Contents

List of Tables

List of Figures

Glossary

Air Defence Radar	A series of fixed air defence radars feed data into a central control and reporting centre providing surveillance information for air defence controllers.
Air Traffic Control	A service that facilitates safe and orderly movement of aircraft within and between airports.
Air Navigation Order	Published by the Civil Aviation Authority for the use of those concerned with air navigation.
Air Traffic Service Unit	A unit established for the purpose of receiving reports concerning air traffic services and flight plans submitted before aircraft departure. Such a reporting office may be established as a separate unit or combined with an existing unit. It is a generic term meaning air traffic control, flight information centre or air traffic reporting office.
Civil Aviation Authority	The statutory regulatory body which oversees and regulates all aspects of civil aviation in the United Kingdom.
Civil Aviation Publication	A series of documents published by the Civil Aviation Authority containing aviation policy and guidance.
Conditional Route	Air traffic service routes of defined airspace which are useable only under specified conditions.
Control and Reporting Centre	A location where air defence radar is used to police airspace, scrambling fighter jets where necessary to intercept and identify any aircraft that are deemed to be suspicious.

Deconfliction Service	A surveillance based air traffic service in which the air traffic controller provides specific surveillance derived traffic information and issues headings or levels aimed at achieving planned deconfliction minima against all observed aircraft.
Defence Infrastructure Organisation	An operating arm of the Ministry of Defence which is responsible for the built and rural estate. The agency's property portfolio is diverse and ranges from naval bases to airfields to forces housing and military training grounds. The DIO's responsibilities relevant to this assessment relate to safeguarding of military aviation interests.
Department of Energy and Climate Change	A ministerial department which works to ensure the UK has secure, clean, affordable energy supplies and to promote international action to mitigate climate change.
Helicopter Main Route	A route where civilian helicopters that service the offshore oil and gas industries operate on a basis.
Instrument Meteorological Conditions	Description of weather conditions that require pilots to fly primarily by reference to aircraft instruments.
Lower Airspace Radar Service	A national system within which participating civil and military air traffic service units provide a radar service to aircraft, subject to controlling capacity, to transiting civil and military aircraft which are operating outside the boundaries of controlled airspace.
Lowest Astronomical Tide	The lowest level (of tide) which can be predicted to occur under average meteorological conditions, storm surges may cause considerably lower levels to occur.
Maritime and Coastguard Agency	Executive Agency responsible for implementing British and international maritime law and safety policy.
Military Aeronautical Information Publication	A document which provides comprehensive information to military aircrew on general and en-route procedures together with information on UK military aerodromes.
Minimum Safety Altitude	An altitude which is at least 1,000 ft above any obstacle or terrain within a defined region.
Ministry of Defence	UK government department responsible for implementing the defence policy set by the UK government and is the headquarters of the British armed forces.
National Air Traffic Services	The main air navigation service provider in the UK. It provides en-route air traffic control services to flights as well as at a number of civil airports.
NATS En-route Limited	A division of National Air Traffic Services (NATS) who provides en-route air traffic control services over the UK.
Precision Approach Radar	A type of radar guidance system designed to provide lateral and vertical guidance to an aircraft pilot prior to landing.

Primary Surveillance Radar	A radar system used in Air Traffic Control (ATC) that detects objects by means of reflected radio signals.
Radar Mitigation Scheme	A scheme involving the implementation of appropriate measures designed to Mitigate the impact of Wind Turbine Generators (WTGs) on radar.
Search and Rescue	The search for and provision of aid to people who are in distress or imminent danger. The general field of search and rescue is typically determined by the type of terrain the search is conducted over.
Secondary Surveillance Radar	A radar system used in ATC that detects aircraft position through communication with an onboard radar transponder. It also requests additional information from the aircraft such as identity and altitude.
Standard Instrument Departure	A published flight procedure followed by some aircraft immediately after take-off from an airport.
Tactical Aid to Navigation	A navigation system used by military aircraft which provides the bearing and distance to a ground station.
Technology Demonstration	A procedure for showcasing the method or features of a product and the viability of a chosen approach.
Technical and Operational Assessment	A pre-planning service offered by NATS which determines at an early stage whether there is likely to be a NATS aviation objection to a wind farm.
Temporary Reserved Airspace	Airspace of defined dimensions allocated for a specific user during a determined period of time.
UK Integrated Aeronautical Information Package	A publication, updated every 28 days, which contains information of lasting (permanent) character essential to air navigation.
United Kingdom Low Flying System	The UK low flying system covers the open airspace of the whole UK below 2,000 ft above ground level. Low Flying by military aircraft is permitted within established low flying areas which exclude large urban areas.
Visual Flight Rules	A set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to operate the aircraft with visual reference to the ground and by visually avoiding obstructions and other aircraft.

Abbreviations and Acronyms

ADR	Air Defence Radar
ATC	Air Traffic Control
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication

DECC	Department of Energy and Climate Change
DIO	Defence Infrastructure Organisation
DS	Deconfliction Service
HMR	Helicopter Main Route
LARS	Lower Airspace Radar Service
MCA	Maritime and Coastguard Agency
Mil AIP	Military Aeronautical Information Publication
MOD	Ministry of Defence
MSA	Minimum Safety Altitude
NATS	National Air Traffic Service
NERL	NATS En Route Limited
PAR	Precision Approach Radar
PSR	Primary Surveillance Radar
RMS	Radar Mitigation Scheme
SAR	Search and Rescue
SID	Standard Instrument Departure
TACAN	Tactical Aid to Navigation
TD	Technology Demonstration
TOPA	Technical and Operational Assessment
TRA	Temporary Reserved Airspace
UK IAIP	UK Integrated Aeronautical Information Package
UKLFS	UK Low Flying System
URD	User Requirement Document
VFR	Visual Flight Rules
WTG	Wind Turbine Generators

20 Military and Civil Aviation

20.1 Introduction

1 This chapter describes the existing environment with regard to the civil and military aviation within and around the Development Area and Offshore Export Cable Corridor, through the evaluation of existing data source and desk studies, and consultation with key stakeholders. Subsequently, this chapter presents an assessment of the predicted impacts of the construction, operation and decommissioning phases of the Inch Cape Offshore Wind Farm and associated Offshore Transmission Works (OfTW) on aviation interests. Details of mitigation are also presented.

2 The potential effects of wind farms on aviation interests generally fall into two scenarios:

- Physical obstruction: infrastructure can present a physical obstruction at, or close to, an aerodrome, flight path or other landing/take off point; and
- Radar/air traffic services: clutter resulting from infrastructure, appearing on a radar display, can affect the safe provision of air traffic services as it can mask unidentified aircraft from air traffic controllers and/or prevent accurate identification of aircraft under their control. In some cases, radar reflections from the Wind Turbine Generators (WTGs) can affect the detection performance of the radar system itself.

3 A number of other potential effects including impacts on search and rescue operations and over flight consideration, among others, are also relevant to the consideration of aviation impacts.

4 This chapter is supported by the following appendices:

- *Appendix 20A: Military and Civil Aviation Impact Assessment*;
- *Appendix 20B: Aviation and Lighting Requirements*; and
- *Appendix 20C: NATS En Route Ltd (NERL) Technical and Operational Assessment*.

5 This chapter also shares linkages with *Chapter 19: Shipping and Navigation* and makes reference to content where relevant.

6 Please note that in aviation terms, the standard measurement of altitude or vertical distance is in feet (ft), and nautical miles (nm) are used for navigational distances: 1 ft equates to 0.305 metres; and 1 nm equates to 1.852 km.

20.1.1 Consultation

7 Inch Cape Offshore Limited (ICOL) has consulted a number of aviation stakeholders throughout the scoping of the Wind Farm and the pre-submission phase of the Project, and the consultees most current comments are summarised in Table 20.1

8 Consideration of the Wind Farm and OfTW potential to impact on aviation stakeholders and receptors in accordance with the standard consultation distances stated in Civil Aviation

Publication (CAP) 764*:* Civil Aviation Authority (CAA) *Policy and Guidelines on Wind Turbines* (CAA, 2012a) was undertaken for the Project. A number of consultees and receptors were scoped out from the consultation process as they were outwith the CAP 764 (CAA, 2012a) consultation zones or criteria which included:

- CAA licenced aerodromes with a surveillance radar – none within 30 km of the Development Area.
- CAA non licenced aerodromes - none within 17 km of the Development Area.
- CAA licenced aerodrome where WTGs would line within any airspace coincidental with any published instrument flight procedure – none within the criteria.
- Unlicensed aerodromes with runway length greater than 400 m – none within 4 km of the Development Area.
- Other aviation activity – none within 10 km of the Development Area.
- Helicopter Main Routes – none coinciding with the Development Area 2 nm either side of the route.
- Offshore Helicopter Platforms – none coinciding with the Development Area 9 nm around a platform.

Table 20.1: Scoping Responses and Actions

Consultees	Scoping Response	Project Response
Military Consultees		
Ministry of Defence (MOD) through Defence Infrastructure Organisation (DIO)	MOD letter 12 February 2013 confirms that the Project will be detectable by, and will cause unacceptable interference to the following radars: • Leuchars Air Traffic Control (ATC) Primary Surveillance Radar (PSR). • Buchan Air Defence Radar (ADR) radar. If the developer is able to overcome the issues stated above, the MOD will request that all WTGs be fitted with 200 candela omni-directional red lighting at the highest practicable point.	**Leuchars ATC PSR** ICOL are intending to submit an initial mitigation scheme to the MOD pending consent submission. Preliminary details are provided in *Section 20.8.1*. **ADR at Buchan** ICOL are further engaging with the MOD to understand the extent of the potential effects and understand the appropriate mitigation that meets Project and MOD requirements. Preliminary details are provided in *Section 20.8.2*. **Lighting Scheme** Lighting of the WTGs will be in accordance with legislation detailed in Article 220 [Annex A] CAP 393, 2012b and summarised in *Appendix 20B*.

