

**DEPARTMENT FOR BUSINESS**  
**ENTERPRISE & REGULATORY REFORM**

**AIR TRAFFIC SERVICE SAFETY CASE  
WORKSHOP**

**URN 07/1142**

**CONTRACT NUMBER: 01.08.09.09/53A**

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**Contractor**

BAE Systems Integrated System Technologies

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## **SECTION 1**      **References**

- 1      HVR Safety Case AT04 13 01 Draft 5 Issue 1
- 2      CAA CAP 670 Air Traffic Services Safety Requirements 12<sup>th</sup> June 2003;
- 3      CAA CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases, 13<sup>th</sup> January 2006
- 4      CAA CAP 764 Policy and Guidelines on Wind Turbines July 2006
- 5      Eurocontrol Standard Document SUR.ET1.ST01.1000-STD-01-01 Edition 1.0 (For Radar Surveillance in En-Route Airspace and Major Terminal Areas).  
[http://www.eurocontrol.int/src/public/subsite\\_homepage/homepage.html](http://www.eurocontrol.int/src/public/subsite_homepage/homepage.html)
- 6      UK ATS Airspace Classifications ACD M94149 09.08.01  
[http://www.caa.co.uk/docs/64/ATS\\_Classifications.pdf](http://www.caa.co.uk/docs/64/ATS_Classifications.pdf)
- 7      Meeting the Energy Challenge, A White Paper on Energy, May 2007, Department of Trade and Industry - <http://www.dti.gov.uk/files/file39387.pdf>
- 8      BWEA website July 2007 - <http://www.bwea.com/ukwed/planning.asp>

## SECTION 2      Introduction

The UK government has set targets for 10% of electricity generation to be produced from renewable sources by 2010, some 8GW of capacity. Further more in March 2007, European Union heads of State endorsed a binding target of a 20% share of overall EU energy consumption should come from renewable sources by 2020. (Reference 7)

In the short to medium term wind power, both on and offshore, represents the main technology we have to achieve these targets.

There is already over the 2GW of installed wind powered capacity in the UK. But there are over 222 wind farm projects currently waiting planning consent (Reference 8). These projects total 10 GW of wind energy; enough to power over 6 million homes.

It is known that the MoD raises concerns in relation to 60% of all proposed wind farm application receive on the grounds of radar interference (source Defence Estates). The ratio is thought to be similar civilian aviation operators raise. Therefore it is a fair assumption that 60% of these projects will have aviation issues that need to be addressed to reach planning consent.

In 2006 the BERR contracted HVR Consulting Services Limited to produce a Safety Case for the Baseline Watchman Primary Surveillance Radar in the Presence of Wind Turbine Interference based on hazards affecting the provision of Air Traffic Services. The resulting document is designed to be used as a generic template for all Terminal (Airport) radar systems outside of regulated airspace. This document will be published later this year and will be available via the BERR website. The BERR require further activities to build upon the HVR work to produce levels of performance for radar equipment in the same terminal environment.

The focus of the workshop was on Air Traffic Services (ATS) for terminal control and en-route services (LARS) in F and G airspace as opposed to the major NATS and Eurocontrol en route airspace and the airspace around major airports. (Reference 6.)

This workshop was the first time that regulators, service providers and radar engineering representatives had gathered with the sole purpose of discussing, agreeing and documenting the Air Traffic Service Safety issues pertaining to the interference caused by wind turbines in the line of sight of Primary Surveillance Radars. By having the regulators, service providers and engineers together the major topic areas could be covered and a cohesive picture formed.

It should be noted that during this workshop it has become apparent that the same or similar words and phrases have different meanings when used in the ATS operating domain to that when used in the Radar engineering domain. Where this is significant the word has been placed in *italics* in the body of the text.

### **SECTION 3**      **Objective of Workshop**

To further refine the BERR sponsored Watchman safety case (created by HVR) for Terminal Airports and aviation services in class F and G airspace.

- Consider and select which radar performance parameters are important to civil and military Air Traffic Controllers operating outside of regulated airspace.  
  
e.g. (but not limited to) Pd, *False alarm* rate, seduced tracks, dropped plots, dropped *tracks*, accuracy, resolution
- Consider what levels of radar performance, for the parameters decided above, would be appropriate.
- Consider more general Equipment performance levels required to meet the TLS numbers e.g. MTBF
- Consider measurement methods for radar performance for the levels decided above.
- Create a list of assumptions around which the above objectives are based.
- Create recommendations where the objectives are and are not, met or agreed.

## **SECTION 4      Attendees**

The BERR sponsored workshop was able to attract the people listed below. This group can be regarded as being representative of key regulators and decision makers that will influence any processes that may enhance the acceptance of wind farms in F and G airspace. The attendees consisted of a broad mix of representatives with extensive experience in their Operational, regulatory and engineering fields of expertise.

