**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)**

# SQD LDR COLIN DEANE
# REBUTTAL PROOF OF EVIDENCE
# IN SUPPORT OF OBJECTION BY
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**Glossary of defined terms**

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| AIAA | Area of Intense Aerial Activity |
| ATC | Air Traffic Control |
| ATCO | Air Traffic Control Officer |
| ATS | Air Traffic Service |
| CAA | Civil Aviation Authority |
| DAP | Directorate of Airspace Policy |
| DF | Direction Finding |
| FIS | Flight Information Service |
| FL | Flight Level |
| RAS | Radar Advisory Service |
| RIS | Radar Information Service |
| TRA | Temporary Restricted Airspace |
| UKLFS | United Kingdom Low Flying System |

**Rebuttal proof**

1. This proof addresses the operational air traffic control aspects of the proofs of evidence submitted by Robert Trott [SWFL/7/2], Kenneth Gwynne James [SWFL/8/2] and Malcolm Spaven [SWFL/10/2 and SWFL/10/3] on behalf of Steadings Wind Farm Limited and John Taylor [WPD/5/2 and WPD/5/3] and Alan Collinson [WPD/6/1 and 6/2] on behalf of Wind Prospects Development Limited.

2. To the extent that I can, I was also address the supplementary proof of evidence of Vic Warren-King [AMEC/9/4] on behalf of AMEC Project Investments Limited, as well as AMEC/0/61, the QinetiQ report “Radar Impact Modelling for the Proposed Ray Wind Farm”. As the Inquiry is aware, the entirety of AMEC’s position on the effects of the proposed Ray development on the Spadeadam radars, and any potential mitigation of those effects, was unknown to me until Tuesday, 19 February 2008. Very early the following day, myself and Group Captain Maurice Dixon from the Air Defence and Air Traffic Systems IPT (ask Mark for the definition of IPT as I am unsure), flew to Denmark for to continue our search for radars with potential benefits in resolving the interference caused by wind turbines.. I returned to the UK at 2300hrs on 21 February. I have therefore has very little time indeed to assimilate and evaluate AMEC’s position. Accordingly, I will have to provide supplementary evidence at a later date, once a technical assessment has been carried out, in order to give my full response.

3. The technical radar issues covered in the proofs of evidence provided on behalf of the developers are dealt with in a rebuttal proof of Mark Spencer, a draft of which I have read.

***Wind Farms Already within LOS of Spadeadam/other MOD sites***

4. Several of the witnesses refer to the fact that there are other wind farms within LOS of SEWTR, or in LOS of other MoD sites.

*Spadeadam*

5. There are ten operational wind farms within LOS of the Spadeadam radars.[1] Currently, technical mitigations do not exist to address the clutter generated by these wind farms. Accordingly, operational measures have to be taken. We do not currently record how often they present on the Spadeadam radars, but I can confirm that both pilot and ATCO workload has increased overall as a result of these wind farms coming into operation. At present, the workload remains manageable, but further proliferation of such developments could well 'tip the balance' between manageable and unmanageable.

6. If the wind farms are displaying as unidentified primary-only radar returns, Spadeadam's ATCOs seek to maintain a 5nm separation from them.[2] In practice, this means that, under RIS, an ATCO warns aircraft when they are approaching the 5nm point from the primary returns. Under RAS, the controller has to issue the warning earlier in order that his 'avoiding action' will achieve a minimum of 5nm lateral separation once the pilot has executed the suggested manoeuvre. Under FIS, if the ATCO assesses that the primary returns present a hazard to the safe conduct of flight, he will warn the aircraft as early as is considered necessary to ensure safety.

7. This approach is taken because of the kinds of airspace and the patterns of traffic in the vicinity of Spadeadam. The airspace is a three-dimensional complex mosaic of different classes and types of airspace. Aircraft approaching the Range are not obliged to adopt the kind of set patterns mandated around aerodromes (SEWTR does not have a runway). The airspace can often contain both civilian and military aircraft that, in uncontrolled airspace, are not bound to fly in the straight lines adopted in civilian controlled airspace.

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1 Mark Spencer carried out a technical assessment of these wind farms, which is attached to his Rebuttal Proof as Annex 1.

2 As prescribed by JSP 552 para 235.150.1.

8. Any accident involving aircraft controlled by or relying upon hazard/traffic information provided by the ATCOs at Spadeadam will have potentially catastrophic consequences (including loss of more than one human life, which may not be restricted to the aircrew involved, but could also include civilians from conurbations into which wreckage may fall). Accordingly, although an occurrence (such as an unidentified primary-only radar return) may carry only a miniscule probability of giving rise to an accident, the potentially catastrophic nature of such an accident means that the probability (although miniscule) cannot be discounted or treated as anything less than real. It follows that the potential consequences of an accident oblige the ATCOs at Spadeadam to deal carefully with any unidentified primary-only radar returns.

9. For the reason just mentioned it is unsafe for an ATCO to assume that an unidentified primary-only radar return(s) in the area of the wind farms is/are part of clutter that can be ignored.[3] Those returns could be, or could be masking, civilian aircraft or military aircraft. Also, military helicopters and private use helicopters (such as pipeline and powerline inspection helicopters, police helicopters and air ambulances) regularly use the airspace in the vicinity of Spadeadam. A low-flying helicopter, in particular, can readily give a return pattern indistinguishable from the clutter produced by one or more of the proposed wind turbines. It would be reckless for the ATCOs not to call the returns to the aircraft under their control in order to ensure the requisite 5nm separation.

10. James suggests [para 8.6 pg 11] that “a windfarm seldom looks like an aircraft track”, and shows a radar screenshot as an example. This is both very simplistic and deceptive. The screenshot of the wind farm in his example could show returns from three gliders, or three light aircraft carrying out general handling acrobatics, or three helicopters hovering over a road accident, or even three Apache helicopters flying at such low level that their SSR is not being picked up. James’s example illustrates the very sort of risk that cannot safely ever be discounted. It may well be that in a high percentage of cases the unidentified primary-only radar return is the product of wind farm clutter. The ATCO must be alert to the possibility, however slim, that there may be cases where the unidentified primary-only radar return is not the product of wind farm clutter.

