Future Airspace Strategy Implementation-ScTMA

Gateway Documentation:
Stage 3 Full Options Appraisal including Safety Assessment
ACP-2019-74

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Roles

Action	Role	Date
Produced	Airspace Change Specialist Airspace Change Compliance & Delivery	August 2025
Reviewed Approved	Manager Airspace Change Compliance & Delivery Airspace Change Compliance & Delivery	August 2025
Reviewed Approved	Airspace Implementation Manager Airspace & Future Operations	August 2025
Reviewed Approved	Manager Airspace Delivery Airspace & Future Operations	August 2025

Change History

Issue	Month/Year	Changes this issue (most recent first)
Version 3.0	August 2025	Updated following Cluster Gateway July 2025 including: • Change history Added. • Methodology section regarding fuel costs has been updated to reflect fuel cost volatility. • WebTAG and UK ETS text updated to remove the reference to European and to reflect emissions rather than number of flights • FASI Map updated to remove reference to Exeter and Manston airports.
Version 2.5	July 2025	Updated document relating to an identified design error relating to the STRAT SID from Edinburgh airport
Version 2.0	December 2024	Updated Document following Gateway Feedback. Updates include: • Clarification that the presented Fuel and CO_2e figures are for the cluster.
Version 1.0	August 2024	Original submission to CAA for Gateway Assessment.

Referenced Documents

Ref No	Name and description	Links
1.	FASIN-ScTMA- Progress through CAP1616	LINK
2.	Stage 1: Assessment Meeting Presentation	LINK
3.	Stage 1: Assessment Meeting Minutes	LINK
4.	Stage 1: Design Principles	LINK
5.	Stage 2: Design Options and Evaluation	LINK
6.	Stage 2: Initial Options Appraisal including Safety Appraisal	LINK
7.	Stage 3: Consultation Strategy	LINK
8.	Stage 3 Consultation Document	LINK
9.	CAP1616 Edition 5: The Process for Changing the Notified Airspace Design	LINK
10.	CAA Airspace Modernisation Strategy (CAP1711)	LINK
11.	CAP1385: CAA Policy on Performance-based Navigation (PBN): Enhanced Route Spacing Guidance	LINK
12.	Policy for the Design of Controlled Airspace Structures	LINK
13.	UK Government Department for Transport's 2017 Guidance to the CAA on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management (abbreviated to ANG2017)	LINK

1. Introduction

1.1 Scottish Airspace Modernisation and the Coordinated Consultation

1.1.1 The Airspace Change Organising Group (ACOG) was formed in 2019 under the direction of the UK Government Department for Transport (DfT) and Civil Aviation Authority (CAA), who co-sponsor and regulate airspace modernisation. ACOG is tasked with developing the UK Airspace Change Masterplan (the Masterplan), with oversight from an impartial Steering Committee of senior representatives drawn from across the aviation sector. More information is available on ACOG's website, www.acog.aero.

1.1.2 The UK's airspace is being upgraded as part of the UK Government's airspace modernisation programme. This includes redesigning the arrival and departure routes that serve many of the UK's airports. Airspace modernisation will be delivered, in part, through a series of linked Airspace Change Proposals (ACPs). Eighteen of the UK's airports are sponsoring ACPs to upgrade the arrival and departure routes that serve their operations in the lower airspace (below 7,000 ft) and NATS En-route PLC. (NERL [1]), the UK's licensed Air Navigation Service Provider for en-route operations, is currently sponsoring seven ACPs to upgrade the route network that sits above 7,000 ft, in busy portions of airspace where there are lots of climbing and descending flights, referred to as Terminal Control Areas (TMAs).

1.2 The Airspace Change Masterplan

1.2.1 Airspace modernisation is a complex programme with many organisations working together on a single coordinated implementation plan out to 2040 – the Masterplan. The changes that make up the Masterplan will upgrade the UK's airspace and deliver the objectives of airspace modernisation.

1.2.2 The Masterplan ACPs are grouped into four clusters. Each is based on the interdependencies between the individual proposals and analysis conducted by NATS into areas of the existing airspace where inefficiencies and delays are expected to worsen as traffic levels grow.

1.2.3 The Masterplan is organised into clusters so that the simpler airspace changes can be deployed sooner, realising benefits earlier. The timelines for making airspace changes are generally shorter for the simpler clusters, like the Scottish Terminal Control Area (ScTMA,) where there are fewer airports and less complex interdependencies.

1.2.4 Figure 1 illustrates the airport sponsored ACPs in each Masterplan cluster, located in:

- the west of the UK, known as the West Terminal Airspace.
- the north of England, known as the Manchester Terminal Control Area (MTMA)
- the south of Scotland, known as the Scottish Terminal Control Area (ScTMA); and
- the southeast of England, known as the London Terminal Control Area (LTMA).

[1] NATS is the UK's principal air navigation services provider and is split into two main businesses, which provide two distinct services:

- NATS (En Route) PLC (NERL) — the regulated business, which provides air traffic management services to aircraft within UK airspace and over the eastern part of the North Atlantic; and
- NATS (Services) Ltd (NSL) — the unregulated business, which provides air traffic control services at many of the UK's major airports (15 civil and 7 military airfields) and other airports overseas.

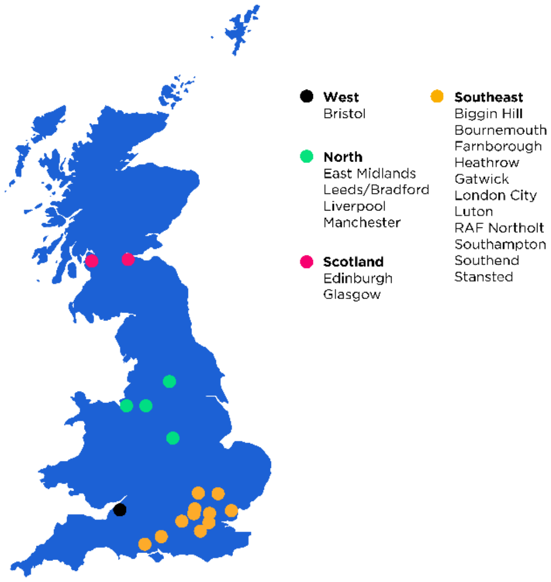


Figure 1: Four clusters of the Airspace Change Masterplan and airport sponsored ACPs.

1.2.5 This ACP is part of the Future Airspace Strategy Implementation North (FASI-N) Scotland cluster of airports as detailed in the Airspace Change Masterplan. This cluster will undertake a coordinated consultation which includes the following ACPs:

- Future Airspace Strategy Implementation North (FASI-N)- Scottish Terminal Manoeuvring Area (ScTMA) (ACP-2019-74). (This ACP)
- FASIN-Glasgow Airport Airspace (ACP-2019-46), and
- FASIN-Edinburgh Airport Airspace (ACP-2019-32).

1.2.6 Collectively, this change will be referred to as “Scottish Airspace Modernisation”.

1.3 Background

1.3.1 This Airspace Change Proposal (ACP) is sponsored by NERL. Today’s Air Traffic Services (ATS) route network has evolved over time but does not exploit modern navigation technology. The objective of this project is to update the route network and around the ScTMA in accordance with the CAA’s Airspace Modernisation Strategy (AMS) using Performance Based Navigation (PBN). This will provide benefits in capacity while minimising environmental impacts.

1.3.2 This document forms part of the document set required for the CAP1616 airspace change process: Stage 3 Consult: Options Appraisal (Phase II - Full) including a safety assessment and a full analysis of the proposed design. Its purpose is to provide a detailed quantitative assessment of the Without Airspace Change option as well as the proposed design (With Airspace Change) option which has been developed from the progressed Stage 2 concepts. This Full Options Appraisal (FOA) builds on the Stage 2 Initial Options Appraisal (IOA) (Reference 6) which was based around a qualitative assessment. This document will include a quantitative assessment of all reasonable costs and benefits of the design options, other costs and benefits described qualitatively and reasons why they could not be quantified. A preferred design option will also be provided, including reasons for the preference.

1.3.3 The scale of the change means that any small modification could ripple through the cluster design, impacting all three ACP designs. This does not prohibit any update to the design following consultation in response to stakeholder feedback, but it was considered disproportional to develop a second option prior to consultation. Therefore, only a single option is presented in this document which is compared to the Without Airspace Change scenario. The option included within this stage is:

- Option 1 – Modernised ATS Route Structure including providing connectivity to SID End points, STARs and holding facilities. (NERL Preferred Option)

1.3.4 This option has been developed in collaboration with Edinburgh Airport and Glasgow Airport and is aligned with the concepts progressed during Stage 2 of the CAP1616 process. Following Stage 2 of the CAP 1616 process, 2 concepts remained for the Eastern Element, an arrival and departure route for the ScTMA via the Firth of Forth which differed only by the impact to the Northumbria Gliding area to the south of the Firth of Forth. Continued engagement has indicated that the proposed mitigation of increasing the available volume of the gliding area, at any one time, by combining the northern and southern portions into a single airspace structure whilst reducing the volume of the extant northern area was acceptable to the gliding community. This has facilitated the design of the most efficient routings and therefore only a single concept has been applied to the proposed design.

1.4 Where are we in the airspace change process?

1.4.1 We have completed Stage 2 Develop and Assess[2], where we developed a long list of concept design options that addressed the Statement of Need and aligned with the Design Principles. The Step 2A Design Principle evaluation reduced this long list of concept design options by rejecting any which did not meet the described Design Principle progression criteria. Finally, the Step 2B Initial Options Appraisal provided a qualitative assessment on the remaining design concepts and Without Airspace Change where we further reduced our list of concepts.

1.4.2 Following the Stage 2 gateway, we have combined and developed our progressed concepts into a network airspace design. In collaboration with Edinburgh Airport and Glasgow Airport we have ensured the collective sponsor designs are compatible with one another so that when combined they produce a single cluster wide design for the ScTMA, the system-wide ScTMA airspace design.

1.4.3 We are currently in Stage 3 Consult/Engage (Figure 2) of the CAP 1616 process. During Stage 3, we formerly consult with our stakeholders on our proposed design. These responses will be analysed, and any subsequent design updates will be made prior to ACP submission at Stage 4 of the CAP 1616 process.

[2] In October 2023, the CAA released a new edition of the CAP1616 with a transition to this guidance for existing ACPs from January 2024. All submissions (Stages 1 and 2) for this ACP completed prior to January 2024 were in adherence with Ed. 4 of the CAP1616. All submissions following this date (Stage 3 onwards) will be in adherence with the new guidance document, CAP1616 Ed. 5.

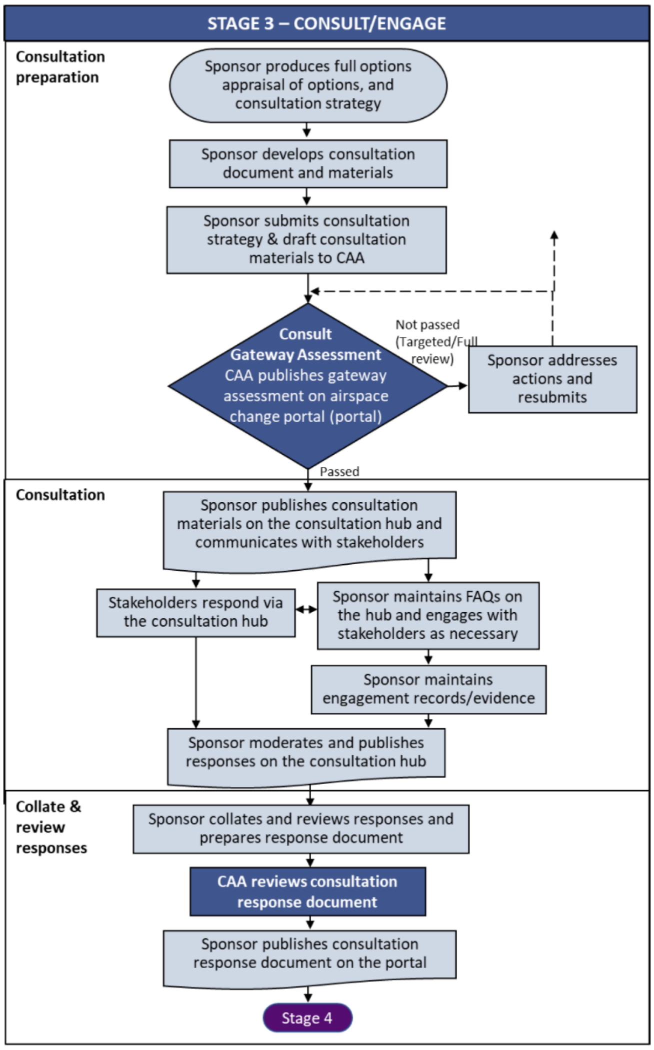


Figure 2: Overview of the CAP1616 Edition 5 Stage 3 Airspace Change Process.

1.4.4 Table 1 summarises the CAP1616 stages already undertaken for this ACP, providing links to previous submission documents with further information.

Airspace Change Stage	Summary	Link to Documents	Summary of engagement activity
Stage 1A [3]	In October 2019 NERL submitted our Statement of Need (SoN) to the CAA. NERL participated in an assessment meeting with the CAA on the 18th June 2019 as part of Step 1A of the CAP1616 process. The purpose of the assessment meeting was for NERL to present and discuss the SoN and to enable the CAA to consider whether the proposal falls within the scope of the formal airspace change process	SoN Assessment Meeting Presentation Minutes	No CAP1616 stakeholder engagement requirements.
Stage 1B	At Stage 1B, NERL developed a set of design principles with identified Stakeholders. The aim of the design principles is to provide high-level criteria that the proposed airspace design options should meet. They also provide a means of analysing the impact of different design options and a framework for choosing between or prioritising options.	Stage 1B Design Principle Report	NERL prepared draft Design Principles and shared these with identified stakeholders and requested feedback. Stakeholder feedback was used to inform the final Design Principles. A full summary of stakeholder engagement in Stage 1 is available in our Stage 1B Design Principle Submission Report
NERL passed the Stage 1 Define Gateway in June 2020			
	Amalgamation of our FASI-N ScTMA ACPs	News article pertaining to ACP amalgamation.	Stakeholders were informed of the NERL intention to amalgamate the two NERL FASIN ScTMA ACPs into a single submission. ACPs were formally amalgamated on 25th March 2022
Stage 2A	At Stage 2A, NERL developed a set of design concepts that addressed the Statement of Need and align with the design principles from Stage 1. Those options were then shared with stakeholder representatives (the same ones engaged with on the design principles), and the feedback used to further inform the proposals.	Stage 2A ScTMA Design Options and Evaluation	NERL developed Design Concepts to modernise the impacted airspace. These concepts were shared with identified stakeholders and requested feedback. Stakeholder feedback was used to inform the final design concepts.

[3] Originally, NERL submitted 2 statements of Need and completed Stage 1 for both ACPs. One focusing on the route network serving Edinburgh, and one focusing on the Glasgow Route network. Due to the interdependencies between the ACPs, these were combined and continued under the single Edinburgh ACP page.

Airspace Change Stage	Summary	Link to Documents	Summary of engagement activity
	The refined concepts were qualitatively assessed against the design principles and a Design Principle Evaluation was produced. NERLs Comprehensive List of Option concepts was then shortlisted before progressing to Stage 2B.		
Stage 2B	Stage 2B requires the Change Sponsor to carry out an Initial Options Appraisal (IOA) of the airspace change concepts which remained following Stage 2A. The IOA described the concepts under assessment and the Without Airspace Change options, before explaining the methodology used to assess each option and the IOA outcome. Following this the document explained, based on the IOA, which concepts were taken forward to Stage 3 and developed into a preferred option.	Stage 2B ScTMA Options Appraisal	No CAP1616 stakeholder engagement requirements.
NERL passed the Stage 2 Develop & Assess in June 2023			
Stage 3	Stage 3 is the Consult/Engage stage of the airspace change process. A change sponsor is required to prepare for a consultation by conducting a Full Options Appraisal (FOA) on the option(s) which have been developed from Stage 2B. The sponsor must also produce a consultation strategy (this document) and produce draft consultation materials. The gateway for Stage 3 is at the mid-point of the stage, once the CAA have assessed the outputs and passed the gateway, the sponsor can commence the consultation according to their published strategy. Following the close of the consultation, the sponsor must produce and publish a consultation response document before proceeding to Stage 4 of the process.		NERL have attended additional design activities with Edinburgh Airport and Glasgow Airport to collaboratively develop our concepts and airport options into a system-wide airspace design that will be consulted upon in a coordinated manner. In addition, NERL has attended engagement sessions with stakeholders that are likely to be impacted by our design to fully understand and inform the development of the proposed NERL design.

Table 1: ACP Progress to-date

2. How to read this document – illustrations of current and potential impacts

2.1.1 The following tables are based on CAP1616 5th edition guidance document CAP1616F, pages 36-41.

2.1.2 Following Stage 2, a single design option, alongside the Without Airspace Change, has been short-listed: this is Option 1. A separate analysis is presented for the Without Airspace Change and the option. For the option the table lists stakeholder groups alongside types of impact the option would have.

2.1.3 The changes described within this ACP will only affect the en-route network in airspace at and above 7,000 ft[4]. However, the changes in this ACP may have a consequential impact on trajectories below 7,000 ft. These impacts are captured within the corresponding airport ACP and are not described herein. In recognition of any consequential impact resulting from this ACP, the ACP Level has been agreed by the CAA as “Scaled Level 1”.

2.1.4 In this document we provide tables for the candidate design option. Note that this is compared against the Without Airspace Change scenario. We describe broadly what we expect the scale of impact might be, for the option.

2.1.5 This document will provide a quantitative assessment of the design option including impacts such as environmental and economic. This will include potential savings which might be achieved if the design option was implemented. As described below, owing to the proposed design option only applying to airspace at and above 7,000 ft, there are some impacts – such as air quality – which will not be affected. This assessment is based on the current design concepts and will be subject to refinement following the upcoming consultation, so the numbers may change as the design is refined. Additionally, the allocation of five-letter name codes to waypoints and route designators for routes is subject to availability and may also change as the design is refined. This is proportionate and in line with the expectations of CAP1616 Stage 3.

2.1.6 Airspace Change Sponsors are required to ensure the FOA meets certain requirements as specified in CAP1616. These are outlined in Table 2, along with where to find the information in this document.

[4] It is acknowledged that there are technical differences between altitudes and flight-levels, however, provided a common reference is used, there is no difference between comparing altitudes or flight levels. For the purpose of this document, 7,000ft (altitude) or FL70 (flight level) can be considered synonymous.

CAP1616 Full Options Appraisal requirement	Where to find in this document
Each shortlisted design option fully developed, including a comparison of its impacts against the Without Airspace Change scenarios	Section 2.2.2
All evidence gaps identified at Stage 2 fully assessed	Section 2.1.7 describes the methodology used to appraise the options quantitatively and qualitatively, including justification for the approach if not quantified.
All reasonable costs and benefits quantified	Section 2.2 describes the methodology used to appraise the options quantitatively and qualitatively, including justification for the approach if not quantified. Section 3 describes the costs and benefits for each option against the "Without Airspace Change" pre-implementation Without Airspace Change. Section 5 provides the monetised benefit over 10 years.
All other costs and benefits described qualitatively	
Reasons why costs and benefits have not been quantified	
Detail on the preferred design option, setting out reasons for the preference (where relevant)	NERL preferred option is presented in Section 3.3.
A more detailed assessment of the impacts on safety, if completed by the change sponsor	Section 6
A quantified and monetised environmental assessment of the design options, including direct and consequential impacts	Section 3 describes the costs and benefits for each option against the "Without Airspace Change" pre-implementation Without Airspace Change.

Table 2: CAP1616 Full Option Appraisal requirements and where to find them in this document.

2.1.7 As part of the Stage 2 submission, we explained that we planned to collect the following data and undertake additional assessments as part of our Full Options Appraisal, see Table 3.

Stage 2 Evidence Gaps	Where to find in this document
Fuel burn	Section 3 quantifies the costs and benefits for each option against the "Without Airspace Change" pre-implementation Without Airspace Change. Section 5 provides the monetised benefit over 10 years.
WebTAG CO_2e emissions analysis	
Monetisation of benefits and impacts	

Table 3: Evidence gaps identified at Stage 2 and where to find them in this document.

2.2 Methodology

2.2.1 The analysis for this ACP has used the most up to date and credible sources of data to assess the relevant impacts. These are referenced as part of this methodology.

Design Evolution

2.2.2 As part of the Stage 2 work, NERL split the design into geographic areas. Each geographic area presented concepts to describe how the proposed option would be developed in these areas. Interdependencies between the ACPs are described in the Cumulative Analysis Framework (CAF) part 1 and the resolution of these interdependencies described in the CAF part 2 here. An introduction to the CAF is included in Appendix B. The evolution of these concepts is described fully in the Consultation Document.

Traffic Forecasts

2.2.3 As part of the FASI-N ScTMA cluster of ACPs a common traffic forecast is required for use between all three ACP sponsors; NERL, Edinburgh Airport, and Glasgow Airport. The network change, this ACP, will require an understanding of the airports' traffic as well as any other traffic using the airspace.

2.2.4 As the airports are most familiar with their extant and future planned traffic including fleet mix, they have provided a traffic forecast for 2023 (Baseline year) as well as 2027 (the year of planned implementation) and 2036 (implementation + 10 years).

2.2.5 The remaining traffic for the number of 2023 Actual Flights are sourced from EUROCONTROL's Network Strategic Tool (NEST) model, considering initial flight planned data for those crossing the ScTMA region at Flight Level (FL) 255 and below.

2.2.6 This traffic has been grown by applying the NATS Dec23 Base Case Forecast to the 2023 traffic sample to forecast traffic volumes for 2027 and 2036.

Fuel and CO_2e modelling

2.2.7 Three sample days from this period were picked to give a good overall representation of Scottish TMA traffic on a north/south/mid North Atlantic Track structure, the day of the week and traffic counts per city pairs. These were the 6th, 25th and 28th July 2023.

2.2.8 The following assumptions were included in the fuel and CO_2e modelling:

- Free Route Deployment 3 at FL255 and above is implemented in both the Without Airspace Change and With Airspace Change Design models
- Edinburgh Airport (Pre-FOA Option 1A&1C) and Glasgow Airport (Option 5) Standard Instrument Departures (SIDs) and arrival transitions provided by the Airports were included in the With Airspace Change Design. Only a single system-wide design is analysed herein[5]
- It should be noted that a system-wide design that could deliver less benefit in terms of fuel burn and CO_2e emissions remains a possibility depending on the options progressed by the airport sponsors following the coordinated consultation. As all the proposed airport design options join the NERL network design at the same location, laterally and vertically, the airport option selected will have negligible impact on the fuel and CO_2e emissions resulting from the network design
- The same traffic sample has been used in both the Without Airspace Change and With Airspace Change Design models to ensure a fair comparison
- Edinburgh Airport has a 30:70 (easterly to westerly) runway in use split
- Glasgow Airport has a 26:74 (easterly to westerly) runway in use split
- Oceanic UK entry and exit points have been fixed such that they are the same per flight in the Without Airspace Change and With Airspace Change Design models

[5] Following FOA analysis the airports will select their options for consultation. The analysed option may not be progressed. Details of Edinburgh Airports and Glasgow Airports proposed designs can be found within their consultation materials.