Consultees	Scoping Response	Project Response
	Further email correspondence with DIO 19 February 2013 confirmed that that additional information should be provided to the MOD on layout and turbine height options within the Development Area, to allow the MOD to further refine an impact assessment. This may reduce potential impact on the ADR at Buchan to an acceptable level and remove the requirement for any technical mitigation. An email from MOD to Department of Energy and Climate Change (DECC) 3 April 2013 confirms the process for removing an ADR or ATC objection. An initial mitigation scheme should be submitted to the MOD by ICOL. The scheme must be considered by the MOD to be feasible and that there is potential (or the MOD cannot prove that there is no prospect) for the mitigation to be implemented within the life of the planning consent.	
Civil Consultees		
Civil Aviation Authority (CAA)	Email response 14 April 2010: CAA has no site specific observations. Specific lighting of WTGs to be approved by CAA.	Lighting of the WTGs will be in accordance with legislation detailed in Article 220 [Part 28] CAP 393, 2012b and summarised in *Appendix 20B*.
National Air Traffic Services (NATS)	NATS Technical and Operational Assessment requested by ICOL for the Project in February 2013 concluded that no impact on NATS en-route radar and infrastructure is anticipated.	No response required.

20.1.2 Policy and Plans

9 A variety of aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. The following documents were consulted to inform the assessment:

- Civil Aviation Policy (CAP) 168*: Licensing of Aerodromes* sets out the standards required at United Kingdom (UK) licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids. (CAA, 2011).
- CAP 393 Air Navigation: *The Order and the Regulations* sets out the provisions of the Air Navigation Order as amended together with regulations made under the Order. It is prepared for those concerned with day to day matters relating to air navigation that require an up to date version of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. (CAA, 2012b).
- CAP 437: *Offshore Helicopter Landing Areas – Guidance on Standards* provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on WTG platforms to represent current best practice. (CAA, 2013a).
- CAP 670: *Air Traffic Services Safety Requirements* sets out the safety regulatory framework and requirements associated with the provision of an air traffic service. (CAA, 2012c).
- CAP 764: *Policy and Guidelines on Wind Turbines* provides assistance to aviation stakeholders to help understand and address wind energy related issues, thereby ensuring greater consistency in the consideration of the potential impact of proposed wind farm developments. (CAA, 2012a).
- *UK Aeronautical Information Publications* (Civil and Military) provides updated information essential to air navigation. (CAA, 2013b);
- (Lighting, Policy Statement) CAA Policy Statement: T*he Lighting of Wind Turbine Generators in United Kingdom Territorial Waters*. (CAA, 2012d).
- Maritime and Coastguard Agency (MCA*): Offshore Renewable Energy Installations, Emergency Response Co-operation Plans (ERCoP) for Construction and Operations Phase, and Requirements for Emergency Response and Search and Rescue (SAR) Helicopter Operations*. (MCA, 2012).

20.1.3 Design Envelope and Embedded Mitigation

10 The potential development parameters and scenarios are defined as a Design Envelope and presented in *Chapter 7: Description of Development*. The assessment of potential impacts on military and civil aviation is based upon the worst case scenario as identified from this Design Envelope, and is specific to the potential impacts assessed in this chapter.

11 Key parameters for the worst case scenario for each potential impact are detailed in Table 20.2 below. For this assessment these include consideration of the maximum number of WTGs across the largest area and with the maximum blade tip height.

Table 20.2: Worst Case Scenario Definition – Wind Farm

Predicted Impact	Design Envelope Scenario Assessed
Construction (and Decommissioning)	
Impacts on Radar	During construction, and prior to commissioning WTG blades will not be rotational. As a result the infrastructure will not be processed and presented onto control displays by the radar. Therefore there will be no impacts on radar.
Physical Obstruction	The worst case scenario for impacts on radar services assumes that the entirety of the Development Area will be populated with WTGs at the maximum blade tip height of 215 m (705 ft) above Lowest Astronomical Tide. This is because the largest area of the highest WTGs will create the largest impact from an obstruction perspective, leading to a greater effect on aviation services. Any aspects of the infrastructure that are lower in height than the WTGs and within the Development Area will not create an incremental effect on aviation interests.
Operation	
Impacts on Radar	As per Physical Obstruction in construction.
Physical Obstruction	As per Physical Obstruction in construction.

12 As the entire Offshore Export Cable is below sea level, it will not have an impact on aviation interests and therefore is not assessed in this chapter (*Section 20.5*).

13 A range of Embedded Mitigation measures to minimise effects on military and civil aviation are captured within the Design Envelope (see *Section 4.5.1*). Currently the mitigation measures detailed in *Appendix 20A* and *Appendix 20B* are considered standard for wind farm projects. This assessment has assumed that they are embedded and the significance of impact is assessed accordingly.

14 Embedded mitigation measures relate to lighting, and marking of works within the Development Area and promulgation of activities. The final scheme will comply with current guidelines and be agreed with the appropriate stakeholders. Current guidance is as follow:

- Article 220 (CAA, 2012) sets out the mandatory requirements for lighting of offshore wind turbines;

- CAP 437: Standards for Offshore Helicopter Landing Areas (CAA, 2013a) sets out the lighting required to facilitate helicopter winch operations to WTG helicopter platforms conducted by day in visual meteorological conditions. The requirement determines installation of 16 – 60 candela steady green lights to indicate to a pilot when it is safe to operate;
- Additional lighting may be required to mitigate the risk to winching operations (onto the WTGs or Operational Service Platforms) and the risk to Search and Rescue (SAR) operations. Requirements are in accordance with a CAA Policy Statement (CAA, Nov 2012) (*Appendix 20B*);
- The MCA has requested that "all lights should be under the control of the Wind Farm Control Centre or, out of hours, a person who has rapid access to control of the Wind Farm lighting and turbines so that they can be switched off/on as required by the emergency situation". CAA policy statement (November 2012); and
- Information will be circulated to relevant military and aviation stakeholders including NATS, MOD, and RenewableUK. Information on potential aviation obstructions will be promulgated within the UK Integrated Aeronautical Information Package (UK IAIP) and notified to the Defence Geographic Centre for marking on aeronautical related charts and documentation.

15 These measures would be delivered as part of the Project (see *Appendix 7A: Draft Environmental Management Plan*).

20.2 Baseline Environment

20.2.1 Baseline Development Area

16 Identification of receptors in the following description of the baseline environment within the Development Area is based upon:

- Desk-top study utilising documentation listed in *Section 20.1.2* including the *UK IAIP* (CAA, 2013b), *Military Aeronautical Publication* (Mil AIP) (No.1 Aeronautical Information Documents Unit(AIDU), 2013) and CAA aeronautical charts (*Appendix 20A*);
- Consultation with relevant stakeholders using standard consultation distances stated in CAP 764: *Policy and Guidelines on Wind Turbines* (CAA, 2012a) as described in *Section 20.1.1*;
- Radar line of sight analysis (see *Appendix 20A*, Section 3-5) carried out on behalf of ICOL; and
- Consideration of key legislative and planning information.

17 The works proposed within the Development Area have the potential to affect a number of receptor groups who have interests in safeguarding existing aviation operations and these are further separated into civil and military below. The following provides a generic description of the receptors considered within the baseline.

Civil Aviation

18 Air Traffic Control (ATC) Radar – The role of ATC primary surveillance radar (PSR) is to provide information on air traffic in the vicinity of an airfield and the radar is normally situated at the airfield they support.

19 NATS En-Route – NATS operate a number of long range radars positioned to provide maximum coverage of UK airspace. Wind farm developments have the potential to impact NATS radar and operations and by association other users of radar data supplied by NATS.

Military Aviation

20 ATC Radar – As with civil ATC the role of ATC primary surveillance radar is to provide information on air traffic in the vicinity of an airfield and the radar is normally situated at the airfield they support. The MOD has objected to a number of wind farm proposals as a result of potential impacts upon the radar and operations provided by the MOD ATC PSR service providers.

21 Precision Approach Radar (PAR) and protected area – PAR provides lateral and vertical guidance for aircraft approaching a landing area. WTGs, when constructed within the arc of coverage of PAR installation, have the capacity to affect PAR in a variety of ways. In particular, the MOD has previously objected to proposals on the basis of track loss, track seduction, and processor overload.

22 Air Defence Radar (ADR) – ADR provide a continuous recognised air picture over the UK. As with ATC Radar, the MOD has objected to a number of wind farm proposals as a result of potential impacts upon the radar and operations provided by the MOD Air Defence control system.

23 Minimum Safety Altitude (MSA) – The potential exists that the Wind Farm will present a physical obstruction to aviation operations with regard to the MSA which is set in areas to ensure separation between aircraft and known obstacles.

24 Low Flying - Low flying is a demanding but essential skill for military aircrew gained through progressive training and continuous practice within the United Kingdom Low Flying System (UKLFS). The ability to operate effectively at low-level by day and night is vital to fast jet, transport aircraft and helicopters, as they support forces on the ground. The MOD may object to developments which provide physical obstructions in or near a UKLFS area.

25 Search and Rescue – The military search and rescue force provides 24 hour aeronautical search and rescue cover in the UK in the role of military and civil rescue, a role delegated to them by the Department of Transport. The search and rescue role is shared with the helicopters of Her Majesty's Coastguard and, recently, civil helicopter operators based at Stornoway and Sumburgh and at two helicopter bases on the English south coast. Physical obstruction caused by the infrastructure within the Development Area has the potential to impact provision of SAR services. Although SAR provision covers both military and civil

interests, for the purpose of this assessment search and rescue is listed within military aviation.

