Ministry of Defence

ACP-2021-078

Enabling Remotely Piloted Aircraft Operations from RAF Fairford

Gateway Documentation:

Stage 2 – Develop & Assess

Step 2B – Initial Options Appraisal

Contents

Introduction

This document forms part of Stage 2 of ACP-2021-078. The purpose of this submission is to demonstrate that the Change Sponsor has followed each requirement as listed in CAP 1616, Airspace Change Process and forms part of the overall requirements for the Stage 2 Develop and Assess Gateway- Step 2B.

This Initial Options Appraisal contains a qualitative assessment of the options presented in Step 2A. The Sponsor utilized feedback gathered from stakeholders in Step 2A as well as historical ADS-B data to identify and analyse potential impacts.

Section 1 - Context

Statement of Need

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 medium- or high-altitude transit.

Design Principles

	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 medium/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

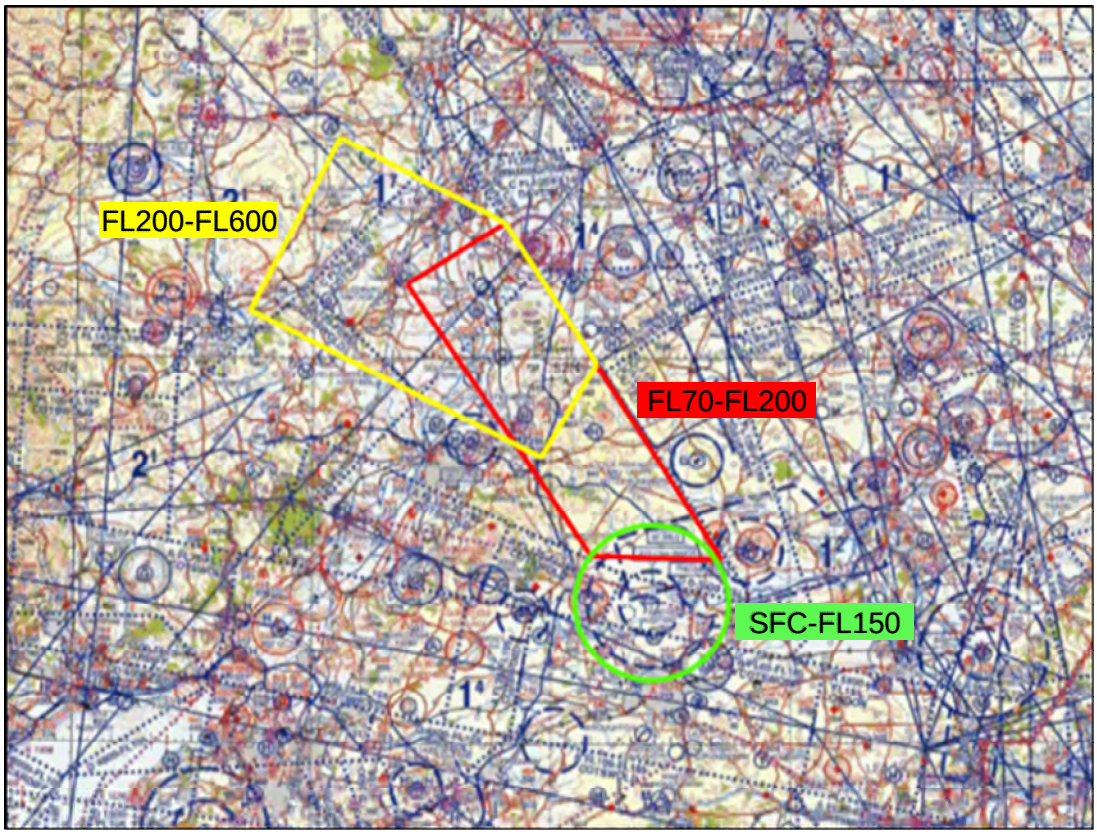
Design Options Summary

The Sponsor prepared a comprehensive range of airspace design options consisting of a “Do Nothing” Option, two HALE RPA Options, and four MALE RPA Options. Stakeholders were invited to comment on how these options aligned with the Design Principles established in Stage 1. The Sponsor further encouraged stakeholders to comment if they determined that the airspace proposals impacted their operations. As a result of this evaluation, the Sponsor has rejected the “Do Nothing” Option and MALE Options 1 and 2 as it was determined that they did not align with the established Design Principles. This initial options appraisal moves forward with 2 HALE Options and 2 MALE Options as well as the “Do Nothing” Option to serve as a baseline. Further details of that evaluation and stakeholder feedback can be found in the Stage 2A Design Principle Evaluation and Stakeholder Engagement Evidence documents.

