



# Safety Case Part 2 – Design Substantiation

## Clash Gour Airspace Change Proposal

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# Executive Summary

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EDF Energy Renewables Ltd (EDFER) and Force 9 Energy (Force9) are jointly proposing the Clash Gour Wind Farm development, the site of which is located approximately 12 nautical miles (NM) southwest of Royal Air Force (RAF) Lossiemouth and 15 NM southeast of Inverness Airport. It has been identified that the presence of the Clash Gour Wind Farm will affect Air Traffic Service (ATS) operations at both locations, thereby requiring a change to the arrangements and procedures in the airspace over and in the vicinity of this Wind Farm.

As part of a scheme for mitigation of the predicted wind turbine effects on the RAF Lossiemouth and Inverness Airport Primary Surveillance Radars (PSR), EDFER and Force9 are progressing with an Airspace Change Proposal (ACP) in accordance with Civil Aviation Authority (CAA) Civil Aviation Publication CAP1616. Work to date on the ACP had revolved around a range of design options, but this has now been progressed down to the single option – the implementation of a Transponder Mandatory Zone (TMZ) over the Clash Gour Wind Farm site. Associated with this will be two-dimensional blanking of PSR returns within the boundary of the TMZ over the geographic definition of the Clash Gour site. The proposed airspace solution (TMZ) only needs to be operational at the point where turbines are being erected and are being brought into testing and operation. It is currently anticipated that turbines will be delivered to site and begin being erected in approximately Q3 2026, so the TMZ only needs to start operation from that point.

Civil Air Publication (CAP) 1616 requires a robust Safety Management process to be an integral part of any proposed airspace change. Moreover, Inverness Airport, RAF Lossiemouth and the Civil Aviation Authority Safety and Airspace Regulation Group (CAA SARG) require assurance that the changes introduced by this Airspace Change will result in safe air operations at all stages of the project lifecycle.

This document is the Safety Case Part 2 (Design Substantiation) for the Clash Gour TMZ and demonstrates that the ATS at both Inverness Airport and RAF Lossiemouth achieves an acceptable level of safety, after the introduction of the Clash Gour TMZ into operational use and throughout its in-service usage. At this stage there is some information missing which is crucial to the completion of the safety assurance document set, i.e. the Part 2 (this document) and Parts 3 & 4.

This is achieved by presenting the evidence that underpins the Safety Argument and demonstrates compliance with the Safety Objectives and Safety Requirements that were derived in the Safety Case Part 1.

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# 1 Introduction

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## 1.1 Background

EDF Energy Renewables Ltd (EDFER) and Force 9 Energy (Force9) are jointly proposing the Clash Gour Wind Farm development, the site of which is located approximately 12 nautical miles (NM) southwest of Royal Air Force (RAF) Lossiemouth and 15 NM southeast of Inverness Airport. The presence of the Clash Gour Wind Farm will affect Air Traffic Service (ATS) operations at both locations, thereby requiring a change to the arrangements and procedures in the airspace over and in the vicinity of this Wind Farm.

As part of a scheme for mitigation of the predicted wind turbine effects on the RAF Lossiemouth and Inverness Airport Primary Surveillance Radars (PSR), EDFER and Force9 are progressing with an Airspace Change Proposal (ACP) in accordance with Civil Aviation Authority (CAA) Civil Aviation Publication CAP1616 [Ref. 01]. Work to date had revolved around a range of design options, but this has now been progressed down to the single option – the implementation of a Transponder Mandatory Zone (TMZ) over the Clash Gour Wind Farm site.

The proposed airspace solution (TMZ) only needs to be operational at the point where turbines are being erected and are being brought into testing and operation. It is currently anticipated that turbines will be delivered to site and begin being erected in approximately Q3 2026, so the TMZ only needs to start operation from that point.

## 1.2 Impact of Wind Turbines on Radar

The effects of wind turbines on aviation interests have been widely publicised but the primary concern is one of safety. There are innumerable subtleties in the actual effects of the wind turbines, but there are two dominant scenarios, that lead to objections from aviation stakeholders:

- Physical: Wind turbines can present a physical obstruction at or close to an aerodrome.
- Radar/Air Traffic Services: Turbine clutter appearing on radar display can affect the safe provision of air traffic services as it can mask unidentified aircraft from the air traffic controller and/or prevent him from accurately identifying aircraft under his control. In some cases, radar reflections from the turbines can affect the performance of the radar system itself.

The most significant impact from wind turbines on the RAF Lossiemouth and Inverness Airport PSRs, and its operational environment, is the risk of wind turbine generated radar returns causing false target generation and track seduction. False or seduced tracks (which in many cases are indiscernible from real tracks) may cause disruption by forcing air traffic controllers to take action in order to maintain radar separation in accordance with standards mandated by the Civil Aviation Authority (CAA) when providing an Air Traffic Service in accordance with UK FIS. Any loss of radar performance in this area along with any misleading or unnecessarily

distracting displayed radar information have the potential to erode levels of efficiency and effectiveness.

