Opinion direction (that a mitigation scheme should be agreed with the MoD on the possible effects on the Buchan radar) may not be needed; this will be a matter for discussion and consultation with DIO.

If a radar mitigation scheme is possible, and available, it is likely to prove expensive to assess and to implement.

Military Aviation - Low Flying

The majority of UK airspace is divided up into a number of low flying areas, the UK Low Flying System. (UKLFS), in which military aircraft can be authorised to fly as low as 250ft from the ground or objects on the ground, a distance known as Minimum Separation Distance (MSD). The UKLFS covers the open airspace of the whole UK below 2,000 ft agl where low flying by military aircraft is permitted within established Low Flying Areas (LFAs) which exclude locations where such flying is restricted or not permitted such as large urban areas.

The Teindland development is within LFA 14, a busy fixed wing low flying area and close to some recovery routes for aircraft returning to RAF Lossiemouth. However, given the nearby gliding site, the other wind developments and the other vertical obstructions in the immediate vicinity of the Teindland location, the DIO objection, based on the development representing a physical obstruction, could be considered unwarranted and is a matter for discussion with DIO. Furthermore, the RAF Lossiemouth Defence Aerodrome Manual clearly states that fixed wing aircraft within 15nm of Lossiemouth should not be flown lower than 1000ft minimum separation distance; aircraft will be required to fly over, or around the development not closer than 1000ft, as they do for the adjacent wind farms, mast etc.

Clarity would be needed on how the project could address the low flying/obstruction issue, as perceived by DIO, other than by not constructing the site; there are no other possible mitigations to a physical obstruction.

Aviation lighting requirements, including MoD specifications, are considered at Page 30.

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Met Office

Previously safeguarded by the MoD, the Met Office are now a consultee in their own right. The Met Office Weather Radar Network underpins forecast services and warnings of severe/hazardous weather and flooding delivered to the public, partners, government agencies/departments (including the MOD, aviation stakeholders and the Environment Agency) and emergency responders.

The detrimental impact of wind turbines on the operation of weather radar networks is a well-documented issue. The rotating blades can cause clutter, partial beam blocking and inaccurate Doppler velocities. The European meteorological network (EUMETNET) programme for the Operational Exchange of weather Radar information (OPERA) recommend that no turbines should be built within 5 km of a weather radar and that proposed developments between 5 and 20 km range should be subject to an impact assessment (OPERA, 2006 and 2010). These recommendations were further endorsed by the World Meteorological Organisation and thus the Met Office has adopted these guidelines for its network safeguarding operations.

The factors they will consider include the following:

- Proximity to Airports
- River catchment response times
- Population density

There are no Met Radars within consultation or safeguarding distance.