Design Options

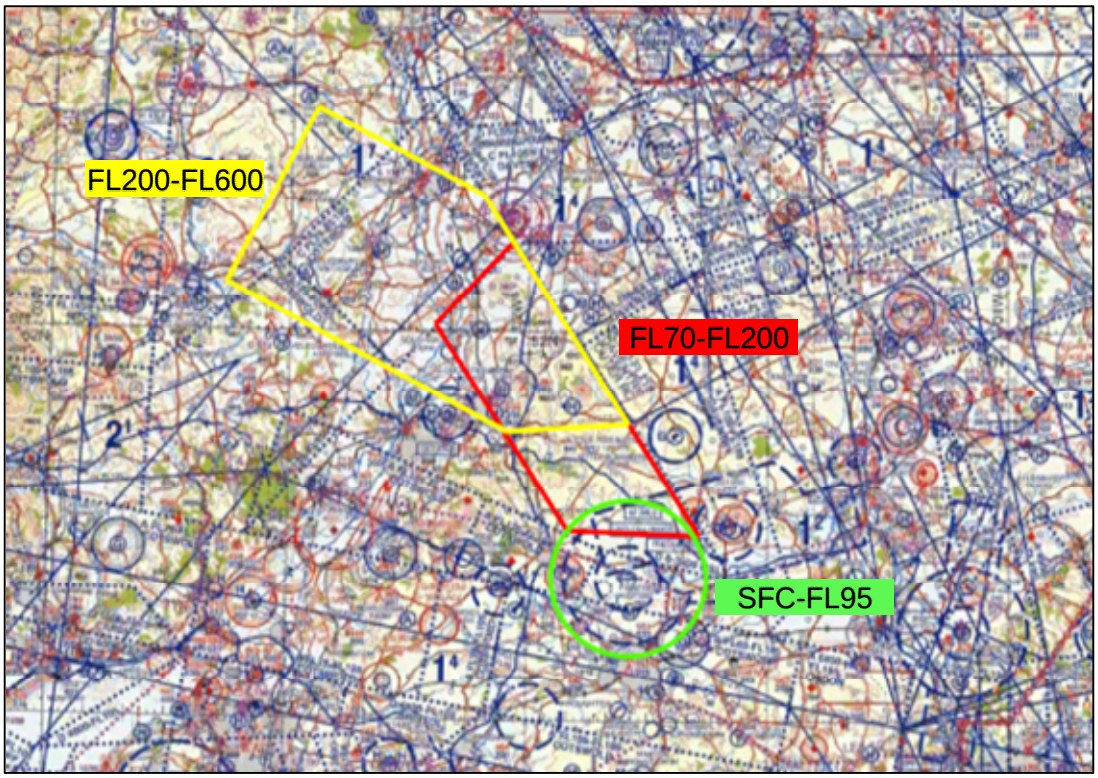
HALE Option 1

In this option, segment A is a 6NM radius centred on RAF Fairford from the surface to FL150. Segment B is an 8NM wide corridor that connects segment A to segment C. Segment B has an altitude of FL70-FL200. Segment C has an altitude of FL200-FL600



HALE Option 2

In this option, segment A is a 6NM radius centred on RAF Fairford from the surface to FL95. In this option, segment B avoids Cotswold CTA 18 to the northwest. The altitude remains FL70-FL200. Segment C is slightly larger than HALE Option 1 and the altitude remains FL200-FL600.