### 1.3 Purpose and Scope

The Civil Aviation Authority (CAA) publish guidance in the form of Civil Air Publication (CAP) 1616 Airspace Design [Ref. 01], aimed at sponsors seeking to formally change the way airspace or procedures are used.

CAP 1616 states that a Safety Assessment is one of four key compliance areas that the CAA will review when making its decision at Stage 5 of the seven-stage airspace change process: The other three compliance areas being Operational and Technical, Consultation Process and Engagement Activities and Environmental Assessment.

The purpose of this Safety Case Report (SCR) Part 2 (design substantiation) is to demonstrate that the Air Traffic Service (ATS) at both RAF Lossiemouth and Inverness Airport achieves an acceptable level of safety after the introduction of the Clash Gour TMZ, both in its transition into operational use and throughout its in-service usage.

This is achieved by presenting the evidence that supports the stated safety argument and demonstrates compliance with the safety objectives and safety requirements that were derived in the Safety Case Part 1 [Ref. 03].

### 1.4 Structure of this Document

This document is structured as outlined below:

- Section 1 – Introduction
- Section 2 – Safety Objectives and Safety Requirements
- Section 3 – Airspace Definition
- Section 4 – Safety Argument Satisfaction
- Section 5 – Design dependencies
- Section 6 – Assumptions, Limitations and Shortcomings
- Conclusions and Recommendations

## 2 Safety Objectives and Safety Requirements

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### 2.1 Safety Objectives

The Safety Objectives for the Clash Gour TMZ implementation were derived from a Hazard Identification meeting and the associated analysis recorded in the Safety Case Part 1 [Ref. 03].

It is not practical to derive numerical Safety Objectives for the design of the TMZ due to the many unpredictable and unquantifiable factors in the operational environment, not least the inherent nature of Class G airspace and the use of that airspace.

Successful use of the TMZ will be reliant upon the serviceability of the cooperative surveillance system of both RAF Lossiemouth (Controlling Authority) and Inverness Airport.

### 2.2 Safety Requirements

A set of Safety Requirements were derived in the Safety Case Part 1 [Ref. 03] by identifying mitigations that manage the risks presented by the hazards.

A consolidated list of these identified Safety Requirements is shown below in Table 1.



No.	Safety Requirement Description	Related Hazard/s
SR01	Consideration shall be given to other windfarms and potential solutions that can be worked collaboratively with other wind farm developers.	Haz01
SR02	Clutter shall be treated as unknown traffic; ATCO will take immediate avoiding action dependent on the radar service being provided.	Haz01
SR03	There shall be Cooperative surveillance coverage over the location of the TMZ.	Haz01
SR04	ATC shall have procedures to address turbine clutter on the radar display.	Haz01
SR05	Sympathetic design of the TMZ should not result in “choke points” in the surrounding Class G airspace.	Haz03
SR06	The TMZ shall be promulgated in the UK IAIP.	Haz03, Haz04
SR07	ATC shall have procedures to address unauthorised access of the TMZ (if detected).	Haz03, Haz04
SR08	TMZ size shall be kept to a minimum (Proposed TMZ is sized to cover the turbines within the development area).	Haz03, Haz11
SR09	There shall be an ability for a non-transponder to request access of the TMZ from the controlling authority.	Haz03
SR10	ATC shall have the tactical ability to draw a TMZ overlay on the radar display.	Haz05
SR11	ATCO shall receive familiarisation and/or training on the TMZ implementation and associated procedures.	Haz05
SR12	There should be alternative ‘support systems’ that display the location of the TMZ.	Haz05
SR13	ATC shall have procedures to address the loss of TMZ demarcation on the radar display.	Haz05
SR14	Radar display maps shall be thoroughly checked before being used.	Haz06
SR15	Primary Echoes shall be used to indicate validity of PSR data.	Haz06
SR16	Inverness Airport ATC shall cease all radar services if the PSR is lost.	Haz07, Haz08
SR17	If PSR is lost, RAF Lossiemouth shall downgrade radar service to SSR alone.	Haz07, Haz08

No.	Safety Requirement Description	Related Hazard/s
SR18	Inverness Airport ATC shall cease all radar services if the SSR is lost.	Haz09
SR19	ATC shall have Loss of SSR procedures.	Haz09, Haz10, Haz11
SR20	Air Navigation Service Providers (ANSPs) shall co-ordinate to allow tactical control of aircraft in the TMZ to maintain separation.	Haz09, Haz11
SR21	Far Field Monitor shall be used to indicate validity of SSR data.	Haz10

Table 1 - List of Derived Safety Requirements

### 2.3 Statutory & Regulatory Requirements

A key element of the ACP is the need to demonstrate that the proposed changes comply with the Airspace and Infrastructure requirements as set out in Appendix F of CAP 1616 [Ref. 01]. In addition, compliance must be shown with the CAA 'Policy for Radio Mandatory Zones and Transponder Mandatory Zones' [Ref. 13] published 13 January 2022.

These requirements are derived from the Single European Sky (SES) Regulations, ICAO Standards and Recommended Practises (SARPs) and European Civil Aviation Conference (ECAC)/EUROCONTROL requirements; the list also includes additional requirements to satisfy UK policy.

