



1Gp Headquarters

WO Battlespace Management Capability
Safeguarding

Defence Infrastructure Organisation - Safeguarding
Kingston Road
Sutton Coldfield
West Midlands
B75 7RL

Email: [redacted]

See Distribution

Reference: 20140317-Windfarm-Planning
Applications-DIO13930-no concerns despite
LOS-U

Date: 17 Mar 2014

**CLOICH FOREST (DIO13930) WIND FARM DEVELOPMENT PROPOSAL - NO CONCERNS
DESPITE LOS**

1. DIO requested that we review the proposal to erect a 18 x 115m turbine wind farm at Cloich Forest. Following a detailed examination of the proposal, the impact of the proposed development on ATC radars and the ATC usage of Airspace in the region it was considered that, although there would be an impact on ATC Operations, the impact was manageable.

Location	Conflicting Radar	DIO Ref
Cloich Forest	Spadeadam PSR	13930

2. At present, HQ 1 GP BM Safeguarding does not have concerns with the Cloich Forest proposal (DIO13930) as it is assessed that the effect on ATC operations at Spadeadam are manageable. This level of concern is held on the basis that there will be no additional turbines or a change in turbine height without a separate planning request. Also considered is that this proposal would be constructed before the number of future consented proposals in the area exceeds that which the radar can manage. The cumulative impact of multiple turbines in any given area would result in the degradation of radar performance. It should therefore be noted that the propagation of turbines in this area could lead to a future concern being raised in order to protect the MoD's radar coverage.

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Ministry
of Defence

AIR DEFENCE & AIR TRAFFIC SYSTEMS RADIO SITE PROTECTION

TECHNICAL REPORT

Issue: 1
Date: 17 March 2014

Title: WR80026/01
DIO 13930(B) – AIR TRAFFIC CONTROL (ATC),
NATIONAL AIR TRAFFIC SERVICES (NATS), AIR
DEFENCE (AD) AND MAA RADARS –
ASSESSMENT OF THE DEVELOPERS
PROPOSAL TO ESTABLISH A WINDFARM AT
CLOICH FOREST, NEAR PEEBLES AND
PENICUIK

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Prepared by:	ADATS DT RSP1d	[REDACTED]	
Authorised by:	ADATS DT Hd RSP	[REDACTED]	

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RAF Henlow, Bedfordshire. SG16 6DN UK

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FOI FORMAT AND SUMMARY

20140317-DIO13930(B) Concerns Cloich Forest-RSP1d-U

Radar Field Strength and/or Radar Line-of-Sight analysis indicates that the proposed windfarm at Cloich Forest shows a high degree of probability that it will be detected by one or more MoD radars to a degree that will affect their function.

Issue: 1 Dated: 17 March 14

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CONTENTS

PRELIMINARY MATERIAL	Page
Title Page & Cover	
Copyright & Release Conditions.....	i
Document Authorisation	ii
FOI Format and Summary.....	ii
Distribution	iii
Contents.....	iii
References.....	iv
Standard Assumptions and Terms	v
Scope.....	1
Introduction	1
Effects of Wind Turbines on Radar Performance	1
Assessment of the Proposed Wind Farm	2
Conclusion and Recommendations.....	2

Figure 1 – Local area map for Cloich Forest windfarm

Figure 2 – Coverage prediction plot for Spadeadam Deadwater Fell Watchman Radar

Issue: 1 Dated: 17 March 14

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REFERENCES

- A. E-mail from Defence Infrastructure Organisation, DIO 13930(B) dated 17 March 2014
- B. JSP846 – Issue 6 dated 09 Oct 12
- C. QINETIQ/D&TS/SEA/TA0705054/1.0 – Assessment of Wind Turbine Effects for DCSA
- D. AWC/WAD/72/655/TRIALS dated 10 May 05 – The effect of wind turbine farms on ATC radar (Qixotic Zephyr trial)
- E. AWC/WAD/72/655/TRIALS dated 06 Jan 05 – The effects of wind turbine farms on Air Defence radars (Swift Crofter trial)
- F. Further evidence of the effects of wind turbine farms on AD radar dated 12 Aug 05 (Mistral Crop trial)

Issue: 1 Dated: 17 March 14

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Standard Assumptions and Terms

RLOS - Radio Line of Sight. This is a linear path estimation of line-of-sight at radar wavelengths that compensates for refractive effects by assuming a reduced earth curvature (4/3 earth radius).

