

Wind Turbines and Air Defence Radar

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Scope

- UK ASACS Mission
 - Threat
 - Military Tasks
- Air Defence Radar and Windfarm Effects
- Air Defence Radar Trials
- Policy
- Operational Risk Assessment & Way Ahead
- Questions

UK ASACS Mission



UK ASACS Mission - Threat

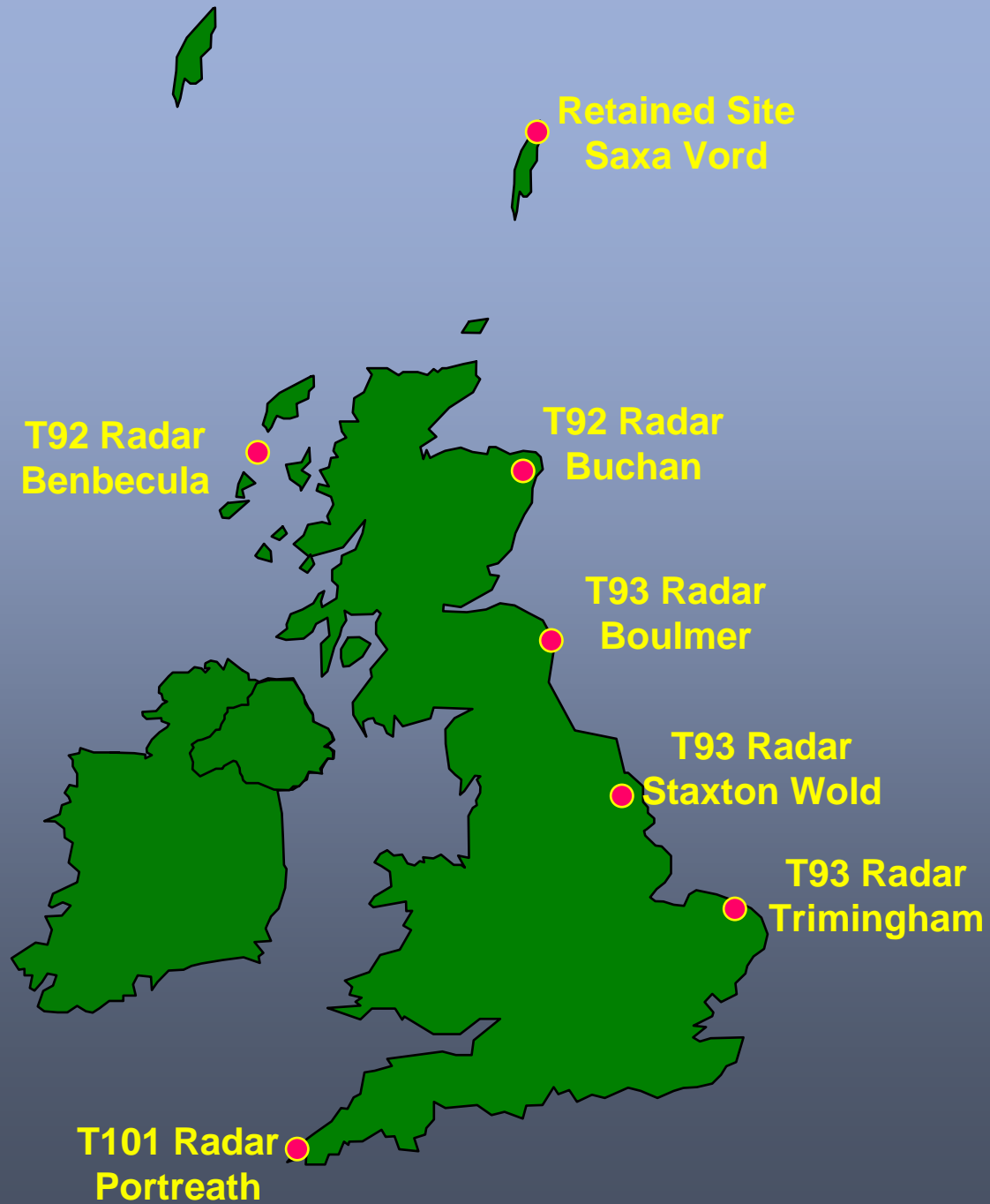
- Military Threat:
 - Military threat to UK significantly reduced
 - Air Surveillance remains vital to ensure that National and NATO airspace integrity is preserved
- Asymmetric Threat:
 - New threat presents new challenges