- Without Airspace Change and With Airspace Change Design flight planned trajectories for 2023 have been extracted from NEST models provided by the Network Manager at EUROCONTROL. These have been imported and simulated in AirTOp
- Trajectory profiles are calculated using NATS business intelligence (BI) data statistics on observed climb/descend rates, speeds and turn rates for Base of Aircraft Data (BADA) aircraft groups
- All aircraft are modelled climbing at their maximum climb performance rates
- No abnormal scenarios (for example: emergencies, weather, missed approaches, go-arounds etc.) are simulated
- Positioning, helicopters and Military flights were not considered in this analysis
- No Danger Area activations are modelled
- A "blue sky" weather scenario, where no wind effects are present, was assumed
- No conflict resolution was applied en-route
- No General Aviation (GA) movements are modelled[6]

2.2.9 There is a correlation between fuel burnt and greenhouse gases emitted. For every 1 kg of fuel that is burnt 3.18 kg (2 d.p.) of CO_2 equivalent (CO_2e) is emitted.[7]

2.2.10 Fuel and CO_2e will be modelled using AirTOp with the assumptions described above.

2.2.11 The model provides a direct comparison between the planned routes of the Without Airspace Change option and the proposed With Airspace Change design option. Due to limitations in the software and an inability to accurately predict future airspace configurations and ATCO decisions it is not possible to predict a future actual track comparison. Therefore, it is considered best practice to compare like for like. A description of the methodology is available in Appendix C.

2.2.12 The model takes into consideration the aircraft type, planned lateral and vertical profiles to forecast the fuel burn and CO_2e.

2.2.13 The forecast fuel burn and CO_2e will be provided for the Without Airspace Change "Without Airspace Change" option and the proposed option for the planned implementation year (2027) and for the planned implementation year +10 (2036).

2.2.14 NERL Analytics have modelled 2 years in AirTOP, 2027 and 2036. This produces an average fuel/CO_2e per flight for both 2027 and 2036, and for both the without airspace change and with airspace change options.

2.2.15 A linear extrapolation between the data for 2027 and 2036 has been applied to calculate the total fuel/CO_2e for each intervening year.

2.2.16 The data will be further broken down to provide indicative values for the 10 most frequent city pairs for both Edinburgh Airport and Glasgow Airport. This will provide some indicative potential savings for particular routes.

2.2.17 Fuel burn (kg) was converted to a monetary value using the published IATA jet fuel in Europe price, £685.99 per tonne, at 861.39 USD (w/e 22nd March 2024) converted to GBP using a conversion factor 0.796 (XE currency exchange rate 2nd April 2024). Fuel prices and exchange rates are volatile, and will have changed since the analysis was undertaken. However, it is important to note that there is a forecast fuel reduction per flight for all options and so there would always be an NPV benefit, regardless of the price and conversion rates applied. This Full Options Appraisal was undertaken on the most up to date sources of data at the time, and as part of the Final Options Appraisal in CAP1616 Stage 4, the fuel prices and exchange rates will be updated.

[6] As the changes described in this submission are contained in the airspace at and above 7,000 ft, the difference in GA fuel and CO_2e between the 2 scenarios is considered to have no perceptible measurable difference, or no difference at all, and therefore is not modelled.

[7] https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

Communities- Noise

2.2.18 The impact of aviation noise is an important consideration to many communities living near or overflown by air traffic, in particular at lower levels.

2.2.19 The government Air Navigation Guidance 2017 (ANG 2017) provides the relative priorities for the minimisation of aviation noise, based on the altitude (height above mean sea level or amsl) which is summarised as:

- Below 4,000 ft, the impact of aviation noise should be prioritised, with preference given to options which are most consistent with existing arrangements
- Between 4,000 – 7,000 ft, minimising the impact of aviation noise should be prioritised unless this disproportionately increases CO_2 emissions
- From 7,000 ft upwards the minimising of CO_2 emissions is of greater priority than aviation noise.

2.2.20 Aircraft at and above 7,000 ft are not considered to have a significant impact on aviation noise. Therefore, as the changes described within this submission are contained within the airspace at and above 7,000 ft amsl, the design has not been required to factor in aviation noise into its decisions.

2.2.21 However, NERL remains cognisant of the high terrain that surrounds the ScTMA and have considered the impact of the proposed design on local communities when considering the locations of holds. In these instances, NERL have provided:

- An indication of the expected holding frequency
- An above ground level for the expected hold tracks in the hold
- An indicative comparison between the population[8] overflown for the extant and proposed hold locations where this is close to 7,000 ft
- The elevation of the highest population located under the hold
- A comparison between the area of National Parks (NPs), National Scenic Areas (NSAs) and National Landscapes (formerly Areas of Outstanding National Beauty – AONBs) overflown by holding aircraft.

Communities- Local Air Quality

2.2.22 Government guidance (ANG2017) says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality. There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.

Tranquillity

2.2.23 The ScTMA airspace sits atop multiple National Scenic Areas (NSAs), National Parks (NPs) and National Landscapes/Areas of Outstanding Natural Beauty (AONBs). NERL will identify which of these areas are overflown and describe any changes to this overflight in the proposed design.

2.2.24 The government altitude-based guidance states that “Where practicable, it is desirable that airspace routes below 7,000 ft should seek to avoid flying over Areas of Outstanding Beauty (AONBs) and National Parks”. However, where such an area is near an airport, such as Loch Lomond and the Trossachs, north of Glasgow, it may not be practicable to avoid these. As such, the overflight of these areas is taken into consideration alongside other impacts such as overflight of populated areas.

[8] Populations are based on the CACI (a company that provides demographic data) 2023 database.

Biodiversity

2.2.25 Airspace changes are unlikely to have an impact on biodiversity because they do not normally involve changes to ground based infrastructure (habitat disturbance). As the changes described within this ACP will only impact flights above 7,000 ft, no such ground-based infrastructure changes are associated with this proposal, therefore this proposal is not predicted to impact biodiversity.

Capacity/ Resilience

2.2.26 Forecast delay has been analysed to see how the proposed With Airspace Change option compares to the Without Airspace Change. This change in airborne delay is presented as a measure of the impact on capacity. This delay has been monetised which provides the overall cost of delay including:

- Fuel cost
- Crew cost
- Passenger compensation cost
- Maintenance cost.

2.2.27 Resilience in this context is the ability to react to unforeseen events that affect the air traffic network such as a runway closure or bad weather. It is how quickly the Air Traffic Controllers (ATCOs) and the airspace they control can recover from disruption. There are many elements to resilience including capacity, staffing, the nature of the disruption and airspace complexity.

2.2.28 These factors are so interlinked that a metric for the concept of resilience cannot be provided - it is not proportional to perform a quantitative assessment, nor to monetise it. However, the ability of an ATCO to react to and manage the impacts of a disruptive event is an indicator of resilience. Resilience will therefore be qualitatively assessed based on the proposed option by NERL Subject Matter Experts (SMEs).

General Aviation- Access

2.2.29 Controlled Airspace (CAS) is the name given to a specific volume of airspace which normally requires the pilot of an aircraft to obtain permission from the ATS provider prior to enter. The primary purpose of CAS is to provide a known airspace environment where separation between aircraft is provided in accordance with the International Civil Aviation Organization (ICAO) classification (A, B, C, D etc) in association with the flight rules under which the pilot is operating (Visual Flight Rules – VFR, or Instrument Flight Rules - IFR). CAS boundaries and classification changes have been quantitatively assessed for the Without Airspace Change and proposed With Airspace Change option. This includes any superfluous CAS that is proposed to be released (reclassified as Class G) to uncontrolled airspace for the proposed option.

General Aviation/ Commercial Airlines

2.2.30 The number of minutes of delay that the options reduce, or increase compared to the Without Airspace Change to assess the economic impact from increased effective capacity, has been analysed.

2.2.31 NATS has a standard cost-per-minute for delay of £30.01 for airborne delays up to 15 minutes and £91.82 for delays greater than 15 minutes. These values include a £25.96 per min fuel cost which will be removed from these values for the cost benefit analysis to avoid counting fuel twice. Subsequently a delay cost of £4.05 for airborne delays up to 15 minutes and £65.86 for delays greater than 15 minutes will be applied. This delay cost of £4.04 was used to monetise the annual airborne cost or benefit of the delay avoided.

Costs

2.2.32 Any airspace change will result in additional costs. The following key impact measures for each option have been qualitatively assessed:

- Training costs for airline crew
- Infrastructure costs for airports or Air Navigation Service Providers (ANSPs)
- Operational costs
- Deployment costs
- Other Costs

3. Design Options Appraisal

3.1 Overview

3.1.1 Each option will be assessed based on key analyses described in CAP1616 5th edition guidance document CAP1616F, pages 36-41.

3.2 Option 0: Without Airspace Change

3.2.1 The Without Airspace Change option is included for comparison purposes only. It is an analysis of the existing airspace design and operation and will provide a reference against which the proposed option can be compared.

Group	Impact	Level of Analysis
Communities	**Noise**	**Quantitative**

This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. The proposal is primarily contained within existing CAS meaning only limited new areas will be overflown. However, additional CAS is proposed to the east of the TMA over the Firth of Forth as well as a couple of other areas to offer protection to existing tracks.

The impacted area includes the following National Parks, National Scenic Areas and National Landscapes (formerly Areas of Outstanding Natural Beauty (AONBs)) that will be overflown by aircraft above 7,000 ft:

National Parks

Lake District, Loch Lomond and the Trossachs, Northumberland and the Yorkshire Dales.

National Scenic Areas

East Stewarty Coast, Eildon and Leaderfoot, Fleet Valley, Knapedale, Kyles of Bute, Loch Lomond, Nith Estuary, North Arran, River Earn (Comrie to St. Fillans), River Tay (Dunkeld), Scarba, Lunga and the Garvellachs, The Trossachs, and Upper Tweeddale.

National Landscapes

The North Pennines and Solway Coast.

Government guidance states that 7,000 ft is the maximum altitude at which noise is a priority for consideration. The changes described within this submission are to the airspace above 7,000 ft and therefore noise is not a priority for consideration. However, NERL is cognisant that the terrain situated under this airspace change is mountainous and that aircraft contained within the proposed holds may overfly the terrain at a height less than 7,000 ft. As this is the Without Airspace Change "Without Airspace Change" option there should be no discernible noise impact.

To acknowledge this potential overflight over the mountainous terrain, a quantitative analysis of this impact is included for the existing Edinburgh and Glasgow terminal holds:

FYNER

The FYNER hold is used by aircraft arriving at Glasgow Airport via the BRUCE STAR and operates between FL70 to FL140. Aircraft holding at FYNER may nominally overfly 51.2 km^2 of the Loch Lomond and the Trossachs National Park. A completed holding pattern would nominally overfly 655 people with highest dwelling having an elevation of 300 ft. The highest terrain situated under the FYNER hold is Beinn Mhòr (2,432 ft) in the Loch Lomond and the Trossachs National Park.

In 2023, aircraft held 23 times at FYNER for an average duration of 2 minutes and 32 seconds. The most aircraft holding on a single day was 1. This is forecast to increase to 1344 and 1787 times in 2027 and 2036 respectively. Hold duration is expected to raise to 4 min 30 s in 2027 and 4 min 54 s in 2036.

FOYLE

The FOYLE hold is used by aircraft arriving at Glasgow Airport via the ERSON STAR and operates between FL70 to FL140. Aircraft holding at FOYLE may nominally overfly 121.8 km^2 of the Loch Lomond and the

Trossachs National Park which includes part of the Trossachs NSA (18.6 km^2). A completed holding pattern would nominally overfly 2,971 people with highest dwelling having an elevation of 695 ft. The highest terrain situated under the FOYLE hold is Ben Ledi (2,884 ft) in the Loch Lomond and the Trossachs National Park. In 2023, no aircraft held at FOYLE. This is expected to increase to 292 and 434 times in 2027 and 2036 respectively. These aircraft are expected to hold for 4 min 6 s in 2027 and 3 min 42 s in 2036. STIRA The STIRA hold is shared between aircraft arriving at Edinburgh Airport and Glasgow Airport via the PTH STAR and operates between FL70 to FL140. Aircraft holding at STIRA do not nominally overfly any NSAs, National Parks or National Landscapes. A completed holding pattern would nominally overfly 41,973 people with highest dwelling having an elevation of 873 ft. The highest terrain situated under the STIRA is Ben Cleuch (2,366 ft) in the Ochil Hills. In 2023, aircraft held 91 times at STIRA for an average duration of 5 minutes and 59 seconds. The most aircraft holding on a single day was 3. This is expected to increase to 1,893 and 3,001 in 2027 and 2036 respectively. Hold duration is expected to fall to 5 min 6 s in 2027 before increasing to 5 min 36 s in 2036. TARTN The TARTN hold is used by aircraft arriving at Edinburgh airport via the AGPED, GIRVA, INPIP and TUNSO STARs and operates between FL70 to FL140. Aircraft holding at TARTN may nominally overfly 43.0 km^2 of the Upper Tweedale NSA. A completed holding pattern would nominally overfly 10,239 people with highest dwelling having an elevation of 1,066 ft. The highest terrain situated under the TARTN hold is Dunslair Heights (1,975 ft) in the Moorfoot Hills. In 2023, aircraft held 1096 times at TARTN for an average duration of 6 minutes and 34 seconds. The most aircraft holding on a single day was 32. This is expected to increase to 25,212 and 33,832 in 2027 and 2036 respectively. Hold duration is expected to fall to 3 min 30 s in 2027 before increasing to 4 min 18 s in 2036. LANAK The LANAK hold is used by aircraft arriving at Glasgow Airport via the AGPED, APPLE, RIBEL or BLACA STARs and operates between FL70 to FL140. Aircraft holding at LANAK do not nominally overfly any NSAs, National Parks or National Landscapes. A completed holding pattern would nominally overfly 76,084 people with highest dwelling having an elevation of 1,000 ft. The highest terrain situated under the LANAK hold has an elevation of 1,080 ft. In 2023, aircraft held 462 times at LANAK for an average duration of 10 minutes and 2 seconds. The most aircraft holding on a single day was 16. This is expected to increase to 10,370 and 11,664 in 2027 and 2036 respectively. Hold duration is expected to fall to 4 min 06 s in 2027 before increasing to 4 min 30s in 2036. It should be noted that the 2023 holding data is based on actual holding data and not modelled holding. Therefore, the comparison between the 2023 and 2027/2036 is not like for like. As this is the existing airspace, there will be no discernible change in noise impact from today beyond an increase in traffic in line with forecast traffic growth as a result of the Without Airspace Change option.		
Communities	**Local Air Quality**	**Qualitative**
Government guidance [9] says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality. There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.		

[9] See Air Navigation Guidance 2017

Wider Society	Greenhouse gas emissions	Quantitative

The impact assessment indicates that 258,591 flights per year would be impacted by the change in 2027, rising to 287,878 in 2036.

Computer modelling indicates an overall CO_2e production of 1,569 kT in 2027 rising to 1,768 kT in 2036.

The overall forecast production of CO_2e emissions in the opening year (2027) and 10 years post-implementation (2036) are shown below:

Year	Edinburgh Airport CO_2e (kT)		Glasgow Airport CO_2e (kT)		Other CO_2e (kT)	Total CO_2e (kT)
	Arrivals	Departures	Arrivals	Departures		
2027	365	577	198	323	105	1569
2028	372	588	200	325	106	1591
2029	378	599	202	327	107	1613
2030	384	610	204	329	108	1636
2031	390	621	206	331	109	1657
2032	397	632	208	334	110	1680
2033	403	643	210	336	111	1702
2034	409	654	211	338	112	1724
2035	415	665	213	340	113	1746
2036	422	676	215	342	114	1768

Table 4: Forecast CO_2e for Edinburgh airport Traffic, Glasgow Airport Traffic and the wider change for the years from implementation to 10 years post implementation for the extant airspace.

The 10 most flown city pairs for Edinburgh Airport and Glasgow Airport for the “Without Airspace Change” option is shown below:

	Airport	Departure Without Airspace Change CO_2e (T)		Arrival Without Airspace Change CO_2e (T)		Combined Without Airspace Change CO_2e (T)	
		2027	**2036**	**2027**	**2036**	**2027**	**2036**
Edinburgh Airport	Heathrow	30,288	34,867	26,799	30,847	57,087	65,714
	Dublin	12,207	13,523	8,231	9,555	20,437	23,078
	Stansted	21,791	25,082	20,649	23,771	42,440	48,853
	London City	13,383	15,404	10,741	12,366	24,124	27,770
	Amsterdam	17,019	19,522	8,786	10,091	25,804	29,613
	Belfast International	5,772	6,645	6,460	7,434	12,232	14,078
	Paris Charles de Gaulle	18,870	21,733	14,181	16,333	33,051	38,065
	Gatwick	17,267	19,883	14,772	17,003	32,039	36,886
	Bristol	9,176	10,558	8,478	9,754	17,654	20,313
	Southampton	6,240	7,181	6,114	7,037	12,354	14,218
Glasgow Airport	Heathrow	22,752	24,164	21,729	23,076	44,480	47,240
	Dublin	7,478	7,950	5,748	6,036	13,226	13,986
	Gatwick	16,415	17,429	15,202	16,147	31,617	33,576
	Amsterdam	13,365	14,197	7,305	7,760	20,670	21,956
	London City	11,034	11,722	8,793	9,336	19,828	21,057
	Belfast International	4,866	5,166	3,841	4,520	8,707	9,686
	Southampton [10]	0	0	0	0	0	0
	Bristol	9,329	9,907	9,552	10,142	18,882	20,049
	Stornoway	2	2	2,437	2,589	2,438	2,591
	Luton	7,688	8,332	7,421	7,884	15,108	16,216

Table 5: Forecast CO_2e for the 10 most commonly flown destinations from Edinburgh airport and Glasgow Airport for the implementation year and 10 years post implementation for the extant airspace.

Note that this analysis only includes flight planned routes and does not include any holding, vectoring, or streaming. Therefore, improvements in predictability leading to improved flight planning and reduced delay and holding could further increase this benefit.

As this is the existing airspace, there will be no discernible change in CO_2e impact from today beyond that resulting from an increase in traffic in line with forecast traffic growth as a result of the Without Airspace Change option.

GA aircraft typically operate below 6,000 ft in the airspace that sits beneath the proposed changes and do not operate to a schedule. It is therefore not possible to quantitatively forecast the impact of this proposed

[10] The forecast provided by Glasgow airport did not include any traffic between Glasgow airport and Southampton airport for 2027 or 2036.

change. As this is existing airspace there is no discernible change in CO_2e impact from today beyond what arises from natural fluctuations in the number of GA aircraft operating within the airspace.		
Wider Society	**Tranquillity**	**Qualitative**
This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic Areas and National Landscapes (formerly Areas of Outstanding Natural Beauty (AONBs)) which will be overflown by aircraft above 7,000 ft: National Parks Lake District, Loch Lomond and the Trossachs, Northumberland and the Yorkshire Dales National Scenic Areas East Stewarty Coast, Eildon and Leaderfoot, Fleet Valley, Knapedale, Kyles of Bute, Loch Lomond, Nith Estuary, North Arran, River Earn (Comrie to St. Fillans), River Tay (Dunkeld), Scarba, Lunga and the Garvellachs, The Trossachs, and Upper Tweeddale. National Landscapes The North Pennines and Solway Coast. Should the Without Airspace Change option be adopted, traffic will continue to fly as they do today and there will be no change in tranquillity impacts from the current operation.		
Wider Society	**Biodiversity**	**Qualitative**
Airspace changes are unlikely to have an impact on biodiversity because they do not normally involve changes to ground based infrastructure (habitat disturbance). As the changes described within this ACP will only impact flights above 7,000 ft, no such ground-based infrastructure changes are associated with this proposal, therefore this proposal is not predicted to impact biodiversity.		
Wider Society	**Capacity/ resilience**	**Quantitative**
There would be no change in the capacity or resilience of the airspace as there will be no change to the extant airspace. However, as traffic numbers grow in line with the forecast, effective sector capacity will become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience. Forecast delay is a good indicator of the capacity and resilience of an airspace. For the ScTMA impacted airspace for the year of implementation, the ScTMA airspace is forecast to generate 64,185 minutes of holding. This is expected to raise to 110,596 minutes 10 years after implementation.		
General Aviation	**Access**	**Quantitative**
Due to this airspace change sitting atop the coordinated changes being sponsored by Edinburgh Airport and Glasgow Airport any raising or lowering of the bases may or may not release CAS due to the dependency of the other sponsors' changes. Therefore, it is prudent to consider the airspace volumes impacted by all three sponsors when considering access to the airspace structures. The extant airspace classification, shown below show there are 2 large areas of Class A airspace, one to the north of the ScTMA airspace and one to the south. VFR flights are not permitted at any level within Class A airspace in the UK [11]. Outside of these areas, below FL195 is Class G or uncontrolled airspace. In Class G airspace aircraft are able to fly without an ATS being provided by ATC providing they are compliant with the requisite flight rules.		

[11] Segregated airspace such as Crossing Areas may exist in Class A airspace and permit, under certain conditions, limited VFR transit across the airspace. During activation these volumes of airspace remain Class A and, due to limited VFR access, are not considered separately here.

