ACP-2019-18

GATEWAY DOCUMENTATION:
STAGE 2 DEVELOP & ASSESS

STEP 2B OPTIONS APPRAISAL (PHASE I) INITIAL

Roles

Action	Role	Date
Produce	Airspace Change Team UAS CDC	13 Jan 22
Review	DAATM	14 Jan 22
Approve	Change Sponsor RAF AIR Cap	14 Jan 22

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Issue	Date	Change Summary
1.0	14 Jan 22	Submitted to CAA

Contents

Introduction

ACP-2019-18 was commenced in 2019 to enable the operation of a large Remotely Piloted Air System (RPAS), Protector RG Mk1, from its main operating base when it comes into service at Royal Air Force (RAF) Waddington from the early-2020s. This requirement remains in place. The Change Sponsor for this ACP is the Ministry of Defence (MOD). There is also an emerging requirement for the RAF Aerobatic Team (RAFAT) to be able to access airspace over RAF Waddington to conduct flying display activity from early 2023. The MOD felt that the best way to manage this new requirement was to combine both the Protector and RAFAT requirements within one airspace change. The Civil Aviation Authority (CAA) and the MOD agreed a means by which to do so (see Reference A) on the CAA ACP Portal for details. In brief a revised Statement of Need was produced. In addition, a rationalisation of design principles was carried out to ensure that the design principles from the original RAFAT ACP were covered satisfactorily by those for ACP-2019-18.

The Ministry of Defence, and specifically Air Capability, is the Change Sponsor for this proposal. The proposal seeks to secure airspace for:

- the integration of Protector RG Mk1 into UK airspace in the early 2020s;
- the RAFAT to conduct training over RAF Waddington.

The purpose of this document is to demonstrate that the Change Sponsor has followed CAP1616 airspace change process. It forms part of the overall requirements for the Stage 2 Develop and Assess Gateway, Step 2B – Options Appraisal.

Executive Summary

This airspace change proposal seeks to secure airspace for:

- the integration of Protector RG Mk1 into UK airspace in the early 2020s;
- the RAFAT to conduct training over RAF Waddington.

The Change Sponsor developed a comprehensive range of airspace design options which were shared with a wide range of identified stakeholders including those who were engaged with in Stage 1B. Feedback on the design options was invited.

Stage 2B requires an initial appraisal of the impacts of the design options against a “do nothing” option. The chosen methodology was to conduct a simple 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”. An initial indication of safety implications was also produced.

Section 1

1 Statement of Need

1.1 There is a requirement for a large Remotely Piloted Air System (RPAS) to operate out of RAF Waddington from the mid-2020s. Pursuit of an ACP optimises an approach, in terms of efficiency and safety, for RPAS to operate from and to RAF Waddington. Furthermore, this approach will support the safe integration of the RPAS into the national airspace structures, given the anticipated performance of on-board systems and the surrounding airspace classification. Access to existing training areas around the UK will also be considered as part of the integration into the national airspace structures. There is an emerging requirement for the RAF Aerobatic Team to conduct display flying activity over RAF Waddington from early 2023 following the Team's relocation from RAF Scampton in late 2022. Integration of this requirement within the Protector ACP is considered the safest operating model.

2 Design Principles

Table 1 - ACP-2019-18 Design Principles

Priority	Design Principle
1	DP(a) Provide a safe environment for airspace users *including consideration of the risk to life of those on the ground during RAFAT display practices*
2	DP(b) Provide access to sufficient area for both training and operational objectives
3	DP(c) Where possible and practicable, accommodate the emerging Airspace Modernisation Strategy DP(d) Minimise the impact to other airspace users
4	DP(e) Endeavour to make the airspace as accessible as possible DP(f) Use Flexible Use of Airspace (FUA) principles to manage the airspace as far as is practicable (Efficiency and Airspace Sharing)
5	DP(g) Use standard airspace structure where possible (Conformity, Simplicity and Safety)

3 Design options summary

3.1 The MOD prepared a comprehensive range of airspace design options upon which it invited feedback and comment from a range of stakeholders. The options were broken into two categories:

a. Airspace designs for the airspace in the vicinity of RAF Waddington below 9500 ft above mean sea level (AMSL) (known as **low level airspace design options**);
b. Airspace designs for the airspace in the vicinity of RAF Waddington 9500 ft AMSL – FL195 (known as **medium level airspace design options**).

3.2 At least one low level and one medium level airspace design will be required to accommodate Protector's operation in the UK; the RAFAT activity will only require one low level airspace design; RAFAT will not require access to any medium level airspace designs.

4 Low Level Airspace Design Options:

4.1 The MOD prepared six low level airspace design options for the airspace in the vicinity of RAF Waddington below 9500 ft AMSL. All except Option 1 LOW will accommodate both the Protector and RAFAT activities. Continuing work is being conducted within the MOD to see if the airspace design could be reduced to the volume of airspace depicted by Option 1 LOW without unacceptable impact on safety or operational capability for Protector in the UK. For this reason it is included. Option 1 LOW is the MOD's preferred airspace design option within the low level design category provided it can be made to work for Protector. Option 1 LOW will accommodate the RAFAT activity.

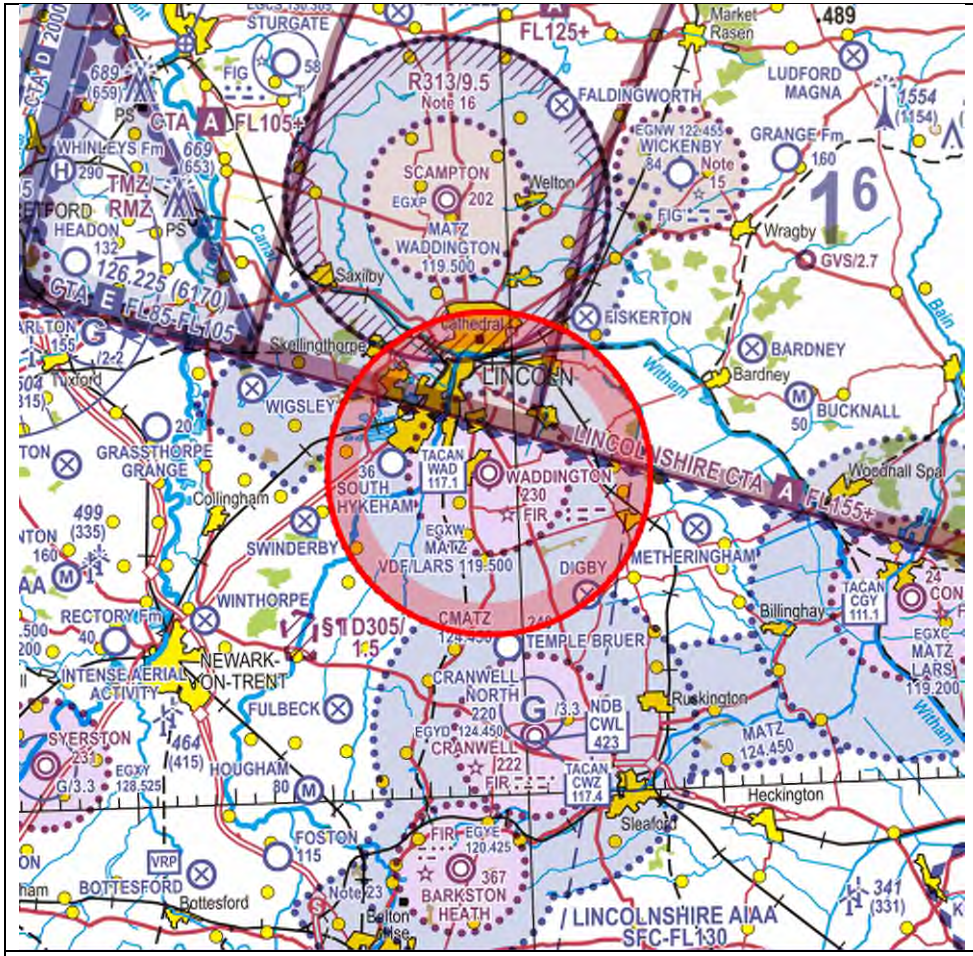
4.2 The low level airspace design options are intended for use as follows:

a. Protector will use this airspace:
   - o During departure from RAF Waddington's main runway. It will execute its automatic take-off profile and perform a spiral climb to 9500 ft AMSL when it will enter one of the medium level airspace design options;
   - o During recovery to RAF Waddington. It will enter one of the low level airspace design options at 9500 ft AMSL from one of the medium level airspace design options. It will then perform a spiral descent and execute its automatic landing profile to the main runway;
   - o During necessary live-flying training sorties, it may remain wholly within a low level airspace design option.

b. RAFAT will use this airspace to conduct its flying display practices from surface to 9500 ft AMSL.