Counter Terrorism Operations



UK ASACS Mission - Tasks

- Compile and disseminate a continuous Recognised Air Picture over the UK and its approaches



UK ASACS Mission - Tasks

- Compile and disseminate a continuous Recognised Air Picture over the UK and its approaches (Air Policing Area 9)
- Conduct air policing against unauthorised and potential threat aircraft

Air Policing:

Detection, identification and tracking of potential 'Rogue aircraft' and coordination and tactical control of the UK's Quick Reaction Alert Force to preserve the integrity of NATO and National airspace.



Windfarm Effects on Air Defence Radar

Air Defence Radar - Characteristics



- Long-range detection of small targets in bearing, range and height – 3D
- Secondary Surveillance Radar (SSR)
- Software based digital signal processing techniques
- Electronic Counter Measures Protection

Windfarm Effects

- Cumulative effect of windfarms can result in a confused and cluttered radar picture and loss of detection of real targets in the area around, above and behind a windfarm
- They affect all types of Air Defence radar
- Presence of wind turbines degrades our overall air surveillance capability in the UK

What Have We Done to Help ...

- MOD/DTI sponsored series of trials and a Feasibility Study into the effect of windfarms on Air Defence Radar

Subject Matter Expertise

- Radar Specialists
 - Air Command & Control, Intelligence, Surveillance and Reconnaissance Operational Evaluation Unit (Air C2ISR OEU)
 - Defence Science and Technology Laboratory (DSTL)
 - (Independent Government advice)
 - BAE Systems (manufacturer of Type 101)
 - Defence Communication Services Agency (DCSA)
 - Directorate of the Chief Technical Officer (DCTO)

Operational Trials

- Trial SWIFT CROFTER
 - Stage 1 – July 2004
 - Stage 2 – September 2004
- Trial MISTRAL CROP
 - March/April 2005
- Trial BLIND GUARDIAN
 - October 2005

Trial Site

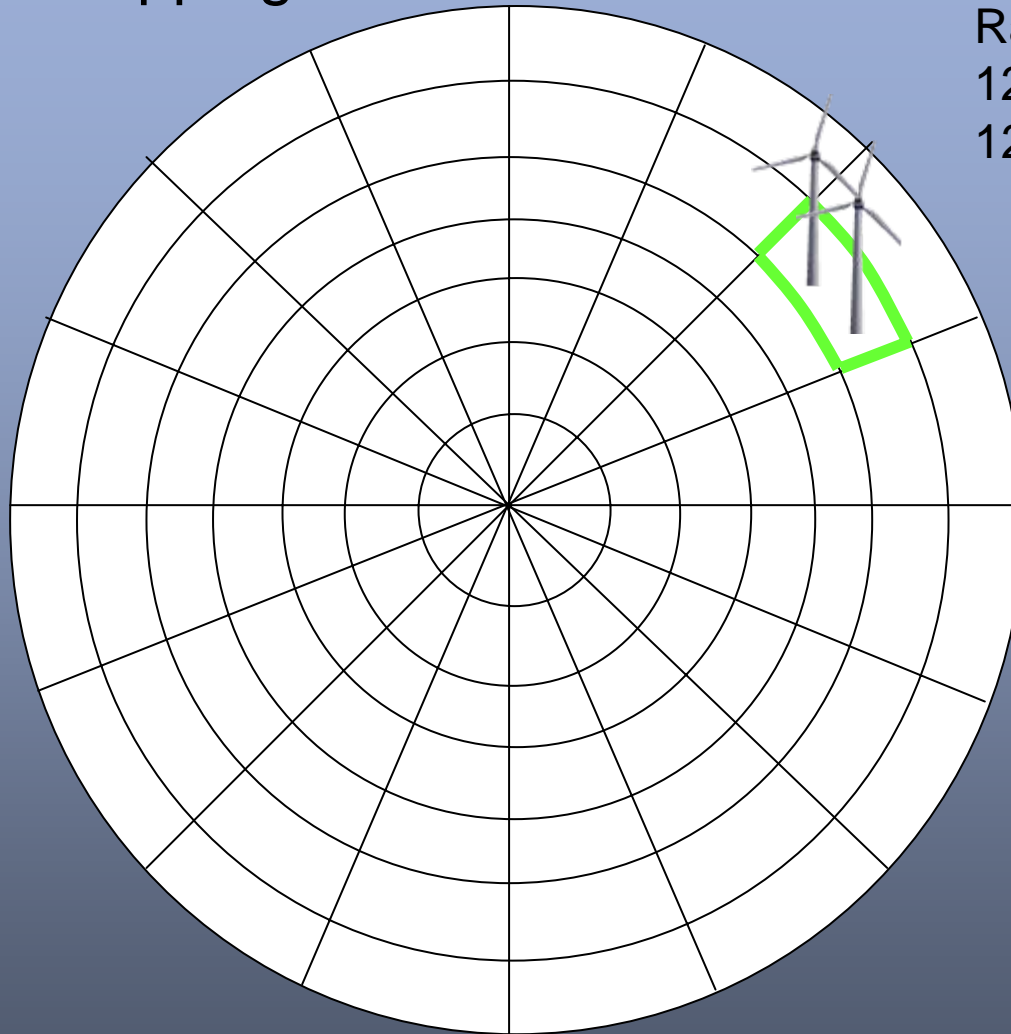
- Wind Turbine Farm
 - Llandinam ('P&L')
 - 103 Mitsubishi turbines.