## 3 Airspace Definition

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### 3.1 Background

This section describes the background for the need for the proposed TMZ by providing the operational context of the Clash Gour Wind Farm and its impact on the provision of a safe and effective ATS at RAF Lossiemouth and Inverness Airport.

### 3.2 Airspace Structure around Clash Gour Wind Farm

In the UK Flight Information Region (FIR) and Upper Information Region (UIR), airspace is classified as A to G in accordance with International Civil Aviation Organisation (ICAO) standards. Airspace Classes A to E are variants of Controlled Airspace (CAS) in which aircraft require an Air Traffic Control (ATC) clearance. Class G Airspace is designated as uncontrolled airspace in which aircraft can operate without any ATC clearance being required, there is no Class B or F airspace within the UK.

The various airspace sectors in the region of the Clash Gour Wind Farm are described and categorised as follows and where applicable, controlling authority is identified:

- Class G Airspace up to Flight Level (FL) 195 immediately overhead the wind farm (approximately 19,500 feet (ft) above mean sea level (amsl)). Aircraft can operate in this area of uncontrolled airspace without any requirement to be in communication with an ATC Unit. Pilots operating in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions.
- Temporary Reserved Area (TRA) 008B is established from FL 195 up to FL 245. Activity taking place within the TRA 008B includes Air Combat and training exercises and supersonic flight. Air Defence Units and other agencies using radar data supplied from the Buchan Air Defence Radar (ADR) (which does not theoretically detect the wind turbines) are responsible for navigation services and support to aircraft activity within the TRA during promulgated activity times.
  - Note: Outside the times that TRA 008B is active, the airspace reverts to Class C Controlled Airspace (CAS) where NATS is responsible for the provision of navigation services to aircraft in transit above FL 195 over the development area.
- Class C CAS is established above FL 245; all aircraft operating in this airspace must be in receipt of an air traffic service from NATS, military controllers located at a NATS Area Control Centre (ACC) or under the control of Military Air Defence.
  - Note: Directly above the site is TRA Gliding (G) Scottish Area North where gliders may operate under specific conditions above FL 195. TRA (G) is established to support the region's gliding operations and can be activated within a specific notification timeframe where required.

In addition, the Clash Gour wind turbines are located within Low Flying Area (LFA) 14, the largest LFA in the UK, covering mainland Scotland north of the Central Region, the Western Isles, Orkney and Shetland.

### 3.3 Impact on Current Operations

The provision of an ATS provided by RAF Lossiemouth could be detrimentally affected. The clutter that would be associated with the wind farm would be in an area where the provision of ATS to aircraft departing from and approaching the aerodrome would take place. In addition, aircraft climbing out and descending into the military low-level system, and aircraft receiving a Lower Airspace Radar Service (LARS)<sup>1</sup> will be affected in the area of the proposed development.

Inverness Airport provides a vital and effective national and international flight network to both the local community and wider Highlands area. The Inverness PSR is utilised to support the provision of ATS to aircraft operating to/from the Airport and to aircraft requesting a service within the declared areas of radar and radio coverage. The introduction of wind turbines at Clash Gour has the potential to cause unacceptable interference to the Inverness Airport PSR thus impacting the safe provision of an ATS.

### 3.4 Proposed Airspace Change - TMZ

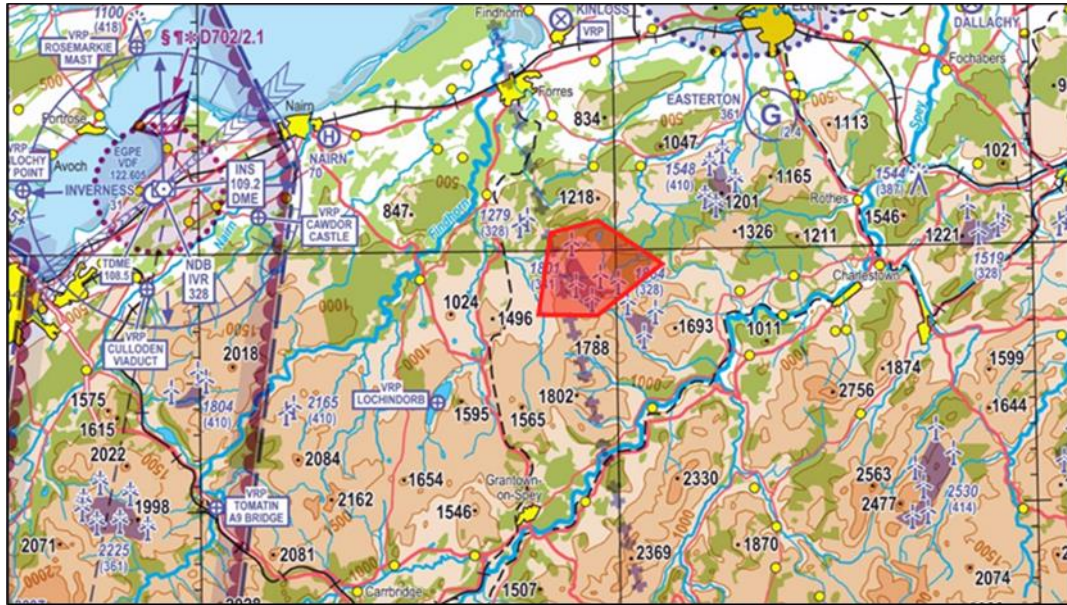
The proposal is for a TMZ with associated PSR blanking over and in the immediate vicinity of the Clash Gour Wind Farm.

