ScottishPower Renewables

ACP-2023-008

Airspace Trial Plan

Transponder Mandatory Zone at Mark Hill Wind Farm

ACP-2023-008

10/5/23

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Abbreviations

ADLS	Aviation Detection Lighting System
AGL	Aeronautical Ground Lighting
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATM	Air Traffic Management
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
DAATM	Defence Airspace and Air Traffic Management
EC	Electronic Conspicuity
EFP	Electronic Flight Bag
EU	European Union
FIS	Flight Information Service
GNSS	Global Navigation Satellite System
HAZID	Hazard Identification
MOD	Ministry of Defence
NATMAC	National Air Traffic Management Advisory Committee
NOTAM	Notice to Aviation

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OCAS	Outside of Controlled Airspace
RTF	Radiotelephony
SDPS	Surveillance Data Processing Systems
SIL	Source Integrity Level
SMS	Safety Management System
SPR	ScottishPower Renewables Ltd
SSR	Secondary Surveillance Radar
TMZ	Transponder Mandatory Zone
UAS	Unmanned Aerial System
VFR	Visual Flight Rules

What this airspace trial involves

Why we are undertaking this trial?

SPR intend to install Aviation Detection Lighting System (ADLS) at several proposed windfarms to minimise the impact of aviation lighting on the visual landscape. The sites being considered for the system are located in and around the Galloway Dark Sky Park buffer zone in Southwest Scotland. NatureScot has raised concerns about the visual impact of aviation lighting in sensitive areas such as the Dark Skies Park.

Current windfarm lighting systems require red obstructon light on wind turbines to comply with CAA regulations. When lit during the hours of darkness and these can cause adverse visual effects in areas of sensitivity such as designated dark skies areas. It is expected that the use of ADLS would minimise this impact while maintaining aviation safety.

As this would be a first of type in the UK, SPR intend to undertake a trial of the technology at their existing Mark Hill windfarm in Southwest Scotland to prove the Concept of Operation. Mark Hill is situated in Class G airspace underneath the Scottish TMA and **is not a lit windfarm due to the height of the turbines.**

There is no mandate for Electronic Conspicuity (EC) carriage in Class G airspace. The Airspace Modernisation Strategy (AMS) includes mandatory EC within the next few years. The ADLS system relies upon EC primarily provided by Automatic Dependant Surveillance Broadcast (ADS-B). Until EC is mandatory in Class G airspace, aircraft not transmitting ADS-B data will be detected by measuring the received signal strength of their radar transponder. This method of detection requires all aircraft using the airspace to be fitted with a transponder. Consequently, SPR are progressing an ACP for a Temporary Transponder Mandatory Zone (TMZ) around Mark Hill.

The results of this trial will verify the ADLS Concept of Operation and provide safety related information for the Civil Aviation Authority. The safety and verification evidence will support regulatory approval for future ADLS deployments and inform new CAA Policy and regulations.

How will we undertake the trial and what is involved?

For the trial to produce evidence in support of ADLS technology we need to collect and analyse aircraft position data from within and out with the trial area. Based on CAA guidance, SPR will identify what, if any traffic, will likely be impacted by this Temporary TMZ. Analysis that compares PSR data with SSR data, will give an indication of the number of non-EC equipped airspace users that could be affected. The trial will also involve some dedicated flight trials to enhance the data collection around ADSL performance.

The trial technology will involve the installation ADS-B receivers only **(not lights)** which will receive messages containing the aircraft's precise position and height. No positional

information is broadcast from aircraft that are only transponder equipped, and estimated range using the Received Signal Strength (RSS) is used. This is a much less accurate method of determining an aircraft position and will require the ADLS detection volume to be larger than if all aircraft had ADS-B. RSS data will be used to examine RSS range accuracy and the extent of the detection volume.

The default position for an ADLS is to have the obstruction lights switched on, with ADLS switching the obstruction lights off when aircraft are not within the pre-defined detection volume of airspace. Consequently, failure of the ADLS would result in the Obstruction lights remaining switched on to maintain aviation safety. **Once again, for this trial there will be no lights installed at Mark Hill windfarm.**

What the trial is aiming to investigate, prove & validate

The Operational Trial has two Principal Aims and associated objectives:

1. To confirm the System Availability and performance of the installed equipment in the environment:

- Reliability of the equipment used in the ADLS – Mean Time Between Failures
- Probability of Target detection
- Target position accuracy
- Correct determination of target type e.g. ADS-B and/or Transponder.

2. To determine the 'Lights on' occurrences and durations based on aircraft detection in a volume of airspace that maintains aviation safety by:

- Correlating target detection inside and outside the TMZ airspace volume with lights on/off
- Identifying any changes to the noise profile of aircraft within the vicinity of the TMZ
- Confirming that the ADLS will reduce the lights on duration compared with uncontrolled Obstruction Lighting.
- Note: no visible lights will be 'switched on' during this trial, there will data collection only.

Inform

The trial will require a temporary TMZ to ensure that aircraft flying within it are mandated by the CAA to have a transponder. This will provide the following positional data information sources:

a) Mode S

As noted above, where ADS-B data is not available, the transponder RSS will be used to estimate the aircraft range.

b) Mode S Extended Squitter

Those aircraft fitted with an enhanced version of transponder (Mode S Extended Squitter) will also broadcast ADS-B. The ADS-B data will be used.

c) Standalone ADS-B Equipment

ADS-B data may be transmitted using standalone equipment only (i.e. no transponder) and is normally deployed in smaller aircraft. As noted above, CAA regulations do not include mandatory EC and consequently there is no associated airspace category. Therefore, in a TMZ, aircraft with the mandated basic transponder and standalone ADS-B equipment, both the RSS and ADS-B method could be used. The trial will use the ADS-B data but post trial analysis may be used for RSS range accuracy assessment.

ADLS is approved and operational in Germany. Whilst this technology is now mandated by the Luftfahrt-Bundesamt (German equivalent of the CAA), the UK CAA require independent safety assurance evidence. The Operational Trial will form part of this evidence.

SPR will initially use a 3NM detection boundary for the temporary TMZ airspace, based on the expected aircraft maximum speed in this area, Figure 2 refers. This limit will be assessed during the trial to determine the performance of the ADLS and whether the detection boundary limit will need to increase or decrease during the trial. Using modelling and data collected from the trial, the feasibility of other limits (e.g. 2.5NM and 3.5NM) will be assessed. If the trial is successful and ALDS is adopted as a solution for Reduced lighting by the Head of Airworthiness Policy and Rulemaking at CAA, it could be deployed at future, and existing windfarm developments. The ADLS may not be an appropriate solution for all developments.

Obstruction lighting provides visibility of obstacles to aircraft operating at night reducing the risk of collision. UK Standardised Rules of the Air[1] prohibit aircraft from flying lower than 500ft above the highest physical obstruction.

For the purposes of this trial, turbine A5 (see Figure 1) has a ground elevation of 227.5m and a turbine height of 110m, giving a total elevation of 337.5m (1108ft).

Calculation of the vertical limit of the airspace for the location of the operational trial, results in the following vertical boundary:

a) Highest elevation of turbine A5: 227.5m (747ft) AMSL

[1] https://www.caa.co.uk/uk-regulations/aviation-safety/basic-regulation-the-implementing-rules-and-uk-caa-amc-gm-cs/sera-standardised-rules-of-the-air/ 10/5/23

b) A5 Turbine height: 110m (361ft) AGL

c) ADLS Safety Margin: 1000ft

Vertical Limit of ADLS airspace volume: 2108ft AMSL (a+b+c)

- Rounding up to the nearest 100ft = 2200ft

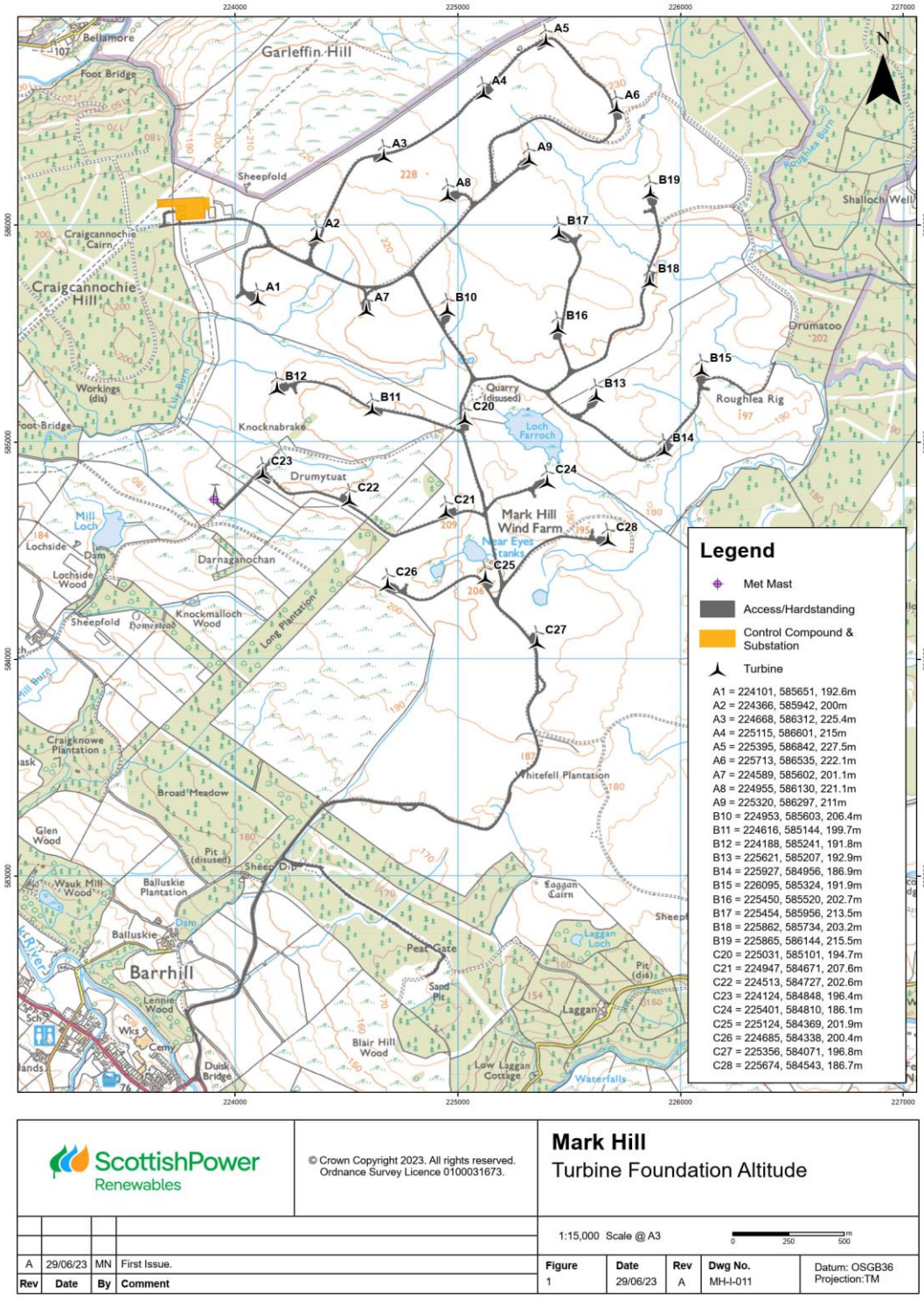

Figure 1- Position of Highest Turbine at Mark Hill

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Therefore, it is anticipated that the dimensions of the airspace for the Temporary TMZ will be 3NM from the boundary of the windfarm by 2200ft AMSL. Figure 2 below shows a schematic example of the parameters required.

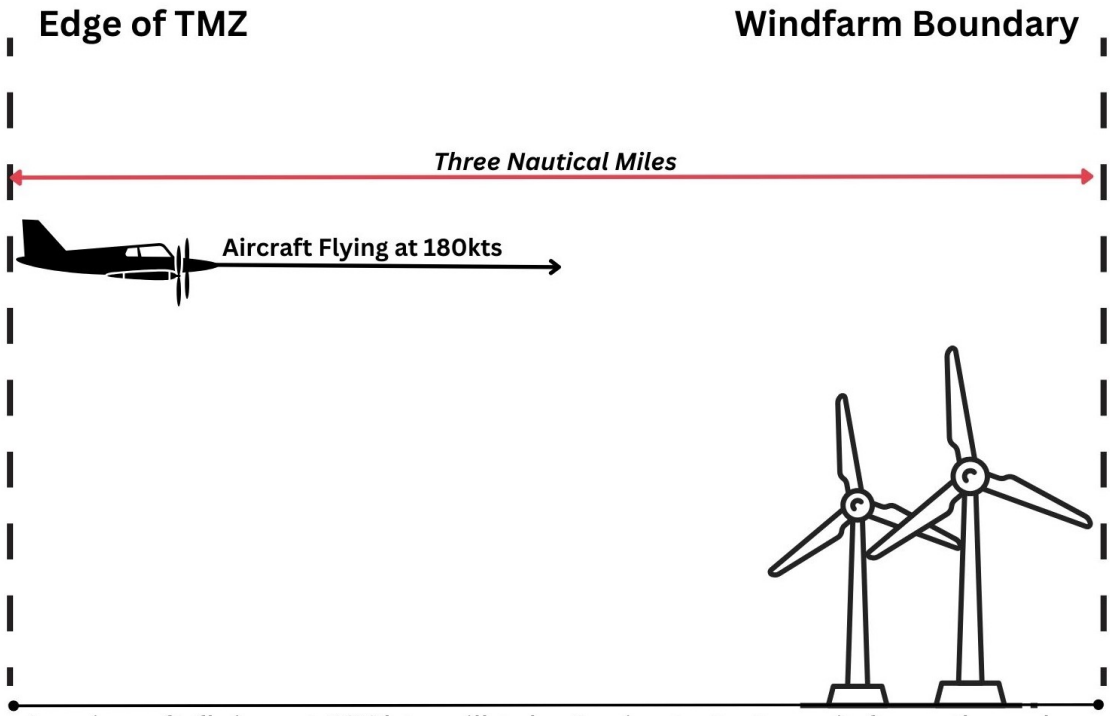

Figure 2 - Example of TMZ Parameters

Data collection will be undertaken over a proposed 6-month period and will help to verify the ADLS Concept of Operation and inform the draft guidance currently being developed by the CAA for ADLS in the UK.

The ADLS supplier will record aircraft detections and the duration of the lights on/off. SPR will verify the performance of the system using several independent means:

a) Independent ADS-B receiver to confirm the ADLS equipment identifies the same aircraft and their positions.

b) NATS En-Route Ltd (NERL) surveillance radar data providing aircraft positions and heights in the TMZ Airspace and surrounding area. This will be used to baseline ADLS performance being the 'True Position' of aircraft.

c) The NERL data will also be used to model the performance with a 2.5NM and 3.5NM horizontal limit. This will be used to provide guidance on the dimensions required for an ADLS in the UK with a supporting rationale.

d) NERL will also be providing surveillance data covering the last 5 years. The same model will be used to verify that an ADLS during this period would have maintained aviation safety while minimising the lights on period.

The defined objective of this trial is to prove, via the data collected, and SPR verification of that data, that ADLS will reduce light pollution in dark sky areas within the UK whilst maintaining aviation safety, albeit with the addition of a TMZ.