Clutter is taken into consideration as part of the propagation model that generates coverage plots and can significantly reduce the probability of detection by the radar.

Stated accuracy for the Ordnance Survey ground height data is $\pm 3\text{m}$ to 1RMS. DES ADATS maintains mapping data at far greater accuracy for the radar positions. The radar aperture heights used in calculation reflect this increase in accuracy.

Areas of the coverage plots shaded in blue indicate where a turbine of the dimensions given is predicted to be detected by the radar.

Level 1 Assessment: Considers RLOS only and is used for radars where no parameters other than physical location are available. This method is not considered to be particularly accurate.

Level 2 Assessment: Calculated probability of detection from available radar parameters, turbine parameters and terrain data. The total RCS of the turbine is used in all instances. This report constitutes a Level 2 Assessment.

Level 3 Assessment: A more extensive Probability of Detection calculation, utilising sectioned RCS. This method is considered to give more accurate answers when RLOS is not present and diffraction is the sole method of detection.

Turbine RCS: A measure of the radar reflectivity of the complete turbine structure.

Turbine Visibility: The amount of the turbine visible over terrain, considering RLOS only. In general, a large positive value is a strong indicator that the turbine will be detected.

Max height for no visibility: A sample cut-off height below which all of the turbine would be obscured by terrain. Note that this figure will vary between turbines with different ground heights in the same proposal.

Visibility over clutter: The amount of the turbine which is un-obscured from the radar by building clutter and terrain (where this is the same as the Turbine Visibility, no clutter exists in the beam path). Where this value is zero or very small, the turbine is completely obscured by clutter and the detection probability will be greatly reduced.

1 Scope

1.1 The purpose of this report is to ascertain the likely effects of the proposed wind turbines at Cloich Forest on the performance of Radar Systems at MoD-related sites.

2 Introduction

2.1 Reference A is a proposal to establish a wind farm of 18 turbines at Cloich Forest, near Peebles and Penicuik. National Grid References were provided for all positions (NT (3)20448 (6)47093). The highest point of the turbine blades will be 115 metres above ground level. A local map of the proposed area is shown at Figure 1.

2.2 Siting restrictions for radars are defined in Reference B. Reference C details methods of determining Radar Cross-Section (RCS) values from a generic turbine model. Reference D defines specific restrictions for siting wind turbines, which apply when there is Line of Sight (RLoS) between radar and turbine. References E and F define additional restrictions applicable only to Air Defence (AD) radars.

3 Effects of Wind Turbines on Radar Performance

3.1 It has been shown that where RLOS exists and/or Radar Field Strength detection occurs, the wind turbines will appear as genuine aircraft targets. This effect has been shown to mask aircraft responses, even when the aircraft is in a high elevation beam and the turbine is in a lower sidelobe. The radar may also be desensitised by its clutter processing within the sector containing wind turbines.

3.2 Additionally, shadowing of aircraft at similar radar to target elevation angles at the wind turbines may occur, degrading radar performance. However, this is only expected to occur over short distances from wind turbines.

3.3 In close proximity, turbines can cause spurious reflections of returns. This is particularly a problem for Secondary Surveillance Radars.

4 Assessment of the Proposed Wind Farm

4.1 Spadeadam Deadwater Fell Watchman Radar Field Strength Coverage summary

4.1.1 Range to Windfarm: 65.325km
Angle to Windfarm: 319.87°

RLOS Visibility 9m
Turbine RCS: 248.8m²
Aux Beam: Outside

4.1.2 A Field Strength Coverage plot was generated for the radar using these parameters (Figure 2), indicating that 13 of the turbines will be detected by the radar.