Name	Job Title	Organisation
Colin Smith	TESD ATC, Airfields and Ranges	MOD Air worthiness & Flight Test Regulator (MAFTR)
Colin Trundle	Aviation Capability Manager	HVR Consulting Services Limited
Phillip Greville	Group Captain Airspace Control Capability	HQ Air Command, RAF High Wycombe
Ginge Paige	SO1 ACC Safety Management	HQ Air Command, RAF High Wycombe
Steve Elks	SO3 ACC Safety Management SE2	HQ Air Command, RAF High Wycombe
Ray Woods	CAA SRG ATSD Surveillance Specialist	CAA SRG
Jonathan Cashmore	AOS IPT ID Branch (2C)	
Mark Spencer	AOS IPT ID Branch (2B)	
Ian Scragg		BAE Systems Insyte
John Holloway		BAE Systems Insyte
Ian Colley		BAE Systems Insyte
Brian George		ATC radar consultant to BERR

## **SECTION 5      Format of the Workshop**

To maximise the time available a pre-workshop was held with the BERR representative to refine the topics for consideration in the larger group.

It was agreed to focus on five topic areas that the group could consider and agree upon.

The five topic areas were:

- Assumptions
- Standards and Regulations
- ATC Procedure
- Safety Case
- Radar Performance

The outputs from these areas are detailed below.

### **5.1            ASSUMPTIONS**

- The outputs from the workshop are not Radar type specific and not specific to a location.
- Wind turbines have the ability to affect Radar performance and therefore affect the provision of ATS.
- Any safety case work to enable Air Traffic Control (ATC) to operate in the vicinity of wind farms must not be a Radar equipment safety case but a safety case for the provision of ATS.
- Withdrawal of ATS is not acceptable as mitigation for a safety event.
- Equipment failures where Radar data is not being used to provide ATS does not constitute a safety event.
- The HVR safety case produced for the BERR (Reference 1) is a good starting point for development of a full operational safety case.
- The minimum target detection displayed to a controller is expected to have a higher Pd than 80% for the volume of airspace they are controlling i.e. operational region (CAP 670)
- The current minimum probability of detection (Pd) acceptable is 80% (CAP 670) and it is assumed that this is applicable in the vicinity of a wind farm.

- It is assumed that the Pd percentage figure given in CAP 670 (80%) will be superseded by European standards. The figure is dependent upon the method of measurement
- It is assumed that radar performance standards in CAP 670 will be superseded, by European standards, within 5 years.
- Until the use of transponders is mandated for all classes of air space then reliance on Secondary Surveillance Radar (SSR) as a major mitigation for interference effects of wind turbines on Primary Surveillance Radar (PSR) will not be attainable.
- Maintaining the identity of an aircraft with an active transponder through wind farm clutter where SSR coverage is available is not normally an issue providing the secondary return and label are not obscured by the primary clutter.
- The MOD has been directed to demonstrate, as a minimum, equivalence to civilian aviation standards (except where contingencies of the service dictate).
- A safety case will exist for the MOD use of Watchman by the end of 2007.

## **5.2 STANDARDS AND REGULATIONS**

### **5.2.1 Review CAP 764**

- Ray Woods provided a quick run through of CAP 764. An update to this document is anticipated.

### **5.2.2 Risk Matrices and Standards**

- The group were quoting different risk matrix and difference safety standards for acceptable target levels of safety
  - HVR quote  $1 \times 10^{-9}$
  - ESARR4 quote  $1.55 \times 10^{-8}$
  - Colin Smith recalled he had seen a standard  $1 \times 10^{-7}$  quoted
- The existing Eurocontrol surveillance standard (Reference 5) does not apply to UK class F and G air space, however, future updates may include this air space.
- It was also stated that Eurocontrol single European sky surveillance performance and interoperability regulation will become European law.
- There needs to be agreed standards appropriate for safety case evolution for ATS in airspace affected by wind farms.

### **5.2.3 Mandatory Carriage of Transponders**

- Many documents still quote March 31<sup>st</sup> 2008 for the enforcement of carriage of transponders.

- The group believe that this is unachievable especially for F and G airspace.
- The group were of the opinion that a blanket mandatory Mode-S transponder carriage would not be achieved in all UK airspace before 2012.
- Therefore reliance on SSR as a major mitigation for wind farms will not be attainable in the near future

#### **5.2.4 Variance within Government**

There are a number of conflicting priorities for government which impact on the issue of wind turbine interference on aviation radar. For example the current acceptance of the increase in civil aviation versus renewable energy targets. Pressure on the Radar bandwidth and the selling of frequencies to mobile phone companies etc. Tight fiscal control and the need to promote work streams to resolve the conflicting interests of windfarm developers and the aviation industry. The additional workloads created by the need to assess wind farm applications, review safety case work etc with limited resource.