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[3] See also paras 38-40 below.

11. The inaccurate impression created by James' use of a single screenshot of a single wind farm is also made plain when reference is made to Appendix 1 of Mark Spencer's Rebuttal Proof, "Assessment of Existing Windfarms Within Line-of-Site of RAF Spadeadam Watchman Radar Systems". In this Appendix, Mark Spencer provides eight screenshots of the returns on Spadeadam's consoles caused by various wind farms in the vicinity of the Range. The variety of different ways in which wind farms show on radar screens is another reason why they increase ATCO workload. Also, the various and changing clutter patterns illustrate why ATCOs simply cannot take the risk that unidentified primary-only radar returns are not aircraft.

*Other MoD sites*

12. There is not a pan-MoD operational approach to wind farms in LOS of military radars. In conjunction with HQ Air Command, each MoD site will conduct its own evaluation of the potential impact of a proposal and will determine the safest operational approach to the clutter caused by the wind turbines, which could be to object to the proposal or could mean an acceptable adjustment to existing procedures,. Spadeadam's policy is rooted in the complexities of the airspace around Spadeadam, combined with the types of sorties being flown by the military aircraft either en route to the Range or participating in training flights.

***The Position of the Wind Farms***

13. Three of the witnesses claim that, because the wind farms fall outside various Danger Areas, Tactical Training Areas and the Spadeadam Area of Intense Air Activity, they will have little or no impact on Spadeadam ATC, either at low level[4] or at medium and high level[5]. Taylor recognises [para 6.18 pg 32] that aircraft might have to be routed around Green Rigg, but says that "there is usually enough airspace to achieve this". Warren-King asserts [paras 7.5.1-7.5.4 pgs 19-20] that a "heading change of some ten degrees" will "take aircraft clear of Ray windfarm".

14. These assessments are fundamentally flawed. They misunderstand both the way in which the airspace over the proposed sites of the wind farms is currently used and the ATC requirements for ensuring the safety of aircraft flying over that area.

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4 Spaven para 7.3 (pg 9); the draft Spaven report paras 6.8-6.11 (pgs 37-38).

5 Taylor para 6.9.1 (pg 28); the draft Spaven report para 6.13 (pg 39).

15. The proposed wind farms are situated in what I will call, for ease of reference, the “Newcastle-Otterburn Corridor”. It is a 10.4nm wide channel of Class G (i.e. uncontrolled) airspace between the restricted airspace over Otterburn Range and the restricted airspace over Newcastle Airport. During significant military exercises, the width of the Newcastle-Otterburn Corridor is reduced to 7.4nm, as a 3nm buffer is imposed from the northern edge of the Newcastle Airport zone, from surface to FL105.

16. The Newcastle-Otterburn Corridor and the Hexham Gap converge on the same piece of airspace at the south-eastern segment of Spadeadam EWTR (N-S for Hexham Gap and E-W for the Newcastle-Otterburn 'corridor'). Accordingly, the Newcastle-Otterburn Corridor is used by military aircraft to approach SEWTR from the east, often flying in from the coast having completed Air-to-Air Refuelling or other sortie elements in the Managed Danger Areas. It is also used to depart the Range.

17. As the aircraft approach and depart, they will be in receipt of ATS from Spadeadam. Although records of airspace use are not kept, I have spoken with the controllers at RAF Spadeadam who state that the Newcastle-Otterburn Corridor is regularly used for all these reasons. As an Area Radar Controller at LATCC(Mil) I myself have often witnessed the busy flow of traffic into and out of Spadeadam, both in the ‘Newcastle-Otterburn’ corridor and in the Hexham Gap.

18. The Newcastle-Otterburn Corridor is also sometimes used by military aircraft that have finished one type of training sortie profile to exit the Range and then manoeuvre to prepare to re-enter on a different type of training sortie profile. Again, such aircraft would be in receipt of ATS from SEWTR.

19. It is incorrect that there will usually be enough airspace to route traffic around the wind farms while still allowing aircraft to approach or depart the Range through the eastern channel. Minimum separation of 5nm is required, both from the restricted airspaces and from any returns being generated by the wind farms.[6] This prescribed separation must be adhered to because of the speed at which the aircraft will be moving. The risks associated with non-adherence to the separation increases with foreign aircrews who use the range. With the clutter that is anticipated will be produced in the channel by the wind turbines from any one of the 3 proposed developments, it will not be possible to guarantee separation of

[6] JSP 552 para 235.150.1.

anywhere near 5nm. The risks are significantly increased if there is more than one aircraft in the vicinity at the same time as the returns from those aircraft will be lost amongst the returns sprayed across the area by the turbines.

20. This will have a significant knock-on effect on the Hexham Gap. As I explained above the Newcastle-Otterburn Corridor and the Hexham Gap converge on the same piece of airspace at the south-eastern segment of Spadeadam. Aircraft that would have normally entered the Range through the Newcastle-Otterburn Corridor may have to be re-routed through the Hexham Gap if the requisite separation cannot be maintained in the Newcastle-Otterburn Corridor. This would place additional pressure on the provision of safe and expeditious ATS in the vicinity of the Hexham Gap, which is already a known choke point.