The Objectives of the ADLS Operation Trial with the associated success criteria is shown in Table 1:

AIM	OBJECTIVE	SUCCESS CRITERIA	COMMENT
Confirm the System Availability	Reliability of the equipment used in the ADLS – Mean Time Between Failures	Consistent with claims in the ADLS Reliability Model.	Statistically verification would require many hours of ADLS operation at multiple sites. This assessment can only determine gross errors in equipment MTBF against that submitted by the manufacturer.
	Probability of Target Detection	Pd > 90%	Value aligns with recognised values for surveillance systems and used in CAA Regulations.
	Target Position Accuracy	ADS-B < 300m, 100ft	
	Correct determination of target type e.g. ADS-B and/or Transponder	Transponder <5NM	
Determine the Lights on occurrences based on aircraft position in a volume of airspace that maintains aviation safety	Evaluate the ADS-B position accuracy for aircraft with a standalone ADS-B equipment and basic transponder.	>99.99%	CAA do not mandate ADS-B equipment must meet a minimum specification. Therefore, postion data integrity may not be assured.
	Correlate target detection inside and outside Airspace volume with lights-on/off	100% correlation when aircraft are present in the detection airspace volume	For aviation safety lights must always be on when aircraft are within the detection volume. Aviation safety is maintained when the system default is lights on.
	Introduction of a TMZ demonstrates minimal impact of normal operations in the area	Normal operations are maintained during hours of TMZ operation	Traffic study will be carried out using recorded data and live data
	No adverse effect on noise profile of aircraft across the area.	Noise analysis will demonstrate negligible change to noise	
	The ADLS will reduce the lights-on duration compared with uncontrolled Obstruction Lighting.	>25% reduction in lights on compared with uncontrolled Obstruction Lighting.	

The Objectives of the ADLS Operational Trial modelling with the associated success criteria is shown in Table 2 below:

OBJECTIVE	DESCRIPTION	SUCCESS CRITERIA	COMMENTS
	Operational Trial Data		
1.	Separate ADS-B receiver to confirm the manufacturer equipment identifies the same aircraft and their positions.	>99.99%	Assumes all ADS-B antennas are collocated.
2.	NERL surveillance radar data providing aircraft positions and heights in the TMZ Airspace and surrounding area. This will be used to baseline ADLS performance being the 'True Position' of aircraft.	ADS-B < 300m, 100ft. Transponder only < 5NM.	
	Modelling using NERL data		
3.	The NERL data will also be used to model the performance with a 2.5NM and 3.5NM horizontal limit. This will be used to verify the EASA guidance to use 3.0NM.	As Operational Trial	
4.	NERL will also be analysing surveillance data covering the last 5-years. The same model will be used to verify that an ADLS during this period would have maintained aviation safety while minimising the lights-on period.	As Operational Trial	

Noise

The CAA held a guidance meeting with SPR and Cyrrus to answer some questions regarding the noise analysis required for the trial. SPR have asked NERL to analyse radar data (primary/secondary radar, recent and historical data) from Lowther Hill radar to determine traffic levels and routes (a traffic survey). This will set the baseline for any noise analysis.

This is still outstanding and will form the 'baseline'. SPR understand that, ahead of trial approval, this baseline evidence will need to be provided to the CAA.

Once the trial is underway further analysis during the trial, will provide evidence of the potential impacts on any GA/Military transits.

Following an analysis of the traffic data, SPR will produce an appropriately scaled noise assessment in support of the trial and its output. Based on the CAA guidance, SPR will identify what, if any traffic, will likely be impacted by this Temporary TMZ and any changes to the baseline traffic patterns and any resulting impact to the noise footprint identified.

Flight Trials

SPR will work with an aircraft operator with experience in carrying out flight trials, to undertake dedicated flight trials. These flight trials will be initially guided by similar trials undertaken in the Netherlands by the technical supplier of ADLS to SPR, but may use a different methodology to reflect the airspace environment and UK CAA regulations.

For the flight trials, the operator will depoy an aircraft which is registered for commercial operation and equipped with the following minimum equipment:

- Transponder with the capability to send Mode A/C and Mode-S/ES (ADS-B with GPS data SIL>=1)
- Programable GPS Navigation system to plan and follow the planned flight path.
- GPS logger e.g. LX-Nano of FLARM device with log interval set to 1 sec (For future use in EC data analysis)
- Radio (with dual watch function if possible)
- Altimeter

Details of flight trials

The flight trial aircraft will undertake a 'pizza slice' activities from 3nm into the centre of the TMZ along with several tangential slices on the 4nm, 3.5nm and 2nm distances, as shown on the map below: (insert some sort of map here showing the way the ac will fly)

The output from the flight trial aircraft will be provided in a similar format shown below in Figure 3 , which represents a previous flight trial activity undertaken in The Netherlands:

line #	Timestamp merged and filtered data	GPS Latitude / ADLS status change	GPS Longitude	Hight HAE	Distance BD7 receiver	Comment
1	2023-05-16T10:13:34.254: INFORMATION	ADLS LIGHTS ON				
2	2023-05-16T10:13:35.00000	51.5220N	3.7181E	152m	12.21km	Distance when status changes
3	2023-05-16T10:18:39.00000	51.5596N	3.8996E	337m	15.44km	Distance when status changes
4	2023-05-16T10:18:40.044: INFORMATION	ADLS LIGHTS OFF				
5		ADLS LIGHTS OFF				
6	2023-05-16T10:20:10.302: INFORMATION	ADLS LIGHTS ON				
7	2023-05-16T10:20:11.00000	51.5783N	3.9524E	268m	17.86km	Distance when status changes
8	2023-05-16T10:25:23.00000	51.6180N	4.1376E	349m	29.66km	Distance when status changes
9	2023-05-16T10:25:24.100: INFORMATION	ADLS LIGHTS OFF				
10		ADLS LIGHTS OFF				
11	2023-05-16T10:35:54.740: INFORMATION	ADLS LIGHTS ON				
12	2023-05-16T10:35:55.00000	51.6361N	3.8397E	410m	9.07km	Distance when status changes
13	2023-05-16T10:39:15.00000	51.6371N	3.7094E	377m	0.62km	Flyover
14	2023-05-16T10:44:39.00000	51.7469N	3.7959E	379m	14.16km	Distance when status changes
15	2023-05-16T10:44:40.053: INFORMATION	ADLS LIGHTS OFF				
16		ADLS LIGHTS OFF				
17	2023-05-16T11:18:29.339: INFORMATION	ADLS LIGHTS ON				
18	2023-05-16T11:18:31.00000	51.6398N	3.5636E	55m	10.04km	Distance when status changes
19	2023-05-16T11:23:27.00000	51.6351N	3.6997E	370m	0.71km	Flyover
20	2023-05-16T11:28:47.00000	51.5868N	3.5243E	357m	13.66km	Distance when status changes
21	2023-05-16T11:28:48.991: INFORMATION	ADLS LIGHTS OFF				
22		ADLS LIGHTS OFF				
23	2023-05-16T11:28:49.995: INFORMATION	ADLS LIGHTS ON				
24	2023-05-16T11:28:51.00000	51.5863N	3.5219E	357m	13.84km	Distance when status changes
24a	2023-05-16T11:32:47.00000	51.5527N	3.3870E	360m	23.88km	added with V2
24b	2023-05-16T11:32:48.400: INFORMATION	ADLS LIGHTS OFF				
		ADLS LIGHTS OFF				
24c	2023-05-16T11:57:42.429: INFORMATION	ADLS LIGHTS ON				
24d	2023-05-16T11:57:43.00000	51.4553N	3.6686E	545m	19.80km	added with V2
25	2023-05-16T12:05:59.00000	51.6261N	3.7134E	851m	0.70km	limit 867m QNE/1014 HAE
26	2023-05-16T12:13:59.00000	51.7323N	3.9684E	837m	21.12km	below activation zone hight
27	2023-05-16T12:14:01.929: INFORMATION	ADLS LIGHTS OFF				
28		ADLS LIGHTS OFF				
29	2023-05-16T12:30:29.490: INFORMATION	ADLS LIGHTS ON				
30	2023-05-16T12:30:31.00000	51.6642N	3.7906E	839m	6.72km	below activation zone hight
31	2023-05-16T12:32:55.00000	51.6311N	3.7076E	817m	0.09km	limit 867m QNE/1014 HAE
32	2023-05-16T12:38:43.00000	51.5541N	3.5143E	799m	15.95km	below activation zone hight
33	2023-05-16T12:38:44.823: INFORMATION	ADLS LIGHTS OFF				
34		ADLS LIGHTS OFF				
35	2023-05-16T12:43:54.645: INFORMATION	ADLS LIGHTS ON				
36	2023-05-16T12:43:55.00000	51.5657N	3.6423E	499m	8.64km	Distance when status changes
37	2023-05-16T12:45:55.00000	51.5745N	3.7197E	537m	6.40km	
38	2023-05-16T12:54:47.00000	51.6141N	4.0785E	530m	25.62km	Distance when status changes
39	2023-05-16T12:54:50.046: INFORMATION	ADLS LIGHTS OFF				
40		ADLS LIGHTS OFF				
41	2023-05-16T13:18:50.130: INFORMATION	ADLS LIGHTS ON				
42	2023-05-16T13:18:51.00000	51.5611N	4.1373E	308m	30.64km	Distance when status changes
43	2023-05-16T13:19:55.00000	51.5570N	4.0974E	305m	28.12km	Distance when status changes
44	2023-05-16T13:19:55.327: INFORMATION	ADLS LIGHTS OFF				
45		ADLS LIGHTS OFF				
46	2023-05-16T13:21:25.624: INFORMATION	ADLS LIGHTS ON				
47	2023-05-16T13:21:27.00000	51.5537N	4.0406E	295m	24.52km	Distance when status changes
48	2023-05-16T13:22:23.00000	51.5523N	4.0066E	306m	22.41km	Distance when status changes
49	2023-05-16T13:22:26.882: INFORMATION	ADLS LIGHTS OFF				
50		ADLS LIGHTS OFF				
51	2023-05-16T13:22:45.923: INFORMATION	ADLS LIGHTS ON				
52	2023-05-16T13:22:47.00000	51.5518N	3.9918E	298m	21.49km	Distance when status changes
53	2023-05-16T13:23:47.00000	51.5500N	3.9550E	294m	19.30km	Distance when status changes
54	2023-05-16T13:23:47.137: INFORMATION	ADLS LIGHTS OFF				
55		ADLS LIGHTS OFF				
56	2023-05-16T13:24:10.207: INFORMATION	ADLS LIGHTS ON				
57	2023-05-16T13:24:11.00000	51.5506N	3.9399E	287m	18.35km	Distance when status changes
58	2023-05-16T13:29:07.00000	51.5488N	3.7576E	142m	9.81km	Flyover
59	2023-05-16T13:32:19.00000	51.5127N	3.7299E	-78m	13.31km	Distance when status changes
60	2023-05-16T13:33:41.042: INFORMATION	ADLS LIGHTS OFF				

Figure 3 – Example of Aircraft Flight Trial output

Stakeholder Engagement

Phase 1 – Targeted engagement prior to agreement for trial

Relevant aviation stakeholders have been identified, as per CAP 1616 para 317, and targeted engagement has been undertaken, on the operational viability of the trial. See Annex A for the Chronology of Engagement.

We determined that virtual stakeholder meetings would be undertaken, where face to face meetings were not feasible for some stakeholders. We scheduled both daytime & evening virtual meetings, along with daytime face to face meetings for several different days/evenings over several months. The team visited some stakeholders in person, where this was requested, and other meetings were held at SPR HQ in Glasgow.

Engagement materials took the form of a PowerPoint presentation, see Annex D, accompanied by verbal explanations. Comprehensive note taking was completed at each session and feedback forms sent out to all attendees. These are attached within the Chronology of Engagement Document at Annex A.

A HAZID session took place on 21 June 2023 which identified that the temporary TMZ will not present an unacceptable safety risk. This was also confirmed in the subsequent Safety Assurance work. In fact, it is argued that there is no or negligible change in the safety risk during the trial period.

Start and End date of the Temporary TMZ Trial

The trial is planned to start on 28 December 2023 and run for 6 months until 28 June 2024. Installation of the equipment will begin in November 2023 for this timeline to be met.

Desired Outcomes

- The capability of the ADLS system i.e. reliability, sensitivity, latency, accuracy.
- Recommendations for the buffers and heights together with the evidence to support the potential permanent TMZ at windfarm sites.
- Draft guidance notes for the CAA and Scottish Government Aviation Lighting Group.
- Updated Concept of Operation documentation, including safety information.

Annex A

Chronology of Engagement

Purpose

Stakeholder Engagement

The purpose of this document is to list the activities that were undertaken, and with whom, as part of the CAP1616 Stage 1 process for airspace trials.

These activities were held between 10 May 2023 and 6 August 2023 and some stakeholders also requested monthly updates on the progress.

Chronology of Engagement

CAP1616 Stakeholder Category	Stakeholder	Invite Sent	Activity	Date of Activity
NATMAC	Airlines UK	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Airspace4all	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Airport Operators Associations (AOA)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Airfield Operators Group	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Aircraft Owners and Pilots Association (AOPA)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Airspace Change Organising Group (ACOG)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Association of Remotely Piloted Aircraft Systems UK (ARPAS-UK)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	Aviation Environment Federation (AEF)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	British Airways (BA)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	BAE Systems	10 May 2023	Presentation Sent	03 July 2023

NATMAC	British Airline Pilots Association (BALPA)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	British Balloon and Airship Club	10 May 2023	Presentation Sent	03 July 2023
NATMAC	British Business and General Aviation (BBGA)	10 May 2023	Presentation Sent	03 July 2023
NATMAC	British Gliding Association (BGA)	18 May 2023	Meeting Attended Presentation Sent	25 May 2023
NATMAC	British Helicopter Association (BHA)	18 May 2023	Meeting Attended Presentation Sent	25 May 2023
NATMAC	British Hang Gliding And Paragliding Association	18 May 2023	Presentation Sent	03 July 2023
NATMAC	British Microlight Aircraft Association (BMAA)	10 May 2023	Meeting Attended Presentation Sent	25 May 2023
NATMAC	British Model Flying Association (BMFA)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	British Skydiving	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Drone Major	18 May 2023	Presentation Sent	03 July 2023
NATMAC	General Aviation Alliance (GAA)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Guild of Air Traffic Control Officers (GATCO)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Honourable Company of Air Pilots (HCAP)	18 May 2023	Presentation Sent	03 July 2023

NATMAC	Helicopter Club of Great Britain	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Heavy Airlines	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Iprosurv	18 May 2023	Meeting Attended Presentation Sent	25 May 2023
NATMAC	Isle of Man CAA	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Light Aircraft Association (LAA)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Low Fare Airlines	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Military Aviation Authority	18 May 2023	Presentation Sent	03 July 2023
NATMAC	Ministry of Defence – Defence Airspace and Air Traffic Management	18 May 2023	Meeting Attended	25 May 2023
NATMAC	NATS	18 May 2023	-	-
NATMAC	Navy Command HQ	18 May 2023	Presentation Sent	03 July 2023
NATMAC	PPL/IR (Europe)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	UK Airprox Board (UKAB)	18 May 2023	Presentation Sent	03 July 2023
NATMAC	UK Flight Safety Committee (UKFSC)	06 August 2023	Presentation Sent	03 July 2023
NATMAC	United States Air Force Europe (3rd AF-DOF)	10 May 2023	Presentation Sent	03 July 2023

Air Navigation Service Providers and Airports	Prestwick Airport	26 April 2023	Attended Meeting Presentation Sent	03 May 2023 05 May 2023
Various	Prestwick Flying Centre	26 April 2023	Presentation Sent	03 July 2023
Various	Prestwick Flying Club	26 April 2023	Attended Meeting Attended HAZID Workshop	03 May 2023 21 June 2023
Air Navigation Service Providers and Airports	Glasgow Airport	26 April 2023	Attended Meeting Presentation Sent	10 May 2023
Air Navigation Service Providers and Airports	Glasgow NATS	01 June 2023	-	-
Air Navigation Service Providers and Airports	Edinburgh ANSP	29 May 2023	Attended Meeting Attended HAZID Workshop	08 June 2023 21 June 2023
Various	MOD (HMS Gannet)	27 April 2023	Attended Meeting Presentation Sent	08 June 2023
Various	NATS (Prestwick Centre)	27 April 2023	Attended Meeting	23 May 2023
Environmental Interest Group	NatureScot	01 May 2023	Attended Meeting Presentation Sent	04 May 2023
Directly Affected Local Aviation Stakeholders	Police Helicopter	29 May 2023	Attended Meeting Presentation Sent	21 June 2023
Directly Affected Local Aviation Stakeholders	Scottish Air Ambulance	01 June 2023	Attended HAZID Workshop	21 June 2023
Directly Affected Local Aviation Stakeholders	South Side Flying Club	27 April 2023	Presentation Sent	03 July 2023

