Mynydd Llanhilleth Wind Farm

Environmental Statement

Appendix 14B TOPA

August 2024

Prepared by:
NATS Safeguarding Office

Technical and Operational Assessment (TOPA)

For Mynydd Llanhilleth
Wind Farm Development

NATS ref: SG33881

Issue 1

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Publication History

Issue	Month/Year	Change Requests and summary
1	September 2022	Combined Pre-Planning Assessment

Document Use

External use: Yes

Referenced Documents

1. Background

1.1. En-route Consultation

NATS en-route plc is responsible for the safe and expeditious movement in the en-route phase of flight for aircraft operating in controlled airspace in the UK. To undertake this responsibility it has a comprehensive infrastructure of RADAR's, communication systems and navigational aids throughout the UK, all of which could be compromised by the establishment of a wind farm.

In this respect NATS is responsible for safeguarding this infrastructure to ensure its integrity to provide the required services to Air Traffic Control (ATC).

In order to discharge this responsibility NATS is a statutory consultee for all wind farm applications, and as such assesses the potential impact of every proposed development in the UK.

The technical assessment sections of this document define the assessments carried out against the development proposed in section 3.

1.2. Airport Consultation

NATS provides air traffic services at most of the UK's major airports. Included in the service that NATS provides to these airports is technical and operational safeguarding.

Whilst the airport owner or operator remains the statutory planning consultee, NATS carries out the assessment and provides technical advice to the airport. This includes making a recommendation on whether to object or not to a planned development.

The Airport Assessment section of this document details any advice NATS would provide to relevant airports.

Please note that where airport consultation is undertaken, any assessment and any statements made refer exclusively to the impact of wind turbines upon the Air Traffic Control infrastructure and only to airports where NATS provides safeguarding services namely Aberdeen, Cardiff, Glasgow, Heathrow, Stansted, Manchester and Southampton.

An airport operator may object on other aviation grounds such as obstacle clearance despite no impact being anticipated on its ATC infrastructure. If in doubt, the airport operator should be consulted for advice.

2. Scope

This report provides NATS En-Route plc's view on the proposed application in respect of the impact upon its own operations and in respect of the application details contained within this report.

Where an impact is also anticipated on users of a shared asset (e.g. a NATS RADAR used by airports or other customers), additional relevant information may be included for information only. While an endeavour is made to give an insight in respect of any impact on other aviation stakeholders, it should be noted that this is outside of NATS' statutory obligations and that any engagement in respect of planning objections or mitigation should be had with the relevant stakeholder, although NATS as the asset owner may assist where possible.

3. Application Details

Wood (Developer) submitted a request for a NATS technical and operational assessment (TOPA) for the development at Mynydd Llanhilleth Wind Farm. It will comprise turbines as detailed in Table 1 and contained within an area as shown in the diagrams contained in Appendix B.

Turbine	Lat	Long	East	North	Tip Height (m)
1	51.7173	-3.0924	324630	202630	180
2	51.7193	-3.1037	323855	202860	180
3	51.7139	-3.1089	323485	202270	180
4	51.7092	-3.1047	323770	201740	180
5	51.7099	-3.0895	324821	201806	180
6	51.7037	-3.0911	324695	201115	180
7	51.7001	-3.0891	324830	200715	180
8	51.7025	-3.1113	323300	201000	180

Table 1 – Turbine Details

4. Assessments Required

The proposed development falls within the assessment area of the following systems:

En-route Surv	Lat	Long	nm	km	Az (deg)	Type
Burrington Radar (cmb)	50.9343	-3.9854	56.7	105.0	35.3	CMB
Claxby Radar	53.4501	-0.3083	145.7	269.8	225.4	CMB
Clee Hill Radar	52.3983	-2.5975	44.8	83.0	204.4	CMB
Debden Radar	51.9902	0.2638	125.9	233.1	263.6	CMB
Pease Pottage Radar	51.0834	-0.2143	114.2	211.5	290.3	CMB
En-route Nav	Lat	Long	nm	km	Az (deg)	Type
None						
En-route AGA	Lat	Long	nm	km	Az (deg)	Type
None						

Table 2 – Impacted Infrastructure

4.1. En-route RADAR Technical Assessment

4.1.1. Predicted Impact on Clee Hill RADAR

Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.

4.1.2. En-route operational assessment of RADAR impact

Where an assessment reveals a technical impact on a specific NATS' RADAR, the users of that RADAR are consulted to ascertain whether the anticipated impact is acceptable to their operations or not.

Unit or role	Comment
Swanwick ATC	Unacceptable
Western RADAR ATC	Acceptable
Military ATC	Unacceptable

Note: The technical impact, as detailed above, has also been passed to non-NATS users of the affected RADAR, this may have included other planning consultees such as the MOD or other airports. Should these users consider the impact to be unacceptable it is expected that they will contact the planning authority directly to raise their concerns.

4.2. En-route Navigational Aid Assessment

4.2.1. Predicted Impact on Navigation Aids

No impact is anticipated on NATS' navigation aids.