21. Quite apart from this, introducing clutter into such a narrow and well-used corridor of uncontrolled airspace adds significantly to the stress levels of the ATCOs. I have already spoken to the potentially catastrophic consequences of any accident involving aircraft under the control of RAF Spadeadam. All ATCOs are acutely aware of these consequences. This adds pressure to the intense concentration under which ATCOs work. Intense, unremitting concentration is required because the margin of error is so small. Introducing clutter of the scale and sort that is anticipated would result from any one of these three proposed wind farms adds a further matter that an ATCO must always keep in mind. Moreover, it reduces the options open to an ATCO for ensuring separation between aircraft. These are particularly significant matters in relation to military aircraft moving at high speeds. When an aircraft is flying at 420 knotts (the typical speed of many of the military fast jets that use Spadeadam), a few seconds' delay or slight miscalculation can take the aircraft several km off course.

*Low-flying aircraft*

22. Depending on the training sortie profile, SEWTR's threat radars may be trying to detect aircraft as they approach, even from a considerable distance outside the Range. As a result, it is an important part of the SEWTR training that aircraft can approach the Range at low level, attempting to use the terrain to evade the threat radars. In Class G airspace and within the UKLFS, aircraft are permitted to fly down to 250ft in order to approach the Range. The channel within which the proposed wind farms are sited is a known area for such an approach. The radar coverage of that airspace at 250ft is not "likely to be intermittent",[7] because of the

[7] The draft Spaven report para 6.12 (pg 38).

downward tilt of Deadwater Fell. Indeed, controllers at SEWTR can observe aircraft as low as 100ft on final approach to Newcastle Airport.

23. The developments will clearly impinge upon the low flying approach to SEWTR. The MoD has concluded that the effect of the physical obstructions presented by the proposed developments, although not desirable, can be managed operationally. This does not mean, however, that the ATC aspects of the low-flying approach are not affected. In fact, quite the contrary – it is clear that certain low-flying approaches in the Newcastle-Otterburn Corridor under the LOS of the Spadeadam threat radars will have to be abandoned. This will put additional pressure on other low-flying approaches to the Range.

*Class G (Uncontrolled) Airspace*

24. The Draft Spaven Report states [para 6.8 pg 37] that the "predominant" traffic in the Class G airspace over the proposed development is military aircraft, and that the flows of light aircraft are "believed to be relatively light" since they generally avoid the area on weekdays because of the intense military activity [para 6.18 pg 40].[8]

25. I am not aware that any statistics concerning frequency of use of the airspace have been recorded. I do, however, know that there are three civilian airfields close to the area of the proposed development: Elwood, 15nm West of Newcastle Airport Eshott, 15nm North of Newcastle Airport and Currock Hill Gliding Site, 6nm Southwest of Newcastle Airport. Light aircraft from these fields, also including helicopters, gliders and microlights can and do use the airspace both during the week and at weekends, and are not deterred from doing so by nearby military activity. More often than not the gliders and microlights, and on occasion the helicopters and light aircraft, do not carry secondary transponders.

26. That is one of the reasons for concern about the proposed wind farms. Because they lie in Class G airspace that is used by civilian aircraft, the ATCOs at Spadeadam cannot simply assume that the unidentified primary-only radar returns in the area of the wind farms are clutter that can be ignored.[9] Those returns could

[8] Reference is made to the CAA's June 2007 Aeronautical Information Publication recommending that light aircraft avoid the Spadeadam AIAA. It should be noted that the proposed wind farms are outside the AIAA (and the prescribed Danger Areas), and the CAA's recommendation would not deter light aircraft traffic from using the airspace over the proposed developments. Indeed, it is one of the obvious slices of uncontrolled airspace in the area for civilian aircraft to utilise.

[9] See also paras 38-40 below.

be, or could be masking, civilian aircraft. For the reasons identified at para 7 above, it would be reckless for the ATCOs not to call the returns to the aircraft under their control in order to ensure the requisite 5nm separation. The acute danger of loss of life should a collision occur requires the ATCOs to act with the utmost care.

27. It should also be remembered that Spadeadam ATCOs provide ATS to increased numbers of civilian aircraft if the controllers at NIA are busy. ATS have been provided to civilian aircraft flying in the vicinity of the proposed wind farm sites. Again, the frequency of provision of ATS to civilian aircraft has not been recorded until the last few months, but it is estimated that approximately 10% of all ATS are given to civilian aircraft. Depending on the qualification of the civilian pilot and the aircraft being flown, that ATS could be a RIS or a RAS.

***The type of ATC provided by Spadeadam***

28. Three of the witnesses suggest that the effects of the wind farms on the ATC service provided by SEWTR will be acceptable or manageable because of the type of service being provided.[10]

29. Warren-King asserts [para 5.1 pg 13] that the service provided in the vicinity of the Range is "by necessity, fairly basic, and will comprise a flight information service [ie a non-radar service] at best". The draft Spaven report recognises that aircraft approaching the Range flying medium level profiles will be in receipt of a radar service, but asserts that this is "likely to be a RIS rather than a RAS" (para 6.13 pg 39).

30. While the type of service given to an aircraft will very much depend on what the sortie demands, what the pilot wants and the prevailing weather conditions, I can categorically state that radar services are routinely provided to aircraft flying at all levels in the vicinity of Spadeadam, including the airspace above the proposed site of the wind farms.

31. RAS is provided, for example, to aircraft descending through cloud into SEWTR or climbing out through cloud, as they could be flying under IFR.

[10] Warren-King paras 5.1-2 (pg 13) and 7.5.7-8 (pg *); draft Spaven report paras 6.13-15 (pgs 39-40) and ref; Taylor ref.

32. It should also be remembered that one of the functions of the Spadeadam radar is to establish and maintain the identity of the aircraft undergoing training, not only to provide ATS but also to monitor the sortie in order that a proper debriefing can be provided once the training is complete. The deliberate introduction of clutter into the vicinity of the Range hampers this important aspect of SEWTR's work.

*The Provision of RIS and FIS*

33. While it is the case that more RIS services are provided than RAS services, this does not mean that the service is any less important for the pilots. The nature of operations at Spadeadam means that the ATCO is often working as a second pair of eyes for pilots with extremely high cockpit workloads. It is therefore crucial that aircraft identity be established and maintained at all times. Moreover, it is important that SSR derived height information is able to be read and monitored easily and not 'muddied' by passing through clutter.