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Directly Affected Local Aviation Stakeholders	Ryanair Base Captain	27 April 2023	Presentation Sent	03 July 2023
Directly Affected Local Aviation Stakeholders	Strathaven Airfield	28 April 2023	Attended HAZID Workshop	21 June 2023
Directly Affected Local Aviation Stakeholders	Loganair	29 May 2023	Presentation Sent	03 July 2023
Various	Transport Scotland	28 April 2023	Presentation Sent	03 July 2023
Directly Affected Local Aviation Stakeholders	Bristows Helicopters	27 April 2023	Attended Meeting Presentation Sent	03 May 2023 04 May 2023
Air Navigation Service Providers and Airports	Edinburgh Airport Safeguarding and Compliance	29 May 2023	Attended Meeting Presentation Sent	08 June 2023
Air Navigation Service Providers and Airports	Cumbernauld Airport	28 April 2023	Attended Meeting Attended HAZID Workshop	08 June 2023 21 June 2023
Elected Representatives	South Ayrshire Council	-	Presentation Sent	05 July 2023
Elected Representatives	Barr Community Council	-	Presentation Sent	05 July 2023
Elected Representatives	Barrhill Community Council	-	Presentation Sent	05 July 2023
Elected Representatives	Colmonell and Lendalfoot Community Council	-	Presentation Sent	05 July 2023
Elected Representatives	Cree Valley Community Council	-	Presentation Sent	05 July 2023

Elected Representatives	Pinmore and Pinwherry Community Council	-	Presentation Sent	05 July 2023

Stakeholders to be Updated

Stakeholder	Frequency of Update
Police Helicopter	Monthly/relevant milestones reached
Bristows Helicopters	Monthly/relevant milestones reached
MOD DAATM	Monthly
NATS	Monthly
NatureScot	Monthly
Edinburgh Airport Safeguarding and Compliance	Quarterly
Edinburgh ANS	Monthly
Prestwick Airport	Monthly
Cumbernauld Airport	Monthly

Annex B

Hazard Identification Workshop Report

References

During the compilation of this document the following source documents were used for subject matter reference:

[1] Regulation (EU) 2017/373Common Requirements for Providers of Air Traffic Management / Air Navigation Services and other Air Traffic Management Network Functions and their Oversight.

[2] European Aviation Safety Agency Easy Access Rules for Air Traffic Management / Air Navigation Services (Regulation (EU) 2017/373).

[3] Civil Aviation Authority Publication CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases.

[4] Civil Aviation Authority Publication CAP 1391 Electronic Conspicuity Devices.

Mark Hill Windfarm HAZID

General

This Hazard Identification (HAZID) Workshop Report has been prepared by Cyrrus Limited for ScottishPower Renewables UK Ltd (SPR).

Background

To comply with CAA Safety Requirements, airspace change sponsors must ensure that risk assessment and mitigation are conducted to an appropriate level, to ensure that due consideration is given to all aspects of Air Traffic Management (ATM).

Accordingly, all potential hazards that could arise from the introduction of a new system, airspace, or change to any existing system or airspace, must be identified and risks assessed.

SPR is part of the ScottishPower group of companies operating in the UK under the Iberdrola Group, one of the world's largest integrated utility companies and a world leader in wind energy.

Figure 1: Mark Hill windfarm

Windfarm installations require obstacle hazard avoidance lighting (AGL) to mark their positions as a warning to low flying aircraft. In the UK, this type of lighting is continuously lit from 30 minutes after sunset to 30 minutes before sunrise, in accordance with Air Navigation Order Article 222; this can cause disturbance within any Dark Sky areas and NatureScot have expressed concerns around this type of lighting.

Current windfarm lighting systems require a system of obstruction lighting which is lit during the hours of darkness and can cause adverse visual effects in areas of sensitivity such as designated dark skies areas.

To minimise the impact of aviation lighting on the visual landscape, SPR would like to install an Aviation Detection Lighting System (ADLS) at their proposed Clauchrie Windfarm extension which is located on the edge of the Dark Skies Park in Southwest Scotland to address the concerns raised by Nature Scotland about the visual impact of aviation lighting.

As this would be a first of type in the UK, SPR intend to undertake a trial of the technology at their existing Mark Hill windfarm in Southwest Scotland to prove the concept; Mark Hill is currently unlit. This will support applications to the Civil Aviation Authority for regulatory approval.

Mark Hill Windfarm is a 28 turbine, 56-Megawatt green power windfarm on a site located approximately 2 kilometres to the northeast of Barrhill, in the South Ayrshire Council area. The site is located on the shallow eastern slopes of Garleffin Hill and falls within the Carrick Forest. The site is also located on the edge of the Galloway International Dark Sky Park.

ADLS works when an Electronic Conspicuity equipped aircraft is detected approaching the windfarm, the ADLS turns on the lights and then turns them off once the aircraft is clear of the area. The proposed ADLS depends on aircraft transmitting their position or responding to radar interrogations, via EC, for the system to detect their presence.

It is proposed that a temporary Transponder Mandatory Zone (TMZ) is implemented with a 3 nautical mile buffer around the windfarm boundary. This will facilitate a trial that enables SPR and the Civil Aviation Authority (CAA) to evaluate the effectiveness of ADLS technology.

This HAZID report is in support of this trial.

Safety Management

All safety management activities related to the TMZ shall comply with applicable statutory safety requirements. SPR is not an Air Navigation Service Provider (ANSP) and therefore do not have their own aviation Safety Management System (SMS). In lieu of this, the CAA CAP 760 guidance will be applied directly to perform the risk assessment.

This document forms part of a systematic process to identify and analyse the potential hazards that could be presented by the trial TMZ.

HAZID Event

Overview and Attendees

A HAZID event took place on Wednesday 22 June 2023 in Central Glasgow. The scope of the HAZID discussions was loosely bounded to temporary implementation of a TMZ for the ADLS trial.

The event drew upon the knowledge and opinion of Subject Matter Experts (SMEs) either familiar with, or affected by, the trial. The following table lists the HAZID event participants.

Name	Organisation	Stake
Fergus, Graham	Air Navigation Services	Edinburgh ATCO and consultant for HIAL
Lister, Andrew	GAMA Aviation	Head of Flight Operations
MacKinnon, Colin	Strathaven Airfield	Owner, Microlight Instructor and member of the BMAA
Maric, Steve	Prestwick Flying Club	Chief Flying Instructor and former airline pilot
McPhee, Ryan	SPR Ltd	Senior Project Manager
Rothon, Mike	Cyrrus Ltd	Safety Specialist (HAZID Facilitator)
Irons, John	SPR Ltd	Assistant Project Manager
Sissons, Kevin	Cyrrus Ltd	Principal Consultant Engineer CNS Systems
Wells, Andy	Civil Aviation Authority	Policy Lead
Wylie, Jim	SPR Ltd	Senior Planning & Environmental Policy Analyst
Wilson, Val	Cyrrus Ltd	Aviation Specialist

Table 1:HAZID participants

Hazards discussed during the HAZID event were focused upon the airspace operational environment. Where hazards or other safety factors were identified outside of the airspace environment (e.g., within flight operations), they were for general discussions only and do not affect the requirement of aircraft operators to conduct their own safety management activities.

Assumption

Existing aviation operations conducted within the area of the proposed TMZ are assumed to be at least tolerably safe and in accordance with applicable statutory aviation safety requirements.

HAZID Process

The HAZID event took the format of guided brainstorming. The HAZID facilitator outlined several scenarios and asked the participants to discuss threats, outcomes, and possible control measures (mitigations).

The SMEs worked as team during the brainstorming session, drawing on each other's knowledge and experience to discuss potential, credible threats to aviation safety.

The aim of the HAZID event was to identify any credible hazards that could arise from the temporary implementation of the TMZ. Some discussion also took place relating to the actual implementation of the ADLS, but this was not the primary focus of the event.

An important aspect of this event was discussion that took place regarding risk control measures / mitigations. The control measures are in fact the main outputs from this particular workshop.

Both preventative and reactive controls were discussed. These have the potential to reduce the likelihood (and therefore the risk) of a potential hazard, and also reduce the likelihood of any severe effects should a hazard be realised. This concept is shown in the following diagram.

Figure 2: Safety Risk Model

The contextual factors that were considered by attendees included, but were not limited to, the following:

- Human Factors (potential errors or failures)
- Environmental factors
- Aircraft equipment and performance.

The discussions were wide ranging and reflected the fact that not all details of the proposed TMZ have been finalised. Therefore, the initial issue of this report represents the output of the event as a series of recommendations, along with a narrative describing the context from which the recommendations have arisen. For this reason, the text in each recommendation is phrased as '*should*' rather than the prescriptive '*shall*' that would be used in a safety requirement.

Stakeholders are invited to carefully review these recommendations and provide additional comments on the practicality and effectiveness of each one.

Both ground and airborne aspects of the Air Navigation Service (ANS) functional system were considered.

The discussions coalesced around the impact of the TMZ implementation on the following four elements of the overall functional system.

1. Aircrew
2. Airborne systems
3. Air Traffic Control (ATC) personnel
4. ATC systems

The discussions covering threats, effects, and recommendations relating to control measures for each of these elements is covered in the HAZID Output documented in the latter pages of this report.

Overview of Mark Hill Windfarm TMZ

General

This chapter provides background information to attain a baseline of understanding of the airspace environment and function of the ADLS.

Prior to participating in the HAZID event, attendees were invited familiarise themselves with the operations and procedures in the vicinity of the windfarm.

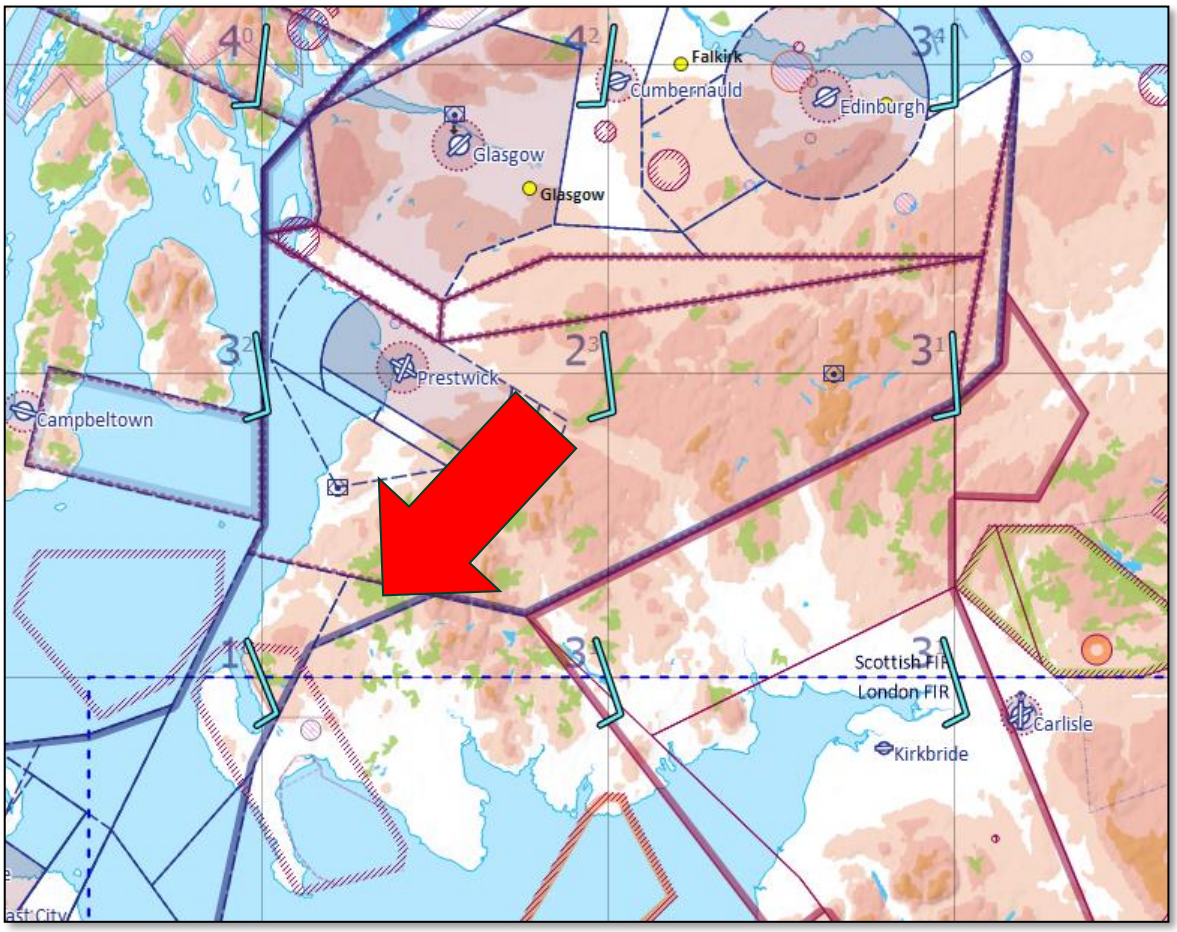


Figure 3: Wide area map

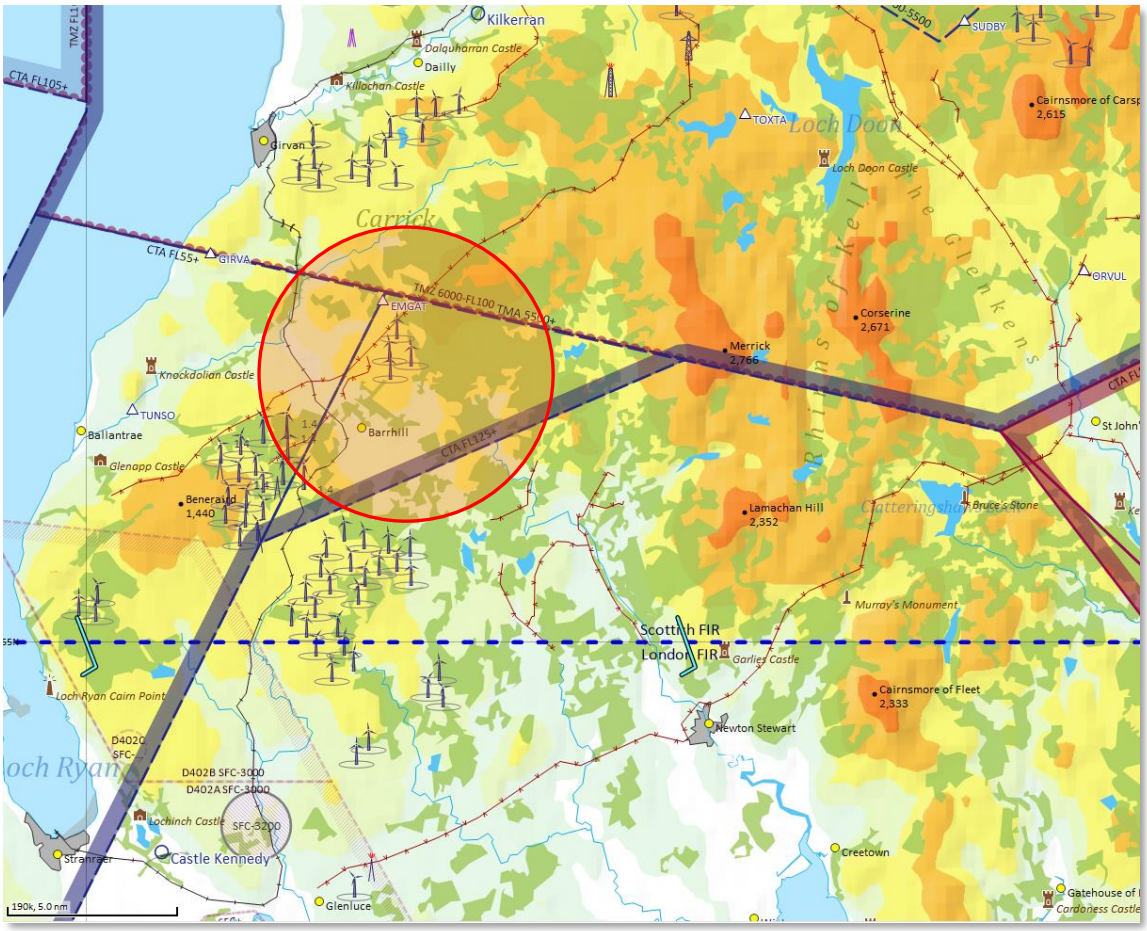


Figure 4: Immediate area map

Windfarm Overview

Mark Hill Windfarm is located in southwest Scotland. It consists of 28 turbines generating 56 Megawatts of electricity and the turbines are 110 metres to the tip.

