



ACP – 2022 -102

Final Submission

CAELUS Project – Grampian Region

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Introduction

1.1 CAELUS Project

This temporary change for an airspace trial is in support of the CAELUS ConOps which looks to trial various aspects of an ecosystem that could be required to facilitate a drone service for NHS, capable of being scaled to operate nationally. The trials will aim to further understanding of the safe operations of BVLOS and indeed all airspace operations in controlled airspace while validating the important potential elements involving NHS services. The flights for this temporary change are planned within a TDA and where appropriate a TSA. UAS operations will need to scale to meet the demand of the populous associated with conurbations. This temporary change enables the project to evaluate and develop the supporting systems in the round across the whole ecosystem to ensure safe and equitable integration of crewed and uncrewed operations whilst providing NHS staff valuable opportunity to understand how a service might operate and to compare across diverse geographies by working within multiple health boards in Scotland. The TDA and TSA provides the safety of flight for all airspace users with the intention to reduce the segregation as these supporting systems are validated, developed, and approved by the regulator.

1.2 CAP 1616 ACP Submission

CAELUS submitted a DAP 1916 22 Dec 22 for a trial ACP for BVLOS operations in the Grampian region to facilitate UAS operations between the Aberdeen and Elgin and Elgin and Inverness. This will support RPAS transfer of non-hazardous medical goods between Aberdeen Royal Infirmary, Dr Grays Hospital and Raigmore Hospital. An assessment meeting was held virtually on 03 May 23 between members of the CAELUS Consortium and the CAA Airspace Regulation (AR) team and RPAS Team. During the Assessment Meeting it was

agreed that it would be appropriate for ACP 2022-102 to follow the Temporary Change process as per CAP 1616. A redacted version of the minutes of that meeting was uploaded to the CAA portal on the 21 May 23 together with a redacted version of the presentation. Whilst this ACP was supported by Aberdeen ATC and RAF LOSSIEMOUTH ATC through Targeted Engagement, unfortunately Inverness ATC have objected to it which is obviously key to Project CAELUS. Despite this we have included all details relating to the TDA between ELGIN and INVERNESS in case anything should change. If the CAA does not support that TDA we fully intend to continue with our plans for the TDAs between ELGIN and ABERDEEN.

1. This document forms part of the CAELUS Consortium submission to the CAA for consideration under the CAP 1616 process for a temporary change and should be read in conjunction with the OSC submitted to the CAA RPAS team by Skyports.

1.3 Statement of Need

2. The Statement of Need submitted is replicated below for ease of reference:

Project Overview

The CAELUS (Care & Equity – Healthcare Logistics UAS Scotland) consortium is led by AGS Airports Ltd on behalf of NHS Scotland and the consortium partners and part funded by Innovate UK through the Industrial Strategy Challenge fund, Future Flight competition. The project which brings together AGS Airports, NHS Scotland, NATS, ATKINS, Cellnex, Connected Places Catapult and 10 other companies are working together to demonstrate the viability of a national drone network that can transport essential medicines, bloods, and other medical supplies throughout Scotland. The project will deliver a Concept of Operations (CONOPS) for the transition to fully integrated UAS operations at a national level. This specific workstream, led by NATS will develop and publish a phased approach outlining proposed airspace constructs and detailing regulatory and technology gaps required to enable the transition. Elements of this CONOPS will be validated through live flight operations, differentiating CAELUS from other projects by seeking to move the industry forward by proposing and validating a method of operations that are fully integrated and sustainable.

- Opportunities /Need
- Healthcare opportunity

With approximately 26% of Scotland's population living in remote or rural areas spread across 69% of the land mass, service delivery can encounter constraints which contributes to treatment inequity. NHS Scotland encompassing the Territorial Boards and Scottish Ambulance Service (SAS) views the adoption of Unmanned Aircraft Systems (UAS) or drones as an opportunity to transform the patient experience and reduce the impact of traffic congestion and CO2 emissions. Key to this is the driver of the NHS Scotland Recovery Plan (2021) which highlights the essential need for research, innovation, and redesign as integral to the recovery of NHS Services. For both SAS and NHS Scotland equity in the delivery of healthcare is a key driver for involvement in this project as NHS Scotland considers how to remobilise and redesign services to address the needs of Scotland's health and social care challenges. A current strategic directive for SHIP (Scottish Health Industry Partnership) is to grow the economy (community wealth building) and support remobilisation, accelerating the adoption of Innovation into NHS and Social Care (Life Sciences in Scotland, 2022). A drone-based network has the potential to reduce mileage and produce significant time saving opportunities improving patient experience, outcomes, and equity in care delivery. As a formal partner of the consortium, NHS Scotland via lead board NHS Grampian, are providing a joined-up approach bringing input and expertise from health boards and SAS under the "Once-for Scotland" banner. The NHS will define and support at ground level the clinical use cases that will be flown or simulated in the live and digital demonstrations.

