



Department  
of Energy &  
Climate Change

# The Aviation Plan: 2015 Update

**In respect of the interaction of wind turbines and  
aviation interests**



# The Aviation Plan

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The Aviation Plan

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URN 14D/448

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# The Aviation Plan

## Energy & Aviation

The UK has a legally-binding EU target to produce 15% of its energy from renewable sources by 2020. To achieve this, at least 30% of our electricity will need to come from renewables by the end of the decade.

UK airspace is recognised as one of the most complex and intensively used segments of airspace in the world. There are a wide range of users requiring access to our airspace and all need to operate within stringent safety standards which help to ensure that the UK maintains an excellent reputation for air safety. The development of sites for wind energy has the potential to cause a variety of negative effects on aviation. These include physical obstructions; the generation of unwanted returns on Primary Surveillance Radar (PSR); adverse effects on the overall performance of communication, navigation and surveillance equipment and potential turbulence. Although it is generally commercial scale turbines that have the greatest impacts, smaller turbines, and the anemometry requirements for larger turbines could also have negative impacts.

The UK is making good progress towards its renewable targets with UK renewable electricity capacity more than doubling since 2010 – from 9.2 GW in 2010 to 22.2GW by mid-2014. Wind energy capacity has risen from 5.4GW to 12.1GW during this period. At the end of 2013, renewables' share of electricity generation was 14.9% (7.9% from wind) and, in the first half of 2014, the UK's wind turbines provided almost 10% of the UK's electricity generation. However, aviation-related issues continue to impact on the deployment of wind energy. Working to resolve these issues could enable cost effective renewable deployment whilst maintaining aviation safety.

This Aviation Plan update is a refreshed and updated version of the original document and is issued to recognise recent achievements and to identify and address the challenges still to be overcome.

## Plan Purpose

The strategic aim of the Aviation Plan is to identify, develop and enable the implementation of mitigation measures to reduce the impacts of wind turbines on radar and aviation to acceptable levels, whilst taking all necessary steps to protect the safety of civilian and military air operations. It encourages a constructive dialogue between the wind and aviation industries and, wherever possible, ensures that strategic approaches are explored and progressed.

The objective of the Plan is to maximise renewable energy capacity, whilst maintaining aviation safety by enabling the deployment of mitigation solutions.

## Background

The Aviation Plan was first published in May 2008. It recognised that there is no universal solution to mitigating the effects of wind turbines on radar but it set a clear vision that offered the opportunity for wind farm developers and aviation stakeholders to identify, develop and implement mitigation measures to reduce the impacts to acceptable levels.

The Aviation Plan has provided a co-ordinated approach to the range of activities that had been put in place to identify and develop solutions. A process of strong governance was established

to drive this work forward which included mechanisms to provide financial support. The establishment of these structures was formally committed to by the key stakeholders in the form of a Memorandum of Understanding (MOU) signed on 11 June 2008. The MOU also focused on the need for research into technical solutions to the problem. A second MOU was agreed in 2010, and published in 2011, that shifted activity towards the deployment of the successful solutions that had been identified. The signatories to the MOU are the Department of Energy & Climate Change (DECC), the Ministry Of Defence (MOD), the Department for Transport (DfT), The Crown Estate, The Scottish Government, RenewableUK, NATS, The Civil Aviation Authority and The Airport Operators Association.

## Governing Structures

### The Aviation Management Board

The Aviation Management Board (AMB) has overall responsibility for ensuring the effective delivery of the Aviation Plan and its agreed programmes of work. It endorses the programme of work set out in the Plan, tasks those member organisations with delivering specific workstreams and monitors progress, issues and risks identified by the Board. A list of future milestones is at Pages 10 - 12. The AMB works with the Fund Management Board (FMB) and other relevant organisations and delivery partners to ensure financial support is available for the work streams. The AMB's Chair and the Aviation Plan Manager, who drive progress through workstream leads, are provided by DECC who ensure progress is reported to Ministers.