Mark Hill windfarm was selected for this trial as it is not far from the proposed Clauchrie windfarm site. Mark Hill windfarm is currently unlit.

TMZ Overview

TMZs are designated volumes of airspace, which require aircraft to be appropriately equipped.

They can be established with or without accompanying controlled airspace. TMZs are utilised to enhance the 'visibility' or conspicuity of aircraft operating within, or in the vicinity of, certain areas of designated airspace for the safety of all airspace operators; This TMZ is being established to support a technology trial.

A TMZ is annotated on a chart with a border of purple semicircles. Details of the zones can be found in the UK AIP, in the AIP General Section

Aircraft wishing to operate within a TMZ in the United Kingdom are required to carry and operate serviceable Mode S Secondary Surveillance Radar equipment ('transponder'). Aircraft wishing to operate within a TMZ without a Mode S transponder will only be accepted at the discretion of air traffic control. Most aircraft with Mode S transponders will also transmit ADS-B data containing their height and position.

The ADS-B data is the primary means of detection used by the ADLS. A TMZ may be permanent or temporary; this particular TMZ is a temporary measure that is being put in place specifically for the ADLS trial.

ADLS Overview

The ADLS system monitors the space above and around the windfarm and, if no aircraft are detected within the designated TMZ boundary, the ADLS will switch off the Obstruction Lights.

This ensures that if the ADLS fails, then the system will leave the lights on.

The ADLS consists of Automatic Dependent Surveillance (ADS-B) and Mode-S transponder receiver equipment, with associated antennae and a light control server. Both ADS-B and Mode-S are forms of cooperative secondary surveillance methods.

ADS-B relies on an aircraft broadcasting its current position, with the position information usually derived from a Global Navigation Satellite System (GNSS) source.

Mode-S are transponder replies to radar interrogations. A passive Mode-S system relies on other radars in the area to elicit the response.

Where ADS-B data is available, ADLS checks the reported position against pre-defined boundaries; for Mark Hill, this will be 3 nautical miles (approximately 5.5 kilometres) from the windfarm boundary and up to 2200ft AMSL.

Where only Mode S is detected, the strength of the received signal is used to estimate the aircraft range; this range could be significantly less accurate compared to ADS-B data. Consequently, the worst-case estimate is used for the position resulting in the lights-on period being increased. This maintains aviation safety but could reduce the 'dark sky' periods.

In some areas with surrounding high terrain, multiple receiver equipment will be required to ensure ADLS coverage around the windfarm. Coverage modelling and verification testing is used to ensure the coverage aligns with the specified boundary around the windfarm.

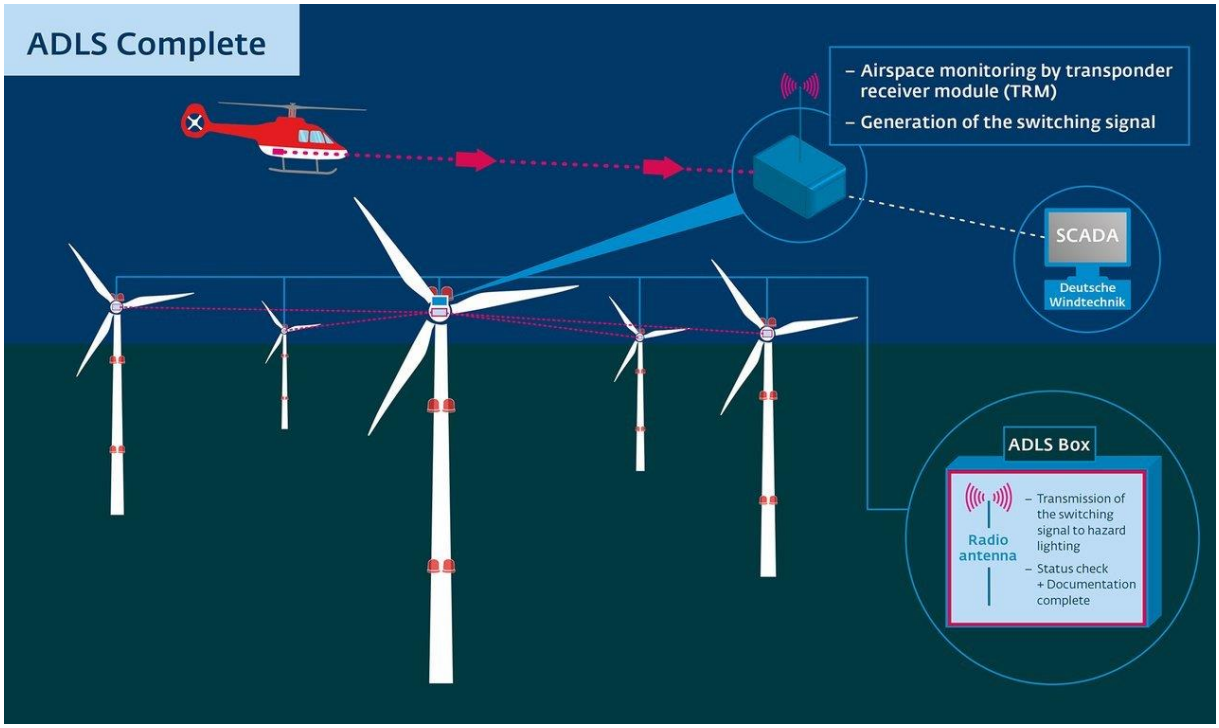


Figure 5: Typical ADLS system concept

Information from the ADLS ambient light sensor is processed and documented within the ADLS system and a 'tell-back 'signal from the 'lights-off' message is used to verify that the signal has been correctly sent and actioned.

It should be noted that, for the trial, no lights will be in place. The system will operate without switching lights off/on but the data required to confirm suitability of ADLS and maintenance of aviation safety will be output.

HAZID Event Output

Introduction

This section contains the output from the HAZID event. It provides a narrative of the main discussion points and a list of recommendations.

Aircrew Considerations

Discussions relating to the effect of the proposed TMZ on aircrew formed the most comprehensive part of the discussions. Approximately 60% of the time was allocated to this topic.

Startle threat

Participants discussed this general point relating to ADLS. It was considered that aircrew in the UK are currently not used to aviation obstruction lighting that suddenly appears in an otherwise dark landscape.

This threat is not applicable to the Mark Hill TMZ trial as **no lights will be installed**. Nonetheless, the consensus from those present was of the necessity to adequately promote the concept of flight activated obstruction lighting.

MHTMZ.REC.1	Prior to implementing ADLS at any site, authorities and service providers should conduct an informative campaign to raise awareness of the technology and its practical manifestation.

Visual pilot avoidance

Pilots that primarily operate under Visual Flight Rules (VFR) and Outside of Controlled Airspace (OCAS) may elect to avoid the TMZ rather than penetrate it. This may be for a variety of reasons, including aircraft equipage, clarity of regulations, etc.

No recommendations specific to the trial TMZ were established in this regard. However, the recommendations relating to high ground and time constraints (discussed below) also apply to this threat.

High ground threat

The high ground in the vicinity of the proposed TMZ was considered to pose a threat for aircrew that choose to route around rather than penetrating the airspace.

It was agreed that it would be simpler to have a uniform 'top' of the TMZ rather than a buffer above the site. This due to the contours of the terrain.

MHTMZ.REC.2	The upper extent of the TMZ should be defined at a constant level Above Mean Sea Level (AMSL) rather than Above Ground Level (AGL).
MHTMZ.REC.3	The upper extent of the TMZ should be considered with respect to overlaying airspace to ensure that it is possible to route over the TMZ without penetrating other airspace.

Poor weather threat

There was extensive discussion about the impact of the TMZ on pilots operating in poor weather conditions. The discussions covered both the actual impact and the strategy for monitoring the impact during the trial period.

It was proposed during the discussions relating to this threat that the possibility of only operating the trial TMZ (and indeed all permanent ADLS related TMZ) at night. This theme was expanded during the discussions on operations at dusk and time constraints on aircrews attempting to arrive at an airfield prior to 'official' night (see 'Time constraints threat' below).

MHTMZ.REC.4	The Aeronautical Information Circular (AIC) for the TMZ, and by extension the information associated with the airspace available on Electronic Flight Bag (EFP) applications[2], should include a contact frequency. The rationale behind this recommendation is that if aircrew are concerned about penetrating the TMZ in deteriorating conditions, there is a defined path to obtaining additional information.
MHTMZ.REC.5	With reference to MHTMZ.REC.4, any ANSP whose contact frequency is listed in the AIP should be briefed about the trial strategy, potentially including the ability to cross the trial TMZ without a transponder.
MHTMZ.REC.6	The forecast weather conditions for the site should be recorded throughout the trial.
MHTMZ.REC.7	One or more webcams and associated recording equipment should be used to monitor the actual weather conditions at the site throughout the trial and compared to the forecast. Any differences between forecast and actual conditions should be analysed.

Participants also discussed the ADLS technological implementation with regard to how the system senses aircraft level. This is in the context of the obstruction lights illuminating when an aircraft penetrates the three-dimensional volume of airspace overlaying the windfarm site.

[2] *Examples of EFP are SkyDemon, Jeppesen ForeFlight, and Garmin Pilot.*

MHTMZ.REC.8	It should be confirmed with the ADLS design authority that the system is referenced to the actual / local barometric pressure and includes compensation for deviations from the standard atmosphere. Note: Secondary Surveillance Radar (SSR) aircraft transponders are referenced to the standard atmosphere at sea level (defined as 1013.2 hectopascals) irrespective of the altimeter subscale setting. Uncertified Electronic Conspicuity (EC) devices may output altitude based on current barometric pressure, Global Navigation Satellite System (GNSS), or a mixture of both.

Time constraints threat

Another well-known concern that affects aircrew is that of time pressures. There is much formal and anecdotal evidence of this being a contributory factor in numerous incidents / accidents, including the impulse colloquially referred to as get-home-itis[3].

The thread relating to restricting the activation of the TMZ to night was expanded during the discussions on this threat and lead to the following recommendations being made.

MHTMZ.REC.9	It should be investigated if there is a possibility of activating the trial TMZ only during 'official night' (defined as 30-minutes after local sunset until 30-minutes before local sunrise).
MHTMZ.REC.10	The clear and consistent method for depicting the temporal nature of the trial TMZ should be determined, including, but not limited to, on paper charts, in the Aeronautical Information Publication (AIP), Notices to Aviation (NOTAM), and EFB apps. Note: It was not determined during the event whether there is a precedent for other TMZ that are only activated at specific times of the day. Subsequent research (albeit limited) has also failed to identify another instance of a time limited TMZ.

As part of the discussions on this threat, the topic of the time when the lights should be activated was also covered. The suggestion was for 30 minutes before sunset until 30 minutes after sunrise. This would mean an overlap period of 1 hour between the ADLS output being enabled and the TMZ being activated.

There are several issues in this regard that require further consideration. For example, obstruction lighting is typically only required during night[4] which is normally defined as the period 30-minutes after sunset to 30-minutes before sunrise. Lighting outside of this time

[3] *https://bea.aero/etudes/gethomeitis/gethomeitis.htm*
[4] *Article 222 of the Air Navigation Order 2016*

could conceivably be a source of confusion and / or lead aircrew to believe the TMZ is already active.

The following recommendation is not related to the trial but should be included in any ongoing ADLS site development.

MHTMZ.REC.11	The time period when the ADLS will activate lighting in response to a valid aircraft transponder signal should be subject to further consideration and analysis and confirmation by the CAA. Note: Since the meeting, CAA have confirmed that official night is 30-minutes after sunset to 30-minutes before sunrise

Cumulative effects with other trials

The workshop considered if there might be an interaction between the TMZ trial and other trials planned to occur at the same time. Reference was made to trials involving Unmanned Aerial Systems (UAS) and the 'segregated airspace' concept.

MHTMZ.REC.12	Although an abbreviated airspace change process is applicable to the trial TMZ, National Air Traffic Management Advisory Committee (NATMAC) stakeholders should still be (and already are being) consulted with regards to the trial.
MHTMZ.REC.13	The trial TMZ sponsors should make direct contact with UAS operators in the planned area to discuss the trial and subsequent plans for the ADLS.

Other users

The threat to aircrew from other users considered both whether the TMZ would create a 'pinch point' and also what would happen if another aircrew was not aware of the TMZ.

It was concluded that due to the low traffic levels, the threat of a pinch point was not realistic in this particular context. However, emphasis was placed on ensuring that all airspace users are aware of the trial and fully understand that the TMZ remains Class G airspace, including the pilot's responsibility for maintaining their own separation. Therefore, supplemental recommendations are made as follows.

MHTMZ.REC.14	The information campaign recommended in MHTMZ.REC.1 should clearly inform airspace users that the TMZ is Class G (i.e., uncontrolled) airspace and that aircrew are responsible for their own separation.
MHTMZ.REC.15	It is a standard requirement to issue a NOTAM for the trial. The NOTAM should include a telephone number and / or webpage which airspace users can easily access further information about the TMZ and the trial. Note: This recommendation is also valid in the event that ADLS are implemented as the technology may be a novel concept to some airspace users.

Inadvertent penetration by users unaware of the TMZ was assessed as not being an immediate safety issue but it was important to identify such events as far as practicable in order to obtain the best possible trial data.

MHTMZ.REC.16	The trial should be designed to capture as many tracks through the TMZ as can be practicably obtained. Specifically, consideration should be given to other types of non-certified EC such as FLARM, CAP 1391 / Source Integrity Level (SIL) Zero Autonomous Dependent Surveillance – Broadcast (ADS-B), PilotAware, etc.

It was also noted during the event that there are numerous ACP consultations ongoing, as well as this one. Stakeholder fatigue is something to be cognisant of and because, as stakeholder engagement is essential to the trial's success, it is important to make the campaign as simple and as compelling as possible and keep engagement channels open.

MHTMZ.REC.17	The trial campaign information (see also MHTMZ.REC.1) should be designed to be simple and compelling in order to maximise stakeholder engagement.

Airborne Systems

The proposed ADLS is a passive system and therefore requires autonomous surveillance equipment to be carried on aircraft, or an external interrogator to elicit a transponder response.

The discussion within this section covered the fact that a proportion of GA aircraft do not carry any EC device, and many more do not carry Mode-S transponders. The discussion about airborne systems reiterated the recommendation that all commonly available forms of EC should be included as part of the trial, where practicable.. This recommendation has already been captured as MHTMZ.REC.16.

The subject of economic support was raised in order to increase the take-up of EC within the GA community.

MHTMZ.REC.18	The possibility of economic support should be considered by the sponsors of the TMZ and discussions on possible incentive / funding streams should be held with GA organisations..

ATC Personnel

The TMZ is not the responsibility of a specific ATC unit. Therefore, it is important to ensure awareness at all units who may be contacted.