Airspace Classification

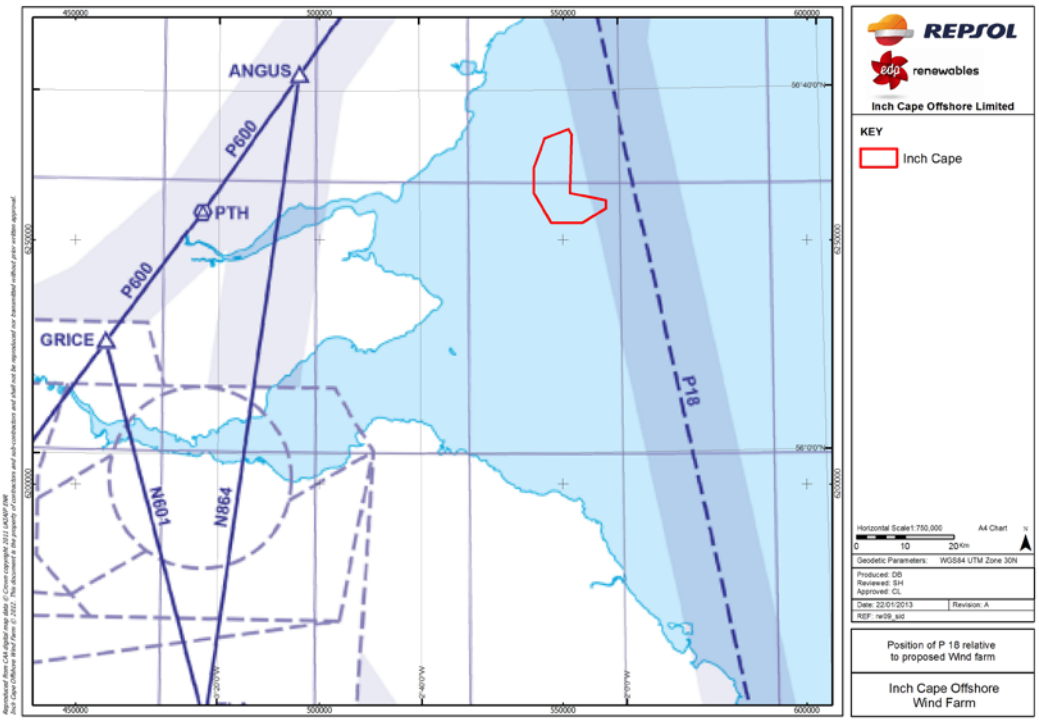
26 The Development Area is situated in an area of predominately Class G uncontrolled airspace which is established from the surface up to Flight Level (FL) 195 (approximately 19,500 ft). There are also discrete areas of Class C and D controlled airspace in the Development Area. Within the different classifications of airspace the following applies:

- Class G uncontrolled airspace: any aircraft can operate in this area of uncontrolled airspace without any mandatory requirement to be in communication with, or receive a radar service from, any ATC unit. Pilots of aircraft operating under Visual Flight Rules (VFR) in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions; and
- Class C and D controlled airspace: only aircraft that have filed a flight plan can operate within controlled airspace. Controllers apply the required levels of separation to aircraft operating in controlled airspace and generally instructions issued to the pilot flying in controlled airspace are mandatory. Aircraft operating in controlled airspace must be in receipt of an air traffic service from NATS or a separate authorised military service provider.

27 Within the Class C controlled airspace there are a number of airways including P 18, Temporary Reserved Area (TRA) 007A, UP 18 and UP 59.

- Airway P 18 is utilised by civil aircraft transiting from Newcastle to Wick and beyond (Figure 20.1). Airway P 18 is a conditional route which is 10 nm wide and when activated, extends in Class D controlled airspace from FL 135 (13,500 ft) to FL 195 (19,500 ft) and Class C controlled airspace from FL 195 to FL 245 (24,500 ft). Conditional routes have restricted times of operation and P 18 is available during discrete operating hours.

Figure 20.1: Position of P 18 Relative to Development Area



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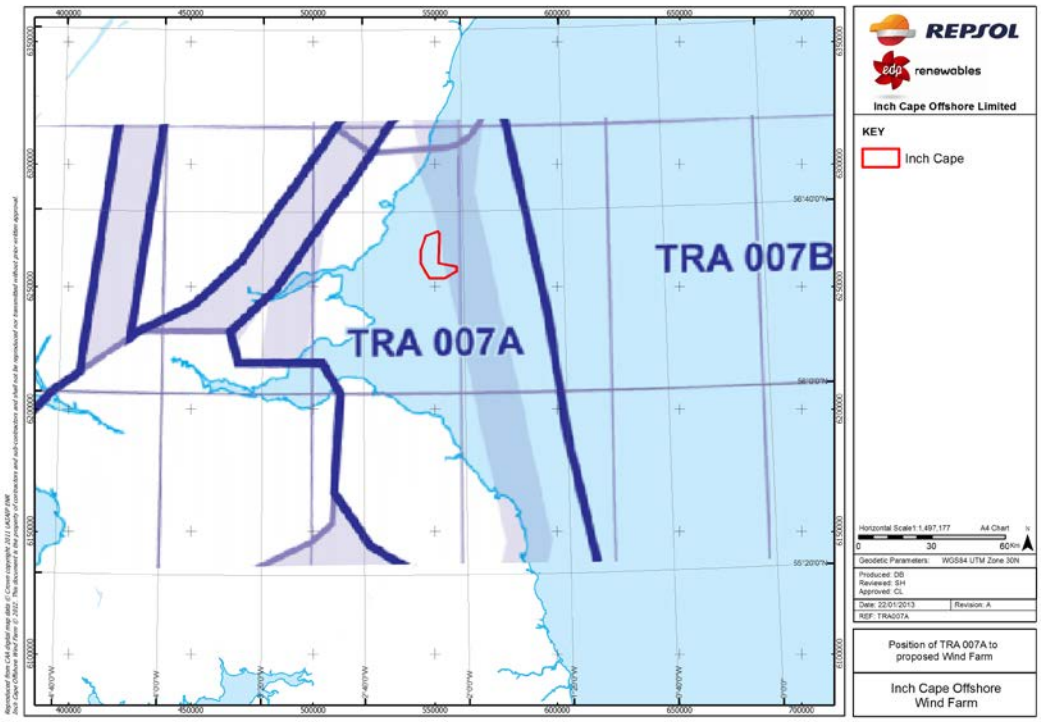
- Temporary Reserved Area (TRA) 007A (Figure 20.2) is used by military aircraft for activities including air combat training, training exercises and supersonic flight (Figure 20.4). It is established above a portion of the Development Area from FL 195 (19,500 ft) to FL 245 (24,500 ft) and is activated Monday – Friday 0830 to 1700 (0730 to 1700 during the months of summer). TRA 007A does not include controlled airspace within Airway P 18 during the published hours of P 18. TRAs allow military aircraft to work autonomously or to be in receipt of an air traffic service from approved air traffic service units, to avoid operational restrictions. Air defence controllers using radar data from ADRs are responsible for navigation services and support to aircraft activity within TRA 007A although RAF Leuchars can provide ATC services utilising the Leuchars PSR within TRA 007A.

Figure 20.2: Position of TRA 007A Relative to Development Area



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- Two upper air routes, UP 18 and UP 59 which extend from FL 245 (24,500 ft) to FL 460 (46,000 ft) overfly the Development Area (Figure 20.3). Aircraft on the upper air routes are controlled by NATS controllers who utilise remote NATS en-route radars. For this portion of airspace, the controllers are located at the NATS Air Traffic Control Centre at Prestwick.

Figure 20.3: Position of Upper Air Routes UP 18 and UP 59 Relative to Development Area

