



Neart na Gaoithe and Inch Cape Offshore Wind Farms

Airspace Change Proposal

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Executive Summary

Neart na Gaoithe Offshore Wind Limited (NNGOWL) and Inch Cape Offshore Limited (ICOL) wish to respectively develop the Neart na Gaoithe (NNG) and Inch Cape (IC) Wind Farms. The Development Areas lie off the east coast of Scotland with NNG lying to the south of IC by approximately 8 kilometres (km). NNG will be located in the Outer Firth of Forth; 15.5 km from Fife Ness, with IC located approximately 15 km off the Angus coastline.

The Issue

The presence of offshore Wind Turbine Generators (WTGs) at NNG and IC would be detectable to the Leuchars Watchman Primary Surveillance Radar (PSR) and will create false radar returns to be displayed to an air traffic controller. This radar “clutter” could obscure primary returns from actual aircraft and could interfere with radar tracking. This has the potential to affect an air traffic controller’s ability to identify primary radar aircraft returns, diminishing the ability of the controller to provide the requisite Air Traffic Service (ATS), and increasing the risk of the controller not detecting a conflict between aircraft. Large numbers of WTGs can also potentially lead to saturation of the radar processing systems. For these reasons, a mitigation solution was included as a requirement of the consents granted by the Scottish Ministers.

Proposed Solution

In developing the plans to resolve the issues described above, NNGOWL and ICOL and the Ministry of Defence (MOD) have considered a variety of options to determine how best to meet the needs of Leuchars Aerodrome, as well as other aviation and non-aviation stakeholders.

NNGOWL and ICOL, the sponsors of the airspace change, are working with the MOD and Leuchars to identify long-term mitigation solutions to address the impact of the WTGs on the Leuchars PSR, which will enable the NNG and IC WTGs to be constructed and operated without affecting Leuchars flying and ATS operations. Until a technical PSR mitigation solution becomes available, it is proposed to introduce airspace control measures through an Airspace Change Process (ACP) to remove and mitigate the clutter presented by the WTGs on the Leuchars PSR radar display screen.

The MOD’s preferred interim solution is to establish a Transponder Mandatory Zone (TMZ¹) around the NNG and IC Wind Farms up to Flight Level (FL)100 (10,000 ft), to be active during the Leuchars Lower Airspace Radar Service (LARS) provision times². Range Azimuth Gating (RAG), commonly referred to as radar blanking, can be applied to radar systems when local clutter conditions are considered detrimental to Air Traffic operations. RAG has the effect of desensitising the radar system by blanking out a portion of radar coverage over a specific area in order to prevent the display of WTG generated clutter on the ATC display at Leuchars. However, radar blanking will also remove primary radar returns from aircraft within the blanked area; hence, in isolation it would not provide sufficient mitigation. To mitigate this removal of primary radar data, it is necessary to establish a TMZ over the Development Areas so

¹ A TMZ is defined by the CAA as “a volume of airspace where aircraft wishing to enter or fly within the defined area will be required to have and operate secondary surveillance radar equipment”. TMZs are notified for the purposes of Article 39(2) of the Air Navigation Order 2010.

² H24.

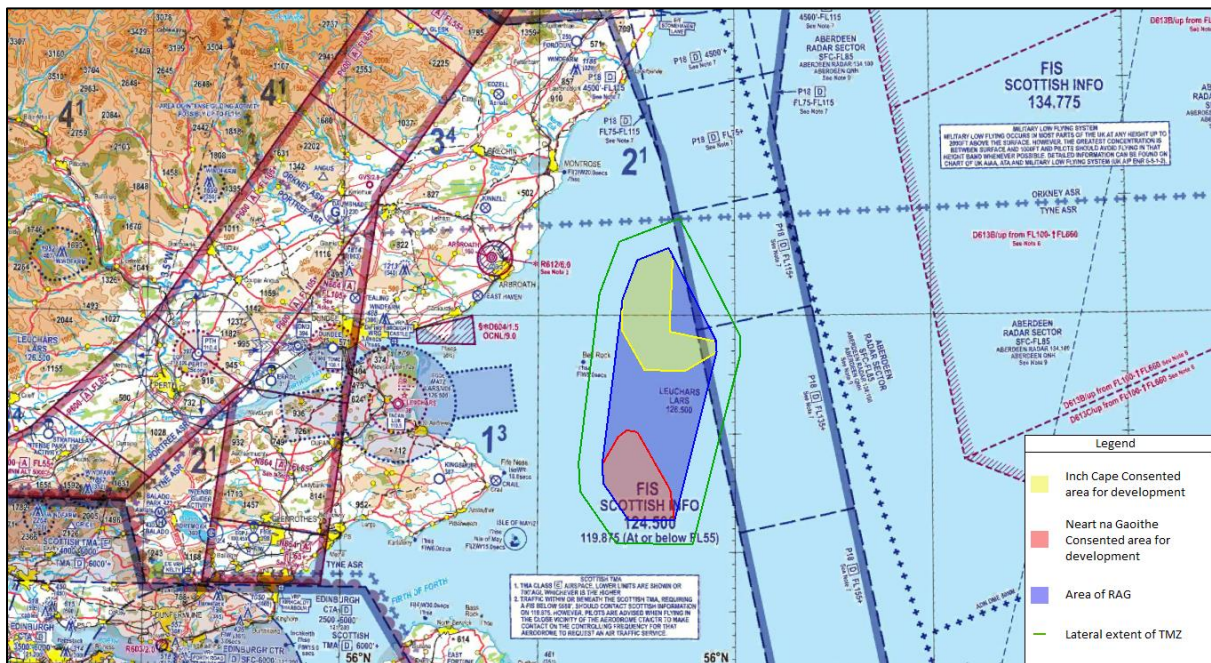
that aircraft within the area will be visible to Air Traffic Control (ATC) utilising Secondary Surveillance Radar (SSR).

The establishment of the TMZ is one element of a two-part Mitigation Package aimed at negating the impact of the clutter from the NNG and IC WTGs upon the Leuchars PSR. The two parts are:

- Element 1: Establishment of a TMZ
- Element 2: RAG Blanking (suppression of the PSR returns within the RAG)

The proposed TMZ (outlined in green) is illustrated in Figure 1 below.

Figure 1 Design of the TMZ application (the RAG is illustrated by the dark blue area encompassing the Developable Areas.



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Two design options for the TMZ were included within the Consultation Document with only one taken forward to submission of the ACP. During consultation, two comments on a preferred design option (that illustrated in Figure 1 above) were made. There were no objections to the TMZ proposal although GATCO and the MOD stated a preference to one of the design options of the TMZ, that which enveloped both Development Areas. The MOD objected to a design option of individual TMZs around each Developable Area.

It would be difficult for a pilot to make a visual distinction between the NNG and IC WTGs. Therefore, from an airspace user’s visual perspective, NNGOWL, ICOL, and the MOD consider that if mitigation involves a change to local airspace arrangements, then it is simpler to encompass all WTGs in the immediate area within a single airspace boundary, rather than two individual TMZs. The MOD in radar trials at Eskmeals in 2013 found that a piling vessel located offshore from the Watchman Radar created significant clutter and hence the recommendation from the MOD should the ACP be approved, is that the TMZ be established from the date the first piling vessel is due on site. Nevertheless, to minimise any impact on other aviation stakeholders, it is proposed to implement the TMZ over two phases, coinciding with the construction activities at each of the Development Areas.

This document outlines the proposal from NNGOWL and ICOL to maintain the safety of the airspace surrounding the Development Areas by mitigating the effects of the WTGs on Leuchars ATS provision.

Consultation

National Air Traffic Management Advisory Committee (NATMAC) members plus selected additional stakeholders were directly consulted. In addition, general public consultation was undertaken by publication of the consultation material on the NNGOWL and ICOL websites. A list of identified stakeholders is at Annex A5 (individual members of the public who submitted unsolicited comments are not listed). The purpose of the consultation was to seek primarily aviation stakeholder comment on the NNGOWL and ICOL proposal and to refine this accordingly prior to implementation.

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Acronyms

Acronym	Meaning
AAIB	Air Accident Investigation Board

Acronym	Meaning
ACC	Airport Consultative Committee
ACP	Airspace Change Process
ACAS	Airborne Collision Avoidance System
ADR	Air Defence Radar
AEF	Air Experience Flight
agl	Above ground level
AIP	Aeronautical Information Publication
amsl	Above mean sea level
ANO	Air Navigation Order
AOA	Airport Operators Association
AOPA	Aircraft Owners and Pilots Association
AR	Airspace Regulation
ARP	Airfield Reference Point
ASA	Advisory Service Area
ASL	Above Sea Level
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATSOCAS	Air Traffic Service Outside Controlled Airspace
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
BAA	British Airports Association
BABO	British Association of Balloon Operators
BALPA	British Airline Pilots' Association
BATA	British Air Transport Association
BBAC	British Balloon and Airship Club
BBGA	British Business and General Aviation Association

Acronym	Meaning
BGA	British Gliding Association
BHA	British Helicopter Association
BHPA	British Hand Gliding and Paragliding Association
BM	Battlespace Management
BMAA	British Microlight Aircraft Association
BMFA	British Model Flying Association
BPA	British Parachute Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CAT	Commercial Air Transport
CO₂	Carbon Dioxide
CTA	Control Area (Class D UK Airspace)
CQWI	Combined Qualified Weapon Instructors Course
DAATM	Defence Airspace and Air Traffic Management
DAP	Directorate of Airspace Policy (part of the CAA – now SARG)
DfT	Department for Transport
DME	Distance Measuring Equipment
DS	Deconfliction Service
ELFAA	European Low Fares Airline Association
ESUAS	East of Scotland University Air Squadron
FL	Flight Level
FOB	Forward Operating Base
ft	feet
GA	General Aviation
GASCo	General Aviation Safety Council
GAT	General Air Traffic

Acronym	Meaning
GAPAN	Guild of Air Pilots and Air Navigators
GATCO	Guild of Air Traffic Control Officers
HCGB	Helicopter Club of Great Britain
HI TAC	High TACAN
HMR	Helicopter Main Routes
HQ DAAvn	Headquarters Director Army Aviation
IAIP	Integrated Aeronautical Information Package
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
km	kilometre
LAA	Light Aircraft Association
LARS	Lower Airspace Radar Service
LoA	Letter of Agreement
LOS	Line of Sight
MAA	Military Aviation Authority
Mil AIP	Military Aeronautical Information Publication
MMATM	Manual of Military Air Traffic Management
MOD	Ministry of Defence
MTWA	Maximum Total Weight Authorised
NAIZ	Non-Automatic Initiation Zone
NATMAC	National Air Traffic Management Advisory Committee
NATO	North Atlantic Treaty Organisation
NATS	The National Air Traffic Service Provider
NERL	NATS En-Route Ltd
NCHQ	Navy Command Head Quarters

Acronym	Meaning
NM	Nautical Miles
NO ₂	Nitrogen Dioxide
NOTAM	Notice to Airmen
OSA	Off-Shore Safety Area
OS	Ordnance Survey
PSR	Primary Surveillance Radar
QRA	Quick Reaction Alert
RA	Regulatory Article
RAF	Royal Air Force
RAG	Range-Azimuth Gating
RDR	Radar
RMZ	Radio Mandatory Zone
SAR	Search and Rescue
SARG	CAA Safety and Airspace Regulation Group
SID	Standard Instrument Departure
SM	Safety Management
SMM	Safety Management Manual
SRG	Safety Regulation Group (part of the CAA)
SSR	Secondary Surveillance Radar
TACAN	Tactical Air Navigation System
TMZ	Transponder (SSR) Mandatory Zone
TRA	Temporary Reserved Area
UAS	University Air Squadron
UAV	Unmanned Air Vehicles
UKAB	UK Airprox Board
UKFSC	UK Flight Safety Committee
VFR	Visual Flight Rules

Acronym	Meaning
VGS	Volunteer Gliding Squadron
VOR	VHF Omni Directional Radio Range
WTG	Wind Turbine Generator

Defined Terms

Acronym	Meaning
Development Area	The area of the Inch Cape or NNG Wind Farm which includes the Wind Turbine Generators (WTGs), inter-array cables, offshore substation platforms and initial part of the Offshore Export Cable and any other associated works
Development Areas	The combination of the Development Area as defined for both Inch Cape and NNG

1 Introduction

The operation of the Neart na Gaoithe (NNG) and Inch Cape (IC) Offshore Wind Farms would affect Leuchars Aerodrome flying and Air Traffic Service (ATS) operations, with the most significant impact being the detection of the Wind Turbine Generators (WTGs) as unwanted clutter by the Leuchars Primary Surveillance Radar (PSR). NNG Offshore Wind Limited (NNGOWL) and IC Offshore Limited (ICOL) and the MOD have worked together to identify a suitable mitigation which will enable the NNG and IC Wind Farms WTGs to be constructed and operated without affecting Leuchars flying operations.

1.1 General

NNGOWL and ICOL wish to develop the NNG and IC Wind Farms respectively. The Development Areas are adjacent to each other with NNG lying to the south of IC by approximately 8 kilometres (km). NNG will be located in the Outer Firth of Forth, approximately 15.5 km from Fife Ness, with IC located approximately 15 km off the Angus coastline.

The most significant impact from WTGs on the Leuchars PSR and its operational environment is WTG generated radar returns causing false target generation. These false radar returns (also known as “clutter”) displayed on the radar screen can adversely impact the situational awareness of air traffic controllers; false tracks (which in many cases are indiscernible from real tracks) could obscure returns from real aircraft. This could affect an air traffic controller’s ability to identify primary radar aircraft returns, undermining their ability to provide ATS and in turn increasing the risk of the controller not detecting a conflict between aircraft. The presence of the NNG and IC WTGs will affect Leuchars Aerodrome flying and radar-based ATS operations, thereby requiring a change to the arrangements and procedures in the immediate airspace surrounding the Development Areas.