Conclusions of MOD Trials

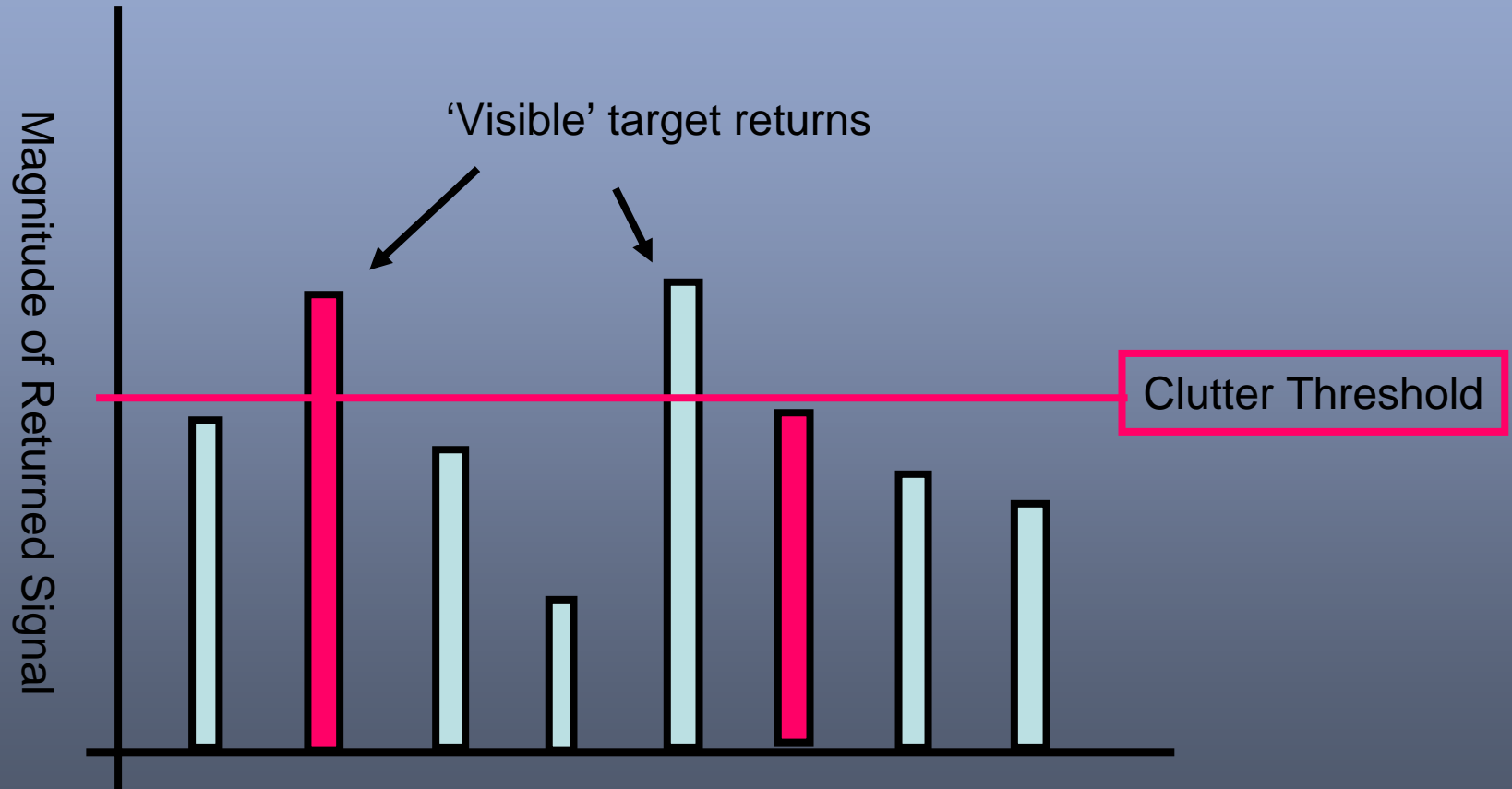
- Effects extend to Radar Line of Sight
- ‘Shadow Effect’ behind and in front of turbines
 - Result of Clutter Mapping technique
 - Diffraction effect not operationally significant
- ‘Overhead Obscuration’
 - Caused mainly by current processing techniques used
 - In addition, interference in Elevation Sidelobes compounds the effect