34. The potentially serious consequences of even a small mistake heighten the importance of this function. Accordingly, any information relevant to the safe conduct of flights is essential and there is an intense need to call potential hazards. Under FIS where radar derived information is available, and under RIS, ATCOs can and do request that, if pilots are able to safely comply with restrictions in order to ensure that separation is maintained, that they agree so to do.

35. Even though the ATCOs at Spadeadam may not be vectoring pilots away from possible conflictions, their workload thus remains high because the identity of aircraft has to be maintained, appropriate hazards still have to be called to the pilots and restrictions have to be called when required. ATCOs stress levels may also be increased during the provision of a RIS or a FIS because they do not have full control over the aircraft, which can make heading and level changes without informing the controller.

36. Spaven [para 7.5 pg 9] implies that the proposed developments would not have an unacceptable impact on SEWTR's operation because aircraft receiving a RIS "will not require rerouting around any wind farm clutter". This is predicated upon the assumption of risks that the MoD is simply not prepared to countenance. It is an irrefutable truth that the presence of any one of the wind farms will increase, however marginally, the probability of an accident involving aircraft under the radar control of RAF Spadeadam. As I have already said, any such accident will have potentially catastrophic consequences. For this reason, I am unable to share Mr Spaven's nonchalance.

37. Where ATS are being provided up to FL195 in Class G airspace (up to FL245 in TRAs), whether RAS, RIS or FIS, it would be considered reckless for an ATCO to ignore a radar return, or to decide not to call a potential hazard. As I mentioned above,[11] the acute danger of loss of life should an accident or a collision occur obliges the ATCOs at Spadeadam to deal carefully with any unidentified primary-only radar returns.

38. Accordingly, Taylor's assessment [para 6.9.5 pg 30] is similarly flawed. Clutter can be 'disregarded' only above FL250 and only in the sense that the ATCO does not call all traffic – the ACTO still remains under a duty to call conflictions. The ATCO would therefore not be permitted to disregard the returns from the proposed development if they conflicted with an aircraft under Spadeadam's control.

39. In this regard, Trott's reliance [para 7.7 pg 21] on the para D3.2.2 of the Wind Energy and Aviation Interests – Interim Guidelines is wholly misleading. The first sentence of the paragraph, which is deceivingly omitted from Trott's proof, makes it clear that the Guidelines are at that point addressing aerodrome radar operations, not en route operations. Aircraft have to adopt specified patterns of flight in the vicinity of aerodromes, and so returns caused by wind farms outside those patterns are much less likely to be aircraft (or to be obscuring aircraft) than is the case with wind farms situated under Class G airspace.

40. It is also not accurate to say that RAF Marham "ignores" returns generated by the Swaffam development 4nm southwest of its aerodrome. Marham's response is based on the fact that there is a Military Air Traffic Zone with a 5nm radius around the aerodrome. The Air Traffic Control Squadron at RAF Marham carried out a safety assessment in relation to the wind farm, and concluded that, since it is highly unlikely that unknown aircraft will enter their Military Air Traffic Zone, controllers may reduce the standard separation requirements between aircraft and returns in the area of the wind farm.[12] They do not ignore the returns – indeed, they remain especially vigilant when passing close to the clutter generated by the Swaffam turbines.

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[11] Para 8.

[12] This is an example of a safety assessment concluding that, based on the restricted nature of the airspace around Marham, the small risk inherent in reducing the standard separation could be borne.

41. Other military aerodromes also do not ignore returns. RAF Wittering, for example, has elongated its flight patters to ensure 5nm separation from a three-turbine development within LOS of its primary radar.

42. Accordingly, para D3.2.2 and the situation at aerodromes such as RAF Marham are irrelevant to the impact of the proposed developments on RAF Spadeadam.

*Provision of a Limited Service*

43. Warren-King suggests [para 7.5.8 pg 20], possibly as a mitigation, that "standard ATC procedure available to both civil and military controllers" would allow the ATCOs at Spadeadam to choose to provide a limited service in the vicinity of the proposed developments if certain criteria cannot be achieved because of radar clutter.

44. This is misleading. In military ATC, the circumstances in which a limited service may be provided are set out in JSP 552 and are delineated by reference to the military definitions of RAS and RIS, also set out in JSP 552.[13] The definitions of RAS and RIS given by Warren-King [para 7.5.7 pg 20] are the civil aviation definitions. Warren-King's statement that if the services set out in para 7.5.7 cannot be achieved because of radar clutter "controllers are able to limit the service provided on condition that pilots are notified accordingly" [para 7.5.8 pg 20] applies to civilian ATC. It does not apply to military ATC.

45. In military ATC, a limited service may only be provided in the circumstances laid down in para 235.135 of JSP 552, namely:

> a. When the aircraft is being flown close to the lateral or vertical limits of solid radar cover or within 10 nm of the edge of the radar display.
> b. When the aircraft is close to areas of permanent echoes or weather returns.
> c. When the aircraft is being flown in areas of high traffic density.
> d. When the controller considers that the performance of his radar is suspect. In addition controllers are to take account of the specific equipment limitations contained in 425.[14]
> e. When the controller is providing a service using SSR-only outwith Class A airspace.

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[13] Paras 253.110 and 253.115.

[14] Section 425 of JSP 552 gives technical specifications for air traffic control equipment and sets out basic principles of use and maintenance.

46. For the reasons set out below, none of the five circumstances identified in para 235.135 will generally apply so as to enable an ACTO at RAF Spadeadam to decide that, because of clutter resulting from one or more of the three proposed wind farms, only a limited service was to be provided.