The main concern for ATC personnel relates to an increase in workload should aircrew request additional information or a specific service in relation to the trial TMZ. In general, this was considered to be a low-risk aspect of the trial, but that units should be briefed on the TMZ parameters and the trial's objectives.

MHTMZ.REC.19	The briefing campaign (see also MHTMZ.REC.1) should cover both airspace users and ATC units.
MHTMZ.REC.20	Further to MHTMZ.REC.4 (publication of contact frequency) and MHTMZ.REC.5 (briefing of unit ATCOs), ATCOs at the relevant Flight Information Service (FIS) (, Scottish Information) should be briefed on the trial parameters and objectives.

ATC Systems

The main concern in relation to ATC systems is an increase in surveillance targets if more aircraft carry transponders.

The discussion also covered an increase in Radiotelephony (RTF) communications and surveillance clutter.

In general, participants agreed that there is unlikely to be any significant impact or hazardous effect relating to ATC systems. For example, contemporary Surveillance Data Processing Systems (SDPS) are able to handle a large number of targets, significantly more than are likely to be present in the area of the trial.

Similarly, the additional RTF traffic should be well within the capabilities of existing systems, even though it may represent a marginal increase in ATCO workload.

HAZID Conclusion

The four main areas of potential hazards were discussed in relation to the trial TMZ. Participants agreed that none of the hazards represent a significant risk to air safety.

The HAZID workshop provided an effective forum at which a range of stakeholders had an initial engagement for both the trial and the wider ADLS concept.

20 recommendations have been made relating to the conduct of the trial and these help to ensure that all risks are As Low as Reasonably Practicable.

Stakeholders are invited to review of this initial report and provide additional comments. The recommendations and comments will be considered and, where appropriate, developed into safety requirements for the trial.

Stakeholders are also encouraged to highlight any safety concerns that were either not covered during the HAZID event or have not been accurately captured in this initial issue of the HAZID report.

It is reiterated that the scope of the event was primarily in relation to the implementation of the temporary TMZ. It is mandatory to conduct another HAZID prior to any operational ADLS deployment. There were no significant risks associated with the trial identified and, as this technology has been tested and is now installed and mandated throughout Germany, we have confidence in the technology but will ensure a full safety case is produced in support of the technology trial.

Annex C

Trial Safety Argument

References

During the compilation of this document the following source documents were used for subject matter reference:

[5] Regulation (EU) 2017/373Common Requirements for Providers of Air Traffic Management / Air Navigation Services and other Air Traffic Management Network Functions and their Oversight.

[6] European Aviation Safety Agency Easy Access Rules for Air Traffic Management / Air Navigation Services (Regulation (EU) 2017/373).

[7] Civil Aviation Authority Publication CAP 760 Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases.

[8] Civil Aviation Authority Publication CAP 1391 Electronic Conspicuity Devices.

[9] Goal Structuring Notation Community Standard, The Assurance Case Working Group (ACWG), document reference SCSC-141C, Version 3, May 2021.

[10] Hazard Identification Workshop Report Transponder Mandatory Zone at Mark Hill Wind Farm, ScottishPower Renewables Ltd, document reference ACP-2023-008, Issue 1.0, July 2023.

[11] Hazard Identification Briefing Transponder Mandatory Zone at Mark Hill Wind Farm, document reference ACP-2023-008, Issue 1.0, June 2023.

[12] Operational Concept ADLS, Cyrrus Ltd, document reference CL-CL-5877-RPT-008.

The latest version of the referenced document shall be used unless a specific edition is stated.

Mark Hill Windfarm TMZ

General

This document relates to the introduction of a temporary Transponder Mandatory Zone (TMZ) at Mark Hill Windfarm. It contains a high-level safety argument with the goal of showing that the temporary TMZ will not present an unacceptable safety risk. In fact, it is argued that there is no or negligible change in the safety risk during the trial period.

This document has been prepared by Cyrrus Limited for ScottishPower Renewables UK Ltd (SPR).

Background

All potential hazards that could arise from the introduction of a new system, airspace, or change to any existing system or airspace, must be identified and risks assessed.

To comply with CAA Safety Requirements, airspace change sponsors must ensure that risk assessment and mitigation are conducted to an appropriate level, to ensure that due consideration is given to all aspects of Air Traffic Management (ATM).

SPR is part of the Scottish Power group of companies operating in the UK under the Iberdrola Group, one of the world's largest integrated utility companies and a world leader in wind energy.

Mark Hill Wind Farm is a 28 turbine, 56-Megawatt green power wind farm on a site located approximately 2 kilometres to the northeast of Barrhill, in the South Ayrshire Council area. The site is located on the shallow eastern slopes of Garleffin Hill and falls within the Carrick Forest. The site is also located on the edge of the Galloway International Dark Sky Park.

Wind farm installations require obstacle hazard avoidance lighting (AGL) to mark their positions as a warning to low flying aircraft. In the UK, this type of lighting is continuously lit from 30 minutes after sunset to 30 minutes before sunrise in accordance with Air Navigation Order Article 222.

The effects of aviation hazard lighting were raised as a concern by NatureScot. As part of the planning process, SPR proposed the inclusion of a new Aviation Detection Lighting System (ADLS) to mitigate the impact of lighting on the visual landscape.

Figure 2: Mark Hill windfarm

The ADLS operates with a 'fail safe' concept whereby the obstruction lights are normally ON but are turned OFF if the system does not detect any aircraft within the defined volume of airspace. As soon as the system detects an aircraft within the volume of airspace, the ADLS turns ON. The proposed ADLS depends on aircraft transmitting their position or responding to radar interrogations for the system to detect their presence.

It is proposed that a temporary Transponder Mandatory Zone (TMZ) is implemented with a 3 nautical mile buffer around the windfarm boundary. This will facilitate a trial that enables SPR and the Civil Aviation Authority (CAA) to evaluate the effectiveness of ADLS technology.

ADLS and TMZ Overview

The HAZID Workshop Report (ref. [10]) included the ADLS theory of operation and an overview of TMZs. The main elements of that description are reproduced at Appendix B of this document for convenience.

Safety Management

All safety management activities related to the TMZ shall comply with applicable statutory safety requirements. SPR is not an Air Navigation Service Provider (ANSP) and therefore do not have their own aviation Safety Management System (SMS). In lieu of this, the CAA CAP 760 guidance (ref. [7]) will be applied directly to perform the risk assessment.

This document forms part of a systematic process to identify and analyse the potential hazards that could be presented by the trial TMZ.

Safety Argument

Overview

The safety argument is presented in pictorial and narrative form. The pictorial representation utilises Goal Structuring Notation (GSN) which is a widely used graphical notation used to represent safety arguments.

The UK Civil Aviation Authority (CAA) include a primer on GSN in their guidance document Civil Aviation Publication (CAP) 760 (ref. [7]). A short summary of the notation is also provided at Appendix A, whilst full details are freely available in the standard (ref. [9]).

The overarching safety goal of the trial is not to increase the level of risk for aviation operations in the vicinity of the windfarm. It should be noted that the practical goal of the trial is to establish the effectiveness of the ADLS equipment and to validate the method for defining an ADLS airspace volume. The trial therefore has the potential to contribute long term safety benefits, it is the direct aspects of the TMZ trial that are covered by this document. Please refer to the verification of the Concept of Operations (CONOPS) (ref.).

Assumption

The Hazard Identification (HAZID) and initial analysis (ref. [10]) were predicated on a single assumption. This is stated as follows:

> *Existing aviation operations conducted within the area of the proposed TMZ are assumed to be at least tolerably safe and in accordance with applicable statutory aviation safety requirements.*

Goal 0: Top-Level Goal

The temporary TMZ does not introduce any additional safety risks.

The top-level goal is consistent with, and possibly goes beyond, the regulatory requirement that risks should be tolerable and As Low as Reasonably Practicable (ALARP). It is intended to argue that the effects of the trial on aviation operations are negligible due to the careful approach that is taken to the trial's implementation.

The top-level goal is summarised in the following GSN diagram.

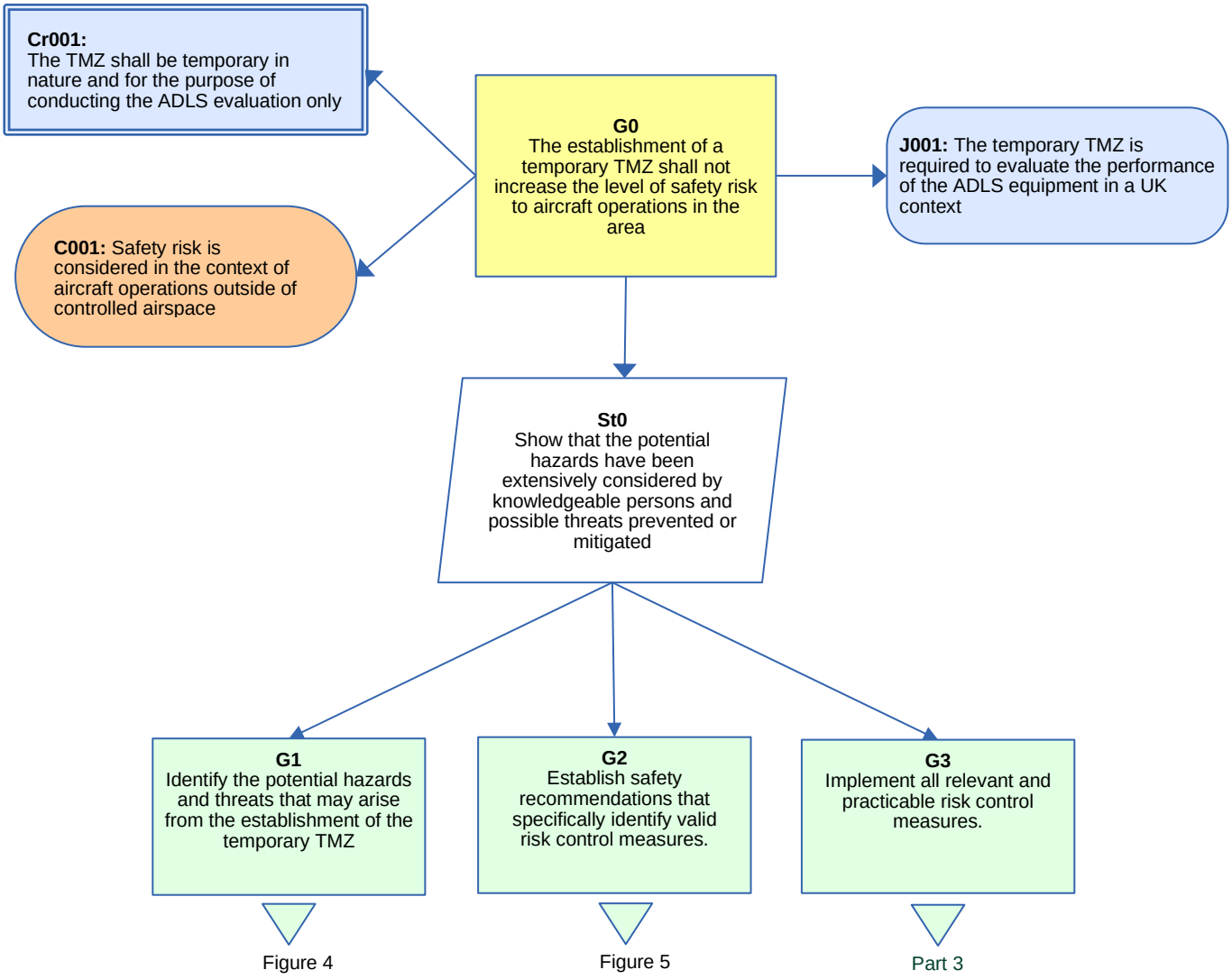


Figure 3: GSN diagram for Goal 0 (G0)

Goal 1: Hazard Identification

Identify the potential hazards and threats that may arise from the establishment of the temporary TMZ.

The potential hazards and threats were discussed during a 4-hour workshop attended by Suitably Qualified and Experienced Persons (SQEPs).

A HAZID event was held on Wednesday 22 June 2023 in Central Glasgow. The HAZID event was attended by representatives from Air Navigation Services, GAMA Aviation, Strathaven Airfield, Prestwick Flying Club, SPR Ltd, and observed by a CAA Windfarm Lighting Subject Matter Expert (SME). The event was facilitated by Cyrrus Ltd who are acting as consultants on the project.

A briefing document (ref. [11]) was provided to attendees to ensure that they were adequately prepared for the workshop. Minutes were taken during the meeting, a report was produced and circulated amongst stakeholders for comment and validation.

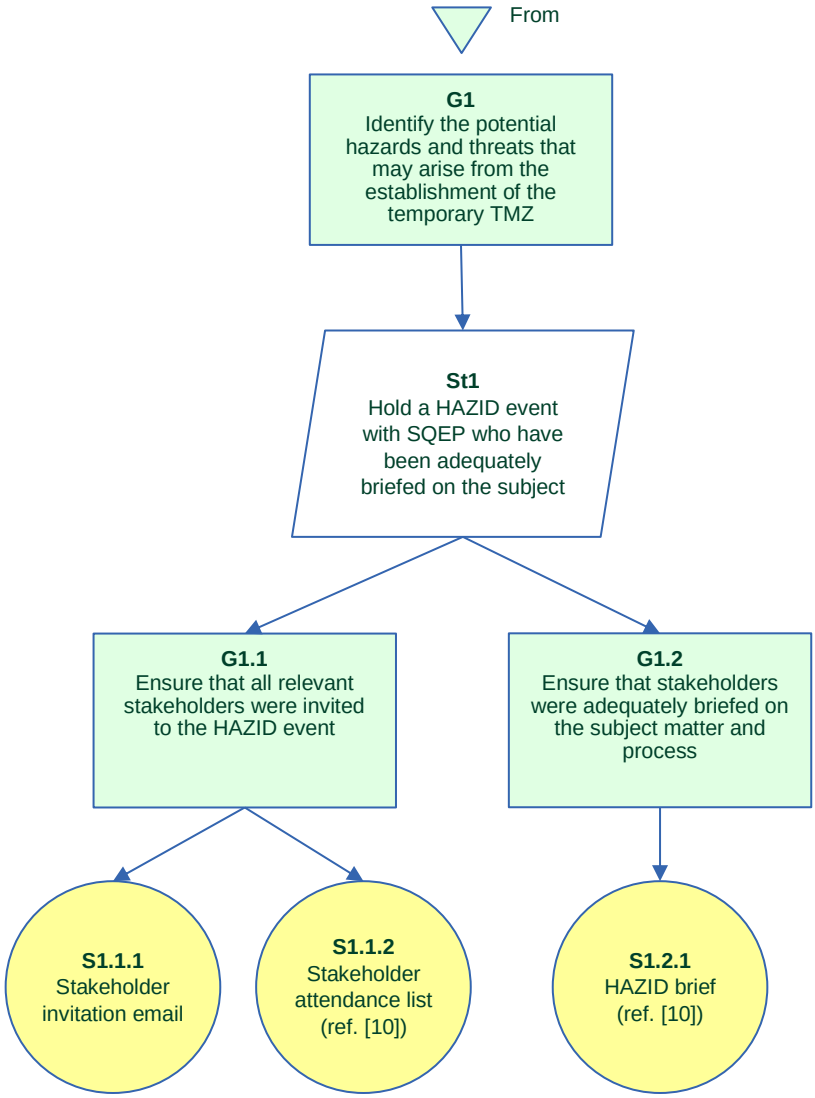


Figure 4: GSN diagram for Goal 1 (G1)

Goal 2: Establish Safety Recommendations

Establish safety recommendations that specifically identify valid risk control measures.

The HAZID event took the form of structured brainstorming and rough notes were taken during the workshop. The rough notes were subsequently organised into groupings and captured in the form of safety recommendations. The output of this analysis was documented in the HAZID Workshop Report (ref. [10]).

