Ministry of Defence

ACP-2021-078

Enabling Remotely Piloted Aircraft Operations from RAF Fairford - HALE

Stage 4 – FINAL SUBMISSION

Contents

Section 1 - Introduction

This document forms part of Stage 4B of the Airspace Change Proposal ACP-2021-078 and has been prepared in accordance with Civil Aviation Publication (CAP) 1616. This proposal began in November 2021 and has developed in line with the process at Figure 1 below within the timeline agreed with the Civil Aviation Authority (CAA).

Figure 1 - Overview of the airspace change process (CAP1616 p.19)

This proposal addresses the need to enable United States military High Altitude Long Endurance (HALE) RPA operations from RAF Fairford. In accordance with CAP 722 – *Unmanned Aircraft System Operations in UK Airspace – Guidance and Policy*, beyond visual line of sight (BVLOS) operations require either a CAA-approved Detect and Avoid (DAA) capability or to remain within a block of airspace that is segregated from other airspace users. This ACP aims to establish suitable segregated airspace to enable HALE RPA without a DAA capability to transition between RAF Fairford and high-altitude transit.

This proposal was deemed by the CAA to be a Level M2 ACP under CAP 1616, as the anticipated consequence of the change proposed is minimal-to-no alteration of civil aviation traffic patterns below 7,000 feet. The proposal has been developed in line with the timeline agreed with the CAA below:

Stage	Date
DEFINE Gateway	25 Mar 22
DEVELOP AND ASSESS Gateway	29 Jul 22
CONSULT Gateway	29 Sep 23
Formal ACP Submission	8 Dec 23
DECIDE Gateway	16 Feb 24
IMPLEMENT (Target AIRAC)	16 May 24

Section 2 - Executive Summary

As outlined in the Statement of Need, the Change Sponsor is seeking to establish a segmented Danger Area (DA) to facilitate Beyond Visual Line of Sight HALE RPA transition between RAF Fairford and high-altitude transit. The ACP initially also sought to accommodate Medium Altitude Long Endurance (MALE) RPA but has since been split into a HALE (this ACP) and MALE (ACP-2022-083) after it was determined that the impact and complexity of accommodating MALE RPA transition from RAF Fairford was much greater than that of HALE RPA transition.

In order to support NATO's Agile Combat Employment concept, the US Air Force is making significant infrastructure investments on airbases in the UK and other allied nations. There is an emerging requirement for military aircraft, including Remotely Piloted Aircraft (RPA), to operate regularly from RAF Fairford. In the current regulatory environment, segregated airspace is required for US HALE RPA without a certified DAA capability. Without a Danger Area structure, US HALE RPA operations would be unable to take place within the UK.

In accordance with CAP 1616, the Change Sponsor sought feedback from stakeholders on draft design principles that would be used to assess various design options to be developed in Stage 2. Some feedback was deemed to fall outside of specific feedback on Design Principles. The overarching theme from general aviation stakeholders was concerns over "removal" of Class G airspace in the area and the restrictions that may be placed on them that would limit their freedom of manoeuvre around the Fairford area. An additional concern from NATS was that any change should not adversely impact traffic using the national air traffic services route structure. As a result of the engagement, one Design Principle was amended, and two new Design Principles were included.

Stage 2A saw 2 HALE Design Options developed against the design principles. Overall, stakeholder engagement identified that the "do nothing" option did not align with the design options and the 2 HALE options did align. This led to the Initial Options Appraisal in which the Sponsor evaluated the airspace Design Options against the "do nothing" baseline. This also involved a period of stakeholder engagement.

After Stage 2, internal analysis completed by the US Air Force and engagement feedback from NATS led to the discounting of the 2 HALE options from Stage 2 and the development of an interim option. After further engagement with NATS to help understands the impacts better, a single option, HALE Option 3, was developed. HALE Option 3 was the sole option taken forward to Stage 3. More details can be found below in Section 8 - Options Development.

Stage 3 saw the development of consultation material as well as a consultation strategy. On passing the CONSULT gateway, the Sponsor began a 6-week consultation which included face-to-face and virtual consultation events.

This consultation generated 17 responses via Citizen Space and other means. These

responses were analysed and categorised accordingly into responses that either have the potential to affect the proposal or not. This was summarised in the Categorisation of Responses document produced in Step 3D. Following the categorisation of responses, it was determined that no significant changes were required to the final proposal. As a result of all the submissions discussed above, the Change Sponsor developed the final proposal outlined in this document.

Section 3 - Current Airspace Description

RAF Fairford is located in Gloucestershire, to the north of Swindon, and the east of Cirencester. It is home to the 99th Expeditionary Reconnaissance Squadron and supports Bomber Task Force operations. It is also host to the annual Royal International Air Tattoo (RIAT), which brings together the global aviation community to enjoy the sights and sounds of hundreds of aircraft from across the world and the ages.

The Fairford ATC Tower is staffed by US Air Force personnel providing Aerodrome Control Services, with all Radar Services provided by RAF Brize Norton ATC. RAF Fairford's ATZ is active 24 hours per day, while its MATZ is activated by NOTAM when the airfield is open. Although the airfield and majority of ATZ and MATZ are contained within Class G airspace, there is some overlap with RAF Brize Norton's Class D CTR, which is active 24 hours per day. RAF Brize Norton ATC (call sign Brize Radar) is the controlling authority for the ATZ when RAF Fairford ATC is closed. Control instructions from the Brize Radar controller are mandatory for all military aircraft operating within the MATZ. Brize Norton ATC are the designated LARS unit for aircraft operating in the region, aiming to provide advice and information for the safe and efficient conduct of flight.

Figure 2 – RAF Fairford Airfield Overview

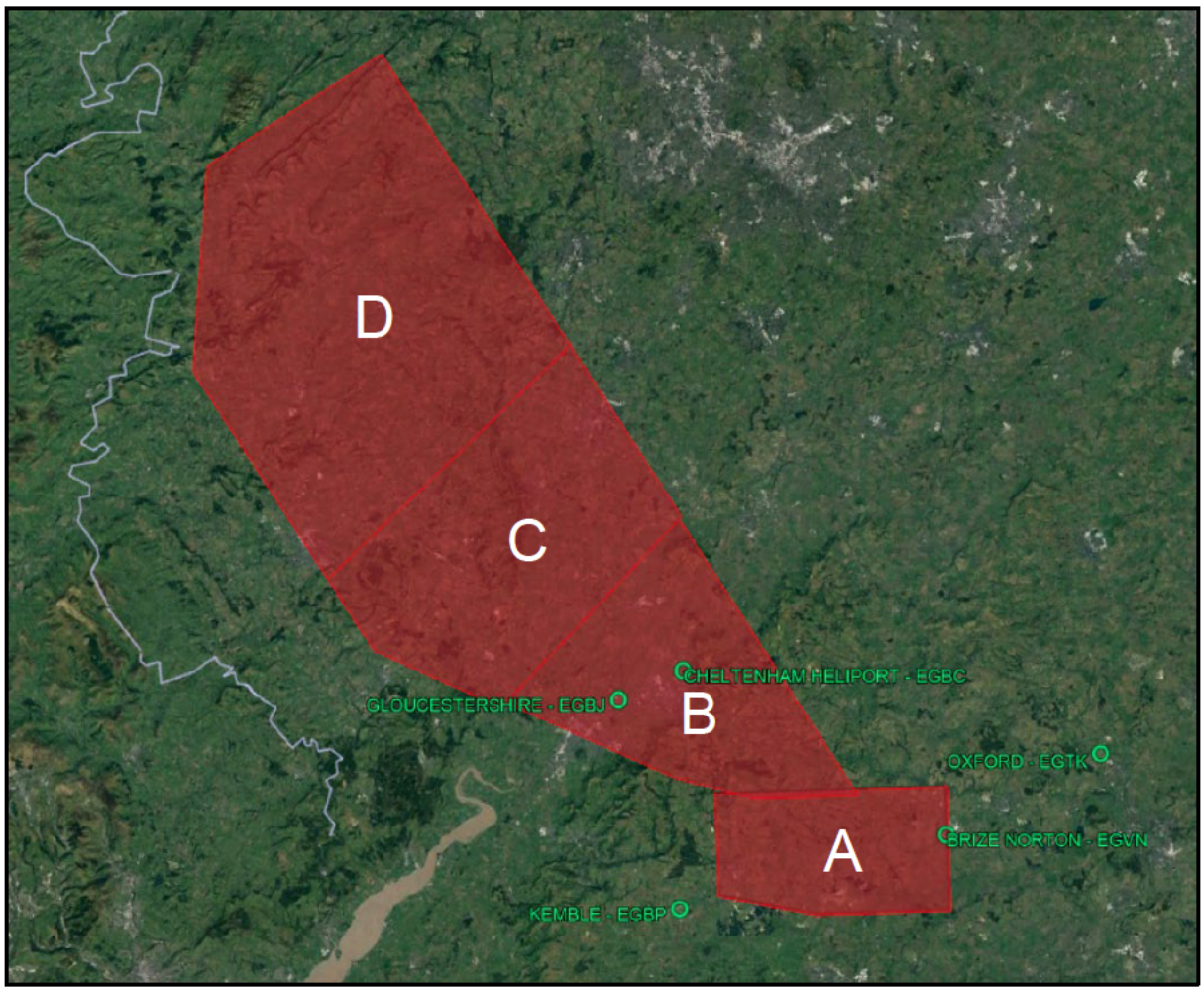

Figure 3 – Airports Adjacent to the proposed Danger Areas

In the local area are London Oxford Airport (formerly known as Kidlington), Cotswold Airport (Kemble), and Gloucestershire Airport. There are also a number of smaller airfields which are busy with GA flying and several gliding, hang-gliding, and microlight sites. With the combination of commercial, business, military, and recreational aviation activity, the airspace in the region can be very congested during the daytime. At night, however, aviation activity outside of controlled airspace declines to close to zero.[1]

[1] Preliminary ADS-B data review in Stage 2 showed only one track outside of CAS in a week. Stakeholder feedback throughout the ACP has confirmed this.

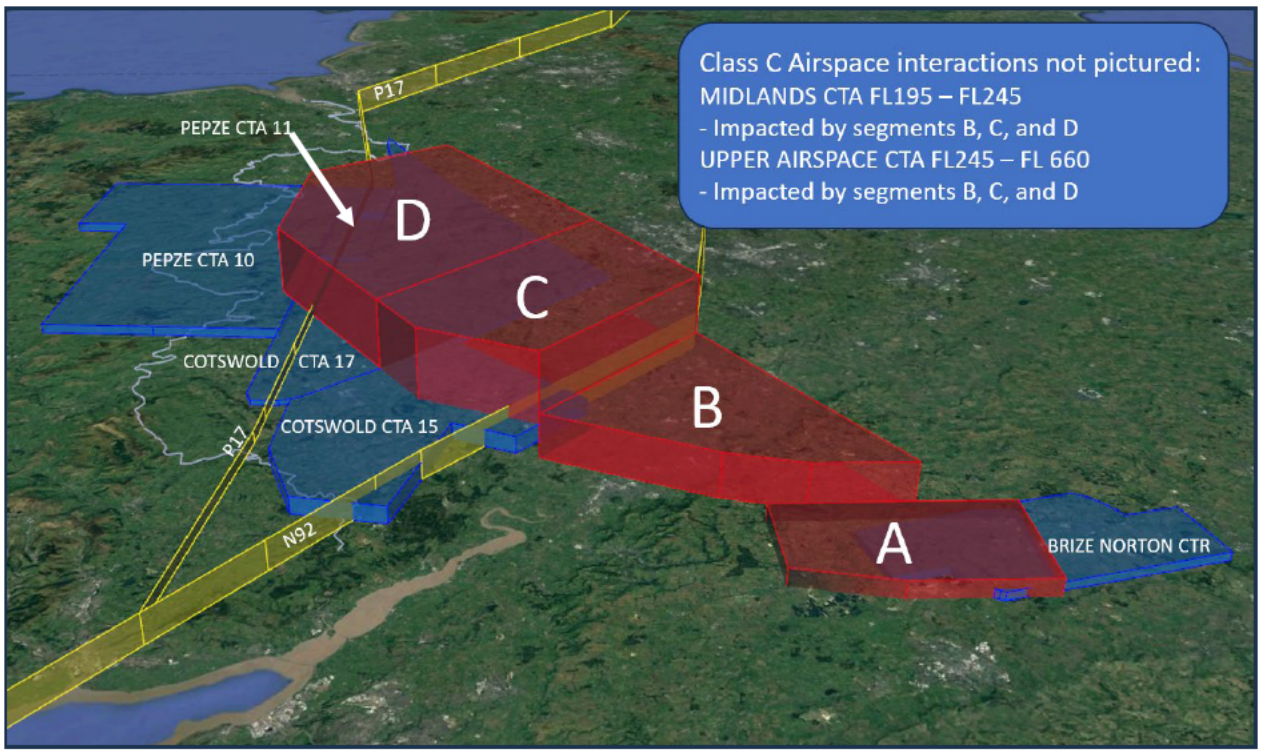

Figure 4 – Interactions with existing airspace and ATS routes

The proposed airspace is adjacent to several controlled airspace structures and ATS routes. Figure 4 shows the airspace and routes that would be impacted by the proposed Danger Areas. Impacts are expected to users of these structures. This will be detailed later in this document.