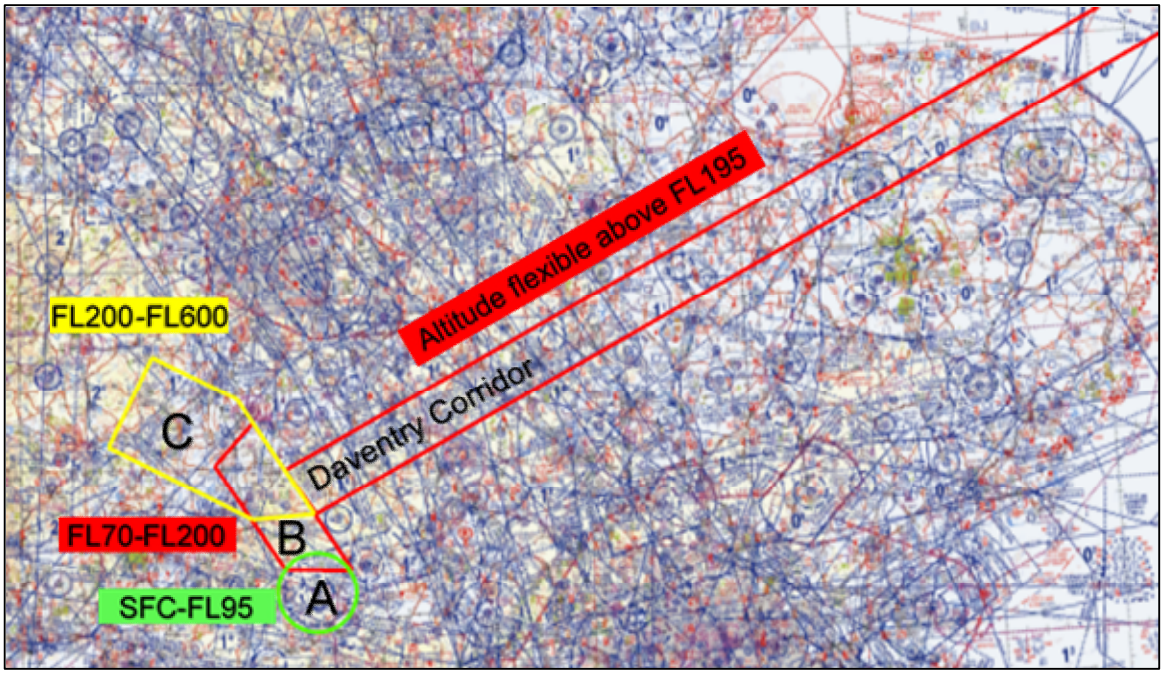


MALE Option 1

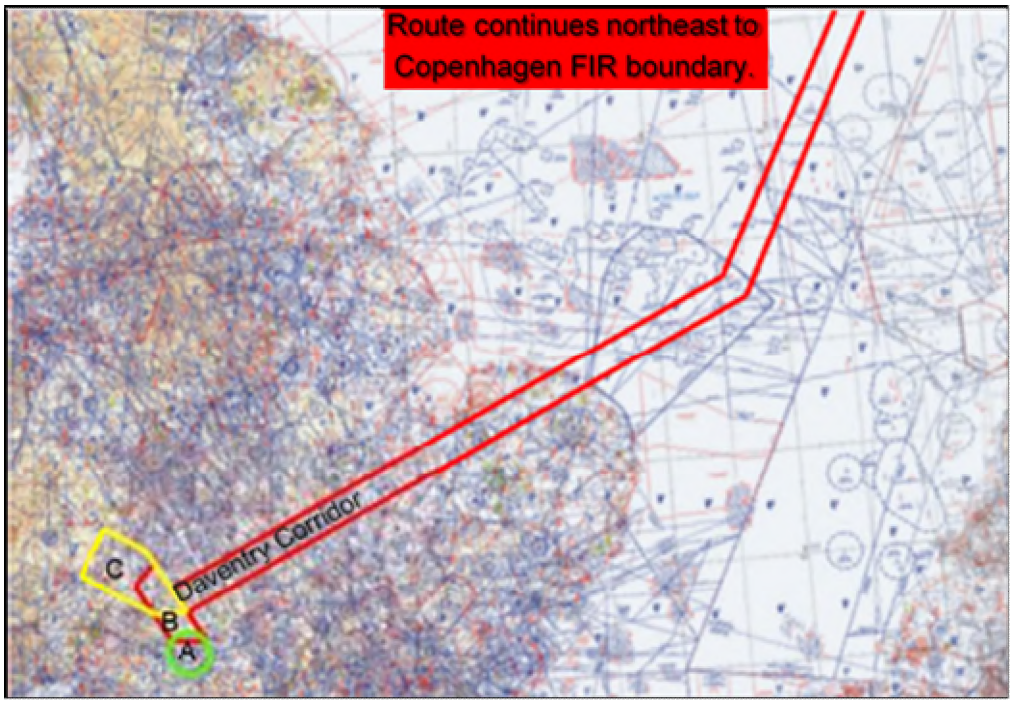
This option was previously identified as MALE Option 3 in Stage 2A, Initial Options Engagement.

In this option, a west-to-east MALE corridor is paired with segments A, B, and C from HALE Option 2. This design allows MALE RPA to climb in segments A, B, and C then transition in airspace aligned with, but above, the Daventry Corridor and then northeast to the border of the Copenhagen FIR. The reverse would apply for RPA inbound to RAF Fairford. The proposed alignment with the Daventry Corridor attempts to utilize the existing procedure for OAT traffic crossing heavily used routes. The Sponsor will also explore the use of the Litchfield, Westcott, or Swindon Radar Corridors above FL195. Further engagement with NATS will be required to explore alternative locations and altitudes for MALE transit corridors that best align with the Design Principles of this ACP. These options will be further analysed in Stage 3.

MALE Option 1



MALE Option 1



MALE Option 2 – Integration in Controlled Airspace

This option was previously identified as MALE Option 4 in Stage 2A, Initial Options Engagement.

Should integration of MALE RPA into controlled airspace be possible, MALE RPA operations would only require a segregated Segment A in Class G airspace from SFC-FL95 or until reaching controlled airspace. From there, RPA would be able to enter controlled airspace via Cotswold CTA 7 or CTA 4. The option of integration into controlled airspace is being pursued for MALE RPA but the Sponsor is currently unsure it this is a viable option due to a lack of Detect and Avoid (DAA) capability.

MALE Option 2

Section 2 – Design Options Appraisal

Methodology

Stage 2B requires an initial appraisal of the impacts of the design options presented in Section 1 against a “Do Nothing” Option. The Sponsor has accomplished a qualitative assessment of the different options, both positive and negative, against the headings identified in CAP1616, Appendix E, Table E2: “Guide to expected approach to key analysis for a typical airspace change”.

The methodology for the qualitative assessment involved extensive stakeholder feedback during Step 2A. During this step, stakeholders were asked to contact the Sponsor if they felt they would be impacted by the design options.

This analysis also included monitoring historical ADS-B data for and civil aircraft operating within the confines of each design option during the entire period of potential airspace activation. Two five-day periods were selected for observation. One was in December 2021 and the other in June 2022. The rationale for selecting these periods was that they represented among the longest and shortest windows of proposed operations. For each day, air traffic data was observed from one hour after sunset until one hour prior to sunrise. This resulted in a total of 102 hours of observation. Where aircraft were observed within one of the proposed design options, the Sponsor further analysed the additional distance, in nautical miles, that would be required to circumnavigate the proposed airspace, should advance planning or a DACS not be utilised.

Summary of Current Civil Aircraft Activity – “Do Nothing” Option

At or Below 7,000ft AMSL

During the 10 nights and 102 hours of observed civil aircraft ADS-B data, two civil aircraft were observed within the proposed airspace design at or below 7,000ft AMSL. Both were DA42 aircraft at 4,500ft AMSL and observed between 1930 and 2030 GMT during the December period.

Stakeholder feedback gathered in Step 2A also confirmed what the Sponsor observed through monitoring ADS-B data and confirmed that minimal civil traffic operates during the proposed period of activation; therefore no impacts to civil traffic are expected to occur below 7,000ft.

Note: Although CAP 1616 does not required the analysis of impacts to military aircraft, the Sponsor acknowledges that some impacts to military aircraft are expected below 7,000ft AMSL, especially with RAF Brize Norton traffic. Due to the mitigating measures mentioned earlier, the Sponsor assesses that Ministry of Defence aircraft are not expected to be impacted in a manner that would cause further secondary effects to civil traffic. Additional engagement will continue throughout the ACP process to ensure that procedures are developed to mitigate these impacts to the maximum extent possible.