A TMZ is airspace of defined dimensions wherein aircraft wishing to enter or fly within the defined area, will be required to have, and operate Secondary Surveillance Radar (SSR) equipment or receive authorisation (clearance) to enter, via radio, from the TMZ Controlling Authority – RAF Lossiemouth.

The concept of Transponder Mandatory Airspace, in the form of a TMZ, has been developed by the CAA to cater for overriding safety reasons where the airspace classification would not normally require aircraft to carry a transponder (note the airspace remains Class G). This SSR equipment must include a pressure altitude reporting transponder capable of operating in Mode A and Mode C and have the capability and functionality prescribed for Mode S Elementary Surveillance. A pilot wishing to operate in a TMZ without such conspicuity equipment may be granted access subject to specific arrangements agreed with the TMZ Controlling Authority – RAF Lossiemouth.

The area of the proposed airspace change is shown in Figure 1, with the Clash Gour TMZ highlighted as the red area on the map. The TMZ, when implemented under this airspace change over this area, and when combined with associated PSR blanking, would remove clutter from the radar display screen, whilst allowing the area to remain a known traffic environment for the Air Traffic Control Officer (ATCO) through the provision of SSR data.

<sup>1</sup> LARS is available to any aircraft operating outside CAS, from ground level up to FL100, within radio and/or radar limits (approximately 40 NM radius of RAF Lossiemouth).



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Figure 1 - Clash Gour TMZ design

The design of the Clash Gour TMZ is a simplified polygon surrounding the locations of 3 wind turbine arrays, comprising Clash Gour, Berry Burn and Berry Burn 2 wind farms; due to the proximity of the Berry Burn and Berry Burn 2 Wind Farm sites to the Clash Gour site, the TMZ also encompasses both of these wind farms.

This was presented as Option 7(E) during the Consultation Phase, Stage 3 of the ACP.

This option has a simplified boundary shape and aircraft intending to enter the TMZ shall be required to be equipped with and operate SSR transponder equipment or to have established two-way radio communications with the TMZ Controlling Authority (RAF Lossiemouth) before entry. The TMZ will extend from the surface to FL195 (approximately 19,500ft).

### 3.5 TMZ Implementation

The objective of establishing the TMZ is not to prevent aircraft from operating near the turbines, merely to require that they operate a transponder, or are in two-way radio contact with the Controlling Authority (RAF Lossiemouth), when so doing. Notwithstanding, there is always potential for a non-transponder equipped aircraft to inadvertently enter the TMZ; thereby becoming invisible to the radar controller. This would pose a potential threat to other flights under the jurisdiction of the controller; a non-transponding aircraft entering the TMZ would simply disappear from the controller's display if the TMZ was to be restricted to the limits of the turbine array. Once a non-transponding aircraft has entered the TMZ, any opportunity to provide separation from other aircraft is lost.

The initial preferred solution was to establish a TMZ with PSR blanking and a buffer zone not exceeding 2.0 NM around the Clash Gour Wind Farm. The reason for the 2NM buffer is to recognise the time PSR requires to pick up an aircraft track (typically 4 to 6s per sweep with the track displayed on the 5th sweep). This considered a scenario where a military fast jet, which are permitted to exceed 250

kts (4NM/min) the RAF Lossiemouth PSR would require approximately 2.0 NM to create a coherent foreground track.

However, with due cognisance of the Walney Transponder Mandatory Zone Post Implementation Review [Ref. 05], the preferred solution taken forward for the Clash Gour TMZ removed the 2NM buffer zone, and thus the TMZ design bounds the area defined by the turbines sited at the Clash Gour Wind Farm.

### 3.6 TMZ Operating Hours

Under normal UK Integrated Aeronautical Information Package (IAIP) arrangements, the operating hours of a particular airspace segment established for ATS purposes are linked to the operating hours of the associated ATS Unit. In this case it will be those of the nominated Controlling Authority – RAF Lossiemouth.

H24 (based on current promulgated operation of Moray TMZ, where RAF Lossiemouth are the Controlling Authority)

This information will be captured within the UK IAIP, detailing the frequency to be used, the boundary of the Clash Gour TMZ and timings.

### 3.7 PSR Performance in the TMZ

The wind turbine clutter will need to be removed from the ATC displays. This will be achieved by attenuating each of the radar's filters over the footprint of the windfarm development area. No PSR targets will be declared within the defined area and therefore the potential clutter associated with the wind turbine developments will not be presented to the controller.