The GSN representation of this goal is straightforward as it decomposes directly to the HAZID report as evidence.

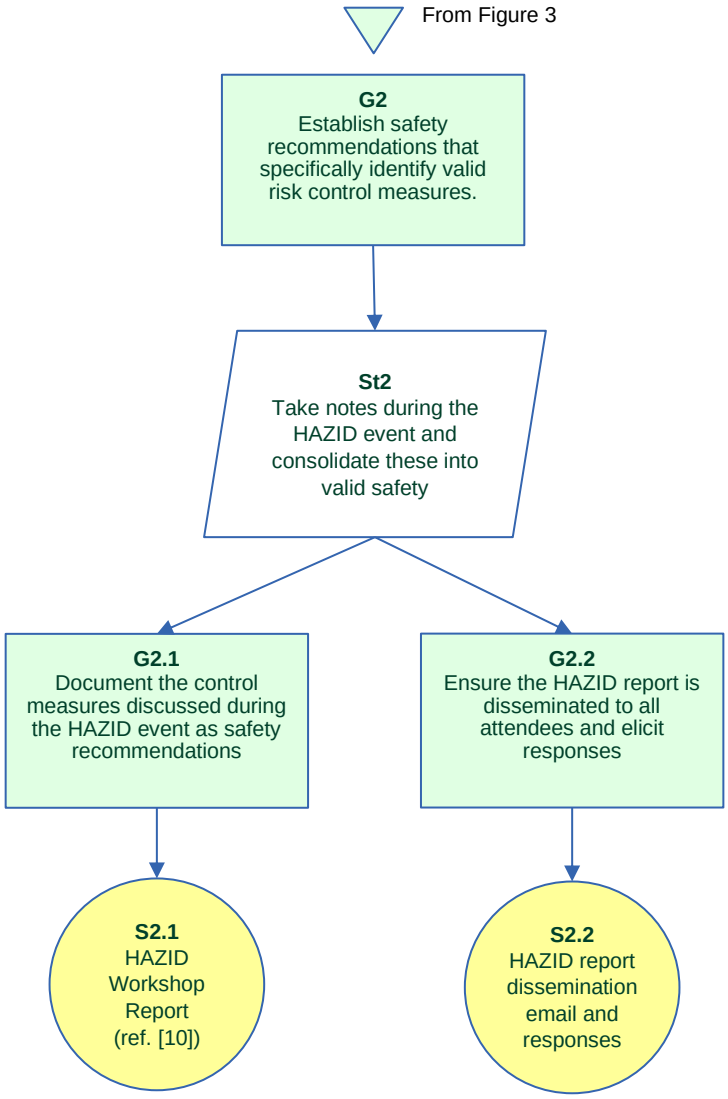


Figure 5: GSN diagram for Goal 2 (G2)

The recommendations are organised into the following groups which align with the hazards and threats considered during the workshop:

- Aircrew considerations, including:
    - Startle threat
    - Avoidance of the TMZ by VFR pilots
    - High ground threat
    - Poor weather threat
    - Time constraints threat

    - Cumulative effects
    - Other users
- Airborne systems
- Air Traffic Control (ATC) personnel considerations
- ATC systems considerations

Evidence of the implementation of the applicable recommendations in each category is provided against the next goal.

Goal 3: Implement Risk Measures

Implement all relevant and practicable risk control measures.

This goal ensures that the risk is managed appropriately by confirming that all relevant control measures are put in place.

Details of the control measures were contained in the HAZID Workshop Report (ref. [10]) as discussed in the previous section. Each recommendation was given a reference number and the tables in this section provide traceability between the recommendations and evidence of their implementation.

Aircrew: Startle Threat

The first recommendation relating to aircrew specific threats is summarised below.

MHTMZ.REC.1	Prior to implementing ADLS at any site, authorities and service providers should conduct an informative campaign to raise awareness of the technology and its practical manifestation.	Evidence: • Project Action Log • ADLS Stakeholder List • Stakeholder Record of Engagement (containing event dates and attendees)

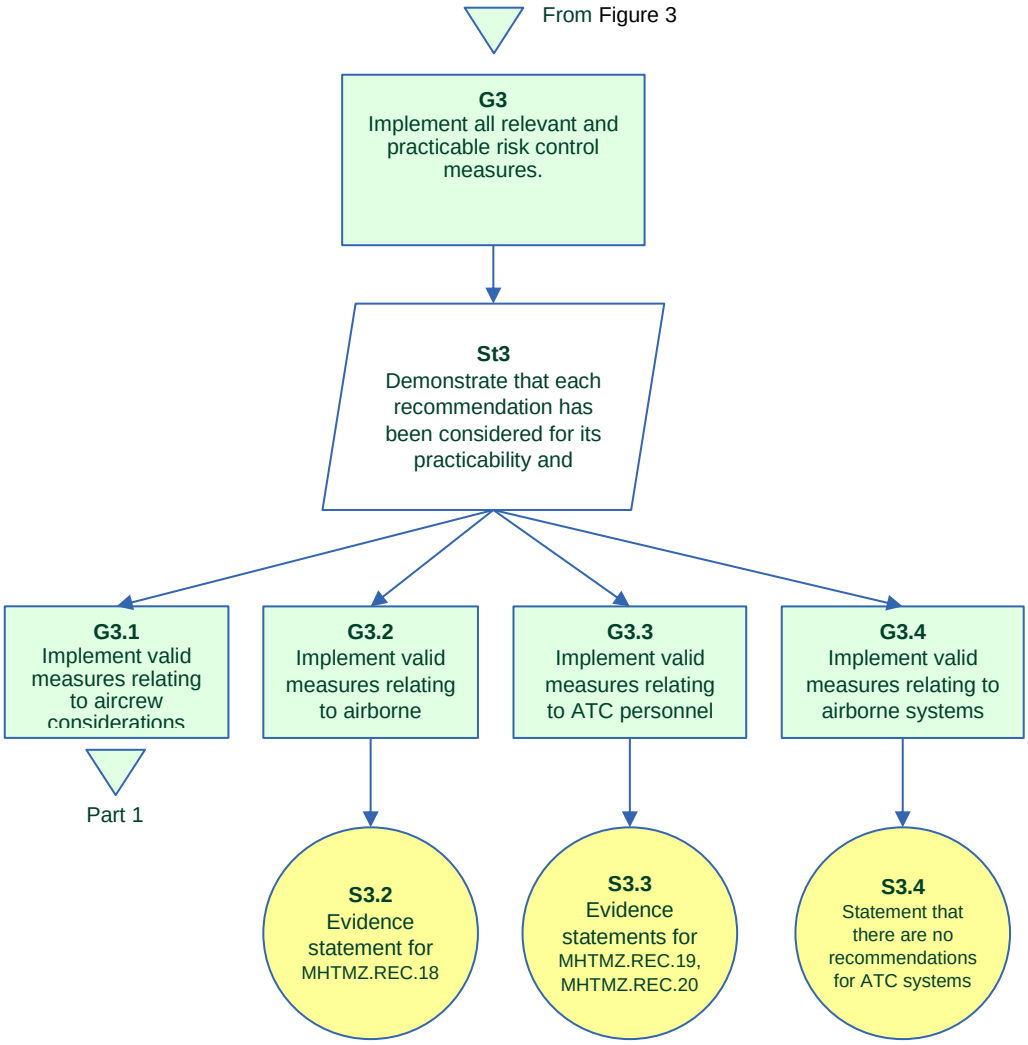


Figure 6: GSN diagram for Goal 3 (G3)

Sub-goal 3.1 has been further decomposed into the specific aspects relating to aircrew that were considered during the HAZID and subsequent analysis. This sub-goal and its corresponding evidence is summarised in the following GSN diagram. No recommendations were made relating to VFR pilots potentially avoiding the TMZ. This is because there were no immediate valid concerns. Consideration has been given to aircrew behaviour relating to high-ground, time pressures, and deteriorating weather conditions.

Note: The evidence for solutions S3.2 to S3.4 starts on page of this report.

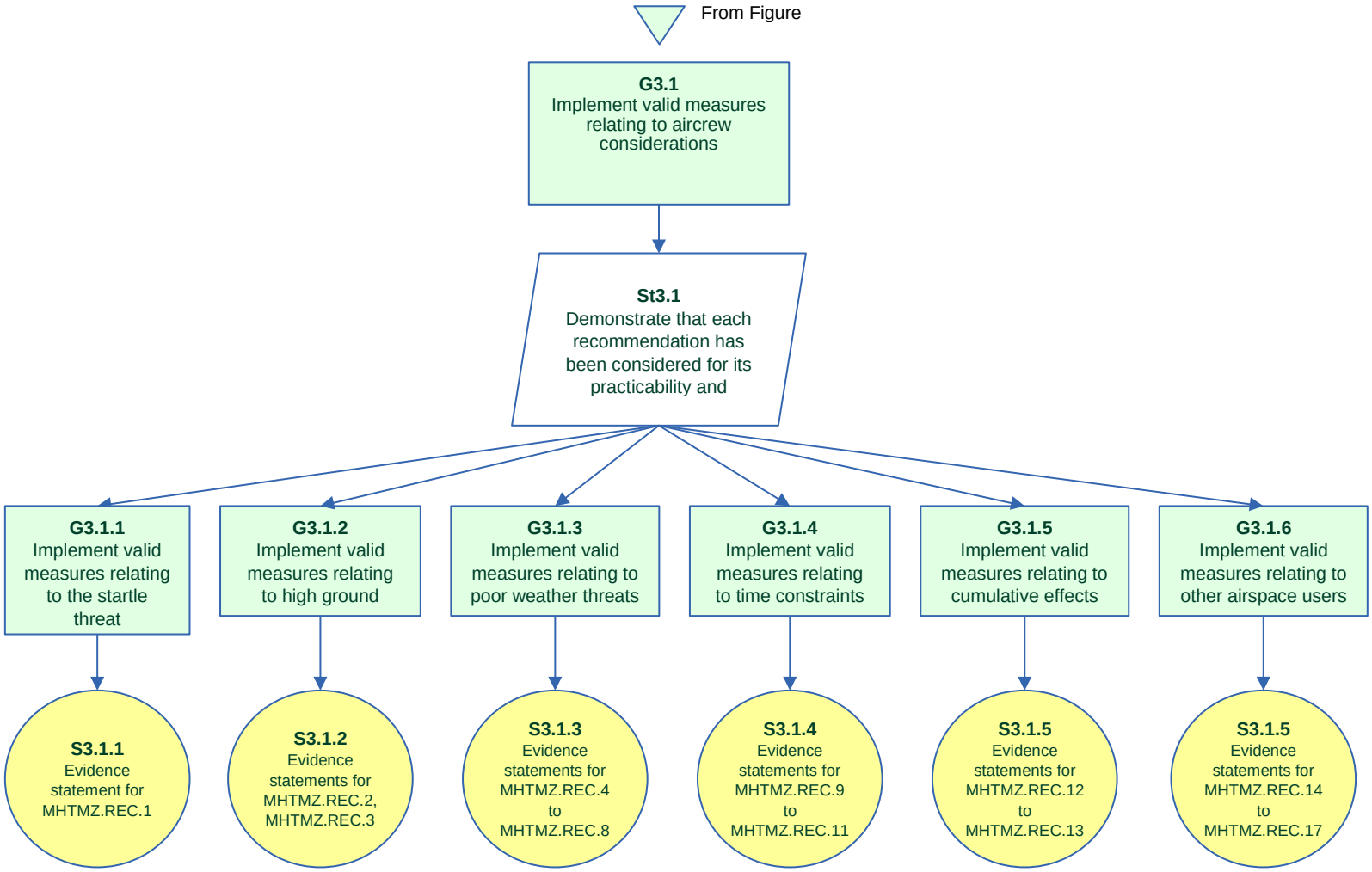


Figure 7: GSN diagram for Goal 3.1 (G3.1)

Aircrew: High-Ground Threat

MHTMZ.REC.2	The upper extent of the TMZ should be defined at a constant level Above Mean Sea Level (AMSL) rather than Above Ground Level (AGL).	Evidence: The temporary TMZ has been designed with an upper extent of 2200 feet AMSL. The ADLS equipment will be calibrated to the atmospheric pressure at mean sea level.
MHTMZ.REC.3	The upper extent of the TMZ should be considered with respect to overlaying airspace to ensure that it is possible to route over the TMZ without penetrating other airspace.	Evidence: The upper limit of the TMZ is 2200 feet AMSL. The lowest point of controlled airspace in the vicinity is 5500 feet AMSL allowing adequate margin for overflights.

Aircrew: Poor Weather Threat

MHTMZ.REC.4	The Aeronautical Information Publication (AIP) entry for the TMZ, and by extension the information associated with the airspace available on Electronic Flight Bag (EFB) applications[5], should include a contact frequency. The rationale behind this recommendation is that if aircrew are concerned about penetrating the TMZ in deteriorating conditions, there is a defined path to obtaining additional information.	Evidence: The implementation of the temporary TMZ will be notified via an Aeronautical Information Circular (AIC) whose contents are received by all major EFB providers. The contact frequency will be Scottish Information (119.875, 124.500). The AIP lists the contact for Scottish Information under ANR633 and operating hours as 0800 to 2000.
MHTMZ.REC.5	With reference to MHTMZ.REC.4, any ANSP whose contact frequency is listed in the AIP should be briefed about the trial	Evidence: A Teams meeting regarding the implementation of the temporary TMZ, took place with stakeholders

[5] *Examples of EFP are SkyDemon, Jeppesen ForeFlight, and Garmin Pilot.*

	strategy, potentially including the ability to cross the trial TMZ without a transponder.	from NATS Prestwick Centre on 29 August 2023. A follow-up email was sent on 05 September 2023.
MHTMZ.REC.6	The forecast weather conditions for the site should be recorded throughout the trial.	Evidence: The trial plan includes a provision for a nominated team member to retain a record of the daily weather forecast at Bar Hill.
MHTMZ.REC.7	One or more webcams and associated recording equipment should be used to monitor the actual weather conditions at the site throughout the trial and compared to the forecast. Any differences between forecast and actual conditions should be analysed.	Invalidation notes: This requirement was considered to be impracticable for the scope of the trial as the infrastructure to make such recordings is not available at the site. Implementing such infrastructure would be disproportionally complex in relation to benefits obtained.
MHTMZ.REC.8	It should be confirmed with the ADLS design authority that the system is referenced to the actual / local barometric pressure and includes compensation for deviations from the standard atmosphere. Note: Secondary Surveillance Radar (SSR) aircraft transponders are referenced to the standard atmosphere at sea level (defined as 1013.2 hectopascals) irrespective of the altimeter subscale setting. Uncertified Electronic Conspicuity (EC) devices may output altitude based on current barometric pressure, Global Navigation Satellite System (GNSS), or a mixture of both.	Evidence: Local barometric pressure will be recorded using calibrated meteorological instruments. Calibration Certificate will be available. Aircraft heights will be corrected using this data to provide height above the wind farm ground level (highest point) i.e. QFE.

Aircrew: Time Constraints Threat

10/5/23

MHTMZ.REC.9	The trial TMZ should only be active during 'official night' (defined as 30-minutes after local sunset until 30-minutes before local sunrise).	Evidence: The trial plan calls for establishing the temporary TMZ on a 24-hour basis. The trial data will be analysed in the middle of April 2024 to check the amount of data that has been collected and, at that time, consideration will be given to TMZ night-only operation, subject to approval by the CAA. It should be noted that the purpose of the trial is to collect data, and therefore it is preferable that the TMZ is active for 24hours.
MHTMZ.REC.10	The clear and consistent method for depicting the temporal nature of the trial TMZ should be determined, including, but not limited to, on paper charts, in the Aeronautical Information Publication (AIP), Notices to Aviation (NOTAM), and EFB apps. Note: It was not determined during the event whether there is a precedent for other TMZ that are only activated at specific times of the day. Subsequent research (albeit limited) has also failed to identify another instance of a time limited TMZ.	Evidence: The approach to implementing TMZ on a temporal basis is to be discussed with the CAA as part of the temporary TMZ approval and subsequent data analysis.

