

**ADATS IPT TB3B ASSESSMENT OF EXISTING WINDFARMS WITHIN
LINE-OF-SIGHT TO RAF SPADEADAM WATCHMAN RADAR SYSTEMS**

References

- A. Mark Spencer Proof of Evidence in support of MoD objection for Northumberland (Green Rigg/ Ray/ Steadings) Windfarm Public Inquiry.
- B. WPD/6/2 – Alan Collinson Proof of Evidence on behalf of Wind Prospect Development Ltd.
- C. WPD/6/3 - Appendix B to Collinson's Proof of Evidence.

INTRODUCTION

1. Under Work Request (WR50177) the Air Defence and Air Traffic Systems Integrated Project Team Technical Branch (ADATS IPT TB) was tasked to complete a technical study on the possible effects of three proposed Windfarms on the Air Traffic Control (ATC) Radar Systems owned and operated by the Ministry of Defence at and around RAF Spadeadam.
2. The results of the study are detailed at Reference A unfortunately, due to the timescales of the Public Inquiry, it was not possible to fully validate the predictions detailed at Annex D to Reference A.
3. At Reference B, Alan Collinson identified the location of Great Orton as having line of sight to the Berry Hill Watchman radar system; this windfarm had previously been discounted from Reference A as internet data had placed the Great Orton windfarm at the wrong location, the correct location has now been confirmed as being NY 311 530

AIM

4. The Aim of this report is to:
 - a. Determine if the windfarms identified at Reference A as having predicted signal strengths greater than -121dBm, that of the Watchman Radar Minimum Discernable Signal (MDS), are detected and displayed by the Deadwater Fell Watchman radar system.
 - b. Determine if the windfarms identified at Reference A as having predicted signal strengths greater than -121dBm, that of the Watchman Radar Minimum Discernable Signal, are detected and displayed by the Berry Hill Watchman radar system.
 - c. Determine if the Great Orton windfarm, as identified at Reference B, is displayed on either the Deadwater Fell or Berry Hill Watchman Radar systems.

**ASSESSMENT OF EXISTING WINDFARMS ON THE SPADEADAM
WATCHMAN RADAR SYSTEMS**

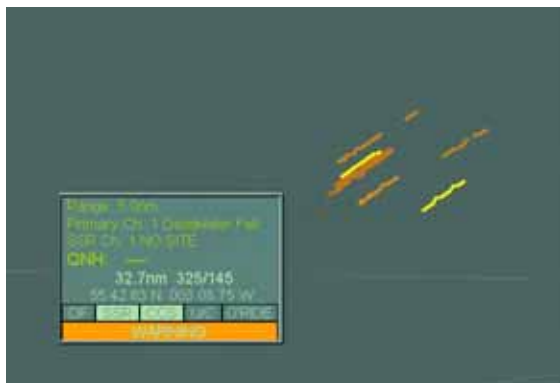
5. During a site visit to RAF Spadeadam between 31st Jan and 1st Feb I conducted an assessment of both Watchman radar systems to determine if the windfarms identified at Reference A were actually visible on the operators' display.

6. Table 1 below details all known operational windfarms which have predicted signal strength greater than the MDS of the Deadwater Fell Watchman radar and whether they were displayed on the operators' console at the time of the assessment.

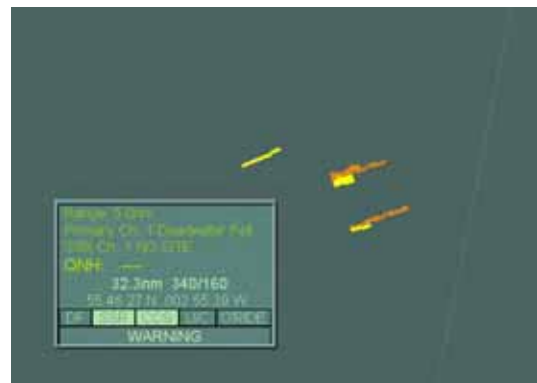
Table 1 – Windfarms with predicted signal strength greater than Deadwater Fell Watchman radar MDS