## 4 Safety Argument Satisfaction

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### 4.1 Overview

This section details the Safety Claims for the Clash Gour TMZ ACP and the supporting arguments that show that the claims are valid. Additionally, the evidence to substantiate these claims is detailed, along with the rationale as to why the evidence is deemed sufficient and valid.

This version of the Safety Argument has evolved from the previous one stated in the SPP [Ref. 02] and earlier version of the Safety Case Part 1, which was solution agnostic. Whereas this revised version recognises that the solution being taken forward is in the form of the Clash Gour TMZ, and associated PSR blanking.

### 4.2 Top Level Safety Claim

The overarching, top-level Safety Claim (Claim 0) is that the implementation of the proposed Clash Gour TMZ shall permit the continued provision of an acceptably safe ATS to be provided from Inverness Airport and RAF Lossiemouth, throughout its in-service usage.

In the context of this project, an acceptable level means a Risk Classification in accordance with CAP760 [Ref. 04] that is either ACCEPTABLE or REVIEW.

Definitions of ACCEPTABLE and REVIEW are given in CAP760 [Ref. 04] as follows:

- **Acceptable** - the consequence is so unlikely or not severe enough to be of concern. The risk is tolerable, and the Safety Objective has been met. However, consideration should be given to reducing the risk further to As Low As Reasonably Practical (ALARP) to further minimise the risk of an accident or incident.
- **Review** - the consequence and/or likelihood is of concern; measures to mitigate the risk to ALARP should be sought. Where the risk still lies within the 'Review' region after ALARP risk reduction has been undertaken, then the risk may be accepted provided that the risk is understood and has the endorsement of the individual ultimately accountable for safety within the organisation.

### 4.3 Subsidiary Claims

To demonstrate Claim 0 is valid, it is necessary to support it with two subsidiary claims, namely:

- Claim 1: The provision of an ATS within the extant airspace is acceptably safe.
- Claim 2: The provision of an ATS within the revised airspace will be acceptably safe.

The following paragraphs develop the underpinning Arguments and Evidence that support these claims.

## 4.4 Claim 1 Context

Claim 1 represents the current operational structure of the airspace and establishes the baseline against which all further claims are substantiated. It demonstrates that the in-use Concept of Operations is acceptably safe and that any local issues are understood; importantly it makes no statement about assuring future safety.

Ref	Argument	Evidence	Rationale
1.1	RAF Lossiemouth is regulated by the MAA	Defence Aerodrome Manual (DAM).	The MAA has full oversight of all Defence aviation activity and undertakes the role of the single regulatory authority responsible for regulating all aspects of Air Safety across Defence.
1.2	Safety is proactively managed at RAF Lossiemouth	Safety related ATS procedures, safety monitoring processes and safety reporting protocols detailed in the DAM.	Adherence to proven procedures can reduce likelihood of an incident.  Effective safety oversight can correct reductions in safety before an incident can occur.
1.3	The current ATS at RAF Lossiemouth achieves a tolerable level of service level incidents.	Aerodrome Reporting is detailed in the DAM.	Any significant deficiencies are likely to be detected.
1.4	Inverness Airport is a UK certified Airport	CAA UK certificated aerodromes website [Ref. 06]	CAA has statutory responsibility to regulate ATS safety within the UK under the Air Navigation Order (ANO2016).
1.5	Safety is proactively managed at Inverness Airport	Safety related ATS procedures are set out in the Manual of Air Traffic Services (MATS) Part 1 [Ref. 07], Inverness Airport MATS Part 2 [Ref. 08] and the HIAL Safety Management System [Ref. 09].	Adherence to proven procedures can reduce the likelihood of an incident.  Effective safety oversight can correct reductions in safety before an incident can occur.
1,6	The current ATS at Inverness Airport achieves a tolerable level of service-level incidents	Safety Monitoring Reports (Mandatory Occurrence Reports) in accordance with HIAL SMS.	Any significant deficiencies are likely to be detected.

Table 2 - Claim 1 Substantiation



## 4.5 Claim 2 Context

The introduction of the Clash Gour TMZ will require that any change in the current operational characteristics and aviation environment must be identified, as must the practises and procedures that manage any safety risk arising from this change. This includes any revised interaction required of the nominated controlling authority (RAF Lossiemouth), interactions with other interested parties, e.g. other airspace users, adjacent airports and ANSPs.

It is imperative that the transition into service of the Clash Gour TMZ is subject to a managed process that ensures all the safety claims, relating to the ATS, remain valid from the point of first use and throughout its operational use. This includes assurance that all external stakeholders are prepared for the revised operational environment.

Claim 2 is supported by four sub-claims:

- Claim 2.1: All hazards pertaining to the introduction of the Clash Gour TMZ have been identified and understood, including those associated with airspace users, adjacent airports, and aviation organisations.
- Claim 2.2: The submitted design of the Clash Gour TMZ is deemed acceptably safe and agreed by the CAA.
- Claim 2.3: The Programme for transitioning the Clash Gour TMZ into operational use is planned and acceptably safe.
- Claim 2.4: The use of the Clash Gour TMZ will remain acceptably safe during its operational life.

