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)

ANDREW JAMES COLEMAN
PROOF OF EVIDENCE
IN SUPPORT OF OBJECTION BY
MINISTRY OF DEFENCE

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Qualifications and History

1. I am Sqn Ldr Andrew Coleman, the Range Controller of the Electronic Warfare Tactics Range RAF Spadeadam, Gilsland CUMBRIA CA7 8AT. I co-ordinate the deployment and use of all threat systems, both radar and visual, in the staging of training at RAF Spadeadam. This involves coordination of all threats used during each aircraft mission to ensure that the Range produces a credible and authentic threat environment on whatever scale requested by the user.

2. I am a Surface-to-Air Weapons Qualified Weapons Instructor, having graduated from the Surface-to-Air Weapons Operational Conversion Unit at RAF Honington in May 1996.

3. I joined the RAF in 1985. From June 1989 to June 1998 I served as Operations Officer of 37 Squadron RAF Regiment at RAF Bruggen, Germany, which was equipped with the Field Standard "C" Rapier short range air defence system. I was appointed Tactics Advisor to the Squadron Commander at RAF Bruggen. I have experience of the operation of live threat systems, having attended two missile live fire events at Royal Artillery Range Hebrides, where I participated in the firing of missiles. In June 1998 I became an Instructor at the Joint Rapier Training Unit at RAF Honington and in March 2002 I was appointed as the Threat Doctrine Offcier to RAF Spadeadam before appointment as Range Controller in March 2005.

Organisation of RAF Spadeadam

4. I report to Sdn Ldr C Jones OC Operations of RAF Spadeadam, who in turn reports to Wing Commander M Toft the Station Commander. I am part of a large team including two Junior officers acting as ground and air tactical advisors and a Senior Air Traffic Control Officer who coordinates all matters to do with airspace, aircraft control and flight safety.

5. Administratively I am responsible for two Flight Operations Assistants who man the communications, organise the daily flying programme and monitor the weather. For normal Range Operations I have an airman Electronic Warfare Threat Coordinator who communicates directly with threat locations. A threat location means the spot where a particular threat system has been located at a particular time. I have set out threat systems below. They are a combination of static and mobile systems.

6. During routine operations I control up to seven threat locations each equipped with radars and other visual threat systems manned by RAF Engineers and Aerospace Systems personnel. Each radar threat system is manned by a dedicated team of RAF Engineer Operator Maintainers. Sgt William Edmonds has provided a proof of evidence giving details of certain systems. My evidence should be read in conjunction with his.

The Threat Systems in use at RAF Spadeadam

7. So far as can be revealed, the threat systems on the Range that have their own radars are as follows:

a. One bespoke copy of an SA-2 FAN SONG static long range tracking radar (max range 45 nm, up to 50 000 ft);
b. One bespoke copy of an SA-3 LOW BLOW static medium range tracking radar (max range 25 nm, up to 40 000ft);
c. One bespoke copy of an SA-6 STRAIGHT FLUSH mobile tracking radar (max range 50 km, up to 40 000 ft);
d. One bespoke copy of an SA-8 LAND ROLL mobile tracking radar (max range 28 km up to 16 000 ft);
e. Two SA-6 STRAIGHT FLUSH mobile Medium Range SAM Fire Control radars, each equipped with a acquisition radar, a tracking radar and an illumination radar (max range of acquisition radar 50 km, up to 40 000 ft);
f. Two SA-8 LAND ROLL mobile Short Range Fire Control radars, each equipped with a acquisition radar, a tracking radar and an illumination radar (max range of acquisition radar 28 km, up to 16 000 ft);
g. Three Skyguard– Oerlikon mobile short range fire control radars each equipped with each equipped with a acquisition radar and a tracking radar (max range of acquisition radar 16 km, up to 14 000 ft);
h. Two ZSU 234 GUN DISH mobile gun control tracking radars (max range 10 km, up to 7 000 ft);
i. Three non-receiving mobile simulator transmitters.

8. All of the threat systems listed above are routinely deployed during training operations. Some of these threat systems have been widely distributed since their development almost two decades ago, and they represent an ongoing deadly threat in many theatres of operation. Also, the technology and method of operation of these threat systems are shared by other anti-aircraft radar-based threat systems also still in use.

9. Routine deployments of the Range involve the use of at least one of each of the real threat systems listed above. Each threat system will either be placed on sites within the boundary of RAF Spadeadam or on remote MOD sites up to 40 km beyond the boundary of the Range. The latter are called "**dispersed sites**". Occasional deployments are also undertaken to sites on private land, subject to landowner's permission and a thorough hazard assessment. There is a permanent off-Range site, Bell's Crag, which faces down the eastern approach to Spadeadam. Other dispersed sites include Brunton airfield north of RAF Boulmer, the edge of Otterburn Training Area, Peat Hill, White Preston, Larriston Fell, Monkside, Carlisle Airport, Albermarle barracks in Northumberland and Charterhall airfield in Northumberland.