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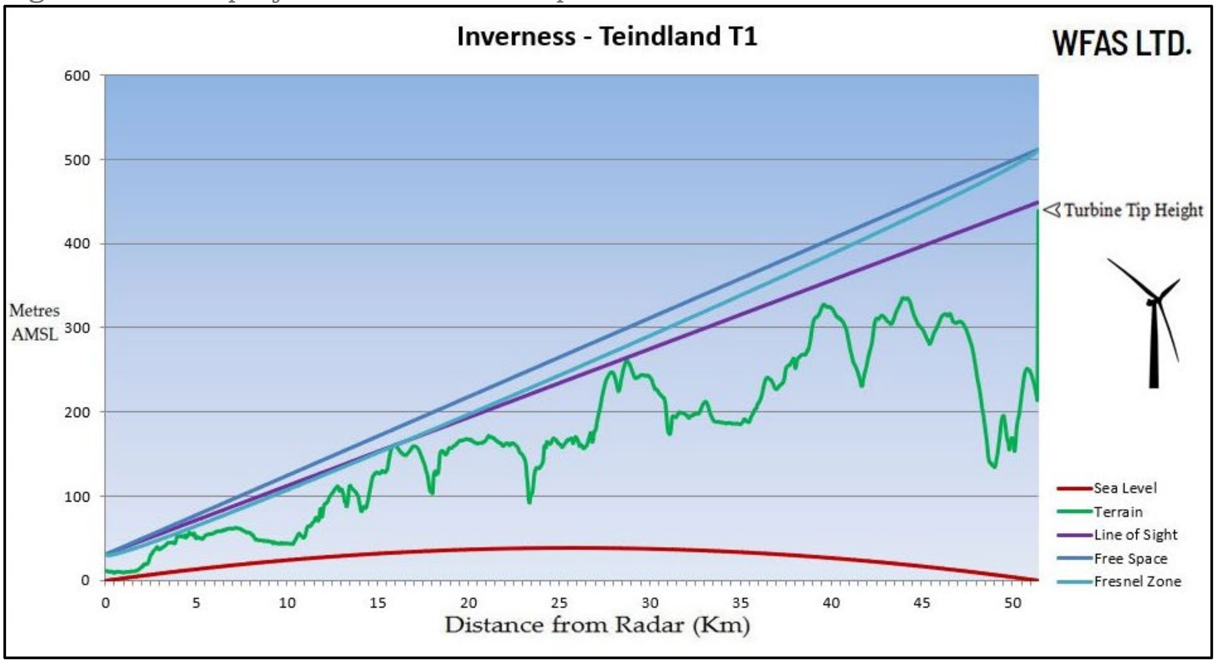
Civil Aviation

Inverness Airport

Inverness Airport is fully equipped with ATC equipment together with a wind farm mitigation TERMA radar. The airport is operated by Highlands and Islands Airports Limited (HIAL). We have undertaken radar projections from the turbine location against the Inverness radars with the radar line-of-sight projections detailed below and overleaf.

Figure 8 – radar projection Inverness Airport PSR



There is a blocking point on the terrain at approximately 28.5km which will partially shield the proposed development from the radar. (Radar line-of-sight is always assessed on "bare earth" basis and with no allowance made for any effects of buildings, vegetation etc.) The radar line-of-sight results are at Table 6.

Table 6 – Inverness Airport radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	51.472	303.8	240.4		9	51.569	280.0	251.9
2	51.248	262.8	199.9		10	51.957	283.4	255.9
3	51.866	265.5	201.8		11	52.196	282.2	254.6
4	51.708	243.9	183.9		12	52.315	252.2	191.7
5	50.808	228.3	169.9		13	52.433	286.8	225.7
6	50.274	231.4	191.5		14	53.03	309.4	247.5
7	50.358	233.8	208.1		15	53.038	331.6	267.4
8	50.924	249.7	223.5					

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Figure 9 – radar projection Inverness Airport TERMA radar