Analysis completed as part of the Section 36 consent application for the NNG and IC Wind Farms concluded that it is highly likely that the Leuchars PSR will detect all WTGs located within the Development Areas. Annex A1 (NNG) and Annex A2 (IC) provide example theoretical radar Line of Sight (LOS) profiles for the Leuchars PSR looking towards the NNG and IC Wind Farms. The NNG and IC WTGs will be detectable to the Leuchars PSR creating extensive ‘clutter’ in the area of the Wind Farms. This extensive clutter would severely restrict the provision of radar-based ATS by Leuchars in the region of the Development Areas.

Responses from the WTGs would reduce the detection capabilities of the radar and the generation of false targets will limit the ability of Leuchars Air Traffic Control (ATC) to discharge their responsibilities when providing air traffic services within

their area of operations. When providing a Deconfliction Service (DS³), Leuchars ATC endeavours to provide five Nautical Miles (NM) lateral separation between aircraft under control and unidentified or unknown radar returns. Therefore, services would be reduced, limited or downgraded within five NM of the boundary of the clutter created by the WTGs and/or route deviation around the turbines may be required. Extensive work to determine a solution to mitigate the potential effect of the turbines on the ATS provided by Leuchars has been undertaken by NNGOWL and ICOL. It has been determined that the introduction of a Transponder Mandatory Zone (TMZ) with PSR blanking over the NNG and IC Offshore Wind Farms will mitigate the effects of the detection of WTGs by the Leuchars PSR.

1.2 Purpose and Objectives

The purpose of this document is to provide information regarding the proposal to establish a TMZ over the NNG and IC Wind Farms to mitigate the effects of the detection of the WTGs by the Leuchars PSR. In order to establish a TMZ, the Airspace Change Process must be undertaken. Osprey Consulting Services Limited (Osprey), on behalf of NNGOWL and ICOL and in accordance with the Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 725, Guidance on the Application of the Airspace Change Process [Reference 1], has prepared this proposal document.

The objectives of this document are to:

- Describe the ongoing and future operations at Leuchars and how these may be affected by the NNG and IC WTGs;
- Detail the proposed change to the airspace over the Development Areas;
- Describe the alternative options for mitigation that were considered and explain why they are rejected due to their inability to mitigate sufficiently for the effects of clutter created by the detection of WTGs on the Leuchars PSR; and
- Provide an overview of the results of stakeholder consultation and environmental assessments for the change in status of the proposed airspace.

1.3 Consultation

National Air Traffic Management Committee (NATMAC) members plus selected additional stakeholders were directly consulted on the proposal. In addition, general public consultation was undertaken by means of publication of consultation material on the NNGOWL and ICOL websites. A list of identified stakeholders is at Annex A5 (individual members of the public who submitted unsolicited comments are not listed). The purpose of the consultation was to seek primarily aviation industry comment on NNGOWL and ICOL's proposal and to refine this accordingly prior to implementation. Such refinement has resulted in a single design option for the TMZ being proposed.

1.4 Related Documents

NNG and IC TMZ Consultation Document (Osprey, 70851 012).

³ Deconfliction Service provides the pilot with traffic information and deconfliction advice on conflicting aircraft. However, the avoidance of other aircraft is ultimately the pilot's responsibility.

NNG and IC TMZ FAQs (Osprey, 70851 016).
NNG and IC TMZ Consultation Report (Osprey, 70851 021).
NNG and IC TMZ Safety Program Plan (Osprey, 70791 007).
NNG and IC TMZ Safety Case Part 1 (Osprey, 70851 017).
NNG and IC TMZ Safety Case Part 2 (Osprey 70851 019).
NNG and IC TMZ Traffic Survey (Osprey, 70851 022).

1.5 Document Structure

This document contains seven main sections and six annexes, outlined below for convenience:

- Section 1, this section, introduces the document;
- Section 2 describes the necessity for an ACP;
- Section 3 gives an overview of the proposed design option;
- Section 4 assess the impact of the proposed TMZ;
- Section 5 details the environment and economic constraints;
- Section 6 analyses the consultation responses; and
- Section 7 provides a list of references.

There are six annexes:

- Annex A1 details the radar line of sight assessment for the NNG Wind Farm;
- Annex A2 details the radar line of sight assessment for the IC Wind Farm;
- Annex A3 provides the coordinates of the proposed TMZ;
- Annex A4 describes the consultation background and methodology;
- Annex A5 lists the consultees; and
- Annex A6 provides illustrations of the Leuchars Instrument Approach Procedures and Standard Instrument Departure Procedures together with the proximity of the Developable Areas.

2 The Need for an Airspace Change Proposal

Leuchars ATC operates under regulatory oversight of the Military Aviation Authority (MAA), providing essential ATS to military and civil aircraft to a range of 40 NM from the airfield, including the Development Areas.

2.1 Overview

The UK Government is legally committed to supporting renewable energy in order to meet its target of generating 15% renewable energy by 2020⁴. Furthermore, the Climate Change (Scotland) Act 2009⁵ contains provisions that set a legally binding target for reducing carbon dioxide emissions by at least 42% by 2020 and at least 80% by 2050, compared to 1990 levels. In order to increase and accelerate the generation of renewable energy in the UK, the UK and Scottish Government's policy, amongst other actions, sets out a plan for accelerating the use of offshore wind.

In support of this commitment to generate renewable energy, the IC and NNG Offshore Wind Farms have been proposed. However, the presence of WTGs within these development areas will produce unwanted effects on the Leuchars PSR and adversely affect the ability of Leuchars ATC to provide an ATS within their area of responsibility.

WTGs located within PSR coverage can reduce the ability of the radar to detect aircraft by saturating the radar receiver with responses. Additionally, the WTGs present themselves as a large number of reflecting moving targets to the radar, which look very similar to aircraft radar returns on the ATC radar display. The consequence is a reduction in the overall effectiveness of the radar in detecting targets, which can result in misidentification of aircraft, loss of track position, loss of track identity and false plots; these in turn can potentially cause safety and operational issues. To mitigate the effects of the WTGs it is proposed to apply radar blanking techniques to the Leuchars PSR. This will eliminate the returns from the WTGs, but it will also eliminate genuine aircraft returns from the ATC display. In order to safely and successfully track aircraft through the Development Areas, it is further proposed to establish a TMZ through the Airspace Change Process (ACP).

This section provides justification for the ACP by providing details of the nature of flying operations at Leuchars and by outlining the potential impacts of the NNG and IC Offshore Wind Farms on Leuchars operations if mitigation was not applied.

⁴ <http://ec.europa.eu/energy/en/topics/renewable-energy>

⁵ <http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/climatechangeact>

2.2 Operations at Leuchars Aerodrome

2.2.1 Aerodrome Tasking and Considerations

As well as the routine activities of aircraft permanently based at Leuchars, there are four principle considerations that must be taken into account when considering the need for radar-based ATS to support ongoing and future military operations conducted at Leuchars, as follows:

- The requirement from the MOD Chief of the Air Staff is that Leuchars maintains the capability to provide radar services 24/7 as a Diversion Aerodrome to aircraft, specifically Typhoon aircraft, operating Quick Reaction Alert (QRA⁶) sorties from RAF Lossiemouth and RAF Coningsby, or other aircraft completing training sorties/missions from other NATO bases, to recover to the aerodrome safely especially in poor weather conditions;
- Leuchars has the capability and will host major NATO exercises (for example, Joint Warrior); this capability will be maintained with Leuchars operating as a Forward Operating Base (FOB) within the military exercise scenarios;
- Leuchars will also host the Combined Qualified Weapon Instructors Course (CQWI); successful completion of this course leads to a formal qualification, which is essential to enable aircrew to return to the frontline to instruct weapons and tactics on operational squadrons. The Course is intensive, lasting five months, during which increased flying activity culminates into an 'operational phase' of tactical flying; and
- The proximity of the aerodrome to the military practice Danger Areas to the east and southeast makes Leuchars an attractive, and possibly the only military aerodrome option, for aircraft diverting in following an emergency or due to inclement weather conditions at their home base.

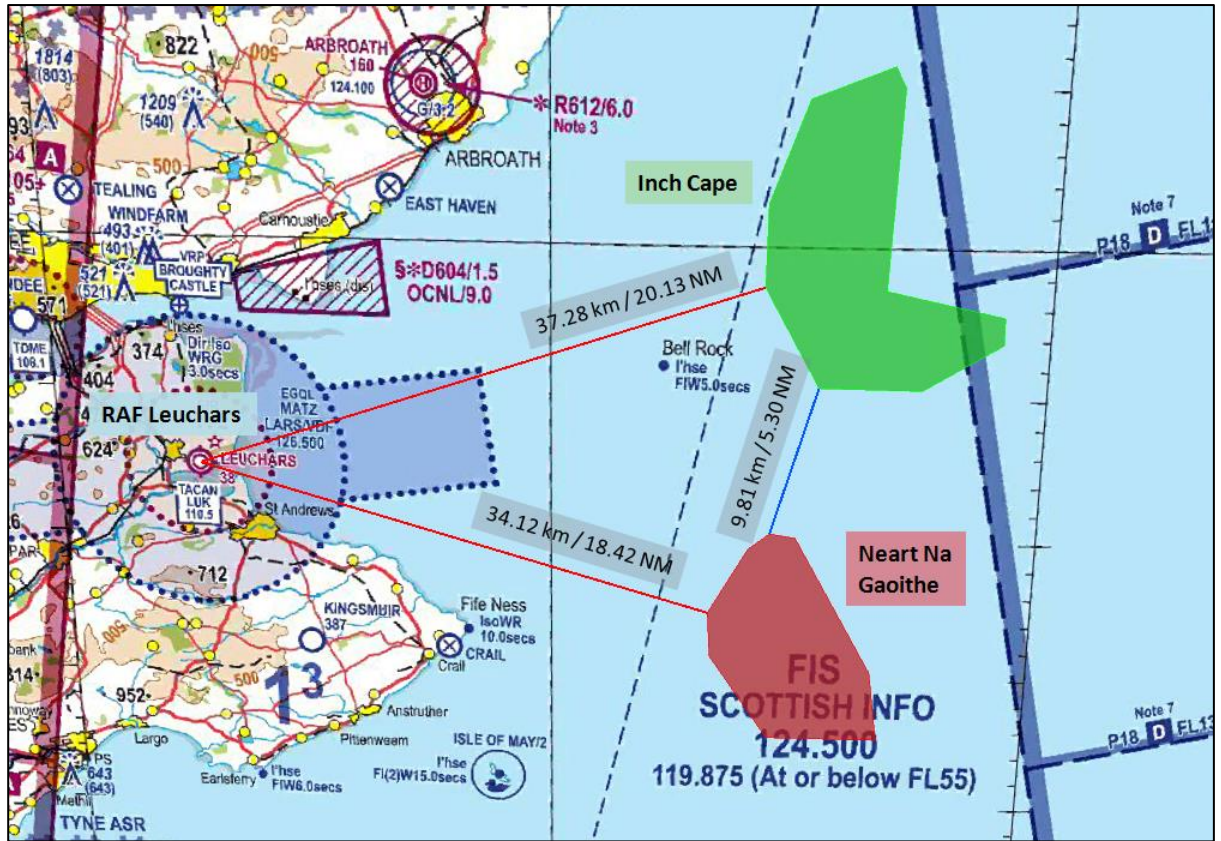
2.2.2 Flying Operations

Approximately 1,100 aircraft movements per month are conducted at the Aerodrome, made up from the normal activity of the based Tutor and Flying Club aircraft, rotary and other civil and military aircraft.

Figure 2 below illustrates the location of the Leuchars Aerodrome in relation to the Development Areas and provides range figures measured from the Leuchars Airfield Reference Point (ARP).

⁶ Aircraft are kept at a permanent readiness state in order to react to situations of national security.

Figure 2 Leuchars Aerodrome and the Development Areas



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2.2.3 ATC Operations

Leuchars ATC provides aerodrome control, and approach control and departure services to a range of general aviation and military aircraft in the airspace around Leuchars. In addition to these standard air traffic tasks, Leuchars ATC provides a service to aircraft participating in the Lower Airspace Radar Service (LARS⁷) within a radius of 40 NM of the airfield every day of the year, 24 hours per day; and a radar service to aircraft operating to and from Dundee Airport on request.

The Leuchars Advisory Service Area (ASA) is notified as an airspace of defined dimensions where military aircraft that are carrying out autonomous operations within the area are to receive, where possible, an ATSOCAS⁸ from a nominated source. Pilots are responsible for selecting the ATS provider and the type of ATS required from the provider.

The obligation to provide standard radar based ATS, the requirement to host complex NATO exercises, the LARS commitment, and the requirement to provide radar services within the ASA for military aircraft together with the requirement to

⁷ LARS - The service is normally provided to radius 30NM, Leuchars provide the service to 40 NM radius.

⁸ ATSOCAS – Air Traffic Service Outside Controlled Airspace. UK Flight Information Services provided by a number of air traffic units and is used by a variety of users.

standby as an emergency diversion aerodrome in all weather conditions, all combine to create an extremely complex controlling environment.

2.3 Impact of the WTGs on Leuchars ATS

2.3.1 General

Figure 3 below illustrates the location of the Leuchars Aerodrome in relation to the proposed TMZ.

Figure 3 Airspace in the vicinity of the Development Areas.



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The airspace around Leuchars is of medium complexity⁹. Leuchars ATC provides a radar based ATS to aircraft outside of controlled airspace, (generally Class G uncontrolled airspace) that are departing, arriving and transiting through the area (generally within 40 NM radius from Leuchars Aerodrome) as well as those military aircraft requesting an ATS and operating within the Leuchars ASA. In Class G airspace, the avoidance of other traffic is ultimately the pilot's responsibility. However, under a DS the controller provides the pilot with specific surveillance-derived traffic information and issues advisory headings and/or levels aimed at achieving the required deconfliction minima. The deconfliction minima required against unknown or un-coordinated traffic, or unknown radar returns (like WTG generated returns) are:

- 9.27 km (5 NM) laterally (subject to surveillance capability and regulatory approval); or
- 3,000 ft vertically and, unless the SSR code indicates that the Mode C data has been verified, the surveillance returns, however presented, should not merge. (Note: Mode C can be assumed to have been verified if it is associated with a

⁹ Can be characterised by the operation of a few CAT movements per hour and a number of flights in the airspace operating under Visual Flight Rules (VFR); the most prevalent being survey and offshore resource recovery operations and the Military.

deemed validated Mode A code. The Mode C data of aircraft transponder code 0000 is not to be utilised in assessing deconfliction minima).