4.3 The MOD selected 9500 ft AMSL as the upper level for the low airspace design options in order to safely accommodate the RAFAT display activity. Since there has to be an onward connection with the medium level airspace design options to enable Protector to continue its climb to access classes A & C airspace, the medium airspace design options have a lower level of 9500 ft AMSL.

4.4 The MOD is reasonably flexible in the choice of upper limit of the low airspace design options; the deciding factors are that it must be high enough to safely accommodate the RAFAT activity and must enable connection to the medium airspace design options. The low level airspace design options are as follows:



Lateral Dimension: 5 nm radius circle centred on RAF Waddington's aerodrome reference point[1] (ARP).

Option 1 LOW

Activation:
Option 1 would be used for both RAFAT and Protector, but only if the MOD is able to develop procedures for Protector which would not unacceptably impact safety or operational capability for Protector in the UK.

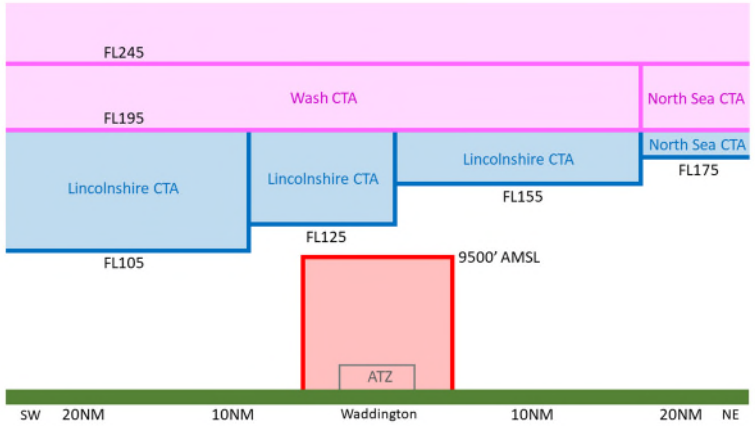
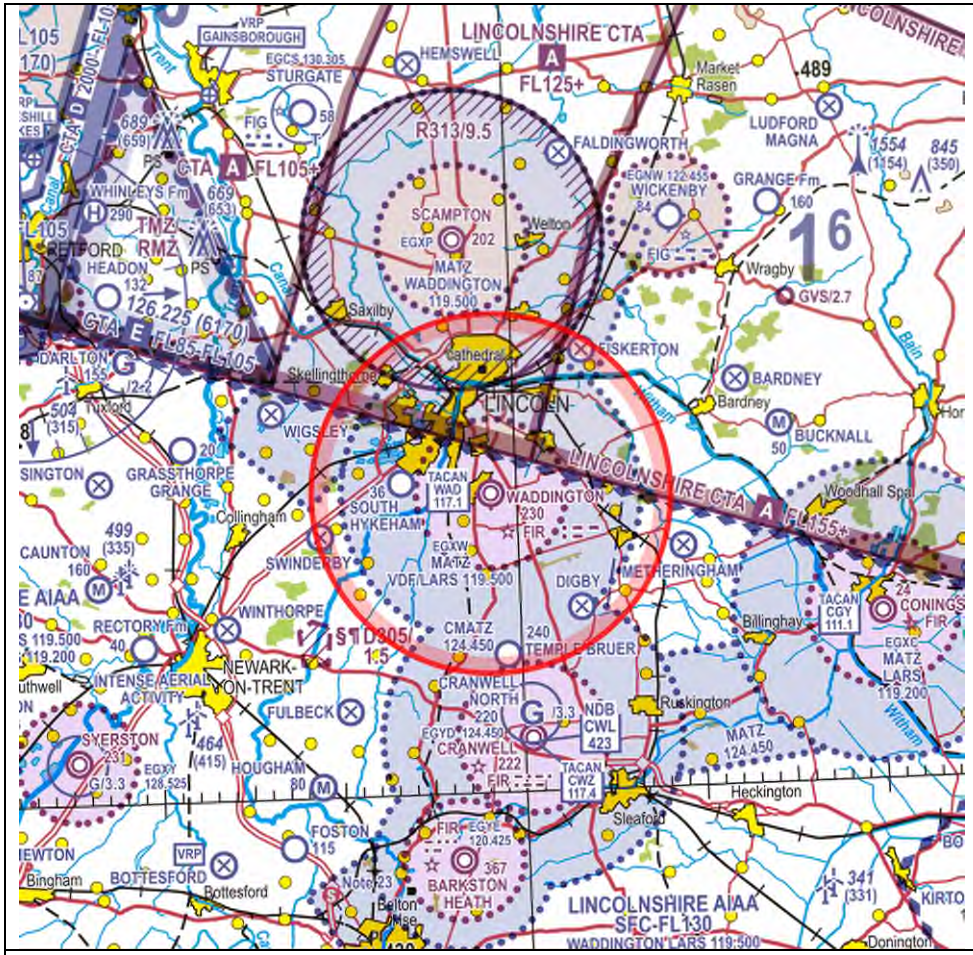


Figure 1- Cross-section SW/NE through extended centreline for RW02/20

Vertical Dimension: Surface to 9500 ft AMSL.

[1] RAF Waddington's airfield reference point is the midpoint of RW02/20 (530958N 0003126W)



Lateral Dimension: 6 nm radius circle centred on RAF Waddington's ARP.

Option 2 LOW

Activation:
Option 2 would be used for both RAFAT and Protector activities.

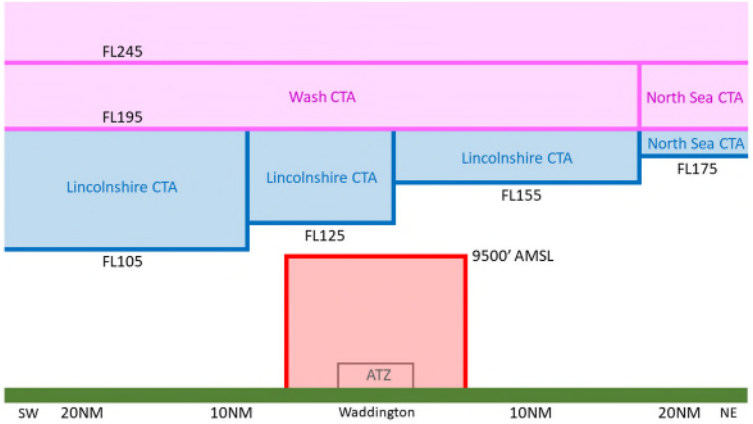


Figure 2 - Cross-section SW/NE through extended centreline for RW02/20

Vertical Dimension: Surface to 9500 ft AMSL.

Option 3 LOW

Activation:
Area A would be activated for RAFAT activity.
Areas A, B & C would be activated for Protector activity.
Areas A, B & C would be activated simultaneously when both activities are planned.