### The Aviation Advisory Panel

The Aviation Advisory Panel (AAP) supports the Aviation Plan by bringing together relevant expertise to consider and make recommendations to the AMB and FMB on work programmes for identifying and developing mitigation solutions. The AAP provides technical advice to the FMB and has engaged in identifying new potential technological solutions of relevance to the Aviation Plan. As commercial mitigation solutions have moved closer to market in recent years, the AAP has not had need to consider new solutions since October 2012. However, the group are able to meet on an ad hoc basis should the need arise.

### The Fund Management Board

The Aviation Investment Fund Company Ltd (AIFCL) was established as an action under the Aviation MOU signed in 2008. RenewableUK led the formation of the fund company, the purpose of which was to bring together wind energy companies with common interest to invest in research and development projects to address the radar issues facing on- and off-shore projects in the UK. The AIFCL is a member of the AMB but is not a signatory to the MOU.

The FMB is the decision-making board of Directors of AIFCL, elected annually by AIFCL shareholders at the Annual General Meeting. The Aviation Plan always anticipated financial contributions to the fund would initially be sought from wind farm development companies, but that when possible and where appropriate, Government and other organisations would contribute to work streams.

The FMB maintains a mechanism, with appropriate governance arrangements, that has to date provided an effective source of finance in support of the development of mitigation solutions through the Aviation Plan. AIFCL funding in excess of £3M has been provided to date with additional funding provided by DECC, the Scottish Government, MoD, The Crown Estate, Marine Scotland and non-AIFCL offshore wind developers on a project specific basis.

## Roles and Accountability

The Aviation Plan is the means by which the parties to the MOU realise their commitments. The AMB is responsible for the governance of the Aviation Plan and members collectively 'own' the plan and commit to progress the agreed activities within it. DECC chairs the AMB and retains accountability for delivery of the Aviation Plan by virtue of its ability to access the necessary levers. Not all activities are under the direct control of AMB members. However, every effort is made by the AMB to identify links and highlight wind energy as a stakeholder in those circumstances. Each activity is given a lead for management or monitoring purposes.

A high level diagram of the Aviation Plan Governance structure and the associated discussion groups is at Annex A.

## Progress

Since 2008, progress has been made in maturing operational and technical mitigation techniques to help counter the effects of wind turbines on aviation radars. Such techniques can include combinations of moving the locations of the wind turbines away from the radar line of sight, introducing radar sector blanking, using Transponder Mandatory Zone/Secondary Surveillance Radar and the use of technical mitigation capability to enhance the radar's capability. However, all techniques are required to satisfy regulatory and safety requirements and must be able to integrate satisfactorily with the host system. Therefore, not all techniques are appropriate in all cases. Further information is available in the Civil Aviation Authority's Civil Aviation Policy 764 'Policy and Guidelines on Wind Turbines'<sup>1</sup> document, with additional guidance and background found through the GOV.UK website.

In addition, the Aviation Plan has helped to bring forward progress in a number of key areas. Examples include:-

### Air Defence Radar

The MOD signed the first Contribution Agreement with wind energy developers for the procurement of an Air Defence radar that provided mitigation for specific wind farm proposals in June 2011. This was for a TPS 77 radar to be located at Remote Radar Head (RRH) Trimingham. Following on from this initial agreement, other wind energy developers requested that two further TPS 77s be installed at RRH Saxton Wold and RRH Brizlee Wood, these were also funded by the developers through Contribution Agreements. In November 2013, a further Agreement was signed with a wind energy developer for the upgrade of the radar at RRH Buchan in Scotland to the TPS 77 standard. The commissioning of these radars and trials to assess the performance of the radars against specific wind farms and to optimise their performance further is on-going. The MOD manages the process by which wind energy developers, where mitigation for specific wind farm proposals has been accepted, can become a party to the Agreement and share the cost of funding the radar.