The following recommendation is not related to the trial but should be included in any ongoing ADLS site development.

MHTMZ.REC.11	The time when the ADLS is active should be subject to further consideration and analysis.	Evidence: The time will be included in the post-trial review. The initial consideration is that the lights will not cause a startle factor because there is a 3 nautical mile buffer around the site – this means that a typical low-level aircrew will initially see the lights at a reasonable distance. Note: for the purpose of this trial, no lights will be switched on/off.

Aircrew: Cumulative Effects

The workshop considered if there might be an interaction between the TMZ trial and other trials planned to occur at the same time. Reference was made to trials involving Unmanned Aerial Systems (UAS) and the 'segregated airspace' concept.

MHTMZ.REC.12	Although an abbreviated airspace change process is applicable to the trial TMZ, National Air Traffic Management Advisory Committee (NATMAC) stakeholders should still be consulted with regards to the trial.	Evidence: • ADLS Stakeholder List • Stakeholder Record of Engagement (containing event dates and attendees) NATMAC members, including UAS operator representatives, are stakeholders to the project and have been engaged.
MHTMZ.REC.13	The trial TMZ Sponsors should make direct contact with UAS operators in the planned area to discuss the trial and subsequent plans for the ADLS.	

Aircrew: Other Airspace Users

The threat to aircrew from other users considered both whether the TMZ would create a 'pinch point' and also what would happen if another aircrew was not aware of the TMZ. It was concluded that due to the low traffic levels, the threat of a pinch point was not realistic in this particular context.

MHTMZ.REC.14	The information campaign recommended in MHTMZ.REC.1 should clearly inform airspace users that the TMZ is Class G (i.e., uncontrolled) airspace and that aircrew are responsible for their own separation.	Invalidation notes: This threat was considered during the HAZID and subsequently during the trial preparations, including dialogue with NATS Prestwick Centre stakeholders. It was concluded that this is not a significant issue and therefore no specific measures are required.
MHTMZ.REC.15	It is a standard requirement to issue a NOTAM for the trial. The NOTAM should include a telephone number and / or webpage which airspace users can easily access further information about the TMZ and the trial.	Evidence: The AIC will be issued with an accompanying NOTAM.

Inadvertent penetration by users unaware of the TMZ was assessed as not being an immediate safety issue but it was important to identify such events as far as practicable in order to obtain the best possible trial data.

MHTMZ.REC.16	The trial should be designed to capture as many tracks through the TMZ as can be practicably obtained. Specifically, consideration should be given to other types of non-certified EC such as FLARM, CAP 1391 / Source Integrity Level (SIL) Zero Autonomous Dependent Surveillance – Broadcast (ADS-B), PilotAware, etc.	Evidence: The trial plan calls for two ADS-B receivers to be deployed along with standard Mode A/C/S receivers. The ADS-B receivers will provide three-dimensional position, whereas the Mode A/C/S receivers will only provide approximate range based on signal strength. Other means of EC are not included within the project scope.

MHTMZ.REC.17	The trial campaign information (see also MHTMZ.REC.1) should be designed to be simple and compelling to maximise stakeholder engagement.	Evidence: Stakeholder engagement has already taken place, and will continue, and feedback obtained. The feedback is recorded in the Action Log where appropriate.

Airborne Systems

MHTMZ.REC.18	The possibility of economic support should be considered by the sponsors of the TMZ and discussions on possible incentive / funding streams should be held with GA organisations.	Evidence: Discussions about providing funding to impacted groups is underway and has been captured in the minutes to the stakeholder meetings on 10 August 2023 and 06 September 2023.

ATC Personnel

MHTMZ.REC.19	The briefing campaign (see also MHTMZ.REC.1) should cover both airspace users and ATC units.	Evidence: The stakeholder group includes NATMAC of which the relevant air traffic service providers are members.
MHTMZ.REC.20	Further to MHTMZ.REC.4 (publication of contact frequency) and MHTMZ.REC.5 (briefing of unit ATCOs), ATCOs at the relevant Flight Information Service (FIS) (e.g., London Information, Scottish Information) should be briefed on the trial parameters and objectives.	Evidence: A Teams meeting regarding the implementation of the temporary TMZ took place with stakeholders from NATS Prestwick Centre on 29 August 2023. A follow-up email was sent on 05 September 2023.

ATC Systems

The main concern in relation to ATC systems is an increase in surveillance targets if more aircraft carry transponders. It has been assessed there is unlikely to be any significant impact or hazardous effect relating to ATC systems. Surveillance Data Processing Systems (SDPS) can handle many targets, significantly more than are likely to be present in the area of the trial. Similarly, the additional RTF traffic should be well within the capabilities of existing systems.

Safety Argument Conclusion

The four main areas of potential hazards were discussed in relation to the trial TMZ. Participants agreed that none of the hazards represent a significant increase in risk to air safety.

The minor impacts of the trial were analysed further, and recommendations made to ensure that any small potential increases in risk have been managed to be ALARP.

Evidence of the implementation or planned implementation of the relevant measures has been presented.

The HAZID Workshop Report provided 20 recommendations of which 18 have already been implemented or are in the process of being implemented.

One recommendation relating to recording of the actual weather conditions was impracticable due to the complexity of providing appropriate infrastructure for a trial.

One recommendation relating to reminding aircrew that the area is Class G airspace was considered unnecessary as the airspace is clearly marked on charts and EFBs.

This report provides a compelling safety argument to show that there is no increase in risk to air operations because of the temporary TMZ trial. Therefore, from a safety perspective there is no reason to prevent the trial from being approved.

Goal Structuring Notation

Goal Structuring Notation (GSN) is a graphical argumentation notation that can be used to explicitly document the individual elements of any argument (claims, evidence, and contextual information) and, perhaps more significantly, the relationships that exist between these elements (i.e., how claims are supported by other claims, and ultimately by evidence, and the context that is defined for the argument).

Arguments documented using GSN can help provide assurance of the critical properties of systems, services, and organisations (such as safety or security properties).

The following text summarises the key aspects of the notation, however reference should be made to the GSN Standard (ref. [9]) or Appendix E of CAP 760 (ref. [7]) for a full understanding.

The purpose of GSN is to document how claims (represented in GSN as goals) are said to be supported by sub-claims (also represented in GSN as goals). Figure 8 shows an example goal in GSN.

In GSN, the claims of the argument are documented as goals and items of evidence are documented as solutions. The relationships represented in GSN are:

- The predicate-conclusion relationship between goals and sub-goals;
- The support that solutions provide for claims;
- The relationship between the argument and the context in which it is stated.

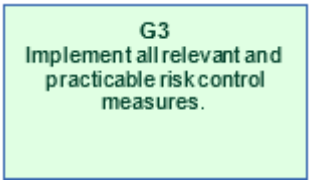


Figure 8: Example of a GSN 'Goal'

Where evidence is asserted to support the truth of the claim, this can be documented by providing a solution in GSN. Figure 9 shows an example solution (reference to evidence) in GSN:

Figure 9: Example of a GSN 'Solution'

The strategy symbol provides information about the reasoning as to why the solutions support claims to sub-claims and ultimately to solutions. The reasoning step is documented in GSN by including the strategy of the argument which links goals. Figure 10 shows an example strategy in GSN:

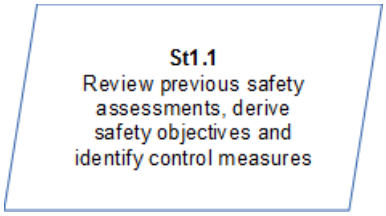


Figure 10: Example of a GSN 'Strategy'

When documenting a GSN goal or strategy it can also be important to capture the context in which the claim or reasoning step should be interpreted. This is achieved in GSN by use of various context symbols.

Figure 4 shows GSN context symbols used in this document:

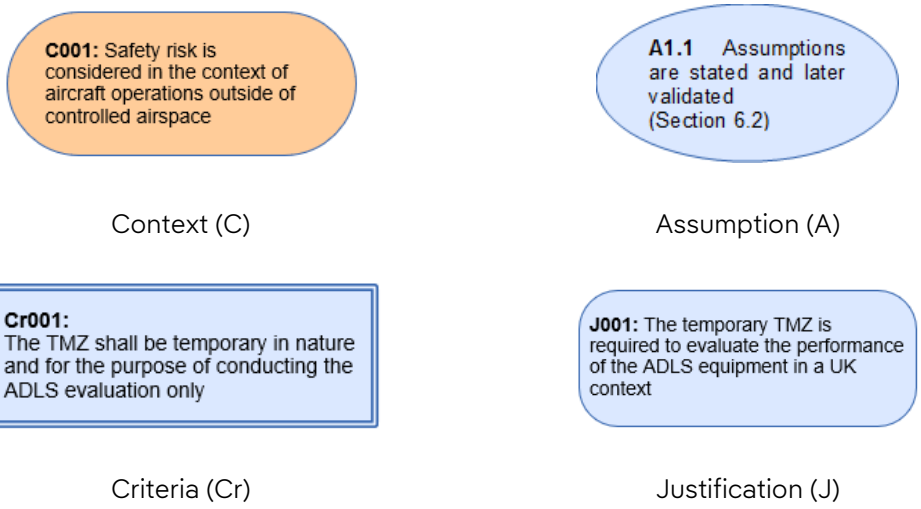


Figure 11: GSN context symbols

SCOTTISHPOWER RENEWABLES

Onshore

ADLS Trial TMZ at Mark Hill Windfarm

ACP -2023-008

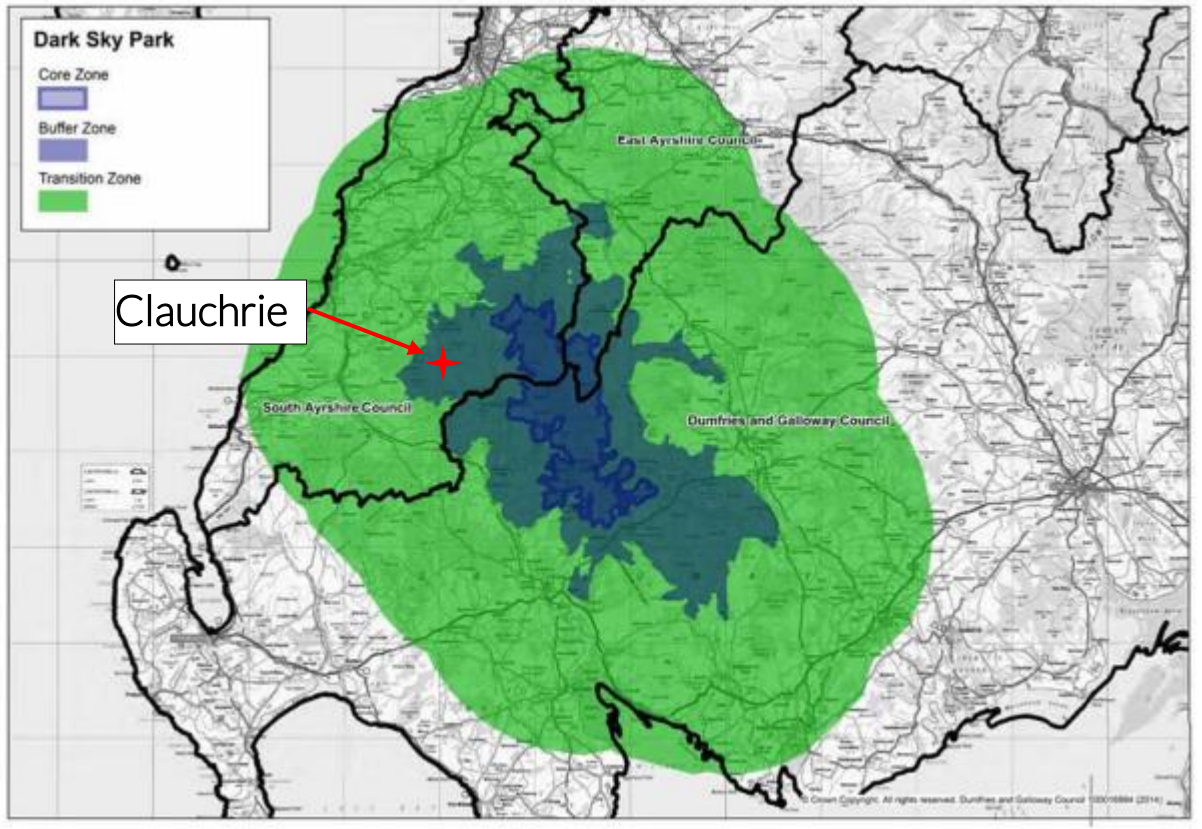
May 2023

Background - SPR

- ScottishPower Renewables (SPR) are part of the Iberdrola Group and one of the worlds largest integrated utility companies and world leader in wind energy.
- In the UK we have over 40 operational Windfarms all managed from our world leading control centre at Whitelee Windfarm near Glasgow.
- We have ambitious growth plans to expand our Onshore wind portfolio, investing in new large scale solar and innovative technologies such Battery Storage and Green Hydrogen. All with a view to tackling the Climate Crisis and helping to achieve Net Zero.

Background – Clauchrie

- Clauchrie Windfarm proposal is for 18 Turbines 200m to blade tip with an installed generating capacity of around 100MW.
- Planning Application has been submitted with determination expected imminently.
- Located in South Ayrshire the development area sits in the buffer zone of the Galloway Dark Skies park
- Visual impact of aviation lighting is a key consideration with ADLS an opportunity for mitigation.



The Challenge

SPR need to find a solution that balances

Aviation safety
and
Visual impacts

The best solution would be to deploy an

AVIATION DETECTION LIGHTING SYSTEM (ADLS)

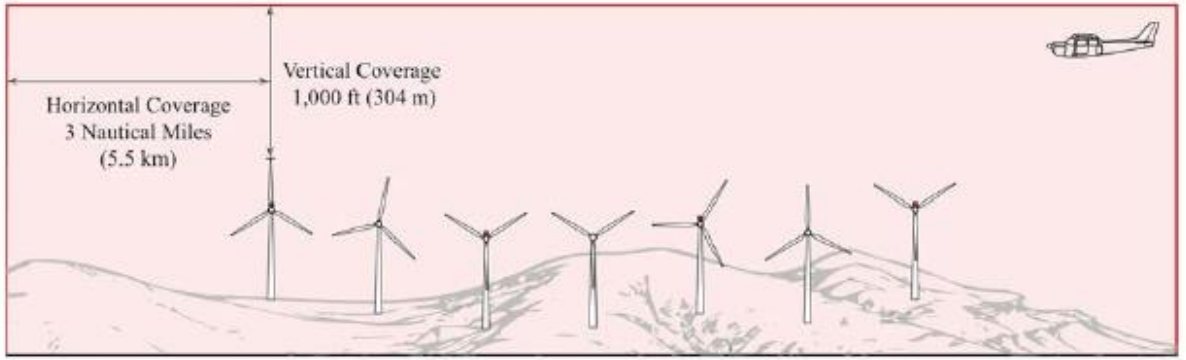
ADLS – How Does It Work?

Visible aviation obstacle lights are only illuminated when an aircraft is in the "box" – i.e. in vertical and lateral proximity to the turbines.

SPR are proposing the following for the box or illumination volume

- 1000ft above tallest tip height in windfarm
- 3nm from all turbines in windfarm

Below is representation of the FAA's box – differs slightly from the SPR proposal



* System above shown in active mode with aircraft in coverage area

ADLS

To deploy an ADLS:

- ADLS has never been deployed in the UK so the regulatory guidance will have to be developed.
- Would have to consider what type of sensor to deploy.