4.3. En-route Radio Communication Assessment

4.3.1. Predicted Impact on the Radio Communications Infrastructure

No impact is anticipated on NATS' radio communications infrastructure.

4.4. Bristol Airport Assessment

4.4.1. Airport Technical Assessment – Bristol Primary Surveillance Radar

Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.

4.4.2. Airport Operational Assessment - Bristol

The proposed development has been examined by technical and operational safeguarding teams and the impact has been deemed to be operationally manageable.

4.5. Cardiff Airport Assessment

4.5.1. Airport Technical Assessment - Cardiff Primary Surveillance Radar

Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.

4.5.2. Airport Operational Assessment - Cardiff

The planned development site is inside controlled airspace, in an area frequently used by commercial flights operating in and out of Cardiff Airport, as such the anticipated impact has been assessed as being <u>unacceptable</u>.

5. Conclusions

5.1. En-route/Airport Consultation

The proposed development has been examined by technical and operational safeguarding teams. A technical impact is anticipated, this has been deemed to be <u>unacceptable</u> both in relation to En-route air traffic as well as the approach control at Cardiff Airport.

Appendix A – Background RADAR Theory

Primary RADAR False Plots

When RADAR transmits a pulse of energy with a power of P_t the power density, P, at a range of r is given by the equation:

$$P = \frac{G_t P_t}{4\pi r^2}$$

Where G_t is the gain of the RADAR's antenna in the direction in question.

If an object at this point in space has a RADAR cross section of σ, this can be treated as if the object re-radiates the pulse with a gain of σ and therefore the power density of the reflected signal at the RADAR is given by the equation:

$$P_a = \frac{\sigma P}{4\pi r^2} = \frac{\sigma G_t P_t}{(4\pi)^2 r^4}$$

The RADAR's ability to collect this power and feed it to its receiver is a function of its antenna's effective area, A_e, and is given by the equation:

$$P_r = P_a A_e = \frac{P_a G_r \lambda^2}{4\pi} = \frac{\sigma G_t G_r \lambda^2 P_t}{(4\pi)^3 r^4}$$

Where G_t is the RADAR antenna's receive gain in the direction of the object and λ is the RADAR's wavelength.

In a real world environment this equation must be augmented to include losses due to a variety of factors both internal to the RADAR system as well as external losses due to terrain and atmospheric absorption.

For simplicity these losses are generally combined in a single variable L.

$$P_r = \frac{\sigma G_t G_r \lambda^2 P_t}{(4\pi)^3 r^4 L}$$

Secondary RADAR Reflections

When modelling the impact on SSR the probability that an indirect signal reflected from a wind turbine has the signal strength to be confused for a real interrogation or reply can determined from a similar equation:

$$P_r = \frac{\sigma G_t G_r \lambda^2 P_t}{(4\pi)^3 r_t^2 r_r^2 L}$$

Where r_t and r_r are the range from RADAR-to-turbine and turbine-to-aircraft respectively. This equation can be rearranged to give the radius from the turbine within which an aircraft must be for reflections to become a problem.

$$r_r = \sqrt{\frac{\lambda^2}{(4\pi)^3}} \sqrt{\frac{\sigma G_t G_r P_t}{r_t^2 P_r L}}$$

Shadowing

When turbines lie directly between a RADAR and an aircraft not only do they have the potential to absorb or deflect, enough power such that the signal is of insufficient level to be detected on arrival.

It is also possible that azimuth determination, whether this done via sliding window or monopulse, can be distorted giving rise to inaccurate position reporting.

Terrain and Propagation Modelling

All terrain and propagation modelling is carried out by a software tool called ICS Telecom (version 11.1.7). All calculations of propagation losses are carried out with ICS Telecom configured to use the ITU-R 526 propagation model.