The SA-6, SA-8 and Skyguard systems

10. The SA range of threat radars and the Skyguard threat radars form a crucial part of the operations at RAF Spadeadam. The capacity to design training sorties against these threat radars is one of the capabilities that makes Spadeadam's electronic warfare training particularly beneficial. In very briefest terms, the SA-6, SA-8 systems each have three radars:

a. A multi-beam acquisition radar which operates like that of a fixed site primary radar (such as the Watchman);

b. A narrow beam mono-pulse tracking radar which can determine more accurately the exact behaviour of aircraft;

c. a high power "spotlight" missile radar (in the case of the SA-6) or a radio frequency controlling signal (known as missile guidance).

The Skyguard only has an acquisition and a tracking radar.

11. Threat systems equipped with acquisition radar display detected objects on a "plan position indicator" consisting of a cathode ray circular radarscope screen with a single rotating line. Radar reflections are displayed on the screen, but not categorised in any way. As some of the acquisition radar technology used in these systems is rudimentary in modern terms, the radar system suffers from the inability to distinguish aircraft returns from normal ground clutter associated with the low level environment, such as hills and trees. The operation of these systems places heavy reliance on the skill and experience of the Former Soviet Union ("**FSU**") operators, who learn to recognise the target based on their interpretation of the display in terms of form and movement. Most FSU operators, often from former client states of the USSR, stay with their units for many years in order to develop the familiarity with the functioning of the radar necessary to achieve peak operation.

12. As with the acquisition radar, the narrow-beam tracking radar can also be affected by clutter produced by the low-level environment, such as hills and trees. The tracking radar is monitored from a separate display, another cathode ray tube and is always controlled by a separate operator. He manipulates the tracker in such a way so that a target lock is achieved – often difficult bearing in mind the simplicity of the display.

13. For reasons which I will explain, in my opinion the SA-6 and SA-8 mobile threat systems are potentially most vulnerable to disruption by the additional clutter source represented by the proposed windfarm developments. This would particularly be the case if they were deployed to sites in the east or north of the Range, or outside the Range near to the area where the windfarms are proposed to be located. I will call these systems at risk of disruption "the **SA Threat Systems**."

Mode of Operation of the SA Threat Systems

14. As indicated above, the SA Threat Systems are equipped with multi-path acquisition radars, which are used to locate incoming aircraft. They are also equipped with target tracking mono-pulse radars, which emit a single beam 1° - 3° wide. This tracking beam determines the height of the aircraft, within a 10m range definition. Finally, the SA Threat Systems also have illumination radars, which are used to guide the missile to its target.

15. When an SA Threat System is deployed during a training exercise, it is powered up and connected to the Range's command and control system, and voice communication with Range Control is established. The aircraft undertaking the training, referred to as "**the target**", will approach RAF Spadeadam. The point at which the crew manning the SA Threat System will be ordered to activate that system and engage the target will depend on the pre-planned scenario. It also depends on where the SA Threat Systems are located and, to a certain extent, weather conditions. As a broad principle, target aircraft can be engaged close to and beyond the area of the proposal windfarm developments (i.e. as they ingress the Range to the east of the proposed windfarm developments).

16. Engaging the target at the SA Threat Systems' maximum radar range gives the radar crew the most opportunity to illuminate and "fire" at the target. A typical maximum range engagement can take up to 90 seconds from the order to engage to nominal missile impact. Accordingly, it is desirable for many training scenarios to

proceed on that basis. It is not, however, a hard and fast rule, and users of the Range sometimes request that they not be engaged until they are will within the “envelope” (i.e. the area within which the missile will reach its target) of the acquisition radar range of the SA Threat Systems. Also, as there are certain well-used approaches to Spadeadam, there are occasions on which the SA Threat Systems will be positioned outside the Range in order to surprise the target aircraft by engaging them when they are within half the envelope so that evasion techniques become less effective. A typical engagement within the envelope, from the order to engage to nominal missile impact, can take 60 seconds for the SA-6 and 20-35 seconds for the SA-8.

17. On receiving the order to engage, the Range Controller provides the SA Threat System with the direction of travel of the target. In this sense, the operation of the SA Threat Systems is dependent on the information relayed by the Range Control, which is provided by the Range’s secondary surveillance radars (also known as IFF radars). IFF is the military equivalent of SSR. Both the Range Controller and the SA Threat Radar operators identify target aircraft by their IFF trace. Aircraft undertaking training at RAF Spadeadam are required to squawk a specified code as a backup safety measure to ensure that only those aircraft are engaged.

18. Once the SA Threat System crew activate the acquisition radar, they will try to “acquire” the target. The SA Threat Systems are equipped with a cathode circular screen on which radar returns from the acquisition radar are displayed. The FSU operator has to distinguish the target from the other returns (including clutter) on the screen. Once the crew of a particular SA Threat System have located a target using acquisition radar, they must then orientate the narrow-beam tracking radar accurately so that it too can acquire and precisely track the target. This acquisition by the tracking radar is referred to as “locking-on” to the target.

19. Taking the SA6 as an example, from the first moment that a target produces a display on the screen, it would take the acquisition radar approximately 8 seconds (two to three sweeps) to plot the target. The operator would then need to assess whether the return did indeed represent a legitimate target. Once that was done, a further 10 seconds would be required to attempt to track and lock on to the target, and another 14 seconds to compute a firing solution (ie calculate how long the missile would take to reach the target). When the target is judged to be in missile range, the crew would activate the missile guidance radar to simulate the launch of the missile.

