

**ELECTRICITY ACT 1989 (SECTION 36 AND SCHEDULE 8)
TOWN AND COUNTRY PLANNING ACT 1990 (SECTION 90)
THE ELECTRICITY GENERATION STATIONS AND OVERHEAD LINES
(INQUIRIES PROCEDURE)(ENGLAND AND WALES) RULES 2007**

**PUBLIC INQUIRY TO CONSIDER SECTION 36 ELECTRICITY ACT 1989
APPLICATIONS BY:**

- (1) STEADINGS WIND FARM LIMITED FOR CONSENT AND DEEMED PLANNING PERMISSION TO CONSTRUCT AND OPERATE A WIND FARM AT KIRKWHELPINGTON, NORTHUMBERLAND (KNOWN AS STEADINGS)**
- (2) AMEC PROJECT INVESTMENTS LIMITED FOR CONSENT AND DEEMED PLANNING PERMISSION TO CONSTRUCT AND OPERATE A WIND FARM AT RAY ESTATE, NORTHUMBERLAND (KNOWN AS RAY WIND FARM)**
- (3) WIND PROSPECTS DEVELOPMENT LIMITED FOR CONSENT AND DEEMED PLANNING PERMISSION TO CONSTRUCT AND OPERATE A WIND FARM AT GREEN RIGG FELL, BIRTLEY, NORTHUMBERLAND (KNOWN AS GREEN RIGG WIND FARM)**

**~~M~~MARK SPENCER
SUMMARY OF PROOF OF EVIDENCE
IN SUPPORT OF OBJECTION BY
MINISTRY OF DEFENCE**

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Glossary of defined terms

AGL	Above Ground Level
Air C2 OEU	Air Command and Control Operational Evaluation Unit
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATS	Air Traffic Services
dBm	Power Ratio in decibels measured with respect to 1 milliwatt
LoS	Line of Sight
MoD	Ministry of Defence
RCS	Radar Cross Section

Summary of Proof of Evidence***Qualifications and history***

1. I, Mark Spencer (ADATS TB3B), became a MoD civil servant in September 1989 under the Telecommunication Technician Officer Training scheme. I have worked in various areas since, including 4 years at the 3rd Line Radar Maintenance facilities at RAF North Luffenham and RAF Sealand. I moved to RAF Henlow TB3 section in August 2000 on promotion to the position of assistant ATC radar systems specialist where I became responsible for the Acceptance Testing of the replacement Precision Approach Radar. In August 2002, on further promotion to my current post as ATC radar systems specialist, I accepted the lead of a small team of Technical Advisors within the Air Defence and Air Traffic Systems Integrated Project Team (ADATS IPT) Technical Branch for ATC Radar Systems, in particular Primary Surveillance Radar (Watchman) and Precision Approach Radar. In all I have over 11 years of experience working specifically on MoD ATC Primary Radar Systems.

2. My proof of evidence considers the anticipated technical impact of the proposed windfarms on the performance of the ATC Radar systems at RAF Spadeadam and/or the microwave link between them. It also identifies the regions of radar coverage that may be affected.

Background Information

3. In paragraphs 6 to 7 of my proof of evidence, I provide general background information on the Watchman primary surveillance radar, explaining the scientific basis on which the radar functions and why wind turbines are sometimes visible as valid targets on the radar display. In paragraphs 8 to 9 I explain how the antenna gain of the radar and the RCS of aircraft and wind turbines combine to produce obscuration, and how shadowing can be caused.

4. I then set out the conclusions reached by the 2003 Air C2 OEU trials conducted to determine the effects of wind turbine farms on ATC Primary Surveillance Radars.

Assessment of the Proposed Windfarms: Line Of Sight Analysis

5. Due to the location of the Berry Hill and Deadwater Fell radars there will be little terrain obscuration between them and each of the proposed windfarm sites. **Figures 2 and 3**, attached to my Proof of Evidence, show in blue the areas in which a wind turbine with a maximum tip height of 100 metres AGL and 125 metres AGL respectively would be visible to Berry Hill radar. **Figure 4** shows in blue the areas in which a wind turbine with a maximum tip height of 100 metres AGL would be visible to Deadwater Fell radar.