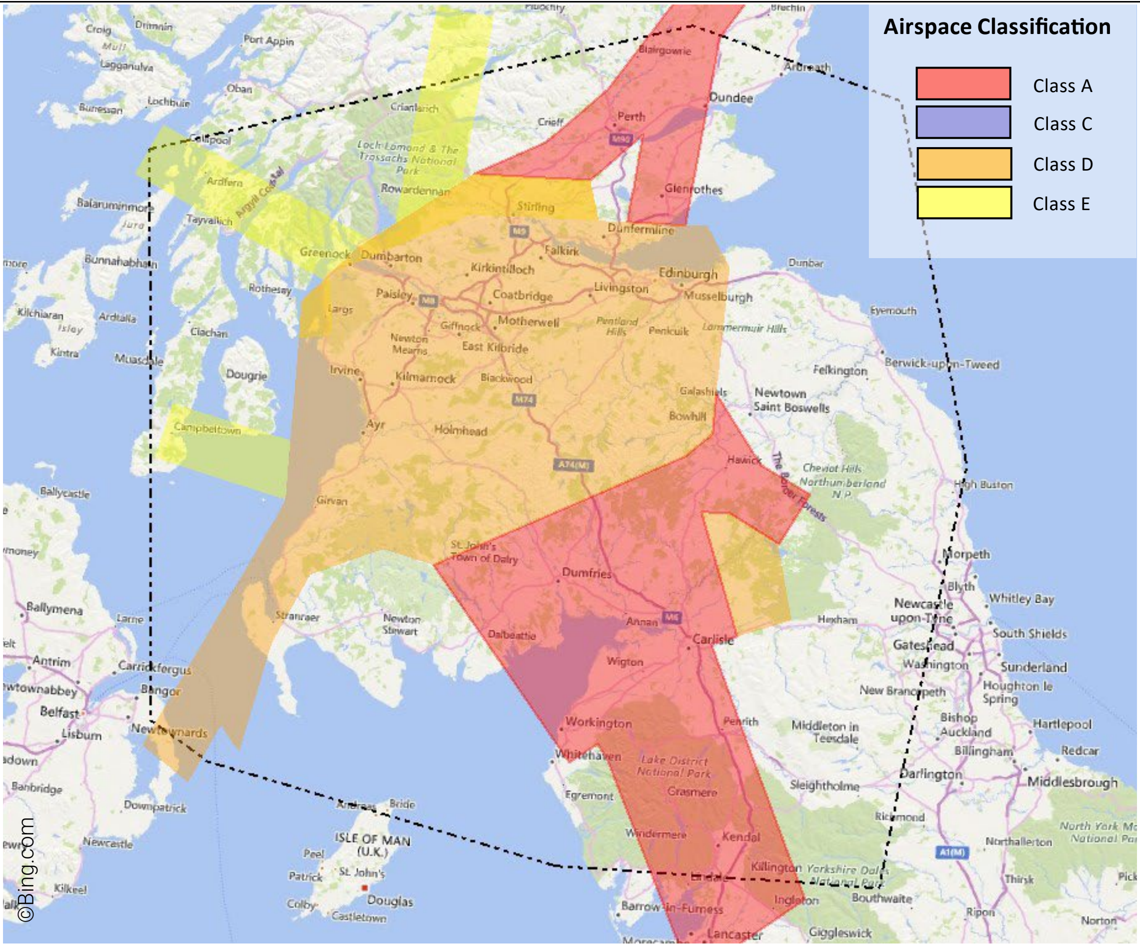


Figure 3: Extant airspace classifications within the ScTMA lateral limits below FL195.

Within the ScTMA the volumes of Class A, C, D and E airspace is shown below.

Airspace Classification	Extant Volume (NM^3)
A	6,714.0
C	0
D	17,691.7
E	11,964.2
Total	36,369.8

Table 6: Volume of airspace classifications contained within the lateral limits of the change.

A is the most restrictive airspace classification and E the least restrictive.

The bases of CAS within the ScTMA impacted airspace are shown below:

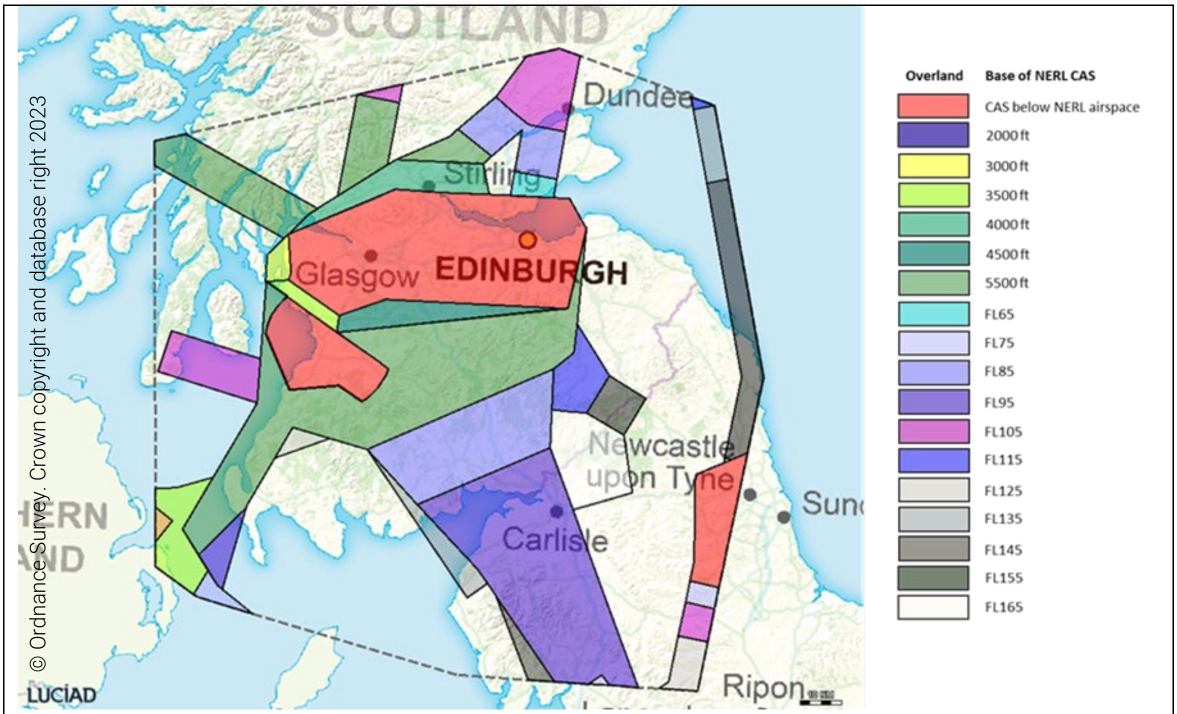


Figure 4: Extant CAS bases of NERL airspace within the ScTMA lateral limits below FL195.

Below the levels shown above is Airport CAS, uncontrolled or Class G airspace.

There would be no change in GA access as there will be no change to the extant airspace. However, as traffic numbers grow in line with the forecast, the ability of ATC to issue clearance to enter the CAS volumes will become diminished.

General aviation/commercial airlines	**Economic impact from increased effective capacity**	**Quantitative**

There will be no change in the economic impact from increased capacity as aircraft will continue to fly the arrival and departure routes they do today. However, as traffic numbers grow in line with the forecast, effective sector capacity may become constrained, partially due to increasing controller workload. This could in turn lead to a reduction in resilience.

Forecast delay is a good indicator of the capacity. For the year of implementation, the ScTMA airspace is forecast to generate 150,500 minutes of holding. This is expected to raise to 226,886 minutes 10 years after implementation. Using the NERL delay holding costs this has a NPV of £4,090,894 in the year of implementation raising to £5,181,13310 years after the planned implementation. Over the 10-year period the total delay cost is forecast as £47,192,818.

General aviation/commercial airlines	**Fuel burn**	**Quantitative**

The impact assessment indicates that 258,591 flights per year would be impacted by the change in 2027, rising to 287,878 in 2036.

Computer modelling indicates an overall fuel burn of 493 kT in 2027 rising to 556 kT in 2036.

The overall forecast fuel burn in the opening year (2027) and 10 years post-implementation (2036) are shown below:

Year	Edinburgh Airport Fuel burn (kT)		Glasgow Airport Fuel burn (kT)		Other Fuel burn (kT)	Total Fuel burn (kT)
	Arrivals	**Departures**	**Arrivals**	**Departures**		
2027	115	182	62	102	33	494
2028	117	185	63	103	33	501
2029	119	189	63	103	34	508
2030	121	192	64	104	34	515
2031	123	196	65	104	34	522
2032	125	199	65	105	35	529
2033	127	203	66	105	35	536
2034	129	206	67	106	35	543
2035	131	210	67	106	36	550
2036	133	213	68	107	36	557

Table 7: Forecast fuel burn for Edinburgh airport Traffic, Glasgow Airport Traffic and the wider change for the years from implementation to 10 years post implementation.

The 10 most flown city pairs for Edinburgh Airport and Glasgow Airport for the Without Airspace Change option are shown below:

	Airport	Departure Without Airspace Change Fuel burn (T)		Arrival Without Airspace Change Fuel burn (T)		Combined Without Airspace Change Fuel burn (T)	
		2027	2036	2027	2036	2027	2036
Edinburgh Airport	Heathrow	9,525	10,965	8,427	9,700	17,952	20,665
	Dublin	3,839	4,252	2,588	3,005	6,427	7,257
	Stansted	6,853	7,888	6,493	7,475	13,346	15,363
	London City	4,209	4,844	3,378	3,889	7,586	8,733
	Amsterdam	5,352	6,139	2,763	3,173	8,115	9,312
	Belfast International	1,815	2,089	2,031	2,338	3,846	4,427
	Paris Charles de Gaulle	5,934	6,834	4,459	5,136	10,393	11,970
	Gatwick	5,430	6,253	4,645	5,347	10,075	11,599
	Bristol	2,886	3,320	2,666	3,067	5,552	6,388
	Southampton	1,962	2,258	1,923	2,213	3,885	4,471
Glasgow Airport	Heathrow	7,155	7,599	6,833	7,257	13,987	14,855
	Dublin	2,352	2,500	1,808	1,898	4,159	4,398
	Gatwick	5,162	5,481	4,780	5,078	9,942	10,559
	Amsterdam	4,203	4,464	2,297	2,440	6,500	6,904
	London City	3,470	3,686	2,765	2,936	6,235	6,622
	Belfast International	1,530	1,625	1,208	1,421	2,738	3,046
	Southampton [12]	0	0	0	0	0	0
	Bristol	2,934	3,115	3,004	3,189	5,938	6,305
	Stornoway	1	1	766	814	767	815
	Luton	2,417	2,620	2,333	2,479	4,751	5,099

Table 8: Forecast fuel burn for the 10 most commonly flown destinations from Edinburgh airport and Glasgow Airport for the implementation year and 10 years post implementation.

As this is the existing airspace, there will be no discernible change in fuel burn impact from today beyond that resulting from an increase in traffic in line with forecast traffic growth as a result of the Without Airspace Change option.

Commercial airlines	Training costs	Qualitative

There would be no additional training required as there will be no change to the extant airspace or procedures.

[12] The forecast provided by Glasgow airport did not include any traffic between Glasgow airport and Southampton airport for 2027 or 2036.

Commercial airlines	**Other costs**	**Qualitative**
There would be no additional associated costs for airlines as there will be no change to the extant airspace.		
Airport/air navigation service provider	**Infrastructure costs**	**Qualitative**
There would be no additional associated infrastructure costs as there will be no change to the extant airspace.		
Airport/air navigation service provider	**Operational costs**	**Qualitative**
There would be no additional associated operational costs as there will be no change to the extant airspace.		
Airport/air navigation service provider	**Deployment costs**	**Qualitative**
There would be no additional associated deployment costs as there will be no change to the extant airspace.		
Airport/air navigation service provider	**Other costs**	**Qualitative**
There would be no additional costs as there will be no change to the extant airspace.		

Table 9: Option 0: Without Airspace Change ("Without Airspace Change" Full Options Appraisal)

3.3 With Airspace Change- Option 1: Modernised ATS Route Structure including providing connectivity to SID End points, STARs and holding facilities. (NERL Preferred Option)

3.3.1 Option 1 modernises the ScTMA airspace through the introduction of systemised routes where appropriate and the introduction of new arrival and departure connectivity to the east of the TMA. It utilises PBN routings which removes the dependency on ground-based navigation aids, ensures the ATS routes are optimally spaced and uses the smallest volume of containment to ensure a safe and efficient Air Traffic Service can be provided.

Group	Impact	Level of Analysis
Communities	**Noise**	**Quantitative**

This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. The proposal is primarily contained within existing CAS meaning only limited new areas will be overflown. However, additional CAS is proposed to the east of the TMA over the Firth of Forth as well as a couple of other areas to offer protection to existing tracks.

The impacted area includes the following National Parks, National Scenic Areas and National Landscapes (formerly Areas of Outstanding Natural Beauty (AONBs)) will be overflown by aircraft above 7,000 ft:

National Parks

Lake District, Loch Lomond and the Trossachs, Northumberland and the Yorkshire Dales

National Scenic Areas

East Stewarty Coast, Eildon and Leaderfoot, Fleet Valley, Knapedale, Kyles of Bute, Loch Lomond, Nith Estuary, North Arran, River Earn (Comrie to St. Fillans), River Tay (Dunkeld), Scarba, Lunga and the Garvellachs, The Trossachs, and Upper Tweeddale.

National Landscapes

The North Pennines and Solway Coast.

Government guidance states that 7,000 ft is the maximum altitude at which noise is a priority for consideration. The changes described within this submission are to the airspace above 7,000 ft and therefore noise is not a priority for consideration. However, NERL is cognisant that the terrain situated under this airspace change is mountainous and that aircraft contained within the proposed holds may overfly the terrain at a height less than 7,000 ft.

To acknowledge this potential overflight over the mountainous terrain, a quantitative analysis of this impact is included for the proposed Edinburgh Airport and Glasgow Airport terminal holds:

FYNER

The FYNER hold is proposed to be flipped, making it Right Hand and the base raised to FL90 equivalent to an altitude increase of 2,000 ft. Aircraft holding at a higher level will have a smaller impact than those holding at a lower level.

Aircraft holding at proposed FYNER hold may nominally overfly 17.3 km^2 of the Loch Lomond and the Trossachs National Park and the Kyles of Brute NSA, a reduction in NP, NSA, and National landscape overflight of 33.9 km^2.

A completed holding pattern in the proposed hold would nominally overfly 304 people (of whom, 265 will be newly overflown), a reduction of 351 people with highest dwelling having an elevation of 314 ft, a marginal increase of 14 ft. The highest terrain situated under the proposed FYNER hold is Sgorach Mor (1,972 ft) in the Kyles of Brute. Therefore, the track of aircraft in this hold would be >7,000 ft agl. This represents an increase of 2,460 ft in the height of overflight.

In 2023, aircraft held 23 times at FYNER for an average duration of 2 minutes and 32 seconds. The most aircraft holding on a single day was 1. This is expected to increase to 269 and 447 times in 2027 and 2036 respectively. Hold duration is expected to raise to 3 min 12 s in 2027 and 3 min 42 s in 2036. The average holding time is forecast to reduce by 1 min 18 s in 2027 and by 1 min 12 s 2036.

	Extant FYNER (2027)	Extant FYNER (2036)	Proposed FYNER (2027)	Proposed FYNER (2036)
Holding Fix Location	560256.12N 0050655.19W			
Inbound track	115.7			
Direction of PTN	Left		Right	
Speed (kts)	230			
Outbound Leg	1 min			
Levels	FL70 – FL140		FL90 – FL140	
Highest Terrain (overflight agl)	2,432 ft (4,568 ft)		1,972 ft (7,028 ft)	
Total Aircraft Holding	1344	1787	269	447
Average Daily holding	~4	~5	~1	~1
Average Hold duration	4 min 30 s	4 min 54 s	3 min 12 s	3 min 42 s
Population overflown by hold	655		304 (265 new)	
Highest population elevation	300 ft		314 ft	
National Landscape/National Park/ NSA area overflown	51.2 km^2		17.3 km^2	

Table 10: Comparison between the extant FYNER and proposed FYNER holds for the years from implementation to 10 years post implementation.

This modification reduces any overflight below 7,000 ft agl and reduces the population overflown as well as the frequency of overflight. Therefore, the proposed FYNER hold offers reduced noise impacts over the current holding arrangements.

COYLE

The COYLE hold is proposed to replace the FOYLE hold and provide a holding location for traffic arriving at Glasgow Airport that would have previously used the STIRA hold. It is proposed to be moved 2 NM further north allowing improved descent profiles for aircraft arriving at Glasgow Airport. Like the extant FOYLE hold, the COYLE hold is proposed to operate between FL70 to FL140.

Aircraft holding at COYLE may nominally overfly 201.8 km^2 of the Loch Lomond and the Trossachs National Park, an increase of 80 km^2.

A completed holding pattern would nominally overfly 1,600 people (of whom, 352 will be newly overflown), a reduction of 1,371 people with highest dwelling having an elevation of 689 ft, a marginal decrease of 6 ft. The highest terrain situated under the proposed COYLE hold is Benvane (2,694 ft) in the Loch Lomond and the Trossachs National Park.

In 2023, no aircraft held at FOYLE. In 2027, 666 aircraft are forecast to hold at COYLE and a similar quantity, 776, is expected to hold in 2036. Hold duration is expected to be 4 min 12 s in 2027 and 3 min 42 s in 2036. This is a comparable duration to what is forecast in the Without Airspace Change scenario.

	FOYLE (2027)	FOYLE (2036)	COYLE (2027)	COYLE (2036)
Holding Fix Location	560834.13N 0042256.41W		561031.3900N 0042228.8900W	
Inbound track	187.5		187.52	
Direction of PTN	Left		Right	
Speed (kts)	230		230	
Outbound Leg	1 min		3.5 NM	
Levels	FL70 – FL140		FL70 – FL140	
Highest Terrain (overflight agl)	2,884 ft (4,116 ft)		2,694 ft (4,306 ft)	
Total Aircraft Holding	292	434	666	776
Average Daily holding	~1	~1	~2	~2
Average Hold duration	4 min 6 s	3 min 42 s	4 min 12 s	3 min 42 s
Population overflown by hold	2,971		1,600 (352 new)	
Highest population elevation	695 ft		689 ft	
National Landscape/National Park/ NSA area overflown	121.8 km^2		201.8 km^2	

Table 11: Comparison between the extant FOYLE and proposed COYLE holds for the years from implementation to 10 years post implementation.

In the design the number of aircraft holding at FOYLE is significantly greater than in the Without Airspace Change "Without Airspace Change" option. This is due to the proposed COYLE hold is used by aircraft arriving through the new Firth of Forth connectivity as well as traffic arriving from Free Route Airspace (FRA).

This proposed hold reduces the population overflown but may be used with greater frequency. On average, this is expected to be <2 per day and therefore considered to offer an improvement over the extant FOYLE hold.

STIRA

The shared STIRA hold is proposed to be removed, thus removing all planned holding in this area. Therefore, this option provides reduced noise impacts for the population in the vicinity of the extant STIRA hold.

TART3

The TART3 hold is proposed to replace the TARTN hold and is proposed to be located 5 NM further south than the extant TARTN hold. The proposed hold has been rotated and raised, operating between FL100 and FL140, equivalent to an altitude increase of 3,000 ft. Aircraft holding at a higher level will have a smaller impact than those holding at a lower level.

Aircraft holding at the proposed TART3 may nominally overfly 50.4 km^2 of the Upper Tweeddale NSA, an increase of 7.4 km^2 when compared to the extant TARTN hold.

A completed holding pattern would nominally overfly 9,648 people (of whom, 153 will be newly overflown), a reduction of 591 with highest dwelling having an elevation of 1,017 ft. The highest terrain situated under the proposed TART3 hold is Dun Rig (2,435 ft) in the Manor Hills. Therefore, the track of aircraft in this hold would be >7,000 ft agl. This represents an increase of 2,540 ft in the height of overflight.

In 2023, aircraft held 1096 times at TARTN for an average duration of 6 minutes and 34 seconds. The most aircraft holding on a single day was 32. In 2027, 20,803 aircraft are forecast to hold at TART3 raising to 29,859 in 2036. This is ~15 % less than forecast for the extant TARTN hold. Hold duration is expected to be comparable to the extant TARTN hold. However, the total holding time for these arrival routes is expected to fall by 13,233 mins p.a in 2027 (15%) and 18,793 mins p.a. in 2036 (13%) representing a reduction in the frequency of overflight in this region. The reduction in holding is partly due to aircraft flight planning to arrive via the Firth of Forth routes and holding elsewhere in the ScTMA, and partly through an increased efficiency in the design reducing holding within the ScTMA airspace.

	TARTN (2027)	**TARTN (2036)**	**TART3 (2027)**	**TART3 (2036)**
Holding Fix Location	554301.89N 0030818.73W		553800.1095N 0030910.9298W	
Inbound track	013.5		340	
Direction of PTN	Left		Left	
Speed (kts)	230		230	
Outbound Leg	3.5 NM		1 min	
Levels	FL70 – FL140		FL100 – FL140	
Highest Terrain (overflight agl)	1,975 ft (5,025 ft)		2,435 ft (7,565 ft)	
Total Aircraft Holding	25,212	33,832	20,803	29,859
Average Daily holding	~ 69	~93	~57	~82
Average Hold duration	3 min 30 s	4 min 18 s	3 min 36 s	4 min 12 s
Population overflown by hold	10,239		9,648 (153 new)	
Highest population elevation	1,066 ft		1,017 ft	
National Landscape/National Park/ NSA area overflown	43.0 km^2		50.4 km^2	

Table 12: Comparison between the extant TARTN and proposed TART3 holds for the years from implementation to 10 years post implementation.

This proposed change reduces any overflight below 7,000 ft agl and offers reduced noise impacts over the current holding arrangements.

LESMA

The LESMA hold is proposed to replace the LANAK hold and is proposed to be located 5 NM further south than the extant LANAK hold. The proposed hold has been rotated and raised, operating between FL90 and FL140, equivalent to an altitude increase of 2,000 ft. Aircraft holding at a higher level will have a smaller impact than those holding at a lower level.

Aircraft holding at the proposed LESMA should not nominally overfly any NSAs, National Parks or National Landscapes.

A completed holding pattern would nominally overfly 14,274 people, a reduction of 61,810 people with highest dwelling having an elevation of 1,023 ft, comparable to the extant LANAK hold. The highest terrain situated under the LESMA hold has an elevation of 1,601 ft, an increase of 521 ft. However, due to the raising of the lowest level in this hold, the track of aircraft in this hold would be >7,000 ft agl. This represents an increase of 1,479 ft in the height of overflight.

In 2023, aircraft held 462 times at LANAK for an average duration of 10 minutes and 2 seconds. The most aircraft holding on a single day was 16. In 2027, 7,564 aircraft are forecast to hold at LESMA raising to 7,619 in 2036. This is ~30 % less than forecast for the extant LANAK hold. Hold duration is expected to be 3 min 12 s in 2027 and 3 min 6 s in 2036. This is a reduction on what is forecast for the extant LANAK hold. The reduction in holding is partly due to aircraft flight planning to arrive via the Firth of Forth routes and holding elsewhere in the ScTMA, and partly through an increased efficiency in the design reducing holding within the ScTMA airspace.