T101 Clutter Mapping

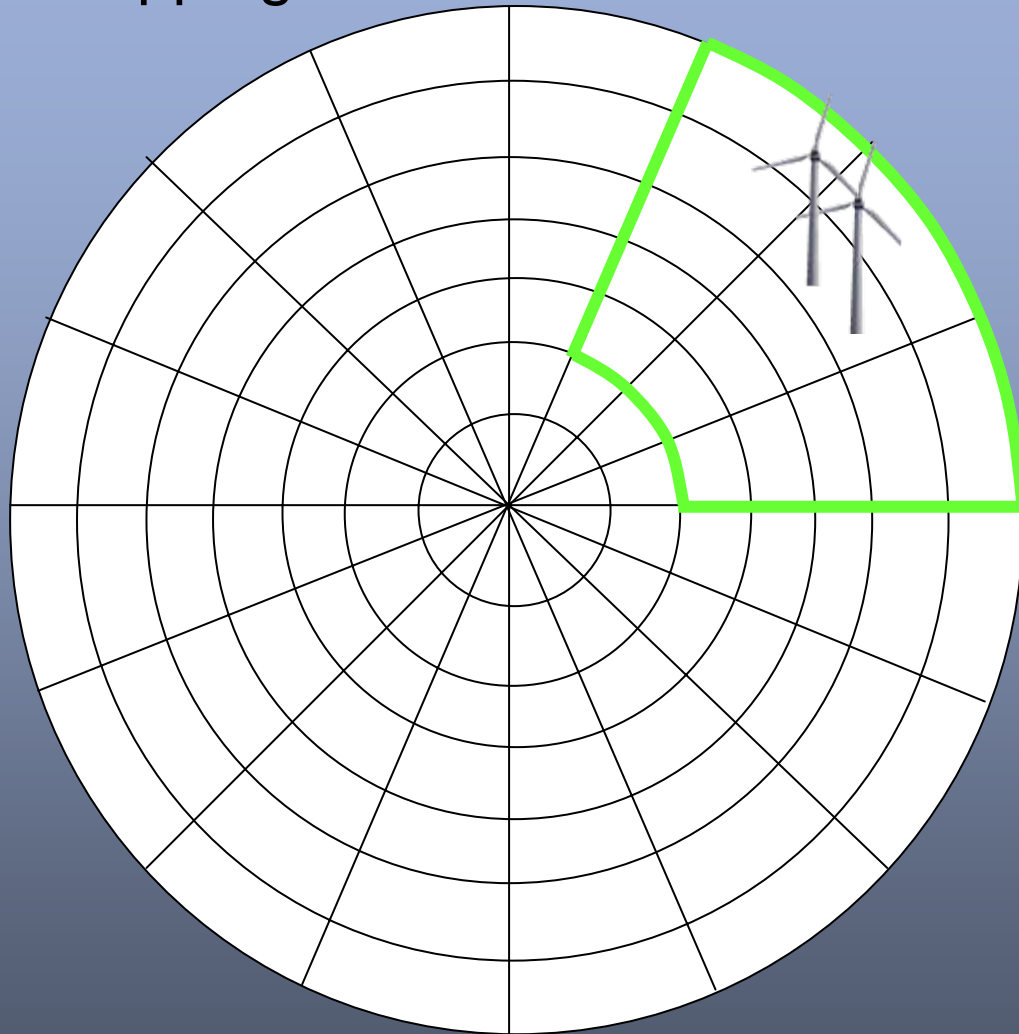


Radar Range Cells:
128 azimuth sectors