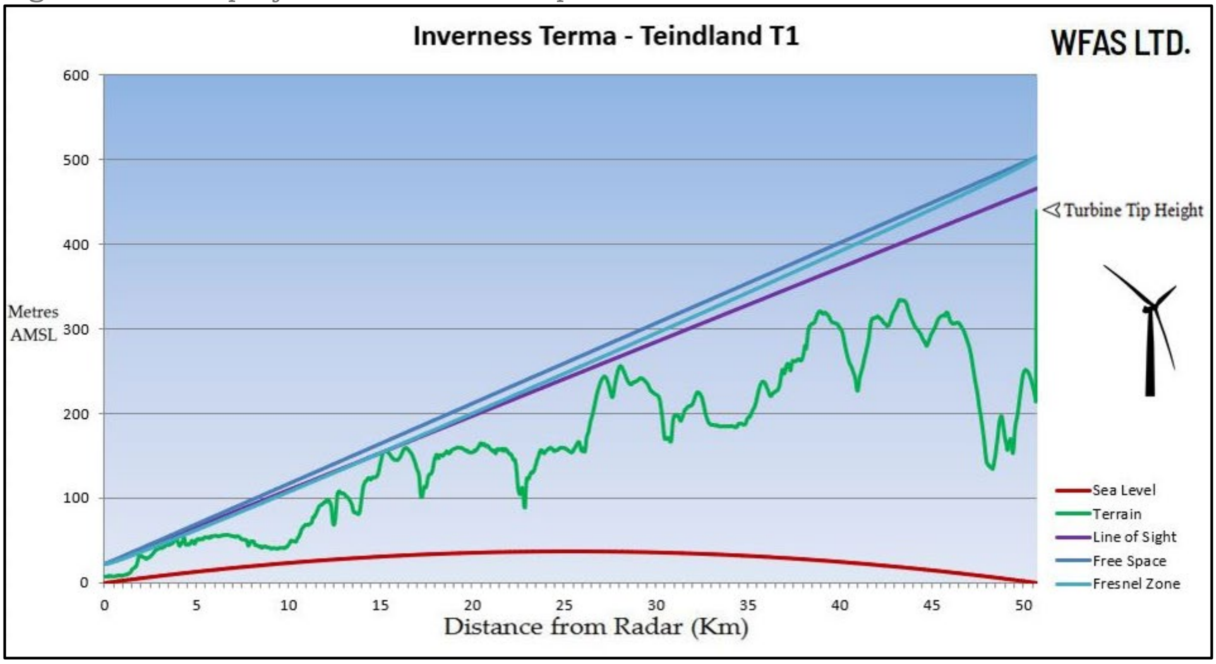

Table 7 – Inverness Airport TERMA radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	50.764	294.6	257.1		9	50.85	277.9	261.4
2	50.538	252.7	217.5		10	51.239	272.7	256.6
3	51.155	257.5	221.8		11	51.479	279.2	263.0
4	50.995	238.8	203.5		12	51.601	248.5	212.7
5	50.092	228.7	193.2		13	51.721	279.0	243.0
6	49.559	231.8	217.0		14	52.317	304.6	268.2
7	49.64	224.5	209.5		15	52.326	324.8	288.2
8	50.206	241.4	225.9					

The TERMA radar is an X-Band radar with a maximum range of unlikely to exceed much beyond approximately 75km (40nm). Accepting that the TERMA radar is being trialled against other developments, and not necessarily in this area, the radar would still be capable of detecting some of the turbines and is unlikely to be a suitable source of mitigation on the main PSR at Inverness.

However, at a range of approximately 51km from the closest turbine of the proposed development to the Airfield Reference Point (ARP) of Inverness Airport, the airport is well outside the stipulated consultation distance for such airports and there should be no potential impact to the airport safeguarded surfaces. In addition to the procedures listed within the public domain, HIAL operate internal procedures which are not available, and they may require an independent assessment (through their preferred company and in accordance with CAP 785) to confirm any possible extent of effects on those procedures.

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HIAL state that they consider that the development may infringe the safeguarding criteria and operation at Inverness Airport; this is not clear from the CAA safeguarding criteria and it can only be that HIAL are applying their own, internal, safeguarding requirement.

HIAL require an assessment of:

- Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC) (see CAP777) requirement.
- Instrument Flight Procedures (IFPs) (see CAP785) requirement. (As the Wind Farm's location is beneath airspace coincident with Inverness Airport's IFPs)
- Primary Surveillance Radar (see CAP670 & CAP764) inc. Optical Line of Site assessment.

HIAL Considerations

1. From the available, published, Inverness Airport aviation charts the Teindland development will not be the dominant obstacle in the area and, therefore, can have no effect on the Surveillance Minimum Altitude. In spite of this it should be expected that HIAL will continue to insist on an aviation impact assessment.

2. The proposed development could be considered coincident with the instrument approach Direct Arrivals ILS/LOC/DME to Runway 23 in that it is approximately 7nm to the north of the published required aircraft track. However, even at the maximum tip height of 230m it will not be the dominant obstacle in the area and should have no effect on the procedure. In spite of this it should be expected that HIAL will continue to insist on an aviation impact assessment.