	LANAK (2027)	**LANAK (2036)**	**LESMA (2027)**	**LESMA (2036)**
Holding Fix Location	554200.87N 0035618.64W		553648.3800N 0035738.8500W	
Inbound track	301.00		330	
Direction of PTN	Right		Right	
Speed (kts)	230		230	
Outbound Leg	4 NM		1 min	
Levels	FL70 – FL140		FL90 – FL140	
Highest Terrain (overflight agl)	1,080 ft (5,920 ft)		1,601 ft (7,399 ft)	
Total Aircraft Holding	10,370	11,664	7,564	7,619
Average Daily holding	~28	~32	~21	~21
Average Hold duration	4 min 6 s	4 min 30 s	3 min 12 s	3 min 6 s
Population overflown by hold	76,084		14,274	
Highest population elevation	1,000 ft		1,023 ft	
National Landscape/National Park/ NSA area overflown	None			

Table 13: Comparison between the extant LANAK and proposed LESMA holds for the years from implementation to 10 years post implementation.

This modification reduces overflight below 7,000 ft agl and significantly reduces the population overflown. Therefore, the proposed LESMA hold offers reduced noise impacts over the current holding arrangements.

STOBS

The proposed STOBS hold will serve traffic arriving at Edinburgh airport that would have used the shared STIRA hold. The STOBS hold is proposed to operate between FL110 and FL140. The highest terrain nominally overflown by aircraft in the STOBS hold is Dundee Law and has an elevation of 571 ft. As this hold is substantially higher than 7,000ft agl, no population counts have been calculated.

This modification reduces overflight below 7,000 ft agl and offers reduced noise impacts over the current holding arrangements at the STIRA hold.

WORM2

The proposed WORM2 hold will serve traffic arriving at Edinburgh airport via the new Firth of Forth arrival routes. These aircraft would have previously used the STIRA or TARTN holds. The WORM2 hold is proposed to operate between FL100 and FL140. There is no significant terrain higher than 500 ft situated below the nominal track of this hold. As this hold is substantially higher than 7,000ft agl, no population counts have been calculated.

This modification reduces overflight below 7,000 ft agl and offers reduced noise impacts over the current holding arrangements at the STIRA and TARTN holds.

Overall, the proposed design will reduce the population overflown at or around 7,000 ft by modifying the ScTMA holds so that they are higher where able and more optimally located for aircraft arriving at the ScTMA airfields. Where the holds have been relocated, the population overflown is reduced therefore delivering further benefit. The design has enabled improved departure profiles further limiting the impact of aircraft noise within the vicinity of the ScTMA.

Communities	Local Air Quality	Qualitative

Government guidance says that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on air quality. There will be no changes in aircraft trajectories below 1,000 ft proposed in this ACP, therefore there will be no change in air quality from today.

Wider Society	Greenhouse gas emissions	Quantitative

The impact assessment indicates that 258,591 flights per year would be impacted by the change in 2027, rising to 287,878 in 2036.

Computer modelling indicates an overall CO_2e production of 1,551 kT in 2027 rising 1,744 kT in 2036. This represents a reduction of 18 kT CO_2e in 2027 and a reduction of 25 kT in 2036.

The overall forecast production of CO_2e emissions in the opening year (2027) and 10 years post-implementation (2036) are shown below:

Year	Edinburgh Airport CO_2e (kilo Tonnes)		Glasgow Airport CO_2e (kilo Tonnes)		Other CO_2e (kilo Tonnes)	Total CO_2e (kilo Tonnes)	Difference to Without Airspace Change (kilo Tonnes)
	Arrivals	Departures	Arrivals	Departures			
2027	365	568	197	315	106	1551	-18
2028	371	579	199	317	107	1572	-19
2029	377	589	200	319	108	1594	-19
2030	383	600	202	321	109	1615	-20
2031	389	611	204	323	110	1636	-21
2032	395	622	205	325	111	1658	-22
2033	401	632	207	327	112	1679	-22
2034	407	643	210	329	113	1701	-23
2035	413	654	210	331	114	1722	-24
2036	419	664	212	333	115	1744	-25

Table 14: Forecast CO_2e for Edinburgh airport Traffic, Glasgow Airport Traffic and the wider change for the years from implementation to 10 years post implementation for the proposed changes.

The 10 most flown city pairs for Edinburgh Airport and Glasgow Airport for Option 1 is shown below:

	Airport	Departure With Airspace Change CO_2e (T)		Arrival With Airspace Change CO_2e (T)		Combined With Airspace Change CO_2e (T)	
		2027	2036	2027	2036	2027	2036
Edinburgh Airport	Heathrow	30,231	34,801	26,600	30,619	56,831	65,420
	Dublin	11,374	12,619	8,407	9,760	19,781	22,379
	Stansted	21,828	25,124	20,552	23,660	42,380	48,784
	London City	13,359	15,377	10,686	12,303	24,045	27,680
	Amsterdam	16,362	18,764	8,650	9,935	25,011	28,700
	Belfast International	5,735	6,601	6,593	7,587	12,327	14,189
	Paris Charles de Gaulle	18,895	21,761	14,148	16,294	33,043	38,055
	Gatwick	17,270	19,887	14,682	16,900	31,952	36,787
	Bristol	9,231	10,621	8,437	9,708	17,668	20,330
	Southampton	6,312	7,263	6,089	7,008	12,401	14,272
Glasgow Airport	Heathrow	21,974	23,339	21,623	22,964	43,598	46,303
	Dublin	7,202	7,670	5,850	6,144	13,052	13,814
	Gatwick	16,061	17,053	15,108	16,047	31,169	33,100
	Amsterdam	13,117	13,933	7,259	7,711	20,376	21,645
	London City	10,736	11,405	8,689	9,225	19,425	20,630
	Belfast International	4,673	4,961	3,931	4,622	8,603	9,583
	Southampton [13]	0	0	0	0	0	0
	Bristol	9,071	9,633	9,511	10,099	18,582	19,731
	Stornoway	2	2	2,280	2,423	2,282	2,425
	Luton	7,368	7,990	7,367	7,828	14,735	15,818

Table 15: Forecast CO_2e for the 10 most commonly flown destinations from Edinburgh airport and Glasgow Airport for the implementation year and 10 years post implementation for the proposed airspace.

WebTAG was used to monetise the greenhouse gas impact over 10 years after the proposed changes. 62% of CO_2e emissions has been classified as traded [14], and 38% as non-traded.

The monetised NPV benefit calculated by WebTAG due to the reduction in per flight GHG emissions is £50,721,493.

Note that this analysis only includes flight planned routes and does not include any holding, vectoring, or streaming. Therefore, improvements in predictability leading to improved flight planning and reduced delay and holding could further increase this benefit.

[13] The forecast provided by Glasgow airport did not include any traffic between Glasgow airport and Southampton airport for 2027 or 2036.

[14] In accordance with the UK Emissions Trading Scheme, CO_2e emissions have been apportioned as either "traded" or "non-traded" within WebTAG via NATS' analysis of traffic origins and destinations.

The WebTAG GHG worksheet outputs are shown in Appendix A: Greenhouse Gas WebTAG Summary.

This analysis demonstrates that the proposed design will deliver a reduction in CO_2e when compared to the Without Airspace Change "Without Airspace Change" option. This reduction is a result of improved connectivity through the introduction of the Firth of Forth routes as well as an increase in efficiency of the ScTMA airspace design. This should lead to a reduction in holding as well as improved flight profiles achieved through the introduction of systemised routes.

GA aircraft typically operate below 6,000 ft in the airspace that sits beneath the proposed changes and do not operate to a schedule. However, the proposed NERL design is expected to improve access to GA aircraft above 7,000 ft through the raising of CAS bases and lowering of airspace classifications. NERL has no way of knowing how the greenhouse gas emissions of GA may be impacted by this proposed change.

Wider Society	Tranquillity	Qualitative

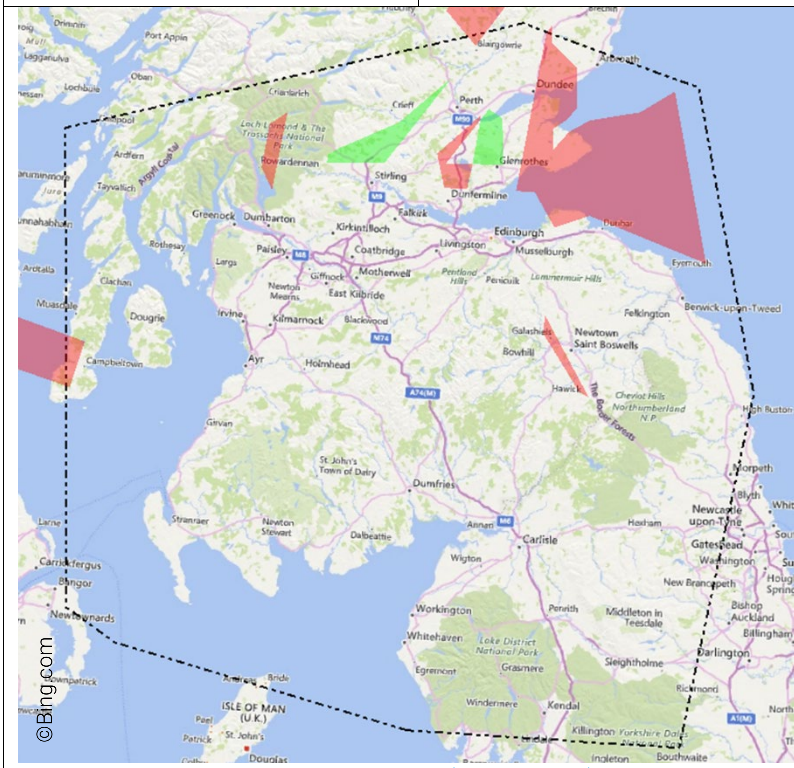


Figure 5: Proposed location of new CAS (shown in red) and released CAS (shown in green) below FL195.

This proposal covers a large portion of Scotland, Northern England and extends West towards the Irish coast. This area includes the following National Parks, National Scenic Areas and National Landscapes (formerly Areas of Outstanding Natural Beauty (AONBs)) which will be overflown by aircraft above 7,000 ft:

National Parks

Lake District, Loch Lomond and the Trossachs, Northumberland and the Yorkshire Dales

National Scenic Areas

East Stewarty Coast, Eildon and Leaderfoot, Fleet Valley, Knapedale, Kyles of Bute, Loch Lomond, Nith Estuary, North Arran, River Earn (Comrie to St. Fillans), River Tay (Dunkeld), Scarba, Lunga and the Garvellachs, The Trossachs, and Upper Tweeddale.

National Landscapes

The North Pennines and Solway Coast.

The NERL Option is not proposing any track changes below 7,000 ft. The option proposes to introduce and release CAS below FL195 as shown above:

The design proposes new CAS (131.1 km^2) overhead the Loch Lomond National Park to provide containment for the proposed COYLE hold in line with the CAA requirements for hold containment. The extant FOYLE hold was infrequently used, and this trend is expected to continue. In addition, 0.3 km^2 of CAS has been released overhead the Loch Lomond National Park through the redefinition of the ScTMA boundaries.

The design proposes to introduce new CAS overhead the Western Edge of the Eilddon and Leaderfoot NSA. This additional CAS is to contain route R2G which is proposed to have a base level of FL115.

The NERL Option proposes to raise bases of CAS below FL195 overhead the Loch Lomond National Park and Upper Tweeddale NSA as shown below:

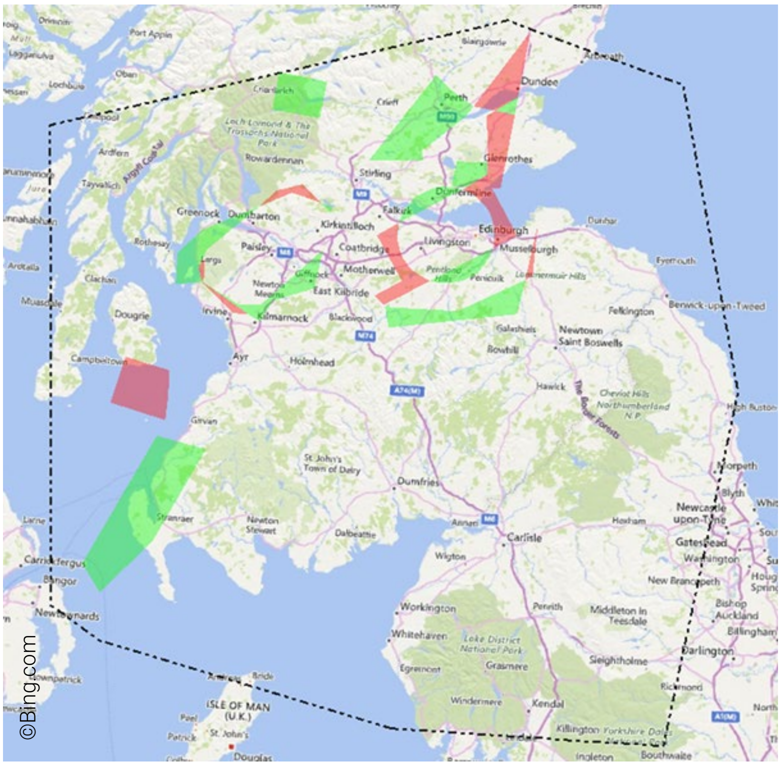


Figure 6: Proposed location of lowered CAS bases (shown in red) and raised CAS bases (shown in green).

The design proposes to raise the base of CAS overhead the northern region of the Loch Lomond National Park (200 km^2) from 5,500 ft to FL95 to better reflect traffic use.

The design proposes to raise the base of CAS overhead the northern region of the Upper Tweeddale NSA (2.6 km^2) from 4,500 ft to 5,500 ft.

Overall, due to the nature of the changes in flight patterns because of the NERL route design, the network modernisation is not expected to have a noticeable impact on tranquillity.

Wider Society	**Biodiversity**	**Qualitative**

CAP1616i: Environmental Assessment Requirements and Guidance for Airspace Change Proposals, page 33 requires an answer to the Habitats Regulations Assessment (HRA) – Early Screening Criteria.

Q1: Are there any changes to air traffic patterns or number of movements expected below 3,000 feet due to the airspace change proposal? If the answer to Q1 is 'no' then habitats regulations assessment is no longer required

The changes proposed within this ACP do not require additional assessments as none of the changes proposed within this ACP are in airspace at or below 3,000 ft.

Wider Society	**Capacity/ resilience**	**Quantitative**

The changes contained within this design option propose to introduce new systemised routes. These routes should provide an efficient deconflicted network design with added connectivity to the east through the Firth of Forth to the upper airspace yielding capacity benefits and a reduction in ATC complexity. This increases the resilience of the ATC network. The connectivity to FRA at higher levels enables increased flight planning flexibility which would allow aircraft operators to flight plan more efficiently and give them the option of avoiding capacity constrained areas. This ability to avoid restrictions by utilising alternative flight plan trajectories is expected to reduce the likelihood of delay and improve the resilience of the wider network.

Forecast delay is a good indicator of the capacity and resilience of an airspace. For the ScTMA design option for the year of implementation, the ScTMA airspace is forecast to generate 114,971 minutes of holding. This is a forecast reduction of 35,529 minutes of holding in 2027. This is forecast to raise to 176,051 minutes 10 years after implementation, a forecast reduction of 50,835 minutes.

Overall, the proposed design should increase the capacity of the ScTMA airspace.

General Aviation	Access	Quantitative

To facilitate the ScTMA airspace design, this ACP, and the airport ACPs will require additional CAS in some areas whilst offering a reduction (either in volume or classification) in others. In addition to requiring a change in airspace volume, a comprehensive review of the existing classifications across the regions has been undertaken and simplified classifications have been proposed. The proposed changes to Control Areas (CTAs)/ TMA airspace blocks included within the NERL ACP are described below:

New and released CAS- Firth of Forth routings.

The proposed Firth of Forth routings provide more direct routings to / from the east. These routes will require CAS containment overhead the Firth of Forth as shown below:

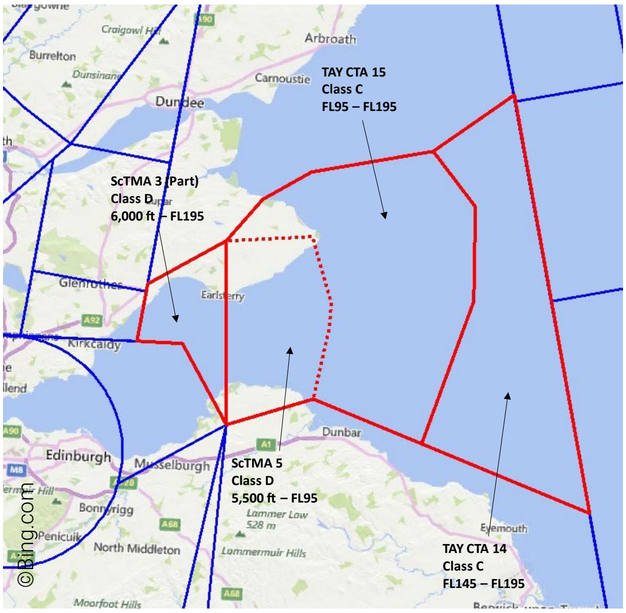


Figure 7: Proposed new CAS (shown in red) for the Firth of Forth connectivity containment.

This additional airspace, proposed areas Tay CTA 14 (Class C, 214.0 NM^3), Tay CTA 15 (Class C, 696.2 NM^3), ScTMA 5 (Class D, 283.4 NM^3) and part of ScTMA 3 (Class D, 139.0 NM^3) equates to a total volume of 1332.6 NM^3 additional CAS. This airspace is primarily situated over the water and at altitudes not typically flown by VFR aircraft.

GA aircraft wishing to cross this area will be able to request a VFR crossing clearance from ATC or if they prefer can remain outside of CAS by flying underneath, or by navigating around, the proposed CAS volumes.

Note: The ScTMA 3 included above also provides containment for routes and procedure using the TAY CTA3, CTA4 and CTA5 realignment. It is only included once to avoid double counting.

New and released CAS - N864 removal and introduction of T8G, T10G and JOSSY1E NAXIL1E, and DOPEY1G STARs

To the north of the ScTMA design, N864, the route north of Edinburgh to connect to P600, has been removed and replaced with the realigned routes T8G and T10G as well as the JOSSY 1E, NAXIL 1E and DOPEY 1G STARs. This connectivity provides improved access to the Portmoak gliding areas through the realignment of TAY CTA1, CTA2, CTA3, CTA4, CTA5 and associated routes. In addition, a hold (STOBS) is proposed in the vicinity of Dundee which requires airspace containment. This has required additional CAS and facilitated the release/reclassification of CAS as shown below:

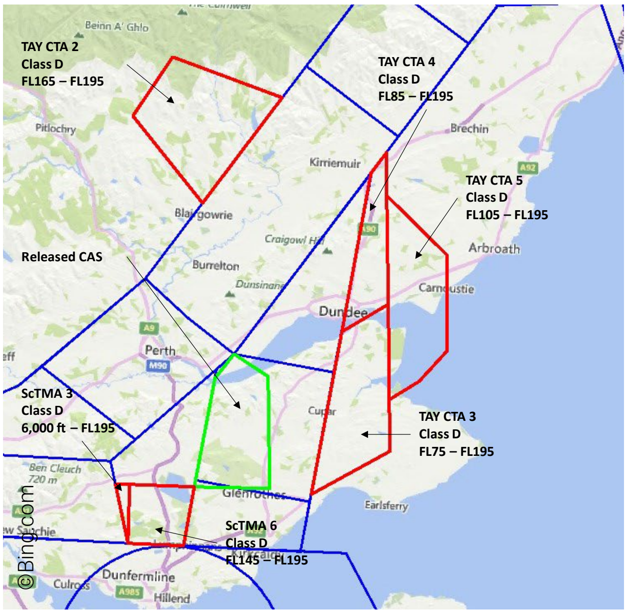


Figure 8: Proposed new CAS (shown in red) released CAS (shown in green) for the realignment of the TAY CTAs.

This additional airspace, proposed areas Tay CTA 2 (Class D, 40.7 NM^3), part of Tay CTA 4 (Class D, 59.3 NM^3), Tay CTA 5 (Class D, 99.4 NM^3), part of Tay CTA 3 (Class D, 75.1 NM^3), part of ScTMA 6 (Class D, 22.4 NM^3) and part of ScTMA 3 (Class D, 6.6 NM^3), equates to a total volume of 303.5 NM^3 additional Class D CAS. The redesign of this portion of airspace to the north of the ScTMA has enabled the release of 103.6 NM^3 Class A airspace.

This airspace is at altitudes not typically flown by VFR aircraft. Where airspace is lower and may be commonly utilised by VFR flights, a commensurate airspace volume is released elsewhere due to there being no change in the number of arrival and departure tracks from the ScTMA airspace. GA aircraft wishing to cross this area will be able to request a VFR crossing clearance from ATC or if they prefer can remain outside of CAS by flying underneath, or navigating around, the proposed CAS volumes.

New and released CAS - Realignment of P600.

To the north of the ScTMA design P600, the route connecting the ScTMA to Aberdeen, has been realigned which will reduce the required airspace to the western edge whilst increasing the required airspace to the east of these CTAs. The realignment has been achieved by removing the existing STIRA hold, this also allows the base levels of theses CTAs to be raised significantly. This reduces the area of CAS for this containment, increasing Class G airspace for GA use. These amended CAS areas are shown below:

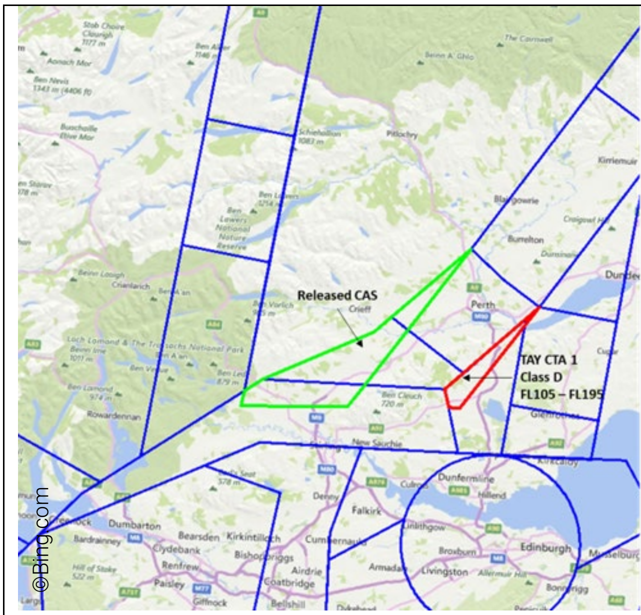


Figure 9: Proposed new CAS (shown in red) and released CAS (shown in green) for the containment of the realigned P600.

A single CTA will require a revision to CAS in this design, Tay CTA 1 (Class D, 29.2 NM^3). The realignment of P600 has enabled the release (reclassified as Class G) of 135.2 NM^3 Class A airspace and 70.4 NM^3 Class D airspace.