128 range cells

Radar Range Cell Assessment



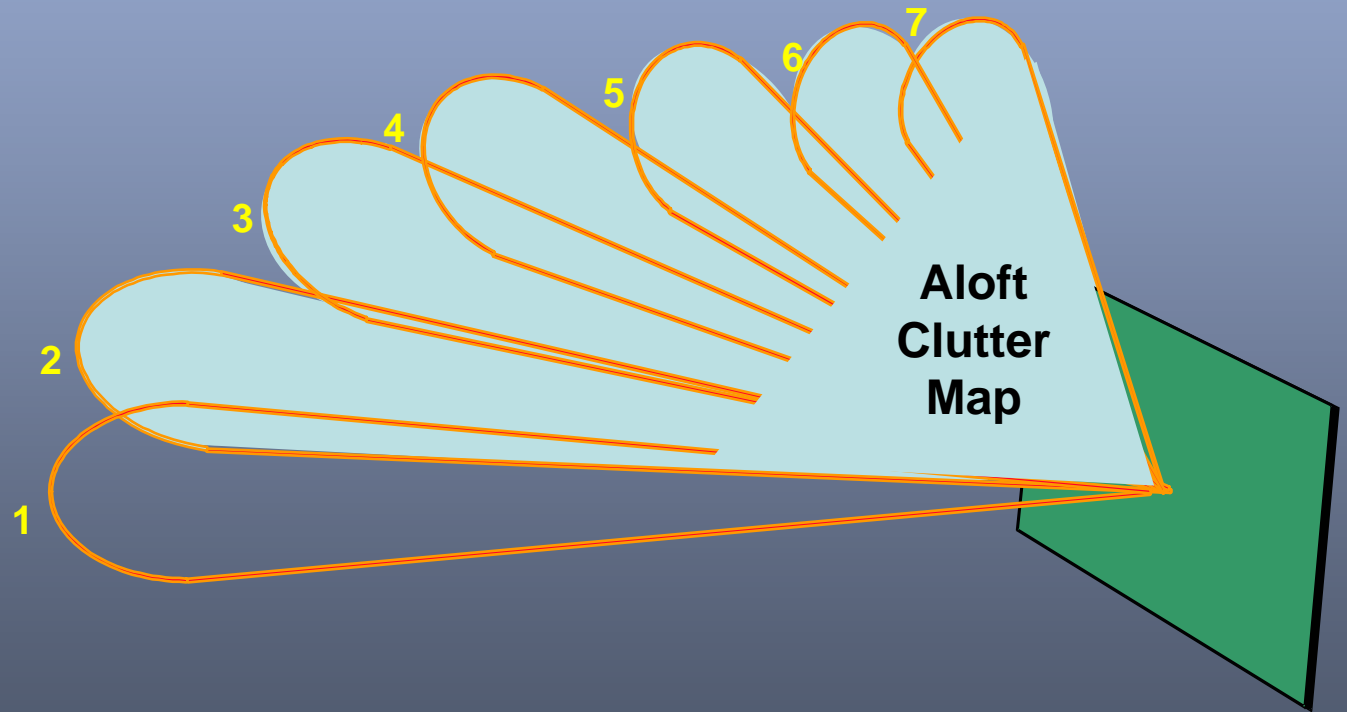