Wind Farm	NGR	Signal Strength for Deadwater Fell		Greater than Watchman MDS	Displayed on Operators' Display	Comments
		Static	Moving			
Kirkheaton	NZ 006 765	-99.1	-103.4	Yes	Yes	As predicted
Holmside Hall	NZ 199 500	-108.5	-107.8	Yes	Yes	As predicted
Tow Law	NZ 130 400	-113.0	-111.1	Yes	No	Not as predicted
Wharrels Hill	NY 175 376	-105.6	-109.8	Yes	Yes	As predicted
Bow Beat	NT 285 475	-103.2	-103.1	Yes	Yes	As predicted
Dun Law	NT 460 560	-103.9	-106.4	Yes	Yes	As predicted
Winscales Extension	NY 303 527	-103.3	-104.3	Yes	Yes	As predicted
WWE High Power	NY 255 435	-102.6	-112.9	Yes	Yes	As predicted
WWA High Sharpley	NZ 375 495	-109.2	-113.2	Yes	Yes	As predicted
Lowca	NX 985 235	-126.8	-119.5	Yes	No	Signal strength of moving part is very close to Watchman MDS figure and therefore the result is as expected.
Great Orton	NY 311 530	TBC	TBC	TBC	Yes	Great Orton has recently been identified as in line of sight therefore signal strength predictions are yet to be confirmed

7. Figure 1 shows examples of windfarms which were displayed on the operators console from the Deadwater Fell Watchman radar at the time of the assessment.



Bow Beat Windfarm



Dun Law Windfarm

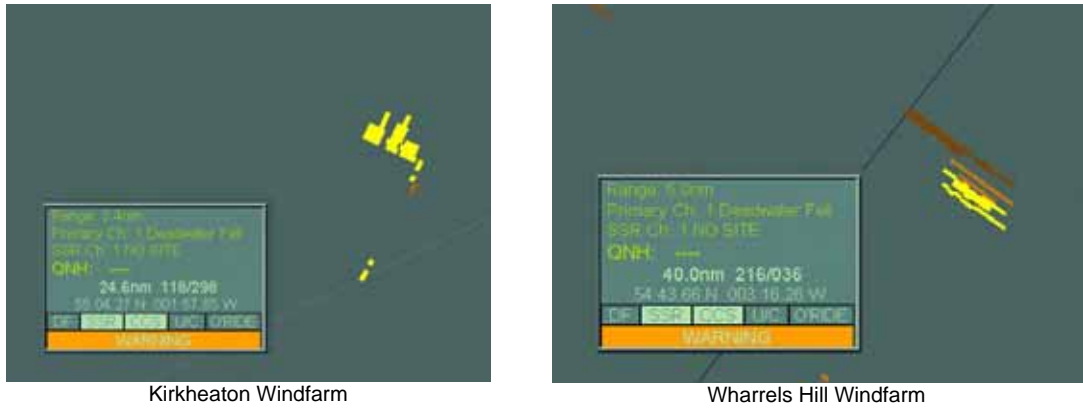


Figure 1 – example windfarms displayed on the Deadwater Fell operators’ display

8. Table 2 below details all known operational windfarms which have predicted signal strength greater than the MDS of the Berry Hill Watchman radar and whether they were displayed on the operators’ console at the time of the assessment.

Table 2 – Windfarm with predicted signal strength greater than Berry Hill Watchman radar MDS

Wind Farm	NGR	Signal Strength for Berry Hill		Greater than Watchman MDS	Displayed on Operators’ Display	Comments
		Static	Moving			
Wharrels Hill	NY 175 376	-106.2	-110.4	Yes	Yes	As predicted
Winscales Extension	NY 303 527	-102.4	-106.0	Yes	Yes	As predicted
WWE High Power	NY 255 435	-103.4	-112.7	Yes	Yes	As predicted
Great Orton	NY 311 530	TBC	TBC	TBC	Yes	Great Orton has recently been identified as in line of sight therefore signal strength predictions are yet to be confirmed

9. Figure 2 shows examples of windfarms which were displayed on the operators console from the Berry Hill Watchman radar at the time of the assessment.