Informing Regulation

Today, most beyond visual-line-of-sight (BVLOS) UAS operations can only be conducted within segregated airspace¹. The most common way to achieve this is to establish temporary danger areas (TDAs) for the UAS to operate within. Current regulation is designed to consider a per flight basis without means to provide a scalable solution. Recognised detect and avoid capabilities are basic. CAELUS intend to validate a developed concept of operations around airspace structure and use that is scalable and sustainable.

Proposed Operations

We aim to utilise volumes of segregated airspace across Scotland in a total of 5 locations to enable us to prove elements of our proposed future concept of integrated airspace. For this

¹ CAA Policy CAP 2533 requires the operation of BVLOS operations within Class D airspace to take place within a Temporary Segregated Area (TSA).

proposal, we intend to fly in the Grampian region representing use cases for NHS Grampian. The use cases will require the airspace to be in place for a maximum of 8 weeks with expected flying during 4 of those weeks. Our proposal is that we activate the segregated airspace for limited duration. The airspace dimensions and duration of activation will be informed by stakeholder feedback. This segment of flying will be undertaken by Skyports. A system of ADS-B Receivers² will be deployed to demonstrate an additional layer of situational awareness to the UAV pilot along the flying routes and contribute to the Detect and Avoid solutions that will form part of the demonstrations.

1.4 Concept of Operations

3. The CAELUS project is supported by a ConOps that has been provided to the CAA and the flights conducted during the activation of the TDA's and TSA's in accordance with the SEGREGATED phase described in CAP 2533. Evidence gathered will be used to support this to work towards the ACCOMMODATION phase of BVLOS flights in unsegregated airspace and to meet the following objectives in a safe manner:

- a. Demonstrate safe integrated BVLOS operations in the vicinity of commercial airport operations inside Controlled Airspace
- b. Determine level of impact for crewed aviation
- c. Demonstrate UA Remote Pilot (RP) can communicate with ATC to ensure airspace is only segregated when absolutely necessary, minimising impact to other airspace users.
- d. Demonstrate the UTM capabilities that could enable upscaling and integration in the future through adoption of technology (such as sharing of flight intent data, mission requests, conformance monitoring)
- e. Produce final report which can be used by CAA to enable a pathway to regulation.

4. The ConOps have been developed to align and be consistent with CAP 1711 CAA Airspace Modernisation Strategy 2033-2040 Pt 1 vision.

The CAELUS consortium has developed a mapping of the trial objectives that will be assessed during the flights planned for this ACP. This work has been completed through several workshops held within the CAELUS Consortium. The output of this is attached to the ACP

² 1 It should be noted that this is part of the CAELUS trial and will in no way be used in operational context for separation standards, detect and avoid or any other safety measure but it will be used to gather data in support of the ConOps and CAELUS project.

submission as Appendix 1 and demonstrates how each objective maps to a Future of Flight 3 'parent' objective together with details of the data and outcomes necessary to demonstrate the success of the trial objectives.

5. The following data will be gathered in order to validate success of the defined objectives and to inform any advice and recommendations to the stakeholders/regulators involved in similar trials:

- a. Operations fully conducted as per identified procedures. Any deviations from ideal uninterrupted flights are in agreement with pre-defined contingency procedures (e.g., rally point landing) and pose no additional risk.
- b. Record any events that would not have occurred if the UAV trial did not take place. That includes aircraft delays, refused/delayed clearances, transits of airspace.
- c. Collection of feedback via interview/questionnaire by ATC and RP.
- d. Gather CAA feedback on the received results. Agree on acceptable repetition required to confirm the concept; agree on any acceptable changes to the processes that would bring the trial a step closer to being considered "routine operations".
- e. Calculations and data recording to determine the surveillance (non-operational) and UTM partners (Plane Finder and ANRA) systems benchmarks.

2 Airspace

2.1 Overview of Operations

The activity undertaken will consist of a series of live flights in the Grampian region to facilitate UAS operations between Aberdeen and Elgin and Elgin and Inverness. This will facilitate UAS transfer of non-hazardous medical goods between Aberdeen Royal Infirmary, Dr Grays Hospital and Raigmore Hospital. The flights will take place over the course of 4 weeks (20 Flying Days) with a payload provided by the NHS. The live trial will see the Skyports UAS flying for 4 weeks during the validity of the AIC (target AIC publication date 27 June 24) and commencing on 1 July 24 at the earliest to ensure aviation stakeholders have sight of the AIC and promulgation of the activation via NOTAM prior to commencing operations.

Operations will take place over a 4-week period with periods of activation up to twice a day. Considering Engagement feedback and the potential for confliction with the General Aviation

The route itself is designed in such a way, so that it lies predominantly over sparsely populated areas. The route is designed to limit the impact on other airspace users' activity, infrastructure ground risk, and the impact of noise pollution.