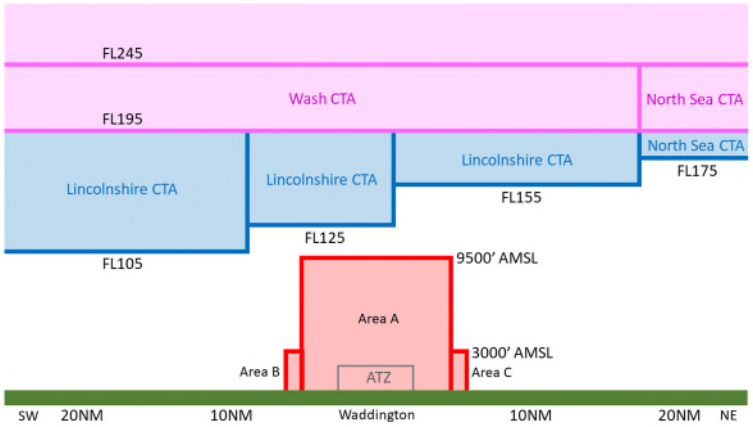
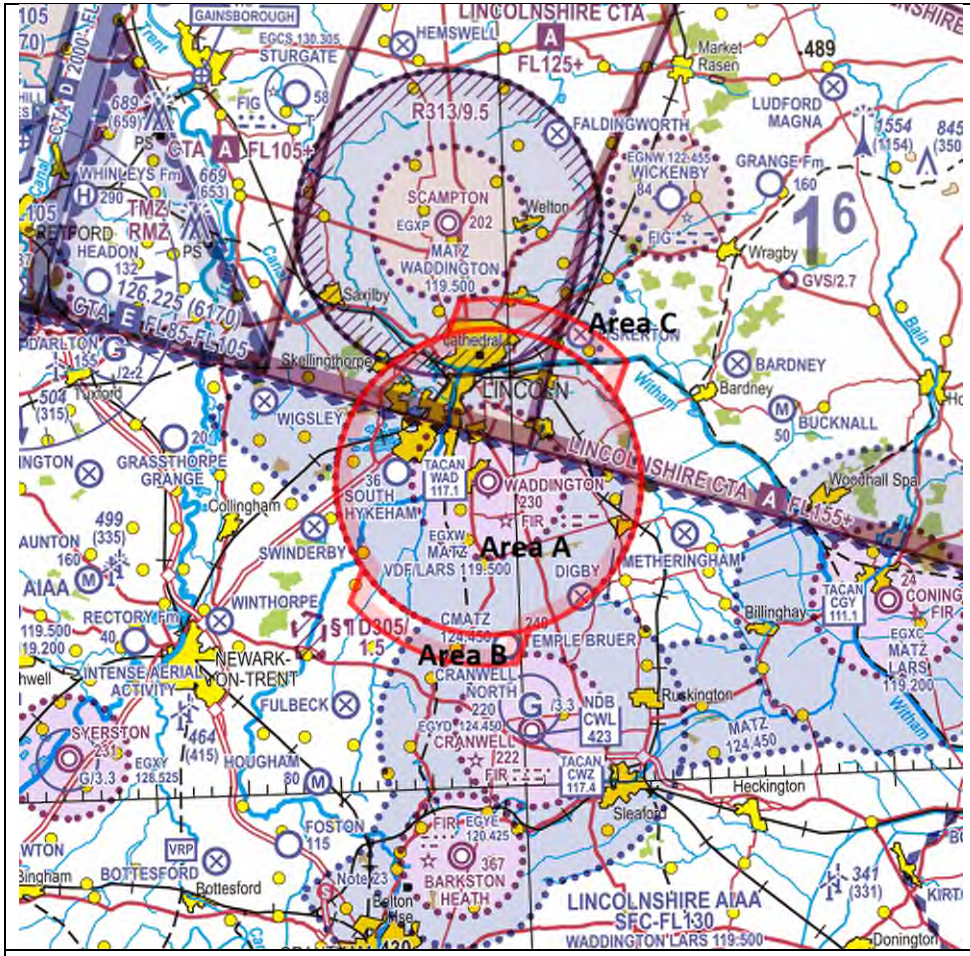


Figure 3 - Cross-section SW/NE through extended centreline for RW02/20

Lateral Dimension:
Area A - 5 nm radius circle centred on RAF Waddington's ARP:
Areas B & C - stubs aligned with the runway centreline, extending from boundary of Area A to 6 nm from ARP into RW02/20 approach/departure lanes and 3 nm either side of RW02/20 extended centreline. The ends of the stubs are perpendicular to the runway extended centrelines.

Vertical Dimension:
Area A - Surface to 9500 ft AMSL;
Areas B & C - Surface to maximum 3000 ft AMSL.



Option 4 LOW

Activation:
Area A would be activated for RAFAT activity.
Areas A, B & C would be activated for Protector activity.
Areas A, B & C would be activated simultaneously when both activities are planned.

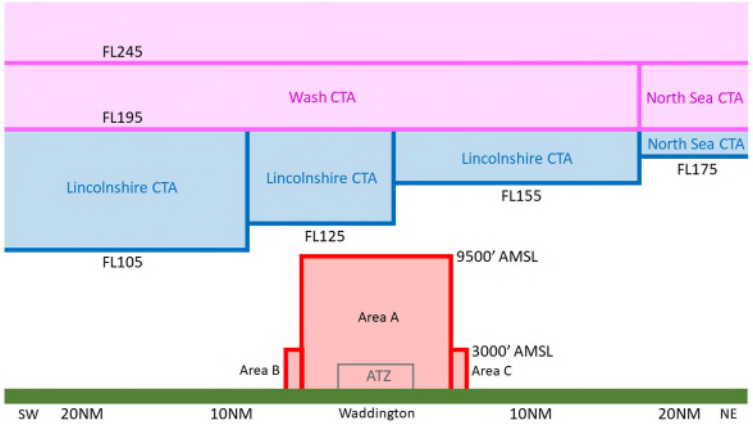
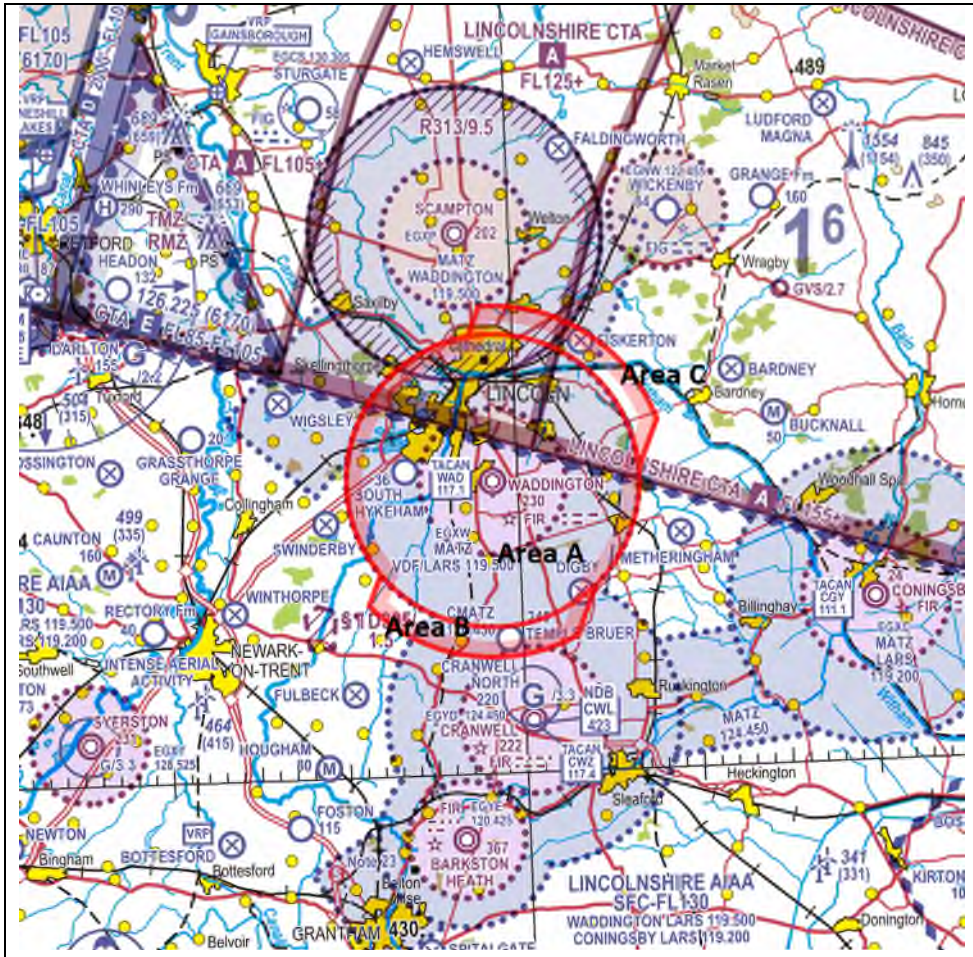


Figure 4 - Cross-section of SW/NE through extended centreline for RW02/20

Lateral Dimension:
Area A - 5 nm radius circle centred on RAF Waddington's ARP;
Areas B & C - stubs aligned with the runway centreline, extending from boundary of Area A to 6 nm from ARP into RW02/20 approach/departure lanes and 3 nm either side of RW02/20 extended centreline. The ends of the stubs follow a 6 nm arc measured from the ARP.

Vertical Dimension:
Area A - Surface to 9500 ft AMSL;
Areas B & C - Surface to maximum 3000 ft AMSL.



Option 5 LOW

Activation:
Area A would be activated for RAFAT activity.
Areas A, B & C would be activated for Protector activity.
Areas A, B & C would be activated simultaneously when both activities are planned.