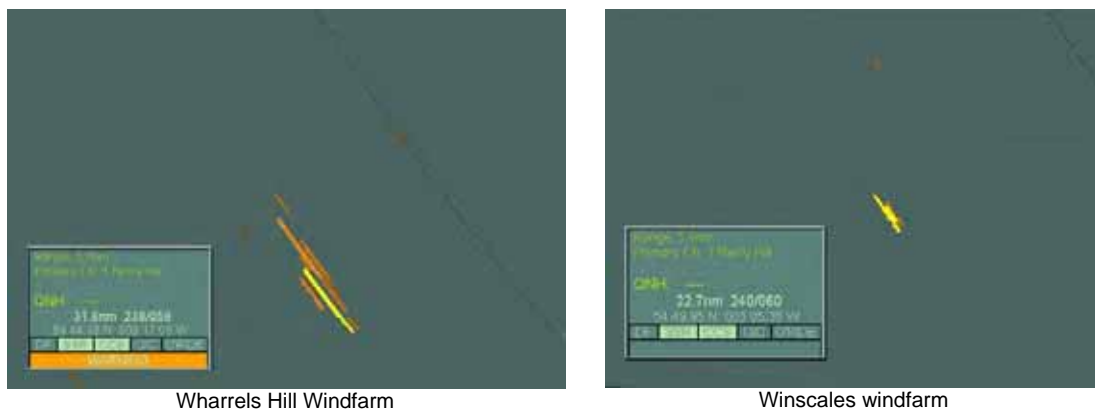


Figure 2 – example windfarms displayed on the Berry Hill operators' display

10. From tables 1 and 2 it is clear that, with the exception of Tow Law, the prediction made at Reference A are fairly well as expected.

11. Tow Law was consented in December 2001. It consists of three 75 m turbines, and lies 76.3 km south-east of the Deadwater Fell radar (a map is available at Figure 2 of Annex D to Reference A, my Proof of Evidence)

12. There are various possible reasons why Tow Law was not displayed on the Deadwater Fell operators' console during the assessment and are given as:

- a. The wind turbines were not turning at time of assessment
- b. The wind-speed and direction at the time of the assessment were such that position of blades had reduced the RCS of the wind turbines to below the estimated value.
- c. The RCS of the turbines is below the predicted value.

It was not possible to determine which of these reasons was the operative cause, however as the prediction from the other windfarms were as expected, in my opinion (a) is the most likely cause.

13. Lowca consists of seven 64m turbines, and lies 98kms south-west of the Deadwater Fell radar (a map is available at Figure 2 of Annex D to Reference A) The signal strength of the Lowca windfarm in relation to Deadwater Fell radar is -119.5 . As this is very close to the -121 minimum discernible signal of the radar, it was expected that the windfarm might only very intermittently be displayed.

ASSESSMENT OF THE GREAT ORTON WINDFARM ON THE SPADEADAM WATCHMAN RADAR SYSTEMS

14. Reference B identified the Great Orton windfarm as having line of sight to the Berry Hill watchman radar, but not appearing on the operators' display on 9 January 2008 (when the developers' witnesses visited Spadeadam. During my site visit on 31 January-1 February 2008, I can confirm that the

Great Orton windfarm was displayed on the operators' consoles, as shown at Figure 3.