3. The radar line-of-sight figures to both Inverness radar are detailed above.

En Route Airspace and NATS En Route Radars

National Air Traffic Services En Route Ltd (NERL) control aircraft transiting through UK airspace from one airfield to another. They operate a network of long-range ATC radars throughout the country. These radars form the network of primary and secondary radars and navigation facilities around the country in order to provide ATC service transiting UK airspace either to destinations abroad or between airports within the UK. Whether or not they would object to any turbine development depends upon whether the turbines show on the radar and what type of airspace is above the site. These radars form the network of primary and secondary radars and navigation facilities around the country in order to provide ATC service transiting UK airspace either to destinations abroad or between airports within the UK.

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In this area NATS operate overlapping radar cover through the areas in which they provide ATC services. Whether or not they would object to any turbine development depends upon whether the turbines show on the radar(s), what type of airspace is above the site and the minimum unaffected radar coverage above any turbines.

There are three main radars in the area and which are utilised by NATS to contribute to the air picture at Alanshill, Perwinnes and Tiree. Alanshill and Tiree can be removed from further consideration due to the terrain between those radars and the proposed development. The radar projection for Perwinnes is presented below.

Figure 10 – radar projection Perwinnes radar

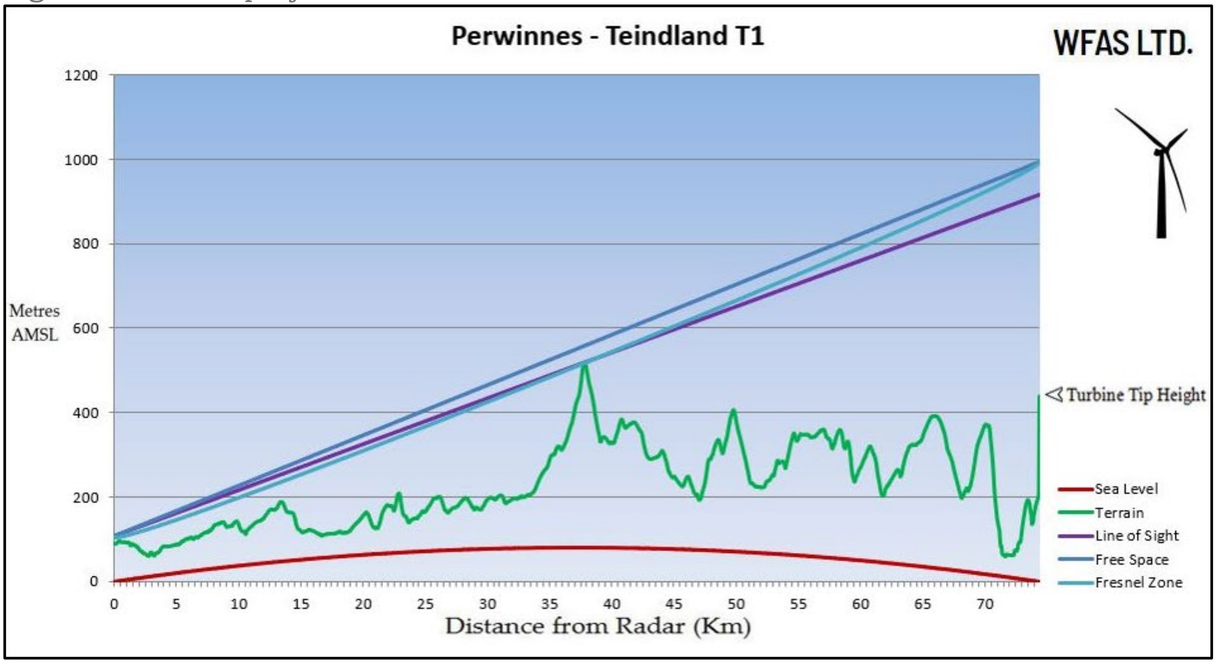

Table 8 – Perwinnes radar line of sight results

Turbine	Tdkm	Hf06 (magl)	Hlos (magl)		Turbine	Tdkm	Hf06 (magl)	Hlos (magl)
1	74.447	785.5	706.4		9	75.89	812.5	729.2
2	74.889	790.8	710.9		10	75.374	791.7	709.2
3	74.447	824.9	745.1		11	74.935	796.4	714.9
4	74.897	813.9	733.0		12	74.549	821.8	741.2
5	75.915	835.3	752.9		13	74.156	833.0	753.2
6	76.402	864.7	781.8		14	73.86	830.3	750.7
7	76.664	842.7	758.8		15	73.566	864.4	785.0
8	76.166	846.1	762.9					

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There should be no NERL issue with, or objection on, the Perwinnes radar. This is in keeping with the Scoping Opinion where NATS response indicates that they will have no objection.