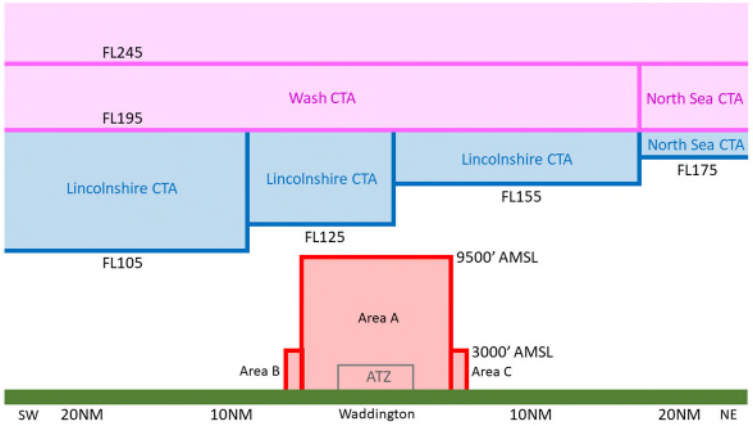
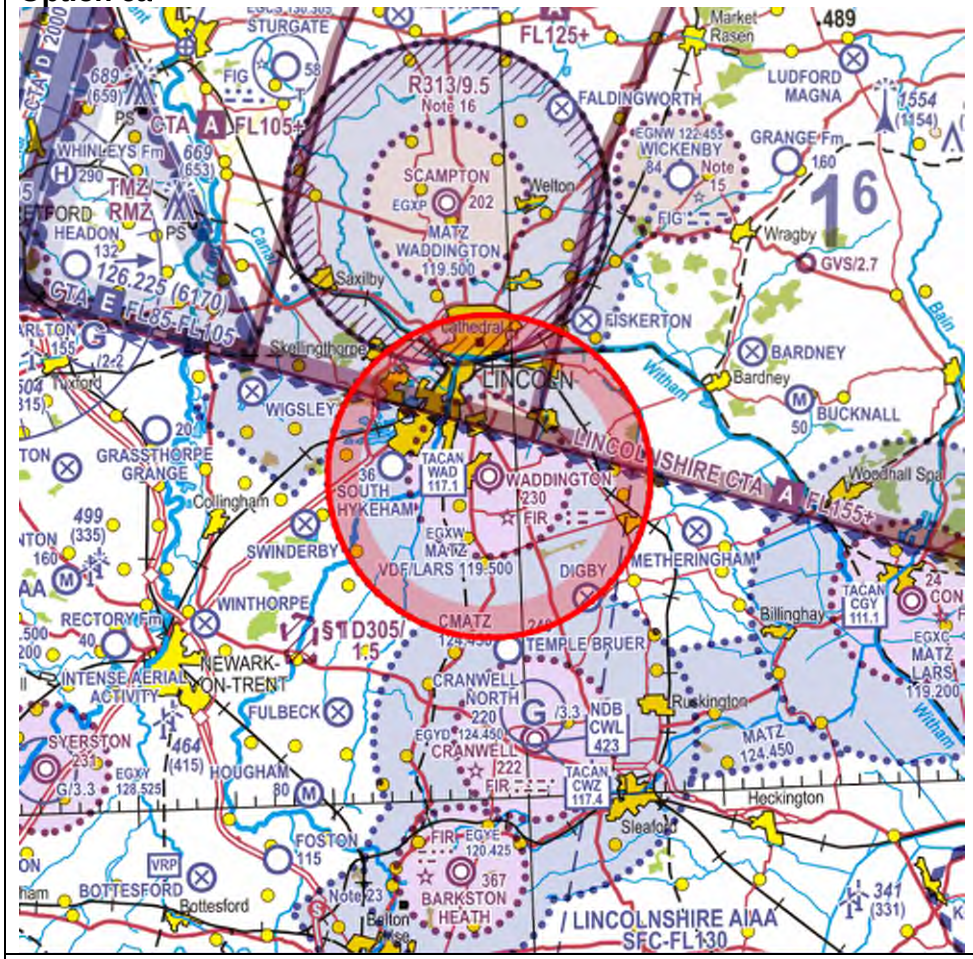


Figure 5 - Cross-section SW/NE through extended centreline for RW02/20

Lateral Dimension:
Area A - 5 nm radius circle centred on RAF Waddington's ARP;
Areas B & C – areas extending from the boundary of Area A to follow a 6 nm arc measured from the ARP, starting 2.5 nm west of the RW02/20 extended centreline and finishing 4.5 nm east of the RW02/20 extended centreline.

Vertical Dimension:
Area A - Surface to 9500 ft AMSL;
Areas B & C - Surface to maximum 3000 ft AMSL.

Option 6a



Lateral Dimensions:
Option 6a LOW - 5 nm radius circle

Option 6 LOW

Activation:
Option 6a would be activated for RAFAT-only activity
Option 6b (areas A, B & C) would be activated for Protector-only activity
Options 6a & 6b (areas A, B & C) would be activated simultaneously when both activities are planned.

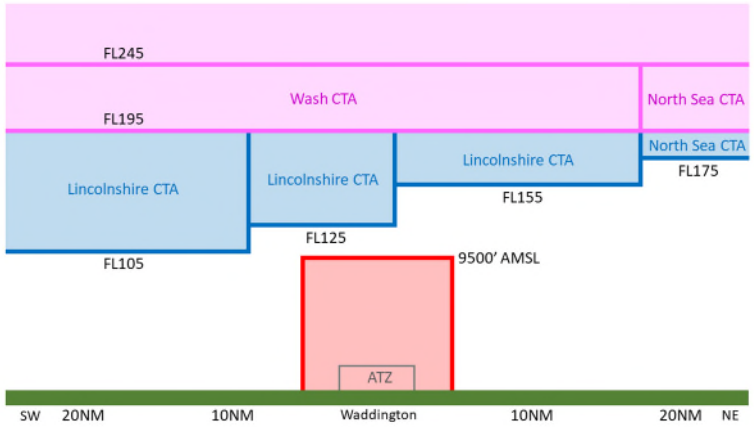
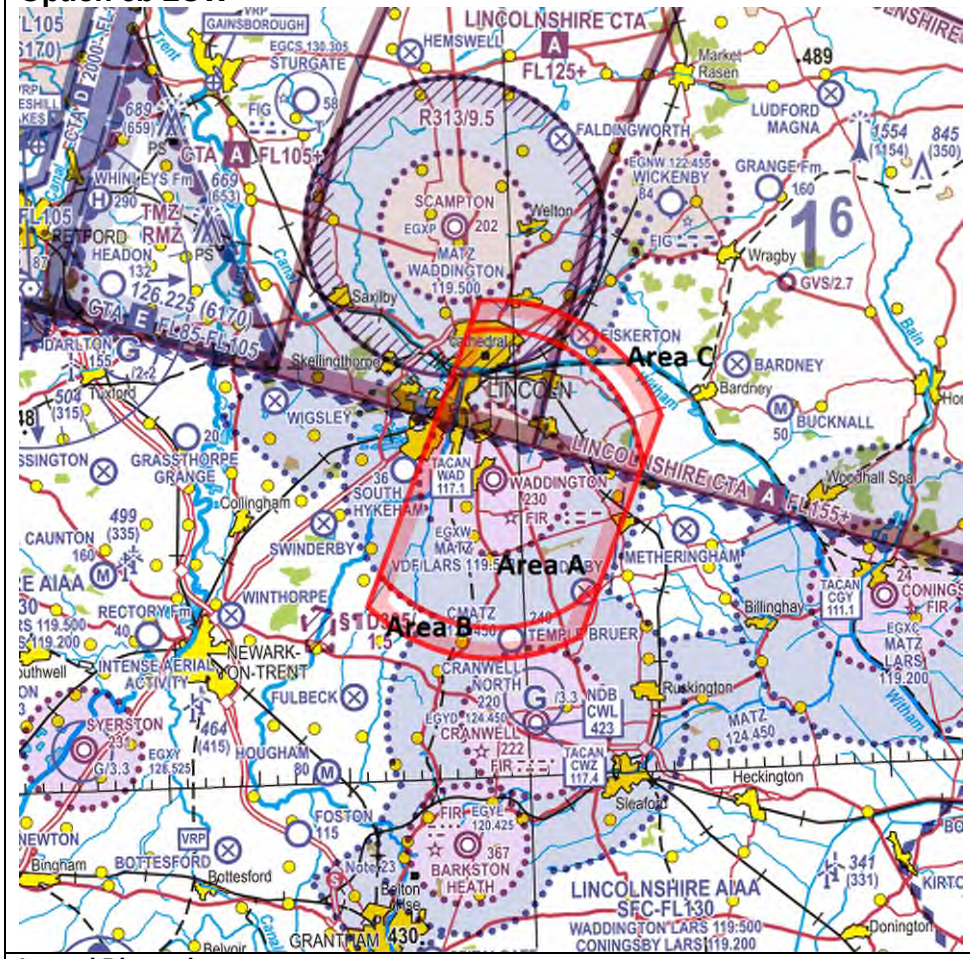


Figure 6 - Cross-section SW/NE through extended centreline for RW02/20

Vertical Dimensions:
Option 6a LOW - Surface to 9500 ft AMSL

Option 6b LOW



Lateral Dimensions:

Area A is made up of a 5 nm radius circle with segments removed to the west and east of the circle. The western edge runs along a line 2.5 nm west of and parallel to the RW02/20 centreline. The eastern edge runs along a line running 4.5 nm east of and parallel to the RW02/20 centreline.