This required new airspace is at altitudes not typically flown by VFR aircraft. Whereas the airspace released extends to lower altitudes benefitting VFR flights.

The realignment of P600 increases the availability of the airspace used by Portmoak Gliding as well as Strathallan and Glenrothes Parachuting, releasing existing CAS to Class G airspace.

GA aircraft wishing to cross this area will be able to request a VFR crossing clearance from ATC or if they prefer can remain outside of CAS by flying underneath, or navigating around, the proposed CAS volumes.

New CAS - Containment of COYLE Hold

Currently aircraft arriving via N560 would fly the ERSON 1G STAR and may have to hold at FOYLE. The FOYLE hold is not currently fully contained within CAS.

Within the proposed design, the removal of the STIRA hold and introduction of new arrival routings means aircraft arriving at Glasgow Airport may approach from 3 directions to this holding area using new procedures (KINGS 1G, EDONU 1G or DOPEY 1G STARs) and may be required to hold at a slightly repositioned hold named COYLE. As part of this redesign the nominal track of the proposed COYLE hold will be provided with CAS containment as stipulated within the CAA Policy for the Design of Controlled Airspace Structures. This additional airspace requirement is shown below:

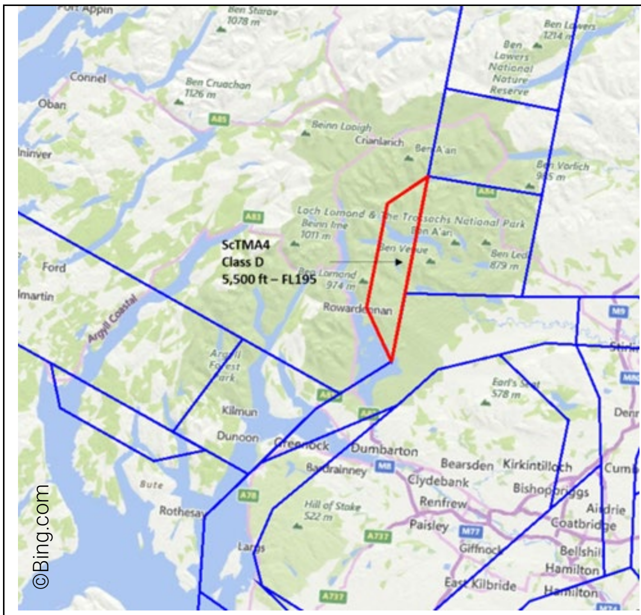


Figure 10: Proposed new CAS (shown in red) for the containment of the COYLE hold.

The additional CAS for this will form part of ScTMA 4 (Class D, 88.0 NM³) which is proposed to have a base of 5,500 ft to accommodate Glasgow Airport departures to the north as well as enabling transitions from the hold to optimise the approach procedures. Whilst STARs must terminate at a hold and transitions start from a hold to provide contingency, the expected amount of actual holding at COYLE is expected to be minimal.

GA aircraft wishing to cross this area will be able to request a VFR crossing clearance from ATC or if they prefer can remain outside of CAS by flying underneath, or navigating around, the proposed CAS volumes.

New CAS - ARGYLL CTAs

Currently aircraft arriving via the BRUCE 1G STAR may have to hold at FYNER The FYNER hold is not currently fully contained within CAS and a new CTA, ARGYLL CTA6 is proposed to provide this. As part of this redesign the nominal track of the revised FYNER hold will be provided with CAS containment as stipulated within the CAA Policy for the Design of Controlled Airspace Structures. This additional airspace requirement is shown below.

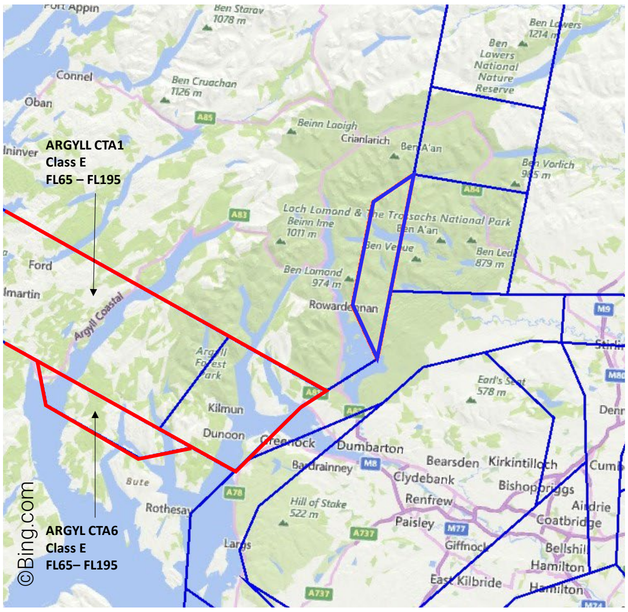


Figure 11: Proposed new CAS (shown in red) for the containment of the FYNER hold and associated traffic.

The redesign has allowed the base of ARGYLL CTA1 to be raised 1,000 ft to FL65. This releases/reclassifies 63.8 NM³ CAS to Class G providing improved access for GA aircraft.

Aircraft arriving at and departing from Glasgow Prestwick Airport via N562 regularly leave CAS and are offered an UK Flight Information Service. As part of this redesign the ARGYLL CTA3 will be elongated to provide CAS containment for these aircraft. The extant ARGYLL CTA 3 is Class E+ and this classification will be retained providing ATC with a known operating environment for these aircraft. This additional airspace requirement is shown below:

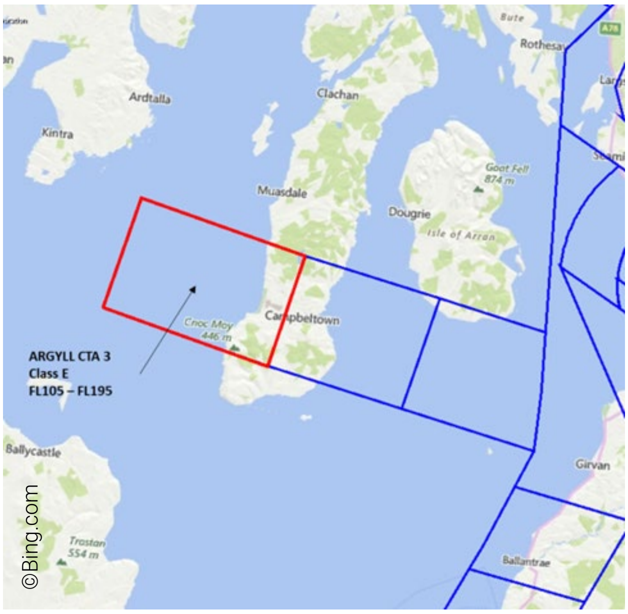


Figure 12: Proposed new CAS (shown in red) for the containment of Prestwick airport traffic arriving via ARGY CTA3.

The additional CAS for this will form part of the ARGYLL CTA3 (Class E+, 88.0 NM^3) which is proposed to have a base of FL105. VFR aircraft do not typically fly at these levels and therefore the impact is expected to be negligible. The Class E+ classification means any aircraft fitted with a transponder will be able to enter this airspace without a clearance or requirement to maintain radio contact.

Released CAS – Borders 8

To the south of the TMA, it was identified that the extant BORDERS CTA8 shown below would no longer be required following the redesign of the NERL airspace.

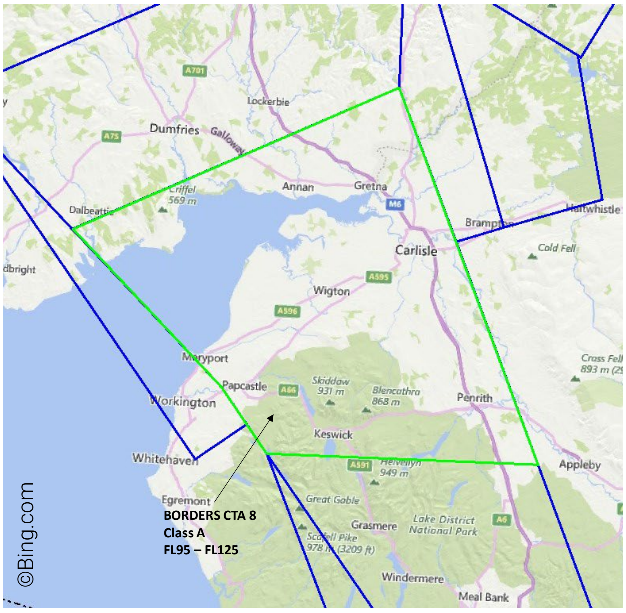


Figure 13: Proposed release CAS (shown in green to the south of the ScTMA.

The deletion of BORDERS CTA8 will release 1456.5 NM^3 of Class A airspace providing a significant new portion of Class G airspace to the south of the ScTMA.

New CAS - R2G Containment

Aircraft departing Edinburgh Airport and Glasgow Airport via Y96 toward Newcastle will utilise the proposed route R2G. As part of this redesign the Borders CTA6 and CTA7 will be extended along the easter edge to provide CAS containment for this route. This allows the route to be separated from the new hold TART3. This additional airspace requirement is shown below:

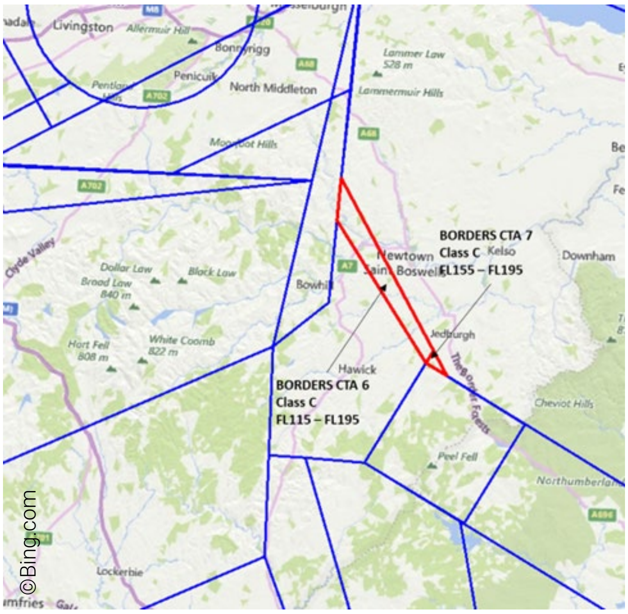


Figure 14: Proposed new CAS (shown in red) for the containment Edinburgh and Glasgow departures via Y96.

The additional CAS for this will form part of the BORDERS CTA6 (Class C, 33.7 NM^3) and BORDERS CTA7 (Class C, 0.9 NM^3) which are proposed to have bases of FL105 and FL155 respectively. This equates to a total volume of 34.6 NM^3 additional CAS. VFR aircraft do not typically fly at these levels so therefore the impact is expected to be negligible.

GA aircraft wishing to cross this area will be able to request a VFR crossing clearance from ATC or if they prefer can remain outside of CAS by flying underneath, or navigating around, the proposed CAS volumes.

Base of CAS Changes - NERL ACP up to FL195

As part of this ACP, the bases of CAS were reviewed. It is proposed to lower bases of CAS in areas where the planned procedures would leave CAS thus ensuring the aircraft remain within a known operating environment. Likewise, in areas where the base of CAS is currently too low for the revised design, the bases are proposed to be raised.

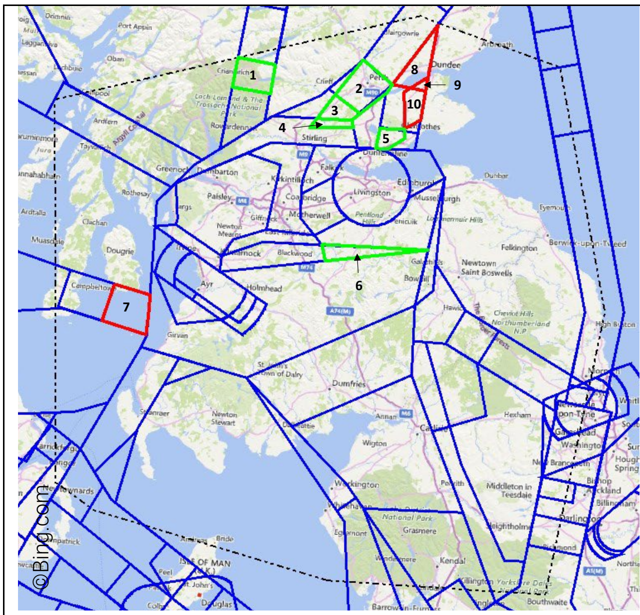


Figure 15: Proposed location of CAS base changes. Raised bases are shown in green and lowered bases are shown in red.

	Airspace block	Without Airspace Change Base of CAS	Option Base of CAS	Volume Change (NM³)
	1	FL55	FL95	-50.0
	2	FL85	FL105	-32.8
	3	FL55	FL105	-32.3
	4	FL60	FL105	-16.7
	5	6,500 ft	FL145	-36.6
	6	4,500 ft	5,500 ft	-8.9
Lowered Bases	7	FL105	FL75	53.3
	8	FL105	FL85	22.7
	9	FL105	FL75	3.5
	10	FL85	FL75	7.1
			Net Volume Change	-170.8

Table 16: Proposed changes to the bases of CAS shown above in Figure 15.

CAS bases are proposed to be lowered:

North of Edinburgh airport, airspace blocks 8-10 are proposed to be lowered to provide containment for the proposed STOBS transition as well as aircraft departing Edinburgh on a STOPP departure via T8G as well as to the west of the ScTMA to provide a known operating environment for traffic arriving at Glasgow Prestwick Airport which is routinely descended outside of CAS to enable an efficient operation. In both instances, the base of CAS will be such that VFR aircraft will be able to fly underneath the proposed base, navigate around, or, provided they are transponder equipped they are permitted to fly in this CAS. The proposed base of FL75 is higher than the operating altitude of most typical VFR flights so these base changes are likely to have negligible impact.

To the west of the ScTMA, airspace block 7 is proposed to be lowered to provide containment to ensure that Prestwick arrivals and departures remain within CAS whilst following their Instrument Flight Procedures (IFP) or the ATS route network in line with the CAA Policy for the design of Controlled Airspace Structures. The proposed base of FL75 (over the sea) is higher than the operating altitude of most typical VFR flights, so these base changes are likely to have negligible impact.

CAS bases are proposed to be raised:

North of the ScTMA along the extant P600 (airspace blocks 2-4), (airspace block 5) and N560 (airspace block 1) is proposed to be raised to reflect the containment requirements of the airspace. In areas 1-4 the base has been raised from FL55 increasing the airspace available for VFR flights. In area 5 the base has raised from 6,500 ft to reflect the change in airspace use in the proposed design. These changes provide VFR aircraft with additional Class G airspace and improve access to the Portmoak gliding and Strathallan, Glenrothes Parachuting area.

Within the TMA airspace, (airspace block 6) the CAS base is proposed to be raised from 4,500 ft to 5,500 ft to release airspace not required by the design. This will benefit VFR aircraft transiting this area of the TMA.

Overall, these changes will provide VFR aircraft with additional Class G airspace. Changes in the base level of CAS within the NERL design will release 170.8 NM^3 of existing airspace to Class G.

CAS Classification Changes - NERL ACP up to FL195

As part of this ACP, the classification of the CAS has been reviewed. The figure below shows the proposed changes in CAS classification. The proposed CAS classifications are simplified, removing most of the Class A airspace from within the lateral limits of the design. Overall, the revised classifications should, subject to Air Traffic Controller workload, increase access to the airspace through the use of lower airspace classification.

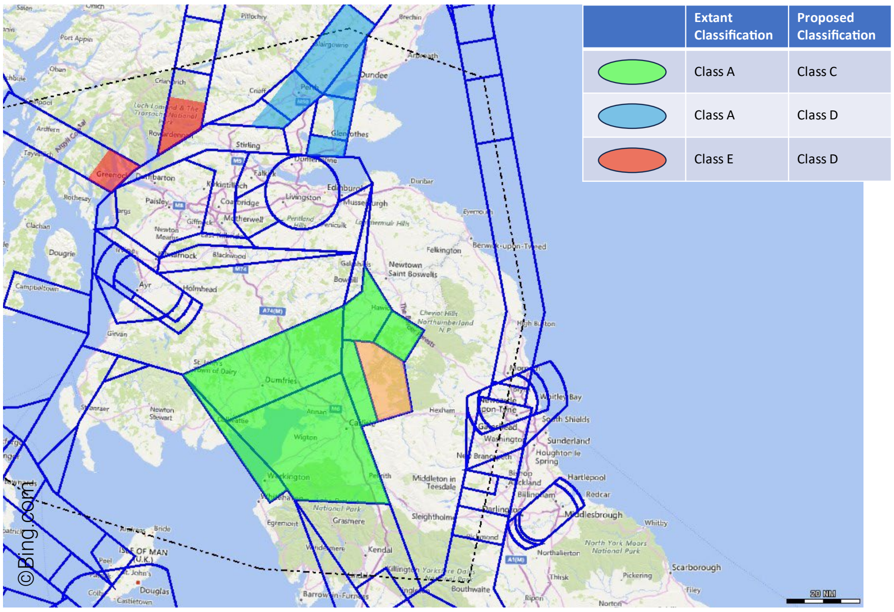


Figure 16: Proposed location of CAS classification base changes.

The table below shows the change in volume of airspace types and classifications for the combined airport and NERL ACPs (Surface to FL195). Due to reassignment of airspace, it would present an inaccurate picture to consider the NERL changes in isolation, as released NERL airspace may be required within an airports design and vice versa. Overall, the proposed FASI-N- Scotland design will require an additional 658.8 NM^3 of CAS. However, in isolation the new CAS required by NERL, above 7,000 ft, to provide the Firth of Forth connectivity is 1038.9 NM^3 (Total new airspace for the Firth of Forth is 1332.6 NM^3) which is predominantly at high level and over the sea. This demonstrates that a substantial airspace volume release (reclassified as Class G) has been achieved in the remainder of the design. In addition to the CAS release, the classification of a substantial volume of CAS has been lowered increasing accessibility to all airspace users.

Airspace Classification	Extant Volume (NM³)	Option Volume (NM³)	Difference (NM³)
CTR	773.2	737.6	-35.5
TMA	9,467.3	9,512.3	+45.1
CTA	26,129.4	26,778.7	+649.3
A	6,714.0	1,417.8	-5,296.2
C	0	3,713.2	-3713.2
D	17,691.7	19,307.5	+1615.9
E	11,964.2	12,590.1	+626.0
Total	36,369.8	37,028.7	+658.8

Table 17: Change in airspace volume for type and classification for he proposed design.

General aviation/commercial airlines	Economic impact from increased effective capacity	Quantitative

The proposed changes will increase the effective capacity of the airspace. The economic impact of this would be positive, however it has not been quantified.

Forecast delay is a good indicator of the capacity. For the ScTMA design option for the year of implementation, the ScTMA airspace is forecast to generate 114,971 minutes of holding. This is a forecast reduction of 35,529 minutes of holding in 2027. This is forecast to raise to 176,051 minutes 10 years after implementation, a forecast reduction of 50,835 minutes. Using the NERL delay holding costs (including fuel) this has a NPV of £3,100,934 in the year of implementation. This is a reduction of £989,959 in delay cost in the year following implementation when compared to the without airspace change option. The cost of delay is forecast to rise to £3,900,845 or a reduction of £1,280,287 for the year 10 years post implementation compared with the without airspace change option. Over the 10-year period the total delay cost is forecast to reduce from £47,192,818 to £35,626,924, a saving of £11,565,891over the period.

General aviation/commercial airlines	Fuel burn	Quantitative

The impact assessment indicates that 258,591 flights per year would be impacted by the change in 2027, rising to 287,878 in 2036.

Computer modelling indicates an overall fuel burn for the proposed option of 488 kT in 2027, a saving of 6 kT, rising to 548 kT in 2036, a saving of 8 kT.

The overall forecast enabled [15] fuel burn in the opening year (2027) and 10 years post-implementation (2036) are shown below:

[15] An enabled benefit is one that relates to the fuel saving resulting from more efficient flight planned routes. This is not an exact representation of the actual change in fuel burn and CO_2e emissions. The actual impact can only be calculated following implementation of the change. This will allow a direct comparison between the pre-implementation trajectory data and actual trajectory data following the change. This will be provided within the Post Implementation Review of the Airspace Change.

Year	Edinburgh Airport Fuel burn (kT)		Glasgow Airport Fuel burn (kT)		Other Fuel burn (kT)	Total Fuel burn (kT)	Difference to Without Airspace Change (kT)
	Arrivals	Departures	Arrivals	Departures			
2027	115	179	62	99	33	488	-6
2028	117	182	62	100	34	494	-6
2029	119	185	63	100	34	501	-6
2030	120	189	63	101	34	508	-6
2031	122	192	64	102	35	515	-7
2032	124	195	64	102	35	521	-7
2033	126	199	65	103	35	528	-7
2034	128	202	66	104	36	535	-7
2035	130	206	66	104	36	542	-7
2036	132	209	67	105	36	548	-8

Table 18: Forecast fuel burn for the proposed change for Edinburgh airport Traffic, Glasgow Airport Traffic and the wider change for the years from implementation to 10 years post implementation.

The 10 most flown city pairs for Edinburgh Airport and Glasgow Airport for the with airspace change option are shown below:

	Airport	Departure With Airspace Change Fuel burn (T)		Arrival With Airspace Change Fuel burn (T)		Combined With Airspace Change Fuel burn (T)	
		2027	**2036**	**2027**	**2036**	**2027**	**2036**
Edinburgh Airport	Heathrow	9,507	10,944	8,365	9,628	17,871	20,572
	Dublin	3,577	3,968	2,644	3,069	6,220	7,037
	Stansted	6,864	7,901	6,463	7,440	13,327	15,341
	London City	4,201	4,836	3,360	3,869	7,561	8,704
	Amsterdam	5,145	5,901	2,720	3,124	7,865	9,025
	Belfast International	1,803	2,076	2,073	2,386	3,877	4,462
	Paris Charles de Gaulle	5,942	6,843	4,449	5,124	10,391	11,967
	Gatwick	5,431	6,254	4,617	5,314	10,048	11,568
	Bristol	2,903	3,340	2,653	3,053	5,556	6,393
	Southampton	1,985	2,284	1,915	2,204	3,900	4,488
Glasgow Airport	Heathrow	6,910	7,339	6,800	7,221	13,710	14,561
	Dublin	2,265	2,412	1,840	1,932	4,105	4,344
	Gatwick	5,051	5,363	4,751	5,046	9,801	10,409
	Amsterdam	4,125	4,382	2,283	2,425	6,408	6,806
	London City	3,376	3,586	2,732	2,901	6,108	6,487
	Belfast International	1,469	1,560	1,236	1,453	2,705	3,014
	Southampton [16]	0	0	0	0	0	0
	Bristol	2,852	3,029	2,991	3,176	5,843	6,205
	Stornoway	1	1	717	762	718	763
	Luton	2,317	2,513	2,317	2,461	4,634	4,974

Table 19: Forecast fuel burn for the 10 most commonly flown destinations from Edinburgh airport and Glasgow Airport for the proposed design for the implementation year and 10 years post implementation.