UK Aeronautical Information Publication data will be updated to ensure the affected routes and CTAs are not active when the Danger Areas are activated.

Section 4 - Statement of Need

The SoN was submitted to the CAA at Stage 1 of the CAP 1616 process. It reads as follows:

In order to support NATO's Agile Combat Employment concept, the US Air Force is making significant infrastructure investments on airbases in the UK and other allied nations. There is an emerging requirement for military aircraft, including Remotely Piloted Aircraft (RPA), to operate regularly from RAF Fairford. In accordance with CAP 722 – Unmanned Aircraft System Operations in UK Airspace – Guidance and Policy, beyond visual line of sight (BVLOS) operations require either a CAA-approved Detect and Avoid (DAA) capability or to remain within a block of airspace that is segregated from other airspace users. This ACP aims to establish suitable segregated airspace to enable RPA transition between RAF Fairford and high-altitude transit.

Section 5 - Proposed Airspace Description

The proposal is to introduce a Danger Area, activated by NOTAM by RAF Fairford through the Military Airspace Management Cell (MAMC). It comprises 4 volumes of airspace as follows:

- A volume of airspace in the vicinity of RAF Fairford from surface up to FL75 (segment A)
- A volume of airspace to the northwest of RAF Fairford from FL50 – FL240 (segment B)
- A volume of airspace to the northwest of RAF Fairford from FL160 – FL500 (segment C)
- A volume of airspace to the northwest of RAF Fairford from FL200 – FL500 (segment D)

These 4 volumes of airspace are joined laterally to allow for the safe and efficient climb and descent of HALE RPA between RAF Fairford and the transit altitude of FL500+ while remaining fully within segregated airspace.

The draft AIP entry for EGDXXX can be found in Figure 5. The depiction of EGDXXX can be found in Figure 7.

Flight Plan Buffer Zone (FBZ)

A 1 NM FBZ is planned for EGDXXX. An FBZ is associated airspace that defines the lateral and vertical limits for validating IFR flight plans when the associated Danger Area is active. The draft AIP entry for EGDXXXZ can be found in Figure 6.

Further details of the Safety Buffer Policy dispensation request can be found at Annex B.

Airspace Utilisation

The proposed airspace is expected be activated 2-3 times per week for up to 3 hours per activation. This window of up to 3 hours is intended to not only accommodate arrivals and departures but to also ensure that the airspace is active for a sufficient time to account for emergency or contingency scenarios. The hours of activation will be between 1 hour after sunset and 1 hour prior to sunrise. The Sponsor understands the impact that may occur on the shoulders of these hours during the winter months and will restrict activation to no earlier than 20:00 UTC and no later than 05:30 UTC for normal operations. Any activations outside of this window are expected to be very rare and will be coordinated as soon as possible.

Draft EGDXXX AIP entry

Identification and Name Lateral Limits	Upper Limit Lower Limit	Remarks
EGDXXXA FAIRFORD 514814.6781N 0013542.6655W 514015.5302N 0013518.3381W 513958.2712N 0014917.4903W 514109.7736N 0015928.0273W 514743.8395N 0015951.5420W 514814.6781N 0013542.6655W	Upper limit: FL75 Lower limit: SFC	AMC - Manageable. Activity: Unmanned Aircraft System Beyond Visual Line Of Sight with an Indicated Airspeed (IAS) of 150 KTS or less (BVLOS less than 150 KTS) Service: DACS: Brize Radar on 124.275 MHz. DAAIS: London Information on 124.750 MHz. Contact: Booking: Military Airspace Management Cell – Managed Airspace, Tel: 01489-612495. Danger Area Authority: HQ Air. Hours: Activated by NOTAM.
EGDXXXB FAIRFORD 520517.9586N 0020404.4772W 514802.5866N 0014539.0339W 514749.0714N 0015601.3430W 514900.9897N 0020407.2290W 515341.5143N 0022131.7597W 520517.9586N 0020404.4772W	Upper limit: FL240 Lower limit: FL50	AMC - Manageable. Activity: Unmanned Aircraft System Beyond Visual Line Of Sight with an Indicated Airspeed (IAS) of 150 KTS or less (BVLOS less than 150 KTS) Service: DACS: Below FL160 Brize Radar on 124.275 MHz. At/above FL160 Swanwick Mil on 128.700 MHz. DAAIS: London Information on 124.750 MHz. Contact: Booking: Military Airspace Management Cell – Managed Airspace, Tel: 01489-612495. Danger Area Authority: HQ Air. Hours: Activated by NOTAM.
EGDXXXC FAIRFORD 521533.3938N 0021509.7197W 520517.9586N 0020404.4772W 515341.5143N 0022131.7597W 515700.8470N 0023402.1072W 520117.1456N 0023841.6667W 521533.3938N 0021509.7197W	Upper limit: FL500 Lower limit: FL160	AMC - Manageable. Activity: Unmanned Aircraft System Beyond Visual Line Of Sight with an Indicated Airspeed (IAS) of 150 KTS or less (BVLOS less than 150 KTS) Service: DACS: Swanwick Mil on 128.700 MHz. DAAIS: London Information on 124.750 MHz. Contact: Booking: Military Airspace Management Cell – Managed Airspace, Tel: 01489-612495. Danger Area Authority: HQ Air. Hours: Activated by NOTAM.
EGDXXXD FAIRFORD 523258.4562N 0023413.8553W 521533.3938N 0021509.7197W 520117.1456N 0023841.6667W 521342.2425N 0025220.6709W 522606.8022N 0025117.9630W 523258.4562N 0023413.8553W	Upper limit: FL500 Lower limit: FL200	AMC - Manageable. Activity: Unmanned Aircraft System Beyond Visual Line Of Sight with an Indicated Airspeed (IAS) of 150 KTS or less (BVLOS less than 150 KTS) Service: DACS: Swanwick Mil on 128.700 MHz. DAAIS: London Information on 124.750 MHz. Contact: Booking: Military Airspace Management Cell – Managed Airspace, Tel: 01489-612495. Danger Area Authority: HQ Air. Hours: Activated by NOTAM

Figure 5 – Draft EGDXXX AIP entry

Draft EGDXXXZ AIP entry

Identification and Name Lateral Limits	Upper Limit Lower Limit	Remarks
EGDXXXAZ FAIRFORD 514915.3521N 0013505.6882W 514841.3641N 0013407.3035W 513952.5951N 0013340.7694W 513916.4147N 0013435.4214W 513858.1516N 0014924.8830W 514014.7343N 0020018.9660W 514046.5546N 0020103.1045W 514806.4123N 0020129.6123W 514842.7985N 0020035.1441W 514915.3521N 0013505.6882W	As per AUP / UUP SFC	For IFR flight planning purposes only.
EGDXXXBZ FAIRFORD 520620.0629N 0020443.4917W 520615.2753N 0020309.4379W 514806.1542N 0014347.1931W 514703.8803N 0014439.2513W 514648.8916N 0015611.0338W 514803.9270N 0020437.9677W 515258.7631N 0022256.1071W 515359.4199N 0022316.9012W 520620.0629N 0020443.4917W	As per AUP / UUP As per AUP / UUP	For IFR flight planning purposes only.
EGDXXXCZ FAIRFORD 521635.9071N 0021545.2937W 521630.0678N 0021413.9129W 520533.7253N 0020224.7493W 520452.2960N 0020230.3344W 515246.8400N 0022041.5732W 515238.9457N 0022141.8357W 515612.7152N 0023506.5660W 520101.5359N 0024021.7501W 520144.5019N 0024014.9035W 521635.9071N 0021545.2937W	As per AUP / UUP As per AUP / UUP	For IFR flight planning purposes only.
EGDXXXDZ FAIRFORD 523402.0525N 0023434.0028W 523352.3132N 0023314.8188W 521548.6483N 0021328.9494W 521505.7055N 0021336.2629W 520014.7449N 0023805.7630W 520020.2767N 0023936.6390W 521325.2214N 0025359.7919W 522640.0854N 0025253.3294W 523402.0525N 0023434.0028W	As per AUP / UUP As per AUP / UUP	For IFR flight planning purposes only.

Figure 6 – Draft EGDXXXZ AIP entry

The proposed airspace will appear on aeronautical charts as shown in Figure 7.

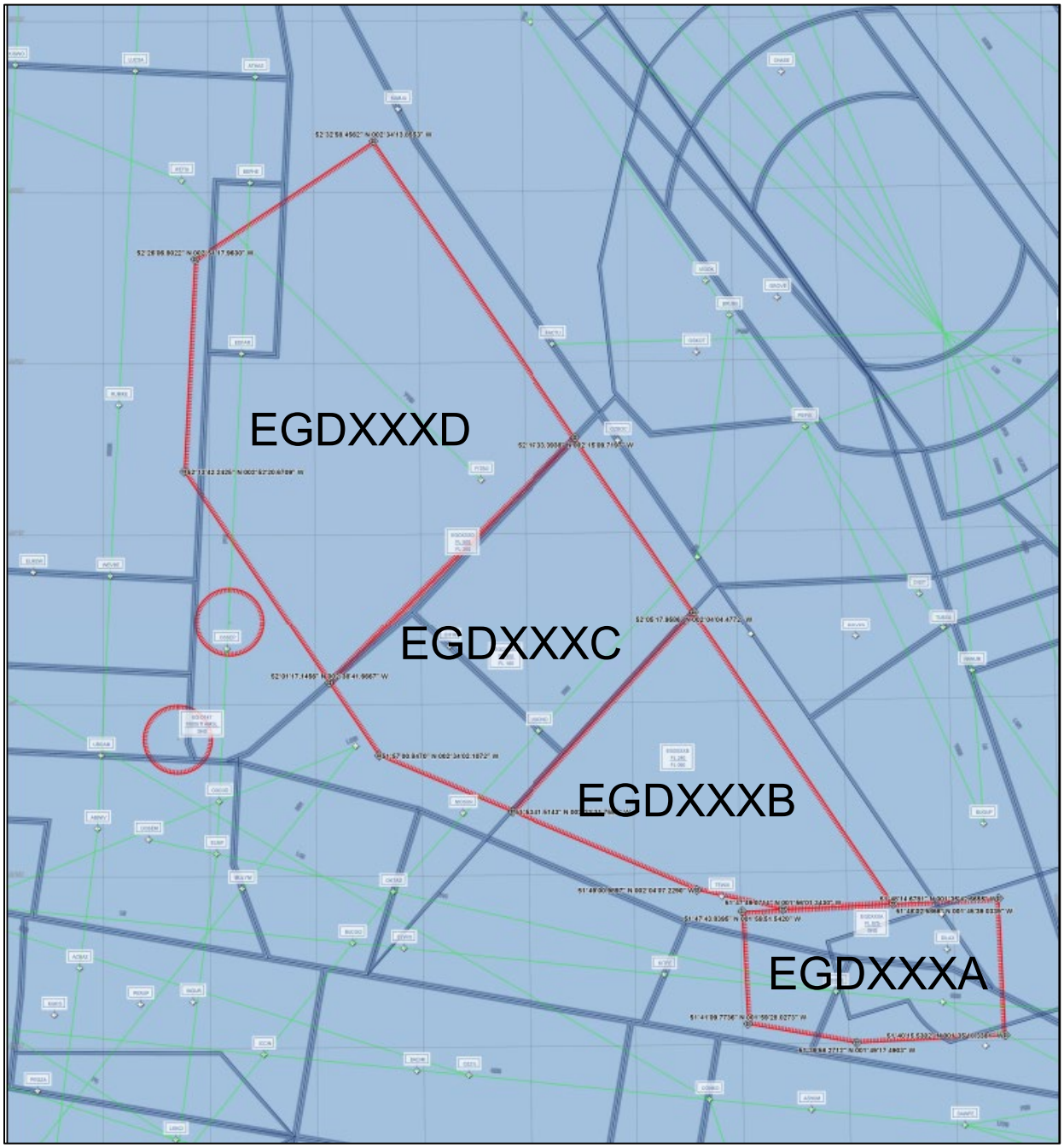

Figure 7 – Depiction of the Proposed Airspace

Section 6 - Engagement and Consultation Overview

Audience

The Sponsor selected aviation stakeholders from an area within a radius of approximately 30 miles from RAF Fairford and has used the National Air Traffic Management Advisory Committee (NATMAC) as a means of broader engagement. The Sponsor has verified that the NATMAC list below is the most up-to-date version. This list was used as the basis for engagement and consultation along with the stakeholders listed in the following tables.