Areas B & C – areas extending from the 5 nm arc of Area A to follow a 6 nm arc measured from the ARP, starting 2.5 nm west of the RW02/20 extended centreline and finishing 4.5 nm east of the RW02/20 extended centreline.

Option 6 LOW (continued)

Activation:

Option 6a would be activated for RAFAT-only activity

Option 6b (areas A, B & C) would be activated for Protector-only activity

Options 6a & 6b (areas A, B & C) would be activated simultaneously when both activities are planned.

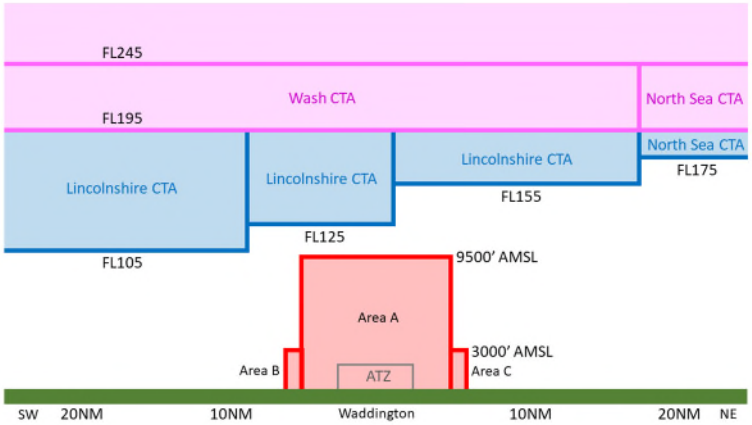


Figure 7 - Cross-section SW/NE through extended centreline for RW02/20

Vertical Dimensions:

Area A – Surface – 9500 ft AMSL

Areas B & C – Surface to maximum 3000 ft AMSL

5 Medium Level Design Options

5.1 The MOD prepared two airspace design options for the airspace in the vicinity of RAF Waddington between 9500 ft AMSL and FL 195. Both options will accommodate the Protector activity as it climbs to reach class A or C airspace. Options 7 and 8 MEDIUM are located directly beneath Class C airspace, which during specified hours[2] is activated as a Temporary Reserved Area (TRA). The MOD is aware that a robust argument must be made for an active TRA to be considered a safe environment for Protector operation and is working on this argument. The upper limit of FL195 for Options 7 and 8 MEDIUM is predicated on this argument being able to be made.

5.2 Option 7 MEDIUM comprises the smaller volume of airspace and the Change Sponsor hopes that the MOD will be able to accommodate the Protector activity within this option. Work is ongoing to develop a safety argument that would enable this. However, should it become necessary, airspace design Option 8 MEDIUM will need to be considered.

5.3 The RAFAT activity will not require access to either of the medium level airspace design options.

5.4 The medium level airspace design options are as follows:

[2] Mon-Fri 0830 to 1700 UTC Winter; Mon-Fri 0730 to 1700 UTC Summer; Excluding English Public Holidays. TRA may be activated at other times by NOTAM.

Lateral Dimension: 20 x 10 nm rectangle aligned to and abutting the southern edge of the Lincs CTA.

Option 7 MEDIUM

Activation:
Provided a safety argument can be made with respect to the CAA Safety Buffer Policy, Option 7 would be activated for Protector activity only, to enable Protector to continue climb into classes A and/or C airspace.

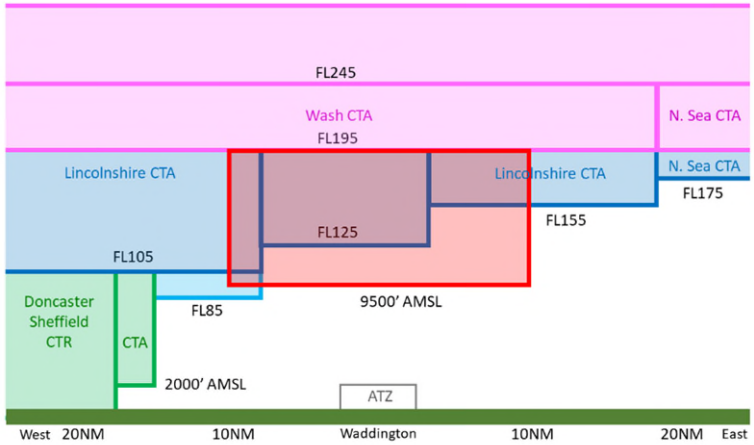


Figure 8 - Cross-section through a line running parallel to the abutting Lincolnshire CTA

Vertical Dimension: 9500 ft AMSL – FL195

Option 8 MEDIUM

Activation:
In the event that the safety argument determines that the additional airspace is required to satisfy the CAA Safety Buffer Policy, Option 8 would be activated for Protector-only activity to enable Protector to continue climb into classes A and/or C airspace.

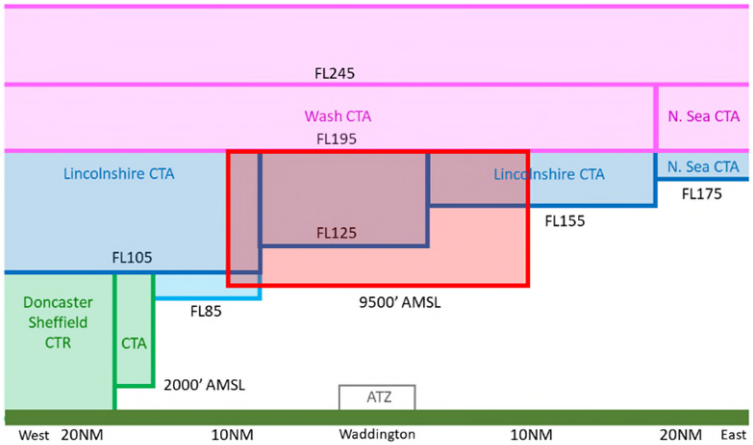


Figure 9 - Cross-section through a line running parallel to the abutting Lincolnshire CTA

Lateral Dimension: 20 x 20 nm rectangle aligned to and abutting the southern edge of the Lincs CTA.

Vertical Dimension: 9500 ft AMSL – FL195

6 Type of Airspace to Accommodate RAFAT and Protector Activities

6.1 RAF Waddington sits entirely within class G airspace, which ordinarily does not provide adequate protection or segregation respectively for RAFAT and Protector at Initial Operating Capability (IOC). The MOD has given much thought to the most appropriate type of airspace to accommodate both activities and a summary follows, taken in turn by each activity and then further summarised in Table below.

6.2 **RAFAT** - The RAFAT activity is afforded additional protection at RAF Scampton through the establishment of EG R313, which is restricted airspace and active on a permanent basis Monday – Friday. This structure is a 5 nm radius cylinder of airspace reaching from surface to 9500 ft AMSL (specified as Regional Pressure Setting). Thought has been given to providing similar protection at RAF Waddington. However, it is felt that an equal measure of protection could be achieved via a less permanent structure, particularly since during RAFAT activity full radar surveillance and air traffic services would be provided by military ATC.