### 4.5.1 Claim 2.1

All hazards pertaining to the introduction of the Clash Gour TMZ have been identified and understood, including those involving other airspace users, adjacent airports, and aviation organisations.

Ref	Argument	Evidence	Rationale
2.1.1	All credible functional hazards and mitigations have been identified.	Hazard Identification Process: <ul style="list-style-type: none"> <li>• HazID Brief [Ref. 10].</li> <li>• HazID Record [Ref. 11].</li> </ul> Consultation with external Stakeholders [Ref. 12].	Hazard Identification conducted with suitably qualified personnel. Hazard gathering should therefore be comprehensive.
2.1.2	Safety Requirements have been specified that reduce the risks associated with the hazards to a level that is Acceptable or Review (in accordance with the SMS of the Controlling Authority – <i>RAF Lossiemouth</i> ).	Safety Requirements specified in the Safety Case Part 1 [Ref. 03], as an output of the HazID.	Any mitigations, control measures or assumptions identified during the HazID are captured as Safety Requirements, such that they can be managed appropriately.

Table 3 - Claim 2.1 Substantiation

#### 4.5.2 Claim 2.2

The submitted design of the Clash Gour TMZ is deemed acceptably safe and agreed by the CAA.

Ref	Argument	Evidence	Rationale
2.2.1	The scope and purpose of the TMZ is accurately defined and consistent with the Operational Requirement.	Airspace Change Proposal - Section 3 of this document. Clash Gour TMZ Consultation document [Ref. 12] includes: <ul style="list-style-type: none"> <li>• The background and justification for the proposed change.</li> <li>• An assessment of the mitigation options available.</li> <li>• An initial assessment of the impact(s) of the proposed change.</li> </ul>	The Clash Gour TMZ is defined and functionally fit for purpose.
2.2.2	A formal Safety Programme has been undertaken, in accordance with a recognised (and approved) Regulatory Standard	Clash Gour ACP SPP [Ref. 02] developed in accordance with the SMS of the Controlling Authority ( <i>RAF Lossiemouth</i> ).	Evidence of an approved and managed process increases confidence in progression of safety activities and claims.

Ref	Argument	Evidence	Rationale
2.2.3	Requirements have been defined and endorsed to ensure Regulatory compliance	Evidence of Adherence to relevant sections of CAP 1616 in Safety Case. Acceptance of Safety Case document pack by the CAA.	Establishes baseline for subsequent Assurance that the Regulatory requirements have been met.
2.2.4	The design of and implementation of the TMZ satisfies all the derived Safety Objectives and Requirements	Compliance with the derived Requirements is detailed in sections 4.6 of the Safety Case Part 2 (this document). Compliance with regulatory requirements – Section 4.7.	Compliance demonstrated by formal analysis that has been conducted with suitably qualified personnel and involving all key Stakeholders. Design and related procedures are demonstrated to function as intended and without significant safety issues
2.2.5	Where practicable, identified hazards have been eliminated, or deemed acceptable and ALARP.	Safety Requirements were defined in the Safety Case Part 1 [Ref. 03]. Compliance with these Safety Requirements (as detailed in sections 4.6 and 4.7 of the Safety Case Part 2 (this document) either eliminates the hazards or reduces the associated risks to an acceptable level.	Elimination/ minimisation of hazards through airspace design and existing or planned mitigation

Table 4 - Claim 2.2 Substantiation

#### 4.5.3 Claim 2.3

The Programme for transitioning the TMZ into operational use is planned and acceptably safe.

This will be the subject of compliance evidence presented in the Safety Case Part 3.

#### 4.5.4 Claim 2.4

The use of the TMZ will remain acceptably safe during its operational life.

This will be the subject of compliance evidence in the Safety Case Part 4.

### 4.6 Compliance with Derived Safety Requirements

Compliance to each of the Derived Safety Requirements is summarised below in Table 5.

No.	Safety Requirement Description	Compliance	Compliant
SR01	Consideration shall be given to other windfarms and potential solutions that can be worked collaboratively with other wind farm developers.	No other new developments identified.  The design of the simplified polygon, and to minimise the bounded area of the Clash Gour TMZ, encompasses the adjacent Berry Burn and Berry Burn 2 wind farms.	Yes
SR02	Clutter shall be treated as unknown traffic; ATCO will take immediate avoiding action dependent on the radar service being provided.	Extant Air Traffic Procedure:  Inverness Airport (MATS Part 2 – <b>reference tbc.</b>  RAF Lossiemouth (ATCOB) – <b>reference tbc.</b>	TBC
SR03	There shall be Cooperative surveillance coverage over the location of the TMZ.	SSR coverage at both Inverness Airport and RAF Lossiemouth.	Yes
SR04	ATC shall have procedures to address turbine clutter on the radar display.	Inverness Airport extant procedures in accordance with:  <ul style="list-style-type: none"> <li>• MATS Part 1 (CAP493) Section 1, Chapter 6, Part 18 – Clutter on the Situation Display.</li> <li>• MATS Part 1 Section 3, Chapter 2, Part 16.</li> </ul> <b>Add in specific extant RAF Lossiemouth procedures.</b>	Partial
SR05	Sympathetic design of the TMZ should not result in “choke points” in the surrounding Class G airspace.	Polygon bounding the Clash Gour TMZ kept to minimal size whilst still encompassing the wind farm area.	Yes
SR06	The TMZ shall be promulgated in the UK IAIP.		TBC in Safety Case Part 3
SR07	ATC shall have procedures to address unauthorised access of the TMZ (if detected).		TBC in Safety Case Part 3

