

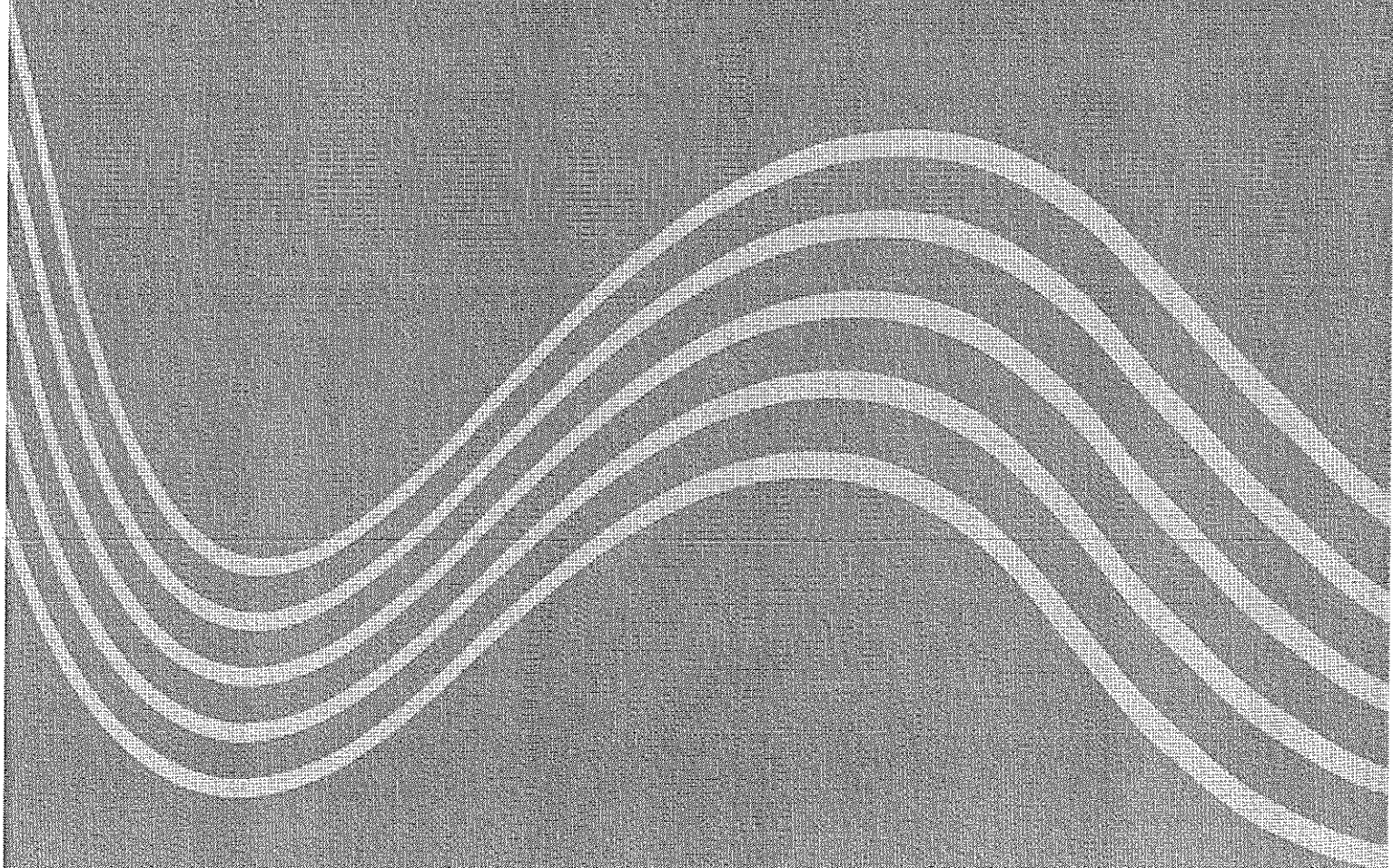
Technical and Operational Assessment (TOPA)

For The Brows Farm
Windfarm Development

Issue 1

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1. Background

1.1. En-route Consultation

NATS 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 radars, 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 assesses the potential impact of every proposed development in the UK.