If the Leuchars radar clutter induced by the NNG and IC WTGs is not addressed, Leuchars ATC will be required to apply 9.27 km (5 NM) separation between any aircraft in receipt of a DS and any unknown or false returns from the WTGs, which could significantly restrict Leuchars operations in this portion of airspace.

In summary, degradation of detection and tracking capabilities of the Leuchars radar in the vicinity of the Development Areas is of importance. Habitually reduced DS from Leuchars ATC in the area of the NNG and IC Wind Farms would effectively render a large volume of the Class G airspace above the NNG and IC Wind Farms unusable unless pilots agree to accept a 'limited primary radar service' or a downgrade in service. It is highly likely that a controller would be unable to maintain track identity in the area of clutter of the WTGs and re-routes would have to be suggested by controllers.

2.3.2 Provision of an Approach Control and Departure Service

Leuchars ATC provides an approach control and departure service in accordance with the MAA Manual of Military Air Traffic Management (MMATM) [Reference 2]. An ATS is provided to the based Grob Tutor aircraft following the recommendation from the Air Accident Investigation Board (AAIB) accident report 6/2010 into the mid-air collision between two Air Experience Flight (AEF) Grob 115E Tutor aircraft in 2009. Air Officer Commanding (AOC) No 22 Group (controlling authority for RAF Grob Tutor aircraft) has mandated that Tutor aircraft are to maintain a radar service during flying operations. However, the five tutor¹⁰ aircraft presently permanently based at Leuchars are unlikely to operate in the location of the Development Areas. Due to their single engine status, sorties over the open sea area are likely to be restricted to a few miles offshore. Nevertheless, Leuchars also provides radar assistance to aircraft operating to and from Dundee Airport.

Leuchars publishes a number of precision approach, standard instrument approach procedures and departure procedures for its predominant runway designated 08/26 within the Military Aeronautical Information Publication (Mil AIP) [Reference 3]. A number of these procedures, listed below, are located within the vicinity of the Development Areas.

- Standard Instrument Departure¹¹ (SID) Runway 08;
- SID Runway 26;
- High TACAN¹² (HI TAC) to Precision Approach Radar¹³ (PAR) Runway 08;
- HI TAC Runway 08;
- TAC or RADAR (RDR) to Instrument Landing System (ILS)/Distance Measuring Equipment¹⁴ (DME) Runway 26; and

¹⁰ Two aircraft are detached to Glasgow Airport.

¹¹ SID – Standard Instrument Departure. An ATC coded departure procedure established at airfields.

SIDs strike a balance between terrain and obstacle clearance, noise abatement and airspace restrictions

¹² TACAN – Tactical Air Navigation System. A navigation system used by military aircraft; it provides the user with a bearing and a distance to a ground or ship based station.

¹³ PAR – Precision Approach Radar. A type of radar guidance system designed to provide lateral and vertical guidance to an aircraft pilot for landing, until the pilot touches down.

¹⁴ DME – Distance Measuring Equipment. A transponder based radio navigation system that measures slant range distance by timing the propagation delay of radio signals.

- HI TAC Runway 26.

Charts depicting the Standard Instrument Approach and Departure Procedures for Leuchars including an overlay of the proposed location of the Development Areas are illustrated in Annex A6.

The presence of the WTGs would limit the use of some of these procedures under a full primary radar service due to the need to avoid the clutter the WTGs would generate on the radar display.

2.3.3 Leuchars LARS

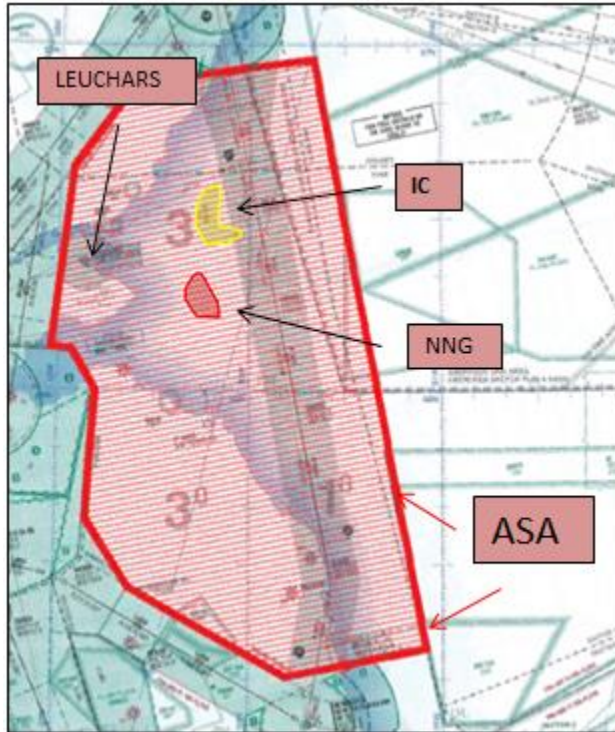
Leuchars ATC provides a LARS with the purpose of ensuring participating pilots are aware of other nearby aircraft and/or flying activities thus enhancing flight safety in the area. This service is available to any aircraft operating in uncontrolled airspace, from ground level up to 10,000 feet (ft), within a 40 NM radius of Leuchars and is provided in accordance with the policy determined by the CAA Safety and Airspace Regulation Group (SARG). LARS is regarded as a very important service which is sponsored by the Department for Transport (DfT) and is determined by the CAA SARG as key to enhancing the levels of safety of the airspace in an area that can be busy with a diverse mixture of aviation activities and aircraft types. The IC and NNG developments would impact LARS provision in the region of the Development Areas. Clutter created by the turbines will obscure primary radar aircraft radar returns and will lead to false track generation. Situational awareness of the controller is likely to be affected and track identity of aircraft under control could be lost.

2.3.4 Leuchars ASA Activities

Leuchars ATC, together with other ATS providers, are responsible for providing radar services in the Leuchars ASA to enhance the safety of aircraft operating in the area. The Leuchars ASA is notified from 5,000 ft above mean sea level (amsl) to FL 195 (approximately 19,500 ft) where pilots of military fixed wing, fast jet aircraft are advised, where possible, to take advantage of receiving an ATS when flying within the area to enhance flight safety.

The Development Areas are located within the lateral extent of the Leuchars ASA. Unmitigated WTG radar returns on the Leuchars PSR will have an adverse impact on the level of service provided to aircraft within the area. There would be a detrimental effect on the provision of timely information by the air traffic controller to assist the pilot in discharging their responsibility for collision avoidance within five NM of the Development Areas. Figure 4 below illustrates the Leuchars ASA and the approximate locations of the Development Areas.

Figure 4 Leuchars Aerodrome and the Leuchars ASA



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2.4 Summary of Impact on Leuchars Operations

There are five principal issues concerning the effects of the NNG and IC WTGs on Leuchars operations. There would be a potentially adverse impact on:

- Approach Control and Departure Services to aircraft operating to/from the aerodrome;
- Radar based ATS provision within the vicinity of NNG and IC Wind Farms and the established Leuchars Instrument Approach and Departure Procedures located overhead the Development Areas;
- Radar based ATS provision to military aircraft within the Leuchars Advisory Service Area (ASA);
- The capability to operate as a radar equipped Instrument Flight Rules (IFR)¹⁵ aerodrome; and
- The requirement to host North Atlantic Treaty Organisation (NATO) and other major exercises.

¹⁵ IFR – Instrument Flight Rules are a set of regulations that governs flights under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck.

3 Options Considered and Proposed Solution

The MODs preferred solution is to establish a single TMZ around the NNG and IC Offshore Wind Farms with associated PSR blanking of WTG returns within the Development Areas.

3.1 Overview

In developing the plans to resolve the issues detailed in Section 2, NNGOWL and ICOL have explored a variety of options in order to propose a mitigation solution that best meets the needs of the MOD and all other aviation stakeholders.

The following range of mitigation options were considered:

- Do Nothing;
- Establish the ability of the MOD to temporarily close down the operation of the WTGs;
- Conduct SSR Alone Operations;
- Implement a Radio Mandatory Zone (RMZ);
- Implement a TMZ; and
- Implement a TMZ with associated SSR Alone operations and Range Azimuth Gating (RAG) blanking with no lateral geographic buffer zone.

This section provides details of the design options considered, along with the results of the extensive evaluation of each.

3.2 Option 0 - Do Nothing

In the event that no mitigating actions are implemented for the NNG and IC Wind Farms, the clutter created by the WTGs will affect the safe and effective provision of a radar-based ATS and operations at Leuchars as described at Section 2 and summarised below:

WTGs located within PSR coverage can reduce the ability of the radar to detect aircraft. The WTGs present themselves as a large number of reflecting moving targets to the radar which look very similar to aircraft radar returns. WTGs detected by radar create the following effects:

- False returns causing false target generation;
- Loss of receiver sensitivity;
- Plot extractor/filter memory overload;
- Presenting an obstruction (shadow); and
- Receiver saturation.

Each of these individual effects reduces the overall effectiveness of the radar in detecting targets, which can result in the misidentification of aircraft, loss of track position, and loss of track identity as aircraft primary radar contacts and track history may be obscured. These in turn can affect the accuracy and timeliness of controller instructions and potentially cause serious safety and operational issues to ATC and the flying community operating within the area of the NNG and IC WTG induced radar clutter.

The Chief of the Air Staff intends to maintain Leuchars as a radar equipped IFR Diversion aerodrome, available 24 hours a day, seven days a week in order to provide a suitable diversion aerodrome for QRA sorties from RAF Lossiemouth and RAF Coningsby, as well as other aircraft completing sorties from other RAF or NATO bases.

If mitigation is not introduced, Leuchars controllers would be required to permanently 'reduce' the primary ATC radar services that it provides to aviation operating within the vicinity of the Development Areas to an unacceptable level. Controllers would be required to vector aircraft around the clutter and this would inevitably lead to greater track distances flown and an increase in both pilot and controller workloads. Established instrument approach and departure procedures detailed in Annex A6, which are located close to the locations of NNG and IC, for aircraft operating in and out of the aerodrome, are likely to require alteration or may even be prohibited, if the clutter created by the WTGs remains unmitigated. This would lead to greater noise exposure to communities, greater fuel burn and an increase in NO₂ and CO₂ emissions through extended routing around the WTG clutter. Option 0 is rejected as not acceptable as clutter created by the WTGs would lead to an unacceptable degradation in Leuchars radar capabilities.

3.3 Option 1 – Temporary WTG Suspension of Operations

It is reasonable to assume that the anticipated clutter on the Leuchars PSR display is only likely to be apparent once the WTGs become operational and begin to turn, due to the technical capabilities of the PSR to "filter out" static targets. It is known that weather, terrain and birds can occasionally appear as returns in unusual circumstances, but it is expected that the WTGs would not be detected during the construction phase. However, MOD radar trials at Eskmeals in 2013 found that a piling vessel located offshore from the Watchman Radar (the same type of PSR as at Leuchars) created significant clutter. MOD has therefore determined there is a requirement for mitigation of the WTGs from the date the first piling vessel is due on site. This also suggests that simply shutting down the WTGs may not resolve the clutter issues they present.

Additional technical and commercial complexities associated with Option 1 are listed below:

- Frequency and duration of switch offs. WTGs are turned off for maintenance; however, any increase in the activation and deactivation of the WTGs would lead to excessive wear and tear;
- As any instruction to turn off the WTGs is not likely to see an immediate cessation of clutter, there is uncertainty over the time it would take for the WTGs to stop turning; and

- The MOD would effectively require the rights to turn off the WTGs at any point in time for any duration, potentially making the Developments unviable.

Consideration was given to providing the ability to close down the WTGs via a telephone call to the NNG or IC operations rooms. However, due to the unpredictable nature of operations within uncontrolled airspace, in which the WTGs are located, this option is unviable, as it would be unable to be sufficiently robust for the dynamic ATC operational environment. Control of the WTGs would remain with the respective developer, and the time taken in initiating the request and the cessation of WTG operations would introduce delay and increased workload at a time when speed is of the essence to ATC.

This option is also not practical from a technical point of view. Electrical generators have a ramp down rate: this is the limit at which the machine can safely reduce its power output to zero, without causing significant aging and/or damage to the equipment. The electrical machines and mechanical equipment need to brake and reduce speed in a controlled manner and emergency stop procedures should only be implemented in emergency conditions.

This option would not be acceptable to NNGOWL or ICOL; furthermore, in the fast moving, dynamic world of ATC operations, Option 1 would be operationally unmanageable, and unacceptable to the MOD. Consequently, Option 1 is rejected as it provides insufficient mitigation for the effects on the Leuchars PSR.

3.4 Option 2 – SSR Alone Operations

In areas of airspace that are not significant to the normal operations at an aerodrome, controllers in some cases are able to tolerate clutter presented onto radar screens. The MOD has rejected this option as it does not solve the problem of being able to distinguish between primary radar returns created by the WTGs and those created by non-transponder aircraft. Simply providing a service using SSR Alone does not prevent non-transponder equipped aircraft from entering the airspace and therefore safety could be compromised as a result of the inability to identify, track and provide separation from those aircraft. This would lead to an unacceptable loss of situational awareness for the controller and potentially an increased risk of mid-air collision.

The MOD through the MAA provide Regulatory Articles (RA) to provide a framework of policy, rules, directives, standards, processes and the associated direction, advice and guidance, which governs military aviation activity and against which air safety is assessed. RA 3241 [Reference 4] covers contingency arrangements for the continued provision of ATS utilising SSR Alone. Military ATC terminal¹⁶ radar controllers may provide an ATS using SSR Alone providing its use is defined in unit orders. However, military controllers are encouraged (in accordance with local orders) to hand-over control of aircraft to adjacent units within overlapping radar coverage (subject to the adjacent unit's radar serviceability) at the earliest opportunity, when other mitigation methods are not available. This is impracticable within the vicinity of the Development Areas as there is limited overlapping radar cover with adjacent LARS units, (the nearest being RAF Lossiemouth, 81 NM to the north of Leuchars).