The TSA and TDA segments have vertical dimensions from Surface Level to a maximum of between 700ft AMSL and 1800ft although the UAS will Cruise not above 400ft AGL. The lateral dimensions of 2-4 Kms and are in the form of a corridor which is segmented as shown at Figures 2,3 and 4 above. The TDAs between Aberdeen and Elgin and between Elgin and Inverness will be activated independently of each other by NOTAM according to the planned flying programme.

2.3 Aeronautical Information Circular (AIC)

The DRAFT AIC which will be submitted to CAA Airspace Regulation together with this document on 8 Apr 24. Please see Appendix 2.

2.4 Buffer Policy

The activity within the TSA and TDA is hazardous activity in accordance with the CAA Buffer Policy. However, Aberdeen ATC are the controlling authority for the CTR within which the proposed TSA is embedded and have been part of the development of the TSA/TDA design and operating procedures, CAELUS2 is seeking dispensation from the buffer policy for the ACP-2022-102. The UAS is also subject to an OSC approval, which contains the evidence that the hazardous activity of BVLOS flight can be contained within the planned volume of airspace. Aberdeen ATC have written a DRAFT LoA between themselves and Skyports which reflects the agreed procedures.

2.5 Adjacent ACPs

The CAA Airspace Change Portal has been reviewed to check on any adjacent ACPs and if there is any impact on this ACP. Aberdeen have ACP-2019-82 which has no impact in either time or space.

3 OPERATIONS

There will be no change to established aircraft routes below 7000ft, no change to existing promulgated airspace including holds or VFR reporting points. A Temporary Operating Instruction (TOI) will be in place for Aberdeen, RAF Lossiemouth and Inverness ATC and Letters of Agreement will be held between those units and the UAS operator (Skyports). The Letters of Agreement are being DRAFTED and will be submitted as soon as possible and will be in place prior to any operations taking place subject to approval from the CAA Aerodrome Inspector.

3.1 Deconfliction Principles

As ANSPs, Aberdeen, Inverness and RAF Lossiemouth ATC will be supporting the segregation of the UAS operating area and other airspace users. Temporary Danger Areas (TDA) in Class G airspace and Temporary Segregated Areas (TSA) in Class D airspace will

be established and promulgated via AIC. Times of activation will be notified by NOTAM at least 24 hours in advance of UAS flight operations.

There are two routes defined: Aberdeen to Elgin (TSA/TDA XXX) which will be activated between 1500 and 1730L only and Elgin to Inverness(TDAXXX) activated between 07:00 and 10:00L only.

The TDA/TSA are sectorised and the upper limit of most sectors not above 1000ft AMSL however there is one sector on the Aberdeen to Elgin route whose upper limit is 1800ft AMSL due to the ground elevation in these areas. The drone will operate not above 400ft AGL at all times.

A Special Use Area Activity Information Service (SUAAIS) will be provided by Aberdeen, RAF Lossiemouth and Inverness ATC to inform airspace users of the Activity state of the TDAs in accordance with the daily NOTAM. A TSA however is totally segregated airspace and when active access by other aircraft is totally forbidden. If access is required by other aircraft the TSA must be tactically deactivated by Aberdeen ATC following co-ordination with Skyports. Further details will be included in the TOI which will be subject to approval by the ATM Inspector and will be part of the condition upon which the TSA may be activated.

3.2 Infringements

In the event of an aircraft in emergency/priority flights or infringement of the TDA/TSA by unknown aircraft, ATC will follow the procedures as set out in the LoA/TOI subject to approval by the CAA ATM Inspector. It is acknowledged that the final approval of this ACP will be conditional upon the approval of the of the LoA/TOI.

3.3 Communications

The Remote Pilot (RP) of the drone will be located remotely at Skyports facility in Buckinghamshire. The RP has 2-way communications with Hub Operators (HO) located at each of the take-off and landing sites.

All communications between ATC and RP will be via mobile phone. At least two mobile phones on different networks will be available to the RP for redundancy. The numbers will be notified on the relevant NOTAM. A third landline will be made available if it is deemed necessary.

3.4 Emergency Access to TDA

In some circumstances Emergency Helicopters (HEMS/SAR/Police) may require access to an Active TDA. In accordance with the Skyports OSC and LoAs the crew will contact the Remote Pilot directly on the Mobile Phone Number published on the relevant NOTAM and coordinate access to the TSA/TDA. The Remote pilot will vacate the TDA segment required by the most expeditious method following this procedure which will be captured in the appropriate LoA.

“Emergency services shall indicate their intended point of interest by sharing grid reference. Skyports shall confirm the current location of the RPAS in relation to the helicopter. If the RPAS is flying within the same sector as the intended helicopter route, or the next TDA sector in the route, then the RPAS should aim to land within 5 minutes of getting the notification as vacating a sector might not be sufficient if extensive SAR is required. If the RPAS is in the TDA prior to the search area then the aircraft shall perform a return to base manoeuvre.”

3.5 Weather

Drone flying weather limitations will be in accordance with the SWOOP KITE limitations as described in the OSC related to this ACP.