Section 0 of this document defines the assessments carried out against the development proposed in section 2, with the result detailed in section 4.

2. Application details

Ribble Valley District Council submitted a request for a NATS technical and operational assessment (TOPA) for the development at The Brows Farm, Higher Road, Longridge, Preston as detailed in the table below.

Table 1 – turbine coordinates and height

Turbine	Easting	Northing	Hub Height	Tip Height
1	362198	438464	15	19.8

3. Assessments Required

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

NERL Radar Sites	Easting	Northing	Range (km)	Range (nm)	Bearing (True)	Type
Claxby Radar	512440	396150	156.09	84.28	287.09	CMB
Clee Hill Radar	359440	277980	160.51	86.67	0.51	CMB
Debden Radar	555540	234840	280.79	151.62	318.28	CMB
Great Dun Fell Radar	371030	532210	94.16	50.84	185.02	CMB
Lowther Hill Radar	289020	610710	187.15	101.05	155.55	CMB
St Annes Radar	334791	430681	28.49	15.38	73.35	CMB
Manchester Combined	381274	382678	58.96	31.83	340.90	CMB
NERL Nav Aid Sites	Easting	Northing	Range (km)	Range (nm)	Bearing (True)	Type
None						
NERL AGA Comms Sites	Easting	Northing	Range (km)	Range (nm)	Bearing (True)	Type
Whittingham Lane	354122	436206	8.39	4.53	73.82	Tx

Table 2 – Impacted Infrastructure

3.1. En-route radar technical assessment

3.1.1. Predicted impact on St Annes 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.

3.1.2. 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
Prestwick Centre ATC	Unacceptable
London Area Control Centre ATC	Acceptable
RDP Asset Management	Acceptable

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

3.2. En-route navigational aid assessment

3.2.1. Predicted impact on navigation aids.

No impact is anticipated on NATS's navigation aids.

3.3. En-route radio communication assessment

3.3.1. Predicted impact on the radio communications infrastructure.

No impact is anticipated on NATS's radio communications infrastructure.

4. Conclusions

4.1. En-route consultation

The proposed development has been examined by technical and operational safeguarding teams. A technical impact is anticipated, this has been deemed to be **unacceptable**.

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_r 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 be 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.