Non-Radar Equipped Licensed Aerodromes

There are no non-radar equipped licensed aerodromes within the recommended consultation distance.

Unlicensed Aerodromes, Gliding, Hang Gliding and Parachuting Sites

The nearest of these is at Easterton and which is outside of the stipulated consultation distance as contained with CAA guidance. It is not raised within the Scottish Government Scoping Opinion but, rather, for completeness, is included here. Notwithstanding the CAA recommended distances quoted for airfields with a runway of the length available at Easterton, the British Gliding Association (BGA) requests that relevant gliding sites and the BGA are consulted where proposed developments are within 10 km of any charted glider launch site. It might be prudent to inform the gliding club of the proposed development.

An extensive search of available documentation has not revealed any further aviation facilities within the stipulated consultation distances. However, it should be noted that not all private airstrips are listed in documents or on charts and that such facilities can be established without planning permission or notification and at short notice.

Aviation Obstruction Lighting

Due to the tip height the development will need to be lit in accordance with CAA policy and it should be expected that the MoD may require that the turbines be lit to MoD specification along with CAA requirements and/or require a lighting assessment; it may prove to be that the project will be required to complete an MoD aviation lighting assessment (and which we can undertake subject to agreed costs). The stance of the MoD will need to be determined and a pre-planning proforma would highlight if they had any low-flying concerns.

CAA extant lighting policy is covered in “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 (01/06/17). It states that any obstruction in excess of 150 metres above ground level constitutes an “en route navigation hazard”. Wind turbines are to be lit with medium intensity (2000 candela) fixed red lights located on the highest practical point, in this case the nacelle. There is also currently a

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requirement for low intensity, 32 candela lights halfway up the tower of a limited number of the turbines. In addition, the MoD may require additional lighting to account for night training.

The recent Scottish Ministers decision on lighting at the proposed wind farm development at Narachan has raised many issues for the wind industry and, essentially, the use of Automatic Detection Lighting Systems (ADLS)[3]. The CAA have, subsequently, issued a consultation document including aviation lighting attempting to correlate opinion of the ADLS specification that could be adopted within the UK. It will be necessary to obtain clear and unambiguous advice on the CAA requirement for lighting and the type that the ECU/LPA will require at the proposed development.

It should be noted, also, that the Scoping Opinion directs that, in relation to lighting, agreement should be reached with NatureScot as to the range that assessment of any lighting impacts should be considered. This will need to be conducted carefully; night aviation lighting is an inherent aviation safety measure and requirement as determined by the CAA and MoD and it not immediately apparent from the Scoping Opinion as to why NatureScot are to be afforded this role in the assessment of effects. Furthermore, the range of possible effects is a singular aspect of assessment but the Scoping Opinion does not seem to include any consideration of lighting pattern, viewpoints to be considered, lighting visibility above/below the horizontal, other wind development lighting, all of which will be determined within CAA requirement, and/or general light pollution in the area. It should also be noted (and accepting that the location, surroundings and extent of existing developments/lighting are different) that NatureScot were an objector to the Narachan development, largely on the effects of visual impact and aviation lighting, and which has caused so much discussion on lighting mitigation solutions.

[3] Energy Consents Unit (ECU) Refusal of Application, Narachan Wind Farm dated 8 March 2024

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Conclusions

There should be no Met Office radar issues.

The MoD objection based on the turbines representing a physical obstruction should be discussed further with DIO given the other vertical development in the immediate vicinity and the published RAF procedures.