For any flight within the TSA approval of activity by Aberdeen ATC will be subject to the Aberdeen METAR showing a minimum cloud base of 1500FT and 5k visibility based on VFR within CLASS D Airspace.

For any flight within the TDA between Aberdeen and Elgin the UAS will be subject to the Aberdeen METAR and an interim Temporary weather station showing a minimum cloud base of 2500FT and 1500m visibility.

For any flight within the TDA between Elgin and Inverness the UAS will be subject to the RAF Lossiemouth and Inverness METAR showing a minimum cloud base of 2000FT and 1500m.

The UAS has several other weather requirements which include wind speed, temperature, and precipitation. Skyports will be responsible for continuing to monitor relevant METARS and TAFS to ensure all weather minima are complied with.

3.6 Emergencies

Emergency procedures are detailed in the Skyports OSC which has been submitted to the CAA RPAS Team. Further ATC emergency procedures are contained within the TOI and subject to approval of the CAA Aerodrome Inspector.

Aberdeen ATC will develop a TOI for the safe operations of the BVLOS flights within the TSA and TDA proposed under this ACP and will be subject to CAA regulatory approval. It is understood that any airspace approved under this ACP will not be activated without the relevant TOIs having been approved.

If Inverness ATC agree with the ACXP they will develop a TOI for the safe operations of the BVLOS flights within TDA proposed under this ACP and will be subject to CAA regulatory approval. It is understood that any airspace approved under this ACP will not be activated without the relevant TOIs having been approved.

4 UAS Specification, Environmental and Noise Impacts

Skyports DS will be using the Swoop Kite for drone delivery operations, supplied by unmanned aircraft system (UAS) manufacturer, Swoop Aero. The UAS has been specifically selected by Skyports to further enhance air safety through the addition of ADS-B 1090 IN and OUT, and Mode S, to further reduce the air risk profile of our operations and improve situational awareness.

Skyports have submitted their OSC to the CAA RPAS team and further details of this UAV can be found within Skyports OSC Vol.2 Swoop Kite. It is acknowledged that any approval of the ACP will be subject to the OSC approval, and no activation of the airspace will be possible without it.

An image of the Swoop Kite and UAV specifications are shown below respectively.



Figure 8 - Swoop Kite EVTOL

Table 2. Swoop Kite EVTOL specifications.

Name	Swoop Kite EVTOL
Flight Performance	<u>Max Range</u> 160 km <u>Cruise Speed</u> 68 kt IAS
OEW/MTOW	22.5kg/26.4kg
Operating Conditions	<u>Max wind speed:</u> 30kts with gusts up to 44kts <u>Precipitation:</u> Moderate rain (10mm per hour) up to 30 minutes, light rain (less than 2.5mm per hour) indefinitely <u>Temperature range:</u> -10 degrees Celsius to 50 degrees Celsius
Transponders	Transponder 1090ES ADS-B Out and ADS-B IN, which can process uncertified ADB-B signals and Mode S

As part of ConOps development, the flights were carefully planned to minimise noise in the areas of operations. Skyports do not envisage any adverse impact on tranquility when operating over inhabited areas due to the following reasons:

According to previous measurements, the mean maximum sound pressure level (L_{ASmax}) of the Swoop Kookaburra Mk III (a typical VTOL UA Skyports uses) during take-off and landing is 76dB, and that when the UA is cruising at a height of 200ft AGL is 49dB, which is virtually undetectable from ground³. The most audible part of the flight, i.e. take-off and landing, typically takes 17.57 seconds at standard climb/descend rate, and 8.98 seconds at maximum climb/descend rate. The UA is a hybrid-powered lift transitional platform which takes off and lands vertically. In normal circumstances, the UA will cruise at a height of 400ft AGL. While the precise noise measurement of the UA to be used on this part of the CAELUS, the Rigittech Eiger, is not available, as it shares a lot of similarities in design with the Kookaburra (both of them being fixed-wing, VTOL), and it is an even smaller, lighter model with fewer motors, we believe the noise impact of the Eiger to be very similar, if not lower, than that of the Kookaburra. The operations will take place over 4 weeks. Skyports believes the noise impact with such a short span of time, and small noise footprint, is negligible.

The routes were carefully designed so that we prioritise operating over sparsely populated areas, and also where possible over the sea. At key locations such as TOLPs, they were also chosen to be located outside/away from residential areas to minimise the noise impact during take-off and landing.

³ 86dB and 59dB if a 10dB noise penalty is added to account for the tonal nature of drones.