The Sponsor determined that contacting individual properties was not needed, as the ACP is assessed to have no impacts below 7,000 feet and is thus expected to have no impacts on individual properties.

NATMAC Stakeholders		
Airlines UK	Airport Operators' Association (AOA)	Airfield Operators' Group (AOG)
Aircraft Owners and Pilots Association (AOPA)	Airspace Change Organising Group (ACOG)	Association of Remotely Piloted Aircraft Systems UK (ARPAS UK)
Aviation Environment Federation (AEF)	British Airways (BA)	BAe Systems
British Airline Pilots' Association (BALPA)	British Balloon and Airship Club	British Business and General Aviation Association (BBGA)
British Gliding Association (BGA)	British Helicopter Association (BHA)	British Microlight Aircraft Association (BMAA)
British Skydiving	Drone Major	General Aviation Alliance (GAA)
Guild of Air Traffic Controllers (GATCO)	Honourable Company of Air Pilots (HCAP)	Helicopter Club of Great Britain (HCGB)
Heavy Airlines	Isle of Man CAA	Light Aircraft Association (LAA)
Low Fare Airlines	Military Aviation Authority (MAA)	Ministry of Defence - Defence Airspace and Air Traffic Management (MoD DAATM)
National Air Traffic Services (NATS)	Navy Command HQ	PPL/IR Europe
UK Airprox Board (UKAB)	UK Flight Safety Committee (UKFSC)	United States Visiting Forces (USVF), HQ United States Country Rep-UK

Local Aviation Stakeholders		
Bath, Wilts and North Dorset Gliding Club	Bristol & Gloucestershire Gliding Club / Nympsfield Airfield	Bristol Airport
Charlton Park Airfield	Clench Common Microlight Site, Marlborough	Cotswold Airport (Kemble)
Cotswold Gliding Club / Aston Down Airfield	Dalton Barracks, Abingdon	Draycott Aerodrome, Swindon
Enstone Airfield	Gloucestershire Airport	London Oxford Airport
Membury Airfield	Oaksey Park Airfield, Malmesbury	RAF Benson
RAF Brize Norton	RAF Little Rissington	RAF Weston-on-the-Green
Rendcomb Airfield	RLC Silver Stars, South Cerney	South Cerney, Cloudbase Paragliding
Vale of the White Horse Gliding, Sandhill Farm	West Wales Airport	Wiltshire Microlight Centre, Calne
Bidford Gliding & Flying Club	Ledbury Airfield	Shobdon Airfield
FLYER		

The following is a list of potentially impacted airlines that were identified based on simulated traffic samples found in the NATS impact analysis. The Sponsor was unable to find the appropriate contact information but attempted to consult with these individual airlines via the airline trade groups in the NATMAC list. No responses were received from the trade groups or the airlines.

Airline Stakeholders		
Air Canada	Air France	Ethiopian Airlines
European Air Transport	FedEx	Jet2
Lufthansa	Ryanair	TUI Airlines
United Airlines	UPS	West Atlantic Cargo Airlines

Local Authority Stakeholders		
Fairford Town Council	Cotswold District Council	Swindon Borough Council
Vale of White Horse District Council	West Oxfordshire District Council	Gloucester City Council

Gloucestershire County Council	Oxfordshire County Council	Warwickshire County Council
Wiltshire County Council	Worcestershire County Council	

Other Local and National Organisations		
Campaign to Protect Rural England	Cotswold AONB	County Land and Business Association
Environment Agency	Local Resilience Forum	Natural England

Individuals		
[redacted]	[redacted]	[redacted]
[redacted]		

Engagement and consultation have been undertaken throughout this ACP. The tables below summarise the activity to date.

Engagement Timeline Overview

Date	Action	Remarks
12 Nov 21	Sponsor email address and Stage 1A documentation (SoN) published on CAA ACP portal.	
9 Dec 21	Engagement letter emailed to stakeholders	Feedback requested by 10 Jan 22
20 Jan 22	Email to all stakeholders extending the engagement period	Feedback requested by 10 Feb 22.
10 Feb 22	Engagement period finished	18 responses received
9 Mar 22	Oxfordshire RAUWG Presentation	51 Attendees
26 Apr 22	Formal engagement with Brize Norton ATC	F2F at RAF Brize Norton
27 Apr 22	Formal engagement with 78 Sqn	F2F at NATS Swanwick
5 May 22	Engagement letter and feedback form emailed to stakeholders.	Feedback requested by 1 Jun 22
24 May 22	Formal engagement with NATS	F2F at NATS Swanwick
1 Jun 22	Feedback deadline	16 responses
7 Jun 22	Follow up engagement with London Oxford Airport	Via Microsoft Teams
7 Jun 22	Follow up engagement with VOWH Flight Centre	Via Microsoft Teams
8 Jun 22	Follow up engagement with BGA	Via Microsoft Teams

9 Nov 22	Engagement with NATS on airspace design	Via Microsoft Teams
29 Nov 22	Engagement with NATS on airspace design	F2F at NATS Swanwick
24 Jan 23	Engagement with NATS on airspace design	Via Microsoft Teams
9 May 23	Engagement with NATS on airspace design	Via Microsoft Teams
6 Jun 23	Engagement with NATS on airspace design	Via Microsoft Teams
27 Jun 23	Engagement with NATS on airspace design	Via Microsoft Teams
1 Aug 23	Engagement with NATS on airspace design	Via Microsoft Teams
5 Sep 23	Engagement with NATS on airspace design	Via Microsoft Teams
2 Nov 23	Engagement with NATS, 78 Sqn, and Brize Norton on LoA development	F2F at NATS Swanwick

Consultation Timeline Overview

Date	Action	Remarks
11 Oct 2023	Stage 3C Consultation Launch	Via emails and CAA Citizen Space
24 Oct 2023	Virtual Consultation- MS Teams meeting	0 attendees
2 Nov 2023	Face to face Consultation- combined consultation with NATS, 78 Sqn, and RAF Brize Norton	17 attendees
2 Nov 2023	Virtual Consultation- MS Teams meeting	1 attendee
7 Nov 2023	Reminder emails sent to Stakeholders	Email
21 Nov 2023	Consultation closed	17 responses received via Citizen Space, email, and consultation meetings

A total of 17 responses were received during consultation; 6 were from individuals[2] and 11 were representing an organisation. Overall, 2 respondents did not support the ACP and 2 did support. NATS submitted a neutral response to the ACP. The other respondents did not indicate support or objection.

Common themes identified throughout consultation and relevant to the ACP are summarised as follows:

- The requirement for Letters of Agreement (LoAs) to be finalized to mitigate impact and increase safety.
- Concerns about disruption/reduction to Class G airspace.
- Concerns about re-routing around the Danger Areas when activated.
- The need for a crossing service for high priority military and civil flights.
- Negative impacts to capacity and efficiency of the air traffic network
- Concern about impacts to Brize Norton based aircraft.

[2] 1 individual completed 3 surveys.

Section 7 - Design Principles

The Change Sponsor engaged with a wide range of potential stakeholders and sought their views on the initial proposed Design Principles in Stage 1. The feedback received was used to finalise the Design Principles below. These were used throughout the ACP process to analyse the design options.

	Design Principle	Priority
a	Provide a safe environment for airspace users	1
b	Provide access to sufficient suitable airspace to enable efficient RPAS transition between the ground and high-level transit routes	2
c	Minimise the impact to other airspace users	3
d	Adhere to FUA principles and strategy	3
e	Where possible and practicable, accommodate the Airspace Modernisation Strategy	4
f	Endeavour to make the airspace as accessible as possible	5
g	Minimise the environmental impact of non-participating aircraft	6

Section 8 Options Development

Option 0 (Do Nothing)

In accordance with CAP 722, Unmanned Aircraft System Operations in UK Airspace – Policy and Guidance[3], any unmanned aircraft operating BVLOS requires a technical capability which has been accepted as being at least equivalent to the ability of a pilot of a manned aircraft to "see and avoid" potential conflicts. U.S. military HALE RPA currently lack this capability and require a block of segregated airspace to operate in the current regulatory environment. As such, the "do nothing" scenario would mean that U.S. military HALE RPA operations would not be possible.

HALE Option 1 (Discounted)

This design option was developed in Stage 2. In this option, segment A was a 6 NM radius centred on RAF Fairford from the surface to FL 150. Segment B was an 8 NM wide corridor that connects segment A to segment C. Segment B had an altitude of FL 70 – FL 200. Segment C had an altitude of FL 200 – FL 600. This option was discounted due to stakeholder feedback and further analysis by the Sponsor after Stage 2.