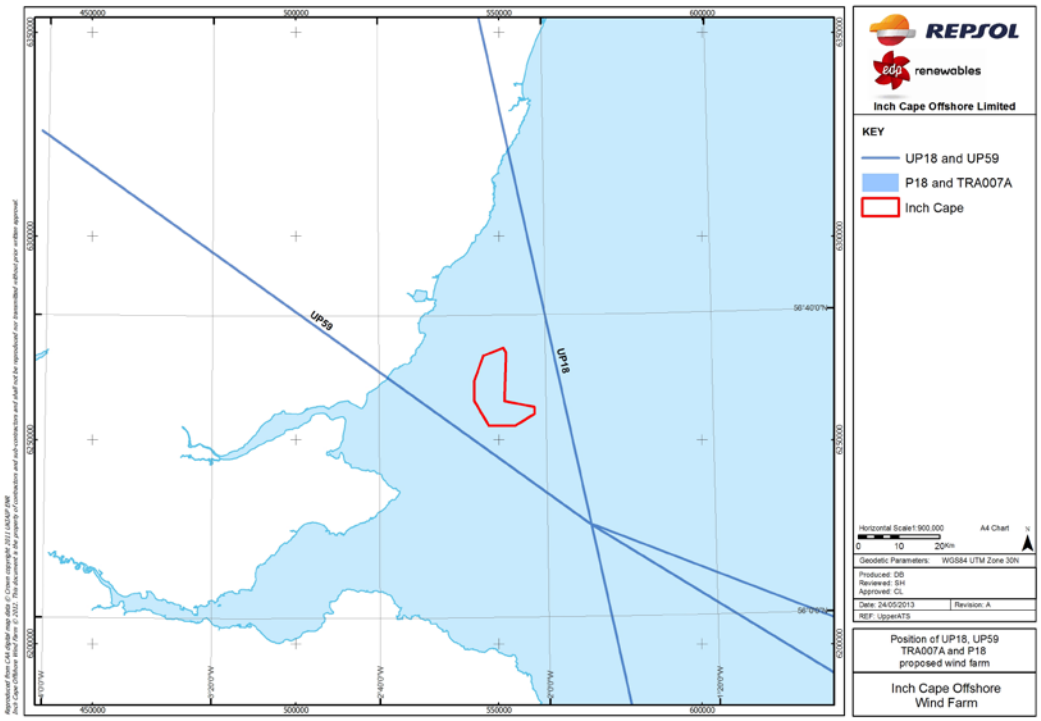

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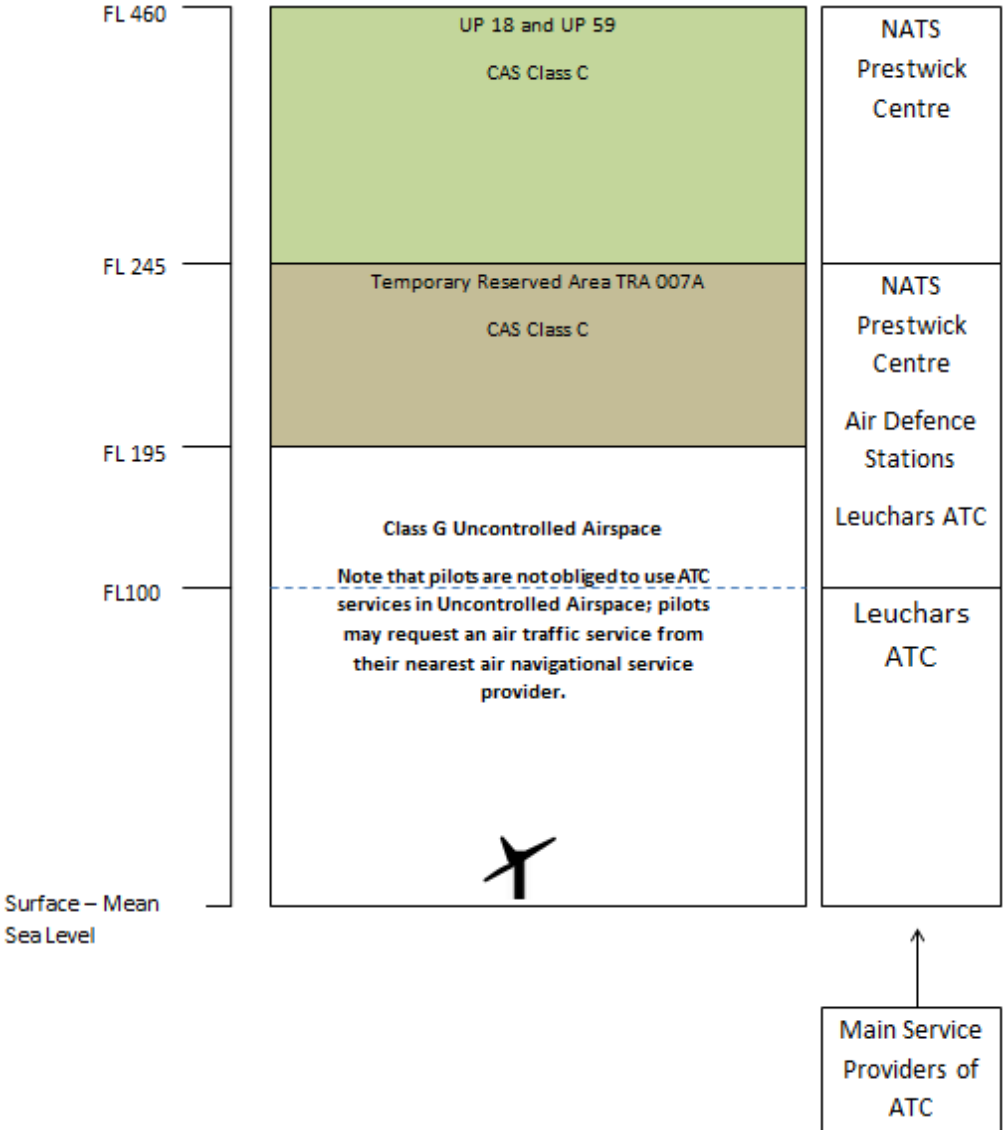
Figure 20.4: Block View of Airspace Structure in the Vicinity of the Development Area (not to scale)



28 When conditional route P 18 (not shown on the diagram above) is activated between FL 135 (13,500 ft) and FL 245 (24,500 ft) an ATC service is provided by civil NATS controllers at the Prestwick Centre. When P 18 is inactive the airspace reverts as per the diagram above.

Civil Aviation Identified Receptors

29 The potential for impact on radar is a function of the radar's technical range, any terrain between the radar and the Development Area, and the operational requirements of the users. ICOL has carried out modelling of radars whose operational range will extend to the Development Area (*Appendix 20A*). However, operational requirements can only be fully assessed by the radar users in consultation with the relevant stakeholders.

NATS En-Route Radar

30 NATS En-route (NERL) was initially consulted in early 2010 and a Technical and Operational Assessment (TOPA) was completed by NATS (*Appendix 20C*) during April 2010 and revised in February 2013 (*Appendix 20C*). The TOPA assessed any potential for effects on NATS navigational aids, air-ground voice communication systems and any NATS radar systems within operational range. ICOL commissioned a line of site analysis (*Appendix 20A*) that assessed the potential for detectability of WTGs on radars within operational range. The TOPA and ICOL assessment concluded that no impacts on NERL radar are anticipated. NERL radar is therefore scoped out of the assessment.

Aberdeen ATC Radar

31 Aberdeen Airport utilises two NATS radars at Perwinnes and Allanshill for the provision of ATC services. These services are provided to aircraft inbound and outbound to the airport and in the northern North Sea airspace, including the Atlantic rim airspace and the East Shetland Basin. These services are available to helicopters operating in support of the oil and gas industry and to civil and military aircraft transiting the area at or below FL 100 (10,000 ft). The helicopter main routes (HMRs) are routes where helicopters operate on a frequent basis. HMRs between Aberdeen and the offshore platforms service the oil and gas platforms and are situated well to the north of the Development Area and outside any CAA recommended consultation ranges. Furthermore, there are no flight procedures that would route aircraft into close proximity of the Development Area and there are no civil ATC radars identified by NATS in the TOPA (*Appendix 20C*). Civil ATC radar coverage is therefore scoped out of the assessment. This is in line with the guidance provided in CAP 764 and detailed in *Section 20.1.1*.

Military Aviation Identified Receptors

32 As for civil radars the potential for impact on radar is a function of its technical range, any terrain between the radar and the Development Area, and the operational requirements of the users. ICOL has carried out modelling of radars from which the operational range will extend to the Development Area (*Appendix 20A*). However, operational requirements can only be fully assessed by the radar users. The MOD has confirmed that the installation of WTGs within the Development Area will be detectable by, and has the potential to cause, unacceptable impacts on the operation of the radars identified below.

RAF Leuchars Air Traffic Control Primary Surveillance Radar

33 RAF Leuchars ATC uses a Watchman PSR to provide services to aircraft inbound and outbound from the airfield, and to military aircraft operating in the vicinity of the Firth of Tay, including in and around the location of the Development Area up to FL 245 (24,500 ft). In addition, RAF Leuchars is responsible for air traffic services to transitory civil and military aircraft requesting a Lower Airspace Radar Service (LARS) operating within a 40 nm radius of the airfield, below FL 100 (10,000 ft), 24 hours per day.

34 At a minimum distance of 37.3 km (20.1 nm), the Development Area is within the operational range of the RAF Leuchars ATC PSR. Radar propagation modelling has been undertaken on behalf of ICOL (*Appendix 20A*) and at a maximum WTG height of 215 m to blade tip; the Wind Farm will theoretically be detectable by the Leuchars ATC PSR. This direct, permanent effect of clutter as generated by the works within the Development Area may hamper the radar operator's ability to distinguish actual aircraft returns from those created by the WTGs, and therefore degrade the safety and efficiency of the air traffic services being provided. The MOD has confirmed WTG within the Development Area will be detectable by, and will cause unacceptable interference to the ATC PSR at RAF Leuchars.

MOD Air Defence Radar (ADR) Buchan

35 The MOD is responsible for the homeland defence of the UK. A series of fixed ADR feed into the Control and Reporting Centre at RAF Boulmer and RAF Scampton, where the UK Recognised Air Picture (RAP) is produced.

36 The Buchan ADR is situated near Peterhead, Aberdeenshire and is a Lockheed Martin FPS-117 (MOD Type 92) radar, similar in operation to the Lockheed Martin TPS-77 ADR. The Lockheed Martin TPS-77 ADR is the only current mitigation accepted by MOD for the effects of WTGs on air defence radar, as implemented in the Greater Wash (see *Section 20.8.2*). At a minimum distance of 98.5 km (53 nm), the Buchan ADR is the closest ADR to the Development Area. Radar modelling (*Appendix 20A*) predicts that WTGs will be displayed on the radar screens of air defence controllers using data from the Buchan ADR. This has the potential to obscure genuine targets and could have safety implications for aircraft under control. The MOD has confirmed WTGs within the Development Area will be detectable by, and will cause unacceptable interference to the RAF Buchan ADR. They have confirmed that provision of further information on Wind Farm layout and WTG heights may reduce potential impact on the ADR at Buchan to an acceptable level.

Other Military Receptors

37 ICOL has considered the potential for impacts on a number of other military receptors upon which it has been concluded the potential for impacts are unlikely. As such, they are scoped out of the impact assessment and only detailed in the baseline for completeness. This has been ratified by MOD responses which have not raised concerns in relation to the following receptors described below.