¹⁶ Terminal Radar refers to radars situated at airfields.

The option of utilising SSR Alone operations without another form of mitigation has been rejected. Non-transponding aircraft would remain undetectable within the Development Areas and potentially the entire area of Leuchars operations if the primary radar was deselected (to remove clutter), resulting in an unacceptable loss of situational awareness.

3.5 Option 3 - Radio Mandatory Zone (RMZ)

A Radio Mandatory Zone (RMZ) over the NNG and IC WTGs would require aircraft to be in two-way communication with ATC and provide information pertinent to the flight prior to entering the designated airspace.

Although ATC would be able to provide some level of service to traffic in the area of the RMZ, the unmitigated clutter would make it difficult to identify aircraft and maintain track identity for the purposes of providing traffic information and separation.

This option was discounted as it provides insufficient mitigation by failing to provide ATC with the required situational awareness.

3.6 Option 4 – Transponder Mandatory Zone (TMZ)

A TMZ alone, with no other form of mitigation was not considered a viable option for mitigation. Without a method to mitigate for the display of primary radar clutter, the degree, accuracy and timeliness of the instructions, advice and information a controller is able to provide to pilots within the TMZ is likely to be negatively affected, with consequent impacts on safety and expedition. There would be an increase in controller workload and the clutter could also result in poor radar performance as a result of processing saturation and desensitisation or shadowing, resulting in loss of radar detection of aircraft within the vicinity of the TMZ. For these reasons, the **TMZ only** option is rejected as providing insufficient mitigation.

3.6.1 Option 4a – TMZ with associated RAG (PSR Blanking) and no lateral geographic buffer zone

Within this proposed solution, the establishment of the TMZ is one element of a two-part Mitigation Package aimed at negating the impact of the clutter from the NNG and IC WTGs upon the Leuchars PSR. The two parts are:

- Element 1: Establishment of a TMZ; and
- Element 2: TMZ with associated suppression of PSR returns within a RAG.

A RAG (or radar blanking area) involves a technical configuration of the PSR to inhibit targets being displayed within a bounded area. It prevents clutter from WTGs on the controllers display by inhibiting their radar returns and subsequently nulls the effects that WTGs have on radar tracks. A RAG also removes all primary returns from genuine aircraft targets. This means that within the area of the RAG there will be no primary radar returns displayed. However, if a corresponding TMZ was established, aircraft entering the area are mandated to be equipped with an operational transponder, enabling the controller to track the aircraft using the data from its SSR transponder and provide a SSR Alone radar service.

This proposed solution provides Leuchars ATC with the capability of assured positional identification and provides Commercial Air Transport (CAT) operators

with collision avoidance mitigation through the cooperative use of ACAS. It will also maintain current levels of safety for the provision of radar services provided using SSR data alone within the vicinity of the Development Areas in accordance with ICAO PANS-ATM 'the carriage of SSR transponders is mandatory within the area'. Aircraft flying through the TMZ will be required to be equipped with and operate SSR transponder equipment or to have established two-way radio communications with Leuchars ATC, the TMZ Controlling Authority. As stated in Section 3.4, military ATCOs may provide an ATS using SSR Alone providing its use is defined in unit orders (as it is at Leuchars). SSR Alone service can be provided to aircraft participating in LARS where no overlapping radar coverage is provided by adjacent LARS units, however once the aircraft is within overlapping radar coverage of an adjacent LARS unit, the aircraft should be handed over [Reference 4].

The airspace classification of the TMZ would remain unchanged. Hence, the ATS available within and around the TMZ would continue to be applied according to CAP 774 The UK Flight Information Services [Reference 5] through the assured provision of SSR data to the controller.

This option purely covers the geographical layout of the Development Areas and does not consider the establishment of a buffer zone. A TMZ without a buffer zone between the boundary of the TMZ and the smaller PSR RAG area would decrease the ability of the controller to detect an aircraft target about to inadvertently enter the blanked area of the PSR. This could have detrimental effects on ATS provision and safety. Creating a TMZ without an additional buffer zone around the RAG would prevent the controller from maintaining primary radar track identity as the aircraft enters/leaves the TMZ. This option (TMZ without a Buffer Zone) has therefore been rejected as it provides insufficient mitigation.

3.6.2 Option 4b - The Proposed TMZ (TMZ with associated RAG (PSR Blanking) and with a lateral geographic buffer zone)

The Proposed TMZ provides the same level of mitigation as Option 5 over the Development Areas, but increases the lateral dimensions of the TMZ to provide a buffer zone around the WTGs. It is considered that this buffer is necessary to mitigate any potential navigation error that could occur close to the area of PSR return suppression. Such a buffer zone would provide time for ATC to provide avoiding action to other aircraft close to the boundary of the TMZ, if required. Thus, it is concluded that an additional volume of airspace should be added to the surface footprint of the Development Areas to cater for TMZ infringements.

The overall aim of the NNG and IC Airspace Change Proposal is to maintain airspace efficiency and effectiveness for all users and mitigate the impacts of the NNG and IC Offshore Wind Farms on Leuchars flying and ATS operations.

The CAA, in CAP 725 [Reference 1], lays down extensive regulatory requirements to be applied to the design of the airspace arrangements. However, most of these requirements, such as Instrument Flight Procedures (IFP) containment, are relevant to the development of Controlled Air Space (CAS), which is not applicable to this TMZ proposal. The significant regulatory requirements applicable to this proposal are that the:

- Dimensions of the proposed airspace should be the minimum practicable to meet the safety and operational requirements; and

- Configuration of the airspace should be as simple as practicable.

Thus, the primary matters for consideration in the development of the proposed TMZ are the lateral and vertical dimensions, including alignment with other, pre-existing, airspace boundaries and the impact on:

- Those aircraft wishing to use the airspace which are not and/or cannot be equipped with a transponder; and
- The operational impact on adjacent Air Traffic Service Units (ATSU) who may not be SSR equipped.

The proposed solution provides Leuchars ATC with an informed traffic environment where each aircraft can be identified and monitored for the purpose of providing separation and traffic information. This provides the assurance that any aircraft in receipt of a service within the TMZ can be positively identified and the appropriate separation can be provided between aircraft.

Until a permanent technical solution to mitigate for the effects WTG induced clutter on the PSR is identified and implemented, the MOD supports the establishment of a TMZ with associated RAG (PSR Blanking) and a two NM buffer zone around the Development Areas up to FL 100 within the Leuchars LARS provision times (24 hours). The development of this option for the configuration of Transponder Mandatory Airspace is detailed in the subsequent paragraphs of this Section of the document.

TMZ Horizontal Buffer Zone

The co-ordinates for the proposed TMZ (with buffer zone) and its proximity to military and civilian aerodromes measured from the airfield reference points (where available) are given at Annex A3. The lateral TMZ boundary would extend two NM around the edge of the Development Areas to allow for any shadow affect and the initiation and establishment of a radar track as aircraft leave or operate in the vicinity of the RAG. The Leuchars Watchman radar rotates at a rate of 15 rpm. Should a target appear just after the antenna has passed, this target would not be picked up until the antenna illuminated it on its next pass, approximately 4 seconds later. Therefore, should an aircraft exit the TMZ just after the antenna has passed, it will take a short time for the radar to detect and display its return. A buffer around the RAG allows the PSR to re-establish a coherent target/plot once an aircraft has exited the RAG (blanked) area, before exiting the TMZ. This is particularly important to the west of the RAG as aircraft approach Leuchars, especially if aircraft are establishing for an instrument approach procedure.

Due to the close proximity of the two wind farms, to avoid issues with visual confusion from the air, difficulty in navigation chart interpretation and visual depiction on ATC video display screens a single TMZ will encompass both wind farms, rather than two individual TMZs. Figure 5 below illustrates the airspace in the vicinity of the Development Areas and the lateral extent of the proposed TMZ, including a two NM buffer zone...

Figure 5 NNG and IC TMZ Proposal including the 2 NM Buffer Zone



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By way of comparison to other offshore wind farm mitigations, the TMZ around the London Array Offshore Wind Farm, administered by Southend ATC, has an internal buffer of two NM beyond the lateral extent of the WTGs.

3.7 Vertical Extent of the TMZ

Airspace in the vicinity of the Development Areas above FL 100 already requires aircraft to carry and operate transponders¹⁷. It is proposed that the TMZ should extend from sea level to FL 100 to ensure all aircraft operating in airspace above the WTGs are mandated to operate transponders.

3.8 Hours of Operation of the TMZ

Under normal UK Integrated Aeronautical Information Package (IAIP) [Reference 6] arrangements, the operating hours of a particular airspace segment established for ATS purposes are linked to the operating hours of the associated ATS Unit. Leuchars ATC will be the TMZ Control Authority with the TMZ operating hours replicating the Leuchars ATC operating hours; the unit operates 24 hours to provide for military diversion aerodrome purposes and the provision of LARS. The information would be published within the UK IAIP, Mil AIP, associated CAA VFR Charts and other applicable aviation documentation, noting the LARS frequency and timings, as well as the boundary of the TMZ.

3.9 Implementation of the TMZ

The MOD has confirmed that from a technical and operational perspective a phased introduction of the TMZ would be acceptable. It is proposed that implementation would be in two distinct phases to match the programme dates for both wind farms which are provided in Table 1 below.

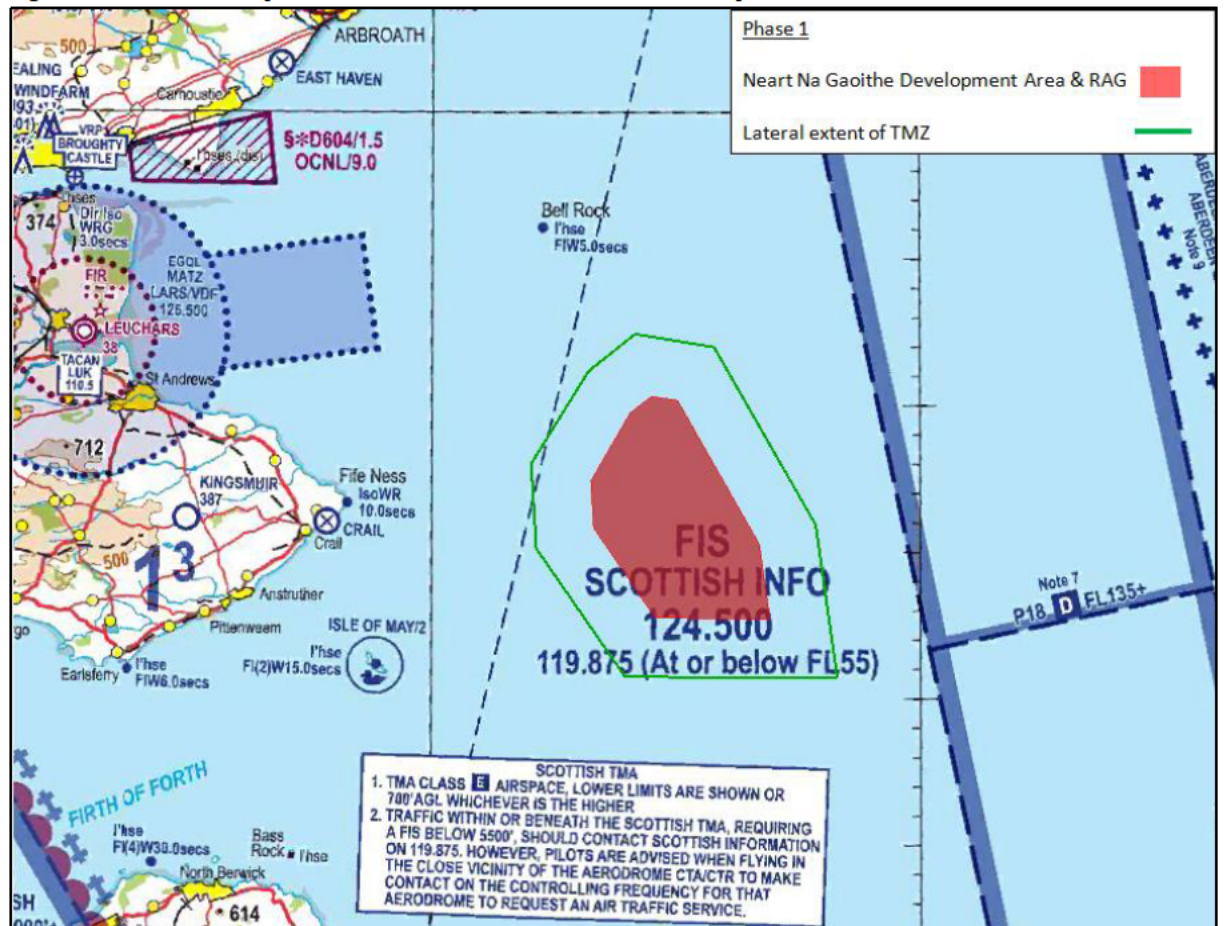
¹⁷ Gliders have notified exemptions to this requirement

Table 1 Programme Dates for NNG and IC Wind Farms

	Start of Construction (Piling Vessel on site)	First Generation
Neart na Gaoithe	April 2017	April 2019
Inch Cape	April 2018	July 2019

As the development of the two wind farms is separated by a year, NNGOWL and ICOL suggest that a phased implementation of the TMZ takes place from the time that the first piling vessel arrives on site for NNG (the first development to be constructed) which is planned for April 2017. Figure 6 below illustrates Phase 1 of the introduction of the TMZ once the first piling vessel arrives on the NNG Development Area.

Figure 6 Phase 1 First Implementation of the TMZ over the NNG Development Area



Construction of IC is programmed to commence in April 2018, at which time the whole area of the TMZ as illustrated in Figure 7 below, will be implemented.

