



Ministry
of Defence

[REDACTED]
DE&S Secretariat (Land Equipment & ISTAR)

Maple 0a
#2043
MOD Abbey Wood
Bristol BS34 8JH



[REDACTED]

Via:

[REDACTED]

Your References:

Our References:
FOI2015/00507

Date: 19 January 2015

Dear [REDACTED],

Thank you for your letter of 31 December 2014 requesting the following information:

I am aware that the Brize Norton primary surveillance radar (PSR) is a significant issue in the development of wind power in the central and southern area of England.

You may be aware that plans by Oxford City Council for a wind turbine could not be progressed due to safeguarding objections associated with Brize Norton radar. Equally many potential schemes in Wiltshire (even very small schemes) cannot be progressed at the moment due to safeguarding concerns, and there are some important potential sites in the area.

I would appreciate any documents or other sources of information that relate to the following specific questions:

- 1. Are any plans to replace or modify the PSR at Brize Norton in the future? When is this planned to be?*
- 2. If there are any plans to replace or modify the PSR at Brize Norton, has the need to make the radar more compatible with wind farm development been considered?*
- 3. Is the need for wind farm compatible radar a significant consideration in the design of any new system?*
- 4. Are available reports positive regarding new technology to overcome potential technical issues associated with PSR at Brize Norton and the compatibility with wind farm developments?*
- 5. Westmill wind farm (located east of Swindon www.westmill.coop) is often cited by government as an exemplar community wind farm project. Are there any reports of studies which have considered the impact on Brize Norton PSR, or safeguarding more generally? If the full reports cannot be released what are the conclusions of such studies?*

I am treating your correspondence as a request for information under the Freedom of Information Act 2000 (FOIA).

A search for the information has now been completed within the Ministry of Defence (MOD), and I can confirm that some information in scope of your request is held.

The information you have requested can be found below and at Annex A.

1. The Brize Norton PSR is due to be replaced under Project Marshall. The installation of new equipment is currently planned to commence in December 2018 and will take approximately seven months.

2. The MOD conducted an Air Traffic Control (ATC) Technology Demonstrator in 2013 to assess potential wind turbine mitigation solutions for military radars. This concluded that although improvements in performance were observed, none of the candidate technologies satisfied the MOD assessment criteria for military ATC radar. As a consequence, a requirement for wind farm mitigation was not assessed for the replacement of military ATC radars under Project Marshall due to the unavailability of a proven solution in the military context.

3. The MOD's preference is to take a strategic approach to windfarm mitigation rather than assessing multiple candidate solutions from multiple wind farm developers. The MOD continues to work proactively with the wind farm industry to identify and deploy wind farm radar mitigation solutions and the possibility of holding further trials are being discussed. However, because the MOD holds no budget for wind farm mitigation, further work is dependant upon the provision of wind industry funding. However, safety remains paramount and MOD retains the right to undertake a case-by-case assessment of all proposed wind farm developments and raise a planning objection if the safety of military operations is unacceptably eroded.

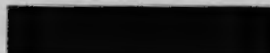
4. The MOD remains proactive in this area and discussions with the wind industry on how further trials might be funded are on-going. Please see attached at Annex A the technology demonstration (TD) summary report on wind turbine mitigation for MOD ATC radars. The aim of the ATC TD was to assess the relative maturity of existing mitigation solutions in comparison with the MOD requirement for ATC PSR in the presence of wind farms.

5. The MOD was first consulted on the Westmill Wind Farm application in February 2007 by the Westmill Wind Farm Co-Operative Ltd. The application was for five wind turbines. The MOD originally objected to the proposal on the grounds that the turbines would be in radar line of sight to the ATC radar at RAF Lyneham and cause unacceptable interference to MOD operations. However, in July 2007 the objection was withdrawn. Whilst there is still a statutory safeguarding map for RAF Lyneham in the public domain, there is no longer a radar at the site. Please see Annex A regarding the current position on research into mitigating solutions.

If you are not satisfied with this response or you wish to complain about any aspect of the handling of your request, then you should contact me in the first instance. If informal resolution is not possible and you are still dissatisfied then you may apply for an independent internal review by contacting the Information Rights Compliance team, 1st Floor, MOD Main Building, Whitehall, SW1A 2HB (e-mail CIO-FOI-IR@mod.uk). Please note that any request for an internal review must be made within 40 working days of the date on which the attempt to reach informal resolution has come to an end.