It should be expected that the MoD might require a lighting assessment and they may stipulate additional lighting to the CAA requirement.

There is a gliding site at Easteron which, although outside of the CAA stipulated consultation distance for minor aerodromes of this runway length, is within the BGA advisory consultation distance.

There should be no other issues or concerns with minor aerodromes, private airstrips, landing, paragliding etc, although such sites can be established at short notice.

The potential development at Teindland has some significant radar interference issues for both the MoD at RAF Lossiemouth and Buchan and, potentially, for HIAL at Inverness and any one of which will prove difficult, and very expensive, to implement mitigation if, indeed, mitigation is technically possible.

It is WFAS' opinion that the possible radar interference issues should be considered as the priority for the project. In consideration of the radar effects the project should immediately undertake the following:

- It will be necessary to initiate consultation with the MoD through DIO on the potentail interference on the Lossiemouth PSR.

  There are trials underway at RAF Lossiemouth on the establishement of a Transponder Mandatory Zone (TMZ) for a wind farm development in the vicinity of the proposed development but it is too early to say if the required Airspace Change Proposal (ACP) will be approved by the CAA[4] as a means of wind turbine mitigation in the area and the proposed TMZ will not cover the Teindland development.

- It will be necessary to consult with HIAL to determine their stance on the line-of-sight implications to the Inverness radars.

[4] By definition, TMZ airspace is airspace of defined dimensions within which the carriage and operation of transponders is mandatory. Not all aircraft are equipped with a transponder and, especially, gliders tend not to be.

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- It will be necessary to consult with HIAL on their understanding of potential impact on their procedures.

- It will be necessary to confirm the actual interference issue on the RAF Buchan ADR. This may not be straightforward. The sumission of a Scoping Report, and with the subsequent Scoping Opinion of the ECU, before any consultation (as far as we know) with the MoD, has resulted in the current position where DIO have issued a stance on the need for mitigation on this radar, and issued that publicly to the ECU. It might prove difficult to get DIO to step back from that position.

WFAS would wish to highlight that the problems the proposed development is likely to experience are significant.

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Acronyms

Acronym	Full Description
ADR	Air Defence Radar
AGL	Above Ground Level
AIAA	Area of Intense Aerial Activity
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATZ	Aerodrome Traffic Zone
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CNS	Communication, Navigation and Surveillance
CTA	Control Area
DME	Distance Measuring Equipment
DIO	Defence Infrastructure Organisation
DVOR	Doppler VHF Omni-Directional Range
GA	General Aviation
HMR	Helicopter Main Route
IAP	Instrument Approach Procedure
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LARS	Lower Airspace Radar Service
LFA	Low Flying Area
LoS	Line-of-sight
MAA	Military Aviation Authority
MATZ	Military Air Traffic Zones
MoD	Ministry of Defence
MSD	Minimum Separation Distance
NATS	National Air Traffic Services
NERL	NATS En Route Ltd
NM	Nautical Mile
OS	Ordnance Survey
PAR	Precision Approach Radar
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RAP	Recognised Air Picture
RMS	Root Mean Square
RN	Royal Navy
RNAS	Royal Naval Air Station

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SCATCC	Scottish Air Traffic Control Centre
SDSR	Strategic Defence and Security Review
SRTM	Shuttle Radar Topography Mission
SSR	Secondary Surveillance Radar
TMA	Terminal Manoeuvring Area
UKLFS	UK Low Flying System
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional range
WTG	Wind Turbine Generator

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Aviation Wind, Solar & Physical Safeguarding

Envams

Aviation Baseline Assessment

Teindland

Appendix 1.0 – Revised Layout Radar Modelling and Suggested Planning Condition

Author - Commander Shane Savage BSc, RN (Retd)

Radar Propagation Modelling – Dr David Bacon BSc, PhD, FIET, C.Eng.
Additional Propagation Modelling and Mapping – Sam Taylor BA (Hons)

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Front Cover photograph of Lowther Hill by kind permission of Iain Russell.