4.1.3 All other radars at this site have been checked.

4.2 There are no concerns regarding the following radars, which have been checked:

4.2.1 RAF Benbecula, Brizlee Wood, Buchan, Leuchars, Spadeadam Berry Hill, Staxton Wold and Trimmingham

4.2.2 MAA Warton

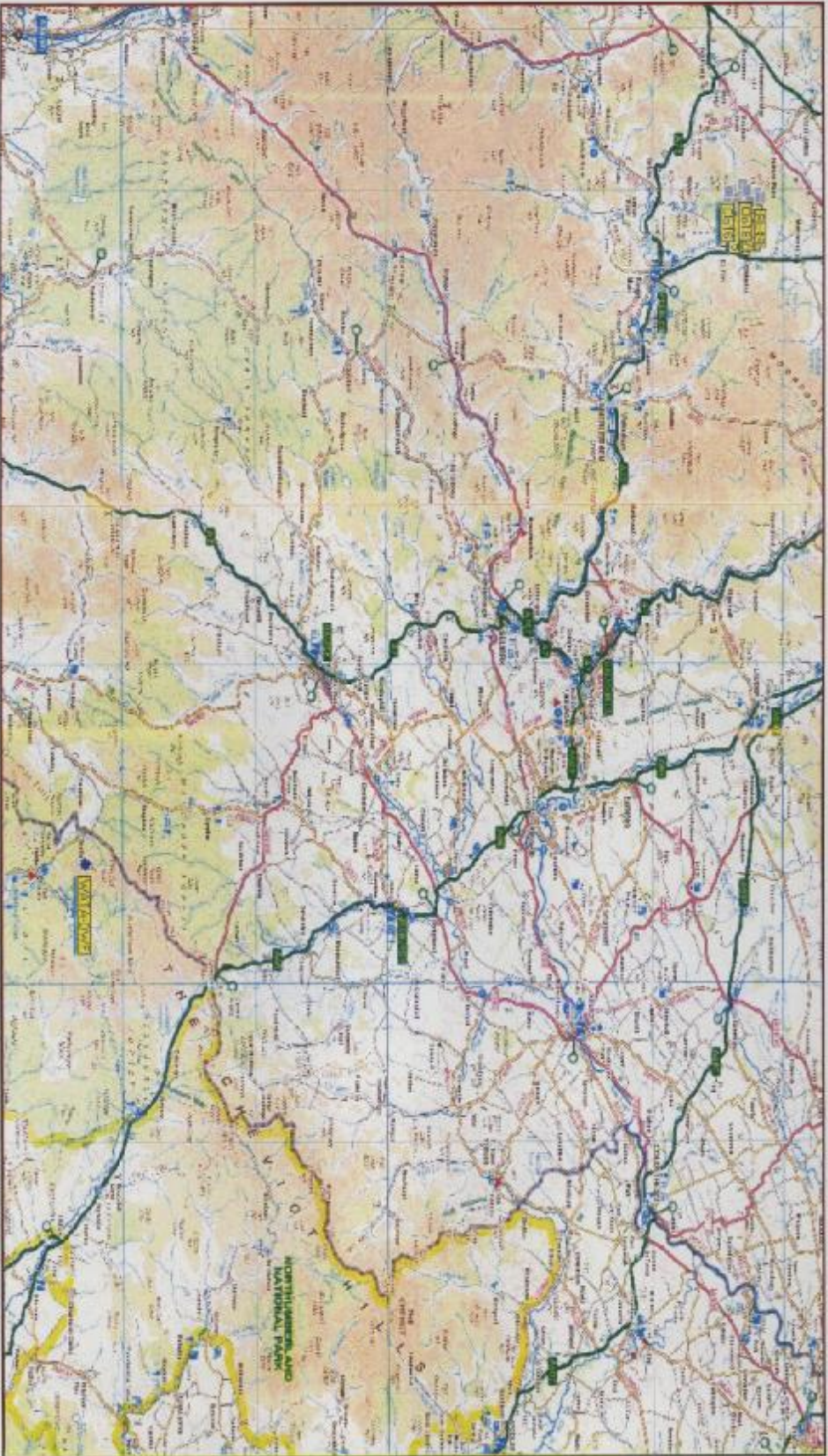
4.2.3 NATS Great Dunfell

4.3 The proposed wind farm is beyond the protected range and/or outside the protective arcs of all other radars.

5 Conclusion and Recommendations

It is recommended that the Operations Staff check whether the proposed wind farm at Cloich Forest is in an area of vital air traffic operations controlled by the radar at Spadeadam Deadwater Fell. If so a decision to object to the proposal should be considered on the grounds referred to in paragraph 3.1 and paragraph 3.2.

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Local area map for DIO 13930(B) Cloich Forest windfarm (NT (3)20448 (6)47093)

Figure 1

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Issue: 1 Dated: 17 March 14

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DIO 13930(B) coverage estimate plot for Spadeadam Deadwater Fell Watchman Radar (115m, 248.8m² RCS)

Figure 2

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Issue: 1 Dated: 17 March 14