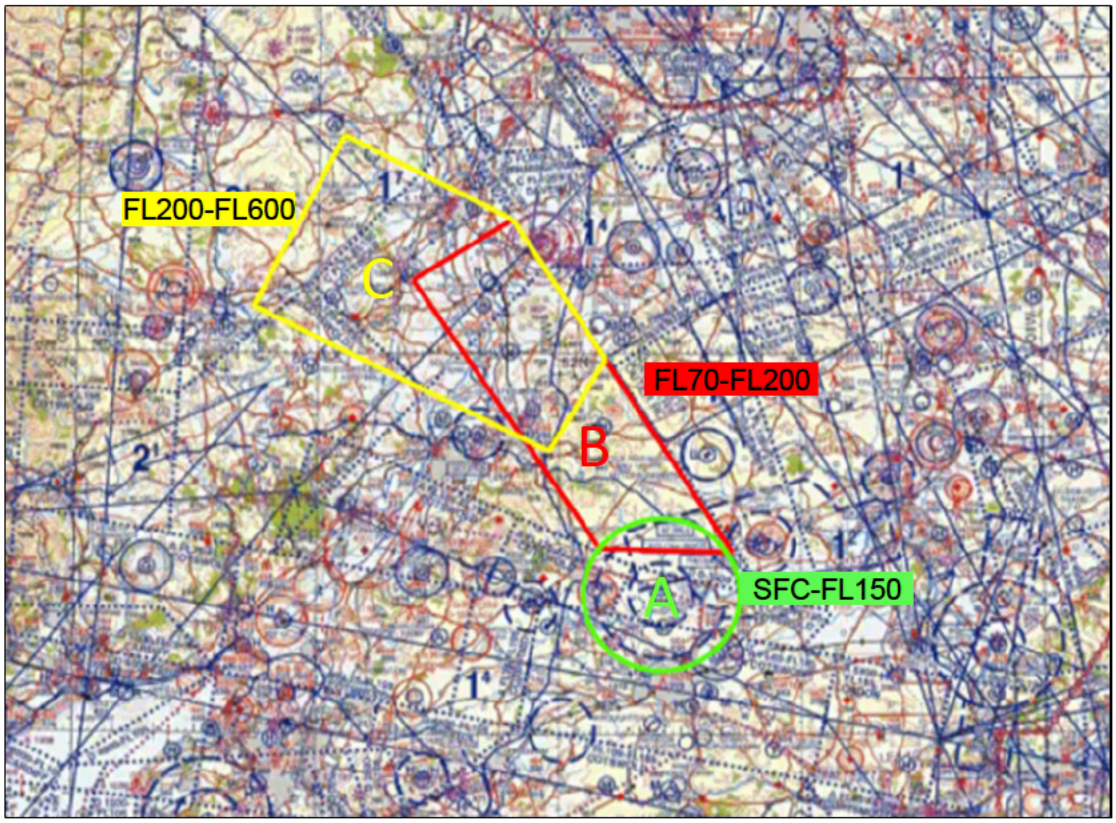

Figure 8- HALE Option 1

[3] CAP 722 Unmanned Aircraft System Operations in UK Airspace – Policy and Guidance

HALE Option 2 (Discounted)

This design option was also developed in Stage 2. In this option, segment A was a 6 NM radius centred on RAF Fairford from the surface to FL 95. Segment B was designed to avoid Cotswold CTA 18 to the northwest. The altitude remained FL 70-FL 200. Segment C was slightly larger than HALE Option 1, and the altitude remained FL 200 – FL 600. This option has been discounted due to stakeholder feedback and further analysis by the Sponsor after Stage 2. Further details are discussed later in this document.

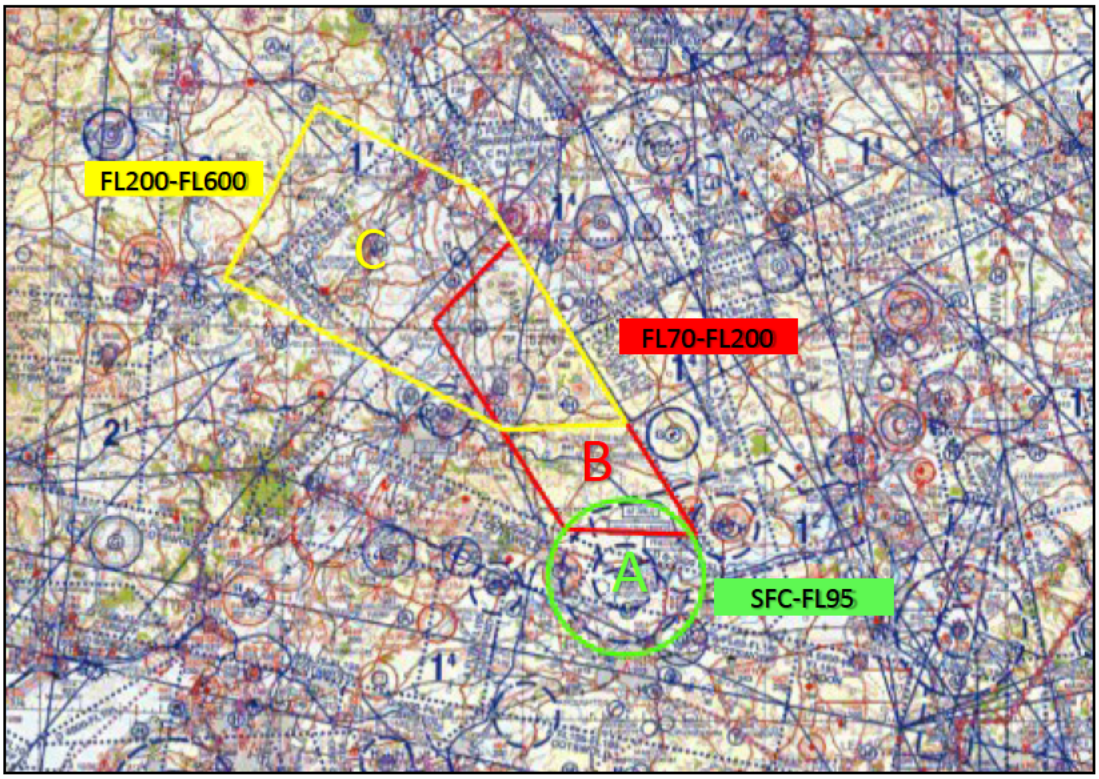

Figure 9 - HALE Option 2

Modification of HALE Options

After Stage 2, NATS identified significant expected impacts from HALE Options 1 and 2 prompting extensive engagement. Much of this engagement was focused on mitigating the impacts from the NATS West Airspace Deployment planned for March 2023. Specific concerns were raised by NATS about the impact of Segment A. NATS feedback indicated that the upper limit altitude of Segment A for both options would cause extensive impacts to flight planning for departures at adjacent airports. Additionally, the southern portion of Segment A for both options was identified as a major impact to civil traffic patterns.

The Sponsor also conducted further analysis[4] and determined that the volumes of

[4] Internal U.S. Air Force analysis. Due to operational security this is not provided in detail but can be requested by the CAA should more information be required.

Segment C in HALE Options 1 and 2 were not sufficient to enable safe and efficient RPAS transition between the ground and the operating altitude in all foreseeable contingency and emergency scenarios. A larger internal safety buffer was also deemed necessary to comply with the CAA's Safety Buffer Policy Letter.

Based on engagement with NATS on expected impacts to civil traffic and the Sponsor's further analysis[5], it was determined that HALE Options 1 and 2 were no longer viable. The Sponsor then worked with stakeholders on modifications to those designs that better aligned with the established design principles.

Interim HALE Option

The initial revision came about after further engagement with NATS on the options presented in Stage 2. The previous HALE options for Segment A included a 6 NM radius around RAF Fairford extending from the surface to FL 95 and FL 150 respectively. NATS requested a revision that would limit the airspace footprint south of RAF Fairford, and also requested that the upper limit of Segment A be lowered. The Sponsor responded by reducing the upper level of Segment A to FL 80 and modifying the shape of Segment A to allow it to be shifted ~5 NM to the north.

After further safety analysis[6], Segment D was also added. This segment added operational flexibility in the event of adverse weather conditions, further minimising risks of excursion in situations such as abnormally high winds at altitude. This option also sought to reduce impacts to other airspace users by permitting a faster climb to operating altitude.

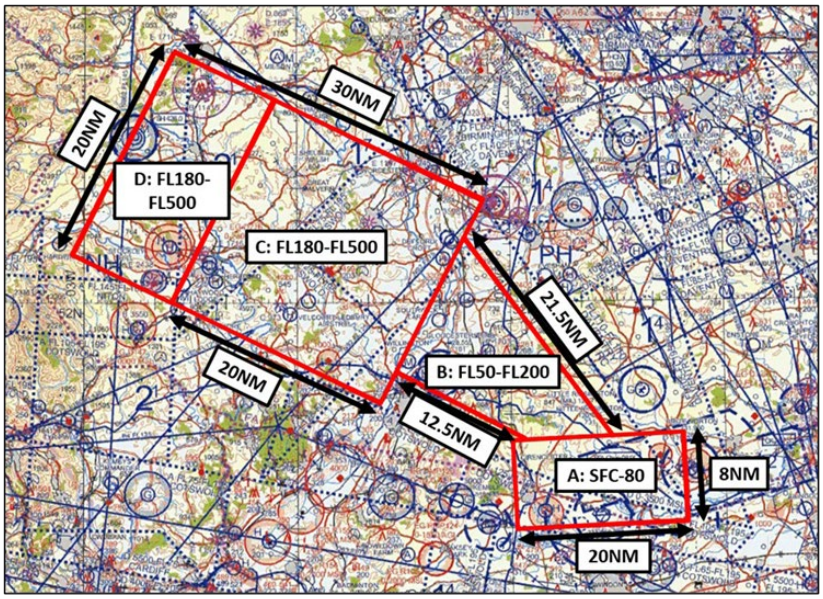

Figure 10 – Interim HALE Option

[5] Internal U.S. Air Force analysis. Due to operational security this is not provided in detail but can be requested by the CAA should more information be required.
[6] Internal U.S. Air Force analysis. Due to operational security this is not provided in detail but can be requested by the CAA should more information be required.

HALE Option 3 – The Submitted Option

After presenting the interim option to NATS, modifications to the interim airspace were suggested that would minimize the impact to other users of the airspace. The Sponsor was able to comply with some of these suggested modifications. Among these were the shifting of Segments C and D further north, shifting the boundary between Segment C and D, and reducing the upper boundary of Segment A to FL 75 and eliminating overlap of adjacent CTAs in the SW corner of Segment A. HALE Option 3 is the result of this engagement.

HALE Option 3 provides a volume of airspace that permits HALE RPA departure from RAF Fairford followed by a turn to the north within Segment A and transition to Segment B. After a climbing transition through Segment B, the HALE RPA continues its climb within Segments C and D to its high-level transition altitude of FL 500 or above. The process is reversed on arrival to RAF Fairford.

This option further allows for increased internal safety buffers and provides more operational flexibility for contingency situations. This greatly reduces the possibility of excursion and is assessed to be the minimum viable airspace needed to fully meet Design Principles A and B.

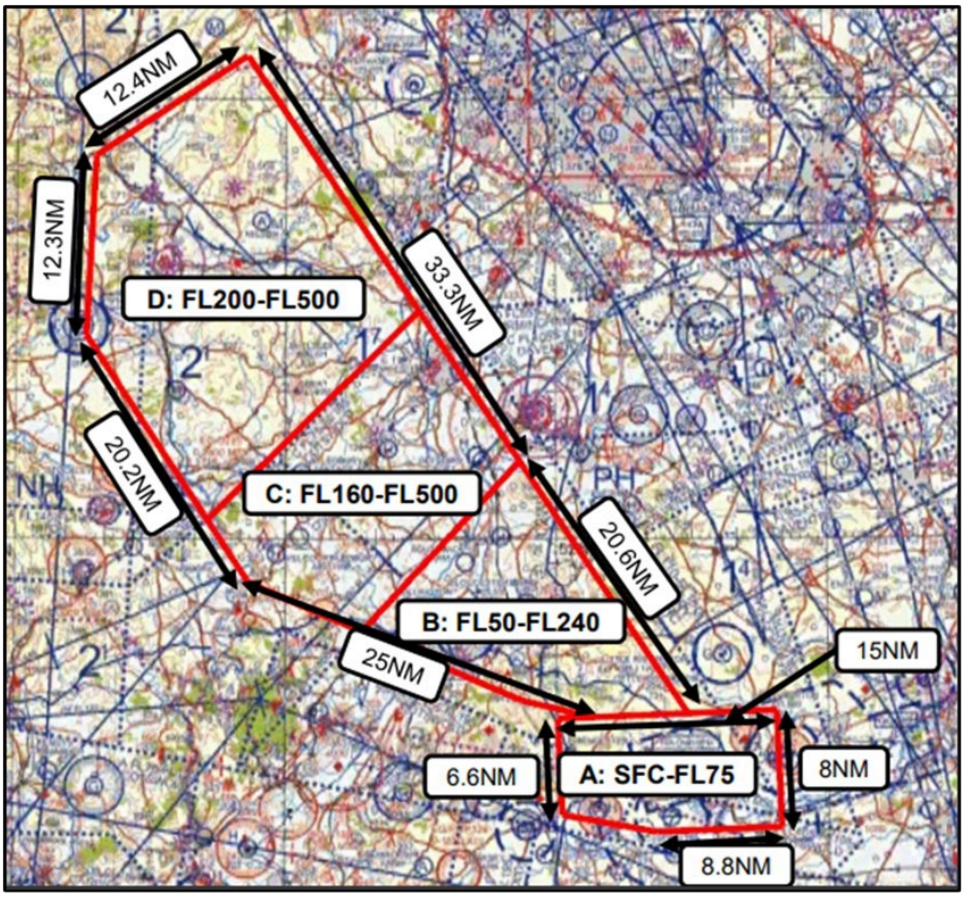

Figure 11 – HALE Option 3

Section 9 - Final Options Analysis/Impact of Options

The following tables detail the appraisal of the proposed airspace design as evaluated against the “do-nothing” baseline.