TOLP – Dobbies Garden Centre - Aberdeen, Whitemyres House, New Park Farm, Lang Stracht, Aberdeen (570903N, 021143W)



Figure 9 - Population density map with flight routes overlaid – Aberdeen TOLP – Dobbies Garden Centre

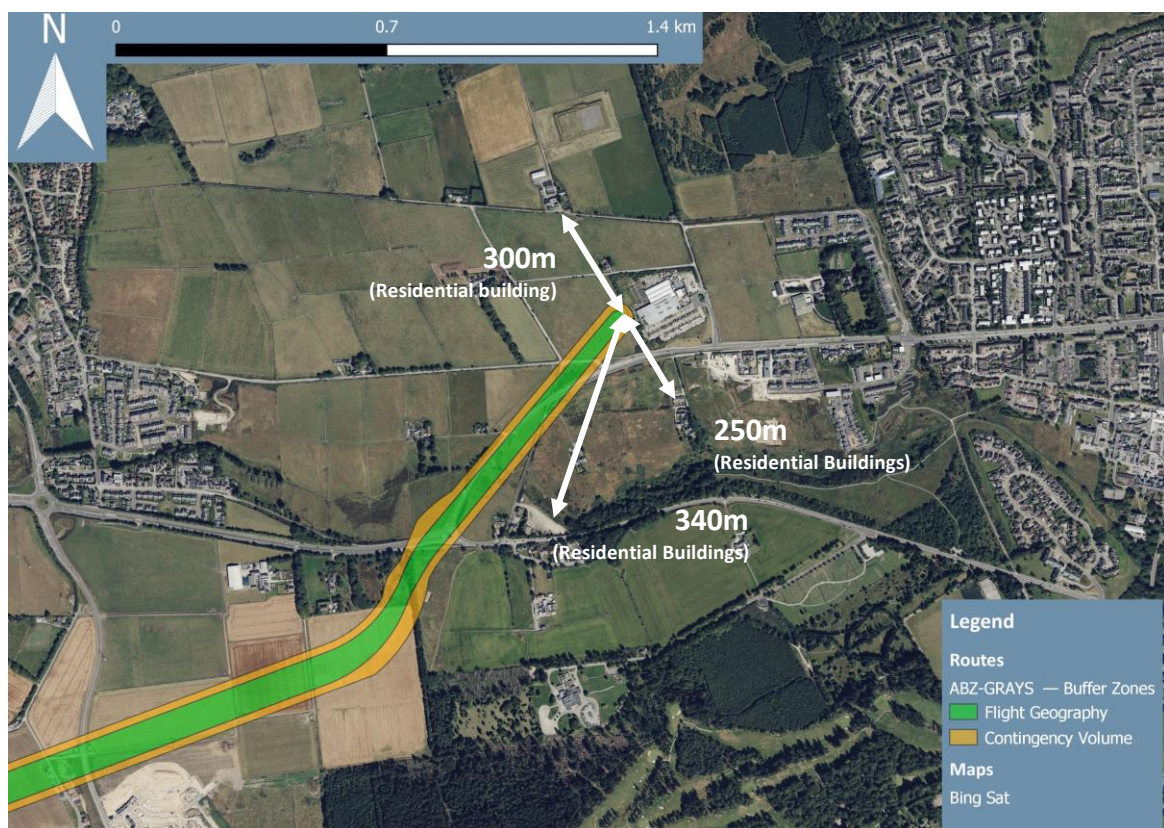


Figure 10 – The closest buildings and sensitive noise receptors to the Aberdeen TOLP at Dobbies Garden Centre

The Aberdeen TOLP is located on grassland next to Dobbies Garden Centre. The closest buildings to the TOLP is the Garden Centre itself who have given approval for us to utilise their land and accept the associated noise of the aircraft taking off and therefore are unaffected by the noise of the UA. The closest sensitive noise receptors are residential buildings to the southeast of the TOLP, which are approximately 250m from the TOLP. At such distance we do not expect the noise emitted by the aircraft to have significant impact on the residents there, this is compounded by the fact that the TOLP and these houses are separated by an A road, which will have its own noise level to overshadow the noise of the UA.