Non Co-operative
Primary Surveillance Radar (PSR)

- Proliferation of sensors
- Spectrum congestion
- Cone of silence
- Separate planning permission

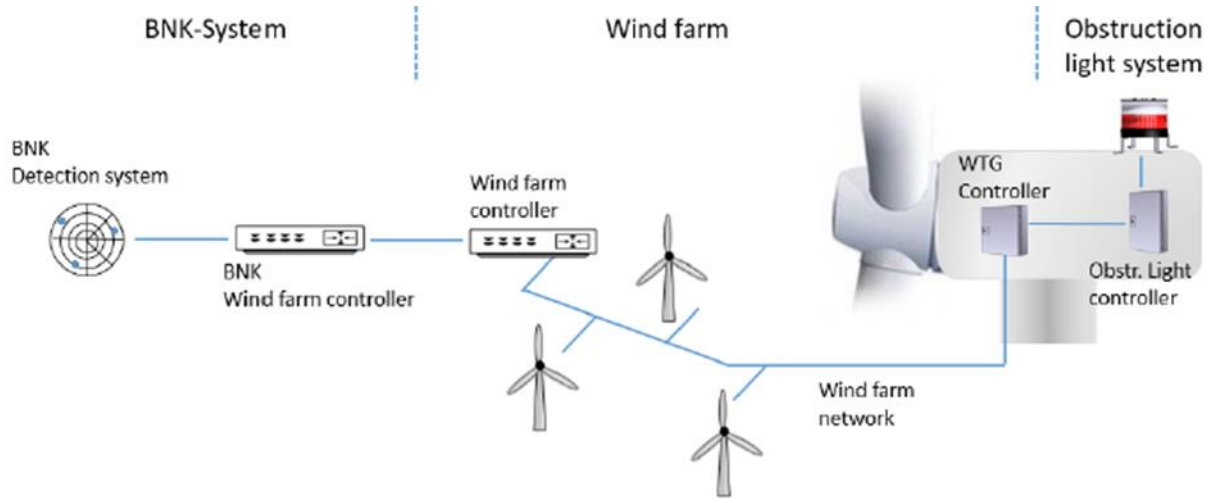
Co-operative
Electronic Conspicuity (EC)

- Mandatory EC carriage
- IR lighting for non-transponding aircraft
- Inter-operability of different systems
- RF congestion if interrogating

ADLS – How it Works

- A sensor detects the approaching aircraft
- The sensor system communicates with the windfarm / lighting system
- The lights are switched on / off depending on aircraft location

BNK is the German name for ADLS – BNK is now mandatory in Germany



ADLS Trial

SPR want to run a trial to prove the EC technology in the UK and we are consulting with you today as there will be a need for a Transponder Mandatory Zone (TMZ) .

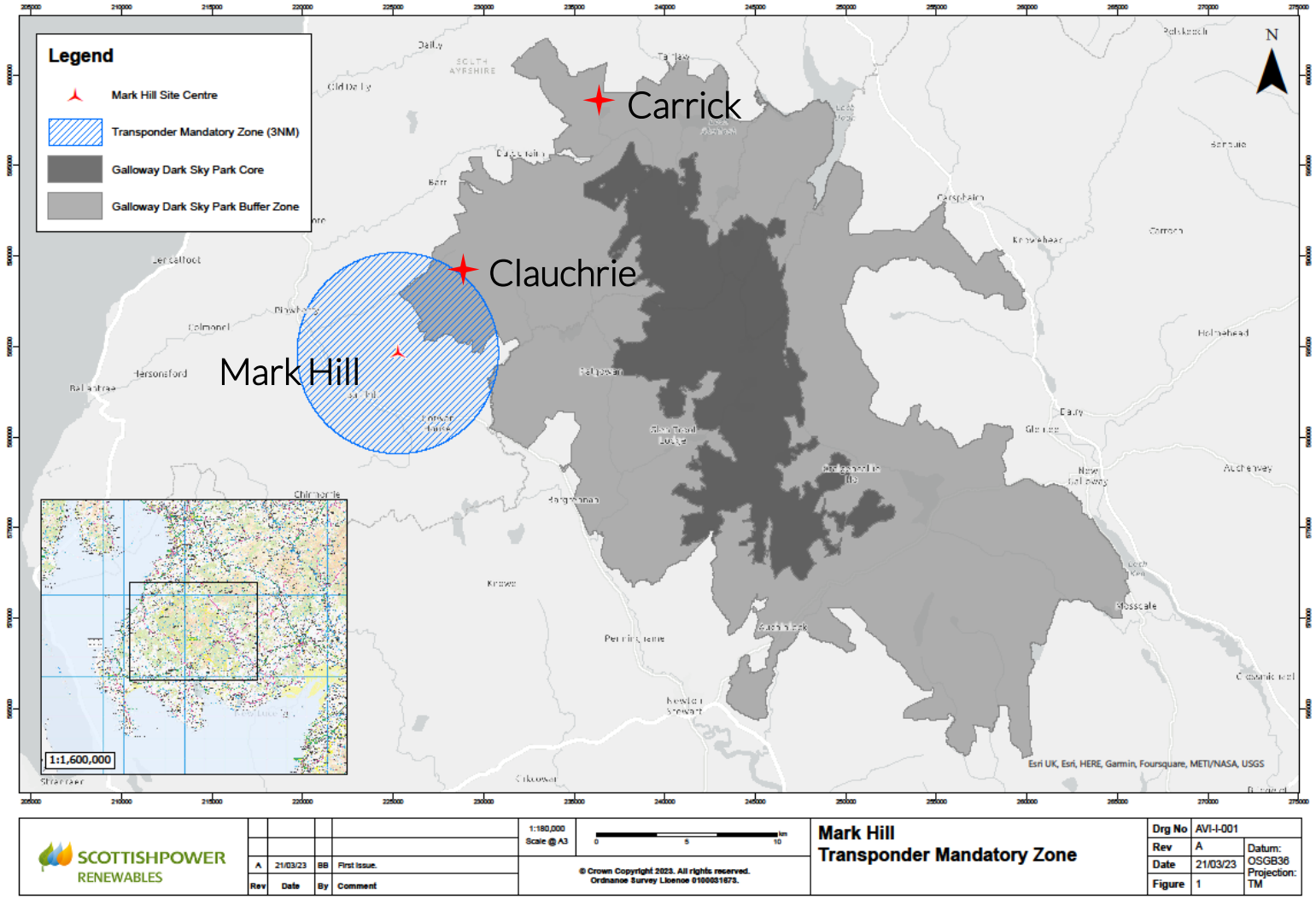
The trial will consist of two parts:

1. A passive trial where the system will collect data this data will then be validated using recorded radar data.

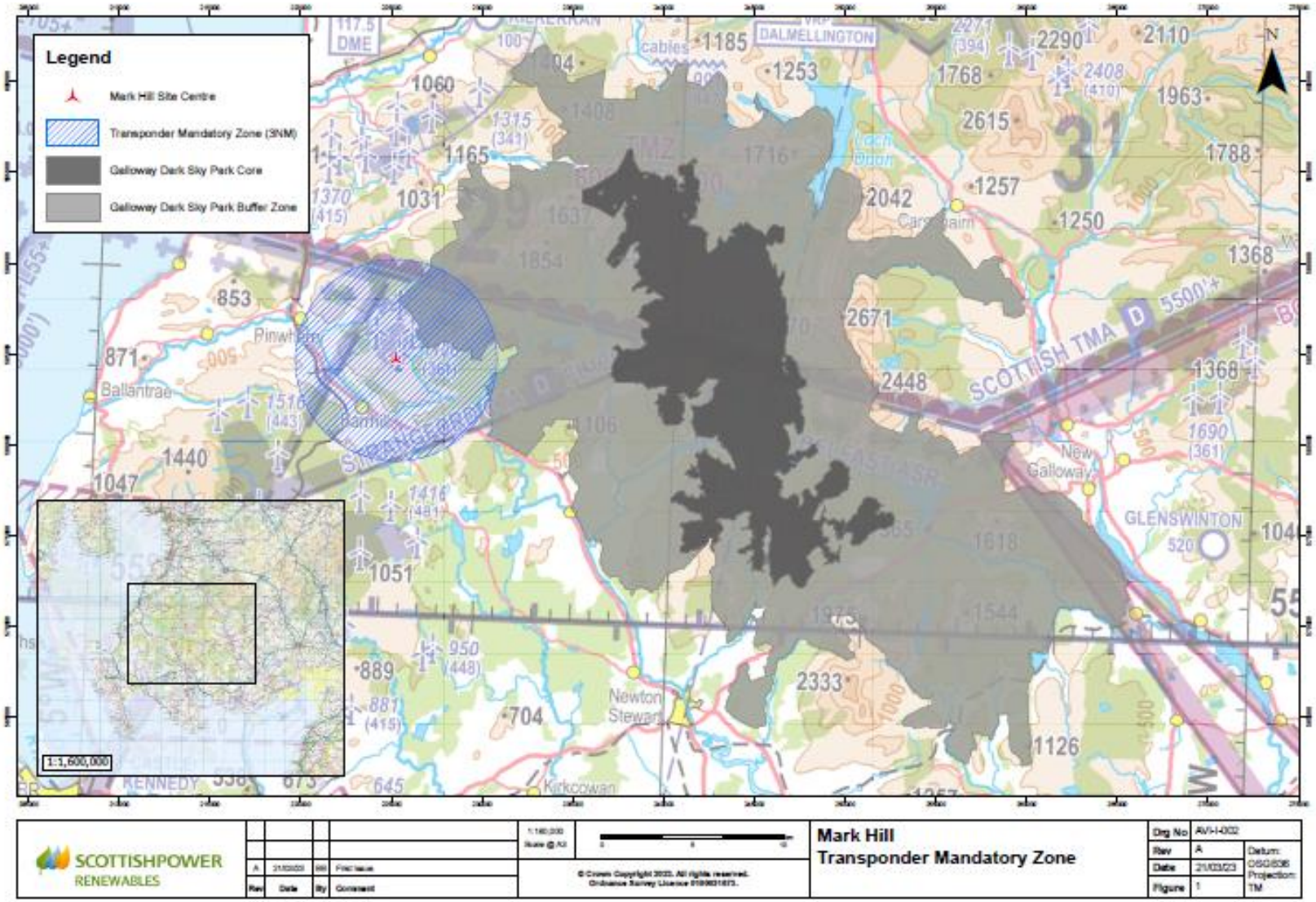
2. A 'live' trial involving deploying the system at a live windfarm. The system will not activate any lights but again will collect data.

A Transponder Mandatory Zone will be established to enable assessment of the box .

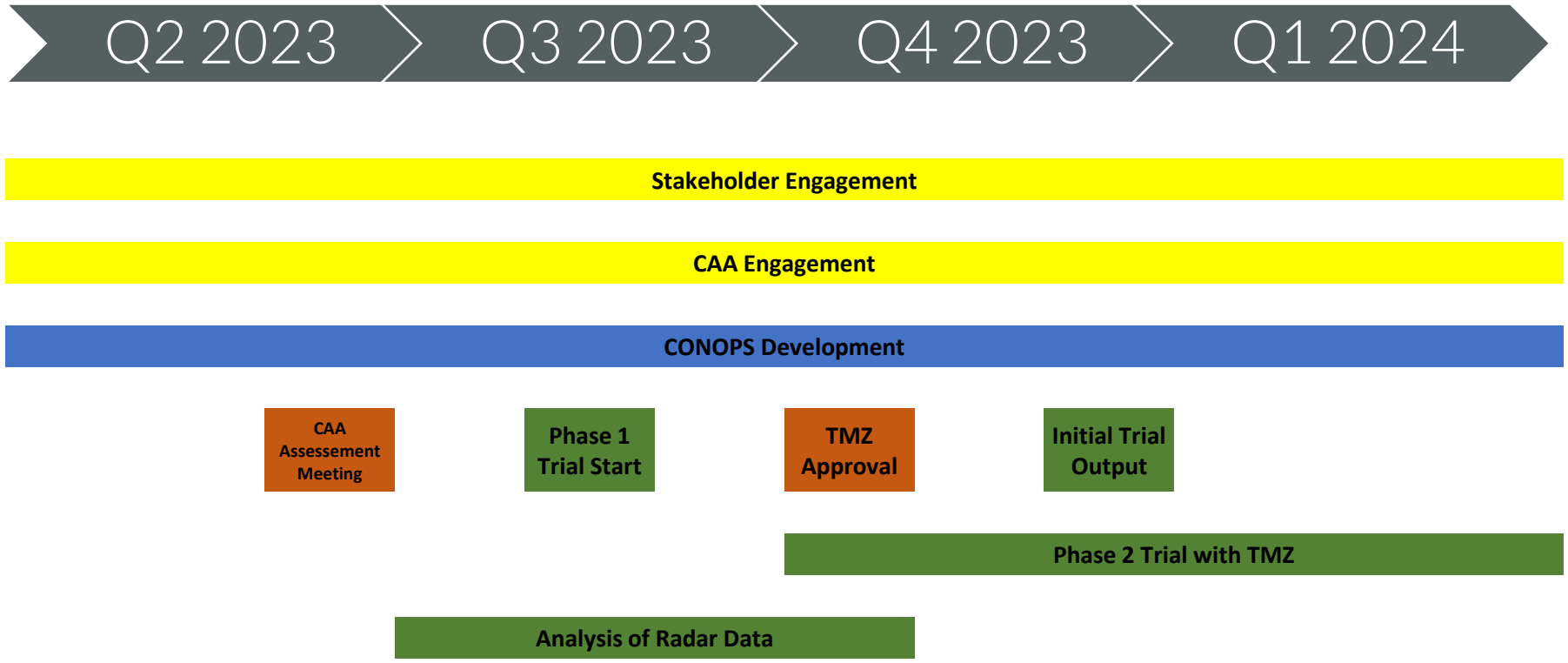
Location of Trial



Location of Trial



Provisional Timescales



Stakeholder Engagement

1. Early engagement with relevant stakeholders, face to face wherever possible.
2. Formal stakeholder engagement.
3. Frequent updates to stakeholders.
4. Stakeholders identified so far include:
    - Government departments
    - Aviation stakeholders, incl Emergency services
    - CAA
    - MOD

Airspace Modernisation Strategy (AMS)

The UK Airspace Modernisation Strategy was reissued in January 2023.

Its stated vision is:

> *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*

This new version builds on the work started in the previous version and puts a greater emphasis on Electronic Conspicuity

Airspace Modernisation Strategy (AMS)

Initiative 11 of the 2018 version :

Deployment of electronic surveillance solutions to aircraft and at airports to aid integration of traffic.

This initiative has been incorporated into several of the Delivery Elements in the new version as can be seen in this table extracted from the 2023 AMS.

This reinforces the importance of the role EC will play in the future delivery of Air Traffic Services.

Category	AMS delivery elements	2018 AMS initiatives further developed through these elements	
Aircraft-Based Navigation	UK-ABN/1. Trajectory-based operations	2, 7, 8, 11, 14	Overarching principle: implementing government policy on minimising the environmental impacts of aviation within the context of supporting a strong and sustainable aviation sector
	UK-ABN/2. Terminal airspace redesign	4, 5, 14	
	UK-ABN/3. Network management	3, 6	
	UK-ABN/4. Integration	3, 9, 10, 11	
Airspace Management	UK-AM/5. Airspace management		
	UK-AM/6. Data services	13, 15	
	UK-AM/7. Future surveillance and spectrum	11, 12	
	UK-AM/8. Integration of communications, navigation, surveillance & spectrum	12, 13, 14, 15	
	UK-AM/9. Aircraft capabilities	New	

Next Steps

- We will use the results of the trial to develop the safety case and guidance material for CAA acceptance.

- Consult on an Airspace Change for a permanent TMZ to support the deployment of ADLS for Clauchrie Windfarm.

- As part of that ACP, consider whether a wider area could be covered to reduce the number of consultations required for future windfarms.

Note: the ACP for a permanent TMZ has already been started ACP-2023-013

CAA Portal

www.airspacechange.caa.co.uk

ACP -2023-008

Any Questions?

Your feedback would be most appreciated