Final Option Appraisal of Proposed Airspace

Table 1 – Summary of Option Appraisal for Proposed Design

Group	Impact	Proposed Design	Do-Nothing
Communities	Noise impact on health and quality of life	As a Level M2 change, CAP1616 states that the prioritised environmental mpact is CO2 emissions, and an assessment of noise impacts is not normally required. This proposal is expected to have minimal to no mpacts below 7,000 feet. Additionally, noise mpacts were not a concern in any of the stakeholder engagement that was carried out prior to Stage 3A.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no change in noise impacts on health and quality of life would occur.
Communities	Air Quality	n accordance with CAP 1616, this assessment is not required as the proposal will not affect emissions below 1,000 feet.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no change in air quality would occur.
Wider society	Greenhouse gas impact	Activation of the proposed airspace will result in an increase of CO2 emissions due to civil traffic being re-routed. Although tactical re-routing and a DACS will be available for the majority of the activation period, it is expected that some aircraft will need to circumnavigate the airspace. Network traffic will be required to flight plan around the proposed airspace, when active. A detailed quantitative analysis of the “worst case” scenario has been provided in Annex A.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no greenhouse gas impact would occur.

Wider society	Capacity / resilience	The proposed airspace will be managed by the Military Airspace Management Cell to minimise disruption and activation will be via NOTAM. Due to the time window of activation and the limited frequency and duration of activation, this is not expected to be significant.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no capacity/resilience mpacts would occur.
General Aviation	Access	Very minimal to no mpacts to general aviation access are expected above the baseline “do nothing” option. This assessment s based upon stakeholder feedback and traffic data both demonstrating minimal to no expected impact to civil traffic below 7,000 feet. Access will be further enabled through the availability of a DACS.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no general aviation impacts would occur.
General Aviation / commercial airlines	Economic impact from increased effective capacity	This option is not expected to have an mpact to the number of air transport movements, estimated passenger numbers, or cargo tonnage carried.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no change to economic impacts from ncreased effective capacity would occur.
General Aviation / commercial airlines	Fuel Burn	Projected fuel burn statistics can be found in Annex A. Due to the ocation of RAF Fairford, HALE Option 3 will have an inevitable impact on commercial airline routing. Although tactical rerouting and a DACS will be available for the majority of the activation period, it is expected that most network traffic will be required to flight plan around the proposed airspace, when active.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no change to fuel burn would occur.

Commercial airlines	Training costs	Not applicable	
Commercial airlines	Other costs	Not applicable	
Airport /ANSP	Infrastructure costs	NATS feedback has indicated that no infrastructure costs are expected with this design.	No infrastructure costs would be associated with a “do nothing” option.
Airport /ANSP	Operational costs	NATS feedback has indicated that operational costs will likely be nil or negligible with this design.	No operational costs would be associated with a “do nothing” option
Airport /ANSP	Deployment Costs	Costs would be incurred by NATS, RAF Brize Norton, and 78 Sqn through the briefing and training of air traffic controllers for RPA operations to include emergency and contingency situations. There will also be costs for ATM system updates. NATS is still conducting planning to determine an estimate for deployment costs associated with this design but is unable to share this with the Sponsor.	Flight operations associated with the ACP would not be possible in a “do nothing” scenario and thus no change to Airport/ANSP deployment costs would occur.

Section 10 - Airspace Description Requirements

	The proposal should provide a full description of the proposed change including the following:	Description for this proposal
a	The type of route or structure; for example, airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/STARs, holding patterns, etc.	Danger Area
b	The hours of operation of the airspace and any seasonal variations	Activated by NOTAM. No seasonal variation. Hours will be from 1 hour after sunset to 1 hour prior to sunrise. Normally, activation will not occur earlier than 20:00 UTC or later than 05:30 UTC.
c	Interaction with domestic and international en-route structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered	The proposed airspace interacts with: MIDLANDS CTA, UPPER AIRSPACE CTA, COTSWOLD CTA 15, COTSWOLD CTA 17, PEPZE CTA 10, PEPZE CTA 11, BRIZE NORTON CTR, ATS Routes P17 and N92, and is ivo London Oxford airport, Cotswold Airport (Kemble), Gloucestershire Airport, and Brize Norton.
d	Airspace buffer requirements (if any). Where applicable describe how the CAA policy statement on 'Special Use Airspace – Safety Buffer Policy for Airspace Design Purposes' has been applied.	See Annex B
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (passenger, freight, test and training, aero club, other) and terminal passenger numbers	N/A
f	Analysis of the impact of the traffic mix on complexity and workload of operations	The airspace will be managed by military air traffic units (Brize Radar and Swanwick Military)
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or airspace management requirements	See Annex C for MOD ATC draft procedures and LOAs

h	Evidence that the airspace design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not)	The airspace design is compliant with CAA Policy Document 20200721-*"CAA Policy for the established for permanent and temporary Danger Areas"* issued by the SARG and is in accordance with CAP 740.
i	The proposed airspace classification with justification for that classification	Danger Area – this has been determined as the best way to achieve the segregated airspace required by CAP 722 - Unmanned Aircraft System Operations in UK Airspace – Guidance and Policy.
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in line with forecast traffic growth. 'Management by exclusion' would not be acceptable	See Annex C for MOD ATC draft procedures. A DACS will be provided by Brize Radar and Swanwick Military when proposed airspace is active.
k	Details of and justification for any delegation of ATS	See Annex C for draft procedures and LoAs detailing the delegation of ATS and detail of the DACS provision.

Section 11 - Safety Assessment

Although the operations driving the need for this ACP are expected to consist of only 2-3 arrivals or departures per week, the Sponsor acknowledges that the establishment of the proposed Danger Areas may introduce the following hazards:

1. Should pilots be unable to accept DACS, the routing of traffic around the proposed airspace may create bottlenecks and increased traffic density in areas near the border of the proposed airspace. Due to the timing and duration of airspace activations and the identified lack of traffic operating in Class G, this is unlikely to have a significant impact. Based on stakeholder feedback, HALE Option 3, the proposed airspace being submitted, is expected to have fewer impacts than the discounted HALE Options 1 and 2.

2. A higher workload is expected to be imposed upon RAF Brize Norton and Swanwick Military ATC due to controlling the RPA, providing/managing DACS requests, and accomplishing tactical re-routing of network traffic. The latter would also increase workload for civil controllers.

3. Pilots of aircraft operating in Class G airspace may not be aware of the activity status of the airspace and inadvertently fly through the active Danger Area during RPA climb/descent. However, due to activity timings/duration and notification procedures, this is deemed to be a highly unlikely scenario.

If Danger Areas are implemented, the following will be in place to ensure risks are mitigated:

1. The proposed airspace will be activated by NOTAM at least 24 hours prior to USAF RPAS operations. Procedures will be adopted to ensure that the airspace is activated only when required and dynamically deactivated when not in use.

2. A 2,000-foot external vertical buffer will be implemented in accordance with the CAA Safety Buffer Policy. The application of this buffer will be detailed in LoAs with NATS and MOD ATS providers.

3. A 2 NM internal buffer is planned in Segments B, C, and D

4. An external FBZ of 1 NM will be applied above FL245 and where the airspace abuts CTAs or has an interaction with an ATS Route. Due to the proximity of adjacent CTAs and ATS routes to each segment of the proposed Danger Area, a 1 NM FBZ will be required for all segments of EGDXXX.

5. An internal buffer will not be applied to all portions of Segment A. The safety buffer will be achieved through vertical means with an altitude restriction of at or below FL 60 until 3NM from the boundary of COTSWOLD CTA 4. The lowest

usable flight level in COTSWOLD CTA 4 will be FL 70. The application of this buffer will be detailed in LoAs with NATS and MOD ATS providers.

6. To minimise the safety impacts of the proposed airspace, a DACS will be available for aircraft under a clearance from either RAF Brize Norton or 78 Sqn (Swanwick Military). Procedures are being developed to allow for the dynamic real-time return of airspace to ATC when needed for higher priority flights or when not actively in use for RPA operations. This will maximise the availability of the DACS and minimise the need for routing around the proposed Danger Areas. RPA will not routinely loiter in the segregated airspace. All airspace design options are intended for egress from and ingress to RAF Fairford only. As such, the Sponsor expects that a crossing service will be available for the majority of the proposed activation window.

7. HALE RPA will remain within segregated airspace at all times within the proposed airspace. During onward transit to/from the proposed airspace, HALE RPA will operate as agreed in a type-specific Operational Arrangement with the CAA and MoD. The Operational Arrangement is in the process of being finalised and is not part of this ACP.

8. Specific emergency procedures are currently being developed. To minimise training requirements on ATC, every effort is being made to standardise lost link and other contingency and emergency procedures. If an emergency occurs within the Danger Area, HALE RPA will be programmed to remain within the Danger Area and hold or land at RAF Fairford.

Conclusion

Activations of airspace for up to 3 hours, 2-3 times per week, and during times of lower traffic density should minimise the impacts of the risks explained previously. The addition of procedures for real-time return of airspace not needed for RPA operations will further minimise these impacts as will the availability of a DACS.

The Sponsor will continue to engage with 78 Sqn and RAF Brize Norton ATC on procedures that will maximise safety and minimise risks to other users of the airspace and the public at large.

Section 12 - Operational Impact

	An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:	Evidence of compliance / proposed mitigation
a	mpact on IFR general air traffic and operational air traffic or on VFR General Aviation (GA) traffic flow in or through the area	The majority of impacts are expected to IFR traffic. The Danger Area will limit flight planning through the airspace but the availability of a DACS through the proposed airspace should allow airways leavers and joiners to transit through the airspace via tactical re-routing. Although this option is available it is not expected to be widely utilised for IFR traffic. Minimal to no impacts are expected to VFR traffic due to the frequency of activation, the time of activation and the duration of activation. The availability of a DACS is expected to mitigate much or all of the potential impacts and is expected to be utilized by VFR traffic.
b	mpact on VFR operations (including VFR routes where applicable);	There are no VFR routes within the proposed airspace. The DACS provision during activation will provide airspace users with access to the airspace for the majority of the activation period.
c	Consequential effects on procedures and capacity, i.e. on SIDs, STARs, and/or holding patterns. Details of existing or planned routes and holds	No impacts are anticipated on civil procedures. Some impacts to capacity are expected due to the requirement to flight plan around the Danger Area while it is active. A DACS could potentially alleviate some of this impact.
d	mpact on aerodromes and other specific activities within or adjacent to the proposed airspace	Local agreements have been drafted to co-ordinate military and civil activities. See Annex C. No impacts are expected to operations at adjacent airports due to the frequency of activation, the time of activation and the duration of activation. The availability of a DACS is expected to mitigate much or all of these potential impacts.

e	Any flight planning restrictions and/or route requirements	Flight planning will be restricted during airspace activation. If a DACS is not utilized or available, IFR traffic will be required to re-route around the Danger Area. Airspace users planning to transit the proposed airspace when notified as active should plan to obtain a DACS from Brize Radar or Swanwick Military. It is anticipated that traffic flight-planned to route to/from Brize Norton during activation times will be able to do so through an FUA restriction, and under the control of Brize Radar.