Above 7,000ft AMSL

During the 10 nights and 102 hours of observed civil aircraft ADS-B data, 112 aircraft, cumulatively, were observed at or above 7,000ft AMSL within at least one of the proposed

airspace options[1]. This resulted in an average of 1.1 aircraft observed per hour and ranged from a high of 2.6 aircraft per hour from 0500-0600Z to a low of 0.3 aircraft per hour between 2300-0000Z. Similar analysis will be applied to the MALE transit corridors once there is more certainty about their location.

As explained previously, the proposed airspace frequency, time, and duration of activation as well as the expected availability of a DACS further minimises the expected impact. As a result, the actual number of civil aircraft impacted during a 10-day period is expected to be much lower than the 112 observed.

The majority of the observed aircraft observed within the proposed airspace were observed transitioning along or near the boundaries of the proposed airspace. Of the 112 aircraft observed, almost 79% would require two or fewer additional nautical miles to circumnavigate the proposed danger areas contained within the design options and 38% would require a deviation of 0.5 or fewer nautical miles.

10 Year Traffic Forecast

The Change Sponsor forecasts little to no increase in air traffic for the years 2023-2033. Traffic outside CAS is unpredictable but given the parameters of this airspace, the Sponsor assumes no increase in General Aviation or commercial traffic outside of CAS. For network traffic, there is still uncertainty due to the effect of the pandemic. In 2021, UK air traffic averaged 41% of pre-pandemic figures with recovery lagging behind Europe and not forecasted to fully recover for a number of years.[2] From 2020-2027 Eurocontrol estimates a 0.4% growth in UK IFR movements with a range of -0.4% to 1.8% when compared to 2019[3]. Military requirements are dynamic, with traffic volumes being determined by operational requirements, therefore difficult to predict.

[1] Only the climb and descent portions (segments A, B, and C) of the airspace designs were analysed. Attempting to provide ADS-B data for MALE transit corridors at this stage is not possible/proportional until there is more certainty of optimal location and altitudes.
[2] https://www.nats.aero/news/no-recovery-for-uk-air-traffic-in-2021-as-pandemic-continues/
[3] https://www.eurocontrol.int/sites/default/files/2021-10/eurocontrol-forecast-2021-2027-traffic-table.xlsx

Options appraisal

The following tables detail the appraisals of each remaining design option respectively as evaluated against the “do nothing” baseline.

HALE Option 1 Appraisal

Table 1 – Summary of Options Appraisal for HALE Option 1			
Group	**Impact**	**HALE Option 1**	**Do Nothing**
Communities	Noise impact on health and quality of life	No noise impacts above the baseline “Do Nothing” Option are anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in noise impacts on health and quality of life would occur.
Communities	Air Quality	No Air Quality impact above the baseline “Do Nothing” Option is anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in air quality would occur.
Wider society	Greenhouse gas impact	The Sponsor assesses that this option will result in a minimal increase of CO2 emissions. Although tactical rerouting 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. If no DACS was used, an average of 3.39 aircraft would be expected to need to route around the proposed airspace for each activation resulting in	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no greenhouse gas impact would occur.

		approximately five additional nautical miles[4] of greenhouse gas impact per activation.	
Wider society	Capacity / resilience	No capacity/resilience impact above the baseline "Do Nothing" Option is anticipated based upon stakeholder feedback, the observation of ADS-B data, the availability of a DACS, and the frequency, time, and duration of proposed airspace activation.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no capacity/resilience impacts would occur.
General Aviation	Access	Very minimal to no impacts to general aviation access are expected above the baseline "Do Nothing" Option. This assessment is based upon stakeholder feedback and ADS-B data both demonstrating no expected impact to civil traffic below 7,000ft. Access will be further enabled through the availability of a DACS.	Flight operations associated with the ACP would not be able to fly 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 impact to air transport movements, estimated passenger numbers, or cargo tonnage carried.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no change to economic impacts from increased effective capacity would occur.
General Aviation / commercial airlines	Fuel Burn	Very minimal additional fuel burn is expected with this option. Although tactical rerouting and a DACS will be available for the majority of the activation	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no change to fuel burn would occur.

[4] Over 102 hours of observation, 116 aircraft were observed in the boundaries of HALE Option 1 (1.13/hr). Cumulatively, those aircraft would incur an additional 175.5 NM of routing to circumnavigate (1.5 NM/aircraft).

		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. When deviations are required, the average additional routing, based on the traffic observed via ADS-B, the average additional routing to circumnavigate this option was 1.5 NM. If no DACS was used, an average of 3.39 aircraft would be expected to need to route around the proposed airspace for each activation resulting in approximately five additional nautical miles of fuel burn per activation.	
Commercial airlines	Training costs	Not applicable	
Commercial airlines	Other costs	Not applicable	
Airport /ANSP	Infrastructure costs	Not applicable	
Airport /ANSP	Operational costs	Not applicable	
Airport /ANSP	Deployment Costs	Minimal costs would be incurred by NATS, RAF Brize Norton, and 78 Sqn through briefing and training ATC for RPAS operations to include emergency and contingency situations. Additionally, there would be costs for ATM system updates.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to Airport/ANSP deployment costs would occur.

HALE Option 1 Summary

The Sponsor assesses that minimal to no impacts are expected below 7,000ft AMSL when compared to the baseline “Do Nothing” Option. This assessment was confirmed by stakeholders and validated through observing historical ADS-B data where two aircraft were observed over the course of 102 hours of observation.