### NATS En-Route Radar

UK en route air traffic control, provided by NATS, uses Raytheon Primary Surveillance Radars (PSRs). Raytheon was commissioned by DECC, the Crown Estate and the AIFCL to research and develop a package of modifications to these radars with the potential to mitigate against wind turbine interference under certain conditions without compromising air safety. The findings of this research have been taken forward successfully by NATS who are now offering a commercial solution (Project RM) to developers whose projects impact on NATS radar operations at Great Dun Fell and Lowther Hill (subject to the mitigation's operational

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<sup>1</sup> CAP 764: <https://www.caa.co.uk/docs/33/Cap764.pdf>

parameters). NATS estimate that Project RM could release planning objections for up to 2GW of new wind capacity with opportunities at other en route radars a possibility should funding be made available. A limited opportunity exists to add further radars to the delivery programme driven by Industry appetite and held up capacity.

### Eskdalemuir Seismology Array

The Eskdalemuir Seismology Array (EKA) is used to support verification of the Comprehensive Nuclear-Test-Ban Treaty. Research conducted in 2005 demonstrated that the construction and operation of wind farms within a 50km radius of the Array could produce seismic ground vibration that could potentially affect its functionality. Although not an aviation issue, the structure established under the AMB was identified as the ideal forum to tackle this barrier and drive progress. Additionally, there was majority support from AIFCL member organisations to support this activity. Following substantial scientific research commissioned by the AIFCL, MOD, the Scottish Government and DECC in 2013, a new methodology for calculating wind turbine seismic ground vibration has been developed. This methodology has been adopted by MOD as part of its safeguarding approach for the EKA and, alongside interim planning guidance, has led to the removal of a significant onshore wind deployment barrier in the Eskdalemuir area. Further information on the research and guidance for future applicants can be found on the Scottish Government website<sup>2</sup>.

### The Task Ahead

Whilst there has been clear progress, there is not one single technical mitigation solution that meets operational needs and satisfies safety and regulatory requirements in every circumstance. One major area where a mitigation solution has still to be proven and implemented is terminal air traffic control (ATC) for military and civilian Primary Surveillance Radars (PSR). During the summer of 2013, the MOD conducted a technical assessment of a number of commercially available ATC radar mitigation solutions against military User Requirements. The assessment concluded that, whilst more than one technology showed an improvement over the baseline performance of MOD's unmodified ATC radar, none fully met MOD's assessment criteria. MOD is proposing to continue its proactive approach to this issue and aims to run a project (Military ATC 'Next Steps') to take the recommendations of the technology assessment forward, subject to wind industry funding. Progress is being made on a case by case basis at civilian aerodromes that each have specific civilian User Requirements.

Another key area which could impact on future radar mitigations is the Government's Spectrum Release programme. This work stream seeks to release 500MHz of spectrum from "public infrastructure" use by 2020 to boost growth in the UK economy. The CAA has been tasked by Government to undertake a major piece of work in support of this programme. This aims to deliver a release from 2.7-2.9MHz (which is currently used by S-Band PSR) by reviewing how non-cooperative surveillance can be best delivered to meet the operational and safety requirements of Air Navigation Service Providers (ANSPs) and consistent with the Future Airspace Strategy (FAS). In parallel, there is an aspiration to use this opportunity to develop a strategic approach to wind farm mitigation in how non-cooperative surveillance is deployed. The CAA leads a work stream in the Aviation Plan to ensure that the AMB is provided with updates on progress at suitable intervals.