Minimum Safety Altitude

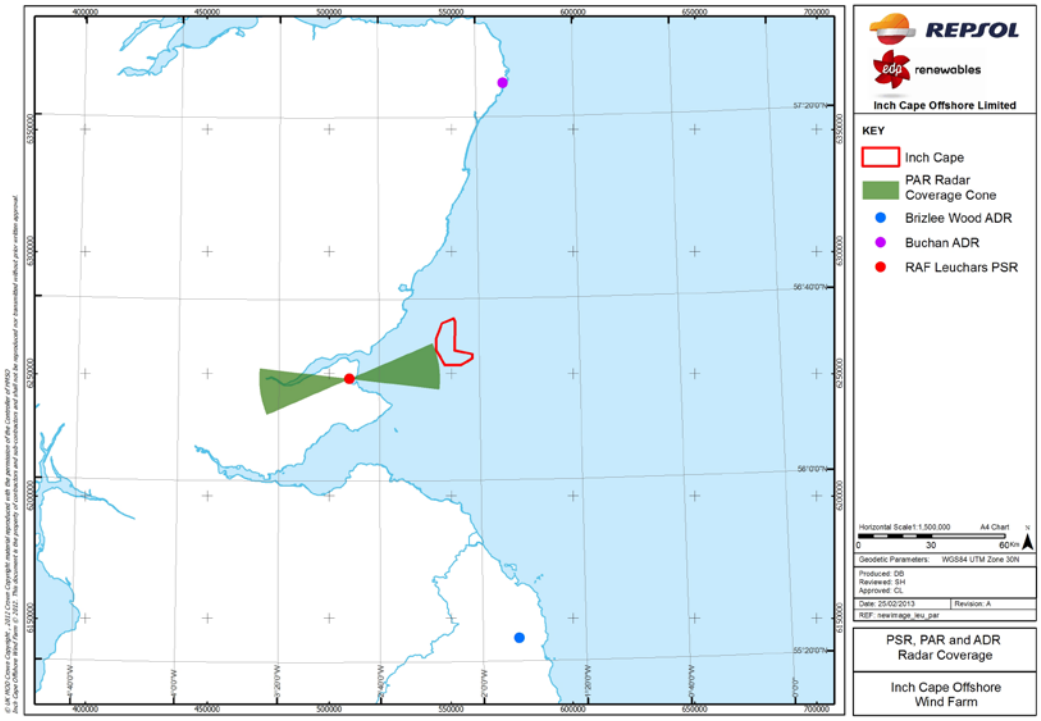
38 The published RAF Leuchars MSA for aircraft operations in instrument meteorological conditions, essentially poor weather, in the region of the Development Area is 2400 ft (731 m). This allows for a minimum of 1,000 ft (305 m) clearance between aircraft and known en-route obstacles. The maximum tip height of WTGs within the Development Area is 215 m (705 ft). Therefore, the existing RAF Leuchars MSA in the area of the Wind Farm will be sufficient, ensuring that a minimum of 1,000 ft vertical separation between the anticipated WTG tip heights and aircraft is maintained. MSA is therefore scoped out of the assessment.

RAF Leuchars Precision Approach Radar

39 The ITT Gilfillan PAR system employed by the MOD is a radar guidance system designed to provide lateral and vertical guidance to an aircraft pilot for landing, until the landing threshold is reached. The PAR is safeguarded out to 20 nm from the runway touchdown point and 20° either side of the extended runway centreline.

40 Figure 20.5 illustrates the PAR safeguarded zone and the position of the Development Area. The whole of the Development Area lies outside of the safeguarded area of the RAF Leuchars PAR and is therefore scoped out of the assessment. There are no additional PAR systems in the region of the Development Area. PAR impacts are therefore not considered further in the assessment.

Figure 20.5: RAF Leuchars Precision Approach Radar Coverage Cone



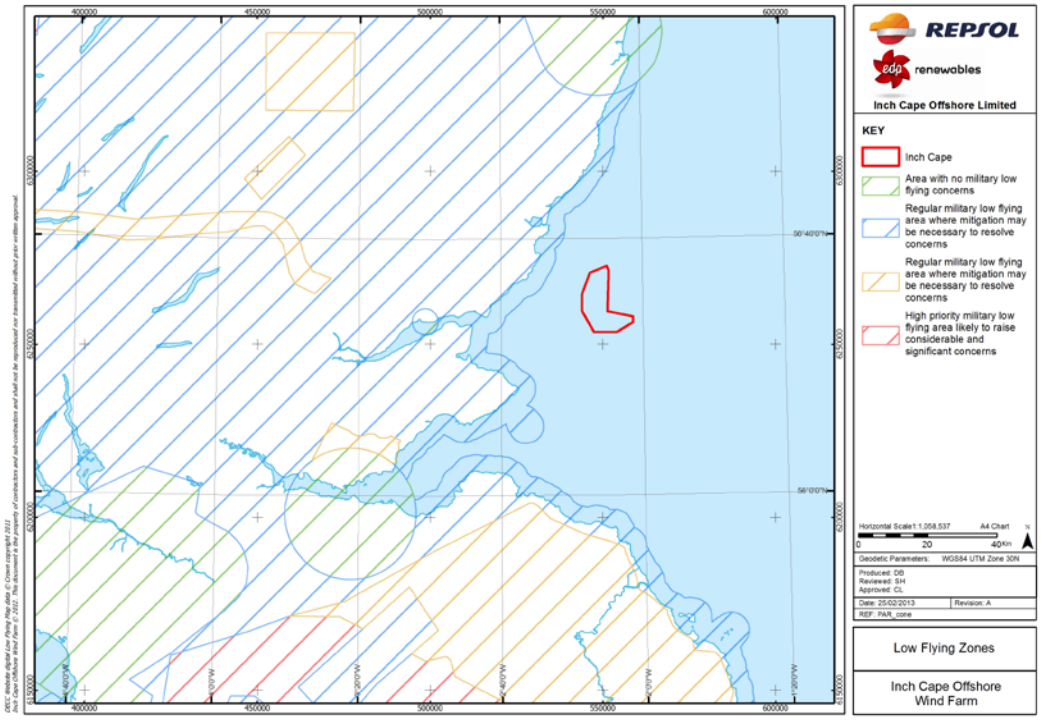
MOD ADR Brizlee Wood

41 The Brizlee Wood ADR is located on Alnwick Moor, Northumberland and is at a minimum distance of 117 km (63.3 nm) from the Development Area. The radar currently in operation is a Lockheed Martin TPS-77 radar, which has recently been installed and is currently undergoing a series of acceptance tests. Radar modelling (*Appendix 20A*) predicts that there is potential for intermittent detection of WTGs in limited areas within the Development Area by the Brizlee Wood ADR. However, in consultation responses from the MOD they have not stated any concerns regarding interference with the ADR at Brizlee Wood and therefore impacts are not considered further in this assessment.

Low Flying

42 The MOD publishes a map of the UKLFS defining the importance of areas of the UK to low flying operations (Figure 20.6). The map is supplied only for guidance about locations likely to be problematic and is not a binding statement of MOD procedure.

Figure 20.6: MOD Low Flying Area Safeguarding Maps in Relation to the Development Area



Reproduced from DECC Website digital Low Flying Map data © Crown copyright 2011.

43 This map shows the Development Area to be located outside of any low flying consultation zones published by the MOD (MOD, 2011), and as such military low flying activities are not considered further in this assessment.

Search and Rescue

44 The physical presence of the WTGs within the Development Area has the potential to represent a collision risk to SAR operations, operating in the vicinity of the Development Area. SAR response is co-ordinated between aviation and marine resources. As such potential impacts on SAR are considered in *Chapter 19* and described in *Section 19.3.1* and *Appendix 19A*.

20.2.2 Summary of the Baseline

45 This section has identified the receptors which have the potential to interact with the Wind Farm and associated works within the Development Area. Those with no identifiable interaction are not considered further in the assessment. The following Table 20.3 summarises the receptors which are considered in the impact assessment.

Table 20.3: Summary of the Receptors Taken Forward to the Assessment

Group	Receptor Groups	Receptors	Impact Assessment
Civil	ATC Radar	Aberdeen ATC	No
	NERL Radar	Radars within operational range	No
			No
Military	ATC Radar	RAF Leuchars ATC PSR	Yes
	PAR	RAF Leuchars PAR	No
	AD Radar	Buchan	Yes
		Brizlee Wood	No
	Obstruction to Aviation	RAF Leuchars MSA	No
		Low Flying	No
		Search and Rescue	*Chapter 19*

20.2.3 Baseline without the Project

46 In the future it is anticipated that the airspace would continue to be used by military and civil aviation stakeholders, as described in *Section 20.1* and *Section 20.2* and the baseline would remain as detailed.

47 However, an announcement was made by Government in 2011 that confirmed that RAF Leuchars would become an army base and the Typhoon aircraft at the unit, which operate in the air defence role, would move to RAF Lossiemouth during 2013. Until the future of the airfield facilities has been decided upon there will be a period of uncertainty whilst the infrastructure is prepared for transfer to the British Army.

48 If it was decided to decommission the radar then the potential for impacts on ATC PSR radar at RAF Leuchars would no longer be a consideration. However, the Defence Infrastructure Organisation (DIO) will continue to safeguard the airfield until a final decision on the future use of the airfield and its facilities has been made. As such the assessment has been carried out assuming that the Leuchars ATC PSR is still in operation.

20.3 Assessment Methodology

49 A list of potential aviation receptors was identified in accordance with CAA *Publication CAP 764, Policy and Guidelines on Wind Turbines* (CAA, 2012a). This assessment considers all radar systems within operational range of the Development Area, as well as military areas of operation, including tactical training and danger areas. For each identified receptor, the physical obstruction and/or radar effect, and then subsequently the operational impacts were considered with any other potential impacts. The operational impact considers: the orientation of approach and departure flight paths, physical safeguarding of flight, types of aircraft flying into the aerodrome, airspace characteristics and flight procedures as published in the UK IAIP and the Mil AIP.

50 Assessment has been informed by the results of baseline studies and consultation, and with reference to the existing evidence base regarding effects of wind farm development.