At or above 7,000 ft AMSL, some impacts can be expected based on the need for network traffic to plan around the airspace during periods of activation. This option was designed to avoid and conform to the most heavily used routes. As a result, where these impacts will vary from the baseline “Do Nothing” Option, these costs are expected to be minimal. The worst-case scenario where no DACS was utilized resulted in a cumulative expected average of five additional nautical miles of flight per activation. This number is expected to be lower in practice as a DACS is expected to be available for the majority of the three-hour period of activation.

HALE Option 2 Appraisal

Table 2 – Summary of Options Appraisal for HALE Option 2

Group	Impact	HALE Option 2	Do Nothing
Communities	Noise impact on health and quality of life	No noise impacts above the baseline “Do Nothing” Option are anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in noise impacts on health and quality of life would occur.
Communities	Air Quality	No Air Quality impact above the baseline “Do Nothing” Option is anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in air quality would occur.
Wider society	Greenhouse gas impact	The Sponsor assesses that this option will result in a minimal increase of CO2 emissions. Although tactical rerouting 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. If no DACS was used, an average of 3.18 aircraft would be expected to	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no greenhouse gas impact would occur.

		need to route around the proposed airspace for each activation resulting in approximately five additional nautical miles[5] of greenhouse gas impact per activation.	
Wider society	Capacity / resilience	No capacity/resilience impact above the baseline "Do Nothing" Option is anticipated based upon stakeholder feedback, the observation of ADS-B data, the availability of a DACS, and the frequency, time, and duration of proposed airspace activation.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no capacity/resilience impacts would occur.
General Aviation	Access	Very minimal to no impacts to general aviation access are expected above the baseline "Do Nothing" Option. This assessment is based upon stakeholder feedback and ADS-B data both demonstrating no expected impact to civil traffic below 7,000ft. Access will be further enabled through the availability of a DACS.	Flight operations associated with the ACP would not be able to fly 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 impact to air transport movements, estimated passenger numbers, or cargo tonnage carried.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no change to economic impacts from increased effective capacity would occur.
General Aviation / commercial airlines	Fuel Burn	Very minimal additional fuel burn is expected	Flight operations associated with the

[5] Over 102 hours of observation, 108 aircraft were observed in the boundaries of HALE Option 2 (1.06/hr). Cumulatively, those aircraft would incur an additional 175.4 NM of routing to circumnavigate (1.6 NM/aircraft).

		with this option. Although tactical rerouting 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. When deviations are required, the average additional routing, based on the traffic observed via ADS-B, the average additional routing to circumnavigate this option was 1.5 NM. If no DACS was used, an average of 3.39 aircraft would be expected to need to route around the proposed airspace for each activation resulting in approximately five additional nautical miles of fuel burn per activation.	ACP would not be able to fly 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	Not applicable	
Airport /ANSP	Operational costs	Not applicable	
Airport /ANSP	Deployment Costs	Minimal costs would be incurred by NATS, RAF Brize Norton, and 78 Sqn through briefing and training ATC for RPAS operations to include emergency and contingency situations. Additionally, there would be costs for ATM system updates.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to Airport/ANSP deployment costs would occur.

HALE Option 2 Summary

The Sponsor assesses that minimal to no impacts are expected below 7,000ft AMSL when compared to the baseline "Do Nothing" Option. This assessment was confirmed by stakeholders and validated through observing historical ADS-B data where two aircraft were observed over the course of 102 hours of observation.

At or above 7,000ft AMSL, some impacts can be expected based on the need for network traffic to plan around the airspace during periods of activation. This option was designed to avoid and conform to the most heavily used routes. As a result, where these impacts will vary from the baseline "Do Nothing" Option, these costs are expected to be minimal. The worst-case scenario where no DACS was utilized resulted in a cumulative expected average of five additional nautical miles of flight per activation. This number is expected to be lower in practice as a DACS is expected to be available for the majority of the three-hour period of activation.

HALE Option 2 is expected to impose slightly less impact than HALE Option 1, due to a smaller volume of airspace in Segments A and B and is the preferred HALE option.

MALE Option 1 Appraisal

Table 3 – Summary of Options Appraisal for MALE Option 1

Group	Impact	MALE Option 1	Do Nothing
Communities	Noise impact on health and quality of life	No noise impacts above the baseline "Do Nothing" Option are anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a "do nothing" scenario and thus no change in noise impacts on health and quality of life would occur.
Communities	Air Quality	No Air Quality impact above the baseline "Do Nothing" Option is anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a "do nothing" scenario and thus no change in air quality would occur.
Wider society	Greenhouse gas impact	The Sponsor assesses that this option will result in a minimal increase of CO2 emissions. Although tactical rerouting and a DACS will be available for the majority of the activation period, it is expected that some aircraft will need to	Flight operations associated with the ACP would not be able to operate in a "do nothing" scenario and thus no greenhouse gas impact would occur.

		circumnavigate the airspace. Network traffic will be required to flight plan around the proposed airspace, when active. If no DACS was used, an average of 3.18 aircraft would be expected to need to route around the proposed climb and descent airspace (Segments A, B, and C) for each activation resulting in approximately five additional nautical miles[6] of greenhouse gas impact per activation. Similar analysis will be applied to the MALE transit corridors once there is more certainty about their location.	
Wider society	Capacity / resilience	No capacity/resilience impact above the baseline "Do Nothing" Option is anticipated based upon stakeholder feedback, the observation of ADS-B data, the availability of a DACS, and the frequency, time, and duration of proposed airspace activation.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no capacity/resilience impacts would occur.
General Aviation	Access	Very minimal to no impacts to general aviation access are expected above the baseline "Do Nothing" Option. This assessment is based upon stakeholder feedback and ADS-B data both demonstrating no expected impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no general aviation impacts would occur.