47. So far as circumstances (a) and (e) are concerned, these will not be applicable. The aircraft will not be being flown close to the lateral or vertical limits of radar cover nor within 10nm of the edge of the radar display. RAF Spadeadam does not provide a service using SSR-only.

48. So far as circumstance (b) is concerned, clutter from wind turbines is not considered to be a permanent echo.[15] An echo can only be classified as permanent if it is stationary. Wind farm clutter is not stationary, either when it presents in a way similar to an aircraft track or when it "sparkles" (i.e. presents a cluster of little dots).[16] Also, the pattern presented changes from day to day. Therefore, although the wind farm is a permanent fixture on the landscape, the turbines do not generate permanent echoes.[17] Category (b) thus does not justify providing a limited service because of clutter from a wind farm.

49. Circumstance (d) also does not provide justification, as the degradation of the radar image by clutter is not considered to make the "performance" of the radar suspect, although it would add unwanted interference.

50. Therefore, the only circumstances in which a limited service could justifiable be provided would be where the aircraft were being flown in areas of high traffic density: i.e. circumstance (c). The proposed developments, however, all fall outside the AIAA, so that aircraft being flown in their vicinity will not fall within circumstance (c).

51. In any event, it would be particularly inapposite for a facility like Spadeadam to provide a partial service, especially on an approach route to the Range. It is incumbent on the ATCOs at Spadeadam to offer as much information as is deemed appropriate to aid the safe conduct of flight and offer warning of definite hazards.

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15 See also paras D3.2.3-4 of the Wind Energy and Aviation Interests – Interim Guidelines.

16 James' misleadingly comments [para 7.2 pg 9] that, because the return from a single wind turbine is stationary, it can be delineated from a moving aircraft. The proposed developments are multiple turbine wind farms, that will not create a permanent stationary echo.

17 This is accepted by Trott in para 7.4 (pg 20).

52. The draft Spaven report states [para 6.30 pg 44] that “limitation of radar services in specified circumstances” is one of the operational measures used at RAF and other UK military units. I am not aware of this occurring at ATC units as a matter of ‘routine business’. I am surprised to hear that it does occur, at least in the unqualified way expressed by Spaven. And I am even more surprised to hear that it does occur and that I am not aware that it does occur. As the report does not give actual examples of where this happens, I have not been able to investigate it further at the time of writing this proof, although more information has been requested. Should this be made available in time, supplementary evidence may have to be provided setting out my full response.

*Low flying aircraft*

53. Taylor, having noted that a typical flight profile for an aircraft entering the Spadeadam range will be 250 ft MSD, asserts [para 6.8.1 pg 26] that provision of radar service “is not compatible with aircraft flying at low level [defined to be at or below 2,000 ft MSD] because they are below, or at the base of, radar services”. He goes on to assert that in the circumstances “the pilot is wholly responsible for avoiding other aircraft.”

54. This assertion has no factual basis so far as aircraft approaching Spadeadam are concerned. It reflects a fundamental failure to understand the nature of the radar service that is being provided at RAF Spadeadam. The radar service at RAF Spadeadam is both intended to be provided and is regularly (if not invariably) provided to aircraft entering the range at 250 ft MSD. Indeed, since its erection and commissioning the Deadwater Fell radar has been tilted 10° down so that greater coverage of low flying can be achieved. Low flying aircraft approaching Spadeadam are offered either a RIS or FIS using radar derived information, with the ATCO acting as the crucial second pair of eyes for the pilots. The draft Spaven report recognises [para 6.12 pg 38] that although low flying aircraft do not normally receive a radar service, this is not the case with aircraft in the vicinity of Spadeadam.

55. The practice at Spadeadam is that ATCOs will call both definite and possible hazards to pilots approaching the Range at low level. It would be a totally unacceptable degradation of the air traffic service either to curtail the returns that are habitually called or to stop offering a radar service in that area on the basis of the aircraft being “low flying.”

56. Warrren-King comments [para 5.1 pg 13] in relation to low flying aircraft that cockpit workload "may be too high for the pilot to accept a formal ATC service". This, too, betrays a fundamental misunderstanding of the requirements of low flying military aircraft using RAF Spadeadam. It is precisely because there is a high cockpit workload that the ATCO is relied upon as the second pair of eyes and has to call potential or actual hazards.

*Replacement of FIS by Basic Service*

57. Taylor argues [para 6.8.3 pg 27] that, when the Air Traffic Services Outside Controlled Airspace (ATSOCAS) review comes into effect in 2008/9, SEWTR will have to change the way in which it calls traffic information. Although he does not say this in terms, the suggestion is that clutter from Green Rigg (or any of the wind farms) will no longer be called to aircraft receiving "Basic Service", the successor to FIS.

58. Taylor states that, under the new regime, in providing Basic Service, ATCOs will be strongly discouraged from routine calling of traffic, and will limit information only to situations where there is a definite hazard of collision.

59. Taylor's argument is misconceived. The way in which primary radar returns (which could be attributed to wind farm clutter or non-transponding aircraft) are currently called is not part of the "routine calling of traffic." When primary radar returns are currently called, it is precisely because the ATCO cannot reliably or definitively distinguish the clutter from the returns produced by wind farms or one or more aircraft such that the ATCO will consider there is a "definite risk of collision." Taylor appears to be confusing "a definite risk of collision" with "risk of a definite collision." There is a very real difference. Once the controller considers that what is displayed represents some probability of collision, then, even if that probability of collision is extremely low, there is a definite risk of collision. Accordingly, the practice under the current rules of FIS will continue under Basic Service.

***Spadeadam's Autonomous Radar Unit Status***

60. Taylor comments [paras 6.9.2-6.9.3 pgs 28-29] that the MoD's "claim" that training can take place "within 60 nm of SEWTR, currently up to FL245"[18] was "at variance" with its own regulations. It seems Taylor has misread what was being said, or alternatively was not aware that training in the TRAs, which are within

[18] SOC para 10f.