Figure 7 Phase 2 Implementation of the TMZ over both Development Areas



3.10 Conclusions

Four options to mitigate for the effects of the WTGs on the Leuchars PSR were considered in depth. The mitigation option that provides the best solution is to establish a TMZ with an associated buffer, together with associated RAG. This mitigation option will also satisfy the Section 36 consent conditions imposed by the Scottish Government to mitigate the effects created by the development on the Leuchars PSR. The impact of this mitigation option is provided in Section 4.

4 Impact of the Proposed TMZ

The overall aim of the NNG and IC Airspace Change Proposal is to maintain airspace efficiency and effectiveness for all users whilst mitigating the impacts of the NNG and IC Offshore Wind Farm on Leuchars flying and ATS operations.

4.1 Overview

A potential drawback of establishing a TMZ is that non-transpondering aircraft may choose to take an alternative route in order to 'bypass' the TMZ, resulting in a change in traffic patterns and ATC workload in this area. This would only reasonably occur when aircraft have been unable to establish two-way radio communications with Leuchars ATC, the TMZ Controlling Authority.

4.2 Impact of the TMZ on Military Operations

The majority of UK and European-based military aircraft carry and operate SSR transponders; in most cases, these are compatible with Mode S systems. The only UK military types that are not transponder equipped are gliders. It is considered that military gliders are highly unlikely to operate as far offshore as the Development Areas and so would be unaffected by the TMZ requirements. The nearest military gliding establishment is at Arbroath Aerodrome (RM Condor); formal consultation with the operators of the aerodrome concluded in no objection to the proposal, as they are unlikely to operate so far offshore in the location of the proposed TMZ.

4.3 Impact of the TMZ on Light General Aviation Operations

All aircraft operating on Public Transport flights within UK airspace are required to be equipped with, as a minimum, Mode S Elementary transponders. It can be assumed that the majority of General Aviation (GA) aircraft over 5,700 kg Maximum Total Weight Authorised (MTWA) are likely to be transponder equipped.

Whilst not prohibited from operating over water, the majority of pilots of light aircraft (sports and recreation) prefer to minimise their over-water flight time by routing predominantly overland, and over water for as short a period as practicable. Leuchars ATC confirm that the majority of GA aircraft working around the north shores of the Firth of Forth and the estuary of the River Tay operate SSR transponders and follow the coastlines, the aircraft are likely to be applying the Right-Hand Traffic Rule 19¹⁸. A pilot following a line feature (a railway, road, river or coastline etc.) must fly so that the line feature is on his left, unless the aircraft is flying in CAS and has been instructed otherwise by an Air Traffic Control Unit. This rule ensures separation between two aircraft following the same line feature but flying in opposite directions as both aircraft will be flying to the right of the line feature.

¹⁸ CAP 393 Air Navigation: The Order and the Regulations (ANO) and RA 2307 Rules of the Air.

The first of two weeklong data collection exercises was completed during the week beginning the 16th March 2015. During this period, no general aviation (GA) aircraft were seen to transit the proposed area of the TMZ. Furthermore, feedback gained from the controlling staff at Leuchars indicated that the incidence of GA or non-SSR equipped aircraft operating in the location of the proposed TMZ is extremely remote. This is supported by the statistics of non-SSR equipped aircraft provided by Leuchars over a four-month period in which less than 3% of aircraft provided with an ATIS were non-SSR equipped, none operating in the location of the proposed TMZ.

Notwithstanding the transponder mandate within a TMZ, provision exists within the TMZ Rules for conditional access by non-equipped aircraft by prior arrangement, establishing two-way radio contact, with the appropriate ATSU (Controlling Authority), in this case Leuchars ATC. It is anticipated that the impact of a TMZ on light GA operations, including glider, microlight and balloon operations, would be minimal as these types are unlikely to be operating as far offshore in the region of the proposed TMZ.

4.4 Impact of the TMZ on Offshore Helicopter Operations

As outlined in Section 4.3 above, aircraft likely to be affected by the proposed TMZ are those with an MTWA of less than 5,700 kg, as above this weight the aircraft are likely to be used for public transport operations and therefore transponder equipped.

Offshore helicopter types are categorised into the following MTWA groups:

- Extra Heavy Twin >20,000 kg (e.g. Chinook);
- Heavy Twin >5,700 kg (e.g. Bell 214ST, Super Puma, EC225, S61 and S92);
- Medium Twin 2,730 to 5,700 kg (e.g. Dauphin, EC155, S75 and AW139); and
- Light Twin <2,730 kg (e.g. Bo105).

The helicopters operated by Bristow Group, CHC Scotia Limited and Bond Offshore Helicopters are heavy and medium twin helicopters equipped with a transponder; however, there are no nearby Oil and Gas platforms or Helicopter Main Routes in the vicinity of the Development Areas. The Maritime and Coastguard Agency operate heavy twin helicopters which are also equipped with a transponder. Light Twin helicopters are unlikely to operate with regularity in the vicinity of the Development Areas.

5 Environmental and Economic Considerations of a TMZ

Overall, it is anticipated that the environmental impact of establishing a TMZ encompassing the Development Areas will be neutral within the three major categories of noise, fuel burn and local air quality.

5.1 Overview

This section discusses the effects of the proposed airspace change on the environment in terms of noise pollution, fuel burn and local air quality. In any airspace decision-making, the CAA must consider the environmental impact of aviation and the disturbance caused to the public.

The proposed TMZ lies offshore in Class G airspace, more than 11.4 km (6 NM) from the Fife and Angus coastlines. No aircraft operations would be excluded from the TMZ, but there remains an extremely remote possibility that some GA operators might elect to route on or closer to shore to avoid the TMZ requirements rather than routing offshore through the TMZ.

Airspace activity in Class G airspace is not routinely monitored. However, two individual surveys of one week duration were conducted and eight months of statistics provided by Leuchars confirmed that the large majority of transit GA (Sports and Recreation included) in the Firth of Forth and the River Tay estuary area remain close (within 1.9 km (1 NM)) to the coastlines. Furthermore, observed traffic farther offshore was transponder equipped and in two-way radio contact with Leuchars, Aberdeen or the Scottish Area Control Centre. Therefore, it is anticipated that there will be very little, if any, traffic displacement due to the proposed NNG and IC TMZ inhibiting GA flight operations.

5.2 Impact of Noise

It is expected that the noise impact after TMZ implementation is insignificant due to the offshore location of the proposed TMZ and the little, if any, traffic displacement different from the pre-implementation situation.

5.3 Anticipated Level of Fuel Burn/CO₂ Emissions

It is recognised that aircraft contribute to carbon dioxide (CO₂) emissions and this has an impact on climate change. Access to the TMZ airspace will be available wherever practicably possible, little, if any, traffic displacement or re-routing is anticipated and any re-route taken is likely to be insignificant. This airspace proposal ensures sustainability of the efficient routing of aircraft and will have minimal, if any, impact on fuel burn and emissions.

5.4 Anticipated Effect on Local Air Quality

CAP 725 [Reference 1], Appendix B, Annex 8 identifies that local air quality at ground level remains largely unaffected by aircraft emissions that take place above 3,000 ft above ground level (agl) because dispersion reduces concentration levels for these emissions. It is understood that in the context of local air quality, the overall objective under CAP 725 is to determine whether the proposed airspace changes will exceed any statutory air quality standards, and if so, what contribution the airport operations make towards such departures.

The proposed TMZ lies offshore and it is not anticipated that Air Quality Standards will be breached.

5.5 Environmental Implications

Overall, it is anticipated that the environmental impact of a NNG and IC TMZ will be neutral, or at worst insignificant, within the three major categories of noise, fuel burn and local air quality. It is not anticipated that the NNG and IC TMZ will reduce the environmental impact of aviation in the subject airspace; however, it is reasonable to expect that the environmental impact of aviation in the subject airspace will not worsen because of the change. Both tranquillity and visual intrusion are unlikely to be impacted by any GA displacement and, in the worst case; the numbers of those currently negatively affected are not likely to increase significantly upon implementation. The establishment of the TMZ is a safety requirement to enable radar-based ATS to be sustained near the NNG and IC Development Areas.

6 Consultation Response Analysis

The NNG and IC TMZ consultation invitations were circulated to a total of 62 stakeholder consultee organisations or individuals, of which two emails were returned as undelivered. Of the eleven responses received; four supported the proposal, seven did not object to the proposal. There were no objections to the proposal although GATCO and the MOD stated a preference to one of the design options of the TMZ, that which enveloped both Development Areas. The MOD objected to a design option of individual TMZs around each Developable Area.

6.1 Overview

This section summarises the aim of the consultation exercise, describes the categories of consultee organisations and individuals that were consulted, and provides a breakdown of the responses received. It also explores the support ratio of consultee responses received to give a general indication of stakeholder acceptance of this proposal.

6.2 Consultation Summary

The purpose of this consultation was to gather and analyse the views of the various stakeholders concerning the proposal to establish a TMZ over the NNG and IC Development Areas. Fundamentally, the consultation has enabled NNGOWL and ICOL to obtain or confirm views and opinions about the impact of the proposed airspace change.

The background to this consultation and the methodology used are detailed in Annex A4 to this document.

6.3 Consultee Organisations

The NNG and IC TMZ consultation invitations were circulated to a total of 62¹⁹ stakeholder consultee organisations or individuals; of these two emails were returned as undelivered. The consultee lists are detailed in Annex A5 and comprise:

- 37 Aviation “National Organisations” (CAA NATMAC list);
- 11 Aviation organisations;
- 10 Local aerodromes; and
- 4 Non-Aviation organisations.

The Consultation Document was distributed via a dedicated link on the NNGOWL and ICOL websites and by email to consultees.

¹⁹ It should be noted that NATMAC comprises a total of 39 organisations, represented by 45 individuals. The consultation document was circulated to each individual. However, this analysis reflects the views of the organisations as a whole and not of the individuals representing them. In some cases it was found that representation had changed from the list provided by the CAA.

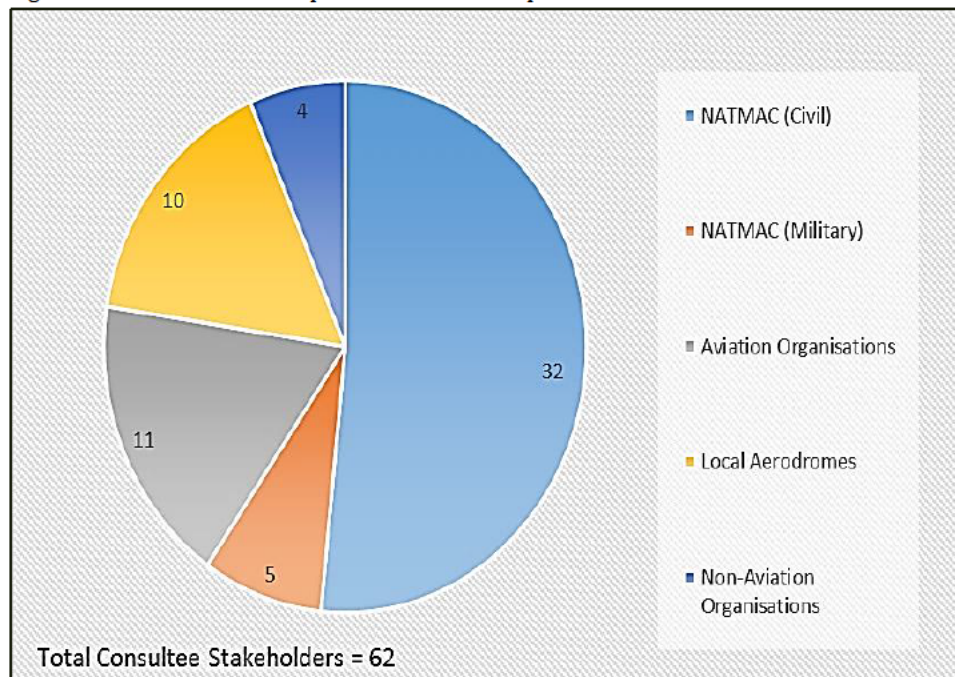
Consultees broadly fall into two categories:

- Aviation Consultees; and
- Non-aviation consultees.

Aviation consultees included aviation parties such as the MOD, airlines, aircraft operators, adjacent aerodromes, all local airspace users and the national bodies representing all UK aviation interests that may be affected by the regulatory requirements within the TMZ. National bodies such as Light Aircraft Association (LAA), British Airlines Pilots’ Association (BALPA), and the Airport Operators Association (AOA) etc. are represented through the auspices of NATMAC, sponsored by the CAA. A number of military organisations are also members of the NATMAC.

Non-aviation stakeholders for consultation included environmental and heritage organisations and the general public. The consultee groups are detailed in Figure 8 below.

Figure 8 NNG and IC TMZ Proposal Consultee Groups



6.4 Response Analysis

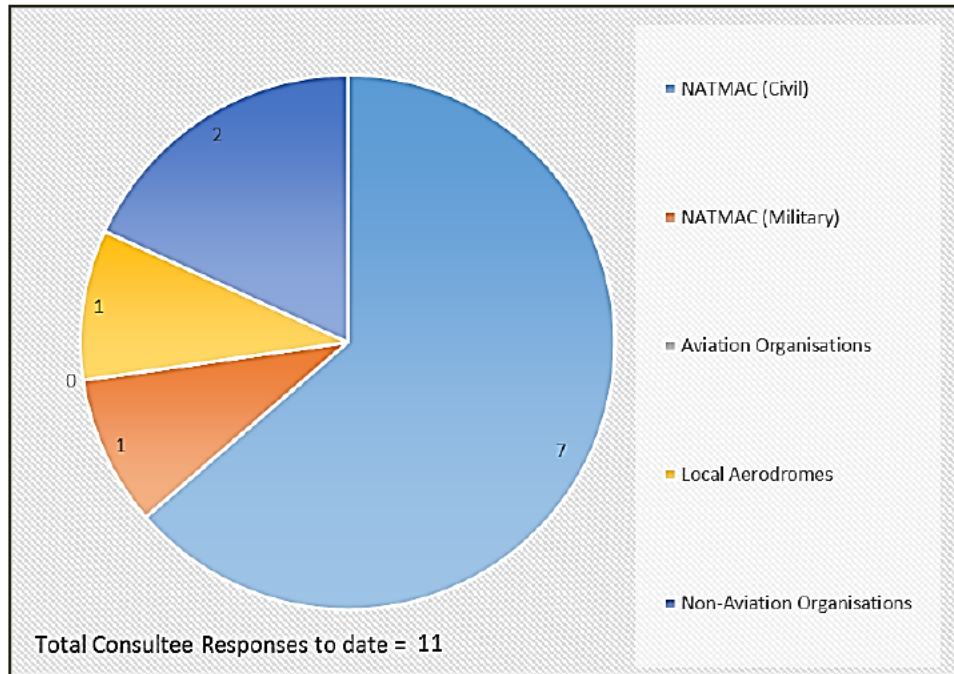
A total of eleven responses (approximately 18 % of consultees) were received. A breakdown is provided in Table 2 and Figure 9 below.