If you remain dissatisfied following an internal review, you may take your complaint to the Information Commissioner under the provisions of Section 50 of the Freedom of Information Act. Please note that the Information Commissioner will not investigate your case until the MOD internal review process has been completed. Further details of the role and powers of the Information Commissioner can be found on the Commissioner's website, <http://www.ico.gov.uk>.

Yours sincerely,



DE&S Secretariat (Land Equipment & ISTAR)

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TECHNOLOGY DEMONSTRATION SUMMARY REPORT

WIND TURBINE MITIGATION FOR MOD AIR TRAFFIC CONTROL RADARS



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TECHNOLOGY DEMONSTRATION SUMMARY REPORT
WIND TURBINE MITIGATION FOR MOD AIR TRAFFIC CONTROL RADARS

Executive Summary

- 1. Introduction.** Ministry of Defence (MOD) planning objections to wind turbines on the grounds of interference with Military Air Traffic Control (Mil ATC) radar is a significant barrier to the deployment of wind energy needed to meet the Government's renewable energy goals. In the 2012 Autumn Statement, it was announced that MOD and Department of Energy and Climate Change (DECC) would work with the wind farm (wf) industry to facilitate an ATC Technology Demonstration (ATC TD).
- 2. Aim.** The aim of the ATC TD was to assess the relative maturity of existing mitigation solutions in comparison with the MOD requirement for ATC PSR (Primary Surveillance Radar) in the presence of wind farms in accordance with MOD User Requirements.
- 3. Conduct of ATC TD.** The ATC TD took place at MOD Eskmeals in Cumbria between 23 June and 29 August 2013, within radar line of site of two offshore wfs. Six companies were selected via open competition to participate in the ATC TD and each mitigation solution was assessed over a 10 day period.
- 4. Results.** The ATC TD has assessed the ability of six mitigation solutions to achieve the required performance in the vicinity of a wf and considered some of the practical challenges associated with an operational implementation project. Whilst more than one Technology showed improvement over the baseline performance, none of them fully met the MOD's assessment criteria during the ATC TD.
- 5. Conclusions.** The ATC TD has gained significant momentum within Defence Equipment and Support (DE&S), MOD Stakeholders and Demonstrators, clarified areas for development within the MOD and also provided an opportunity for industry to explore issues associated with integrating their technology with existing MOD equipment.
- 6. Recommendations.** The recommendation for activity after the ATC TD is for the MOD to continue to proactively seek a solution. Further detail will be articulated in the MOD's response to the March 2014 milestone in the National Infrastructure Plan to confirm next steps¹ for Military ATC radar.

¹ Subject to the agreement of a suitable funding model with wf developers.

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TECHNOLOGY DEMONSTRATION SUMMARY REPORT

WIND TURBINE MITIGATION FOR MOD AIR TRAFFIC CONTROL RADARS

Introduction

1. The Government is committed to sourcing at least 15% of UK energy from renewable sources by 2020, of which wind generated energy makes an important contribution. However, MOD planning objections to wind turbines, on the grounds of interference to Air Traffic Control (ATC) military radar, are a barrier to deployment of wind energy to meet the Government's 2020 renewable energy targets. Recognising the urgency to develop a mitigation solution to the problem, Ministers from MOD and Department of Energy and Climate Change (DECC) made a commitment in Autumn 2012 to identify and assess potential mitigation solutions via a MOD led Technology Demonstration.

2. The ATC TD was funded by the wind farm (wf) developer industry and other interested stakeholders. The Air Traffic Control Technology Demonstration (ATC TD) took place at MOD Eskmeals in Cumbria, within radar line of site (LOS) of two offshore wind farms (132 wind turbines in total).



Figure 1 - Ormonde and Walney wfs and the TWMn at Eskmeals

3. **Aim.** The aim of the ATC TD was to assess the relative maturity of existing mitigation solutions in comparison with the MOD requirement for ATC Primary Surveillance Radar (PSR) in the presence of wind farms in accordance with MOD User Requirements².

4. **Objectives.** The objectives of the ATC TD were to:

- a. Select six proposed mitigation solutions to be demonstrated at the ATC TD.