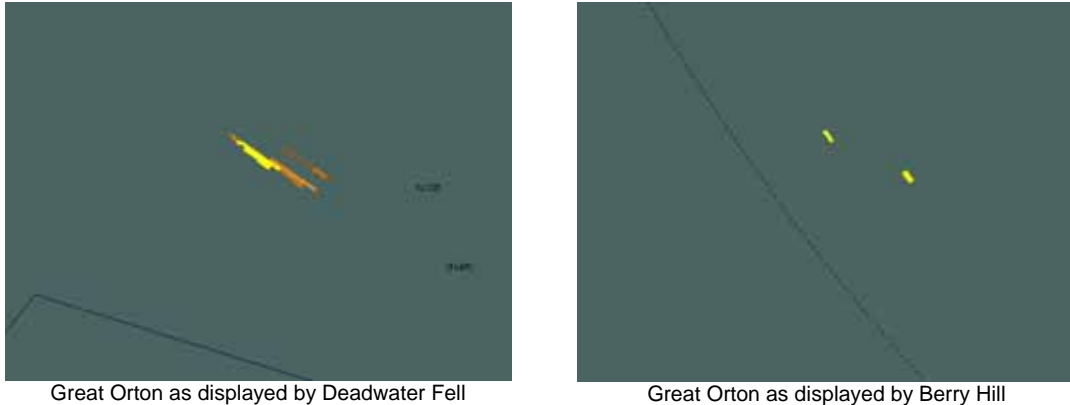


Figure 3 – Great Orton Windfarm as displayed by the Spadeadam radar systems

ADDITIONAL ANALYSIS

15. To provide additional confidence in the values of predicted signal strength further analysis was completed on the actual signal strength the Bow Beat windfarm presents to the Deadwater Fell Watchman radar. I would have liked to have assessed each of the windfarms, but weather conditions were so severe during my visit that I only had time to assess Bow Beat, otherwise I ran the risk of being snowed in the Deadwater Fell radar

16. The methodology used for this assessment is as follows:
- a. A calibrated variable attenuator is placed in the receiver chain.
 - b. The attenuator is then varied by 1dB steps until the returned signal from the windfarm is removed from the operators' display.
 - c. The amount of attenuation required is then added to the Watchman Minimum discernable signal (-121dBm).
 - d. The result is then compared with the figures predicted at Reference A.

Windfarm Aspect	Predicted Signal Strength	Required Attenuation	Actual Signal strength	Comparison	Comments
Static	-103.2 dBm	28 dB	93 dBm	10.3 dBm	
Moving	-103.1 dBm	15 dB	106 dBm	2.9 dBm	

Table 3 Bow Beat additional analysis

17. Initial analysis of the signal strength for the static element of the Bow Beat windfarm could suggest that the predicted signal strength has been understated by approx 10dB, however on investigation, it was discovered the Deadwater Fell Radar also has line of sight to the ground upon which the

windfarm stands (figure 4). Therefore the signal strength of the static element as measured in Table 2 is made up of the windfarm return and ground return and therefore a stronger signal would be expected.

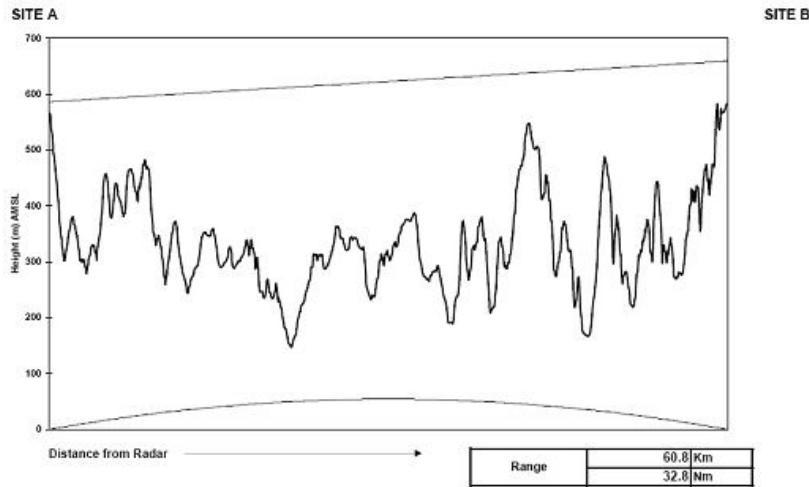


Figure 4 – Terrain profile between Deadwater and Bow Beat windfarm.

18. Analysis of the signal strength for the moving element of the Bow Beat windfarm shows the predicted signal strength for the moving element is similar to the actual signal strength.

CONCLUSION

19. From this assessment it is possible to conclude the methodology used to calculate the signal strengths for each of the proposed wind turbines (detailed at Reference A) is sufficiently accurate to assess if the returned signal strength from a wind turbine is enough to penetrate the Watchman Minimum discernable signal.

20. Great Orton windfarm is in LOS of the Deadwater Fell radar and does have sufficient signal strength to appear on the operators’ display at Spadeadam.

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