TOLP – Dr Grays Hospital TOLP, Farmland located at 573819N, 031934W

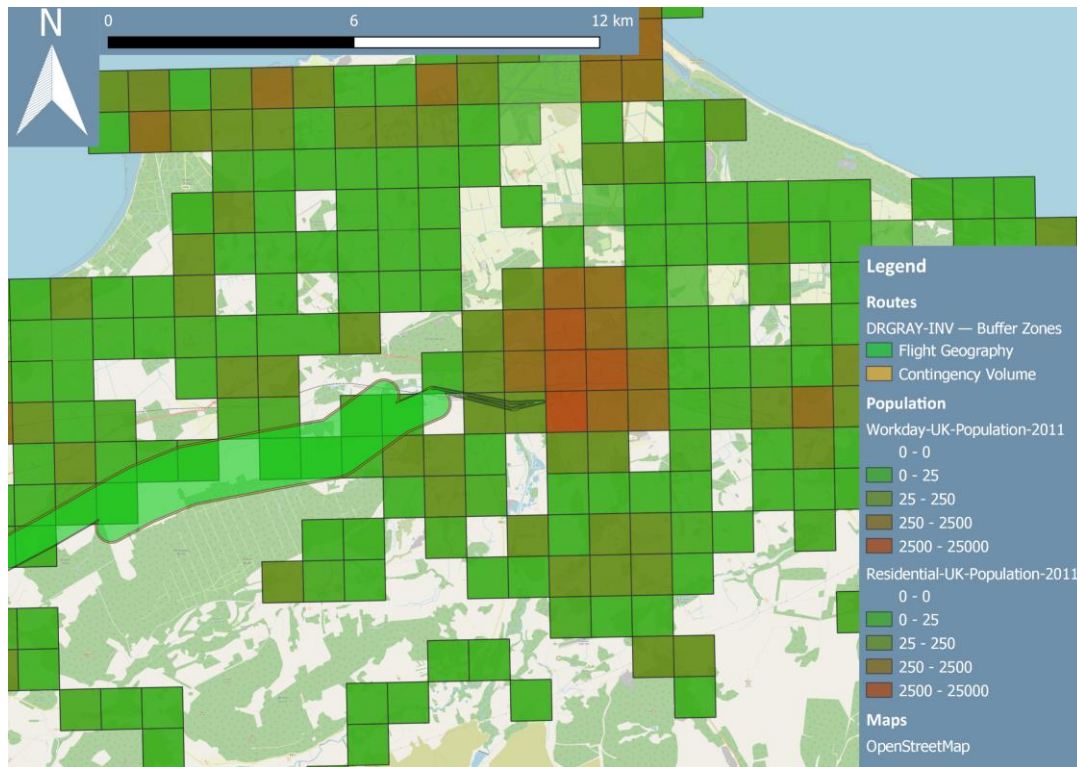


Figure 11 - Population density map with flight routes overlaid – Dr Grays TOLP

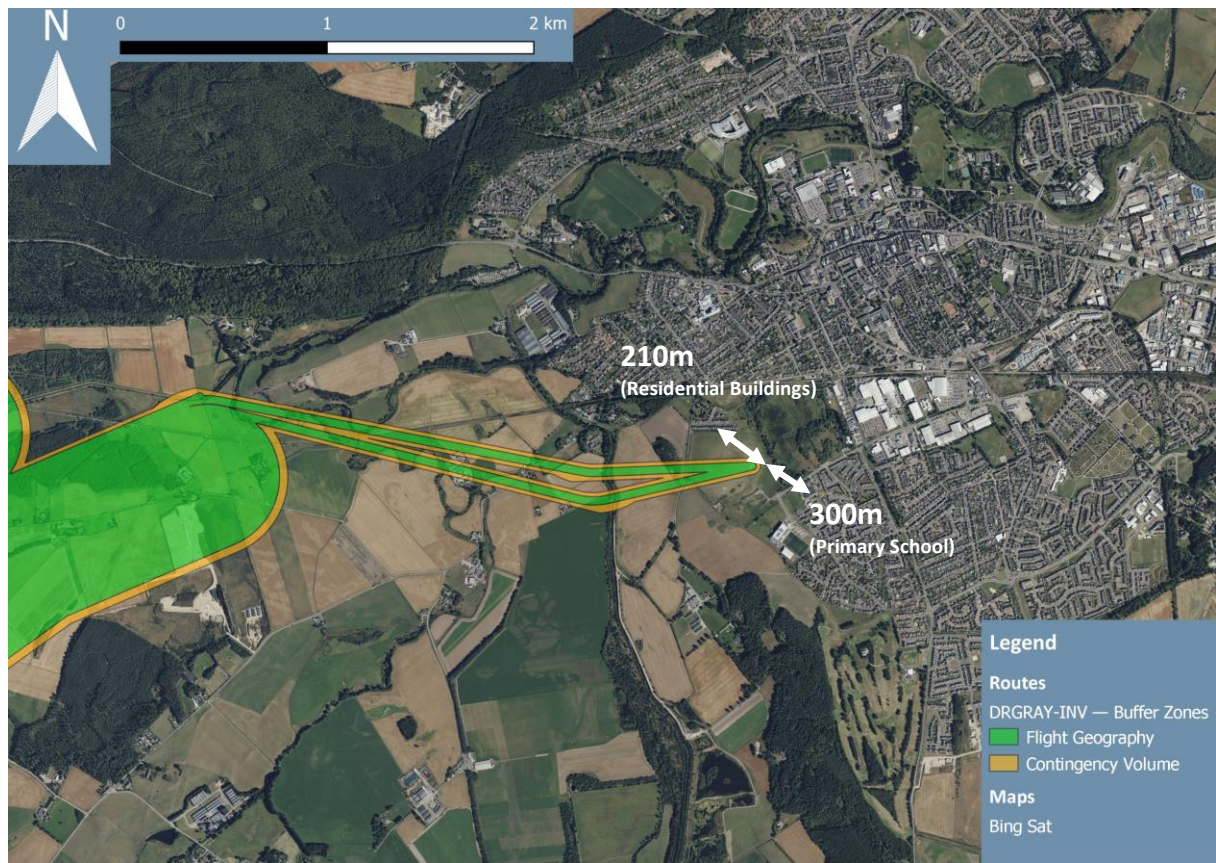


Figure 12 - The closest buildings and sensitive noise receptors to the Dr Grays TOLP

The Dr Grays TOLP is located on grassland to the South of Elgin. As the hospital is located in a congested area, the TOLP was chosen at a distance from the hospital to minimise ground risk from safety and operational perspective, and noise impact from environmental perspective. The closest buildings from the TOLP are a residential area approximately 210m from the TOLP, and a primary school 300m to the South-East of the TOLP. At these distances, and given the trees located around the area of the TOLP, it is anticipated that the noise impact on these locations shall be negligible.