[6] Over 102 hours of observation, 108 aircraft were observed in the boundaries of MALE Option 1 (1.06/hr). Cumulatively, those aircraft would incur an additional 175.4 NM of routing to circumnavigate (1.6 NM/aircraft).

		Access will be further enabled through the availability of a DACS.	
General Aviation / commercial airlines	Economic impact from increased effective capacity	This option is not expected to have an impact to air transport movements, estimated passenger numbers, or cargo tonnage carried.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to economic impacts from increased effective capacity would occur.
General Aviation / commercial airlines	Fuel Burn	Very minimal additional fuel burn is expected with this option. Although tactical rerouting 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. When deviations are required, the average additional routing, based on the traffic observed via ADS-B, the average additional routing to circumnavigate this option was 1.5 NM. If no DACS was used, an average of 3.39 aircraft would be expected to need to route around the proposed airspace for each activation resulting in approximately five additional nautical miles of fuel burn per activation.	Flight operations associated with the ACP would not be able to fly 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	Not applicable	

Airport /ANSP	Operational costs	Not applicable	
Airport /ANSP	Deployment costs	Minimal costs would be incurred by NATS, RAF Brize Norton, and 78 Sqn through briefing and training ATC for RPAS operations to include emergency and contingency situations. Additionally, there would be costs for ATM system updates.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to Airport/ANSP deployment costs would occur.

MALE Option 1 Summary

The Sponsor assesses that minimal to no impacts are expected below 7,000ft AMSL when compared to the baseline “Do Nothing” Option. This assessment was confirmed by stakeholders and validated through observing historical ADS-B data where two aircraft were observed over the course of 102 hours of observation.

At or above 7,000ft AMSL, similar impacts are expected to those of HALE Option 2 as they share the same climb and descent airspace (Segments A, B, and C). Detailed qualitative analysis was completed on these segments but more analysis is needed to determine the best location and impacts of MALE RPAS transit corridors. Qualitatively, the Sponsor expects additional impacts to be caused by a segregated transit corridor, but it is impossible to assess the full impacts at this stage. More engagement will occur to facilitate a comprehensive qualitative and quantitative appraisal of this option in Stage 3.

MALE Option 2 Appraisal

Table 4 – Summary of Options Appraisal for MALE Option 2

Group	Impact	MALE Option 2	Do Nothing
Communities	Noise impact on health and quality of life	No noise impacts above the baseline “Do Nothing” Option are anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below 7,000ft.	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in noise impacts on health and quality of life would occur.
Communities	Air Quality	No Air Quality impact above the baseline “Do Nothing” Option is anticipated based upon stakeholder feedback and ADS-B data both showing no impact to civil traffic below	Flight operations associated with the ACP would not be able to operate in a “do nothing” scenario and thus no change in air quality would occur.

		7,000ft.	
Wider society	Greenhouse gas impact	The Sponsor assesses that this option will not result in an increase of CO2 emissions. Six aircraft over 102 hours were observed in the boundaries of this option (0.06 aircraft per hr) and some of those were in controlled airspace so technically outside of the boundaries of this option. A DACS will be available for the majority of the activation period and is expected mitigate any small remaining impact potential. If no DACS was used, an average of 0.18 aircraft would be expected to need to route around the proposed airspace for each activation resulting in approximately 0.076 additional nautical miles[7] of greenhouse gas impact per activation.	Flight operations associated with the ACP would not be able to operate in a "do nothing" scenario and thus no greenhouse gas impact would occur.
Wider society	Capacity / resilience	No capacity/resilience impact above the baseline "Do Nothing" Option is anticipated based upon stakeholder feedback, the observation of ADS-B data, the availability of a DACS, and the frequency, time, and duration of proposed airspace activation.	Flight operations associated with the ACP would not be able to fly in a "do nothing" scenario and thus no capacity/resilience impacts would occur.
General Aviation	Access	Very minimal to no impacts to general aviation access are expected above the	Flight operations associated with the ACP would not be able to fly in a "do nothing"

[7] Over 102 hours of observation, six aircraft were observed in the boundaries of MALE Option 2 (0.06/hr). Cumulatively, those aircraft would incur an additional 2.5 NM of routing to circumnavigate (0.42 NM/aircraft).

		baseline “Do Nothing” Option. This assessment is based upon stakeholder feedback and ADS-B data both demonstrating no expected impact to civil traffic below 7,000ft.	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 impact to air transport movements, estimated passenger numbers, or cargo tonnage carried.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to economic impacts from increased effective capacity would occur.
General Aviation / commercial airlines	Fuel Burn	Very minimal additional fuel burn is expected with this option. Although tactical rerouting 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. When deviations are required, the average additional routing to circumnavigate this option was 0.42 NM. If no DACS was used, an average of 0.18 aircraft would be expected to need to route around the proposed airspace for each activation resulting in approximately 0.076 additional nautical miles of fuel burn per activation.	Flight operations associated with the ACP would not be able to fly 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	Not applicable	
Airport /ANSP	Operational costs	Not applicable	
Airport /ANSP	Deployment Costs	Minimal costs would be incurred by NATS, RAF Brize Norton, and 78 Sqn through briefing and training ATC for RPAS operations to include emergency and contingency situations. Additionally, there would be costs for ATM system updates.	Flight operations associated with the ACP would not be able to fly in a “do nothing” scenario and thus no change to Airport/ANSP deployment costs would occur.