SR08	TMZ size shall be kept to a minimum (Proposed TMZ is sized to cover the turbines within the development area).	As detailed in section 3.4.	Yes
SR09	There shall be an ability for a non-transponder to request access of the TMZ from the controlling authority.		TBC in Safety Case Part 3
SR10	ATC shall have the tactical ability to draw a TMZ overlay on the radar display.		TBC in Safety Case Part 3
SR11	ATCO shall receive familiarisation and/or training on the TMZ implementation and associated procedures.		TBC in Safety Case Part 3
SR12	There should be alternative 'support systems' that display the location of the TMZ.		TBC in Safety Case Part 3
SR13	ATC shall have procedures to address the loss of TMZ demarcation on the radar display.		TBC in Safety Case Part 3
SR14	Radar display maps shall be thoroughly checked before being used.	Extant Air Traffic Procedures: Inverness Airport (MATS Part 2 – <b>reference tbc.</b> RAF Lossiemouth (ATCOB) – <b>reference tbc.</b>	TBC in Safety Case Part 3
SR15	Primary Echoes shall be used to indicate validity of PSR data.	Part of normal daily checks. Will need to confirm the presence of Permanent Echoes on PSR systems at time of implementation: Inverness Airport. RAF Lossiemouth	Partial
SR16	Inverness Airport ATC shall cease all radar services if the PSR is lost.	Extant Air Traffic Procedures: Inverness Airport (MATS Part 2 – <b>reference tbc.</b>	TBC
SR17	If PSR is lost, RAF Lossiemouth shall downgrade radar service to SSR alone.	Extant Air Traffic Procedure: RAF Lossiemouth (ATCOB) – <b>reference tbc.</b>	TBC

SR18	Inverness Airport ATC shall cease all radar services if the SSR is lost.	Extant Air Traffic Procedure: Inverness Airport (MATS Part 2 – <b>reference tbc.</b>	TBC
SR19	ATC shall have Loss of SSR procedures.	Extant Air Traffic Procedures: Inverness Airport (MATS Part 2 – <b>reference tbc.</b> RAF Lossiemouth (ATCOB) – <b>reference tbc.</b>	TBC
SR20	Air Navigation Service Providers (ANSPs) shall co-ordinate to allow tactical control of aircraft in the TMZ to maintain separation.		TBC in Safety Case Part 3
SR21	Far Field Monitor shall be used to indicate validity of SSR data.	Extant equipment fit to be confirmed with: Inverness Airport. RAF Lossiemouth.	TBC

Table 5 - Compliance with Derived Safety Requirements

#### 4.7 Compliance with Statutory and Regulatory Requirements

As stated in the Safety Case Part 1, the key element of the ACP is that the Clash Gour TMZ is established in accordance with the requirements of the CAA's ACP (CAP 1616). CAP 1616 [Ref 01] sets out the specific requirements for airspace change proposals. Further demonstration is required to show compliance with the CAA 'Policy for Radio Mandatory Zones and Transponder Mandatory Zones'. The significant regulatory requirements in that policy [Ref. 13] that are applicable to the Clash Gour TMZ, specifically this Safety Case Part 2 is:

- RMZ/TMZ should be of the minimum dimensions practicable to meet the safety requirements identified by the change Sponsor.

Thus, the primary matters for consideration in the development of the Clash Gour 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 above considerations are reflected in the TMZ design, as detailed in 3.4 and compliance with the Safety Requirements detailed in Table 5 above.

Other areas of the RMZ/TMZ policy [Ref. 13] will be covered in the Safety Case Part 3.

## 5 Design Dependencies

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### 5.1 Technical Dependencies

The successful operation of the Clash Gour TMZ is dependent upon:

- Serviceability of the RAF Lossiemouth SSR.
- Serviceability of the Inverness Airport SSR.
- Successful blanking (total suppression) of the PSR data across the 'footprint' of the Clash Gour wind turbines.

### 5.2 Operational Dependencies

The successful operation of the Clash Gour TMZ is dependent upon:

- The nomination of the TMZ Controlling Authority (RAF Lossiemouth).
- Timely promulgation of the Clash Gour TMZ in the AIP.
- Consultation with local stakeholders.
- Approval to operate 'SSR only' in the area of airspace defined as the Clash Gour TMZ.

## 6 Assumptions, Limitations and Shortcomings

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### 6.1 Assumptions

The Controlling Authority for the TMZ shall be RAF Lossiemouth.