51 Considering the general implications of impacts on aviation interests in critical functions of safety and defence, it is considered that all the identified receptors are of high sensitivity. In addition to this, the magnitude of effects will be binary; i.e. the impacts are either acceptable or unacceptable to the relevant stakeholders. As such, it is considered inappropriate to apply the matrix approach considering a spectrum of significance and magnitude conclusions. Instead impact conclusions will either be concluded as significant (i.e. unacceptable) or not significant (i.e. acceptable).

52 In the instance where impacts are unacceptable then ICOL will work with the relevant stakeholders to find appropriate mitigation solutions. These solutions should be agreed between ICOL and the infrastructure owner/operator, and consultation will continue through the consenting process.

53 As the entire Offshore Export Cable is below sea level, there is no potential for interaction between aviation interests. It is therefore considered that any works within the Offshore Export Cable Corridor will not have an impact on aviation interests and therefore is not assessed further in this chapter.

20.4 Impact Assessment Development Area

20.4.1 Effects of Construction

MOD RAF Leuchars Air Traffic Control Primary Surveillance Radar

54 During construction, and prior to commissioning, WTG blades will not be rotational. As a result the infrastructure will not be processed and presented onto control displays by the radar. Therefore there will be no impacts on radar. Construction within the Development Area will have no significant effect on the RAF Leuchars Primary Surveillance Radar system.

MOD Buchan Air Defence Radar

55 During construction, and prior to commissioning. WTG blades will not be rotational. As a result the infrastructure will not be processed and presented onto control displays by the radar. Therefore there will be no impacts on radar. Construction within the Development Area will have no significant effect on the MOD Buchan ADR system.

20.4.2 Effects of Operation and Maintenance

MOD RAF Leuchars Air Traffic Control Primary Surveillance Radar

56 RAF Leuchars provide radar services for aircraft on departure and recovery to the airfield as well as LARS to participating aircraft.

57 In the vicinity of the Development Area, aircraft will be transiting through Class G Uncontrolled Airspace (anyone can fly here without talking to ATC) and may request a deconfliction service (DS) from the controllers at RAF Leuchars. DS is the highest level of radar service provided to pilots in Class G uncontrolled airspace: essentially the controller must provide instructions to the pilot to ensure the aircraft remains adequately separated from 'unknown traffic' or clutter. For a pilot requesting a DS, on a flight path within five nautical miles of the Development Area, the air traffic controller will be unable to provide the five nautical miles separation (between clutter within the Wind Farm and an aircraft) required for the safe provision of the service.

58 Operators at RAF Leuchars use another navigation system, in addition to PSR: Tactical Aid to Navigation (TACAN) provides the user with the bearing and distance information to a ground station. Radar service provision that supports the arrival procedures to RAF Leuchars (as detailed in *Appendix 20A*) which utilise the TACAN hold procedures from the east for runway 08/26 are affected by the location of the expected WTG clutter. The TACAN procedures are likely to be frequently used to maintain qualification of procedures with aircrews during training exercises. The holding patterns for aircraft utilising the Leuchars TACAN are likely to be affected by clutter from the Wind Farm.

59 Departing aircraft from the airfield will normally follow a published departure procedure which will keep aircraft clear of terrain. The aircraft will follow a Standard Instrument Departure (SID) profile immediately after take-off. SIDs strike a balance between obstacle clearance, noise abatement and airspace management considerations. Aircraft departing under VFR will normally depart the airfield via the most expeditious route, which may include flying a SID. RAF Leuchars publishes four SIDs for each runway. The SID 1 profiles for both runway 26 and 08 at Leuchars take the departing aircraft towards the Development Area.

60 Aircraft returning to the airfield, under an air traffic service from RAF Leuchars, from the vicinity of the Development Area (not utilising the TACAN hold procedure) are also likely to be affected by the expected clutter, as the airspace available to the controllers to manoeuvre aircraft into the recovery stream under a DS, is reduced due to the fact that

controllers are mandated to maintain standard separation of 5 nm on any unknown radar contact.

61 RAF Leuchars is also a provider of LARS, a national system within which participating civil and military Air Traffic Service Units provide a radar service to aircraft, subject to controlling capacity, within approximately 30 - 40 nm of each radar station. RAF Leuchars provides this service out to 40 nm, 24 hours per day. LARS is established to enhance the safety and the efficiency of air traffic services provided to aircraft flying from or close to aerodromes not protected by controlled airspace. It encourages aircraft flying through the area to request an air traffic service which would allow air traffic controllers to separate aircraft based on known intentions and therefore reduce the need for avoiding action. Controllers will need to provide 5 nm separation between an aircraft in receipt of a DS and any radar clutter which has the potential to obscure unknown targets. Use of LARS in the proximity of the Development Area would be limited; light civilian aircraft tend to stay overland as they invariably do not carry the relevant safety equipment to operate at a distance from the coastline. However, for aircraft requesting LARS in the vicinity of the Development Area, the type of service provided to aircrew in the region would be restricted due to expected radar clutter created by the WTGs.

62 In consultation the MOD have confirmed WTGs in the Development Area will detectable by, and will cause unacceptable interference to the ATC PSR at RAF Leuchars. In addition, radar propagation modelling has been undertaken (*Appendix 20A*) and the interaction of radar with WTGs is well understood. Therefore, there is a low uncertainty in this assessment and the effect is considered probable to occur.

63 Operation and maintenance of the Wind Farm and OfTW, within the Development Area, has been assessed as having a significant effect on ATC PSR at RAF Leuchars.

MOD Buchan Air Defence Radar

64 The Buchan ADR provides surveillance and minute to minute information on air activity required to defend the UK air defence region, particularly from the air. Air defence radar resources are used in support of training exercises on an almost daily basis. TRA 007A is established above the Development Area from FL 195 (19,500 ft) up to FL 245 (24,500 ft). Promulgated training activities within the TRA include air combat, tests and trials and supersonic flight. Air defence controllers using the radar data from ADRs are responsible for early detection, navigation services and support to aircraft activity within and crossing TRA 007A.

65 Radar modelling (*Appendix 20A*) predicts that WTGs will be displayed as clutter on the radar display of air defence controllers using data from the Buchan ADR. This has the potential to obscure genuine targets and could have safety implications for aircraft under control. The MOD, through DIO, has stated, in an email dated 04 February 2011 to ICOL, that their sole concern is the possible detection of the Wind Farm to the airfield ATC PSR at RAF Leuchars. Further correspondence from DIO, dated 12 February 2013, to ICOL, stated that the Wind Farm would cause unacceptable interference to the Buchan ADR. On the 19 February 2013,

DIO confirmed that that additional information should be provided to the MOD on layout and turbine height options within the Development Area, to allow the MOD to further refine an impact assessment. This may reduce potential impact on the ADR at Buchan to an acceptable level and remove the requirement for any technical mitigation.

66 WTGs in coverage areas of the Buchan ADR could shield the radars from genuine aircraft targets from the air defence controller. These direct and permanent effects would affect the controller's ability to provide a safe service to aircraft in support of air defence activities, and in support of training exercises within and crossing TRA 007A.

67 Construction within the Development Area has been assessed as having a significant effect on the MOD Buchan ADR.

20.4.3 Effects of Decommissioning

68 The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase. The approach to decommissioning is described in *Section 7.12*. A decommissioning plan will be prepared in accordance with the requirements of the *Energy Act 2004* (see *Section 3.2.5*) and will be subject to approval from Department of Energy and Climate Change prior to implementation. Any agreed mitigation will remain in operation whilst any WTGs remain operational.

20.5 Impact Assessment Offshore Export Cable Corridor

69 As infrastructure in the entire Offshore Export Cable Corridor is below sea level, it will not have an impact on aviation interests and therefore is not assessed in this chapter.

20.6 Impact Interactions

70 The potential for individual impacts identified through the impact assessment to interact and create new, or more significant impacts on Military and Civil Aviation has been assessed. No such interactions have been identified.

71 The potential for impacts from other projects to interact with those identified in the impact assessment and cumulative impact assessment to result in a greater long term effect has been assessed. No such interactions have been identified.

20.7 Cumulative Impact

72 The assessment of cumulative impacts is structured as following;

- Cumulative impacts of Wind Farm with the OfTW, i.e. the Project, are assessed, followed by;
- Cumulative impacts of the Project with other projects and activities in the area.

20.7.1 Cumulative Impact of the Project

73 As detailed in *Section 20.3* and *Section 20.5* there are no impacts resulting from OfTW within the Offshore Export Cable Corridor. Therefore impacts of the Project will be the same as the Wind Farm and OfTW works within the Development Area in isolation.

20.7.2 Cumulative Impact of the Project with Other Projects

74 The full list of projects and activities considered as part of the cumulative assessment, are found in *Section 4.7.3*, Figure 4.1. These fall into the following categories:

- Other offshore wind farms in the Firth of Forth and Tay area; and
- Other projects and activities.

75 Potential effects on the following receptors are considered in this cumulative impact assessment:

- MOD RAF Leuchars ATC PSR; and
- MOD Buchan ADR.