T101 Clutter Mapping



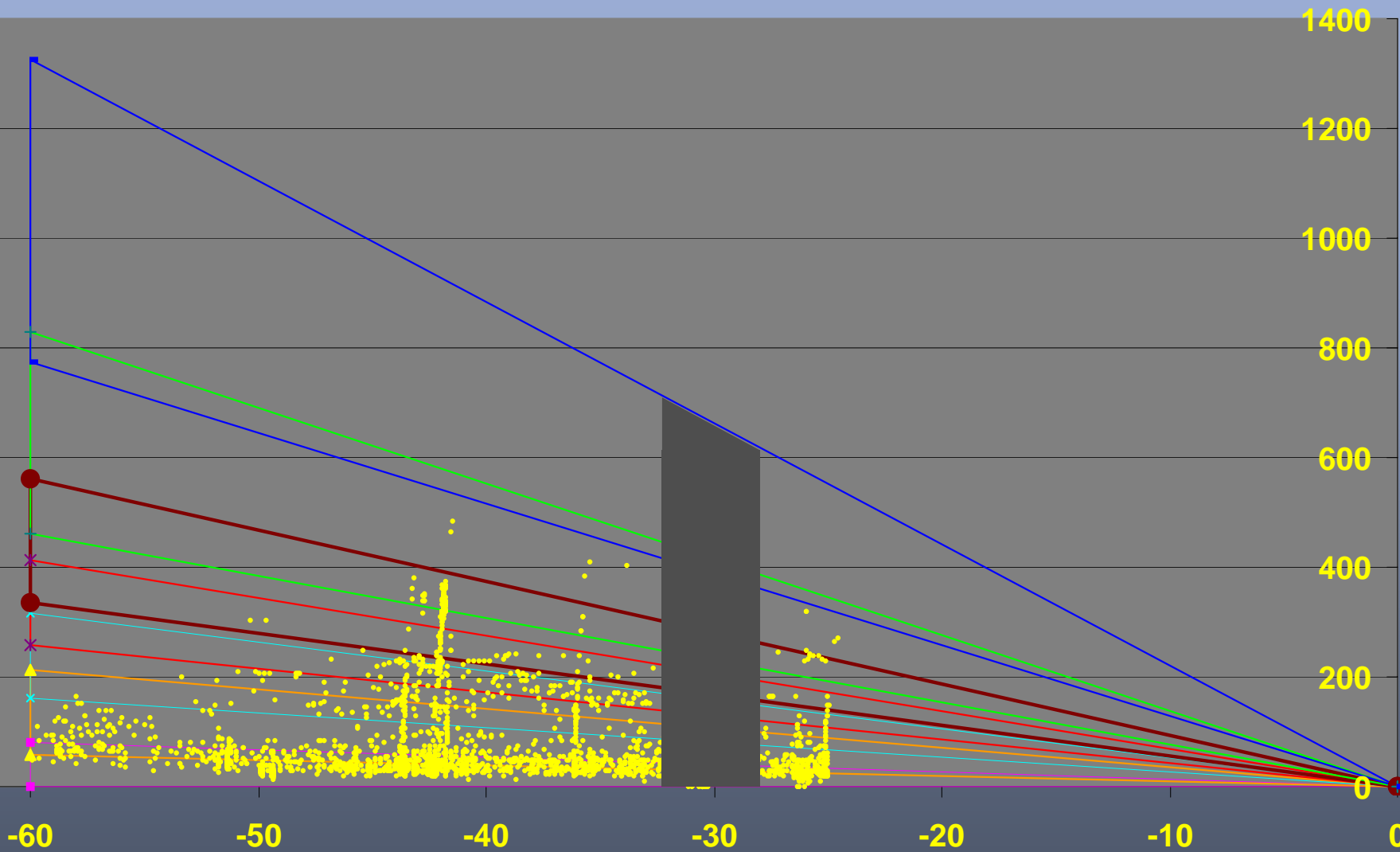
Clutter Cells:
Contains 64
Radar Range Cells