² User Requirement Document (URD) for the sustainment of Military Air Traffic Control (ATC) Primary Surveillance Capability With Wind Turbines in Radar Line of Sight dated 17 Dec 2012.

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- b. To plan and execute the ATC TD, including a baseline assessment and six 10 day technology demonstrations between 23 June and 29 August 2013 at a site selected by the Ministry of Defence (MOD).
- c. Observe and determine the ability of each proposed mitigation solution to achieve the required performance in the vicinity of a wind farm.
- d. Assess the impact, if any, on the implementation of a mitigation solution to Mil ATC Operations, including, but not limited to Rules and Regulations and Safety Case
- e. Consider the ability of each company to model predicted performance of their mitigation solution at the ATC TD, and subsequently predict the performance at a site specified by the Authority, plus a hypothetical group of wind turbines.
- f. Observe the maturity of the mitigated solutions in their demonstrated form at the ATC TD using the MOD Technology Readiness Maturity Model and consider the issues associated with the integration of a mitigation solution into an existing MOD ATC PSR.
- g. Assess the Deliverables submitted to the MOD by each company.

Conduct of Technology Demonstration

- 5. Six technology demonstrations took place between 01 July and 29 August 2013. The performance of the unmitigated MOD TWMn radar was assessed prior to the technology demonstrations (23 to 28 June 2013) and this formed the ATC TD baseline.
- 6. **Selection of participants.** The requirement to award a maximum of six opportunities to demonstrate a proposed solution was competed in accordance with the Defence and Security Public Contracts Regulations (DSPCR).
- 7. **Technology Demonstration site selection.** Three primary criteria informed the selection of MOD Eskmeals as the site most suitable to conduct the MOD ATC TD:
 - a. a suitable number of wind turbines within Line Of Sight (LOS) in order to generate meaningful data.
 - b. availability of suitable infrastructure support, including security, to operate radars and support equipment; and
 - c. ability to deploy the TWMn radar for the duration of the ATC TD.
- 8. **Wind farms used for the ATC TD.** Two offshore wind farms (wf) were identified as being in LOS for the ATC TD; Walney 1&2 (DONG Energy) and Ormonde (Vattenfall). A fourth wf West of Duddon Sands (DONG Energy) was being constructed during the flying phase of the ATC TD. More detail on the wind farms that were the subject of the ATC TD is provided at Annex A.
- 9. **Equipment under test (TWMn).** A Tactical Watchman (TWMn) system was deployed for the ATC TD. Further detail on the TWMn system is provided at Annex C.

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10. **Order of demonstration.** The six demonstration (and the Baseline) periods took place as follows:

- Baseline 23 June to 28 June 2013
- Demonstrator 1 01 to 09 July 2013
- Demonstrator 2 10 July to 19 July 2013
- Demonstrator 3 20 July to 29 July 2103
- Demonstrator 4 30 July to 08 August 2013
- Demonstrator 5 09 August to 18 August 2013
- Demonstrator 6 19 August to 28 August 2013

11. **Modelling requirement.** Evidence of the modelling capability of the Demonstrator was a key requirement of the ATC TD and was demonstrated through the means of completing three modelling reports:

- a. **Modelling Report 1** – A prediction of performance at MOD Eskmeals.
- b. **Modelling Report 2** – Verification of the predicted performance.
- c. **Modelling Report 3** - Prediction of the performance for a hypothetical scenario

12. **Data recording.** During the ATC TD the MOD collected analogue video recordings of the TARDIS analogue radar display screens and digital plot extracted (PEX) output. Additionally, aircraft GPS data and telemetry data for the Ormonde and Walney wfs was also collected.

13. **Flight profiles.** Flight profiles were designed to include flying above the wind turbines, in front of and behind the turbines at various heights and approaches.

14. **Aircraft types used.** All flights were undertaken with a Diamond DA-42 aircraft (Figure 2 - Cobham Diamond DA-42) and a Twin Squirrel helicopter (Figure 3 - PDG Helicopter Twin Squirrel).



Figure 2 - Cobham Diamond DA-42



Figure 3 - PDG Helicopter Twin Squirrel

Technology Demonstration Results

15. Whilst more than one Technology showed improvement over the baseline performance of the unmitigated MOD TWMn radar for the key performance criteria of Probability of Detection (Pd)

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and False Alarm Rate (FAR), none of them fully met the MOD's assessment criteria at the ATC TD.