20. The actions of the Threat System operators are recorded on a touch screen indicating when they are complete, so that the final computer debrief file can be compiled for the pilots undertaking training. If at any time lock on the target aircraft is lost, the Threat System reverts to standby and the operator of the acquisition radar attempts to re-acquire the target until told to disengage by Range Control.

21. Ex Russian radars, such as the SA Threat Systems, are difficult to operate, especially in comparison to more modern systems. Modern systems are largely automated and take the pressure off the operator by dealing automatically with certain clutter, jamming or threat recognition/ordering. This is not the case with the SA Threat Systems, where the radar information relied on by the operator is "raw".

Extent of Anticipated Interference

22. The introduction of an additional source of clutter, especially one that involved the production of moving returns, would significantly increase the already heavy workload of the SA Threat Systems' operators. Such returns would represent more information on the SA Threat Systems' Plan Position Indicators, from which operators would be required to distinguish target aircraft. It needs to be remembered that once the order to engage is received, from then until told to disengage, the operators are working in a highly charged environment where no lapse of concentration and no distraction can be tolerated.

23. The introduction of an additional course of clutter will, depending on the amount, location and nature of it, very likely mean that the operators of the acquisition radar, even experienced operators, will take more time to locate target aircraft, putting additional time pressure on the subsequent steps in the process, (i.e. locating the target aircraft with the narrow beam tracking radar and locking on to the aircraft).

24. From my understanding of the obscuration effect of windfarms on primary radar (see, for example, the RAF's trial of 10 May 2005)[1] in my opinion, based on my knowledge of the operation of the acquisition and tracking radars of the SA Threat Systems, obscuration would present a similar problem for the SA Threat Systems. It is likely, therefore, that target aircraft would be obscured from the sight of the Threat System operators when target aircraft flew over the position of the proposed developments or through the shadow of those developments.

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[1] CD301.

25. If I am correct in my assessment of the effect of obscuration on the on the SA Threat System acquisition and tracking radars, it is possible that some of the positions at which SA Threat Systems are currently located would be rendered unusable for all practical purposes.

26. It is also possible that the obscuration and shadowing caused by the proposed developments could disrupt the narrow-beam, monopulse tracking radar by causing it to lose the target when an aircraft flies through any obscuration or shadowing caused by the proposed developments. This interference with or delay in acquisition of and locking on to the target would affect the SA Threat Systems' reaction time and seriously impede the chances of a full engagement. Obscuration and shadowing could also disrupt the missile guidance radar.

27. Tactically, the proposed developments might represent an approach that could be exploited by attacking aircraft. However, this is unlikely to replicate what a pilot might expect to encounter in enemy territory. If a windfarm were situated in enemy territory and the "vulnerable point" being defended by the SA Threat Systems could not be moved, it is likely that the enemy would de-activate the windfarm development if it caused a degradation of the arc of acquisition around the vulnerable point. Users of Spadeadam are, accordingly, unlikely to want a mission involving operational wind turbines as it does not provide realistic hostile training.

Basis for Assessment of Anticipated Interference with SA Threat Systems

28. At the time of writing, I am unaware of any independent scientific study having been carried out to assess the effect of windfarms upon threat radars. I have therefore relied on my own knowledge of the operation of these radars in order to gauge the anticipated effect of the proposed windfarms. I have been provided with the basic statistics for each of the three proposed windfarms: number of turbines; diameter of turbines; hub height and location of the turbines. The fact that the turbine blades move, are concentrated in a relatively small area and have vertical extent means that they would, it can be safely assumed, present a large feature off which RF energy can reflect. It can be safely anticipated that the SA Threat Systems' acquisition and tracking radars would pick up quantities of reflected energy from both the wind turbines and the masts.

29. Should any of the proposed developments proceed, it would be my responsibility to determine whether the utility of the area in which they were

positioned was degraded to such an extent that the approach to RAF Spadeadam between Otterburn and Newcastle would have to be abandoned. Should this occur, it would represent a significant reduction in the usability of the Spadeadam range, as that area is a particularly good low-level entry point into the Range. It would also considerably diminish the breadth and realism of the training that the Range can provide.

Recognition of the Anticipated Interference with Threat Systems

30. To my knowledge, those whose work solely involves the control and operation of threat radars are not, and have not conventionally been, asked for their views on the impact of wind turbines on threat radars. Discussions between personnel at RAF Spadeadam, including me, and the RAF's point of contact for windfarm assessments, Sqn Ldr Colin Deane, concerned the impact on air traffic control radars. We did not delve into the impact on threat radars. As a result, those involved with direct responsibility for the Threat Systems at RAF Spadeadam were not probed about the anticipated effect on Spadeadam's threat radars of the clutter, obscuration and shadowing likely to result from the proposed windfarm developments until that question was brought to my attention on 12 March 2008.

A J COLEMAN
Sqn Ldr
17 March 2008