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

Shadowing

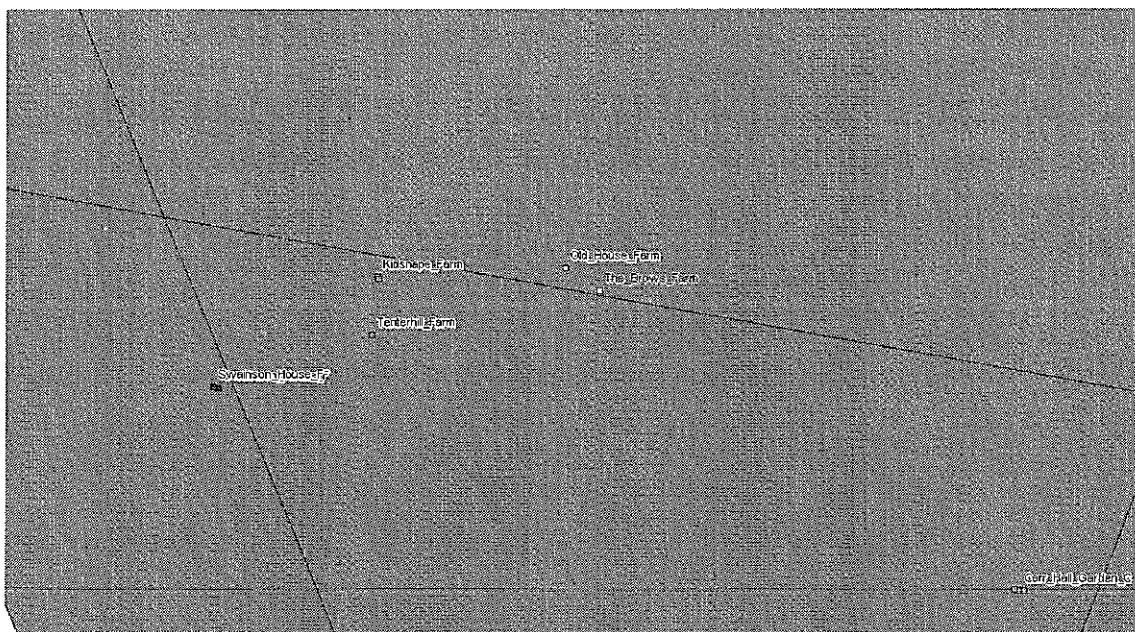
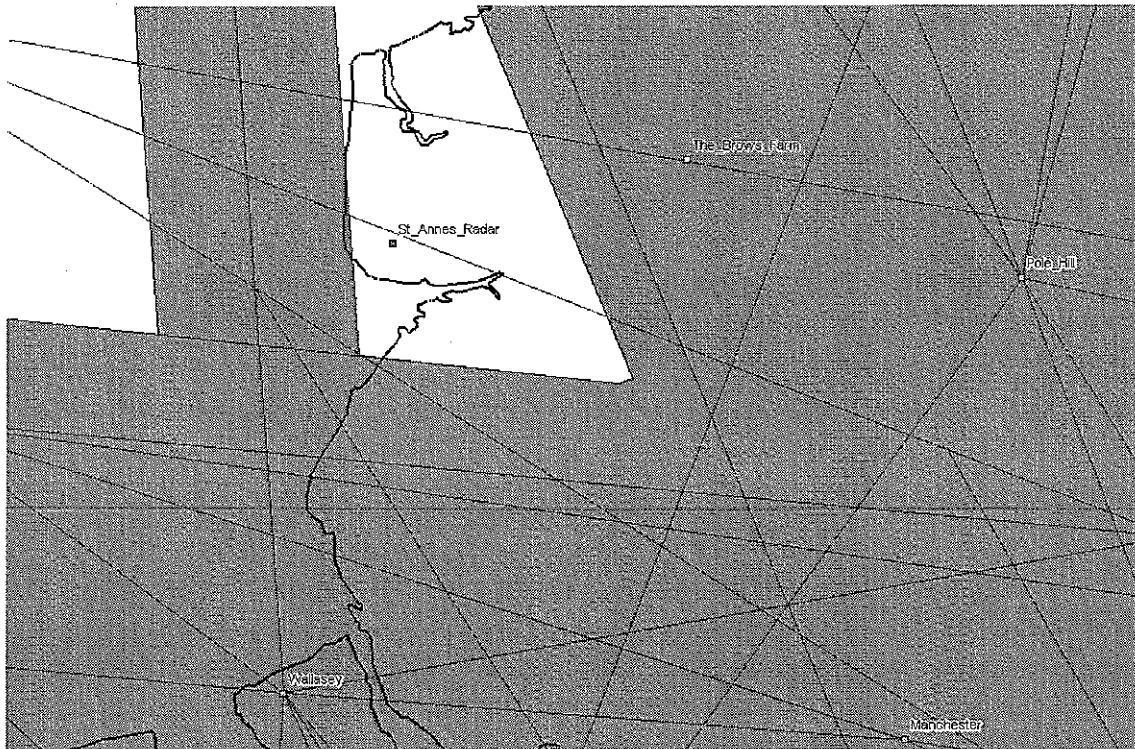
When turbines lie directly between a radar and an aircraft not only do they have the potential to absorb or deflect, enough power such that the signal is of insufficient level to be detected on arrival.

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 6.99). All calculations of propagation losses are carried out with ICS Telecom configured to use the ITU-R 526 propagation model.

Appendix B – Diagrams



■ consented/built ■ impact -accepted ■ impact -objection ■ mitigated
 ■ mitigation -proposed □ no impact □ refused/withdrawn