Clutter Cell:
2.8° azimuth
3.84km depth

Overhead Obscuration



Overhead Obscuration



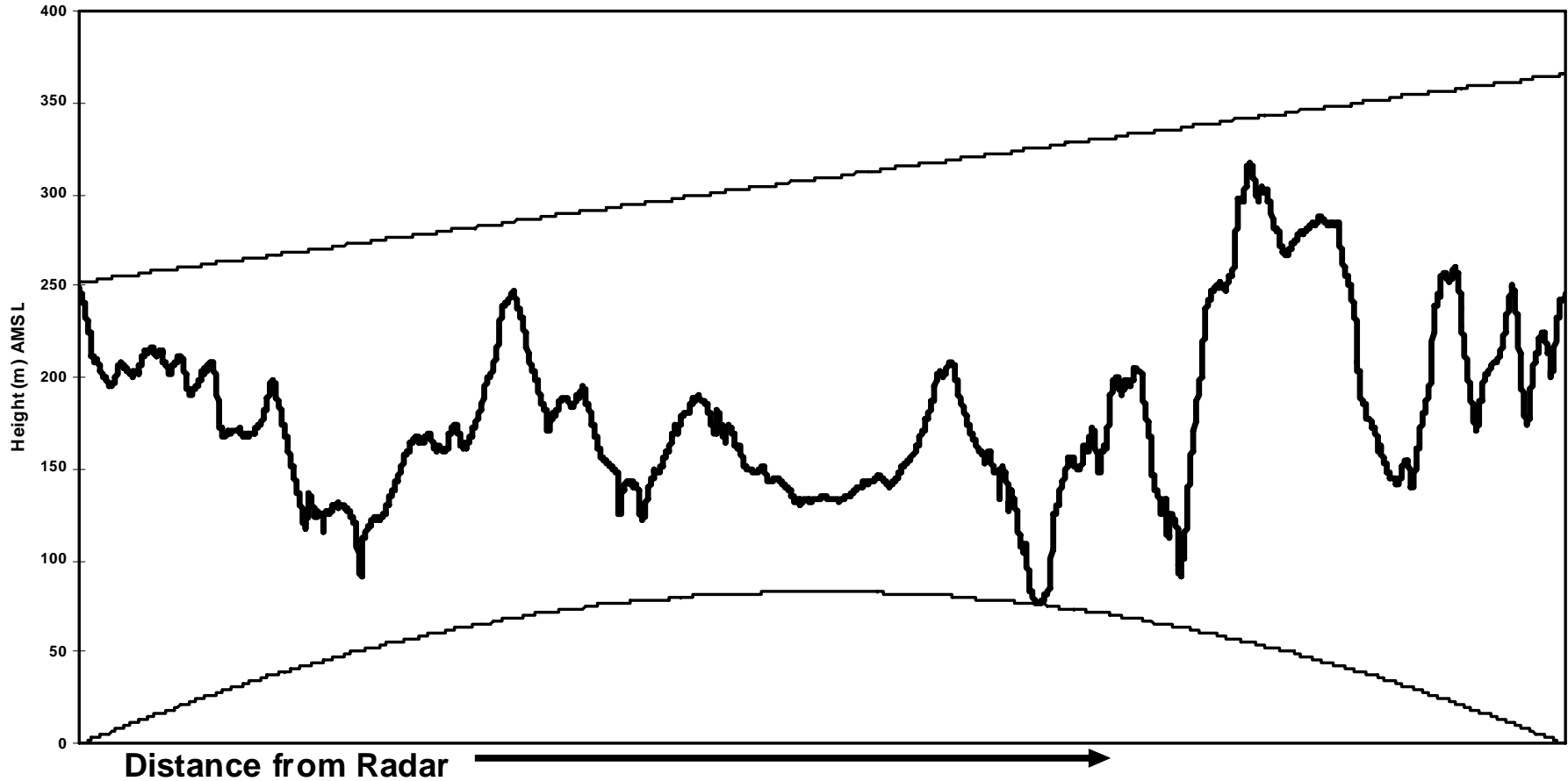
Conclusions of MOD Trials

- Displayed Clutter
 - Minor clutter returns – after processing
 - No operational impact with Operator Intervention

Air Defence Radar Policy

- Policy Lead – SO1 Air D CT & UK Ops
- SME – SO2 DACCS & Sensors, AFC HQ
- Concerns raised if radar line of sight
 - Previous range restriction has been lifted

Line of Sight Profile



Operational Risk Assessment & Way Ahead

Mitigation Techniques

- Use of fine clutter maps (clutter map range/azimuth resolution equal to radar range/azimuth resolution)
- Adaptation of radar clutter processing techniques to prevent detections in one beam adversely affecting the sensitivity of other beams
- Adaptation of the radar's Background Averager to reduce the impact of a large radar cross section object
- Use of additional radars as gap-fillers to mitigate loss of coverage
- Radar cross section reduction for wind turbines
- Use of optimised layouts for windfarms within line of sight of AD radars