Note: negative values in the "Delta" column represent reductions in fuel burn or benefit.

The average calculated network fuel burn saving per flight for the overall change is 31 kg compared to the Without Airspace Change (based on 258,591 forecast impacted flights in 2027).

This benefit per flight would lead to noticeable per annum savings due to the annual traffic in this part of UK airspace. Current fuel costs predict an annual fuel saving of £3,983,566 in 2027, rising to £5,322,439 in 2036.

These figures are based on the IATA jet fuel in Europe price, £685.99 per tonne, at 861.39 USD (w/e 22nd March 2024) converted to GBP using a conversion factor 0.796 ((XE currency exchange rate 2nd April 2024).

[16] The forecast provided by Glasgow airport did not include any traffic between Glasgow airport and Southampton airport for 2027 or 2036.

Note that improvements in predictability leading to improved flight planning and reduced delay and holding could further improve upon this saving. Note that this analysis only includes flight planned routes and does not include any holding, vectoring, or streaming. Therefore, improvements in predictability leading to improved flight planning and reduced delay and holding could further increase this benefit.		
Commercial airlines	**Training costs**	**Qualitative**
Flight procedures worldwide are updated with each aeronautical information regulation and control (AIRAC) cycle and airlines update their procedures accordingly, training as required. This proposal is not anticipated to require additional training costs for airlines.		
Commercial airlines	**Other costs**	**Qualitative**
There are no additional associated costs for airlines anticipated.		
Airport/air navigation service provider	**Infrastructure costs**	**Qualitative**
This proposal is not expected to change Airport or ANSP infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/air navigation service provider	**Operational costs**	**Qualitative**
This proposal is not expected to change Airport or ANSP operational costs.		
Airport/air navigation service provider	**Deployment costs**	**Qualitative**
This proposal for the system-wide ScTMA change is expected to require air traffic controller familiarisation training, in the order of 90-100 controllers and c.50 assistants at NATS Prestwick, including extensive use of the NATS simulator facility. Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availability of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery. The Military ANSP would also require briefing prior to deployment.		
Airport/air navigation service provider	**Other costs**	**Qualitative**
This proposal is not expected to change Airport or ANSP other costs.		

Table 20: Option 1: Modernised ATS Route Structure including providing connectivity to SID End points, STARs and holding facilities. (NERL Preferred Option) Full Options Appraisal

3.3.2 Compared to the Without Airspace Change, the performance of this design represents a benefit in terms of CO_2e emissions, fuel burn, capacity & resilience.

3.3.3 The partially Systemised PBN system should offer an efficient network design which would keep aircraft safe with minimal ATC intervention. Connectivity to and from FRA airspace has been simplified providing an efficient route structure to the higher airspace where aircraft can take advantage of optimal trajectories.

3.3.4 The improved efficiency of the ScTMA design has been enabled through the introduction of new connectivity to the east of the TMA, overhead the Firth of Forth (Firth of Forth) which has allowed the redistribution of flights within the airspace.

3.3.5 Where able, holding locations have been raised and relocated minimising the population overflown. The improved efficiency of the design is forecast to reduce holding for aircraft arriving at Edinburgh Airport and Glasgow Airport.

3.3.6 The proposed Firth of Forth connectivity will require an additional 1332.6 NM^3 CAS located predominantly over the sea at levels above those usually flown by GA. This volume of airspace is partially offset by the release (reclassified as Class G) of 673.8 NM^3 superfluous airspace throughout the rest of the impacted area. This has been in part through the raising of CAS bases and in part through the redrawing of the lateral limits. In addition, a large volume, 5296.2 NM^3 Class A Airspace has been downgraded to Class C airspace. This will provide potential access for GA aircraft where none exists in the extant airspace.

3.3.7 As such, this option is NERL's preferred option and is presented for consultation under CAP1616 Stage 3.

4. AMS Alignment

4.1.1 The alignment of NERLs preferred option with the AMS is demonstrated in Table 6.

AMS criteria	How this ACP aligns with the AMS
Safety: Maintaining and, where possible, improving the UK's high levels of aviation safety has priority over all other 'ends' to be achieved by airspace modernisation.	The incorporation of PBN systemised routes will lead to a more efficient airspace design with simpler, fewer conflictions. This will increase capacity while continuing to improve the current high safety standards.
Integration of diverse users: Airspace modernisation should wherever possible satisfy the requirements of operators and owners of all classes of aircraft, including the accommodation of existing users (such as commercial, General Aviation, military, taking into account interests of national security) and new or rapidly developing users (such as remotely piloted aircraft systems, advanced air mobility, spacecraft, high-altitude platform systems).	The Design options included within this documentation are the result of extensive engagement with the impacted airspace users. This has ensured that: • Airspace access will be maintained or improved • The airspace will be classified to support access to users as appropriate • There is no conflict with national security requirements • The proposed designs will efficiently use the airspace to enable the expeditious flow of traffic, including all classes of aircraft across the commercial, General Aviation and military sectors.
Simplification, reducing complexity and improving efficiency: Consistent with the safe operation of aircraft, airspace modernisation should wherever possible secure the most efficient use of airspace and the expeditious flow of traffic, accommodating new demand and improving system resilience to the benefit of airspace users, thus improving choice and value for money for consumers.	The design options described within this documentation introduce a systemised airspace design within the impacted airspace. This systemised airspace design will: • Reduce conflictions • Reduce tactical ATC intervention • Improve CCO and CDO operations • Reduce Fuel burn and CO_2 emissions • Increase predictability. These designs have considered the forecast growth and all international recommended practices and obligations to ensure that the minimum amount of CAS required to provide a safe and efficient airspace design is used. This design process has included a review of the extant CAS bases and Airspace Classification. Where possible CAS bases have been raised releasing CAS and access to CAS has been increased by downgrading the existing classifications where it is safe to do so. Throughout the design process, airspace users impacted by the proposed design have been engaged with to ensure a thorough understanding of any impact on both sides, and palatable compromises were made to the design as needed. The impacted airports have been engaged throughout the design process to ensure that sufficient capacity has been incorporated into the network designs to accommodate

	the airports aspirations to develop their operations in line with their business plans.
Environmental sustainability: This will be an overarching principle applied through all airspace modernisation activities. Modernisation should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance (ANG) and, in doing so, will take account of the interests of all stakeholders affected by the use of airspace.	This ACP will accommodate changes made to the lower level (below 7,000 ft) airspace by the corresponding airport led ACPs. Minimising the noise impact of these changes is a priority for these ACPs and will be considered in all options proposed. This ACP seeks to introduce a new arrival and departure route over the sea which will enable a reduction in land overflight, reducing the cumulative noise impact to ground based stakeholders. However, this ACP proposes changes to the en-route network which will only affect flights at and above 7,000 ft 7,000 ft. As such, in accordance with the DfT altitude-based priorities, noise impacts are not prioritised. Introduction of a systemised route structure will lead to an improved environmental footprint of the airspace by: • Improving the efficiency of the airspace • Reducing conflictions requiring ATC intervention • Improving CCO and CDO operations • Reducing Fuel burn and CO_2 emissions per flight. The proposed designs are consistent with the objectives in ANG2017. The proposed airspace structures strike an appropriate balance in accordance with the environmental objectives as set out in the ANG 2017.

Table 21: Design alignment with the AMS

5. Cost Benefit Analysis

5.1.1 The monetised benefits of the system-wide option (NERL Option 1, Edinburgh Airport Pre FOA Option 1A&1C and Glasgow Airport Option 5) and have been totalled in analysis below (Note, with 2 years before implementation, project and deployment costs have not been quantified at this stage. The discount rate of 3.5% p.a. has been applied from 2024 as per the standard rate given in the Treasury Green Book Annex A6[17]). TAG outputs are calculated using a 2024 base year and are presented in Market prices.

5.1.2 The results in Table 7 show that the monetised benefit over ten years for the NERL Preferred Option are (£89,290,000).

5.1.3 It should be noted that the methodology for CO_2e and fuel analyses (See Appendix C) provided in earlier sections and detailed in Annex B of the CAF2 as well as of this document, applies equally to the monetisation presented here. While this methodology may mean that the presented results differ from what may be achieved in reality, this can only be assessed with accuracy post change when actual data is available. It is, however, considered that the methods used present the best estimation possible in advance of a change occurring, and in all cases the extent of the potential effect would be to the scale the potential benefit, rather than presenting a disbenefit.

[17] The Net community benefit (CO_2e) is already discounted through the WebTAG workbook.

Year	2027 1	2028 2	2029 3	2030 4	2031 5	2032 6	2033 7	2034 8	2035 9	2036 10	10 year total benefit
Discount Factor (Pre-applied)	0.90	0.87	0.84	0.81	0.79	0.76	0.73	0.71	0.68	0.66	
Net Wider Society Benefit (CO_2e) [18]	1,617,958	1,735,596	1,850,466	1,962,588	2,071,980	2,178,663	2,282,659	2,383,992	2,482,684	2,578,759	21,145,344
Net Airspace Users Benefit (CO_2e) [19]	3,006,467	3,005,579	3,144,594	3,178,334	3,085,208	2,993,386	2,903,026	2,865,557	2,739,757	2,654,239	29,576,149
Net Airspace Users benefit (Fuel cost) [20]	3585209	3577165	3569121	3561076	3553032	3544987	3536943	3528899	3520854	3512810	35490095
Net Airspace Users benefit (Delay Cost excluding fuel) [21]	169,533	206,902	241,550	273,618	303,240	330,547	355,659	378,696	399,767	418,981	3,078,493
Present value (rounded to the nearest £1,000, NPV is the sum of unrounded data)	8,379,000	8,525,000	8,806,000	8,976,000	9,013,000	9,048,000	9,078,000	9,157,000	9,143,000	9,164,000	89,290,000

Table 22 NERL Option Cost benefit for preferred option (whole £ only)

[18] The Wider Society Benefit CO_2e is the Non-Traded WebTAG Data.

[19] The Airspace users CO_2e benefit is the Traded WebTAG Data.

[20] The fuel cost includes the fuel used for holding. This has been removed from the Net Airspace Users benefit (Delay cost) row of the CBA

[21] The delay cost quoted in the Economic impact from increased effective capacity assessment in Table 5 includes the additional fuel associated with holding. This fuel is included in the Net Airspace Users benefit (Fuel cost) above and is removed from this row to avoid double counting.

6. Safety Assessments

6.1.1 This section provides a brief, qualitative overview of the impact of the preferred design option on aviation safety. It should be noted that the preferred option is likely to be progressed. Previous design options, rejected at Stage 2 and 3, also met design principles on safety but were considered sub-optimal with regards to other success criteria.

6.2 Options Appraisal Safety Assessment – Without Airspace Change Option

6.2.1 The current operation uses a published route structure and airline operators flight-plan to follow available ATS routes or flight plannable Directs (DCT) as published in the Route Availability Document (RAD). The published routes are supportive of strategic de-confliction between flights against active Special Use Airspace volumes (such as Danger Areas) and airspace with constrained radiotelephony or surveillance coverage. The routes also provide an operational framework that is conducive to Air Traffic Controllers' familiarity with traffic patterns, potential conflict points and practices for conflict avoidance/resolution. Flights into and out of the airspace volume (i.e., across boundaries with other Sectors and Air Traffic Control Units) are managed via published waypoints and agreed co-ordination points (COPs).

6.2.2 In addition to flights following routes, some may be instructed to take a more direct path through the airspace. This is done in a tactical manner by Air Traffic Controllers based on their judgement that a different path can be followed safely. Air Traffic Controllers are supported in their task by tools that includes EFD (electronic flight data) and radar surveillance tools.

6.3 Safety Assessment – With Airspace Change Option- Systemised Network & CAGVI (Consideration and Guidance for Vertical Interactions)

6.3.1 Project activities so far have included multiple iterations of fast-time simulation computer modelling and Real Time Development Simulations. Safety and Human Factors experts have attended a significant part of these workshops.

6.3.2 The feedback from the simulations and from the early design activities has been assessed during Preliminary and Secondary Safety Issues Identification Workshops that have formed the basis for the planning and the execution of the Safety and HF activities throughout the project lifecycle.

6.3.3 The initial findings from the workshops at the time of this Safety Statement are as follows:

- Airspace Safety Review – An Airspace Safety Review was conducted during Stage 2b of the CAP 1616 process against a previous design option. Initial work has indicated that overall, the design option would result in a small improvement in safety. Additional ASRs are required to determine overall safety improvement against a mature design option.
- Tempest Assessment – The proposed design within Stage 2b was predicted to result in a small safety benefit (<1%) in terms of NATS En Route RAT ATM Ground points at the NATS En Route Level. Michelangelo assessments have replaced Tempest and will be conducted against a mature design option to determine a revised safety benefit.

6.3.4 Safety has been assessed throughout the development of the design process. Following the NATS process of analysing the preferred design option, the perceived risks are assessed and categorised by NATS SMEs, and appropriate mitigations proposed. NATS SMEs consider that any proposed mitigations suitably address the perceived risks. Notable elements of the preferred design option that have been assessed include areas which abut Flexible Use of Airspace (FUAs), amendments to airspace classifications and sectorisation, and CAGVI.

6.3.5 Certain mitigations seek to reduce or eliminate the impacts of risks associated to novel design elements, such as CAGVI and the tactical manoeuvring of traffic within a systemised network (associated with mixed-mode operations). Those mitigations investigate the future utilisation of currently available tools, as well as current procedures and agreements with interfacing airports, and their application within the proposed operation to minimise risk and the need for tactical intervention. Where intervention is deemed necessary, either by design or by the need to maintain safety, the appropriate training shall be prescribed which determines best practices to enable intervention and maintain flexibility within the operation without detriment to the level of safety.

6.3.6 Additional analysis is required after consultation to fully realise the effectiveness of these proposed mitigations against an updated design proposal. Until then, Safety will be unable to determine a 'safe/not safe' conclusion until the proposed design is defined and finalised. Following Consultation, the design will be further defined, and a final safety assessment will be conducted.

6.3.7 Further considerations are being made for fallback procedures within the evolving assurance envelope and the suitability of current fallbacks within the new operation, namely the adoption of 5nm separation in the event of radar failure. Full assessment of fallbacks will be made following the completion of Consultation and the definition of required procedures.

6.3.8 Subsequent to the Safety activities and subsequent liaison meetings with different stakeholders, the design team will identify, if necessary, any updates required to the proposed design, and this will be assessed during further development simulations prior to Consultation.

6.3.9 The concept of operations for the systemised airspace is that aircraft will file a flight plan and fly it as prescribed by the route design. Additionally, the routes themselves have been designed to reduce opportunity for confliction. As such, the level of tactical intervention required will be reduced from that of today. Furthermore, the introduction of CAGVI to the design which, once flight-planned, aircraft will follow and meet the lateral profile and any pre-determined altitude and level restrictions unless otherwise instructed. The concept is expected to deliver tangible safety benefit and other efficiencies to the operation that are to be fully determined within further safety assessments.

6.3.10 Future safety activities for ScTMA will include:

- Hazard Analysis/HESAP
- Airspace Safety Reviews (ASR), and
- ATC Procedures Safety Analysis (APSA).

6.3.11 The proposed ATS route structure will consist of formally defined PBN routes, meaning that route spacing rules and route containment will be considered in accordance with current CAA policies. The changes introduced are aimed at reducing ATC workload – the concept underlying the proposed design is the introduction of a systemised ATS route network.

6.3.12 Appropriate safety cases will be written, as will an analysis of CAP1385 route separation criteria of each route segment against adjacent proposed routes.

7. Conclusion and Next Steps

7.1.1 The objective of this ACP is to modernise the route network surrounding the Scottish Terminal Control Area (ScTMA) in accordance with the Civil Aviation Authority's (CAA's) Airspace Modernisation Strategy (AMS) using Performance Based Navigation (PBN).

7.1.2 This is expected to provide capacity benefits through systemisation by reducing interactions whilst also providing environmental benefits through a reduction in fuel burn and CO_2e emissions.

7.1.3 The changes discussed within this consultation are contained in airspace at and above 7,000 ft amsl and as such the assessment of environmental impacts is limited to CO_2e emissions within this submission. However, as these changes are coordinated with the changes proposed within the FASI-N Edinburgh Airport and Glasgow Airport submissions, the cumulative fuel and CO_2 impact will be described for the system-wide airspace design (NERL Option 1, Edinburgh Airport Pre-FOA Option 1A&1C, and Glasgow Airport Option 5). It should be noted that a system-wide design that could deliver less benefit in terms of fuel burn and CO_2e emissions remains a possibility depending on the options progressed by the airport sponsors following the coordinated consultation.

7.1.4 The objectives of airspace modernisation in the ScTMA FASI-N change align with the overall aims of the AMS and is expected to:

- Maintain and where possible improve the high levels of aviation safety, simplifying the airspace design and reducing the complexity of the flight paths
- Increase the airspace capacity to accommodate reasonable growth in demand for commercial air transport whilst minimising delays, enhancing Scotland's global connections, giving better value and more choice for businesses and individual travellers and helping to stimulate economic growth benefiting the Scottish population.
- Improve the environmental sustainability of aviation in Scotland, reducing CO_2 emissions through more efficient flight paths and enabling aircraft to climb more quickly, descend more quietly and reduce the total adverse effects of aircraft noise on people
- Secure the most efficient use of airspace, by creating an airspace design that can facilitate better sharing and access for commercial air transport, the Military, General Aviation, and in due course, new and emerging forms of aviation.

7.1.5 We thank all stakeholders who have participated in engagement thus far and look forward to their feedback during consultation and continued involvement with the development of this proposal.

7.1.6 A single option is presented for consultation:

- Option 1: Modernised ATS Route Structure including providing connectivity to SID End points, STARs and holding facilities. (NERL Preferred Option).

7.1.7 Consultation will include detail of the benefits and impacts, monetised such that the overall benefit and impacts can be assessed.

8. Appendix A: WebTAG Calculations for the ScTMA

8.1.1 The data used for the inputs to WebTAG are given below:

Traffic Forecasts

Year	Edinburgh Airport	Glasgow Airport	Overflights	Total
2027	147,539	90,862	20,190	258,591
2028	150,016	91,487	20,342	261,845
2029	152,492	92,113	20,494	265,099
2030	154,969	92,738	20,647	268,353
2031	157,445	93,363	20,799	271,607
2032	159,922	93,989	20,951	274,862
2033	162,398	94,614	21,103	278,116
2034	164,875	95,239	21,256	281,370
2035	167,351	95,865	21,408	284,624
2036	169,828	96,490	21,560	287,878

Table 23 Traffic forecast for the ScTMA system-wide change.

Computer Modelling Results: Without Airspace Change CO_2e

Year	Edinburgh Airport CO_2e (kilo Tonnes)		Glasgow Airport CO_2e (kilo Tonnes)		Other CO_2e (kilo Tonnes)	Total CO_2e (kilo Tonnes)
	Arrivals	Departures	Arrivals	Departures		
2027	365	577	198	323	105	1569
2028	372	588	200	325	106	1591
2029	378	599	202	327	107	1613
2030	384	610	204	329	108	1636
2031	390	621	206	331	109	1657
2032	397	632	208	334	110	1680
2033	403	643	210	336	111	1702
2034	409	654	211	338	112	1724
2035	415	665	213	340	113	1746
2036	422	676	215	342	114	1768

Computer Modelling Results: Option 1 CO_2e

Year	Edinburgh Airport CO_2e (kilo Tonnes)		Glasgow Airport CO_2e (kilo Tonnes)		Other CO_2e (kilo Tonnes)	Total CO_2e (kilo Tonnes)	Difference to Without Airspace Change (kilo Tonnes)
	Arrivals	Departures	Arrivals	Departures			
2027	365	568	197	315	106	1551	-18
2028	371	579	199	317	107	1572	-19
2029	377	589	200	319	108	1594	-19
2030	383	600	202	321	109	1615	-20
2031	389	611	204	323	110	1636	-21
2032	395	622	205	325	111	1658	-22
2033	401	632	207	327	112	1679	-22
2034	407	643	210	329	113	1701	-23
2035	413	654	210	331	114	1722	-24
2036	419	664	212	333	115	1744	-25

WebTAG GHG Workbook for Option 1

Scheme Name: NERL ScTMA ACP-2019-074

Present Value Base Year	2024	Unit of account	Market prices
Current Year	2024		
Proposal Opening year:	2027		
Project (Road/Rail or Road and Rail):	Road		

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£): £50,721,493
(Sum of traded and non-traded emissions - see note below on accounting for UK allowances in the traded sector)

*positive value reflects a **net benefit** (i.e. CO2e emissions reduction)

Quantitative Assessment:

Change in carbon dioxide equivalent emissions over 60 year appraisal period (tonnes): -215,696
(between 'with scheme' and 'without scheme' scenarios)

*negative value reflects a **net benefit** (CO2e emissions reduction)

Of which Traded -144684.0106

Change in carbon dioxide equivalent emissions in opening year (tonnes): -18,466
(between 'with scheme' and 'without scheme' scenarios)

Net Present Value of traded sector carbon dioxide equivalent emissions of proposal (£): £29,576,149
*N.B. This value has been adjusted to account for the cost of emissions covered by the UK Emissions Trading Scheme (UK ETS), **under the assumption that all assessed traded emissions are within the scope of the UK ETS**. For further information, including guidance on the valuation of traded emissions outside the scope of the UK ETS, please refer to TAG Unit A3, section 4.1.*

*positive value reflects a **net benefit** (i.e. CO2e emissions reduction)

Change in carbon dioxide equivalent emissions by carbon budget period:

	Carbon Budget 1	Carbon Budget 2	Carbon Budget 3	Carbon Budget 4	Carbon Budget 5	Carbon Budget 6
Traded sector	0	0	0	-13531.72372	-70927.78455	-60224.50235
Non-traded sector	0	0	0	-4934.638351	-31748.23889	-34329.37213

Qualitative Comments:

Sensitivity Analysis:
(Traded and non-traded)

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £79,239,199

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£): £23,021,774

Data Sources:

Modelling Assumptions: AirTOp

- It is assumed that Free Route Deployment 3 at FL255 and above is implemented in both the Without Airspace Change and With Airspace Change Design models
- Edinburgh airport (Pre-FOA Option 1A&1C) and Glasgow airport (Option 5) arrival transitions and departure routes for a single option, provided by the Airports, are modelled in the With Airspace Change Design model
- It should be noted that a system-wide design that could deliver less benefit in terms of fuel burn and CO_2e emissions remains a possibility depending on the options progressed by the airport sponsors following the coordinated consultation. As all the proposed airport design options join the NERL network design at the same location, laterally and vertically, the airport option selected will have negligible impact on the fuel and CO_2e emissions resulting from the network design
- The same traffic sample has been used in all Without Airspace Change and With Airspace Change Design models to ensure a fair comparison
- Oceanic UK entry and exit points have been fixed in most cases such that they are the same per flight in the Without Airspace Change and With Airspace Change Design models
- Without Airspace Change and With Airspace Change Design flight planned trajectories for 2023 have been extracted from NEST models provided by the Network Manager at EUROCONTROL for complete journeys (Airport to Airport). These have been imported and simulated in AirTOp
- Trajectory profiles are calculated using NATS business intelligence (BI) data statistics on observed climb/descend rates, speeds and turn rates for BADA aircraft groups
- All aircraft are modelled climbing at their maximum climb performance rates as requested by the ScTMA ATC Design Team
- No “go-arounds” were simulated
- Positioning, helicopters and Military flights were not considered in this analysis.
- No Danger Area activations are modelled
- Validation of the Without Airspace Change and With Airspace Change models has been conducted by the ScTMA ATC Design Team and Analytics
- Unconstrained demand was modelled, thereby excluding the naturally occurring influence of flow restrictions (i.e. no regulations were applied to the traffic sample)
- A “blue sky” weather scenario, where no wind effects are present, was assumed
- No conflict resolution was applied en-route
- Controller tasks were completed instantaneously with each controller able to control multiple aircraft simultaneously (i.e. no workload or response time constraints)
- Randomisation of flight plan departure times was conducted for 10 simulation runs per Without Airspace Change and With Airspace Change Design model each
- Fuel burn determined using NATS NEMO tool which uses BADA 4.2 data. Aircraft types not in BADA 4.2 use BADA 3.13 data
- Fuel burn is modelled at nominal mass for all aircraft other than UK Arrivals which are modelled using low mass
- Fuel burn and CO_2e is calculated to the FIR boundary only
- The annual fuel and CO_2e values have been calculated using the delay per flight and scaled annual flights
- No speed constraints are applied in the en-route airspace to provide arrival spacing.