There is a need for government to establish priorities regarding these issues and allocate appropriate resource.

### **5.3 ATC PROCEDURE**

#### **5.3.1 Class F and G airspace**

- Class F and G airspace is getting smaller creating a higher density of traffic and choke points.
- It was stated that some aircraft tend to follow set routes in F and G airspace.
- Increased navigational accuracy (GPS) and maintaining set heights, is resulting in a reduction of mitigation offered by the “big sky” theory.
- Recent statistics are showing a reduced level of *airprox* incidents which may be a result of less military traffic flying in the UK coupled with a reduction in civilian flying training, however both these factors may be temporary resulting in future air space pressures.
  - It was stated that there was increase in sites declared for micro-light flying
- An increase in wind farms without mitigation will exacerbate class F and G airspace congestion and have an adverse impact on the safe provision of ATS.

#### **5.3.2 MOD Review of Wind Farm Applications**

- The MOD explained that resources are limited in reviewing accurately up to 1000 applications per year.
- The current lack of resource is justifiably leading to a safety first approach.
- Lack of resources invariably cause a delay to response to applications and limits the effort that can be applied to each application. If the MOD had additional

resource target turn around times would be met and more time could be spent investigating operational work arounds.

- MOD would welcome funding to establish additional posts to assist in this work.

## **5.4 SAFETY CASE**

### **5.4.1 HVR Report**

- The BERR sponsored HVR safety case report was agreed as a good starting point for development of a full operational safety case. This will be published on the BERR website.
- The quantitative approach to risk assessment detailed in the HVR report was discussed and it was felt that a qualitative approach would be more appropriate for a terminal ATC environment where operational Subject Matter Expert (SME) input is required.

### **5.4.2 Hazards generated by a Wind Farm to ATC services**

- It was accepted that Planners and Developers may not fully understand the operational impact that clutter generated by wind farms can present to providers of ATC services.
- The major wind farm related operational risks identified were
  - obscuring low level climb out traffic
  - Loss of *track* identity (three or more consecutive updates not visible to the controller)
  - traffic manoeuvring being obscured by clutter
  - Additional work in vectoring traffic around clutter
  - A general rise in controller workload
- The group believe there would be benefit in producing a simple guide to aid the understanding of the problems associated with wind farms. , this could be incorporated with existing BERR guidance material or produced as a small standalone document.