TOLP- MacDonalD Drumossie, Old Perth Road, Inverness, IV2 5BE (572721N, 040933W)

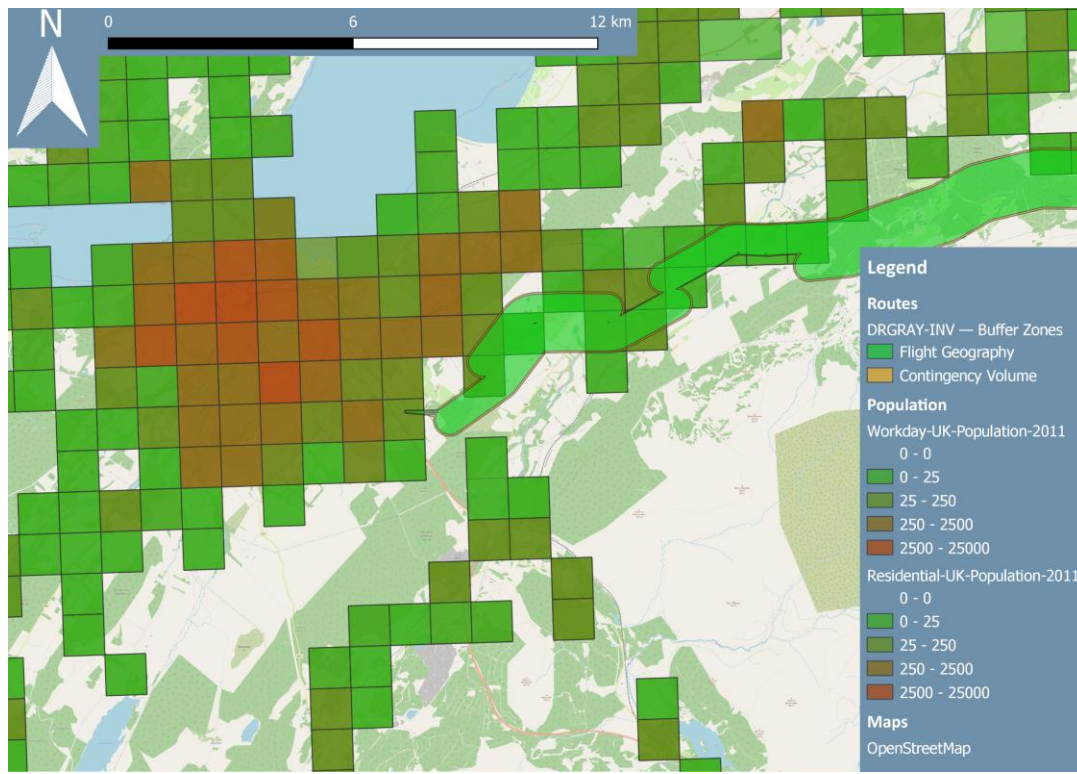


Figure 13 - Population density map with flight routes overlaid – Inverness TOLP

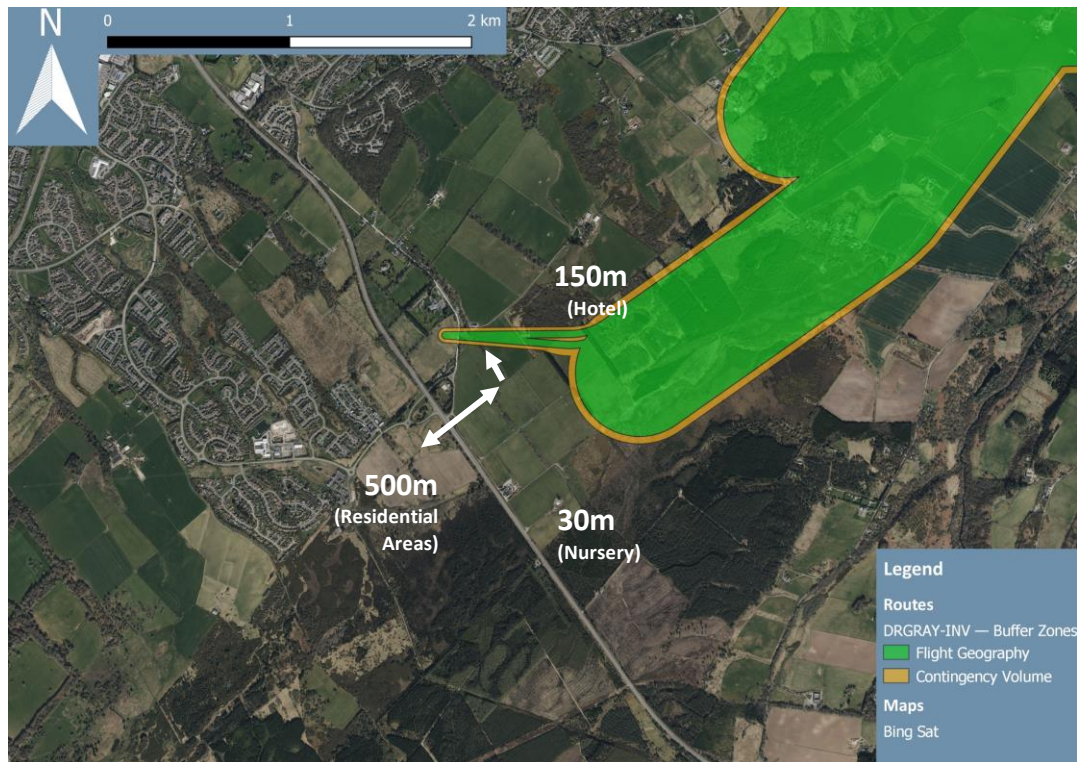


Figure 14 - The closest buildings and sensitive noise receptors to the Inverness TOLP

The Inverness TOLP is located on grassland owned by MacDonald Drum Mossie Hotel. The TOLP shall be 150m from the hotel itself, with the hotel agreeing to the noise from the aircraft during the 4-week operational period. This TOLP is very secluded with the nearest sensitive noise receptor 500m to the West of the TOLP. This is a residential area, but is also separated by the A9, a 70mph road, with the noise from this expected to fully negate the noise from the UA.

5 Stakeholders and Engagement

The CAA CAP 1616 includes the requirement for Sponsors to engage with aviation stakeholders and relevant stakeholders and give due consideration to the potential impacts of the change on airspace users. The proposal is subject to those requirements for a temporary change as detailed in CAP 1616. A summary of feedback and also stakeholder evidence are attached at Appendix 2 and 3 respectfully.

CAELUS undertakes to engage with stakeholders post the decision of the CAA regarding this ACP to inform them of the outcome. CAELUS undertakes to also inform stakeholders of updated operations 2 weeks prior to any planned flying to remind them of the operations and enable schedule deconfliction. Promulgation will also take place via the AIC which will be published in accordance with the cycle and NOTAMs issued at least 24 hours prior to any activation.

6 Complaints

It is understood by CAELUS that complaints may be received regarding the activation of the TSA/TDA and that these complaints need to be recorded and addressed appropriately. The stakeholders engaged so far have corresponded successfully via the caelus2airspace@traxinternational.co.uk email address and this email address will be provided in the email informing the stakeholders of the outcome as a method by which complaints can be raised. The AIC will contain this email address and ask that all are forwarded to the same for addressing. All complaints, together with any infringements, will be addressed and recorded accordingly.