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<sup>2</sup> <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance>

## Work Stream Summary

Key Work Stream	Description	Owner
Military ATC 'Next Steps'	MOD to take forward a wind industry funded Technology Pilot in order to prove a technical solution that meets MOD requirements for mitigating the effects of wind turbines.	MOD
Spectrum Release	<p>To assess emerging surveillance technologies in relation to Future Airspace Strategy Surveillance requirements with the aim of also delivering a strategic solution to the impact of wind turbines on aviation consistent with government's targets for spectrum release by 2020.</p> <p>Development of a layered surveillance environment to include an analysis of cooperative and non-cooperative surveillance requirements.</p>	CAA
Air Defence Radar Capacity/Upgrades	To extend the physical roll-out of TPS-77 standard radars where wind industry demand exists, enabling wind energy developers to become party to existing Contribution Agreements where appropriate and subject to successful operational assessment.	MOD
NERL PSR	<p>To extend the physical roll-out of Project RM where wind industry demand exists, enabling wind energy developers to become party to existing Contribution Agreements where appropriate and subject to successful operational assessment.</p> <p>To extend the benefit of Project RM and undertake trial to remove or reduce the RM limitations and enable more developers to benefit and release more capacity.</p>	NATS
Precision Approach Radar	To explore the potential for mitigating the impact of wind turbines upon the MOD Precision Approach Radar.	MOD
Turbulence	To conduct research to better understand how wind turbines can induce turbulence that impacts aircraft, and identify gaps where coordinated R&D can add value.	CAA

Work Stream	Description	Owner
Voice Communications	To gain a greater understanding of the issues that wind turbines can cause to aircraft voice communications in order to enable the development of unambiguous and scientifically credible guidelines.	CAA and NATS
Offshore Aviation Operations	<p>The Offshore and Aviation Group, co-chaired by TCE and RUK evolves into a forum to:</p> <ul style="list-style-type: none"> <li>• Resolve the barriers to renewable energy deployment caused by the interaction between aviation and offshore renewable developments at an operations level.</li> <li>• Identify common aviation operations issues affecting offshore renewable developers, other offshore users, aviation operators and ANSPs.</li> <li>• Raise awareness of identified issues with relevant stakeholders and strategies for resolution.</li> <li>• Facilitate knowledge exchange for offshore aviation activities.</li> </ul>	TCE and RUK
Scottish Wind Farm and Aviation Group (SWAG)	<p>The SWAG group, chaired by the Scottish Government, is a forum allowing more focus on Scottish aviation issues and early plans relate to:</p> <ul style="list-style-type: none"> <li>• Looking at evidence around locality and type of aviation objections to wind developments in Scotland order to identify hotspots and the scale of the problem.</li> <li>• Publish information on SG website, with the aspiration to include a statement from each of the ANSP's setting out their position, their approach to dealing with developers, and any progress being made in relation to solutions.</li> </ul>	Scottish Government
Evidence	To continue to assess and understand the scale of the problem and to develop appropriate surveys for gathering data as required to support AMB work-streams.	DECC and RUK