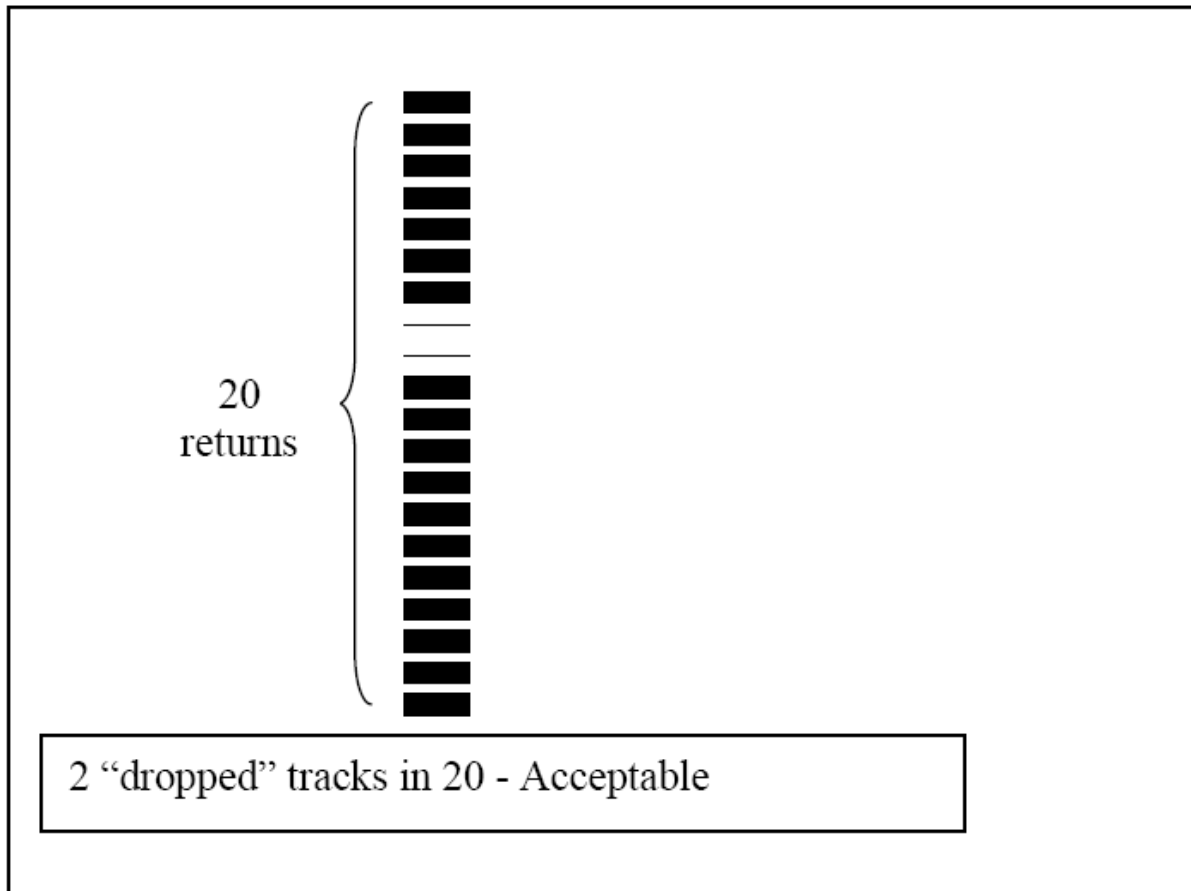
## **5.5 RADAR PERFORMANCE**

### **5.5.1 Pd, *False target*, *seduction*, *accuracy*, etc.**

- Various Pd figures were identified by the group ranging from 80% for Civil Radars, 90% for military Radars and final approach areas for Surveillance Radar Approaches (SRA's) to 95% proposed for Eurocontrol
- There are different measurement methods for Pd

- Discussion over the principle of measuring an acceptable Pd over wind farms took place. The two in twenty concept (Figure 1) was considered as an area which, following further examination, has potential for defining an acceptable Radar performance standard.
- Pd is not the only performance issue, *false target* (Clutter); seduction, accuracy etc have to be considered with acceptable performance standards defined.
- The MOD have accepted that they need to correlate the Military terminal Radar performance standards and in particular to take account of the potential effects caused by wind farms (e.g. NATS have quoted ten *false alarms* per sweep plus two for each additional wind farm for Glasgow)
- Definition of acceptable Pd, *False target* (Clutter), seduction, accuracy etc over wind farms and the measurement methodology needs to be agreed.
- **Proposal of the two in twenty concept:-**
  - The two in twenty concept has been proposed from a number of aspects.
  - It has been used by the UK RAF in achieving a performance standard for their Replacement Precision Approach Radar (RPAR) system
  - It would help with a pragmatic approach to measuring Pd over wind farms or other relatively small areas where only a statistically small sample is likely
  - Technically, two in twenty dropped *tracks* meets a 90% ratio for Pd
  - Two consecutive dropped *tracks* fits within the operating procedure where aircraft have to be re-identified after three consecutive dropped *tracks* or operationally, if no more than 2 consecutive *tracks* are dropped then *track* identity is maintained
  - The two in twenty concept may give an Air Traffic Controller a view as to the operational state of the Primary Surveillance Radar
- **Areas of the two in twenty concept that require further discussion:-**
  - How many 2 in 20 drops would be acceptable over a wind farm?
    - On every *track* that over flies?
    - No more than (say) 1 in every 10 over flights?
  - How does the concept fit with the inter turbine visibility concept?
  - How often is *track* identity lost in the operational environment now when not in the presence of wind farms?
  - What would the impact of bad weather be on the concept?
  - Any agreed new standards or methods of measurement need to be derived from an ATS operational perspective that can be justified by an ATS operationally based safety case.

- Similar approaches could be used to agree other radar parameters/standards for acceptable performance over wind farms.