Table 2 Responses from consultees

	Consultee Groups	Number Consulted	Responses	%
1	NATMAC (Civil)	32	7	21.9
2	NATMAC (Military)	5	1	20.0
3	Aviation organisations	11	0	0

4	Local aerodromes	10	1	11.1
5	Non-Aviation Consultees	4	2	50
	Totals	62	11	17.7%

Figure 9 Responses from listed Consultees



It should be noted that “NATMAC (Civil)” and “NATMAC (Military)” comprise those organisations who are members of the CAA’s NATMAC. The NATMAC consultee list includes some CAA Departments who, for reasons of CAA impartiality, do not respond to consultations.

6.5 Meetings with Major Stakeholders

Prior to the commencement of the consultation period, a number of consultation meetings were requested with the following stakeholders:

- Aberdeen Airport
- Perth Airport
- Dundee Airport
- Fife Airport
- Arbroath Aerodrome (Royal Marine Condor)
- Kingsmuir Aerodrome
- Archerfield Aerodrome
- East Fortune Aerodrome
- Edinburgh Airport
- Bond Offshore Helicopters
- CHC Scotia Limited
- Bristow Group
- Scottish Area Control Centre (ACC)

The purpose of these meetings was to present the detail that would be incorporated into the Consultation Document to ensure there were no surprises for stakeholders when it came to formal comment. A meeting was held on 17th February 2015 at Aberdeen Airport in which a brief on the proposed TMZ was presented. This meeting was attended by National Air Traffic Services (NATS) Aberdeen Airport, Bristow Group and Bond Offshore Helicopters. CHC Scotia and the Scottish ACC were unable to attend. Information was subsequently exchanged by email with CHC Scotia and the Scottish ACC.

Of the above, Aberdeen Airport, Perth Airport, Dundee Airport, Arbroath Aerodrome, Archerfield Aerodrome, Edinburgh Airport, Bond Offshore Helicopters, CHC Scotia and Bristow Group stated that they had no objection to the proposal.

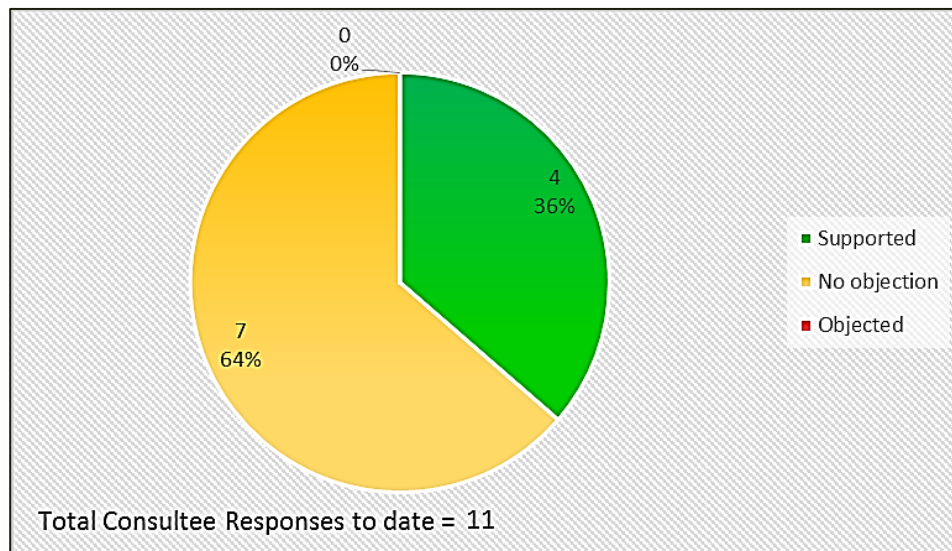
6.6 Consultation Support Ratio

Of the eleven responses received from the consultee organisations:

- 4 consultees (36.4 %) supported the proposal; and
- 7 consultees (63.6 %) did not object to the proposal.

There were no objections to the TMZ proposal although the MOD and GATCO stated a preference to one of the design options. Figure 10 below provides an illustration of the consultation support ratio.

Figure 10 Support Ratio from Listed Consultees.



6.7 Key Issues Arising from Consultee Responses

A final report of the consultation completed by NNGOWL and ICOL has been completed [Reference 7], it includes an analysis of all submissions received throughout the consultation period and identifies the main issues raised by consultees.

6.7.1 British Gliding Association

The British Gliding Association (BGA) highlighted their concern with respect to the establishment of CAS and similar restrictions. The BGA have no objection to the introduction of CAS where levels of risk to CAT justify such levels of protection, but do not support restrictions where risks are un-assessed or based solely on prejudice or supposition.

The BGA said that the proposal lacks justification and suspect that a proper analysis would confirm that no action needs to be taken. The introduction of a TMZ would thus be seen as dis-proportionate to actual risk. The Association therefore reiterated their statement that no precedent should be taken from its lack of formal objection. The BGA stated that given that in this case the airspace in question is of little or no strategic interest, the Association stopped short of submitting a formal objection and for reasons of expediency only have recorded its formal position as "no objection".

6.7.2 Ministry of Defence (MOD)

The MOD stressed that in general the establishment of a TMZ continues to be an interim solution until a long-term technical solution is implemented (after which the TMZ should be cancelled). With respect to the proposal, the MOD highlighted the following caveats in relation to their formal response:

- a *'The TMZ continues to be an interim solution to the interference issues caused by this proposed development on the RAF Leuchars PSR'.*
- b *'The developers honour their agreement to fund the implementation of Range and Azimuth Gating (RAG) hardware that will be required by the RAF Leuchars PSR, and that this proves effective at removing the radar clutter within the proposed TMZ whilst ensuring that there is no negative impact on the remainder of the PSR's coverage. Any solution will also need to take into account equipment changes as part of Programme MARSHALL'.*
- c *'The developers honour their agreement to provide funding to identify, trial and subsequently implement a long-term technical solution and, once operational, cancel this TMZ as part of the ongoing Post Implementation Review process'.*
- d *'The Safety Case being completed by the developers of NNG and IC is approved by the RAF Leuchars Duty Holder chain'.*

6.8 Publication

Should the CAA, without the need for further design optimisation or analysis, accept the Airspace Change Proposal, NNGOWL and ICOL suggest a phased implementation of the TMZ. Phase 1 of the implementation would coincide with the initial arrival of the first piling vessel to the NNG Development Area, expected to be for commencement of construction of NNG during April 2017. Notification of Phase 1 of the TMZ would take place to coincide with a double AIRAC Cycle before construction commences.

During April 2018, arrival of the first piling vessel for construction of the IC Development Area is planned, at which time Phase 2, the full dimensions of the TMZ would be implemented with prior notification of the extension occurring a suitable period ahead of construction.

NIL

NNGOWL and ICOL proposes to detail the TMZ within the UK Mil AIP Leuchars AD2 entry, in UK IAIP ENR GEN 1.5 (Aircraft Instruments, Equipment and Flight Documents) and ENR 6.1 (Helicopter Main Routes and Northern North Sea Off-Shore Safety Area (OSA) and any other applicable military and civilian documentation. This would serve the purpose of formally notifying the TMZ; the AIRAC dates are to be confirmed.

NIL

7 References

Table 3 Table of References

Reference	Name	Origin
1	CAP 725 CAA Guidance on the Application of the Airspace Change Process Third Edition (corrected) April 2007	CAA
2	MAA Manual of Military Air Traffic Management First Published 17 November 2014 Last Updated 4 February 2015	MOD
3	Military Aeronautical Information Publication AIRAC Cycle 09	No1 AIDU
4	Regulatory Article 3241 SSR Alone Operations February 2015	MAA
5	CAP 774 The UK Flight Information Services Version 2.3 4 February 2015	CAA
6	UK Integrated Aeronautical Information Package AIRAC 09/2015	NATS AIS
7	Neart na Gaoithe and Inch Cape Offshore Wind Farm TMZ 70851 021 Consultation Report Issue 1 15 September 2015	Osprey

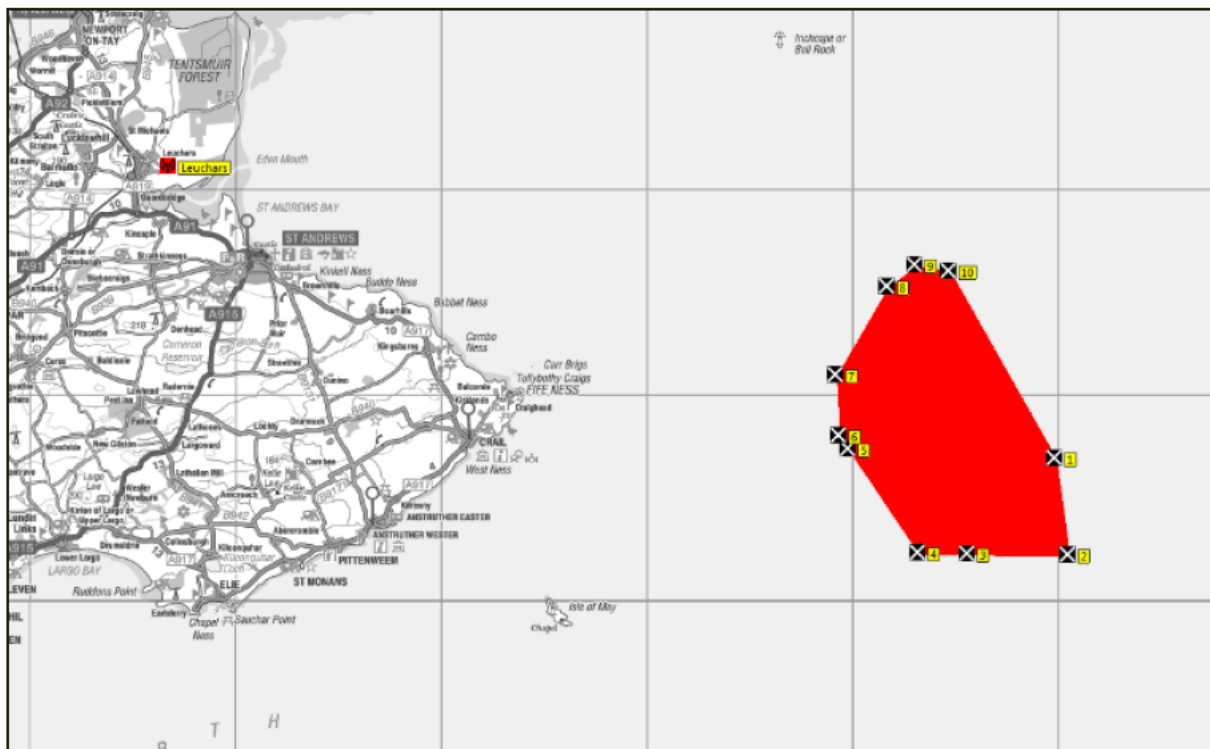
A1 Annex A1 NNG Wind Farm Line of Sight Assessment

A1.1 Overview

This annex contains the results of the radar Line of Sight (LOS) assessment for the NNG WTGs in respect of the PSR located at Leuchars.

The analysis was carried out using representative points, (labelled 1-11) on the NNG Development Area, as illustrated in Figure 11, and detailed in Table 4 below.

Figure 11 NNG Boundary Points around the Development Area considered for the LOS Assessment.



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Table 4 Summary of NNG Development Area Boundaries

Boundary Point	Latitude WGS84	Longitude WGS84	Blade Tip Height (m)
1	N56.254514°	W2.164969°	197
2	N56.212024°	W2.154251°	197

Boundary Point	Latitude WGS84	Longitude WGS84	Blade Tip Height (m)
3	N56.212526°	W2.233308°	197
4	N56.212768°	W2.271549°	197
5	N56.257986°	W2.327131°	197
6	N56.263775°	W2.334248°	197
7	N56.290508°	W2.337206°	197
8	N56.329192°	W2.297092°	197
9	N56.338526°	W2.275308°	197
10	N56.336184°	W2.248497°	197

A1.2 LOS Assessment Methodology

Over the distance between a PSR and a WTG, radar signal will attenuate (lose power) and be refracted and diffracted (change direction). The likely radar performance characteristics for the assessed radar station were predicted in order to model the radar signal. The intervening terrain and signal path between the assessed radars and the boundary points of the Development Areas of NNG have been modelled using ATDI ICS LT (version 3.9.92). For LOS analysis, the terrain path has been assessed to determine whether the intervening terrain is likely to be significant enough to prevent the WTGs/boundary points being detectable by radar. The direct LOS and the 1st Fresnel zone, an elliptical zone around the direct LOS where the radio waves remain strong, were assessed. Objects that infringe upon the Fresnel zone or the direct LOS will cause the signal to diffract and attenuate. The effect of diffraction means that the direct transmitted radio waves and those in the upper 1st Fresnel zone can still reach the WTG and be returned to the radar receiver, hence why it is not always obvious that terrain shielding is sufficient.