The CAA AR team will be furnished with copies of any complaints, infringements and the outcomes of the same. The CAELUS consortium is made up of in part NATS and AGS and Skyports and there is a mature relationship between all parties, as well as an established relationship with all 3 ANSPs which will allow the raising of any complaints that have been made by other methods, such as through the ANSPs direct, and the recording and addressing of the same. Again, the CAA will be furnished with copies of any complaints that are brought to the attention of any of the CAELUS partners in connection to this ACP.

7 Safety Assessment

Temporary Operating Instructions(TOIs) by the ANSPs for the operation of the airspace (to be approved by the ATM Inspector) and Letters of Agreement with the UAS operator will be in place to ensure safe operations prior to commencement of operations planned for 1st July 2024. A HAZID will be conducted by the ANSPs with the relevant stakeholders and that will form the basis for the TOI.

Skyports DS OSC Vol 3. SWOOP Kite contains further details of each hazard, mitigations, evidence, statements of tolerability and the safety risk summary statement for the operation of the platform to demonstrate the safe operation of the platform.

8 Summary

CAELUS seeks to develop the NHS Scotland use cases as detailed in the Statement of Need together with validation of the objectives in support of the CAELUS ConOps being developed by NATS. It is submitted that the temporary airspace is designed to minimise impact to other aviation users yet sufficient to contain the hazardous activity of the BVLOS flight. The stakeholder response was encouraging with several stakeholders engaging with meaningful discussions and their input was used to inform the final design and operations of the airspace. A key Objector to the proposal is INVERNESS ATC whose reasoning can be seen the Annex 2 (Engagement). If the TDA complex between ELGIN and INVERNESS is not approved we wish to continue to pursue the TDA complex between ELGIN and ABERDEEN, The final trial is also supported by a provision of SUA AIS by the ANSPs who have been fully engaged with the process.