60nm of SEWTR, takes place up to FL245. Outside those areas, training only took place up to FL195.

61. As the SOC went on to explain, that has now changed. The Directorate of Airspace Policy of the CAA granted Spadeadam autonomous radar unit status, confirmed in the letter dated 7 January 2008.[19] Accordingly, regulation JSP552 235A.140.3 no longer applies. SEWTR now provides radar services to military aircraft in the upper air (including at higher altitudes than FL245) anywhere within its area of responsibility. This extends to the airspace over the site of the proposed developments.

62. As a further result, SEWTR is authorised to provide radar services to military aircraft crossing the civilian airway L602, which is used by aircraft overflying Newcastle to and from the Continent. This airway passes directly over Green Rigg, Ray and Steadings proposed developments.

63. As the letter from the DAP makes clear, the impetus behind the change was the need to "support future Typhoon aircraft operations within, and in the vicinity of, the Spadeadam Electronic Warfare Tactics Range." This is because Typhoon aircraft very often operate in upper airspace and descend rapidly into the 'theatre of operation'. It is precisely this kind of manoeuvre that needs to be practiced at the Range. Such sortie profiles will require change of ATS from Radar Control above FL195, to RAS, RIS or FIS when in Class G airspace, which will attract the aforementioned traffic information and or separation standard requirements, dependant upon the potential hazards to the safe conduct of flight.

***The Airspace Around Spadeadam***

64. The draft Spaven report maintains [para 2.16 pg 6] that controllers responsible for Classes A, B, C and D airspace can "assume that any unidentified primary-only radar return within the controlled airspace is not an aircraft", because such aircraft would have had to enter the airspace without permission. Such an assumption would be both wrong and extremely foolhardy. In 2007, there were 811 infringements of controlled airspace by civilian light aircraft which were lost or disorientated or suffering technical problems or had deliberately entered the airspace. The controllers at Spadeadam simply cannot afford to operate on such assumptions.

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[19] Submitted to the inquiry on 14 February 2008.

***Aircraft performing high-energy manoeuvres***

65. The draft Spaven report claims [para 6.26 pg 43] that aircraft performing high-energy manoeuvres are "highly likely to lose primary radar identity, particularly on a radar with a rotation of only 7.5 rpm".[20] This is simply incorrect. Primary radar identity is not lost during high-energy manoeuvres. Rather, it is likely that secondary identity will be lost. It should be noted that the radars at Spadeadam operate at between 10 and 12 rpm.

66. Warren-King also addresses the performance of high-energy manoeuvres. He does not suggest that such manoeuvres cause a loss of primary radar identity, but rather that they "will make any form of positive control difficult to achieve" (para 5.1 pg 13). It is not clear what is meant by "positive control". The ATCO is still obliged to monitor the path of the flight, to make the pilot aware of any hazards and to limit those manoeuvres should the prevailing traffic situation so require, which is a positive control instruction.

***Loss of Track Identity***

67. Loss of track identity occurs where an aircraft which had been presenting a track on the radar screen no longer does so, either because it is invisible to the radar or because the screen is so congested with returns that the track of the aircraft cannot be discerned. If this persists for three sweeps of the radar, the ATCO is obliged to re-identify the aircraft. This may be a simple operation of the SSR Ident facility or could require a series of turns and DF traces[21] to ensure that positive identity is achieved.

68. Taylor conjectures that the impact of loss of track identity "has been overstated and is very rarely if ever a problem. Experienced controllers have no difficulty in maintaining track identity through wind turbine generated clutter. Controllers also have the advantage of Secondary Surveillance Radar…" (para 3.6 pg 8). This is not the case. No matter what the experience of controllers is, track identity can be and is lost in clutter, especially under the following circumstances (all of which may apply to the proposed wind turbine site):

a. The aircraft is not flying in a straight line;
b. The aircraft is not flying in a set pattern;

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[20] See also Spaven para 7.9 pg 10.

[21] A DF trace is a line on the radar display that is shown when the subject aircraft makes a radio transmission.

c. The aircraft is not flying at a constant speed, and may hover over or linger in a particular area;
d. The ATCO is not providing ATS to the aircraft (e.g. a civilian glider plane).

69. SSR labels do not necessarily ameliorate this problem, as they too can be obscured by the clutter from the wind farm, effectively rendering the aircraft's path and height invisible. SSR labels can also 'drop off' low flying aircraft.

***Suggested Mitigations***

70. The various technical mitigations proposed by the developers' experts will be addressed by the MoD's technical expert, Mark Spencer. I will, however, comment as appropriate on these mitigations from an operational perspective.

*SSR as Mitigation - General*

71. Trott claims [para 6.3 pg 17] that it is "very rare for SSR to give inaccurate positions of aircraft on radar displays". Collinson [para 9.3 pgs 22-23] provides a more temperate analysis of SSR, recognising that it "routinely suffers from a number of problems", which he relates. These limitations, as well as the fact that transponders sometimes cease functioning altogether, mean that it is not an acceptable risk strategy to rely solely on SSR to ensure the safety of aircraft in the vicinity of Spadeadam.

72. Despite recognising some of the limitations of SSR [para 2.13 pg 5], the draft Spaven report states [para 6.15 pgs 39-40] that the identity of traffic as it flies through wind turbine clutter can be maintained through the use of SSR labels, which "should remain visible". Unfortunately, as mentioned above, the clutter on the display generated by wind turbines can also obscure SSR labels, and make the information, particularly that relating to height, difficult to read.

73. While it is the case that the SSR labels can be rotated, this requires the positioning of a small cursor over the obscured area, in order to click on the label. Each click rotates the label 45 degrees. Even on a clear screen, it may take more than one try before a label is rotated. The operation of rotating the label will take time and will focus the ATCO's attention fully on that part of the screen, which will reduce his ability to divide his attention effectively to other areas where he may be controlling other aircraft.

