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)**

WILLIAM ANDREW EDMOND
PROOF OF EVIDENCE
IN SUPPORT OF OBJECTION BY
MINISTRY OF DEFENCE

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Glossary of defined terms

CW – Constant Wave
Ghz – Gigahertz
MTI – Moving Target Indication
TAR – Target Acquisition Radar (slash 1)
TTR – Target Tracking Radar (slash 2)

Proof of Evidence

Qualifications and History

1. I am Sgt William Andrew Edmond, J8174624, Instructor and Technical Manager at RAF Spadeadam, Emitter Training School, RAF Spadeadam, Gilsland, Cumbria, CA8 7AT.

2. I have been a radar technician for 29 years, working for 26 of these years on RADAR systems and the other 3 on radio and satellite communications. I have worked on RADAR systems from 3 Ghz to 23 Ghz frequency range. These cover most RADAR systems from long range Air Defence to short range missile systems and microwave links. My RAF Spadeadam experience started in 1983 and I have a total of 19 years service here.

3. My present duties are as full time reserve working as technical manager and lead instructor. As technical manager I can be called to assist on any of the Range's threat system. I am deputy Radiation Protection Officer and this task involves periodic testing and analysis of the Range's radio frequency output. As lead instructor I am responsible for the content and instruction of the Range's main threat system courses, which include instruction on the SA-6, SA-8, ZSU, T1 and T43. I have worked on the Skyguard system with experience on a number of missile and gun-laying systems.

4. My qualifications include BTEC Level 3 in Electronics, (ONC) Military Qualifications in many RADAR, Radio and Data Communication systems. I am classed as a system authority on an American threat system and I am used as a consultant for the system by the American maintenance factory. I have written the materials and run the only formal instructional course for this system.

5. My experience of the systems are as listed below,

    (1) SA-2/3 FANSONG LOWBLOW, I have a basic understanding of this system, although the instructor for this system at RAF Spadeadam is one of my subordinates.

(2) SA-6 STRAIGHT FLUSH, I have a basic understanding of this system, although the instructor for this system at RAF Spadeadam is one of my subordinates.

(3) SA-6 STRAIGHT FLUSH (T43) bespoke copy is in my main area of expertise I have an in-depth understanding of this system and its R.F. output.

(4) SA-8 LANDROLE, I have a basic understanding of this system, although the instructor for this system at RAF Spadeadam is one of my subordinates.

(5) SA-8 LANDROLE (T43) bespoke copy this is in my main area of expertise I have in-depth understanding of this system and its R.F. output.

(6) Skyguard I have worked on this system and have a basic understanding of its operation.

(7) The Defence E3 Authority and I test all the above systems each year for in-depth characterisation of their R.F. output. These checks are used to determine the safe working areas and as a confidence check on the systems' RADAR signatures.

The Threat Systems in use at Spadeadam

6. The basic description of the threat systems in use at Spadeadam is as follows. Some of the systems differ slightly but they all use the same basic layout.

7. Initially we search the area using a target acquisition radar. This is usually called "TAR" or "slash 1." This TAR allows us to see a full 360 degrees around our chosen site. While we are searching around this area, the TAR will show returns from objects the radar beam bounces off. This can include clouds, trees, TV relay masts and even road vehicles.

8. Once a target, has been identified we will bring a second transmitter, the Target Tracking Radar (called "TTR" or "slash 2"), on to the relevant bearing. This Radar has a different beam shape from the TAR. On the TAR, the beam is narrow in the horizontal but wide in the vertical, where as the TTR is narrow in the vertical and wide in the horizontal.

9. The TTR can differentiate the height of the target. This lets us narrow down our search. The TTR will scan up and down, until the strongest signal is received. To help narrow this search we can specify a range into the computer, which helps to eliminate

unwanted returns. The range is achieved by using the TAR picture and placing a range gate over the target. This gives the computer the range when the TTR has the strongest signal. The computer then uses Pythagoras' theorem to calculate an intercept angle for the missile or gun to engage the target.

10. Our missile systems use a guidance transmitter is called "Slash 3." There are two types of missile transmitters: constant wave ("CW") and pulsed (called "Triplets"). These missile transmitters only operate for a short time, namely the equivalent to a missile's range. A missile's range is limited as missiles can only carry a small amount of fuel.