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Issue

WFAS Ltd has been tasked with conducting radar modelling of the revised turbine layout for the proposed Teindland wind development.

The positions modelled were as supplied by Envams Ltd.

This report should be read in conjunction with the previous Aviation Baseline Assessment.

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Radar Modelling

The radar projections shown in this report have been produced using specialist propagation prediction software (RView) which 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 and models terrain using the Ordnance Survey (OS) Landform Panorama digital terrain model, which has a post spacing of 50 metres and has a root mean square (RMS) error of 3 metres. 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. 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 and models the trajectory of radar signals at different elevations permitting the 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.

It should be noted that the radar modelling software used to compile this report does not model against a fixed point in space, namely it does not measure against a fixed tip height. In our opinion modelling on such a basis is misleading in that, for example, such models will show if a 230m tip height is visible to any, each and all of the radars with the operational range over the turbine position but will not indicate if a 229m tip would not be visible. RView measures against a geographical point on the earth's surface and determines the lowest level that any, each and all of the radars with the operational range over that position can detect contacts at both the theoretical base of radar cover and the lowest level of solid radar cover.

For assessment purposes it can be assumed that the respective radar operators will look at their value for the radar line-of-sight (HLos) which will be below the base of solid radar cover (Hf06) as the basis for any objection. In any subsequent discussion on specific locations the Hf06 figure could be introduced in determining the radar's ability to detect and present the turbine return on the radar screen. Simplistically, it can be viewed as the height when the radar might see it (HLos) and the height when it can be considered that the radar will, in all probability, detect the turbine (Hf06).

The values are measured in metres (m) above ground level (agl); for the turbine not to be visible to the radar the values have to be greater than the turbine tip height (230m) for turbines 1, 3, 4, 7, 9, 10,11 and 12 and 200m for turbines 2, 5, 8 and 13.

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Table 1 – modelled positions

Number	Easting	Northing	Tip magl
1	328302	853741	230
2	329214	853691	200
3	327475	854327	230
4	328139	852711	230
5	328975	855377	200
7	328350	852177	230
8	328543	854715	200
9	328598	853271	230
10	327650	853877	230
11	329575	853252	230
12	328775	852677	230
13	327962	853140	200

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RAF Lossiemouth

Table 2 – RAF Lossiemouth Primary Surveillance Radar (PSR) line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	18.775	3.6	1.6		8	18.019	0.0	0.0
2	19.239	5.0	0.9		9	19.327	24.4	19.5
3	17.891	24.3	15.5		10	18.373	3.04	24.0
4	19.636	69.2	56.4		11	19.797	21.2	16.3
5	17.654	0.1	0.0		12	19.938	46.6	39.4
7	20.21	101.3	87.2		13	19.173	58.4	46.6

All of the proposed turbines will show, and with some to ground level, in an area key to the MoD operations and training.   This a similar set of results to the original assessed layout and the envisaged MoD stance on this radar remains unchanged.

The Watchman radar at Lossiemouth has been decommissioned and is removed from further consideration.

The TERMA radar is to be decommissioned and is removed from further consideration.

RAF Buchan

Table 3 – RAF Buchan Air Defence Radar (PSR) line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	84.055	540.5	274.1		8	83.971	486.4	342.8
2	83.146	542.1	288.2		9	83.693	586.6	309.8
3	84.963	513.0	306.8		10	84.721	554.9	289.2
4	84.067	627.6	350.7		11	82.724	582.5	309.1
5	83.656	484.2	352.8		12	83.432	620.2	345.5
7	83.785	665.3	388.2		13	84.303	608.5	330.0

The radar at RAF Buchan should not be capable of detecting the turbines of the proposed development but it should be noted that, in the cases of some high-powered radars such as ADR, it is possible for the radar beam to bend over the horizon and the line-of-sight results will depend on the parameters entered into the model. Whilst the figures indicate that there should be no line-of-sight, it was a condition of the DIO removal of their initial objection that the turbine positions did not change[1]; these new positions and results will have to be presented to DIO for their consideration.