A1.3 LOS Assessment Results

The LOS assessment has been completed based on a selection of five boundary locations spread around the Development Area. The consented tip height 197 m above sea level (ASL) has been used for the analysis. Osprey concludes one of four opinions following radar LOS assessment on the potential detectability of a WTG/boundary point by radar:

- **Yes** - the location is highly likely to be detected by the radar: direct line of sight exists between the radar and the wind turbine/boundary point;
- **Likely** – the location is likely to be detected by the radar at least intermittently: direct line of sight skims terrain/only a small part of the 1st Fresnel zone is blocked;

- **Unlikely** – the location is unlikely to be detected by the radar but cannot rule out occasional detection: around 60% or more of the 1st Fresnel zone upper limit is blocked; and
- **No** – the location is unlikely to be detected by the radar as significant intervening terrain exists: entire 1st Fresnel zone of signal is blocked.

LOS diagrams have been produced illustrating the likely detectability of the NNG Offshore Wind Farm by the assessed radar stations. Within the diagram below, the signal propagation is modelled from the radar (far most left) to the WTG blade tip (far most right). The black line in the diagram with area underneath filled in dark brown represents the terrain profile between the radar and the boundary point. The red line in the diagram represents the direct LOS between the two locations. The orange ellipse around the direct line of sight represents the 1st Fresnel zone. The light blue and magenta lines are not relevant to this assessment. Figure 12 below shows the LoS profile between the Leuchars PSR and Point 1, the furthest point to the Leuchars PSR. This result is indicative of that for all of the points assessed; all locations are highly likely to be detected by the Leuchars PSR at an altitude of 197 m amsl. The assessment result is “Yes” for all Points.

Figure 12 LOS Profile between the Leuchars PSR and Point 1 at NNG..

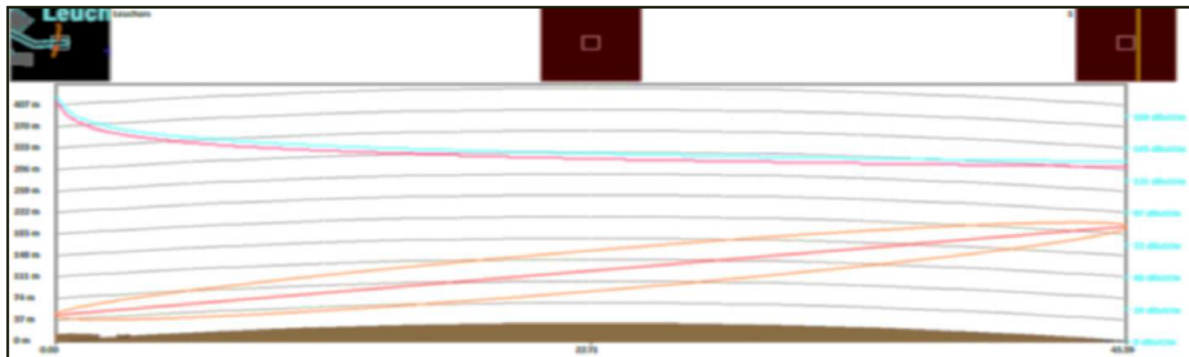


Table 5 Summary of Development Area Boundaries

Radar Station	Approx. Range to NNG Development Area Boundary	Assessment Result
Leuchars (PSR)	34 km / 18.4 NM	Yes (for all points)

A1.4 Conclusion

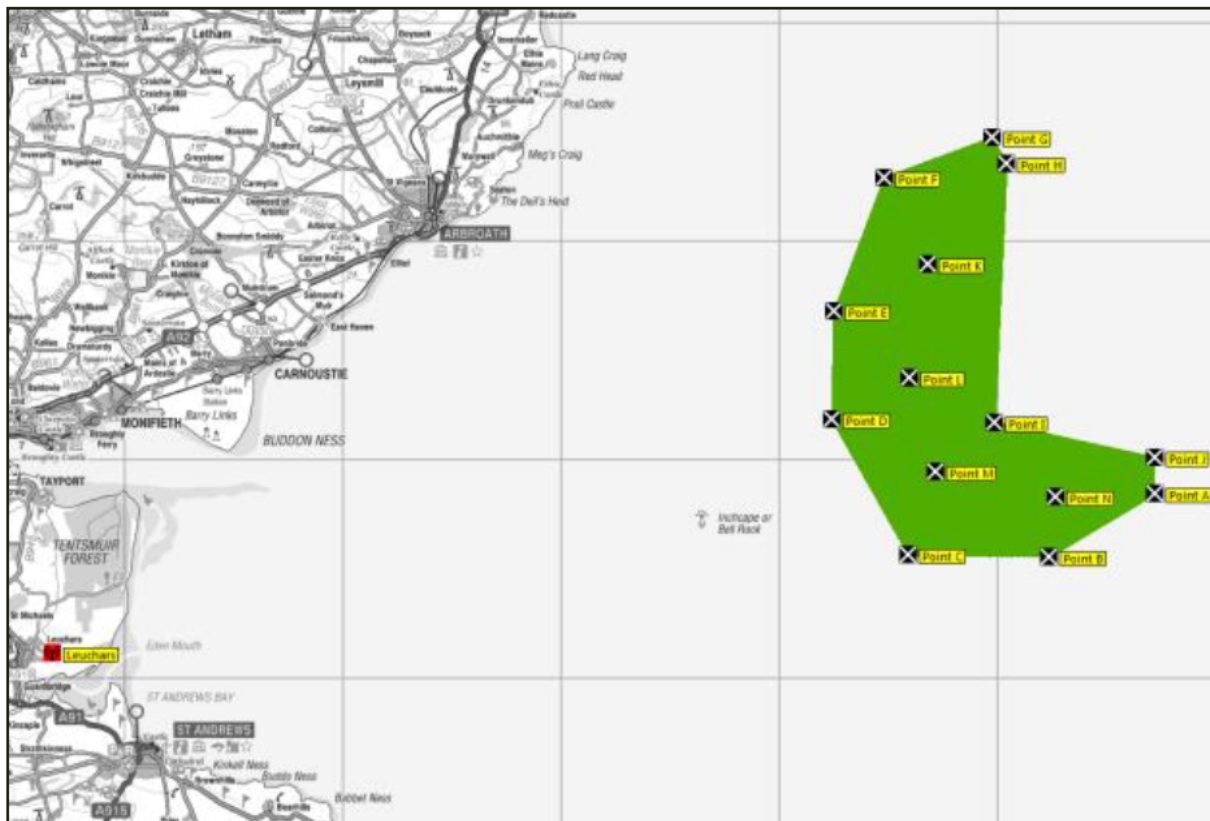
In conclusion, with a blade tip height of 197 m ASL, the boundary points for the NNG Development Area are highly likely to be detected by the PSR at Leuchars due to the lack of intervening terrain that exists between the radar and the proposed development. Although every care has been taken during the line of sight modelling and analysis process, modelling limitations and assumptions obviously lead conclusions to be based on theoretical results. The results are therefore indicative, and actual radar performance may differ from this analysis.

A2 Annex 2 IC Wind Farm Line of Sight Assessment

A2.1 Overview

This Annex contains the results of the radar Line Of Sight (LOS) assessment for the IC WTGs in respect of the PSR located at Leuchars. The analysis was carried out on representative points (labelled A to N) on the IC Development Area as illustrated in Figure 13 below and presented in Table 6 below. As explained in Annex A1 above for the NNG Development Area, the same methodology was applied to an assessment on the WTGs at IC.

Figure 13 IC Boundary Points around the Development Area considered for the LOS Assessment.



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Table 6 Summary of Development Area Boundaries

Boundary Point	Easting/Northing	Blade Tip Height (m)
Point A	397208/728451	215

Boundary Point	Easting/Northing	Blade Tip Height (m)
Point B	392328/725577	215
Point C	385902/725670	215
Point D	382411/731833	215
Point E	382484/736818	215
Point F	384813/742889	215
Point G	389723/744763	215
Point H	390371/743575	215
Point I	389830/731691	215
Point J	397183/730129	215
Point K	386775/738980	215
Point L	385940/733755	215
Point M	387142/729476	215
Point N	392637/728294	215

A2.2 LOS Assessment Results

The LoS assessment has been carried out based on 14 boundary locations and a tip altitude of 215 m amsl.

Figure 14 below shows the LoS profile between the Leuchars PSR and Point A, the furthest point to the Leuchars PSR. This result is indicative of that for all points assessed; all locations are highly likely to be detected by the Leuchars PSR at an altitude of 215 m amsl. The assessment result is “Yes” for all Points. [REDACTED]

Figure 14 LOS Profile between the Leuchars PSR and Point A at IC.

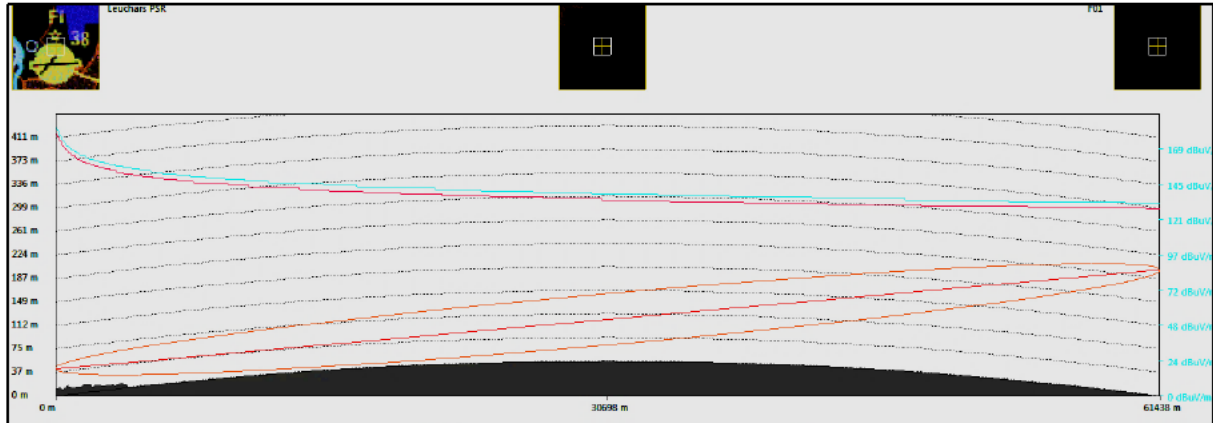


Table 7 Summary of Development Area Boundaries

Radar Station	Approx. Range to IC Offshore Development Area Boundary	Assessment Result
Leuchars (PSR)	37 km / 20.1 NM	Yes (for all points)

A2.3 Conclusion

In conclusion, with a blade tip height of 215 m ASL, the boundary points for IC are highly likely to be detected by the PSR at Leuchars due to the lack of intervening terrain that exists between the radar and the Development Area.

A3 Annex 3 Proposed TMZ Coordinates

A3.1 Overview

The co-ordinates for the proposed NNG and IC TMZ are provided in Table 8 below.

Table 8 Proposed TMZ Coordinates.

Point ID	Latitude	Longitude
1	N56° 10' 43.410"	W2° 9' 17.874"
2	N56° 10' 45.216"	W2° 14' 2.323"
3	N56° 10' 46.089"	W2° 16' 19.964"
4	N56° 11' 38.247"	W2° 19' 15.051"
5	N56° 14' 20.989"	W2° 22' 35.306"
6	N56° 14' 41.859"	W2° 23' 0.987"
7	N56° 15' 42.175"	W2° 23' 38.288"
8	N56° 17' 18.487"	W2° 23' 49.097"
9	N56° 17' 44.539"	W2° 23' 46.828"
10	N56° 31' 30.766"	W2° 20' 47.054"
11	N56° 32' 0.710"	W2° 20' 36.524"
12	N56° 32' 6.063"	W2° 20' 33.155"
13	N56° 32' 7.620"	W2° 20' 32.024"
14	N56° 35' 22.077"	W2° 18' 18.858"
15	N56° 36' 31.442"	W2° 16' 13.943"
16	N56° 37' 32.565"	W2° 11' 26.275"
17	N56° 36' 38.278"	W2° 6' 57.655"

Point ID	Latitude	Longitude
18	N56° 35' 59.903"	W2° 6' 19.580"
19	N56° 35' 59.718"	W2° 6' 19.391"
20	N56° 35' 56.701"	W2° 6' 16.547"
21	N56° 35' 54.763"	W2° 6' 14.744"
22	N56° 28' 42.096"	W1° 59' 37.191"
23	N56° 27' 49.678"	W1° 59' 13.838"
24	N56° 27' 4.984"	W1° 59' 12.660"
25	N56° 26' 24.530"	W1° 59' 18.402"
26	N56° 12' 14.704"	W2° 5' 46.226"
27	N56° 11' 58.966"	W2° 5' 55.480"

The proximity of TMZ to military and civilian aerodromes (measured from the aerodrome airfield reference point where provided) are provided below in Table 9.

Table 9 TMZ Proximity to Military and Civilian Aerodromes.

Aerodrome	Proximity of edge of TMZ (NNG) (NM)	Proximity of edge of TMZ (IC) (NM)
Leuchars	18.1	20
Dundee Airport	24.9	24.6
Perth Aerodrome	36.5	36.2
Aberdeen Airport	52	36.5
Edinburgh Airport	39.5	47.6
Arbroath Aerodrome (RM Condor)	18.4	11.4
Fife	28.9	35

Aerodrome	Proximity of edge of TMZ (NNG) (NM)	Proximity of edge of TMZ (IC) (NM)
Kingsmuir (Sorbie) Aerodrome	13.9	19.7
East Fortune Aerodrome	20.7	30.4
Archerfield Aerodrome	20.4	29.7

A4 Annex 4 Consultation Background and Methodology

A4.1 Background to the Consultation

NNGOWL and ICOL, as the sponsors of the proposed airspace change, are required to submit a case to the CAA to justify the change in airspace over the NNG and IC Offshore Wind Farms. In addition, as part of the CAA's ACP, it is the responsibility of NNGOWL and ICOL to consult with all relevant stakeholders who may be affected directly or indirectly by the proposal.