MALE Option 2 Summary

The Sponsor assesses that minimal to no impacts are expected with this option when compared to the baseline “Do Nothing” Option. This assessment was confirmed by stakeholders and validated through observing historical ADS-B data where only six aircraft were observed within the confines of this option over the course of 102 hours of observation.

MALE Option 2 is the preferred MALE option but is contingent upon approval for MALE RPAS to operate in controlled airspace.

Summary of Preferred Options

HALE Option 2

HALE Option 2 has been confirmed as a viable airspace design option to accommodate the ingress and egress of HALE RPAS to/from RAF Fairford. This option is preferred over HALE Option 1 because it aligns better with the Design Principles. Specifically, the decreased dimensions of Segments A and B better align with Design Principles C and D. Further analysis is also required to determine the vertical buffer required for BVLOS RPAS. Should a 2,000ft vertical buffer be required, the dimensions of Segment A will need to be slightly increased to SFC-FL110 in order to permit transition from Segment A to Segment B at FL90. The Sponsor expects this change to result in minimal to no impacts over the current HALE Option 2 design.

MALE Option 2

Integration of MALE RPAS in CAS is the preferred option of the Sponsor as well as stakeholders. The Sponsor will continue to pursue a layered safety approach that would permit this. Should integration not be possible, the preferred MALE option is MALE Option 1.

MALE Option 1

Stakeholder feedback has determined that a MALE RPAS climb in the vicinity of Fairford and subsequent transition via a single altitude or altitude block better aligns with the Design Principles than the climbs in transit initially proposed. The Sponsor will continue to engage

further to determine optimal placement of transit corridors to reach the FIR boundary crossing points, including use of existing OAT radar corridors at or above FL195, cognisant that they would need to be activated as Danger Areas. Similarly to HALE Option 2, if a 2,000ft vertical buffer is required, Segment A will need to be slightly increased to SFC-FL110 in order to permit transition from Segment A to Segment B at FL90.

Section 3 – Safety Assessment

The earlier Summary of Preferred Options indicates the Sponsor's preference to establish segregated airspace in the form of danger areas. This also aligns with stakeholder feedback received in Step 2A. The Sponsor acknowledges that the establishment of the proposed Danger Areas may introduce the following hazards:

HALE Option 1

1. Should pilots not be able 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 activity timings/duration and the identified lack of traffic operating in Class G, this is unlikely to have a significant impact. There may be more impact within the CTAs affected by segment A if traffic is concentrated in the southern portion of the east-west route, though initial ADS-B assessment indicates that ATS network traffic levels affected would still be low.

2. A higher workload is expected to be imposed upon RAF Brize Norton and Swanwick Military ATC due to controlling the RPA and providing/managing DACS requests and 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, notification procedures and ATC provision, this is deemed to be a highly unlikely scenario.

If danger areas are implemented the following will be in place to ensure safety is managed:

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. 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 effective segregation of the airspace during NOTAM activation windows only when needed for RPAS operations followed by the dynamic real-time return of the airspace to ATC. This will maximise the availability of this service and minimise the need for routing around the proposed Danger Areas. RPAS will not routinely loiter in its 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 three-hour activation window.

3. RPAS will remain within segregated airspace at all times until exiting UK airspace or landing at RAF Fairford.

4. Emergency procedures are currently being developed. To minimize training requirements on ATC, every effort is being made to standardise lost link and other contingency and emergency procedures across all RPAS platforms.

HALE Option 2

While the dimensions of HALE Option 2 are slightly different from HALE Option 1, they are very similar and the Sponsor assesses that the safety implications will be the same as those listed for HALE Option 1.

MALE Option 1

The climb and descent airspace (Segments A, B, and C) of MALE Option 1 are identical to HALE Option 2 and the safety implications are also the same as indicated above. The introduction of MALE transit corridors may introduce similar hazards. Due to the extended segregated corridors required for this option, the Sponsor assesses that there is a greater opportunity for these hazards to exist when compared to HALE Options 1 and 2.

More analysis is needed to determine the best location and potential hazards of MALE RPAS transit corridors. It is impossible to assess the safety implications specific to the transit corridors at this stage. More engagement will occur to facilitate a comprehensive safety assessment of this option in Stage 3.

MALE Option 2

The Sponsor is exploring options for the integration of MALE RPAS into controlled airspace. If this were to be possible, MALE RPAS would remain within segregated airspace when not in controlled airspace.

The potential hazards are the same as listed in HALE Option 1 but due to a much smaller volume of segregated airspace, there is a smaller opportunity for these hazards to exist when compared to the other design options.

Conclusion

Activations of airspace for three-hour periods, two to three times per week, and during times of lower traffic density should minimise the impacts of the risks explained previously. The addition of real-time return of airspace not needed for RPAS operations will further minimise these impacts as will the availability of a crossing service.

The Sponsor will continue to engage with 78 Sqn (Swanwick Military) 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 4 – Stage 2 Environmental Impact Assessment

As part of the Stage 2B Initial Options Appraisal, CAP 1616 requires completion of an Environmental Impact Assessment. The information presented in **Section 3** outlines the methodology utilised by the Sponsor to assess the potential environmental impact of any of the proposed Design Options against the "Do Nothing" Option. In accordance with CAP 1616, the environmental impact of military activity will not be considered during this ACP but the environmental impact from other air traffic as a result of the introduction of a new airspace structure must be considered.