*SSR as Mitigation - Mode S Transponders*

74. Spaven comments [para 7.13 pg 10] that the "mandatory carriage of Mode S transponders from 2008 will further reduce the problem of primary-only radar returns such as those generated by wind turbines".

75. It is correct that mandatory carriage of Mode S transponders from 2008 could assist in reducing the problem of primary-only radar returns such as those generated by wind turbines. However, the limitations of this requirement need to be recognised. In particular, it will not remove the problem. First, the carriage of Mode S transponders will not be enforced within the next five years. Secondly and in any event, there is simply not a sufficiently robust way to ensure that all aircraft, including gliders and light aircraft, are fitted with the requisite expensive and potentially heavy equipment, particularly in light of opposition from the general aviation community. Indeed, Taylor recognises this [para 3.9 pg 10], and expressly refuses to rely on the mandatory carriage of Mode S transponders as a mitigation. It is enough to say that unless carriage of Mode S transponders is universal, there remains a real risk that a primary-only radar return has been generated by an aircraft.

*Fill-in radar - Lowther Hill*

76. The draft Spaven report comments [para 6.41 pg 46] that "services to military aircraft in both controlled and uncontrolled airspace in the Steadings area can already be provided using the Lowther Hill radar, which does not have line of sight to the three proposed wind farms".[22] While it is the case that Spadeadam has access to the data from NATS Lowther Hill,[23] this information cannot be used for providing ATS, as Lowther Hill has never been flight checked. The information is only ever used for situational awareness.

77. Moreover, Lowther Hill does not provide sufficient radar coverage of the area of the proposed developments to be relied upon. Mark Spencer can provide details of the anticipated base of radar cover, but this would fall woefully short of the cover needed to pick up the aircraft running in to SEWTR at low-level.

*Fill-in radar – Berry Hill radar and AMEC's mitigation*

78. Warren King states in his supplementary statement [para 8.18.6 pg 27] that the Qinetiq modelling has given him "reason to assume that it will be operationally acceptable and technically feasible, to blank out the clutter on the Deadwater Fell

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22 See also James para 9.3.3 (pg 13).

23 Draft Spaven report para 6.23 (pg 42).

radar and replace it with a ‘patch’ from Berryhill [sic]”. I cannot share his assumption.

79. It is an inescapable fact that nine of the Ray turbines are in LOS of the Berry Hill radar. Even if only a single blade of each turbine is in LOS, that means that nine 45m turbines, situated between 31.9kms and 35.2kms from the radar, are seen by the radar. I have not seen anything in the Qinetiq report, or in any of AMEC’s further evidence, that indicated that this will not still cause significant clutter on the Berry Hill radar. Nowhere does the Qinetiq report conclude that the clutter from Ray will be reduced, let alone eliminated, by the proposed mitigation.

80. As I stated in para 2 above, the very short space of time in which I have had to process AMEC’s supplementary information means I will have to provide supplementary evidence at a later date in order to give my full response to this suggested mitigation.

*Installing a third radar at Spadeadam*

81. Warren King, in his supplementary statement, relays an offer from AMEC to finance, “either in full or in part”, the installation of a third radar for the use of Spadeadam ATCOs, which would be terrain shielded from the proposed Ray wind farm [para 8.18.8 pg 27].

82. The MoD will very seriously consider AMEC’s offer. Unfortunately, that will likely entail AMEC providing much more detailed information about the proposed positioning of such a radar than is contained in the Qinetiq report [para 7.3 pgs 43-45].[24] This, combined with the very brief time I have had to consider AMEC’s offer, means that further supplementary evidence will have to be provided setting out the MoD’s full position.

83. In the interim, it is important to bear in mind what will be involved in a project to install a new radar. AMEC and the MoD would have to agree on what type of radar could be provided. A specification, setting out the basic operational requirements of the radar would then have to be drawn up by the MoD. The chosen type of radar would then have to be tested against the specification at the various positions suggested by AMEC, in order to ensure that it provided sufficient

[24] Warren King [para 8.18.8 pg 27] also cites “7.14”, but as no such paragraph exists, I take it that he is referring to the concluding paragraph, 7.4, on pg 45.

radar coverage of the proposed Ray site. It is difficult to gauge how long this process would take, but it would likely be some months.

84. Should the trials identify a suitable site, the radar would then have to be commissioned. Once the radar was built, it would have to be flight checked in order to ensure that it did in fact meet the MoD's specification.

85. Alongside this process, the composite picture or "mosaicing" side of the mitigation would also have to be addressed. The technology to produce a composite picture of the Deadwater Fell and Berry Hill radars would have to be identified and a specification would have to be written. The technology would then have to be tested against the specification in order to ensure that it would be implemented in the radars. Once implementation had taken place, the technology would have to be flight checked before it could be brought into operation.

86. Obviously, this project would cost a significant amount of money. The MoD is finding it difficult to finance the upgrading and replacement of its current radars. Finding the money to finance the building of a new radar, simply in order to provide coverage over a wind farm, would be almost impossible. It would therefore be overwhelmingly likely that AMEC would have to bare the totality of the costs of this project itself.

87. Finally, it goes without saying that such a project would also have to go through the planning process and be granted planning permission.

*Delineation of Wind Farms on Radar Display*

88. James suggests [para 9.2 pgs 12-13] that a possible operational measure applicable to SEWTR would be "to provide the air traffic controller with visual cues and reminders that there are turbine echoes in areas of the display, and to act as an aide-memoire when distinguishing between turbine returns and those returns which controllers call 'unknown traffic'". It should be clear from what is said above that this is not a workable operational mitigation. Given the nature of activities in the vicinity of the Range, SEWTR is not prepared to run the risk of ATCOs assuming that unidentified primary-only radar returns are wind farm clutter, whether the wind farm is delineated on the screen or not.