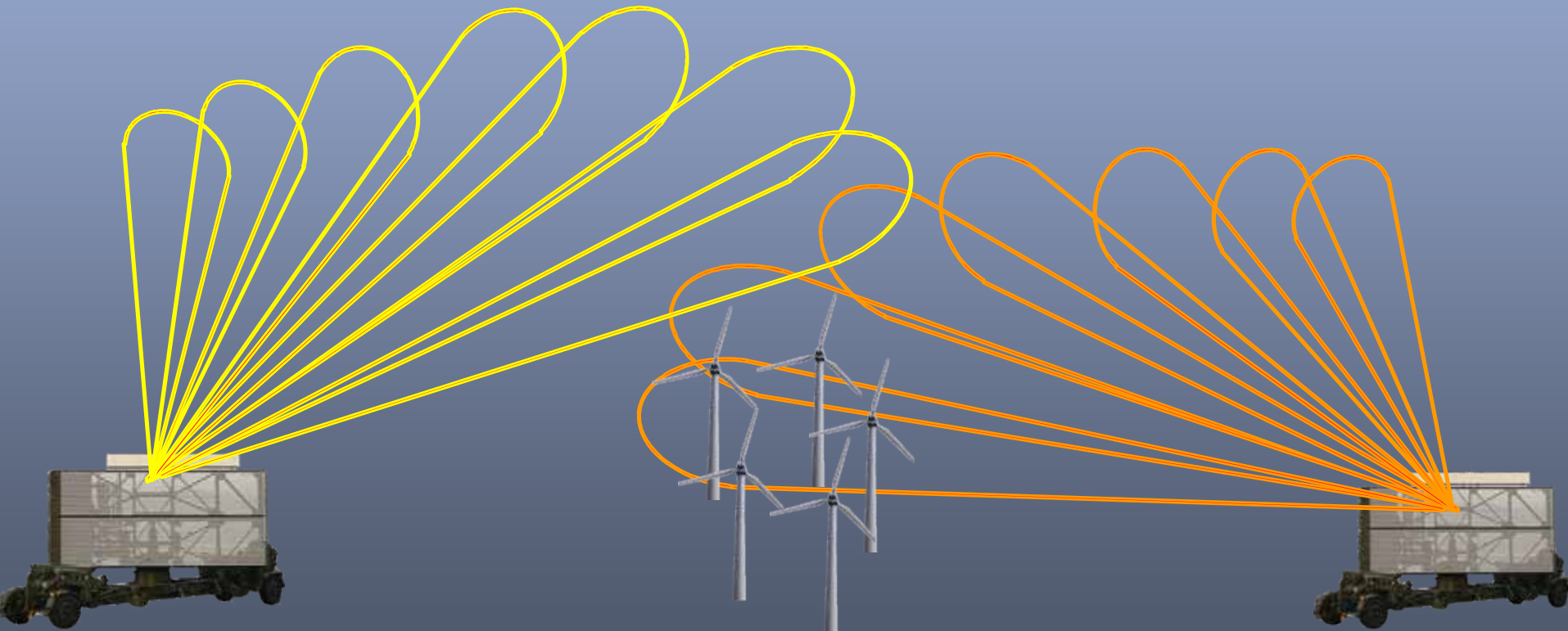
Overall Conclusions

- Successful development of techniques should resolve most extant onshore and offshore windfarm problems relating to the AD radars
- MOD is confident that mitigation solutions have been identified
- Operational community would continue to manage the loss of very low-level cover in discrete areas in and around the UK

Overall Conclusions

- Software techniques identified are only theoretical and may not be available for practical demonstration for at least 12-18 months.
- The use of an additional gap-filling sensor utilising electronic tilt to form a composite air picture has now been validated as a credible solution
- MOD Policy Director has stated that MOD has no available funding to develop and implement the above modifications

Additional Sensor Solution



Next Steps

- DTI evaluating options and investigating funding
- DTI to produce Roadmap of which options to be taken forward

Air Defence Radar Policy Way Ahead

- Policy will remain extant until mitigation solutions identified have been proven and implemented
- Any changes of policy will be as a result of validated test data from an operational trial

Questions