[1] Email DIO/WFAS dated Mon 24/06/2024.

Inverness Airport

Table 4 – Inverness Airport PSR line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	51.337	216.6	165.2		8	51.608	272.9	245.8
2	52.247	250.1	189.7		9	51.624	240.5	180.7
3	50.527	237.2	211.4		10	50.688	230.3	204.4
4	51.161	249.1	186.4		11	52.601	271.2	209.9
5	52.071	300.6	271.8		12	51.797	262.3	198.7
7	51.374	284.0	220.9		13	50.987	236.8	177.8

Table 5 – Inverness Airport TERMA radar line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	50.621	218.9	196.5		8	50.889	271.0	254.5
2	51.532	242.5	208.6		9	50.911	235.5	200.3
3	49.809	228.4	213.3		10	49.972	233.0	217.9
4	50.45	240.9	205.8		11	51.888	266.1	229.9
5	51.35	282.1	265.3		12	51.086	254.0	218.4
7	50.665	274.9	237.6		13	50.274	231.1	196.3

There is an increase in the number of turbines which be visible to the PSR and there remains visibility to the TERMA radar, the latter of which will not be suitable as mitigation for the proposed development.

NATS

Alanshill

Table 6 – Alanshill PSR line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	62.393	1014.8	845.0		8	62.04	1079.5	911.6
2	61.494	1007.8	840.6		9	62.159	1000.2	831.1
3	63.144	1057.8	885.8		10	63.023	1047.7	876.1
4	62.69	1001.6	831.0		11	61.194	993.6	827.2
5	61.541	1113.6	947.1		12	62.065	989.0	820.1
7	62.559	1003.9	832.6		13	62.807	1015.1	844.1

Perwinnes

Table 7 – Perwinnes PSR line-of-sight results

Turbine	Tdkm	Hf06magl	Hlosmagl		Turbine	Tdkm	Hf06magl	Hlosmagl
1	75.5	814.1	732.1		8	75.821	808.8	725.6
2	74.703	817.2	736.3		9	74.999	814.4	733.4
3	76.512	843.9	760.2		10	76.124	827.6	744.8
4	75.095	803.7	723.2		11	74.162	826.8	746.8
5	75.822	729.2	645.4		12	74.535	826.0	746.1
7	74.637	786.7	707.2		13	75.47	836.6	755.1

Neither of the NATS radars should be capable of detecting the turbines in the revised layout.

Conclusions

The potential radar issue against the PSR at RAF Lossiemouth remains with the amended layout.

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RAF Lossiemouth

It will be necessary to agree a Planning Condition with the MoD, through DIO, on a radar mitigation scheme to address the effects on the radar at RAF Lossiemouth. The following is suggested:

> *"Other than for the sole purposes of assessing the extent of any effects on the Air Traffic Control Radar ("the Radar") at RAF Lossiemouth, and the subsequent design of a radar mitigation scheme to address those effects, no turbine(s) shall be operated unless and until an Air Traffic Control Radar Mitigation Scheme to address any impact of the wind turbine(s) upon air safety has been submitted to, and approved in writing by, the Local Planning Authority.*
>
> *The Air Traffic Control Radar Mitigation Scheme will be a scheme designed to mitigate the impact of the development upon the operation of the Air Traffic Control Radar used by RAF Lossiemouth and the air traffic control operations of the airfield which are reliant upon the Radar.*
>
> *The Air Traffic Control Radar Mitigation Scheme shall set out the appropriate measures to be implemented to mitigate the impact of the development on the Radar, and the ability to deliver a safe ATC radar service, and shall be in place for the operational life of the development.*
>
> *No turbine(s) shall become operational unless and until all measures required by the approved Air Traffic Control Radar Mitigation Scheme, to be implemented prior to the operation of the turbine(s), have been implemented and the Local Planning Authority has confirmed this in writing. The development shall thereafter be operated fully in accordance with the approved Air Traffic Control Radar Mitigation Scheme."*

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