*RAG Mapping*

89. Collinson proposes [para 10.1 pgs 24-25] that RAG mapping could provide a technical solution "if operator distraction is a concern". He very properly points

out, however, that in removing the distracting clutter, RAG mapping also removes the ability to detect aircraft in the same area. He goes on to say, though, that If “the area is small aircraft transit times are small before returns are restored to the operator”.

90. While his analysis is correct for aircraft flying straight through a particular area, it is not correct for aircraft that are general handling or are hovering. If, for example, a glider or a pipeline/power line inspection helicopter were to fly into a blanked out area at slow speed, it is quite possible that an ATCO engaged in controlling aircraft operating in another area would not notice. Should the glider or helicopter hover over in the blanked area (as one would expect from a helicopter inspecting power lines in the wind farm or a glider making use of the interesting air currents above a wind farm), that aircraft could be rendered completely invisible to the ATCO. It is clear how dangerous such a situation would be, particularly as the ATCO would not have any warning of the craft exiting the blanked out area.

91. For the same reason that ATCOs cannot simply ignore clutter generated by wind turbines, a mitigation which simply blocks detection of returns from a particular area is not acceptable.

92. Also, in military ATC, if an aircraft is lost for three sweeps of the radar, it has to be re-identified. Therefore, any RAG mapping that obscured an aircraft for three sweeps of the radar would not only unacceptably degrade the service, but would also increase ATCO workload.

*Plot extraction – ADT and SENSIS*

93. Taylor proposes [para 6.10.3 pg 31] the SENSIS plot extraction system as a viable mitigation, because “it will be capable of filtering out any wind turbine clutter whilst maintaining an optimal radar picture enabling a full ATC service to be maintained”. He comments that it is “entirely probable” that work on the system will be “completed” “within the next year”.

94. Both the SENSIS system, produced by Selex Sistemi Integrati (Selex) and the Advanced Digital Tracker (ADT) being developed by British Aerospace Systems (BAeS) are plot extraction systems, They were trailed at Clatter in mid-Wales between 24 April and 8 June 2006 to assess their viability as mitigates of wind turbine interference. Clatter was chosen as it was used during a previous BAES Insyte-run demonstration of ADT capability and is in LOS of four wind farms (P&L, Cefn Croes, Bryn Titli, and Carno).

95. An MoD Tactical Watchman radar was calibrated against a range of aircraft types and then, in turn, the ability of both SENSIS and ADT to provide ATS (in terms of plot extraction, tracking, probability of false alarm attributable to wind turbines, and track quality) for aircraft flying close to and above wind turbines was assessed.

96. The trial showed that both SENSIS and ADT were successful in reducing those effects but neither was able to provide sufficient mitigation to allow the MOD to accept that they allowed for the safe control of aircraft in the vicinity of wind turbines.[25]

97. Since the visit to Spadeadam the MOD has contacted a senior Business Development Manager at BAeS. The position (as best as we have been able to discover from our inquiries) is as follows:

1. At the very best ADT is 12 months away from being ready for trailing.

2. It is not clear precisely what those trials will involve.

3. Limited steps have so far been taken to develop the ADT into something which can be tested against real wind turbines using a real radar and real aircraft.

4. In order to develop the ADT into something which can be tested against real wind turbines using a real radar and real aircraft, before starting BAeS will need civil and military aviation authorities (i.e. the CAA and MoD and possibly NATS) to provide a firm performance specification. The specification process is being undertaken, but is far from close to completion.

5. Only when BAeS has the performance specification can work begin on developing the ADT so as to meet that specification. BAeS has no idea how long it would take to meet that specification as it has yet been produced.

6. Once BAeS has developed the ADT sufficiently that it believes that it will meet the specification, it will need to be tested to see whether in practice it does meet the specification. This can be an iterative process and just the testing and improving process can take years.

98. From inquiries made of those concerned, SENSIS is less advanced in its development stage than is the ADT. RAF personnel have been invited (with

[25] It should be pointed out that the MoD was quite prepared to release the results of the ADT and SENSIS trials, but was asked not to do so by the manufacturers.

others) to a week long workshop sometime in April to try to help SENSIS develop the SPE-3000 into acceptable wind turbine mitigation. The process sketched above for BAeS will apply equally to SENSIS.

99. It is, therefore, fanciful to suggest that either SENSIS or ADT will provide a feasible mitigation within the next five years.

*The "Tilting Mitigation" proposed by WPDL*

100. The technical aspects of this proposed mitigation are addressed in the Mark Spencer's rebuttal proof [paras 28-43]. I will only speak to the operational implications of adopting this mitigation.

101. First, it is clear that, from an operational perspective, the only radar that could be tilted is Berry Hill. It is crucial to maintain the current -10° tilt of Deadwater Fell, in order that the low flying activities in and around Spadeadam can be monitored and appropriate ATS provided.

102. In his technical report, Mark Spencer illustrates the current coverage achieved by Berry Hill of a Hawk fighter jet (ie a $1m^2$ target) flying at an attitude of 500 feet above ground level [Annex 2 to his Proof]. This aircraft is a good exemplar, as it is used for low flying and Spadeadam is a recognised and well used training ground for Hawk pilots.

103. By comparing Figure 3 [para 10 pg 4] with Figures 4-6 [para 11 pgs 5-6], one can clearly see the significant diminution in coverage produced by tilting Berry Hill. Even a 2° tilt drastically reduces the radar coverage, and a 4° tilt reduces coverage to within a 20nm radius of Berry Hill.

104. The implications of this are clear. Tilting Berry Hill would render it completely unusable on its own. In that scenario, if Deadwater Fell were to go offline for any reason, Berry Hill would not be able to provide sufficient coverage for the safe provision of ATS, and all operations at Spadeadam would have to cease. It should be obvious that the MoD is simply unable to countenance even a slim chance that such a shutdown could occur.

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