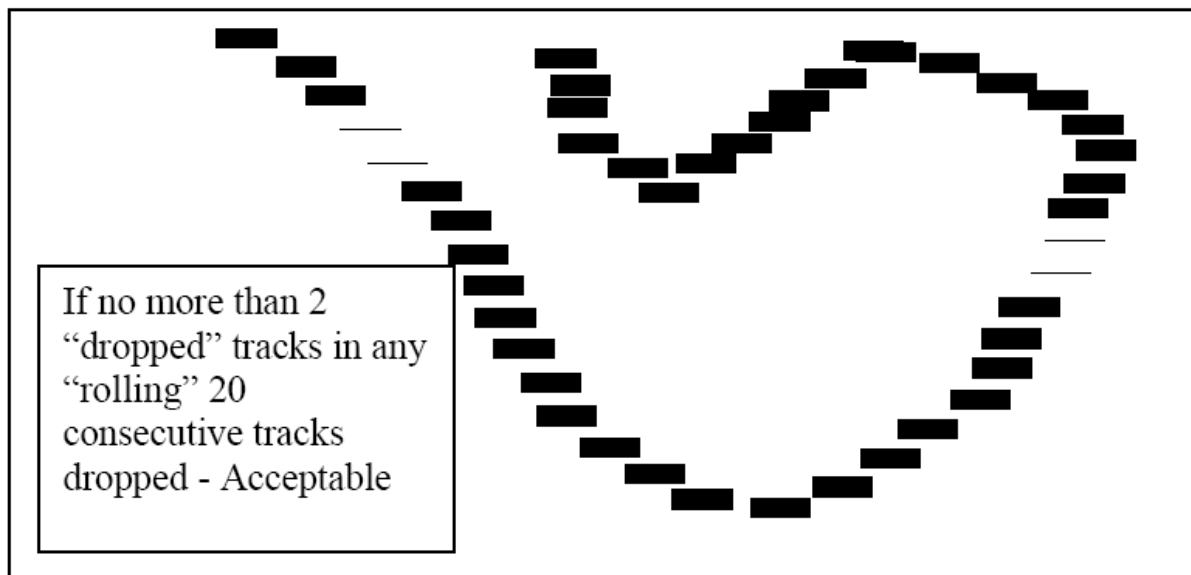
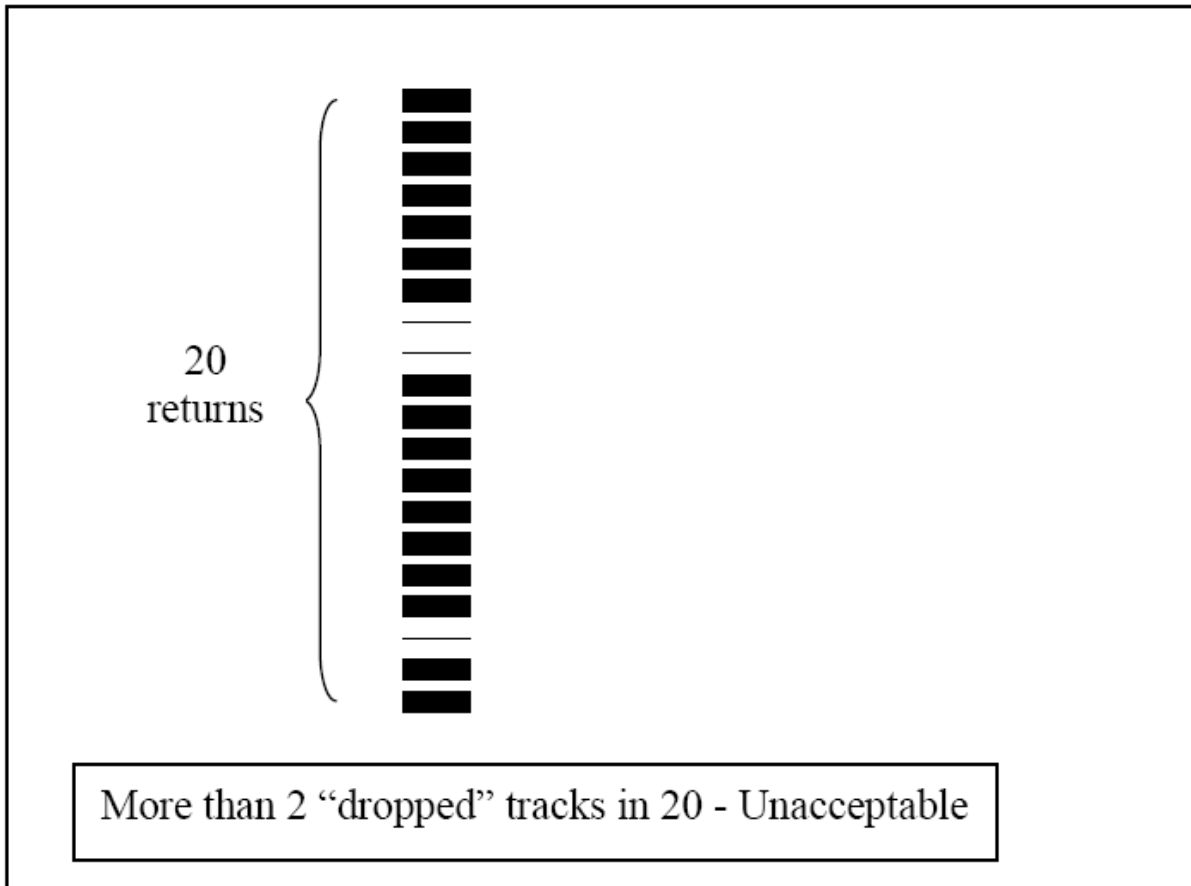


Figure 1 – The Two in Twenty Concept

### 5.5.2 Acceptability of Plot Extracted Radar Display

- Traditionally in the terminal environment MOD have used a non plot extracted display and this has enabled them to acquire climb out traffic as soon as the Radar detects them.
- On entering radar cover most plot extracted systems in the ATC environment will delay display to the operator until the third successive detection.
- The current draft new Eurocontrol surveillance standard specifies output on second update for 5NM separation and first update for 3NM separation, after first detection.
- The MOD believes that the most likely offerings for future MOD surveillance capability procurement will include a plot extracted display.