6.3 **Protector** – In broad terms civil and military regulations specify that without an appropriately approved Detect and Avoid (DAA) capability, Protector must be flown using a Layered Safety Approach that specifically requires flight in segregated airspace. Protector is fitted with TCAS II, which may be approved to provide a DAA capability in airspace where all traffic can be expected to be operating a transponder (i.e. transponder-mandatory airspace). The MOD is producing an Airspace Integration Safety Argument (AISA) for the introduction of Protector at IOC into UK airspace. This work aims to develop an evidenced argument for the safe operation of IOC Protector under Instrument Flight Rules (IFR) and under an air traffic service within transponder-mandatory airspace, as well as in suitable segregated airspace. The AISA is therefore looking at the following types of airspace:

a. Class A airspace:
b. Class C airspace;
c. Class D airspace that is notified as a Transponder Mandatory Zone (TMZ)[3];
d. Class E airspace that is notified as a TMZ, although it is thought to be less likely to be able to produce an acceptable safety argument;
e. Class G airspace, segregated in the form of a notified Danger Area.

[3] Class D is usually designated around an aerodrome, hence not above FL100

Table 2 - Proposed Airspace Types for Consideration with MOD Comment

Type of segregated airspace	Suitability for RAFAT	Suitability for Protector	MOD Comment
Class A	No	Yes	IFR flight is mandatory in class A airspace, which is not suitable for RAFAT
Class C	Yes	Yes	Not justifiable in terms of: o Restrictions placed on other airspace users; o Air traffic management resourcing; o Flexible use of airspace (notified hours of activation in UK AIP).[4]
Airspace Class D above FL100 or if below FL100 is also a TMZ[5]	Yes	Yes	Not justifiable in terms of: o Restrictions placed on other airspace users; o Air traffic management resourcing; o Flexible use of airspace (notified hours of activation in UK AIP).
Class E	Unknown	Unknown	Pending AISA for Protector, but thought unlikely to be suitable.
Class G Danger Area	Yes	Yes	Less impact on other airspace users since it can be tactically managed (does not have notified hours of activation in UK AIP).
TMZ/RMZ	No	Possibly	Not considered viable for RAFAT

6.4 The establishment of a class G restricted area was considered and discounted, as it was thought to be an overly restrictive option in terms of access to other airspace users. Whilst access to a restricted area can be managed by ATC, the aviation community is familiar with the danger area construct and the ability to obtain a Danger Area Crossing Service (DACS). Protector does not require the additional level of protection afforded by restricted airspace. Radar surveillance provision and air traffic services provided by military ATC would ensure that the establishment of a danger area for RAFAT activities would constitute adequate protection. It is envisaged, therefore, that the most economical type of airspace to be implemented (in terms of hours of activation, access to airspace and manpower resource) would be segregated airspace in the form of a danger area.

[4] Whilst there is current discussion regarding the possibility of tactically turning controlled airspace volumes on and off, the likely timescale involved precludes it as an option for this ACP.

[5] TMZ = Transponder Mandatory Zone.

Section 2

7 Methodology

7.1 Stage 2B requires an initial appraisal of the impacts of the design options presented in Section 1 against a "do nothing" option.

7.2 The chosen methodology is to conduct a simple 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". This approach has been applied previously in other Airspace Change Proposals of similar scale/proportionality that have successfully passed the Stage 2 Gateway and it has been deemed compliant both with the spirit of CAP1616 and the Government Green Book.

8 The Do-nothing option

8.1 RAF Waddington sits entirely within class G airspace, which ordinarily does not provide adequate protection or segregation respectively for RAFAT and Protector at IOC. In broad terms civil and military regulations specify that without an appropriately approved DAA capability, Protector must be flown using a Layered Safety Approach that specifically requires flight in segregated airspace. Protector will not have an appropriately approved DAA at IOC. Protector will be based at RAF Waddington. Additionally, having protected airspace is deemed essential for the safety of the RAFAT pilots and other airspace users. The "do-nothing option" would effectively deny access to the airspace directly above RAF Waddington for Protector and RAFAT.

9 Options Appraisal

9.1 Table 3 details the appraisal of the low airspace design options and the "do-nothing" option against the high-level objectives and assessment criteria laid out in CAP1616, Appendix E, Table E2. All 6 low airspace design options have been represented together in Table 3, since at this early stage of appraisal their impacts seem to be almost identical. Where a potential difference has been identified, this has been made clear in the table.

9.2 Over and above the requirement in CAP1616 Appendix E, Table E2, an additional row has been added to the table outlining initial safety considerations in brief. The list is not exhaustive and will be expanded as required as the options appraisal in matured.

Table 3 – Summary of options appraisal for Options 1 – 6 LOW

Group	Impact	Options 1 – 6 LOW	Do-Nothing
Communities	Noise impact on health and quality of life	**Civil aircraft:** Some increase in noise likely over a limited range of areas as some GA and military aircraft will: • choose to route around the segregated airspace • be required to route around segregated airspace if activity within precludes clearance Other aircraft will opt for a crossing service (e.g. DACS), which will be granted when possible. Majority of stakeholders who provided feedback carry radios and	There would be no change from present since neither activities would be able to operate at RAF Waddington

Table 3 – Summary of options appraisal for Options 1 – 6 LOW

Group	Impact	Options 1 – 6 LOW	Do-Nothing
		speak to ATC so rerouting could be minimised. Estimate of impact can be refined by reference to stakeholders and interrogative software (MOD is investigating). **Protector** is powered by a Honeywell TPE331-10 Turboprop engine; more information regarding noise can be ascertained to estimate noise impact. **RAFAT** activity will be largely switching display practice locations between RAF Scampton and RAF Waddington. No additional noise effect anticipated as flying tempo will not change, but noise will impact different communities.	
Communities	Air Quality	**Civil aircraft:** Minimal reduction in overall air quality thought to be likely as establishment of segregated airspace should lead to minimal reroute of GA aircraft. **Protector** is powered by a Honeywell TPE331-10 Turboprop engine; more information regarding emissions can be ascertained to estimate effect on air quality. **RAFAT** activity will be largely switching display practice locations between RAF Scampton and RAF Waddington. No additional reduction in air quality but will affect different communities.	There would be no change from present since neither activities would be able to operate at RAF Waddington
Wider society	Greenhouse gas impact	No additional flying anticipated from civil GA community. Estimated Protector flying tempo is 1 - 2 flights per week initially, although requirement is evolving. Change sponsor can firm up estimate. No additional flying anticipated from RAFAT. Minimal increase anticipated in Greenhouse gas impact from Protector activity, although overall reduction in impact is likely in local area due to relocation/retirement of several flying assets from RAF Waddington. Change Sponsor will endeavour to provide some quantitative assessment of this for Phase II appraisal.	There would be no change from present since neither activities would be able to operate at RAF Waddington
Wider society	Capacity / resilience	Not applicable	There would be no change from present since neither activities would be

Table 3 – Summary of options appraisal for Options 1 – 6 LOW

Group	Impact	Options 1 – 6 LOW	Do-Nothing
			able to operate at RAF Waddington
General Aviation	Access	There may be a small impact on ease of access to the low airspace design options by GA. Estimated initial Protector flying tempo will require activation of segregated airspace 1 – 2 days per week. Protector will spend minimal time (approximately 10 minutes during departure or recovery phase) in any of the low airspace design options. Access by GA will be maximised by the ability to obtain a crossing service (e.g. DACS). Access to the low airspace options is likely to be impacted during RAFAT display practices. RAFAT is currently in the process of determining which if its display / training activities can be safely conducted at Waddington, which in turn will inform the estimate of usage, and thereby assist with impact on access to the airspace by GA. Change Sponsor will endeavour to provide some this for Phase II appraisal.	There would be no change from present since neither activities would be able to operate at RAF Waddington
General Aviation / commercial airlines	Economic impact from increased effective capacity	Not applicable	There would be no change from present since neither activities would be able to operate at RAF Waddington
General Aviation / commercial airlines	Fuel burn	There may be a small increase in fuel burn if GA do not / cannot take advantage of a crossing service (e.g. DACS) to achieve a direct routing. Estimate of impact can be refined by reference to stakeholders and interrogative software (MOD is investigating). There will be a greater increase for **Option 2 LOW** as it encompasses the greatest volume of airspace.	There would be no change from present since neither activities would be able to operate at RAF Waddington
Commercial airlines	Training costs	Not applicable	Not applicable
Commercial airlines	Other costs	Not applicable	Not applicable

Table 3 – Summary of options appraisal for Options 1 – 6 LOW

Group	Impact	Options 1 – 6 LOW	Do-Nothing
Airport /ANSP	Infrastructure costs	Not applicable	Not applicable
Airport /ANSP	Operational costs	Not applicable	Not applicable
Airport /ANSP	Deployment costs	Not applicable	Not applicable
Safety Considerations (not exhaustive list)		• Pilots being unaware of new airspace • Re-route through unfamiliar areas • Funnelling as a result of need to re-route • Increased risk of loss of safe separation / mid-air collision (LoSS/MAC) due to re-routing aircraft creating bottlenecks • Increased controller workload due to funnelling, DACS requests • Proximity of RAF Cranwell visual and radar circuit traffic	There would be no additional safety considerations since neither activities would be able to operate at RAF Waddington

9.3 Table 4 details the appraisal of the MEDIUM airspace design options and the "do nothing" option against the high-level objectives and assessment criteria laid out in CAP1616, Appendix E, Table E2. Both medium airspace design options have been represented together in Table 3, since at this early stage of appraisal their impacts seem to be almost identical. Where a potential difference has been identified, this has been made clear in the table.