Section 13 - Supporting Infrastructure/Resources

	General Requirements	Evidence of compliance / proposed mitigation
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures	N/A
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures	N/A
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures	N/A
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered	Brize Norton ATC and Swanwick Military operate 24/7 and will be able to provide DACS throughout hours of activation of proposed airspace, when not needed for HALE RPA operations. The likelihood of equipment failure is thought to be very low but HALE RPA are designed to operate safely within the pre-established buffer on pre-coordinated departure and arrival routes in the event of primary or secondary radar failure.
e	Effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material	N/A
f	A clear statement on SSR code assignment requirements	SSR code assignment in accordance with ENR 1.6 ATS Surveillance Services and Brize Norton ATC procedures.

g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change	Brize Norton ATC and Swanwick Military have a sufficient number of suitably qualified ATCOs to provide DACS. See Annex C

Section 14 - Airspace and Infrastructure

	General Requirements	Evidence of compliance / proposed mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments	HALE RPA are designed to operate safely within the pre-established buffer on pre-coordinated departure and arrival routes in the event of primary or secondary radar failure.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in CAA policy statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace'. Describe how the safety buffer is applied, show how the safety buffer is portrayed to the relevant parties, and provide the required agreements between the relevant ANSPs/ airspace users detailing procedures on how the airspace will be used. This may be in the form of Letters of Agreement with the appropriate level of diagrammatic explanatory detail.	HALE RPA are designed to operate safely within the pre-established buffer on pre-coordinated departure and arrival routes in the event of primary or secondary radar failure. See Annex B – Application for dispensation from CAA policy statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace'
c	The Air Traffic Management system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures	There will only be one HALE RPA within the structure for each activation. See Annex C for draft MOD ATM procedures for further details

d	Air traffic control procedures are to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures	There will only be one HALE RPA within the structure for each activation. See Annex C for draft MOD ATM procedures for further details
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable	When active, transit of the Danger Area will be available through a DACS unless in use by HALE RPA. When not activated, the airspace reverts to previous classifications.
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation	Changes to the airspace, if successful, will be notified through the AIRAC publication. Airspace will be published on aeronautical charts and detailed within the AIP. Notification of activation will be accomplished via NOTAM.
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified	N/A
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle	Changes to the airspace, if successful, will be notified through publication that is promulgated via the AIRAC cycle.
i	There must be sufficient R/T coverage to support the Air Traffic Management system within the totality of proposed controlled airspace	Brize Norton and Swanwick Military air-ground-air radio provision is adequate for the entirety of the proposed airspace.
j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	See Annex C for draft MOD ATM procedures

k	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site, etc.) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	No impacts are expected to low flying, gliding, parachuting, microlight site, etc. due to frequency, duration, and time of activation.
	ATS Route Requirements	Evidence of compliance / proposed mitigation
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/Eurocontrol standards	N/A
b	Where ATS routes adjoin terminal airspace there shall be suitable link routes as necessary for the ATM task	N/A
c	All new routes should be designed to accommodate P-RNAV navigational requirements	N/A

	Terminal Airspace Requirements	Evidence of compliance / proposed mitigation
a	The airspace structure shall be of sufficient dimensions to contain appropriate procedures, holding patterns and their associated protected areas	N/A
b	There shall be effective integration of departure and arrival routes associated with the airspace structure and linking to designated runways and published instrument approach procedures (IAPs)	N/A
c	Where possible, there shall be suitable linking routes between the proposed terminal airspace and existing en-route airspace structure	N/A
d	The airspace structure shall be designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace	N/A

e	Suitable arrangement for the control of all classes of aircraft (including transits) operating within or adjacent to the airspace in question, in all meteorological conditions and under all flight rules, shall be in place or will be put into effect by the change sponsor upon implementation of the change in question (if they do not already exist)	N/A
f	The change sponsor shall ensure that sufficient visual reference points are established within or adjacent to the subject airspace to facilitate the effective integration of VFR arrivals, departures and transit of the airspace with IFR traffic	N/A
g	There shall be suitable availability of radar control facilities	Brize Norton and Swanwick Military surveillance equipment provides coverage of the entire airspace structure.
h	The change sponsor shall, upon implementation of any airspace change, devise the means of gathering (if these do not already exist) and of maintaining statistics on the number of aircraft transiting the airspace in question. Similarly, the change sponsor shall maintain records on the numbers of aircraft refused permission to transit the airspace in question, and reasons why. The change sponsor should note that such records would enable ATS managers to plan staffing requirements necessary to effectively manage the airspace under their control	In accordance with CAP 740 and Annex C, LoAs will request that Brize Norton and Swanwick Military gather and maintain statistics for aircraft requesting transit of the DA, and specifically those refused a DACS.
i	All new procedures should, wherever possible, incorporate Continuous Descent Approach (CDA) profiles after aircraft leave the holding facility associated with that procedure	N/A

	Off-route airspace requirements:	Evidence of compliance / proposed mitigations:
a	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	See Annex C for draft MOD ATM procedures.

b	Should there be any other aviation activity (military low flying gliding, parachuting, microlight site etc.) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	No impacts are expected to low flying, gliding, parachuting, microlight site, etc. due to frequency, duration, and time of activation.

Section 15 - Environmental Assessment

The environmental impact of military activity was not considered during this ACP but the environmental impact from other air traffic as a result of the introduction of a new airspace structure was considered.

HALE Option 3, the final proposed option, was evaluated for impacts to civil traffic using a representative traffic sample provided by NATS Analytics. This sample confirmed that no impacts are expected below 7,000 feet for this design option, further validating the categorisation of this ACP as a Level M2 change. In accordance with CAP 1616, only CO_2 emissions are required to be assessed as a part of the Environmental Assessment of a Level M2 change.

CO_2 Emissions

An increase in CO_2 emissions is expected as a result of this change. The “worst case” scenario impact is presented in detail in Annex A of this document.

Noise, Local Air Quality, Tranquility, and Biodiversity

Since no impacts are expected to civil traffic patterns below 7,000 feet, no adverse impacts related to noise, local air quality, tranquility, or biodiversity are expected. While impacts to civil traffic patterns below 7,000 feet are highly unlikely, the Sponsor has planned impact mitigation efforts to include NOTAMs when proposed airspace would be active, activation during periods of low traffic density, and the utilisation of a DACS.

Summary of Final Options Appraisal

The “do nothing” option does not permit BVLOS RPAS operations and is only presented as a baseline for comparison.

HALE Option 3, the proposed final option being submitted, has been developed to satisfy Design Principles A and B. It was also designed with extensive engagement with ATS providers and other stakeholders to satisfy Design Principles C-G to the maximum extent possible.

The Sponsor assesses that no impacts are expected below 7,000 feet when compared to the baseline “do nothing” option. This assessment was confirmed by stakeholders during engagement and consultation and has been validated through observed and simulated traffic data.

At or above 7,000 feet, impacts can be expected based on the need for network traffic to plan around the airspace during periods of activation. This option was designed with extensive engagement with NATS to avoid heavily used routes to the maximum extent possible. The worst-case scenario for fuel burn and CO_2 emissions (where no DACS is utilised) is presented in Annex A.

Annex A – Environmental Impact Assessment

Overview and Methodology

NATS Analytics were engaged to produce an Environment Impact assessment. This assessment was produced in September 2023 and based on the following assumptions:

- A 1 NM flight plan buffer zone (FBZ) would occur above FL245 and where the ACP-2021-078 Danger Area abuts Control Areas (CTAs) and has an interaction with an Air Traffic Service (ATS) route.
- A 2,000ft vertical buffer was applied above and below the ACP-2021-078 Danger Area where it abuts/overlaps CTAs.
- In the scenario presented, the Danger Area can be activated 1 hour after sunset to 1 hour before sunrise. For the winter schedules, this equates to the longest night (~ 21st Dec) between 17:00 to 07:00 UTC hours. For the summer schedules, the danger area can be activated between 21:00 to 05:00 UTC. For summer, the night-time activation period is based on the traffic sample date 08/04/23 as opposed to the shortest day (~ 21st June) to model a worst-case scenario.[7]
- The Danger Area will be activated 2 to 3 times per week, in 3 hourly segments with a range of 6-9 hours activation per week. It may be activated on weekends as well as weekdays.
- No other special use airspace (SUA) volumes are active at the same time therefore the analysis relates only to the ACP-2021-078 Danger Area.
- The fuel impact of the change would happen at cruise. This is calculated by multiplying the difference in route length (NM) by the BADA 4.2 aircraft type cruising fuel burn rate at its Requested Flight Level (RFL).
- The traffic sample is representative and can be used to represent the impact of a 3-hour activation segment.
- The traffic forecasts are grown using the NATS March 2023 Base Case Forecast and assumes a steady growth rate of 0.7% for 2029 and onwards.
- The environmental results were filtered to only include those flights present in both simulations. No military or helicopter flights are modelled.
- 20% of emissions are traded, 80% are non-traded. For WebTAG submission, the carbon dioxide equivalent (CO_2e) emissions are reported as traded (flights whose origin and destination are within the EU) or non-traded.[8][9]

Simulated baseline air traffic models have been produced using tool NEST (V1.8) and Emissions figures have been produced using BADA 4.2 data. These products have been

[7] The current proposal is for activation between 20:00 and 05:30 UTC for normal operations.
[8] The % of flights CO2 Traded is defined as the % of UK domestic flights; flights between UK and Gibraltar, & flights departing the UK to EEA states within the dataset (% same for all years). The % of flights non-Traded is defined as all flights with destination outside of EEA states (% same for all years).
[9] CO2 Traded is calculated as the Simulated CO2 x % flights CO2 Traded, and CO2 non-Traded is calculated as the Simulated CO2 x % flights CO2 non-Traded.

made available by the European Organisation for the Safety of Air Navigation (EUROCONTROL).

The traffic sample is taken from the 2303 AIRAC from EUROCONTROL covering the period of 23/03/2023 to 19/04/2023. This AIRAC was chosen to give an up-to-date baseline set of traffic that was not considerably impacted by the Covid-19 pandemic and included the West Airspace Implementation.

The following 3 days were picked to simulate a typical winter schedule: 23/03/2023, 24/03/2023, and 25/03/2023. Another 3 days were picked to simulate a typical summer schedule: 30/03/2023, 03/04/23, and 08/04/23. These 6 days were picked to give a good overall representation of traffic, with the following factors considered: day of the week, traffic count, and city pair flows.

During winter, the ACP-2021-078 Danger Area may be activated between 17:00 - 07:00 UTC (based on the longest night ~ 21st Dec) and in summer, the Danger Area may be activated between 21:00 - 05:00 UTC. For summer, the night-time activation period is based on the traffic sample date 08/04/23 as opposed to the shortest day (~ 21st June) to model a worst-case scenario.

The traffic sample is defined as any flight whose simulated trajectory changed due to the activation of the Danger Area. Over the 6 sample days, 172 aircraft crossed the Danger Area.

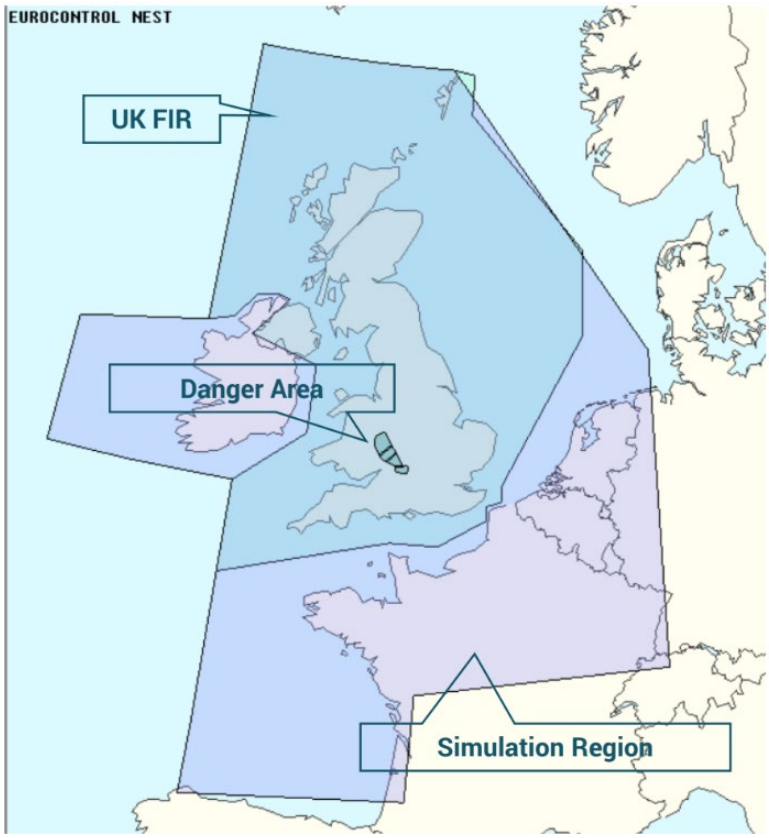

Fig A-1 – Simulated Region

Effect on Aviation

Due to the proximity of the Danger Area to the southern edge of the UK FIR (London FIR), some flights need to change their UK entry/exit point between the Baseline and Scenario simulations in order to produce a valid flight plan. Therefore, a Simulation Region was created for this study, matching the UK FIR on the Atlantic boundary but expanding across European airspace. This fixes the Oceanic UK FIR entry/exit point for any transatlantic flights, ensuring that the North Atlantic Tracks are utilised in a realistic manner.