In Stage 2A, Initial Options Engagement, 6 potential options appraisals were presented (two HALE and four MALE). Based upon feedback from stakeholders, a "short list" of four options (two HALE and two MALE) were analysed. Any additional feedback received throughout Stage 3 consultation will be used to refine as required.

Aircraft Activity Impact

Analysis by the Sponsor as well as stakeholder feedback indicated there was insufficient traffic affected below 7,000ft to be able to generate meaningful results using WebTAG. ADS-B data was used to complete the Initial Operations Appraisal and associated Environment Impact Assessment. The methodology for the assessment consisted of monitoring historical ADS-B data for and civil aircraft operating within the confines of each design option during the entire period of potential airspace activation. Two five-day periods were selected for observation. One was in December 2021 and the other in June 2022. The rationale for selecting these periods was that they represented among the longest and shortest windows of proposed operations. For each day, air traffic data was observed from one hour after sunset until one hour prior to sunrise. This resulted in a total of 102 hours of observation. The airspace monitored for the analysis is shown in the **Initial Options** section of this document.

As stated previously, impact mitigation efforts will include NOTAMs when proposed airspace would be active (typically two to three times/week for a period of approximately three hours for each event) and utilisation of a DACS. Based upon these actions and data obtained from ADS-B data, the sponsor determined that it is highly unlikely that aircraft operating at or below 7,000ft will experience any impact. Furthermore, almost 79% of aircraft operating above 7,000ft would require a rerouting two nautical miles or less. A detailed explanation of methodology and analysis used for this qualitative assessment is listed in **Section 2 (Methodology and Summary of Current Civil Aircraft Activity)** of this document.

It was also assessed that due to no expected impacts to civil traffic below 7,000ft AMSL, no adverse impacts are expected from noise, local air quality, tranquillity, or biodiversity. An increase in CO2 gas emissions is expected but only above 7,000ft AMSL and is expected to be minimal based on the frequency, time, and duration of airspace activation as well as the availability of a DACS. Please refer to Table 1,2,3 and 4 in the Options Appraisal for detailed explanations of data analysis methodology and findings related to Environmental Impact.

Impact Conclusion

Noise
The Sponsor is unable to apply a specific Noise Modelling Category to this ACP. Based on the expectation of no impacts below 7,000ft AMSL for all design options, the Sponsor assesses that none of the options will result in an increase in adverse impacts from noise above the baseline

“Do Nothing” Option. Additionally, it will not change the type of aircraft operating; therefore, aircraft are expected to produce the same level of noise impact as is currently produced. Due to this, the amount of residents impacted remain largely the same.

Local Air Quality
The sponsor assesses that, compared to the baseline “Do Nothing” Option, a minimal increase in CO2 emissions are expected at higher altitudes for HALE Option 1, HALE Option 2, and MALE Option 1. Despite this, no impacts to civil traffic are expected below 7,000ft AMSL and none of the proposed design options are expected to result in any adverse impacts to local air quality.

Tranquillity
Due to no expected impacts below 7,000ft AMSL for all design options, no adverse impacts to tranquillity are expected.

Biodiversity
The area in the vicinity of RAF Fairford includes the Cotswold Area of Natural Beauty (AONB) and several Sites of Special Scientific Interest (SSSI), however, feedback received from Natural England indicated no evidence of impact to wildlife in the vicinity of proposed airspace. This has also been validated through the ADS-B analysis indicating no expected impacts to civil traffic below 7,000ft AMSL.

CO2 Emissions
Minimal impacts from CO2 emissions are expected for HALE Option 1, HALE Option 2, and MALE Option 1. Through the observation of ADS-B data and evaluating that against the proposed design options each of those options are expected to result in approximately five nautical miles of additional CO2 emissions per activation.

The Sponsor will continue to refine any impacts further identified during ongoing engagement with Stakeholders throughout the ACP. The Sponsor will also continue to research various methods and sources to enable quantitative assessments for the Full Options Appraisal in Stage 3.

Section 5 - Next Steps

This document will be submitted to the CAA as evidence to support the ACP-2021-078 Stage 2B. It is part of the documentary evidence for the Stage 2 Assessment Gateway (document deadline 15 Jul 22, for the CAA's Assessment Gateway scheduled for 29 Jul 22).

The Sponsor remains open to any and all feedback on the Design Options and their suitability, or other aspects of the ACP. More detailed information about the shape and size of preferred Design Options, as well as a full appraisal of their impact, will be presented during Stage 3 – Consult, at which time there will be a 12-week formal consultation period.

Evidence to be collected for Options Appraisal (Phase II) Full

The Change Sponsor will collect or build upon the following information to inform the next stage of the Options Appraisal:

1. Comprehensive WebTAG data, where required.
2. Traffic patterns for the full extent of the MALE transit corridor routings, once refined.
3. More details on the expected costs to ANSPs for training related to this ACP.
4. Development of quantitative analysis (CO2 and fuel burn) for affected parts of the ATS network.
5. Safety argument for reduction of BVLOS RPA buffer requirements (deviation from policy statement).

Development of a layered safety case for integration of MALE RPA in CAS will continue in parallel with the ACP

ACP Timeline

The agreed timeline for this ACP is as follows:

Stage	Submission	Gateway
DEFINE GATEWAY	11 Mar 22	25 Mar 22
DEVELOP AND ASSESS GATEWAY	15 Jul 22	29 Jul 22
CONSULT GATEWAY	12 Aug 22	26 Aug 22
UPDATE AND SUBMIT	6 Jan 23	
DECIDE GATEWAY		28 Apr 23
IMPLEMENT		10 Aug 23