Table 4 – Summary of options appraisal for Options 7 & 8 MEDIUM

Group	Impact	Options 7 & 8 MEDIUM	Do-Nothing
Communities	Noise impact on health and quality of life	No noise impact anticipated as Protector only operating in segregated airspace for short duration and above 9500 ft AMSL	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington

Table 4 – Summary of options appraisal for Options 7 & 8 MEDIUM

Group	Impact	Options 7 & 8 MEDIUM	Do-Nothing
Communities	Air Quality	No reduction in air quality anticipated as Protector only operating in segregated airspace for short duration and above 9500 ft AMSL	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
Wider society	Greenhouse gas impact	No additional flying anticipated from civil GA community. Estimated Protector flying tempo is 1 - 2 flights per week initially, although requirement is evolving. Change sponsor can firm up estimate. Minimal increase anticipated in Greenhouse gas impact from Protector activity, although overall reduction in impact is likely in local area due to relocation/retirement of several flying assets from RAF Waddington. Change Sponsor will endeavour to provide some quantitative assessment of this for Phase II appraisal.	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
Wider society	Capacity / resilience	Not applicable	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
General Aviation	Access	Estimated Protector flying tempo will require activation of segregated airspace 1 – 2 days per week and will spend very little time in the medium airspace. Whilst feedback from stakeholders revealed that few operated within the medium airspace options, access by GA will be maximised by the ability to obtain a crossing service (e.g. DACS). Access by Skydive Langar, a local paradropping school could be problematic for **Option 8 MEDIUM**. The Change Sponsor is confident that **Option 8 MEDIUM** can be redesigned to remove the impact on Skydive Langar.	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
MOD/RAF Aviation	Access	May be some impact on access for MOD/RAF aviation conducting training sorties up to FL120 and accessing Gamston Corridor/ joining controlled	

Table 4 – Summary of options appraisal for Options 7 & 8 MEDIUM

Group	Impact	Options 7 & 8 MEDIUM	Do-Nothing
		airspace. Impact should be minimal unless trher is some reason why military pilots are unable to obtain DACS / crossing clearance. Any impact likely to be greater for **Option 8 MEDIUM.** Change Sponsor will investigate and endeavour to provide more information at Phase II.	
General Aviation / commercial airlines	Economic impact from increased effective capacity	Not applicable	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
General Aviation / commercial airlines	Fuel burn	Unlikely to have any impact on fuel burn since few GA operate above 9500 ft AMSL. Estimate of impact can be refined by reference to stakeholders and interrogative software (MOD is investigating). Any impact likely to be greater for **Option 8 MEDIUM.**	There would be no change from present since without segregated airspace Protector would not be able to operate from RAF Waddington
Commercial airlines	Training costs	Not applicable	Not applicable
Commercial airlines	Other costs	Not applicable	Not applicable
Airport /ANSP	Infrastructure costs	Not applicable	Not applicable
Airport /ANSP	Operational costs	Not applicable	Not applicable
Airport /ANSP	Deployment costs	Not applicable	Not applicable

Table 4 – Summary of options appraisal for Options 7 & 8 MEDIUM

Group	Impact	Options 7 & 8 MEDIUM	Do-Nothing
Safety Considerations (not exhaustive list)		• Pilots being unaware of new airspace • Re-route through unfamiliar airspace (proximity to controlled airspace) • Funnelling as a result of need to re-route • Increased risk of loss of safe separation / mid-air collision (LoSS/MAC) due to re-routing aircraft creating bottlenecks • Increased controller workload due to funnelling, DACS requests • CAA Safety Buffer Policy	There would be no additional safety considerations since neither activities would be able to operate at RAF Waddington

10 Summary of preferred options

10.1 Following the design principle evaluation carried out at Step 2A of the ACP, the Change Sponsor has allocated the following ranking for its low and medium airspace design options.

10.2 **Low design options in order of preference**

10.3 Preference 1 - Option 1 LOW. This could be a viable design option, pending ongoing work to enable it to accommodate Protector ATLC flight profiles. If it can be made acceptable, this will be the MOD's preferred design option.

10.4 Preference 2 - Options 3, 4 and 5 LOW are jointly the second preferred design options as they meet all of the DPs. They will comprise a greater volume of segregated airspace than Option 1 LOW, but less than Option 2 LOW. They add minimum complexity compared with Option 6 LOW.

10.5 Preference 3 – Option 6 LOW. This option meet all of the DPs, but uses a greater volume of airspace than Option 1 LOW and adds more complexity compared with Options 3, 4 and 5 LOW.

10.6 Preference 4 – Option 2 LOW meets all of the DPs. Whilst it is simple in design, it has the largest volume of airspace and as this was placed at priority 3 in the DP ranking, it is the least suitable option.

10.7 **Medium design options in order of preference**

10.8 Preference 1 - Option 7 MEDIUM. Provided that a robust argument can be made with respect to the CAA Safety Buffer Policy this option comprises the least volume of airspace between the MEDIUM options and is, therefore, the MOD's preferred medium design option.

10.9 Preference 2 - Options 8 MEDIUM is the second preference of the medium design options as it comprises a greater volume of airspace than Option 7 MEDIUM. It will require some amendment to remove any impact on Langar Skydive's operation.

11 Safety assessment

11.1 It is useful to describe why specifically segregated airspace is being requested for the Protector and RAFAT activities at RAF Waddington.

11.2 **Protector**. UK military aviation is regulated by the Military Aviation Authority (MAA). Accordingly the Protector programme is subject to the MAA Regulatory Publications (MRP). Of particular relevance to the operation of Protector in UK airspace is MAA Regulatory Article (RA) 2320 – MAA regulation for operation of military RPAS. The RA states the criteria for beyond visual line of sight (BVLOS) RPAS operation such that within UK airspace, BVLOS operations should:

a. *Either* employ an appropriately approved DAA capability to enable compliance with the Rules of the Air appropriate to the class of airspace,
b. *or* be flown using a Layered Safety Approach that specifically requires flight in segregated airspace.

11.3 When Protector comes into service it will be fitted with a limited DAA capability only, which is not likely to meet the requirements to fly in all classes of airspace. The working assumption is that Protector will be able to fly within classes A and C airspace without restriction. Since RAF Waddington is located within class G airspace, some form of airspace segregation is required for its transit through current class G airspace in order to be able to achieve onward transit using classes A and C airspace.

11.4 Establishment of a danger area (or other suitable airspace) will permit Protector to perform its planned activities in a safe environment, maintain regulatory compliance, and provide protection of other airspace users of any associated and identified hazardous activities.

11.5 **RAFAT**. Having some form of protected airspace is essential for the safety of RAFAT pilots and other airspace users. When display flying, the Team generally fly at 360kts, from 100ft above ground level (AGL) up to approximately 8000 ft AGL if the weather allows a vertical routine. This makes reaction times slow, and it can be cumbersome to reactively manoeuvre the formation. As all pilots take references from the Team leader, there are very few pairs of eyes looking out for other traffic and the Team relies on a radar service for early warning of intruders.