The Scenario trajectories were simulated within the Simulated Region, with the Oceanic entry and exit points matching those from the initial flight plan to replicate the North Atlantic Tracks on the chosen traffic sample days.

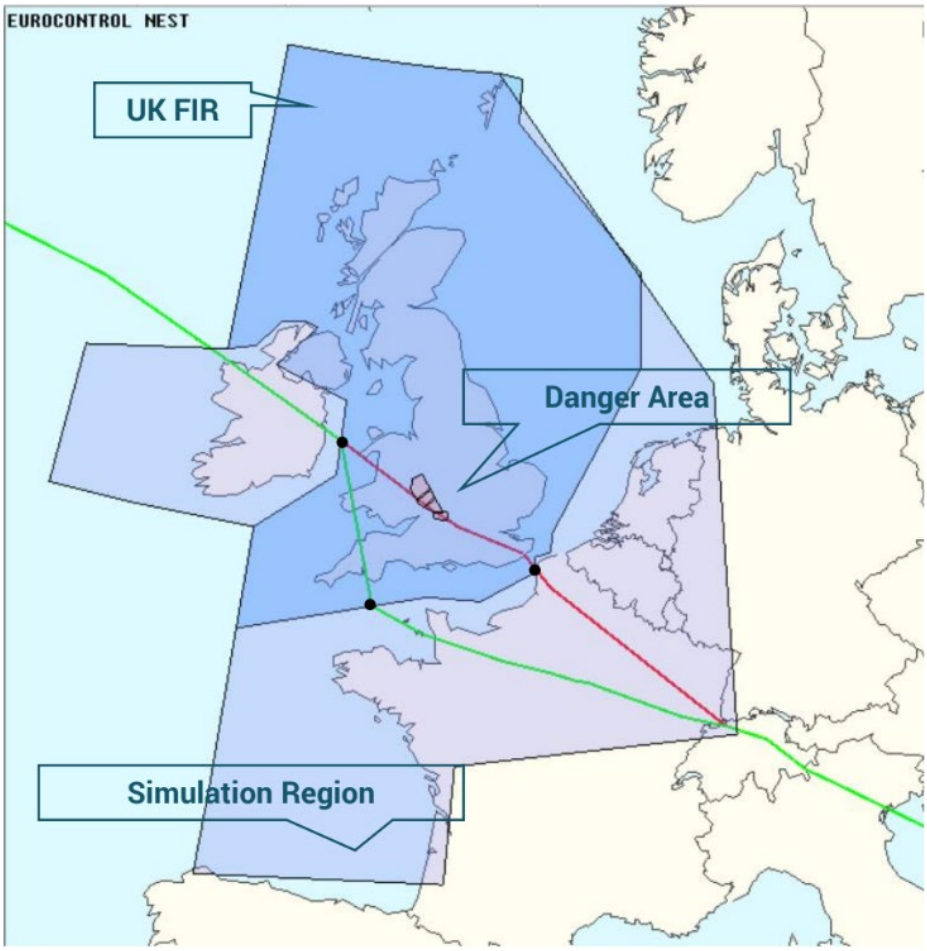

Fig A-2 – Example Trajectory

The image above shows an example pair of Baseline (red) and Scenario (green) trajectories. The black dots mark the points where the flight enters or exits the UK FIR. In the Scenario, where the ACP-2021-078 Danger Area is active, the flight has to take a longer route across the UK FIR to avoid the Danger Area. For this particular flight, the route length has increased by 77 NM, therefore increasing its fuel burn and CO_2e emissions.

Environmental Impact

The track distance flown within the UK FIR (NM) was taken from the Baseline and Scenario models and used to calculate the change in distance flown. The fuel burn at cruise by aircraft type was then taken from the BADA 4.2 PTF tables and used to calculate the fuel burn change based on the change in distance flown.

The flights modelled were used to represent a typical 3-hour long activation segment of the ACP-2021-078 Danger Area. With a maximum of 9 hours of activation per week, this has been scaled up to represent a maximum annual impact (468 activation hours per year).

The figures below show baseline trajectories compared to the simulated trajectories of traffic routed around the activated Danger Areas.

Fig A-3 – Baseline Trajectories

Fig A-4 – Re-routed Trajectories when Danger Areas are active

Winter Environmental Impact – Average per flight

The average route length, fuel burn and carbon dioxide equivalent (CO_2e) emissions per impacted flight per hour during the winter hours (between 17:00 and 07:00 UTC) are given in the table below. The average flight has increased track distance of 41NM, increased fuel burn by 335kg and related emissions by 1,065kg when the ACP-2021-078 Danger Area is activated. The greatest number of flights would be impacted if activation occurred in the 3-hour period between 17:00-20:00. The greatest overall impact on fuel/CO_2e would occur if activation occurred between 22:00-01:00 or 02:00-05:00, affecting fewer but much heavier aircraft.

Winter schedules		Average Track Distance (NM)			Average Fuel Burn (Kg)			Average CO_2e Emissions (Kg)		
Hour	Flights	Baseline	Scenario	Difference	Baseline	Scenario	Difference	Baseline	Scenario	Difference
17:00-18:00	12	1,506	1,541	34	11,959	12,128	169	38,030	38,567	537
18:00-19:00	16	2,401	2,451	51	24,170	24,557	387	76,861	78,091	1,231
19:00-20:00	4	2,330	2,362	32	33,958	34,122	164	107,986	108,508	522
20:00-21:00	3	1,048	1,066	18	5,454	5,549	95	17,344	17,646	302
21:00-22:00	5	2,062	2,117	55	31,649	32,205	556	100,644	102,412	1,768
22:00-23:00	6	2,041	2,085	44	21,745	22,067	322	69,149	70,173	1,024
23:00-00:00	2	1,675	1,793	118	8,798	9,415	617	27,978	29,940	1,962
00:00-01:00	1	5,048	5,108	61	56,738	57,420	682	180,427	182,596	2,169
01:00-02:00	0	0	0	0	0	0	0	0	0	0
02:00-03:00	1	3,480	3,537	58	35,953	36,548	595	114,331	116,223	1,892
03:00-04:00	8	2,311	2,347	36	34,355	34,727	372	109,249	110,432	1,183
04:00-05:00	5	3,130	3,175	45	42,291	42,845	554	134,485	136,247	1,762
05:00-06:00	7	3,868	3,899	31	66,386	66,905	519	211,107	212,758	1,650
06:00-07:00	11	1,184	1,208	24	6,220	6,342	122	19,780	20,168	388
Average	**6**	**2,193**	**2,234**	**41**	**25,936**	**26,271**	**335**	**82,476**	**83,542**	**1,065**

- CO_2e is a standard measurement that considers the impact of all greenhouse gas emissions due to fuel burn as if they were all carbon dioxide. For aviation fuel, the conversion rate is 1kg fuel to 3.18kg of CO_2e.
- Numbers are presented rounded to nearest whole kg or NM. The data behind the scenes uses unrounded numbers. Positive numbers indicate additional contributions (penalty), negative numbers indicate lower contributions (benefit).

Summer Environmental Impact – Average per flight

The average route length, fuel burn and carbon dioxide equivalent (CO_2e) emissions per impacted flight per hour during the summer hours (between 21:00 and 05:00 UTC) are given in the table below. The average flight has increased track distance of 31 NM, increased fuel burn by 277 kg and related emissions by 881 kg when the ACP-2021-078 Danger Area is activated. The greatest number of flights would be impacted if activation occurred in the 3-hour period between 02:00-05:00. The greatest overall impact on fuel/CO_2e would occur if activation occurred between 00:00-03:00 or 01:00-04:00, affecting fewer but much heavier aircraft.

Summer schedules		Average Track Distance (NM)			Average Fuel Burn (Kg)			Average CO_2e Emissions (Kg)		
Hour	Flights	Baseline	Scenario	Difference	Baseline	Scenario	Difference	Baseline	Scenario	Difference
21:00-22:00	6	997	1,038	42	7,424	7,715	291	23,608	24,534	925
22:00-23:00	3	2,001	2,041	40	32,264	32,476	212	102,600	103,274	674
23:00-00:00	2	1,026	1,068	42	5,490	5,710	220	17,458	18,158	700
00:00-01:00	1	4,068	4,085	16	76,217	76,523	306	242,370	243,343	973
01:00-02:00	4	3,542	3,618	77	37,509	38,167	658	119,279	121,371	2,092
02:00-03:00	8	4,002	4,037	35	49,888	50,313	425	158,644	159,995	1,352
03:00-04:00	11	3,348	3,368	20	39,775	39,984	209	126,485	127,149	665
04:00-05:00	7	3,580	3,583	3	53,298	53,324	26	169,488	169,570	83
Average	**5**	**3,004**	**3,035**	**31**	**37,816**	**38,093**	**277**	**120,255**	**121,136**	**881**

- CO_2e is a standard measurement that considers the impact of all greenhouse gas emissions due to fuel burn as if they were all carbon dioxide. For aviation fuel, the conversion rate is 1kg fuel to 3.18kg of CO_2e.
- Numbers are presented rounded to nearest whole kg or NM. The data behind the scenes uses unrounded numbers. Positive numbers indicate additional contributions (penalty), negative numbers indicate lower contributions (benefit).

Annual Minimum Environmental Impact

The table below shows the annualised **minimum** impact (best case scenario) from activating the ACP-2021-078 Danger Area in terms of fuel burn and CO_2e emissions for years 2024 – 2033.

Overall, an average of 15 flights are impacted per typical 3-hour long activation segment. With a minimum of 2 activations per week, this equates to a minimum of 1,560 flights impacted per year based on 2023 traffic. The weighted average fuel burn per flight of 32,999 kg in the baseline and 33,299 kg in the simulated scenario for the whole flight trajectory have applied to the annual impacted traffic to obtain the total fuel burn (in tonnes) for each scenario.

The traffic forecasts are grown using the NATS March 2023 Base Case Forecast to estimate the average annual impacts from 2024 to 2033 (10 years post deployment) and assumes a steady growth rate (GR) of 0.7% for 2029 and onwards.

Year	GR%	Impacted Traffic	Baseline Fuel Burn (Tonnes)	Scenario Fuel Burn (Tonnes)	Fuel Impact (Tonnes)	Baseline CO2e Emissions (Tonnes)	Scenario CO2e Emissions (Tonnes)	CO_2e Emissions Impact (Tonnes)
2023		1,560	51,478	51,947		163,700	165,191	
2024	5.7%	1,649	54,415	54,911	496	173,040	174,617	1,577
2025	1.8%	1,679	55,405	55,910	505	176,188	177,794	1,606
2026	1.4%	1,703	56,197	56,709	512	178,706	180,335	1,629
2027	1.1%	1,722	56,824	57,342	518	180,700	182,348	1,648
2028	1.2%	1,743	57,517	58,041	524	182,904	184,570	1,666
2029	0.7%	1,755	57,913	58,440	527	184,163	185,839	1,676
2030	0.7%	1,767	58,309	58,840	531	185,423	187,111	1,688
2031	0.7%	1,779	58,705	59,240	535	186,682	188,383	1,701
2032	0.7%	1,791	59,101	59,639	538	187,941	189,652	1,711
2033	0.7%	1,804	59,530	60,072	542	189,305	191,029	1,724

* 2023 is used as a baseline to estimate future impacts. 2024-2033 serves as the 10-year period of expected impacts.