A4.2 Method of Consultation

The NNG and IC TMZ consultation was conducted in accordance with the principles set out in the Cabinet Office Code of Practice on Consultation²⁰, as required by the CAA.

Osprey, on behalf of NNGOWL and ICOL, prepared a comprehensive Consultation Document. Full details of the proposed change, including rationale, perceived impacts and the mitigation measures undertaken by NNGOWL, ICOL and the MOD, were provided in the Consultation Document.

A link to the Consultation Document was made available on the NNGOWL²¹ and ICOL²² websites. All consultees were notified by email detailing the consultation on how to access the Consultation Document.

Local aviation stakeholders were engaged at an early stage during the design process. Prior to the preparation of the Consultation Document, information briefs were provided to the following major stakeholders:

- Aberdeen Airport;
- Perth Airport;
- Dundee Airport;
- Fife Airport;
- Arbroath Aerodrome (Royal Marine Condor);
- Kingsmuir Aerodrome;
- Archerfield Aerodrome;
- East Fortune Aerodrome;
- Edinburgh Airport;
- Bond Offshore Helicopters;
- CHC Scotia Limited;
- Bristow Group; and
- Scottish ACC.

²⁰ <https://www.gov.uk/government/publications/consultation-principles-guidance>

²¹ NNG – <http://www.neartnagaoithe.com/TMZ-Consultation.asp>

²² IC - <http://www.inchcapewind.com/publications/TMZ/TransponderMandatoryZone>

The primary purpose of these briefs was to present the detail that will be incorporated into the Consultation Document to ensure there are no surprises for stakeholders when it comes to formal comment.

Full consultation commenced with wide circulation of the electronic Consultation Document to all identified stakeholders on 15th June 2015 on completion of the design process and environmental studies. The consultation process ran until 7th September. This allowed a minimum of twelve weeks required for formal consultation²³, recognised the number of Public Holidays during the period and provided scope for any unforeseen delays at the start, or any significant issues that might arise during the process.

Consultees were asked to consider the proposal and submit a response to NNGOWL and ICOL in writing or through a dedicated email address [REDACTED]

In order to promote maximum response, three reminder emails were sent to those consultees who had not yet provided a response to date. The first email reminder was sent, on 5th August 2015 (more than one month before the end of the consultation period), to all consultees listed at Annex **Error! Reference source not found.** who had not responded by that date. A second email reminder followed on 24th August to only consultees who had not responded by that date. A final email to all those consultees who had not responded by the end of consultation was sent providing a further day for response to the consultation request.

²³ The Cabinet Office Code of Practice on Consultation [Reference 2] and the CAA requirements specify a minimum period of 12 weeks for consultation.

A5 Annex 5 Stakeholder Consultee List

A5.1 Aviation Consultees

National Organisations (NATMAC)

Consultee	Also known As
Aircraft Owners and Pilots Association	AOPA UK
Airport Operators Association	AOA
Aviation Division Navy Command Headquarters	NCHQ
Aviation Environment Federation	AEF
BAE Systems Warton	BAES
British Air Transport Association	BATA
British Airline Pilots' Association	BALPA
British Airports Association	BAA
British Airways	BA
British Association of Balloon Operators	BABO
British Balloon and Airship Club	BBAC
British Business and General Aviation Association	BBGA
British Gliding Association	BGA
British Hang Gliding and Paragliding Association	BHPA
British Helicopter Association	BHA
British Microlight Aircraft Association	BMAA
British Model Flying Association	BMFA
British Parachute Association	BPA
Civil Aviation Authority	CAA SRG

Defence Airspace and Air Traffic Management (incl. the Military User Advisory Consultative Team)	DAATM (MUACTION)
Euro UAV Systems Centre Ltd	
European Low Fares Airline Association	ELFAA
General Aviation Safety Council	GASCo
Guild of Air Pilots and Air Navigators	GAPAN
Guild of Air Traffic Control Officers	GATCO
Headquarters Director Army Aviation	HQ DAAvn
Heavy Airlines	
Helicopter Club of Great Britain	HCGB
Light Aircraft Association	LAA
Light Airlines	
Low Fares Airlines	
Ministry of Defence	MOD
NATS (NSL)	NSL
NATS En-Route Ltd	NERL
PPL/IR Europe	PPL/IR
The British Business and General Aviation Association	BBGA
UK Airprox Board	UKAB
UK Flight Safety Committee	UKFSC
3 AF-UK/A3	

Aviation Consultees

Consultee
Bristow Group Aberdeen

CHC Scotia Limited Aberdeen
Bond Offshore Helicopters Aberdeen
British Association of Balloon Operators (BABO)
Eastern Airways
Fisheries Protection Agency
Helicopter Safety Steering Group
Loganair
NATS Limited Aberdeen
NHV UK (North Sea Helicopters)
The General Aviation Alliance

A5.2 Aerodromes / Local Aviation Consultees

Consultee
Leuchars EGQL SATCO
Dundee Airport EGPN SATCO
Perth Aerodrome EGPT SATCO
Aberdeen Airport AGPD SATCO
Edinburgh Airport EGPH SATCO
Arbroath Aerodrome RM Condor OC 662 Volunteer Gliding Squadron (VGS)
Fife Aerodrome EGPJ SATCO
Kingsmuir Aerodrome Sorbie
East Fortune Aerodrome
Archerfield Aerodrome

A5.3 Non-Aviation Consultees: National Bodies

Consultee
Friends of the Earth
Scottish National Heritage
Northern Lighthouse Board
Maritime and Coastguard Agency

A5.4 Civil Aviation Authority

Consultee	Also known As
Safety and Airspace Regulation Group	SARG
Safety and Airspace Regulation Group Head of Aerodrome & Air Traffic Standards Division	SARG AAA Manager Aerodromes
Safety and Airspace Regulation Group Flight Ops Division	SARG Flight Ops Division
Safety and Airspace Regulation Head of Airspace Regulation	SARG AAA Manager Airspace Regulation

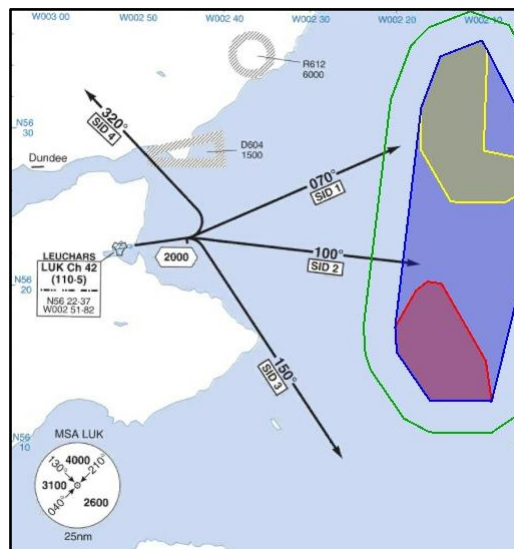
A6 Annex 6 Leuchars Standard Instrument Departure (SID) and Instrument Approach Procedures (IAPs)

A6.1 Overview

The following figures provide a visual indication of the location of the Leuchars departure and arrival procedures and the proposed TMZ.

A6.2 Leuchars Standard Instrument Departures (SID) – Runway 08

Figure 15 Leuchars SID Runway 08.

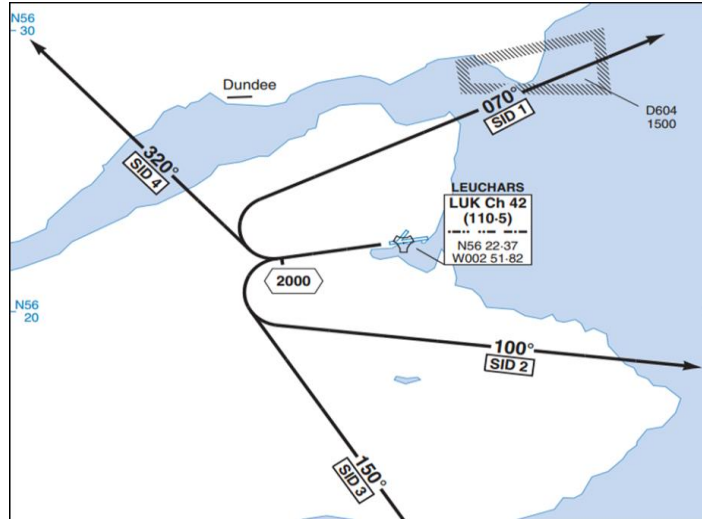


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A6.3 Leuchars SID – Runway 26

The TMZ would be located to the east of the published route outside of the area of the figure, however, the SIDs heading east will take departing aircraft utilising the SID towards the Development Areas. Figure 16 below illustrates the Runway 26 SID.

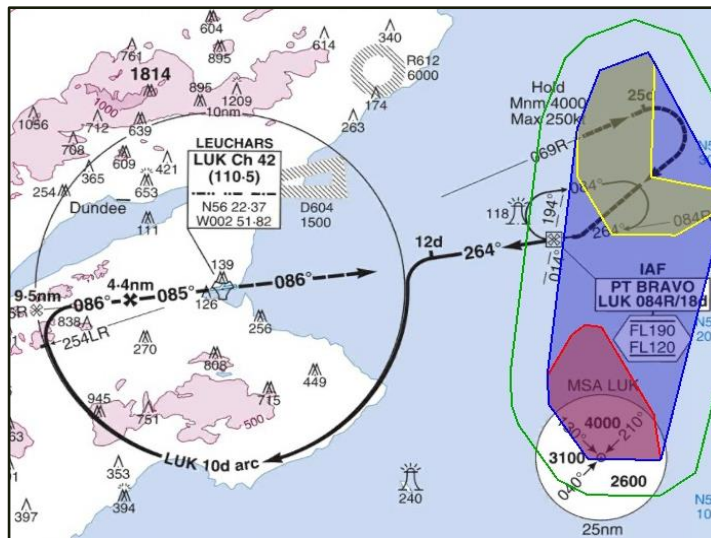
Figure 16 Leuchars SID Runway 26.



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A6.4 Leuchars HI TAC to Precision Approach Radar (PAR) – Runway 08

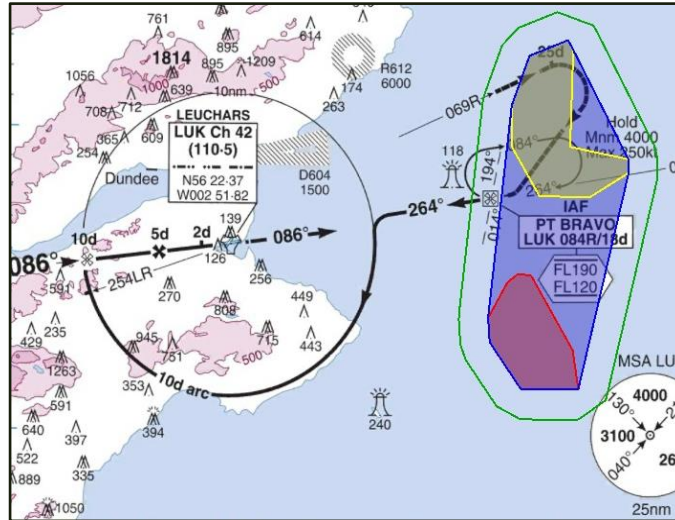
Figure 17 Leuchars HI TAC to PAR Runway 08.



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A6.5 Leuchars HI TAC – Runway 08

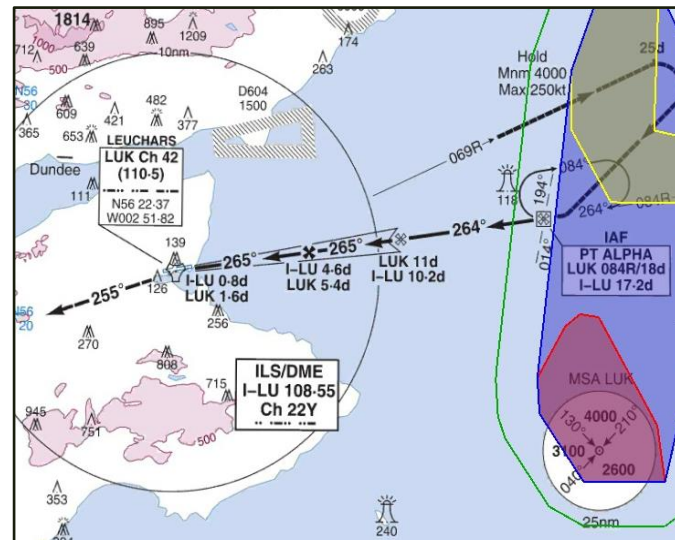
Figure 18 Leuchars HI TAC Runway 08.



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A6.6 Leuchars TAC or RDR to ILS/DME – Runway 26

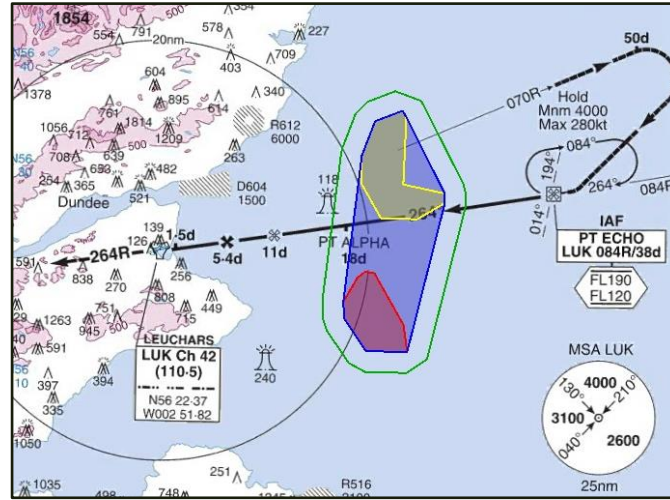
Figure 19 Leuchars TAC or RDR to ILS DME Runway 26.



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A6.7 Leuchars HI TAC – Runway 26

Figure 20 Leuchars HI TAC Runway 26.



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