6. 100% of the Steadings Farm and Green Rigg wind turbines and approx 35% of the Ray Estate wind turbine blade tips would be in direct LOS from the Berry Hill radar. 100% of all the proposed wind turbine blade tips would be in direct LOS from the Deadwater Fell radar.

7. I carried out a detailed LOS analysis from each radar to each of the proposed turbines, using the methodology detailed at **Annex A**. The results are summarized in Tables 2 to 4 (pages 10 to 12) and Tables 5 to 7 (pages 13 to 15) of my Proof of Evidence. The individual path profiles are provided in **Annex B** (Berry Hill) and **Annex C** (Deadwater Fell) to my Proof of Evidence.

Impact Assessment of the Proposed Windfarms

8. I identified the perceived impact of each of the proposed windfarms on the Watchman radars using methodology endorsed by the Civil Aviation Authority, implemented through the ADTI HTZ Warfare software package. This software predicted the signal strength presented by each of the turbines to the Watchman radars.

9. The results showed that the signal generated by all the proposed turbines would be sufficiently strong to be detected and displayed by both the radars. The results in relation to Berry Hill are set out at Tables 8 to 10 (pages 16-18) and in relation to Deadwater Fell at Tables 11 to 13 (pages 19-21).

Assessment of the Proposed Windfarms: the Microwave Link at Bolt's Law

10. Radar data from the Watchman radar at Deadwater Fell is sent to Berry Hill ATC via a microwave link which uses a repeater situated at Bolt's Law. **Figure 1**

attached to my Proof of Evidence shows that the proposed windfarms will not interfere with this.

Assessment of Windfarms in the Vicinity of Spadeadam's Radar Systems

11. **Annex D** contains a detailed assessment of all known windfarms (either operational, under construction, planning consented or in planning) which have line-of-sight to either or both of the Watchman Radars at Spadeadam. Ten operational windfarms, two under construction and 15 in the planning system are likely to be displayed on Deadwater Fell radar. Two operational windfarms and five in the planning systems are likely to be displayed on Berry Hill radar.

Possible Windfarm Mitigations

12. There are five known, proven methods by which it would be possible to remove or reduce the returns generated by the proposed wind turbines. For the reasons given in paragraphs 35 to 48 of my Proof of Evidence, in my professional assessment none of these measures, either singly or in combination, would provide a materially significant mitigation within the next five years.

13. The possible mitigations examined are:

- a. Raising the radar threshold detection level: desensitisation by 29 dB would be required to prevent signal returns from the proposed windfarms being displayed; this would result in many wanted signals not being displayed.
- b. Utilising an "in-fill" radar and producing a composite picture: I identified six potential in-fill radars and calculated the predicted radar coverage of each for a Hawk aircraft flying at 2000 ft above ground level (**Figures 6-14**). The predictions show that none of the potential in-fill radars would provide sufficient uninterrupted coverage of the area of the proposed windfarms.
- c. Improving the Radar Signal Processing to automatically differentiate the turbines from wanted returns: despite some advances being made, no radar manufacturer has demonstrated an acceptable signal processing technique, and none is likely to do so within the next five years.
- d. Reduction in the RCS of wind turbines: the practicality of such stealth technology remains unproven.
- e. Aggregate of technologies: the combination of Improving the Radar Signal Processing and reducing the RCS of wind turbines could

potentially provide a way forward, but is unlikely to come to fruition in the next five years.

Conclusion

14. The proposed windfarms at Green Rigg, Ray Estates and Steadings Farm will be clearly visible to both the Berry Hill and Deadwater Fell radar systems and the presence of a number of turbines will have a materially adverse impact on RAF Spadeadam's ability to support Air Traffic Services in each of the following respects:

- a. It will result in an increase in displayed clutter. MoD Operational Staff must conduct a detailed study of the effects of the displayed clutter taking into account the required separation distance; in general terms ATC are obliged to pay heed to clutter returns in close proximity to aircraft under their control and would have to assume that such returns were other aircraft in conflict. Moreover, the presence of a number of clutter returns would mask the returns from real aircraft.
- b. It will result in a reduction in radar detection – The Radar's ability to detect aircraft in the vicinity of the wind turbines would be significantly reduced in and around the proposed windfarm locations.

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