Annual Maximum Environmental Impact

The table below shows the annualised **maximum** impact (worst case scenario) from activating the ACP-2021-078 Danger Area in terms of fuel burn and CO_2e emissions for years 2024 – 2033.

With an estimated average of 15 flights impacted per typical 3-hour long activation segment and a maximum of 3 activations per week, this equates to an estimated maximum of 2,340 flights impacted per year based on 2023 traffic. The weighted average fuel burn per flight of 32,999 kg in the baseline and 33,299 kg in the simulated scenario for the whole flight trajectory have applied to the annual impacted traffic to obtain the total fuel burn (in tonnes) for each scenario.

The traffic forecasts are grown using the NATS March 2023 Base Case Forecast to estimate the maximum annual impacts from 2024 to 2033 (10 years post deployment) and assumes a steady growth rate (GR) of 0.7% for 2029 and onwards.

						Baseline CO2e	Scenario CO2e	
Year	GR%	Impacted Traffic	Baseline Fuel Burn (Tonnes)	Scenario Fuel Burn (Tonnes)	Fuel Impact (Tonnes)	Emissions (Tonnes)	Emissions (Tonnes)	CO_2e Emissions Impact (Tonnes)
2023		2,340	77,217	77,921	704	245,550	247,789	2,239
2024 *	5.7%	2,473	81,606	82,349		259,507	261,870	
2025	1.8%	2,518	83,091	83,848	757	264,229	266,637	2,408
2026	1.4%	2,553	84,246	85,013	767	267,902	270,341	2,439
2027	1.1%	2,581	85,170	85,946	776	270,841	273,308	2,467
2028	1.2%	2,612	86,193	86,978	785	274,094	276,590	2,496
2029	0.7%	2,630	86,787	87,577	790	275,983	278,495	2,512
2030	0.7%	2,648	87,381	88,177	796	277,872	280,403	2,531
2031	0.7%	2,667	88,008	88,810	802	279,865	282,416	2,551
2032	0.7%	2,686	88,635	89,442	807	281,859	284,426	2,567
2033	0.7%	2,705	89,262	90,075	813	283,853	286,439	2,586
2034	0.7%	2,724	89,889	90,708	819	285,847	288,451	2,604

* 2023 is used as a baseline to estimate future impacts. 2024-2033 serves as the 10-year period of expected impacts.

Associated Fuel Cost Data Based on Simulation

The traffic forecasts are grown using the NATS March 2023 Base Case Forecast to estimate the annual maximum impact (worst case scenario) from 2024 to 2033 (10 years post deployment) and assumes a steady growth rate (GR) of 0.7% for 2029 and onwards.

The table below provides details on the cumulative fuel burn and CO_2 emmisions of the aircraft that are simulated to be impacted along their normal route of flight. This serves as a baseline to analyse the delta between the additional expected impacts imposed by the ACP airspace in the worst-case scenario. This simulation shows that the increase to fuel burn, CO_2 emmisions, and the cost associated with fuel burn are simulated to be 0.9% in the worst-case scenario.

Year	Base Growth Flights	Base Growth Rate	Flights p/a in change area	Simulated Fuel Burn (T)	Simulated CO2 (T)	Delta from baseline (fuel)	Delta from baseline (CO2)	% flights CO2 Traded	% flights non-traded	CO2 traded (T)	CO2 non traded (T)	Fuel Cost (GBP)
2023	2,340		2,340	77,921	247,789	704	2,239	20%	80%	49,558	198,231	£46,008,284
2024	2,473	5.7%	2,473	82,349	261,870	743	2,363	20%	80%	52,416	209,454	£48,622,787
2025	2,518	1.8%	2,518	83,848	266,637	757	2,408	20%	80%	53,370	213,267	£49,507,868
2026	2,553	1.4%	2,553	85,013	270,341	767	2,439	20%	80%	54,111	216,230	£50,195,740
2027	2,581	1.1%	2,581	85,946	273,308	776	2,467	20%	80%	54,746	218,562	£50,746,628
2028	2,612	1.2%	2,612	86,978	276,590	785	2,496	20%	80%	55,382	221,208	£51,355,970
2029	2,630	0.7%	2,630	87,577	278,495	790	2,512	20%	80%	55,805	222,690	£51,709,648
2030	2,648	0.7%	2,648	88,177	280,403	796	2,531	20%	80%	56,229	224,174	£52,063,917
2031	2,667	0.7%	2,667	88,810	282,416	802	2,551	20%	80%	56,653	225,763	£52,437,670
2032	2,686	0.7%	2,686	89,442	284,426	807	2,567	20%	80%	57,076	227,350	£52,810,833
2033	2,705	0.7%	2,705	90,075	286,439	813	2,586	20%	80%	57,500	228,939	£53,184,587

Year	Delta from baseline (fuel in tonnes)	Increased Fuel Cost
2024	743	£ 438,704
2025	757	£ 446,971
2026	767	£ 452,875
2027	776	£ 458,189
2028	785	£ 463,503
2029	790	£ 466,456
2030	796	£ 469,998
2031	802	£ 473,541
2032	807	£ 476,493
2033	813	£ 480,036

Using the simulated delta in fuel burn and the fuel assumptions, the table to the left shows the estimated increase in cumulative annual fuel cost in a worst-case scenario. This equates to an average of ~ £178 in fuel cost per flight impacted[10]. The table below shows the jet fuel price figures used to derive these costs.

Fuel Assumptions (IATA jet fuel price)		Date Updated	Source
Fuel price USD/ tonne	$772.13	17/07/2023	https://www.iata.org/en/publications/economics/fuel-monitor/
USD/GBP conversion rate	0.76	17/07/2023	https://www.exchangerates.org.uk/Dollars-to-Pounds-currency-conversion-page.html
Fuel price GBP/ tonne	£590.45		

[10] (Additional annual fuel burn * £590.45)/ # of impacted flights annually Note: The % of flights CO2 Traded is defined as the % of UK domestic flights; flights between UK and Gibraltar, & flights departing the UK to EEA states within the dataset (% same for all years). The % of flights non-Traded is defined as all flights with destination outside of EEA states (% same for all years).

Impact Mitigation

This Environmental Assessment is intended to show the worst-case scenario of environmental impacts. The Sponsor expects the actual impact to be lower due to the following mitigating measures.

DACS

Although network traffic will be required to flight plan around the airspace when active, a DACS is still expected to provide some mitigation of this impact. An activation window of up to 3 hours is required to provide flexibility in case the planned departure or arrival time is impacted by adverse weather or minor maintenance delays. This duration also ensures that the airspace is active in the event the aircraft needs to land shortly after takeoff in an emergency or contingency scenario. In normal operations, the airspace is only expected to be in use for 45-55 minutes per activation. When possible, the airspace will be made available to ATS providers, via a DACS, to minimize required re-routing of civil aircraft around the Danger Area.

Reduced Activation Window

Early in this ACP, it was evident that the volume of airspace required for HALE RPAS operations would have a significant impact to civil traffic. In an effort to minimise this impact, the Sponsor conceded to a reduced activation window of nighttime only activations. The sponsor further reduced this to 1 hour after sunset to 1 hour before sunrise to further reduce impacts to civil traffic.

After the NATS assessment was completed, the Sponsor was able to agree to a NATS request to further limit the activation window to 20:00 - 05:30 UTC to avoid peak traffic periods in the winter months. This equates to a 4.5-hour reduction in the activation window simulated in this assessment. Using the traffic samples from the winter hours scenario, this reduced window would drop the average number of aircraft impacted from 6 to 3.6 per hour. This reduction is due to an average of ~10 aircraft per hour no longer being impacted from 17:00 - 20:00 and 05:30 - 07:00.

While the Sponsor intends to operate only during this reduced window, flexibility is required for the rare occasion when operational necessity requires activation outside of this window (but still within 1 hour after sunset to 1 hour prior to sunrise). This expected to be very rare but cannot be accurately estimated at this time.

Greenhouse Gases Workbook - Worksheet 1

Greenhouse Gases Workbook - Worksheet 1

Scheme Name:	Fairford RPAS ACP
Present Value Base Year	2010
Current Year	2023
Proposal Opening year:	2024
Project (Road/Rail or Road and Rail):	road

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£):	-£2,339,003

*positive value reflects a net benefit (i.e. CO2E emissions reduction)

Quantitative Assessment:

Change in carbon dioxide equivalent emissions over 60 year appraisal period (tonnes): (between 'with scheme' and 'without scheme' scenarios)	24,920
Of which Traded	4993.940843
Change in carbon dioxide equivalent emissions in opening year (tonnes): (between 'with scheme' and 'without scheme' scenarios)	2,363
Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£): (N.B. this is not additional to the appraisal value in cell I17, as the cost of traded sector emissions is assumed to be internalised into market prices. See TAG Unit A3 for further details)	-£586,168

*positive value reflects a net benefit (i.e. CO2E emissions reduction)

Change in carbon dioxide equivalent emissions by carbon budget period:

	Carbon Budget 1	Carbon Budget 2	Carbon Budget 3	Carbon Budget 4
Traded sector	0	0	0	1937.311537
Non-traded sector	0	0	0	7739.688463

Qualitative Comments:

Sensitivity Analysis:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):	-£3,508,504
Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):	-£1,169,501

Data Sources:

Annex B – Application for dispensation from CAA policy statement *Safety Buffer Policy for Airspace Design Purposes Segregated Airspace*

Due to the intense utilisation of the airspace surrounding RAF Fairford, the Sponsor will be seeking dispensation from the Safety Buffer Policy to minimise impacts to other users of the airspace and further align with the other design principles of this ACP.

The Sponsor is seeking dispensation from the established lateral buffer from edges of TMAs, CTRs, CTAs (excluding the Upper CTAs) and from ATS Routes above FL195 to 3NM in all cases. This request is made with the mitigating factors below.

- HALE RPA operating from RAF Fairford will operate at or below 150kts IAS within the proposed Danger Areas at all times.
- HALE RPA will operate on pre-coordinated predictable arrival and departure procedures, which will ensure the RPA remains contained within EGDXXX during climb and descent.
- HALE RPA will use pre-coordinated and predictable lost link and emergency procedures, which will ensure the RPA remains contained within EGDXXX.
- A 2 NM internal buffer will be maintained in Segments B, C, and D.
- An internal buffer will not be applied to all portions of Segment A. The safety buffer will be achieved through vertical means with an altitude restriction of at or below FL 60 until 3 NM from the boundary of COTSWOLD CTA 4. The lowest usable FL in CTA 4 will be FL70.
    - An LoA with NATS and MOD ATC will detail how this is to be achieved.
- An external FBZ of 1 NM will be applied above FL245 AND where the airspace abuts CTAs or has an interaction with an ATS Route.
    - Due to the proximity of adjacent CTAs and ATS routes to each segment of the proposed Danger Area, a 1 NM FBZ will be required for all segments of EGDXXX.
- Reduced risks will exist due limited periods of operations:
    - Activation window during periods of lower traffic density (primarily between 20:00 – 05:30 UTC).
    - Activation expected only 2-3 times per week.
    - Activation duration expected of only 6-9 hours per week.
- Reduced risk will exist due to the planned provision of a DACS.
- Detailed LoAs with NATS, 78 Sqn, Brize Radar and MAMC will be accomplished for the scheduling/activation/deactivation of the airspace and management of HALE RPA activity within the danger areas.

The Sponsor is not seeking dispensation from the 2,000-foot vertical buffer required in CAA policy statement *Safety Buffer Policy for Airspace Design Purposes Segregated Airspace.* A 2,000-foot vertical buffer will be applied externally. Adherence to the vertical buffer will be ensured procedurally via LoAs with NATS and MOD ATS providers.