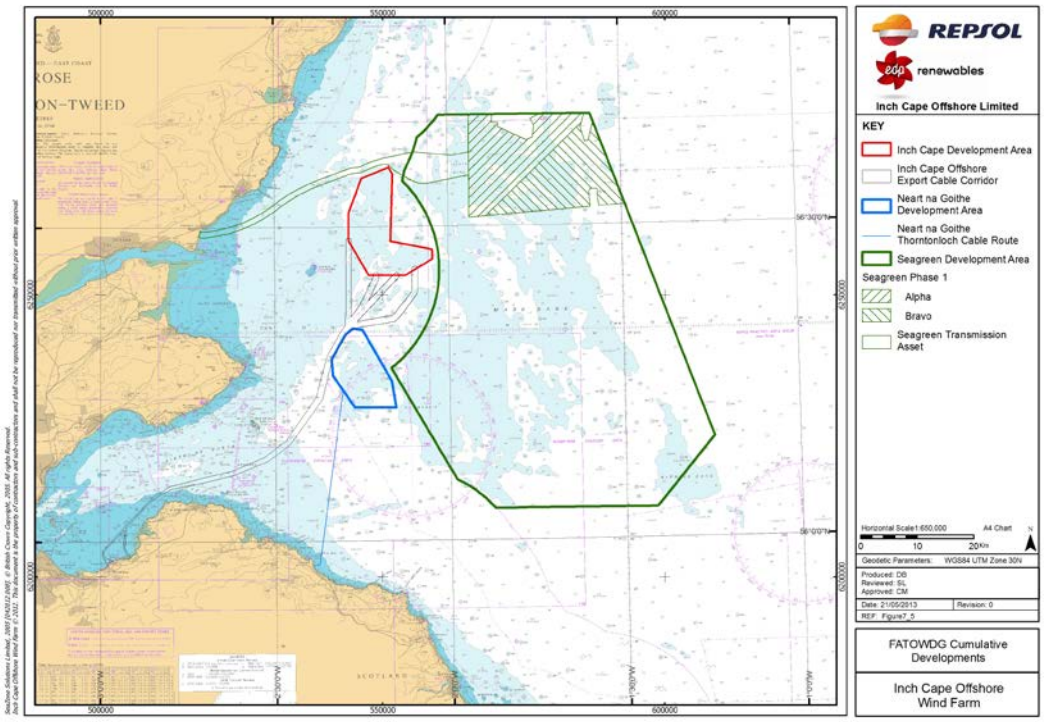
Other Offshore Wind Farms in the Firth of Forth and Tay Area

76 The location of the Neart na Gaoithe and the Firth of Forth Round 3 wind farms in the Firth of Forth are shown in Figure 20.7.

77 The Neart na Gaoithe wind farm development is located to the south of the Development Area, approximately 5.5 nm at its closest point; the WTGs have a maximum blade tip height of 197 m and are understood to be distributed throughout the development boundary.

78 The Firth of Forth Phase 1 sites are located directly to the east of the Development Area and the WTGs have a maximum blade tip height of 199 m. For the purpose of this assessment it is assumed WTGs will be distributed evenly over the Alpha and Bravo sites (Phase 1).

Figure 20.7: Other Offshore Wind Farm Projects Considered for Cumulative Impact



Other Projects and Activities

Other Offshore Wind Farms

79 Other offshore wind farms for consideration include:

- European Offshore Wind Deployment Centre (Aberdeen);
- Hywind Demonstration Site (near Aberdeen);
- Methil (Fife Energy Park) Offshore Demonstration Wind Turbine (Methil);
- Beatrice Offshore Wind Farm (Moray Firth); and
- Moray Firth R3 Zone 1 (Eastern Development Area) (Moray Firth).

Onshore Wind Farms

80 Other offshore and onshore wind farms have the potential to interact with radars at Buchan and Leuchars if they are within the operational range of the radars.

Other Coastal Projects

81 Other coastal projects for consideration include:

- Forth Replacement Crossing (Firth of Forth);
- Rosyth International Container Terminal Project (Rosyth);
- Coastal Improvement Works at the Mouth of the Barry Burn (Carnoustie);

- Edinburgh Harbour Master Plan (Edinburgh Waterfront Development) (Leith);
- Port of Dundee Expansion (Dundee Waterfront Development); and
- Montrose Tidal Array (GlaxoSmithKline Tidal Energy Project) (Montrose).

Other Onshore Projects

82 Other onshore projects for consideration include:

- Grangemouth Renewable Energy Plant (Grangemouth);
- Rosyth Renewable Energy Plant (Rosyth);
- Dundee Renewable Energy Plant (Dundee);
- Victoria and Albert Museum at Dundee (Dundee);
- Captain Clean Energy Project (Caledonia Clean Energy Project) (Grangemouth); and
- Cockenzie Combined Cycle Gas Turbine Power Station (Cockenzie).

83 The static nature of the infrastructure in the other coastal and onshore projects means that impacts on radar are not anticipated. In addition to this their location means there will be no impacts relating to physical obstruction. As such the other coastal and onshore projects are scoped out of the following assessment.

20.7.3 Effects of Construction

MOD RAF Leuchars Air Traffic Control Primary Surveillance Radar and MOD Buchan Air Defence Radar

84 As with the Wind Farm and OfTW construction phase, within the Development Area assessment (*Section 20.4.1*), the impact on radar systems is only present once a WTG is operational. Therefore, there will be no significant effect on the identified receptors.

20.7.4 Effects of Operation and Maintenance

RAF Leuchars Air Traffic Control Primary Surveillance Radar

85 The detection of WTGs within the Development Area, Neart na Gaoithe and the Firth of Forth Phase 1 wind farms is likely to create unwanted radar returns on the RAF Leuchars ATC PSR display system. This could hamper the operators' ability to distinguish actual aircraft returns from those created by the wind farms.

86 Radar modelling (*Appendix 20A*) predicts that WTGs within the Development Area, Neart na Gaoithe and the Firth of Forth Phase 1 wind farms will be detected by the RAF Leuchars ATC PSR system.

87 As the Neart na Gaoithe and Firth of Forth Phase 1 wind farms are theoretically detectable to the PSR at Leuchars it is implicit that the more sites that are proposed or built, the greater the impact on the provision of ATC PSR services.

88 Because the other two wind farms are theoretically detectable to the RAF Leuchars ATC PSR, they would create, in effect, a large area within which significant clutter can be expected. All of the wind farms are located in areas where controllers using the Leuchars ATC PSR are required to detect and control aircraft, depending on the service provided at each location. It is evident that, as larger areas are covered and the extent of the clutter increases, the availability of uncluttered airspace reduces.

89 In addition to these wind farms it is possible that there are a number of smaller onshore and offshore wind farms that may have an incremental impact on the radar by increasing the area of clutter. It is understood that larger scale offshore wind farms, such as the Moray Firth R3 Zone 1 (Eastern Development Area), are not within the operational range of the Leuchars ATC PSR. It is expected that the MOD's response to the Project has included consideration of reasonably foreseeable projects that have the potential to present a cumulative effect on the Project and their response includes a consideration regarding wider impacts on their safeguarding responsibilities.

90 Cumulative impacts of operation and maintenance has been assessed as having a significant effect on the RAF Leuchars ATC PSR system.

MOD Buchan Air Defence Radar

91 Radar propagation modelling indicates that the Neart na Gaoithe wind farm will not be detected by the Buchan ADR. There will however, be potential for cumulative effect on the Buchan ADR created by the Firth of Forth Phase 1 wind farm. As the Firth of Forth Phase 1 wind farm is theoretically detectable to the ADR at Buchan it is implicit that the more sites that are proposed or built, the greater the impact on the provision of radar services. In effect, a larger area within which significant clutter can be expected will be created. The Firth of Forth Phase 1 and the Inch Cape Development Area are located in areas where controllers using the Buchan ADR are required to detect and control aircraft.

92 In addition to these wind farms it is possible that there are a number of smaller onshore and offshore wind farms that may have an incremental impact on the radar by increasing the area of clutter. It is expected that the MOD's response to the Project has included consideration of reasonably foreseeable projects that have the potential to present a cumulative effect on the Project and their response includes a consideration regarding wider impacts on their safeguarding responsibilities.

93 Cumulative impacts of operation and maintenance has been assessed as having a significant effect on the MOD Buchan ADR.

94 It is the desire of ICOL that a collaborative approach to mitigating the effects of the Project with the adjacent developments is undertaken to ensure an acceptable effect on the Leuchars ATC PSR and Buchan ADR. ICOL will continue to work with the Neart na Gaoithe and the Firth of Forth Phase 1 developers, the MOD and any other identified developers to ensure that opportunities are identified, and where possible, mitigation proposals are aligned. Further details can be found in *Section 20.8*.

20.7.5 Effects of Decommissioning

MOD RAF Leuchars Air Traffic Control Primary Surveillance Radar and MOD Buchan Air Defence Radar

95 As with the Development Area assessment conclusions in *Section 20.4.3* decommissioning processes will have no significant cumulative effect on the Leuchars ATC PSR or Buchan ADR, however mitigation will remain in operation whilst any WTGs remain operational.

20.8 Additional Mitigation

96 Embedded Mitigation measures provided within *Section 20.1.3* are considered standard for wind farm projects and therefore this assessment has assumed that they are in place and significance is assessed accordingly. This section considers any Additional Mitigation necessary to reduce significant effects identified in the assessment to acceptable levels.

97 An email from MOD to Department of Energy and Climate Change (DECC) of 3 April 2013 confirmed the process for removing an ADR or ATC objection:

- *"It is the responsibility of the applicant to submit the initial mitigation proposal to the MOD for consideration. The mitigation proposal should detail how the proposed mitigation will work and is specific to the proposed wind farm/turbine.*
- *This mitigation proposal is reviewed by the MOD's operational and technical advisors who comment on the feasibility of the proposal. The proposal should include the necessary level of detail to allow the MOD to undertake a full assessment.*
- *If the advisors consider that the proposal is not appropriate to mitigate the impact of the development of the ADR/ATC radar, then the mitigation proposal is rebutted.*
- *If the proposal is considered to be feasible and there is potential (or the MOD cannot prove that there is no prospect) for the mitigation to be implemented within the life of the planning consent, then the mitigation is accepted subject to agreement being reached on an appropriate condition.*
- *DIO propose a planning condition to the applicant, which is required to ensure that further detail is submitted to the Consenting Authority and MOD post-consent in the form of a Radar Mitigation Scheme (RMS).*
- *Once agreed, the condition is suggested to the Consenting Authority for inclusion on any forthcoming consent. The RMS is effectively the means by which the mitigation will be implemented post-consent. The condition will be discharged, as appropriate, when the scheme is approved and implemented.*
- *At present, each stage of the process is afforded three weeks. As such, this results in a target nine week timescale from submission of the mitigation proposal to the production of a suspensive condition. This process is well established and therefore it is possible to shorten the length of the proposed timescale, dependent on the availability of resources."*

98 The following *Sections 20.8.1* and *20.8.2* provide a high level summary of the technical mitigation solutions which are expected to be provided to the MOD in ICOLs initial mitigation proposal and final RMS.