Figure 2. A *Processed Video* output is shown on the left and a plot extracted output is shown on the right. The target is moving from top right to bottom left in both pictures.

## SECTION 6      Summary of Recommendations

- There is a need for standards to be agreed by regulators and ATS providers appropriate to UK Class F & G airspace. This would allow a consistent approach to be taken in the construction of safety cases for ATS in UK Class F&G air space, in which there are wind farms present.
- Pressure needs to be applied to aviation policy makers, user groups and industries in order to hasten the mandatory carriage of transponders if SSR is to be used as a major mitigation technique to counter the interference caused by wind turbines to PSR .
- UK Government needs to determine priorities to ensure complimentary policies between UK Government departments responsible for transport, renewable energy targets and the radio frequency spectrum.
- Support in the form of funding and incentives are required to enable and encourage aviation organisations affected by potential wind farm developments, to develop the technology, procedures/ and mitigations etc to continue safe operation of aircraft in the aviation environment when wind turbines are in the line of sight of Primary Surveillance Radar.
- The HVR safety case template document should be reviewed independently by an aviation safety subject matter expert to ascertain if a qualitative approach would improve the utility of the document.
- MOD would welcome funding to establish additional posts to assist in the review of wind farm applications.
- A simple guide aimed at the wind energy industry and planners , would aid in the understanding of the problems associated with wind farms, as presented to ATS providers, when in line of sight of Primary Surveillance Radar and would therefore be beneficial. This could be incorporated with existing BERR guidance material or produced as a small standalone document.
- Discussion and definition of acceptable Pd, *False target* (Clutter), track seduction, accuracy etc over wind farms is needed and the measurement methodology needs to be agreed.

## SECTION 7            Recommendations on Moving Forward

The group made the following recommendations for further work

- A sponsored workshop consisting of UK aviation policy makers, regulators, ATS providers and other subject matter experts to gather relevant standards, discuss and agree those applicable to providing a safe aviation environment when wind farms are in line of sight of primary surveillance radar. This with a view to making recommendations to Eurocontrol representatives.
- UK Government (possibly CAA DAP) to identify the inhibitors to implementing mandatory transponder carriage (perhaps through the commissioning of a study) and develop a realistic plan that delivers this policy prior to 2010.
- BERR to identify “champions” from the UK Government departments that need to consider complimentary policies between defence, renewable energy, transport and radio frequency spectrum needs.
- BERR to co-ordinate a multi-national year on year phased budget (possibly through the International Energy Agency) to award against applications for promoting novel or innovative ideas that mitigate the interference of wind turbines in line of sight of Primary Surveillance Radar. (Does the Queens award scheme still run?)
- BERR Aviation Safety Sub Group to identify independent Aviation Safety Subject Matter Experts from Industry and Academia.
- Enquire whether BWEA would fund a simple guide that explains what the effects are to ATS providers and why current technology does not mitigate the effects. Suggested contributors would be ATS providers and Primary Surveillance Radar subject matter experts.
- A sponsored workshop with UK and Eurocontrol aviation regulators and radar industry representatives discussing, recommending and agreeing appropriate methods of measurement and specification levels for the safe detection of aircraft in the presence of wind turbines that are in the line of sight of primary surveillance radar.











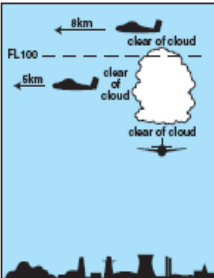

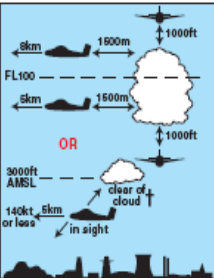


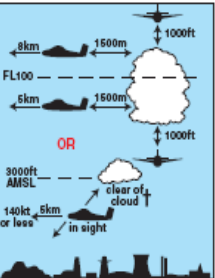


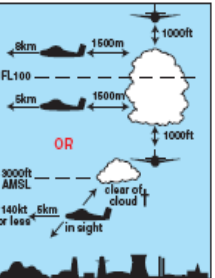

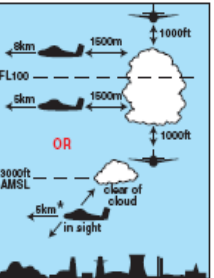

## **SECTION 8**      Useful Definitions, Acronyms and Abbreviations

It should be noted that during this workshop it has become apparent that the same or similar words and phrases have different meanings when used in the ATS operating domain to that when used in the Radar engineering domain. Where this is significant the word has been defined in both contexts.