9. Appendix B: Introduction to the CAF

9.1.1 This proposal is NERL's part in the redesign of the wider area referred to as the ScTMA cluster. This cluster also includes a proposal from Edinburgh Airport and Glasgow Airport for their routes below 7,000 ft.

9.1.2 The ACPs in the SCTMA cluster must adhere to CAP1616 and the UK Airspace Change Masterplan Iteration 3 – ScTMA (referred to as 'the Masterplan').

9.1.3 The Masterplan outlines how the options in each cluster ACP relate to one another (their interdependencies), including any design conflicts and the potential solutions. The Masterplan includes a Cumulative Analysis Framework (CAF), described here, that considers the cumulative and collective impacts of the cluster ACPs when viewed as an integrated system. Cumulative impacts occur when specific options from different ACPs overlap in the same airspace below 7,000 ft. In contrast, collective impacts represent the combined positive and negative effects of all the cluster ACPs combined.

9.1.4 The CAF guides ACP sponsors in identifying the interdependencies between their proposals and provides a suite of metrics to evaluate the potential solutions to design conflicts, highlighting where there may be trade-offs, for example between mitigating noise and reducing greenhouse gas emissions. The CAF ensures that the cumulative and collective impacts of the cluster ACPs have been considered by the sponsors when developing their individual proposals.

9.1.5 The CAF has three parts that are aligned to the three phases of options appraisal that the individual ACPs are required to conduct in the CAP1616 process. These parts are explained below and summarised in Table 9.

9.1.6 CAF Part 1 (CAF1) provides a basis for the ACP sponsors to collaborate on the identification of interdependencies and resolution of any design conflicts, before producing the CAP1616 Full Options Appraisals. The outputs of the CAF1 review for the Scottish cluster ACPs are reported in the Masterplan Iteration 3 – Scotland here. The CAF1 outputs are also summarised in ACOG's document titled 'Description of the proposed system-wide design for the Scottish (ScTMA) Cluster of the Airspace Change Masterplan'.

9.1.7 CAF Part 2 (CAF2) provides information on how the consultation options in the three separate ACPs in the ScTMA cluster work together as a system. CAF2 is generated by combining information from each sponsors Full Options Appraisals. The result is a suite of suite of tables and diagrams to match those presented in the Full Options Appraisals in the cluster's individual ACPs, but which show 'cumulative' and 'collective' performance for the whole cluster, rather than the performance for a single ACP.

9.1.8 The outputs of the CAF2 review are expected to be of value to stakeholders who are interested in the impacts of the three Scottish cluster ACPs when viewed as a system. The CAF2 report has been produced by ACOG using information from Edinburgh, Glasgow and NATS' Full Options Appraisals

9.1.9 CAF2 is provided in this ACP here. The CAF2 report has been collated from, and on behalf of, the individual ACPs by ACOG.

9.1.10 The CAF Part 3 (CAF3) will be produced after the consultation, once the preferred designs have been finalised by the ACP sponsors, incorporating stakeholder feedback. The CAF3 will use information from the Final Options Appraisals produced for the Edinburgh, Glasgow and NERL ACPs.

CAF Phase	Key characteristics and use	Link to CAP1616 and Masterplan
CAF1: Review of Route Interdependencies, Design Conflicts and Trade-Offs	• Provides an assessment of design conflicts and trade-offs between route options in interdependent ACPs • Provides a basis for sponsors to resolve design conflicts considering collective performance (including cumulative impacts) • Trade-off information may be drawn from Initial Options Appraisals • Qualitative, with additional quantitative assessment added where necessary	• Prior to sponsors starting CAP1616 Full Options Appraisal • Outputs will be presented in the Stage 3 Consult Gateway submissions and Masterplan Iteration 3 • CAF1 information in Masterplan Iteration 3 demonstrates how cumulative impact, collective impact and trade-offs have been accounted for in the design pre-consultation
CAF2: Full CAF	• Identifies cumulative impact of consultation options • Generation of information to describe collective cluster -wide performance and trade-offs for consultation options • Comparison between cluster-wide consultation option(s) and the cluster-wide baseline • Information drawn from Full Options Appraisals	• After each sponsor in the cluster has completed Full Options Appraisal • Outputs are presented in the Stage 3 Consult Gateway submissions (and Masterplan Iteration 4 which will be produced after consultation)
CAF3: Final CAF	• Identifies cumulative impacts of final designs • Generation of information to describe collective performance and trade-offs in the final cluster-wide design • Comparison between final cluster-wide design and the cluster-wide baseline • Information drawn from Final Options Appraisals	• After each sponsor in the cluster has completed Final Options Appraisal • Outputs will be presented in Masterplan Iteration 4 • Comparison of CAF3 and CAF2 output in Masterplan Iteration 4 will demonstrate how cumulative impact, collective impact and trade-offs have been affected by the design updates in Stage 4

Table 24: CAF Stages as Summarised in ScTMA Masterplan Iteration 3.

10. Appendix C: Supplementary methodology information for Scottish Airspace Modernisation CO_2e calculation

Background

To supplement the Full Options Appraisal (FOA) document submitted by the Scottish Airspace Modernisation cluster sponsors, the following information includes specifics on the technical methodology used to model future enabled CO_2e benefits brought by the proposals. An enabled CO_2e benefit correlates with the fuel saving resulting from more efficient routes within the new proposals.

To provide this analysis, modelling is used to simulate the design with the goal of understanding a proposal's performance verses the current airspace, referred to as the baseline. This is standard practice in all airspace change proposals, and an important step to ensure alignment is made to the CAA's Airspace Modernisation Strategy.

Providing background information to this analysis helps to highlight that aircraft profiles modelled many years ahead of implementation may differ from those flown in reality. There are always variables such as weather, world events, military activity and more, which cannot be predicted. To aid transparency, this annex has been produced to demonstrate that the methodology used provides a good indication of the enabled benefit of the proposed change. The actual impact can only be calculated following implementation of the change. This will allow a direct comparison between the baseline trajectory data and actual trajectory data following the change, as part of the Post-Implementation Review.

Modelling lateral profiles for CO_2e

For the lateral element of a flight, both arriving and departing aircraft are generally 'tactically' [22] routed by controllers to fly the most optimum trajectory possible given the traffic scenario and airspace limitations at that time. Tactical intervention is most notable in low traffic conditions close to the departure point or destination and reduces the track milage a given aircraft will fly, thereby reducing its emissions.

Furthermore, the difference is not the same for every flight. In reality, no two flights are ever the same and the differences are impossible to predict. While it is recognised that modelling the planned tracks may vary from the actual tracks seen in reality, the industry standard modelling process used (i.e. planned tracks and BADA performance database) provides a good assessment for the performance of a proposal.

In addition, tactical lateral shortcuts and, less often, lateral track extensions, are subject to a myriad of factors including interaction other aircraft, ATC workload, military activity, and weather which by their nature cannot be foreseen with a degree of certainty. So, for large scale airspace changes it is not possible to model this accurately or forecast exactly how this will change.

However, when a whole flight is modelled, the difference between flight planned routes and actual routes flown tend to average out - as illustrated in CAF2 Annex C. Therefore, for the lateral portion of a flight, the flight plan route is a good approximation. When the whole end-to-end flight plan route is modelled, with the addition of holding analysis, this provides a good indication of whether a proposed change will positively or negatively impact the CO_2e greenhouse gas emissions for a specific flight or flights.

Modelling vertical profiles for CO_2e

Similarly, for the vertical element of a flight, no two flights are the same, climb and descent rates are based on engine type, aircraft weight, wind, temperature etc. As set out in the CAF2 Annex B, arrival profiles are more

[22] Tactical intervention is where air traffic control instruct aircraft to fly away from their planned route. Tactical intervention typically occurs to provide more efficient/direct routes, to resolve conflicts between aircraft or to generate an efficient landing sequence.

consistent than departure profiles as an economic descent rate is similar between all aircraft and descent restrictions on STARs are consistently applied by air traffic control (ATC).

However, for departures, level off restrictions on SIDs exist which may, in reality, not be required due to the traffic scenario at the time. For example, an aircraft can be tactically climbed by ATC above the SID restrictions. How many aircraft will be climbed above the SID profile in the future or how many will level off due to conflicting aircraft elsewhere in the climb is not possible to predict with accuracy. The modelling therefore assumes that level off restrictions are present in both scenarios described below.

It should be noted that there are some trends that are likely in a more systemised environment in future. With some SIDs climbing to higher levels it is expected that:

a) it is more likely that aircraft will fly the vertical restrictions on a SID and
b) the modelled CO_2e difference between an aircraft levelling off on the SID and not levelling off will be less (when comparing the vertical elements in isolation).

The following examples show the CO_2e generated by commonly flown single flight. These are modelled using BADA at a nominal weight in nil wind and are provided for context.

Example 1

Airbus A320 GLASGOW Runway 05 to PALMA cruise level of FL350. Portion of flight to CALDA (N of Manchester)		
SCENARIO	RESTRICTED (as modelled)	UNRESTRICTED
EXISTING AIRSPACE	6.16T	5.77T
PROPOSED AIRSPACE	5.66T	5.17T
DIFFERENCE	0.50T	0.60T

Based on the table above, the variance of Restricted vs Unrestricted benefits, in this example, is between 0.50T and 0.60T.

Example 2

Airbus A380 GLASGOW Runway 23 Cruise Level FL370. Portion of flight over North Sea to UK boundary at PETIL.		
SCENARIO	RESTRICTED (as modelled)	UNRESTRICTED
EXISTING AIRSPACE	49.05T	48.52T
PROPOSED AIRSPACE	47.98T	47.02T
DIFFERENCE	1.07T	1.50T

Based on the table above, the variance of Restricted vs Unrestricted benefits, in this example, is between 1.07T and 1.50T.

Example 3

Boeing 737-900 from EDINBURGH runway 06. Cruise level of FL330. Portion of flight over North Sea to Amsterdam		
SCENARIO	RESTRICTED (as modelled)	UNRESTRICTED
EXISTING AIRSPACE	9.89T	9.40T
PROPOSED AIRSPACE	9.18T	9.08T
DIFFERENCE	0.71T	0.32T

Based on the table above, the variance of Restricted vs Unrestricted benefits, in this example, is between 0.71T and 0.32T.

Example 4

A Boeing 737-800 from EDINBURGH runway 24 Cruise Level of FL200. Flight to Belfast		
SCENARIO	RESTRICTED (as modelled)	UNRESTRICTED
EXISTING AIRSPACE	4.12T	3.93T
PROPOSED AIRSPACE	4.03T	3.98T
DIFFERENCE	0.09T	-0.05T

Based on the table above, the variance of Restricted vs Unrestricted benefits, in this example, is between 0.09T and –0.05T.

These examples show how, for both the existing departures and the proposed departures, an unrestricted climb profiles would generate less CO_2e than the restricted vertical profiles that are modelled.

In Examples 1, 2 and 3 the proposed SIDs also facilitate a shorter flight plan track mileage and so in both the restricted and unrestricted scenarios there is a CO_2e saving regardless of vertical considerations.

However, in Example 4 the planned track mileage is further in the proposed option compared to the baseline due to the ground track of the proposed SID and the associated network changes. Therefore, flying the existing SID with no vertical restrictions would, when modelled, generate less CO_2e than flying the proposed SID with no vertical restrictions.

Summary

Any enabled benefits claimed for a proposed new design is inherently a prediction for how planes will fly post deployment, several years from the point of modelling.

The benefits attributed to the cluster are calculated based on route forecast data provided by Eurocontrol using the NEST tool which is the European standard. The efficiency of each aircraft is then analysed using BADA information through AirTop, an industry leading fast time modelling tool.

Assuming an equal spread of aircraft types between all appropriate departure routes then overall CO_2e and overall track mileage would always be directly correlated if vertical restrictions are removed.

With this assumption in mind, it is acknowledged that when future traffic forecasts are considered, there may be a reduced benefit for both airports in the Scottish Airspace Modernisation cluster if vertical restrictions are not modelled. This is more likely to have a greater impact on Edinburgh Airport, based on the forecast track mileage difference. Furthermore, it should be noted that the benefits stated may even increase.

However, it is expected that the impact of track mileage differential would be minimised by the track savings enabled by proposed access, particularly from Edinburgh Airport, to the highly beneficial Firth of Forth routes for larger (and therefore greater CO_2e generating) aircraft.

We expect the real-life outcomes to be somewhere between a flight plan-based model such as the ones we have analysed, and an optimal fuel-efficient profile scenario. However, as it is not possible to accurately forecast this outcome, the procedural departure profiles are used as an approximation of benefit until real life track data, including both lateral and vertical profiles, can be used to corroborate findings through the Post Implementation Review process.

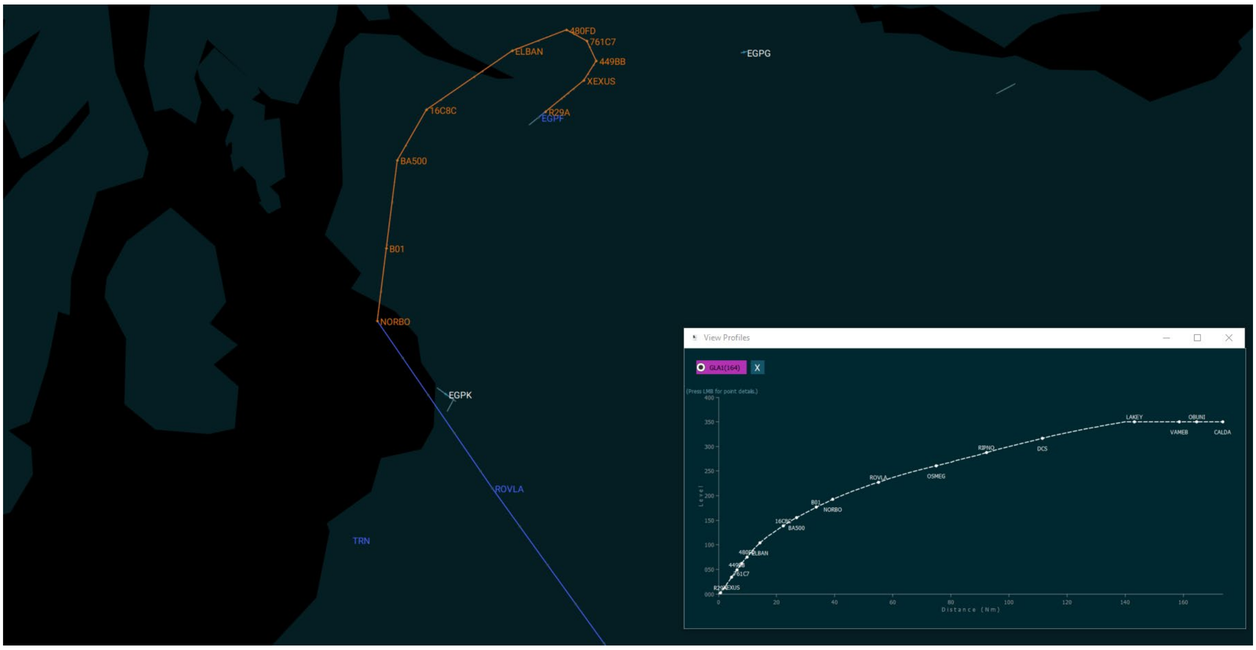
In all cases it is important not to consider one factor in isolation.

To conclude, it is acknowledged that based on the methodology described above, there is a possible difference between the enabled benefits reported and reality. Regardless of which methodology is used, it is anticipated that the proposed changes will enable a cluster wide CO_2e benefit on average per flight.

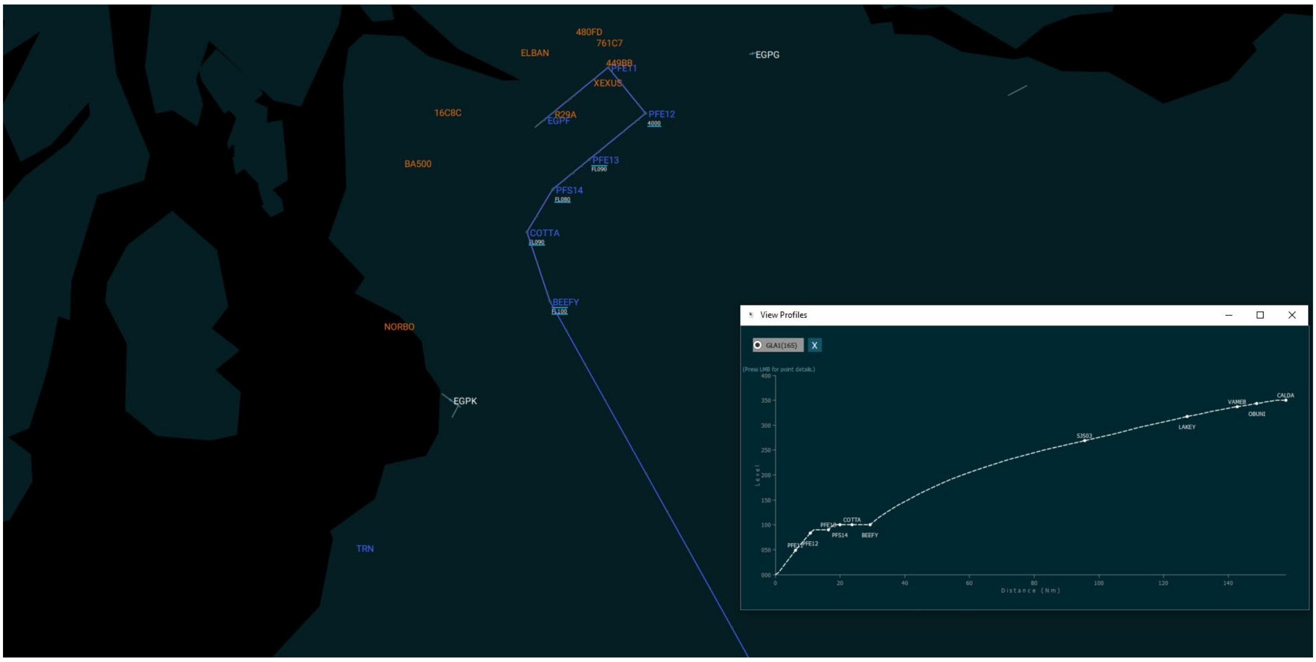
Figures for Examples

Example 1 Glasgow to Palma baseline restricted - NORBO1J SID – TRACK LENGTH 173.2nm

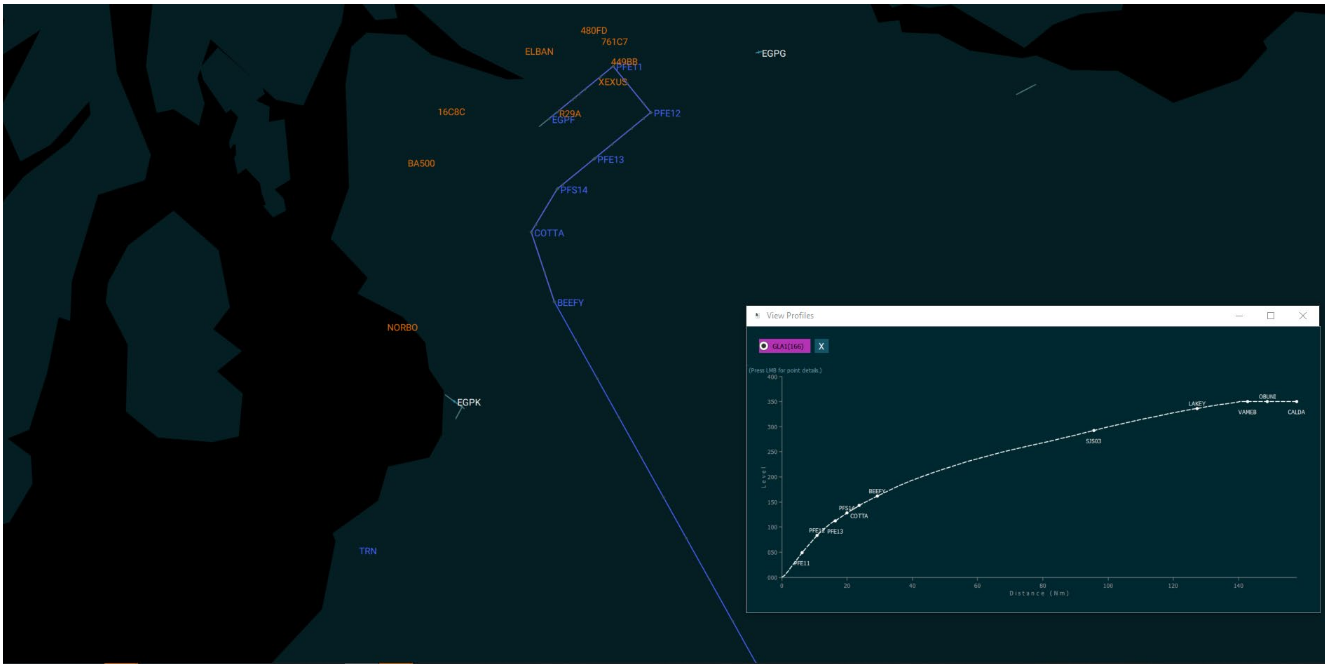
Example 1 Glasgow to Palma baseline unrestricted – NORBO1J SID – TRACK LENGTH 173.2NM