20.8.1 MOD RAF Leuchars Air Traffic Control Primary Surveillance Radar

99 No mitigation is required during construction. When constructed and operational, all of the WTGs within the Development Area will theoretically be detected by the ATC PSR at Leuchars leading to an operational impact, as confirmed in consultation with the MOD (*Section 20.1.1*). The patch of clutter likely to be produced on the radar display is within the path taken by aircraft departing from and arriving at the airfield.

100 Previous technical mitigation solutions accepted by the MOD for radar impacts have included 'infill' solutions. An infill solution involves the removal of PSR data where radar clutter is anticipated in the vicinity of the WTGs, and replacing it with an alternate radar source which is not affected by radar clutter. The MOD has stated a requirement for 'seamless integration' to be an integral factor in the acceptability of any technical infill mitigation solution for ATC radar. The MOD has published a draft document *User requirement document (URD)* for *the sustainment of military air traffic control (ATC) primary surveillance capability with wind turbines in radar line of sight* (MOD, 2012). This document contains the standards stipulated by the MOD for acceptable integration of an infill solution.

101 A number of emerging technologies may potentially offer acceptable technical mitigation for ATC impacts, pending demonstration and acceptance by the MOD. The MOD and the DECC are presently undertaking a technology demonstration (TD) programme which will allow performance and compliance against the User Requirement Document (URD) for impacts on ATC radar to be demonstrated. It is expected that the TD will inform the agreement of acceptable mitigation with the MOD.

102 The emerging technologies fall into different categories and include, but are not limited to the following.

Resolution Infill

103 Resolution infill consists of a sensor that is located within or near to the wind farm and provides surveillance of a given volume surrounding the wind farm. The sensor does not operate in the same way as a traditional PSR and is able to differentiate WTGs and aircraft. The false radar returns can then be suppressed through utilisation of the clutter free coverage volume. The technology is still in development. It is understood that resolution infill systems will include bespoke radar system integration solutions; work to achieve and demonstrate 'seamless integration' is on-going. Examples of resolution infill solutions include:

- Aveillant HR Infill Holographic Radar™: a small scale sensor developed by Aveillant which is primarily designed to be located with the affected PSR system or can be installed within or in proximity to the wind farm itself; and

- C Speed LightWave Radar: designed to be co-located with the affected PSR system and exploits the basic principles of radar operation in order to distinguish between returns from aircraft and returns from WTGs.

Thruput Midas

104 The Thruput Midas family of mitigation includes Midas III, a system designed for use with raw video radar data; and Midas IV, designed for implementation in a digital processed display system. The systems are different in terms of their approach to removing WTG radar returns, although due to the commercial confidentiality of the development programme, technical detail is not available to be elaborated further in this ES. It is, however, anticipated that both systems will undergo extensive trial and integration activities in the next 12 months, at different airports across the UK.

Terma Scanter 4002

105 The Terma Scanter 4002 radar is a maritime radar which could be used as an air surveillance radar with the benefit of providing inter-WTG visibility and the ability to track aircraft inside and around wind farms.

106 A Scanter 4002 system is currently installed at Copenhagen Airport, where the local air traffic controllers are able to review detection performance against aircraft in the vicinity of a number of WTGs.

107 The radar is an X-Band system, which operates in a higher frequency than traditional S-Band ATC radar, which leads to the following capabilities: improved pulse compression; narrow beamwidth; less desensitisation; and increased accuracy. The radar has a range of 40 nm, and could therefore be a suitable candidate for RAF Leuchars.

Cassidian ASR-NG

108 Cassidian ASR-NG is a combined Primary/Secondary radar system which includes technology that allows for safe guidance of aircraft in the vicinity of WTGs. It is unknown how the technology inherent in this system successfully mitigates the effect of WTGs on radar. Further analysis is required to ascertain specific detail as to whether this system can be utilised.

Watchman Upgrade

109 The equipment manufacturer of the Watchman radar, which is in use across a large number of MOD airfields, has proposed a wind farm mitigation upgrade for their radar system.

Summary

110 ICOL intends to work with the MOD in agreeing a solution appropriate to mitigation impacts on Leuchars ATC PSR. An initial mitigation proposal will be submitted to the MOD which will review a number of candidate technologies. It is expected that the RMS will be influenced and informed by the TD and will be in compliance with the URD.

20.8.2 MOD Buchan Air Defence Radar

111 No mitigation is required during construction. On the 19 February 2013 DIO clarified that the provision of further information on Wind Farm and WTG heights may reduce potential impact on the ADR at Buchan to an acceptable level. If this was the case then there would be no further requirement for technical mitigation.

112 If mitigation through design is not feasible for reducing impacts to an acceptable level then technical mitigation will be considered. The Lockheed Martin TPS-77 ADR is the only current mitigation accepted by MOD for the effects of WTGs on air defence radar, as implemented in the Greater Wash. The MOD requires that a volume of airspace above WTGs must exist, which achieves agreed performance metrics when mitigation is in place. This is called an 'Aviation Specification', and provides guarantees for MOD that the radar performance is maintained immediately above and beyond the lateral confines of a wind development.

113 The ability of the TPS-77 radar to meet the Aviation Specification is due in part to the radar's 3 – Dimensional Non Automatic Initiation Zone (NAIZ) capability. The establishment of a NAIZ surrounding WTGs prevents the radar from both displaying false radar returns from WTGs and initiating new tracks associated with PSR returns within the zone. Tracks which have been formed from returns originating outside the NAIZ should still be tracked if it enters the NAIZ e.g. an aircraft transiting over the NAIZ.

114 It is expected that it would be possible to create a NAIZ around the Project WTGs, and this enhanced signal processing ability of the TPS77 radar could permit WTGs to be constructed and operated in accordance with meeting an Aviation Specification.

115 The Buchan T92 radar (type AN / FPS-117) is the baseline version from which the TPS-77 is derived. Through the development of the TPS – 77 radar the Buchan ADR has been subject to updates to closer align its capability to that of the TPS-77. However, further upgrades to the T92 radar are required to provide acceptable wind farm mitigating capabilities through the utilisation of a 3-D NAIZ to meet an Aviation Specification. This facility is not currently available on the existing T92 radar at Buchan.

116 As detailed in *Section 20.8.1*, ICOL intends to work with the MOD in agreeing a solution appropriate to mitigate impacts on Buchan ADR, following the process set out by the MOD. An initial mitigation proposal will be submitted to the MOD which will consider potential candidate technologies. It is expected that the RMS will be in compliance with the URD. A description of the mitigation and purpose is summarised in Table 20.4 below.

Table 20.4: Summary of Monitoring and Mitigation Measures

Effect	Mitigation and Monitoring Measures	Purpose/Outcome
RAF Leuchars ATC PSR	Implementation and integration of technical mitigation solution will be agreed as per the process set out by the MOD and detailed in *Section 20.8* above. This assumes that the MOD requirements as stipulated in the URD can be met.	Mitigation will remove the WTG radar returns from the ATC PSR display.
MOD Buchan ADR	In relation to Buchan Air Defence Radar, additional information shall be provided to the MOD as layout and turbine height options within the Development are considered, to allow the MOD to further refine an impact assessment. If there is a residual unacceptable impact, implementation and integration of a technical mitigation solution will be agreed with the MOD in collaboration with other beneficiaries of the mitigation solution. Technical mitigation, if required, will most likely be in the form of modifications or upgrade to the Buchan T92 ADR.	Mitigation through design has the potential to reduce operational impacts to an acceptable level. If required then technical mitigation will remove the WTG radar returns from the ADR display.

20.8.3 Offshore Export Cable Corridor

117 No Additional mitigation is proposed. No significant impacts have been identified.

20.8.4 Cumulative Impacts

118 The conclusions for the Project and the Project with other projects are the same as the Development Area in isolation.

20.9 Conclusions and Residual Impacts

20.9.1 Development Area

119 In the absence of mitigation, significant effects on the following identified aviation stakeholders will occur:

- MOD RAF Leuchars ATC PSR; and
- MOD Buchan ADR.

120 Potential mitigation measures are being discussed with the MOD and a collaborative approach to mitigation by the Forth and Tay Offshore Wind Farm Developer Group will be sought where possible. This will also be informed by the MOD TD Programme.

121 When suitable technological mitigation is procured and in operation, there will be a negligible residual effect on the MOD RAF Leuchars ATC PSR and the MOD Buchan ADR systems.

122 The residual impacts identified following application of appropriate Additional Mitigation (*Section 20.8*) are identified in Table 20.5 below.

Table 20.5: Summary of Effects and Mitigation

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction				
Impacts on ATC radar	RAF Leuchars ATC PSR	Not Significant	N/A	Not Significant
Impacts on AD radar	MOD Buchan ADR	Not Significant	N/A	Not Significant
Operation and Maintenance				
Impacts on ATC radar	RAF Leuchars ATC PSR	Significant	Technical mitigation if required will most likely be in the form of an infill solution informed by the MOD TD.	Not Significant
Impacts on AD radar	MOD Buchan ADR	Significant	Design mitigation will include provision of more detail on layout and WTG heights. Technical mitigation if required will most likely be in the form of modifications or upgrade to the T92 ADR.	Not Significant
Decommissioning				
Impacts on ATC radar	RAF Leuchars ATC PSR	Not Significant	Mitigation remains in operations whilst any WTGs remain operational.	Not Significant
Impacts on AD radar	MOD Buchan ADR	Not Significant	Mitigation remains in operation whilst any WTGs remain operational.	Not Significant

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