## Aviation Plan Milestones

### Summary of milestones to be delivered in the Aviation Plan Work Streams

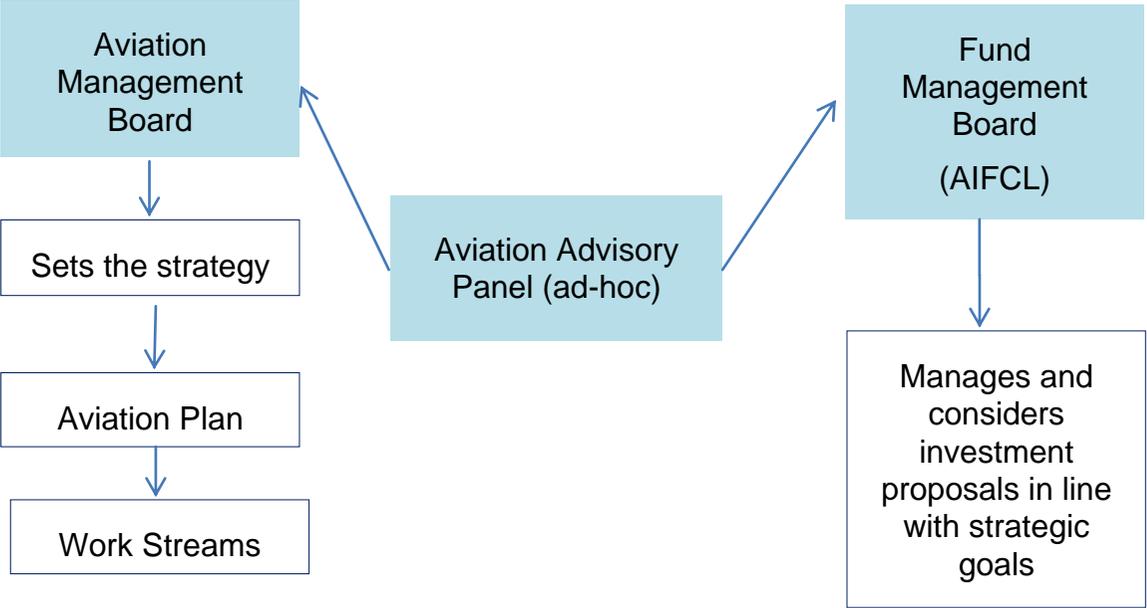
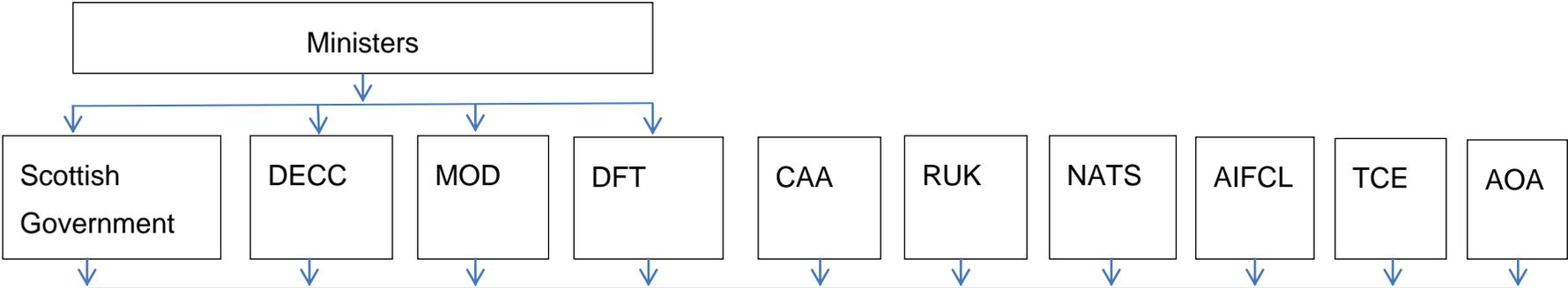
Work Stream	Start Date	End Date	Description	Owner
Spectrum Release	Started	On-going	Trials	CAA
	Jan 2015	Jan 2015	Outcome of first trials reported	
	Mar 2015	Mar 2015	Go/No-Go decision by Programme Management Board to continue studies with some or all of the technologies	
	TBC	TBC	Continue studies into technology readiness and product offerings	
	TBC	TBC	Second round of trials using advanced features e.g. increased sensor range and networked solutions	
	TBC	TBC	Go/No-Go decision by Programme Management Board to adoption	
	TBC	TBC	Completion of technology, regulatory and risk impact assessment	
	TBC	TBC	Implementation commences	
Military ATC 'Next Steps'	Dec 2014	Mar 2015	TMZ 'stage 1' application process is commenced by the wind industry	MOD
	Started	Mar 2015	Funding for 'Next Steps' initial activities is obtained	
	Jan 2015	Mar 2015	'Next Steps' milestone plan is available	
PAR	Started	Mar 2015	Engage with the PAR Radar Manufacturer to explore the potential for wind turbine mitigation.	MOD