Appendix B – Diagrams

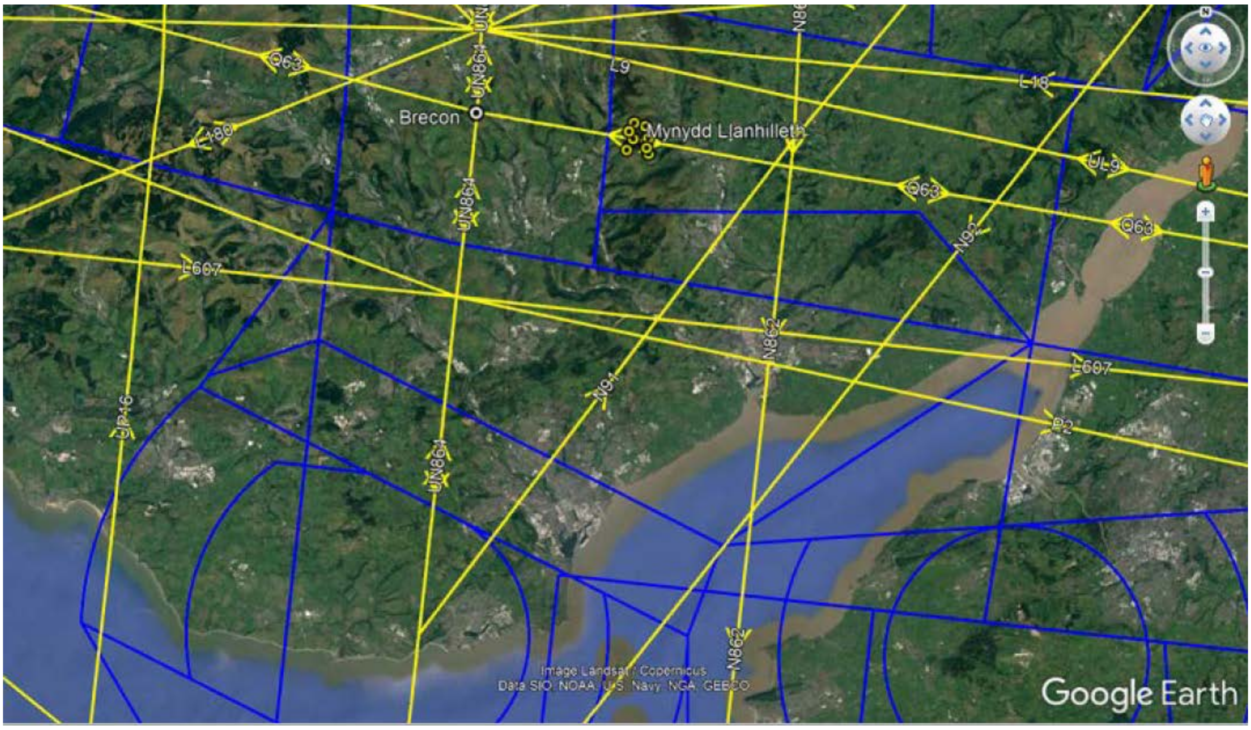

Figure 1: Proposed development location shown on an airways chart

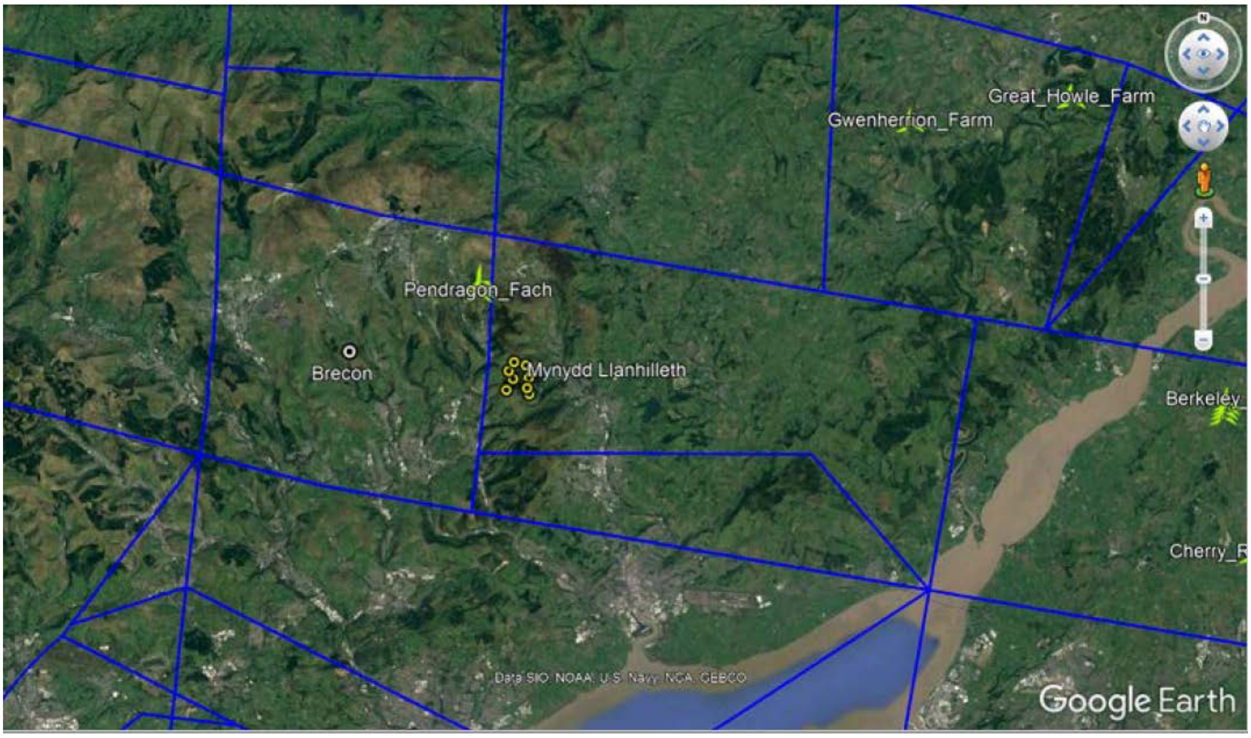

Figure 2: Proposed development shown alongside other recently assessed applications

consented/built impact –accepted impact –objection mitigated
mitigation –proposed no impact refused/withdrawn

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