ACD	CAA DAP Aeronautical Charts and Data
Airprox	The agreed definition of an Airprox is a situation in which, in the opinion of a pilot or a controller, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved was or may have been compromised. CAA Airprox Board
Airspace classifications	See Below
ATC	Air Traffic Control
ATS	Air Traffic Service
BWEA	British Wind Energy Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Paper
Clutter	Unwanted echoes returning from the transmitted pulse often from trees, buildings, birds and wind turbines
DAP	CAA Directorate of Airspace Policy
BERR	Department for Business, Enterprise and Regulatory Reform
ESARR	Eurocontrol Safety Regulatory Requirement
False Alarm	A noise voltage that exceeds a signal to noise threshold
False Target	An item of radar clutter that exhibits similar characteristics to a wanted target return
GPS	Global Positioning System
GW	GigaWatts
LARS	Low Airspace Radar Services
MOD	Ministry Of Defence
MTBF	Mean Time Between Failures
NATS	National Air Traffic Services
NM	Nautical Miles
Pd	Probability of Detection, expressed as a ratio for a target of a certain Radar Cross Section and target fluctuation characteristics at maximum range. Pd is relative to false alarm probability and receiver signal to noise ratio.
Processed Video	The video signal (usually analogue) that outputs from the radar. The level of processing will depend on what has been specified for the radar performance.

PSR	Primary Surveillance Radar
Qualitative Analysis	Evidence of the properties of a system, or an element of a system, that is not numerically based. Def-Stan 00-56 iss.4
Quantitative Analysis	Evidence of the properties of a system, or an element of a system, that is based on countable or measurable properties on a numerical scale. Def-Stan 00-56 iss.4
Track (ATS)	A paint with processed video display or a plot with plot extracted display
Track (Engineering)	A collection of plots associated with a particular target
Track Seduction	Track seduction is when a plot other than that produced by the source of the track is selected as the update and has the effect of steering the track away from the actual path of the source. If on subsequent scans further 'alternative' plots are available to sustain the deviated path then the track is said to have been seduced. An aircraft track being seduced onto vehicles as it over flies a busy road would be a good example of track seduction.
SME	Subject Matter Expert
SRA	Surveillance Radar Approach
SSR	Secondary Surveillance Radar
TLS	Target Level of Safety
SSR Transponder	A secondary surveillance radar transmitter-receiver fitted to an aircraft that transmits signals automatically when it receives predetermined signals
URN	Unique Report Number
UK	United Kingdom

# UK ATS AIRSPACE CLASSIFICATIONS

CONTROLLED AIRSPACE							
	A	B	C	D	E	F	G
IFR	<p>SEPARATION: All aircraft</p> <p>SERVICES: Air traffic control service</p> <p>SPEED LIMITATION: Not applicable (Unless notified for ATC Purposes)</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: All aircraft</p> <p>SERVICES: Air traffic control service</p> <p>SPEED LIMITATION: Not applicable (Unless notified for ATC Purposes)</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: IFR from IFR IFR from VFR</p> <p>SERVICES: Air traffic control service</p> <p>SPEED LIMITATION: Not applicable (Unless notified for ATC Purposes)</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: IFR from IFR</p> <p>SERVICES: Air traffic control service including traffic information about VFR flights (and traffic avoidance advice on request)</p> <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: IFR from IFR</p> <p>SERVICES: Air traffic control service and traffic information about VFR flights as far as practical</p> <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: IFR from IFR (participating IFR traffic)</p> <p>SERVICES: (See Note) Air traffic advisory service Flight information service</p> <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: Not required</p> <p>ATC CLEARANCE: Not required</p>	<p>SEPARATION: (See Note) Not provided</p> <p>SERVICES: (See Note) Flight information service</p> <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: Not required</p> <p>ATC CLEARANCE: Not required</p>
	VFR	<p></p> <p>VFR FLIGHT NOT PERMITTED</p>	<p>SEPARATION: All aircraft</p> <p>SERVICES: Air traffic control service</p> <p>VMC MINIMA</p>  <p>SPEED LIMITATION: Not applicable</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: VFR from IFR</p> <p>SERVICES: Air traffic control service providing: i) Separation from IFR ii) VFR traffic information (and traffic avoidance advice on request)</p> <p>VMC MINIMA</p>  <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: Not provided</p> <p>SERVICES: Air traffic control service providing: traffic information on all other flights</p> <p>VMC MINIMA</p>  <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: </p> <p>ATC CLEARANCE: Required</p>	<p>SEPARATION: Not provided</p> <p>SERVICES: Air traffic control service providing: traffic information as far as practical</p> <p>VMC MINIMA</p>  <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: Not required</p> <p>ATC CLEARANCE: Not required</p>	<p>SEPARATION: (See Note) Not provided</p> <p>SERVICES: (See Note) Flight information service</p> <p>VMC MINIMA</p>  <p>SPEED LIMITATION:  below FL100</p> <p>RADIO: Not required</p> <p>ATC CLEARANCE: Not required</p>