### 6.2 Limitations

This Safety Case Part 2 is limited to the introduction of a TMZ and associated PSR blanking to mitigate against the adverse effects of the Clash Gour wind farm on the Inverness Airport PSR and RAF Lossiemouth PSR.

The application of a TMZ and associated PSR blanking for any other wind farm developments must be subject to a separate safety assurance programme.

### 6.3 Shortcomings

The Clash Gour TMZ and associated PSR blanking effectively masks the impacts of wind turbines on the PSR performance at Inverness Airport and RAF Lossiemouth. It does not mitigate against certain effects of the wind turbines on the PSR.

The surveillance system and approach to PSR blanking at Inverness Airport is still to be confirmed. Whilst most of this demonstration of compliance will sit within the Safety Case Part 3, any change in approach may require this document to be revisited.

The surveillance system and approach to PSR blanking at RAF Lossiemouth is still to be confirmed. However, it is expected that the demonstration of compliance for this will sit within the Safety Case Part 3.

Evidence items associated with extant procedures in the Inverness Airport MATS Part 2 and the RAF Lossiemouth ATCOB are still to be appended to this document. This shall be complete nearer, but prior to the point of transition of the Clash Gour TMZ into operational service.



## 7 Conclusions & Recommendations

### 7.1 Satisfaction of Safety Argument

The top-level safety claim (Claim 0) is that the implementation of the proposed Clash Gour TMZ shall permit the continued provision of an acceptably safe ATS to be provided from Inverness Airport and RAF Lossiemouth, throughout its in-service usage.

Claims, Arguments and Evidence are provided in section 4 demonstrating that this Claim is supported and achieved.

### 7.2 Compliance with Safety Objectives and Requirements

The Safety Case Part 1 [Ref. 3] derived safety requirements that reduce the risks associated with the implementation of the Clash Gour TMZ to an acceptable level.

The status of compliance of these safety requirements is shown above in Table 5.

Compliance with some safety requirements cannot yet be demonstrated as they are dealing with the implementation and transition of the Clash Gour TMZ into operational service. These safety requirements, as shown in Table 6, are carried over to the Safety Case Part 3.

No.	Description
SR06	The TMZ shall be promulgated in the UK IAIP/MIL AIP.
SR07	ATC shall have procedures to address unauthorised access of the TMZ (if detected).
SR09	There shall be an ability for a non-transponder to request access of the TMZ from the Controlling Authority.
SR10	ATC shall have the tactical ability to draw a TMZ overlay on the radar display.
SR11	ATCOs shall receive familiarisation and/or training on the TMZ implementation and associated procedures.
SR12	There should be alternative 'support systems' that display the location of the TMZ.
SR13	ATC shall have procedures to address the loss of TMZ demarcation on the radar display.

No.	Description
SR20	ANSPs shall co-ordinate to allow tactical control of aircraft in the TMZ to maintain separation

Table 6 - Safety Requirements carried over to Safety Case Part 3

### 7.3 Compliance with Regulatory Requirements

The design rationale described in section 3, along with the compliance to the derived safety requirements (Table 5) demonstrates compliance to the applicable principles of CAP 1616 [Ref. 1] and the CAA RMZ/TMZ policy [Ref. 13].

### 7.4 Recommendations

None at this point.

## 8 References

Ref	Title	Origin
[Ref. 01]	CAP 1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements. V4 Issued March 2021 <sup>2</sup>	CAA
[Ref. 02]	Safety Programme Plan Clash Gour Airspace Change Proposal 71609 013, Issue 1, 5 <sup>th</sup> January 2022	Osprey
[Ref. 03]	Safety Case Part 1 Safety Requirements Clash Gour Airspace Change Proposal 71609 018, Issue 2, 30 <sup>th</sup> April 2024	Osprey
[Ref. 04]	CAP 760: Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers 1st Edition (inc. amendments 2010/01), 10 <sup>th</sup> December 2010	CAA
[Ref. 05]	Walney Transponder Mandatory Zone Post Implementation Review May 2019	CAA
[Ref. 06]	<u>CAA UK Certificated Aerodromes list</u>	CAA
[Ref. 07]	CAP 493, MATS Part 1 Edition 10, 28 March 2022	CAA
[Ref. 08]	Inverness Airport MATS Part 2	HIAL
[Ref. 09]	HIAL Safety Management System	HIAL
[Ref. 10]	Hazard Identification Briefing Pack Clash Gour Airspace Change Proposal 71609 014, Issue 2, 14 <sup>th</sup> February 2022	Osprey

<sup>2</sup> Email from CAA 15 December 2023 confirmed that CAP1616 Version 4 shall apply to this ACP until it is concluded.

[Ref. 11]	Hazard Identification Record Clash Gour Airspace Change Proposal 71609 015, Issue 3, 18 <sup>th</sup> March 2022	Osprey
[Ref. 12]	Clash Gour Wind Farm ACP-2021-046 Consultation Document 71609 024, Issue 1, 6 <sup>th</sup> March 2023	Osprey
[Ref. 13]	Policy for Radio Mandatory Zones and Transponder Mandatory Zones 13 January 2022	CAA