11.6 A statement prepared by RAFAT is at Annex A; it outlines how its displays are managed from a safety perspective.

11.7 Para 6 outlines the MOD's preference to implement the segregated airspace in the form of danger areas. This also ties in with the feedback received from the majority of stakeholders engaged with in Stage 2A of this ACP. If danger areas are implemented the following will be in place to ensure safety is managed:

a. Any airspace will not be permanently active; it will only be activated when RAFAT or Protector flying is due to take place. Proven procedures will be adopted to ensure that the airspace is activated and notified as and when required. This will involve appropriate NOTAM action being taken at least 24 hrs in advance. To ensure minimum disruption to other airspace users a DACS will be offered within all implemented airspace. This means that, even if the airspace has been notified as being active, it may be possible for both civil and military aircraft to transit through it under a clearance from either RAF Waddington or Swanwick Military.

b. RAF Waddington ATC will be manned at all times during RAFAT and Protector operations. Information on the current status of the airspace will be available, including a DACS from RAF Waddington or other appropriate military ATC units.

c. Protector will remain within its segregated airspace at all times until it has reached either class A or C for further transit or has landed. Emergency procedures are being drawn up and several panels / workshops are in train to ensure all appropriate aviation stakeholders are involved / informed.

d. Protector will not routinely loiter in its segregated airspace. The low and medium airspace design options are intended for egress from and ingress to RAF Waddington only. This means that, whilst the airspace may be active, the air vehicle may not be operating within it. In addition It should be noted that the presence of Protector within its segregated airspace does not preclude its use by other aircraft. The airspace will not be required to remain sterile; ATC procedures are being drawn up to enable simultaneous use by other airspace users. ATC services will be available throughout the activation of the segregated airspace as appropriate to provide access to other airspace users. This will:

    - Minimise the requirement for re-routing of civil or military airspace users

    - Enable co-ordinated access to the segregated airspace by aircraft transiting the local area, aircraft airways joining, general handling aircraft and those wishing to utilise the Litchfield and Gamston Radar Corridors.

e. Access to the low airspace options is likely to be impacted during RAFAT flying display events/training at RAF Waddington, resulting in other airspace users requiring to hold outside the airspace until a clearance to route through can be given or by taking a re-route.

f. Re-routing of aircraft due to the segregated airspace may impact safety. The MOD intends to make a crossing service available to other airspace users, which will help to mitigate the potential increased risk incurred by re-routing. Safety may be impacted through the need to re-route as follows:

    - Re-route through unfamiliar areas

    - Funnelling as a result of need to re-route

    - Increased risk of loss of safe separation / mid-air collision (LoSS/MAC) due to re-routing aircraft creating bottlenecks

    - Increased controller workload due to funnelling and dealing with airspace crossing requests (e.g. DACS)

11.8 As Tables 3 and 4 indicate, the Change Sponsor must consider the effect that MOD activity may have on other airspace users. The Change Sponsor will need to keep General Aviation fully informed of the changes to airspace, the availability of a crossing service (DACS etc). This will maximise awareness, thereby reducing the likelihood of infringement of active segregated airspace. Media engagement, local airspace group briefings and other informing activities will be put in place.

Section 3

12 Next steps in this proposal

12.1 This document will be submitted to the CAA as evidence to support the ACP-2019-18 Stage 2B.

12.2 It is part of the documentary evidence for the Stage 2 Assessment Gateway (document deadline 14 Jan 22, for the CAA's Assessment Gateway scheduled for 28 Jan 22).

12.3 The following CAP1616 timeline is anticipated:

Event as per CAP 1616	**Planned Date**
Stage 3 – Consult	29 Apr 22
Stage 4 – Update and Submit	3 Oct 22
Stage 5 - Decide	13 Feb 23
Stage 6 - Implement	18 May 23

Annex A

RAFAT ACP IMPACT STATEMENT

Background.
The Royal Air Force Aerobatic Team, officially known as RAFAT but more commonly referred to as The Red Arrows, perform high energy, highly dynamic low-level aerobatics in formations of up to 9 aircraft. Team training in the UK typically takes place from late September to late March using protected airspace over the Teams home-base at RAF Scampton. This airspace is 5nm radius up to 9300ft AGL and is known as EG R313. While training in the UK, there are normally 6 x 30-minute daily training slots (Monday-Friday) to allow 3 x slots for the main section and 3 x slots for the Synchro Pair. Typically, in early March, the Team are able to put the different formation elements together and start their 9-ship training, with a requirement for only 3 x 30-minute daily training slots. The Team then depart the UK for warmer climes and perfect their display routine abroad, typically in Greece and/or Cyprus. Following the Teams return to the UK in mid-late May, the display season typically provides the currency the Team need to keep their routine honed and consequently, practice display flying is infrequent during the summer months.

Airspace.
Having protected airspace is essential for the safety of the Team pilots and other airspace users. When display flying, the Team generally fly at 360kts, from 100ft AGL up to approximately 8000ft AGL if the weather allows a vertical routine. This makes reaction times slow, and it can be cumbersome to reactively manoeuvre the formation. As all pilots take references from the Team leader, there are very few pairs of eyes looking out for other traffic and the Team relies on a radar service for early warning of intruders. Following the decision to sell RAF Scampton, the Team will relocate to RAF Waddington in late 2022. While the Team plan to continue to focus almost entirely on the use of EG R313 for its training requirements, occasional use of RAF Waddington has been identified as best practice. This scenario is discussed in option 1 below. A more recent development has required further analysis of all future RAFAT training and this is discussed in option 2 below.

Option 1 (preferred). Occasional 30-minute practice slots over RAF Waddington are being considered to allow the Team to bed-in at their new home-base. This would allow the Teams important corporate visit and PR programme to continue without the complications of having to bus people to/from Scampton. Supervision of the Team would also be better served at their home-base and there are many other good reasons for considering this option. It must be stressed that this preferred option will only see infrequent RAFAT flying over RAF Waddington utilising protected airspace proposed under this ACP. Such activity will be limited to the minimum required and will be almost completely restricted to the winter training months before the Team deploy abroad in late March/early April each year. Such limited training will also provide vital information about the suitability of the site, should option 2 below be required in the longer-term.

Option 2. A recent development now threatens the future of EG R313 beyond April 2023, and it is conceivable that EG R313 will be removed at some point at, or after this date. Should this occur, the Team will be forced to enact a contingency plan that has been developed to ensure they can continue training. This would potentially see greater use of RAF Waddington and the protected airspace being proposed by this ACP. To ensure the site is suitable for such activity, option 1 will provide invaluable test and evaluation data as it is not yet known just how suitable the site will be. It must be stressed that if option 2 is used, EG R313 will be permanently removed.

Conclusion. The Teams preference is to retain the current status quo, with a near 100% focus on the continued use of EG R313, with occasional, short duration display slots overhead RAF Waddington. However, challenges surrounding the Teams move to RAF Waddington and the recent development of a threat to the very future of EG R313 itself has led to a requirement to look

at using alternative airspace. Without protected airspace, the risk of mid-air collision would be unacceptably high, and the RAF has a duty of care to mitigate risks and create an operating environment that is safe for all users. Through flexible use of airspace and the hope that EG R313 can continue to be used indefinitely, it is considered highly likely that any impact to other airspace users while RAFAT operate over RAF Waddington will be very limited. Should EG R313 become unusable, RAF Waddington may be used as one of a number of MOD sites used for Team training but in this situation, EG R313 will be permanently removed.

SAFETY ASSURANCE

Background. RAFAT display activity is governed by both military and civil regulations: Military Aviation Authority Regulatory Article 2335 (MAA RA 2335) and Civil Air Authority Civilian Air Publication 403 (CAP403). Whilst the applicability of the regulations can differ for some display activity (RA 2335 over MOD Property, CAP 403 over Non-MOD Property) the most restrictive of the regulations will be applied.

Assurance Activity. Display activity, including practice displays, will only be conducted within the bounds of an (MAA or CAA as required) approved display area and remains subject to the same rigorous levels of supervision, coordination, and control, of a full public display. The approval of a display area and profile considers the proximity of congested areas and the risk to 3rd parties. In addition, each practice is subject to authorisation and supervision by the Flying Display Supervisor who holds an accredited Flying Display Director qualification. All display activity overhead RAF Waddington will be monitored by Air Traffic Control and the Flying Display Supervisor who maintains direct radio communications to the participating aircraft. All displays (including practice) are video recorded to support rigorous debrief. The first and highest priority of any debrief is always any safety elements.

Conclusion. RAFAT display flying, as with all military flying, is risk managed to levels that are ‘As Low as Reasonably Practicable’ and ‘Tolerable’. Any activity that does not meet these criteria shall be ceased immediately until appropriate mitigation can be applied to assure continued safe conduct.