Work Stream	Start Date	End Date	Description	Owner
MOD Air Defence Capacity	Started	Dec 2015	TPS-77 Air Defence Radars capacity increase NB: A case-by-case operational assessment of wind farm mitigation proposals will still be required in all circumstances and a capacity increase is no guarantee of acceptance.	MOD
MOD Air Defence Upgrades	Started	Dec 2015	RRH Buchan and RRH Benbecula upgraded to TPS-77 standard	MOD
Turbulence	Started	TBC	LIDAR trials and analysis of findings	CAA
	Jan 2015	Mar 2015	Development of guidelines	
	Apr 2015	Sep 2015	Publication of guidelines in CAP 764	
Voice Communications	Jul 2015	Sep 2015	Work Package 2 - Establish the level of magnitude of interference	CAA
	Oct 2015	Dec 2015	Work Package 3 -Agree Safeguarding Guidelines	
	Jan 2016	Mar 2016	Work Package 4 - Publish Safeguarding Guidelines	
	TBC	TBC	Work Package 5 - Develop full interference model	
	TBC	TBC	Work Package 6 – Investigation/design of a wind farm planning tool	
Project RM Implementation		Mar 2015	Deadline for interest in new radar upgrades – Claxby	NATS
		Sep 2015	Great Dunn Fell upgrade	
		Mar 2016	Lowther Hill upgrade	

Work Stream	Start Date	End Date	Description	Owner
Evidence	Jan 2015	Feb 2015	2014 RUK Members Survey preparation and design	RUK & DECC
	Feb 2015	Mar 2015	Trawl for responses	
	Mar 2015	Apr 2015	Analysis and 'first impressions' draft	
		Jun 2015	Report to AMB	
Offshore Aviation Operations Group	Mar 2014	On-going	OAOG to engage with O&G industry and scope next steps for developing an offshore aviation guidelines for renewables	TCE & RUK
	Nov 2014	Jun 2015	OAOG assist in developing any agreed work to produce guidelines.	
Scottish Wind Farm & Aviation Group	TBC	TBC	Evidence gathering completed	SG
	TBC	TBC	Dissemination ANSP status and approach	

# Annex A - Aviation Plan Governance Flow Chart

## High Level Structure



## Annex B - Contact Information

### **The Airport Operators' Association**

3 Birdcage Walk  
London  
SW1H 9JJ  
[www.aoa.org.uk](http://www.aoa.org.uk)

### **The Civil Aviation Authority**

Safety and Airspace Regulation Group  
CAA House  
45-59 Kingsway  
London  
WC2B 6TE  
[www.caa.co.uk/windfarms](http://www.caa.co.uk/windfarms)

### **The Crown Estate**

16 New Burlington Place,  
London  
W1S 2HX  
[www.thecrownestate.co.uk](http://www.thecrownestate.co.uk)

### **Department of Energy and Climate Change**

3 Whitehall Place  
London  
SW1A 2AW  
[www.gov.uk/government/organisations/department-of-energy-climate-change](http://www.gov.uk/government/organisations/department-of-energy-climate-change)

### **Department for Transport**

Great Minster House  
76 Marsham Street  
London  
SW1P 4DR  
[www.gov.uk/government/organisations/department-for-transport](http://www.gov.uk/government/organisations/department-for-transport)

### **Ministry of Defence – Defence Infrastructure Organisation**

Kingston Road  
Sutton Coldfield  
West Midlands  
B75 7RL  
[www.gov.uk/government/organisations/defence-infrastructure-organisation](http://www.gov.uk/government/organisations/defence-infrastructure-organisation)

### **NATS Windfarms**

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[www.nats.co.uk](http://www.nats.co.uk)

**RenewableUK**

Greencote House  
Francis Street  
London  
SW1P 1DH

<http://www.renewableuk.com/>

**The Scottish Government**

Energy Consents Unit  
5 Atlantic Quay  
150 Broomielaw  
Glasgow  
G2 8LU

[www.scotland.gov.uk/Home](http://www.scotland.gov.uk/Home)

## Memorandum of Understanding Signatories



## The Aviation Investment Fund Company Ltd



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