11. We have a minimum of fifteen deployable systems. These can be deployed on Spadeadam camp area or to a number of sites scattered around the local area, from Haltwhistle in the south to Hawick / Coldstream in the north, and from Kirkudbright in the west to Seahouses in the east. We can, depending on the system, be deployed anywhere as long as access and frequency clearance are given. To give an example, Skyguard can be used to check for low flying aircraft virtually anywhere in the United Kingdom.

12. To be effective, we must move our threat systems around. If we did not, our systems would be like a fixed speed camera: the pilots would know where they were and could be ready for the effects. Moving the systems in an unpredictable pattern forces the aircrew to be on the look out at all times. This is the best form of training, as it is not to be expected that a real enemy will play fair and tell us where they have deployed their systems.

13. Our systems vary from British and American built emulators and simulators through European built threat systems to actual Russian built systems. The technology varies from thermionic valve-based systems to fully digital systems, from basic receiver systems to fully active systems (i.e. able to react to jamming and interference). A downside to a system being able to react to jamming and interference is that if it encounters any moving targets that stay in the area (for example, a wind turbine) it is not able to cancel the effect, so the false target would persist as a target and show on our screen: this will mask the real target within the noise.

14. One of our main countermeasures to discriminating between moving targets and background interference is a system called "moving target indication" ("MTI" for short). This involves taking one received signal (1), storing it for one return, then subtracting it from the next signal (2), which has the effect of cancelling a return if it is the same size and in the same location: anything that is left is moving (3).

Anticipated Effects of Wind-turbines on Threat Systems' Radars

15. I expect that in some of the locations at which our threat systems are deployed, the turbines will be readily visible on their radar screens. This assessment is based on:

a. The sorts of object that are already displayed on the screens of our threat radars,
b. The approximate dimensions of the turbines (90m diameter blades, 125m base to tip height) and
c. Their approximate location (the gap between the Otterburn training range and the Newcastle zone).

16. Because the turbine blades will be large and are turning, I would expect that these will present as moving targets. In these circumstances, the MTI will not be able to cancel the signal, with the result that all such returns will show as moving. This will cause a saturated area with lots of moving targets and so the computer will not be able to identify the actual target.

17. I would expect this problem to prove more pronounced on the TAR system. As the beam on the TAR is wide on the vertical and narrow on the horizontal, I would expect that we will get a blind spot above the source. This blind spot will be for a slightly larger area than the source. The best description is if you stand in the sea and face a wave it breaks around you, there will be a small area in front of you that deflects the next wave and a larger area behind you where the wave cannot form. This is similar to a Radar shadow. This effect can be disastrous as it causes a blind spot like a large block above and round the source.

18. I would expect that on any system that does not have the MTI facility the effect will be worse as we will not be able to delete the any of the effect of the turbine masts and other ground clutter. This would completely saturate our receiver for the area around the source.

19. Although I have not carried out modelling exercises to demonstrate the above assessment, it is based on my experience of the effects of lesser sorts (i.e. with a smaller radar cross section) of moving objects, e.g. storm clouds, on the operation of the threat systems. Unlike wind turbines, the storm cloud effect is only temporary. In terms of not being able to do anything about it, the main source of the problem, as I see it, is that the angle of incident at which our beam strikes the turbine will effect the received signal and this will be a variable that we will not be able to counteract. This would be a particularly significant problem for the TAR system, but even the TTR

would have a problem (principally because it is not aligned with best signal on initial line up).

20. A second problem that I would anticipate resulting from the turbines is that as the blades rotate, the Radar will see them as above but also, dependent on the direction of rotation, we could end up with return signals bouncing around the whole wind farm from blade to blade, turbine to turbine. Our tracking systems are built to track small frontal areas of aircraft and the frontal area of a turbine will be larger so a better target for the tracking system.

21. Finally I have attached a PowerPoint presentation that I use to explain our principals to new arrivals. I have had to modify this to exclude classified information, but I hope this assists the Inquiry. I quite accept that in order to get a precise measure of the effects of these windfarms on a threat system radar, it would be necessary to run a SA-6, SA-8 and Skyguard against a wind farm of the sort proposed and see what happens.

22. I can give a more in-depth analysis, but in the time allowed this proof was as detailed as I could be.

SGT W.A.EDMOND
18/03/2008