 Not applicable to Military aircraft

† Helicopters may fly at or below 3000ft AMSL clear of cloud and in sight of the surface.

\*At speeds of 140kt IAS or less flight is permitted in flight visibilities to 1500m. Helicopters may operate in less than 1500m flight visibility at a speed which, having regard to the visibility, is reasonable.

NOTE: In Class F and Class G airspace a Radar Advisory Service (RAS), a Radar Information Service (RIS) and Approach Control Service may be available from Air Traffic Service Units. Pilots are urged to make use of these services, details of which are published in AICs and other documents.

Figure 3. CAA Definition of UK ATS Airspace Classification



1. INTRODUCTION
2. CLASSES OF CONTROLLED AIRSPACE
3. PRE-FLIGHT PREPARATION – GENERAL
4. PRE-FLIGHT - CROSSING CAS
5. PRE-FLIGHT - LANDING INSIDE CAS
6. PRE-FLIGHT - TAKING OFF WITHIN CAS
7. THE FLIGHT PLAN

8. IN FLIGHT - BEFORE ENTERING CAS
9. VFR FLIGHT IN CAS
10. IFR FLIGHT IN CAS
11. SPECIAL VFR FLIGHT
12. LEAVING CAS AND POST FLIGHT
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14. SUMMARY

## 1. INTRODUCTION

a. Although much of the United Kingdom is covered by Class G (uncontrolled) airspace, around many aerodromes controlled airspace has been established to provide an adequate level of safety for commercial air transport. Fortunately, general aviation pilots may fly in much of that controlled airspace, even in poor weather, provided they and their aircraft are properly qualified and equipped.

b. This leaflet is intended to give pilots without an instrument rating guidance on the use of controlled airspace (CAS) in the UK. It should be read in conjunction with the Aeronautical Information Publication (AIP), which contains specific procedures for each piece of controlled airspace in the UK. Pilots should also consider obtaining the assistance of an instructor when entering controlled airspace for the first time.

c. [Further guidance](http://www.caa.co.uk/dap) for individual control zones and areas may be found on the 'VFR guide supplements', under 'aeronautical charts' of the Directorate of Airspace Policy's web site [www.caa.co.uk/dap](http://www.caa.co.uk/dap).

## 2. CLASSES OF CONTROLLED AIRSPACE

a. Class A airspace is prohibited to pilots without a valid instrument rating, unless they have been given special VFR clearance in a control zone (see paragraph 11).

b. Flight under VFR (visual flight rules) is permitted in Class B airspace (none currently exists in the UK), provided the pilot is under air traffic control. Flight under IFR (instrument flight rules) requires a valid instrument rating.

c. VFR flight is also allowed in Class C airspace, but in the UK this is all currently above Flight Level (FL) 195, where VFR flight is not normally permitted unless specifically authorised. Again, IFR flight requires a valid instrument rating.

d. In class D airspace, VFR flight is permitted with the specific permission of the air traffic controller. In UK airspace, IFR flight is permitted, under control, to holders of a PPL with valid UK IMC ratings (IMC ratings may not be added to an NPPL).

e. In class E airspace, IFR flight is again permitted, under control, to PPL holders with valid UK IMC ratings. Provided the pilot maintains the VMC applicable to controlled airspace, pilots may fly under VFR in Class E airspace without informing air traffic control. However, it is usually appreciated, and often advisable, to inform the controlling agency of your presence.

f. Class F airspace is not controlled airspace. It is advisory airspace in which an air traffic service is provided to participating IFR traffic. In the UK there is no need for pilots who are following VFR to obtain permission to enter Class F airspace, nor indeed to inform anyone that they are doing so. However, since commercial operators may be using the airspace, we recommend that pilots inform the appropriate air traffic service unit of their presence whenever practicable. Flight under IFR in class F airspace should take advantage of a Radar Information or Radar Advisory Service as described in SafetySense leaflet 8, "Air traffic services outside controlled airspace".