Baseline Results

16. The baseline unmitigated TWMn results demonstrated that the unmitigated TWMn did not meet the requirement for Pd over the wf areas.

Conclusions

17. The ATC TD has gained significant momentum within DE&S, MOD Stakeholders and Demonstrators, clarified areas for development within the MOD and also provided an opportunity for Industry to explore issues associated with integrating their technology with existing MOD equipment.

Annexes

- A. Wind Farm Details
- B. Key URD Requirement to be evaluated
- C. Solution Descriptions

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ANNEX A TO
ATC TD SUMMARY
REPORT
DATED 22 JANUARY 2014

WIND FARM DETAILS

1. **Walney Offshore Wind Farm.** Walney is composed of 102 turbines. The rotor hub is located approximately 90 metres above mean sea level and the rotor diameter is 120 metres. This site is owned and managed by Dong Energy.
2. More information on Walney Offshore Wind Farm can be found at the Dong Energy website http://www.dongenergy.com/Walney/About_Walney/About_the_project.



A Walney wind turbine



An Ormonde wind turbine

3. **Ormonde.** Ormonde is composed of 30 turbines. The rotor hub is located approximately 90 metres above mean sea level and the rotor diameter is 126 metres. This site is owned and managed by Vattenfall.
4. More information on Ormonde Offshore Wind Farm can be found on the Vattenfall website <http://www.vattenfall.co.uk>
5. **West of Duddon Sands.** The West of Duddon Sands Offshore Wind farm was under construction at the time of the ATC TD and is a joint venture between DONG Energy and ScottishPower Renewables. The wind farm will comprise 108 wind turbines.

KEY URD REQUIREMENTS TO BE EVALUATED

[URD 1.1.2] A 90% probability of detection (Pd) in all areas shall be maintained during the ATC TD using a representative Aircraft provided by the Authority.

URD 1.1.3] Detection and continuous tracking of representative aircraft at heights above the wind turbines shall be possible at the following ranges: 500' @ 10nm, 1000' @ 15nm, 1500' @ 20nm.

[URD 1.1.4] Detection of 'pop-up' targets appearing over the wind turbines shall be possible in real-time in accordance with DefStan 00-972.

[URD 1.1.5] ATS information generated by the solution shall be accurate enough so that ATS could be provided. Information shall be accurate and no worse than 60m/0.1 Degrees System Error 60m/0.1 Degrees Random Error in accordance with DefStan 00-972.

[URD 1.1.6] The FAR shall be no more than the overall system. Plot loss, plot seduction, shadow effect, distortion of returns at range shall be prevented.

[URD 1.1.7] The data update rate shall be every 3 seconds.

[URD 1.1.8] The solution shall be able to distinguish between adjacent targets.

[URD 1.1.9] The solution shall be able to suppress PE, weather and ground clutter and shall permit detection on the display of ac returns within the coverage envelope of the flown profiles, at all radial target speeds of the representative aircraft.

[URD 1.1.10] The solution shall demonstrate that Clutter suppression options are selectable.

[URD 1.1.15.] The solution shall be capable of identifying which sensor is providing the data and that sensor identification information can be displayed.

[URD 1.2.2] The solution shall be operated without the Mil ATC Operator having to perform any extra tasks due to the wf mitigation solution.

SOLUTION DESCRIPTIONS

1. The TWMn System and Tactical Radar Display (TARDIS) were deployed at the ATC TD. The TWMn is an S-band radar, providing a deployable airspace surveillance capability for Mil ATC. The air-conditioned TWMn cabin contains the transmission, reception and processing units, and the two beam antenna assembly and turning gear are mounted externally onto the cabin. The TARDIS provides an approach control room facility for up to four Mil ATC Operators. The TWMn and associated support equipment is shown in Figure C 1 - TWMn and support equipment at Eskmeals.



Figure C 1 - TWMn and support equipment at Eskmeals

Technologies Demonstrated

2. The six Demonstrator's wf mitigation solutions utilised the following technologies:
- Demonstrator 1 – Display screen clutter removal system.
 - Demonstrator 2 – Signal Processing Rack replacement.
 - Demonstrator 3 – Gap infill.
 - Demonstrator 4 - Signal Processing Rack replacement.
 - Demonstrator 5 - Gap infill.
 - Demonstrator 6 - Gap infill.