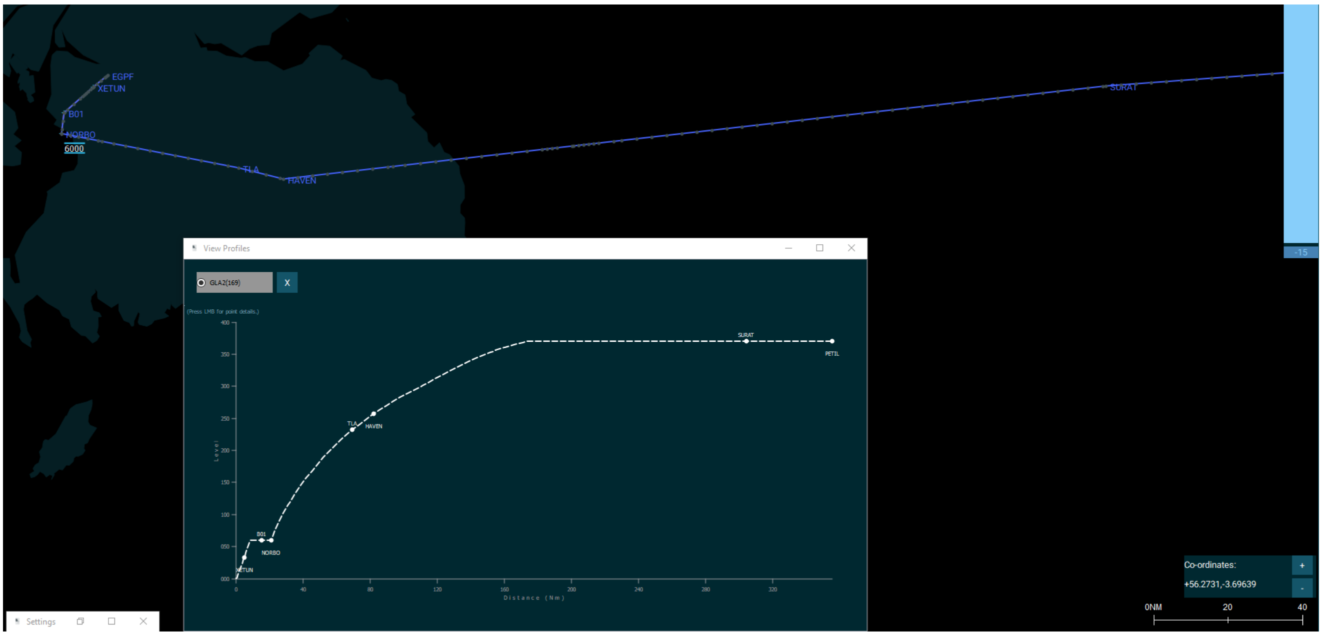
Example 1 Glasgow to Palma proposal restricted BEEFY1Y – TRACK LENGTH 157.38NM



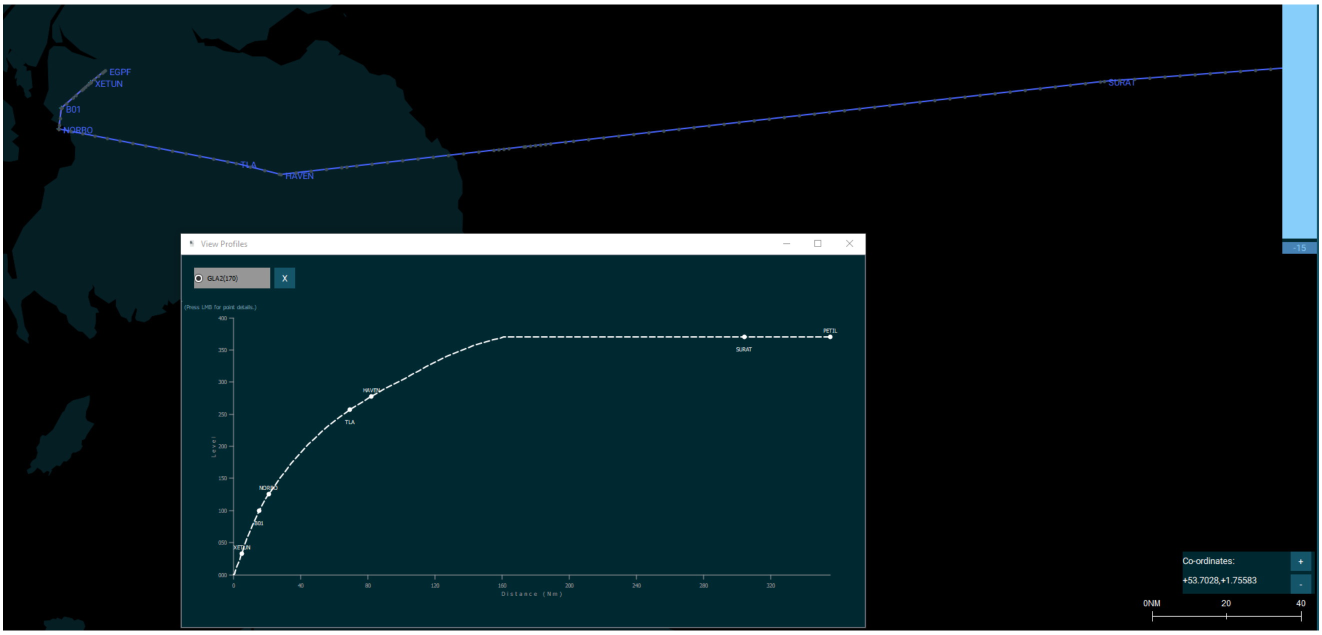
Example 1 Glasgow to Palma proposal restricted BEEFY 1Y – TRACK LENGTH 157.38NM



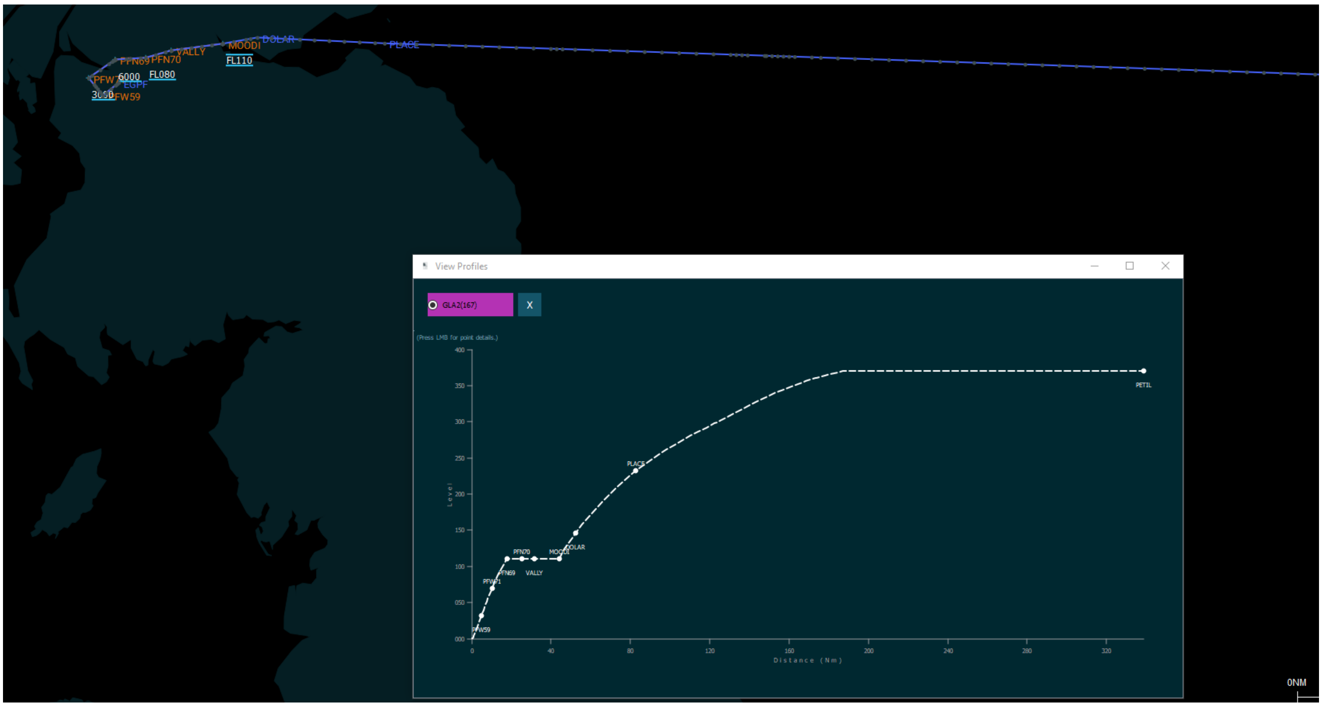
Example 2 Glasgow to Dubai baseline Restricted – NORBO 1H TRACK LENGTH 354.74 NMS



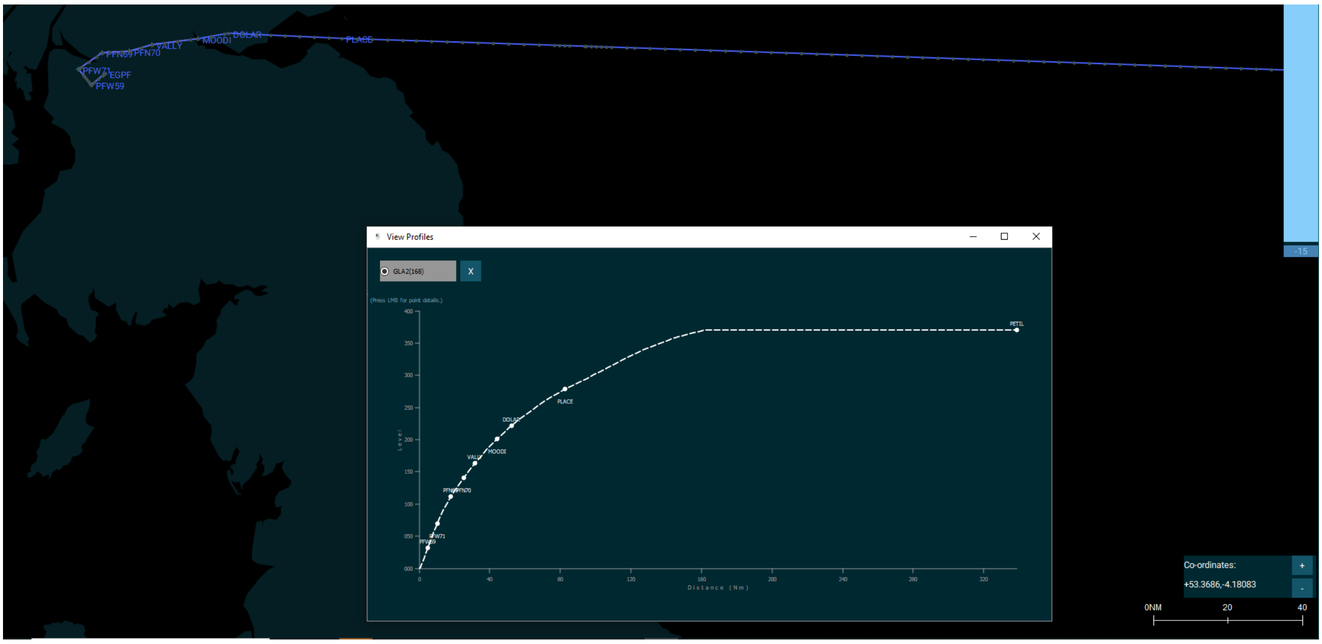
Example 2 Glasgow to Dubai baseline Unrestricted NORBO 1H TRACK LENGTH 354.74 NMS



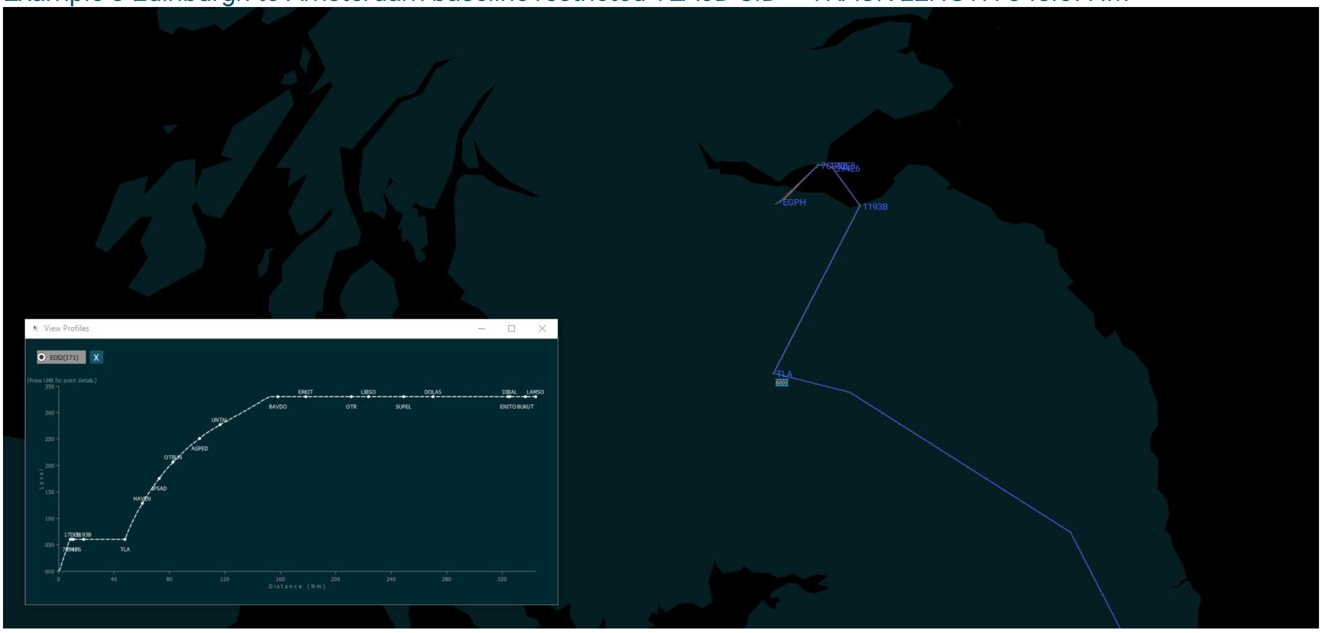
Example 2 Glasgow to Dubai Scenario Restricted – MOODI1W TRACK LENGTH 337.79NM



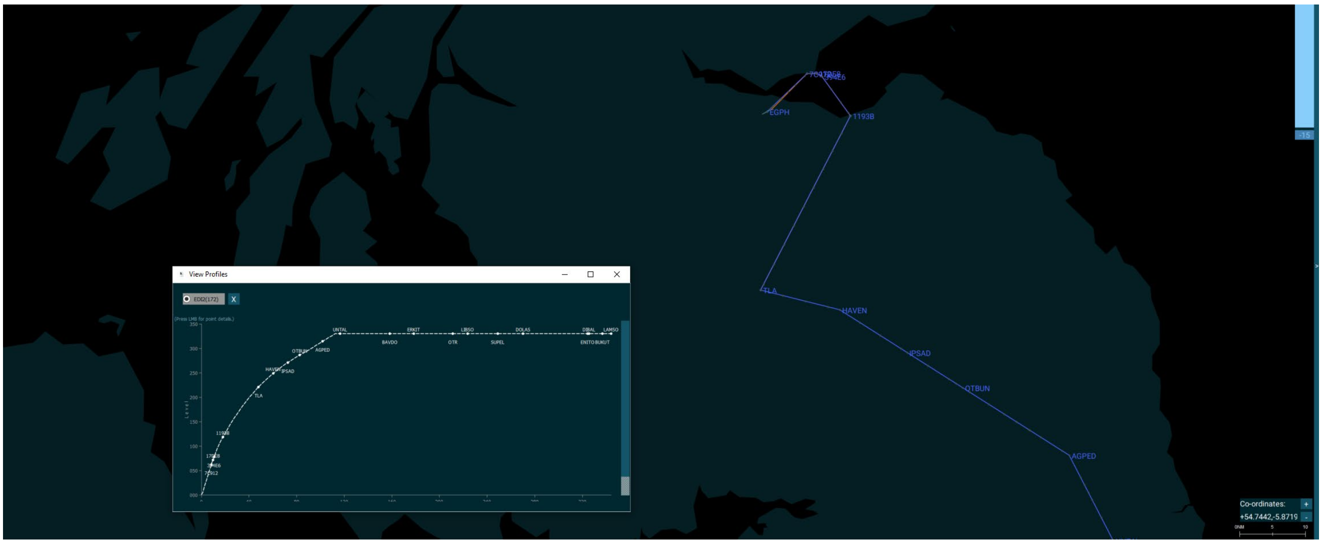
Example 2 Glasgow to Dubai Scenario Unrestricted MOODI1W TRACK LENGTH 337.79NM



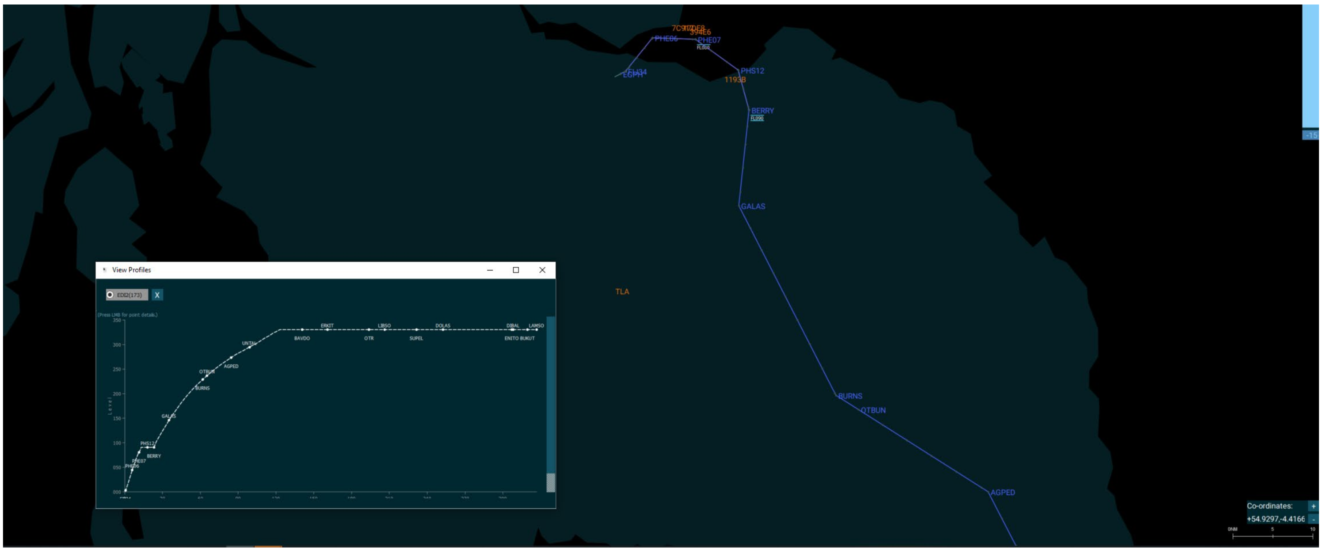
Example 3 Edinburgh to Amsterdam baseline restricted TLA6D SID – TRACK LENGTH 343.57NM



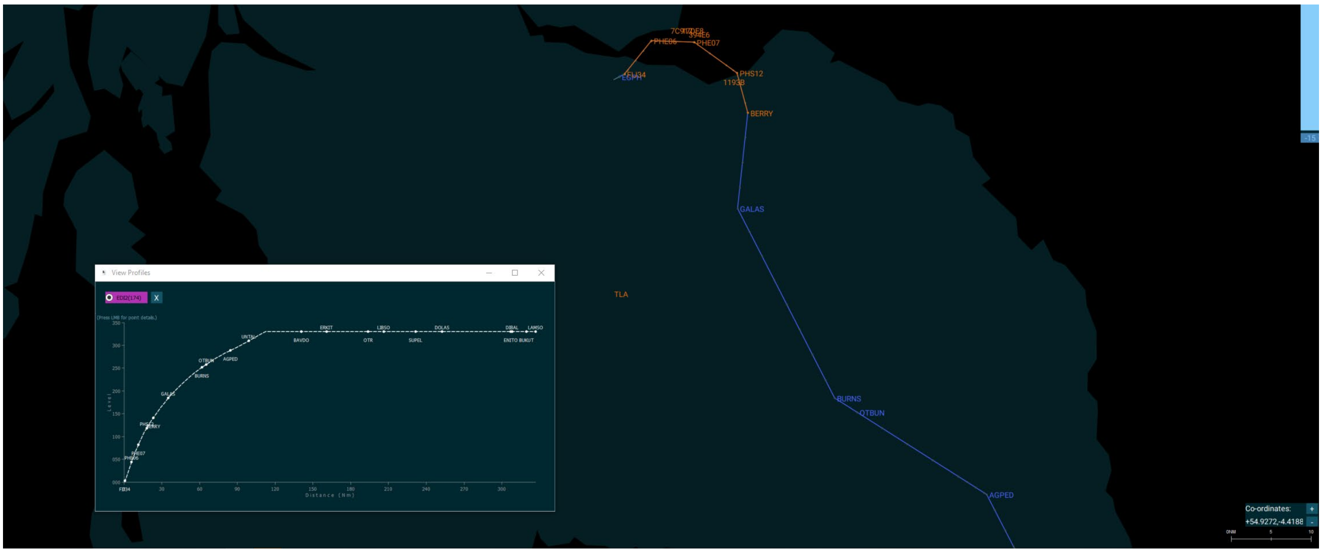
Example 3 Edinburgh to Amsterdam baseline unrestricted TLA6D SID – TRACK LENGTH 343.57NM



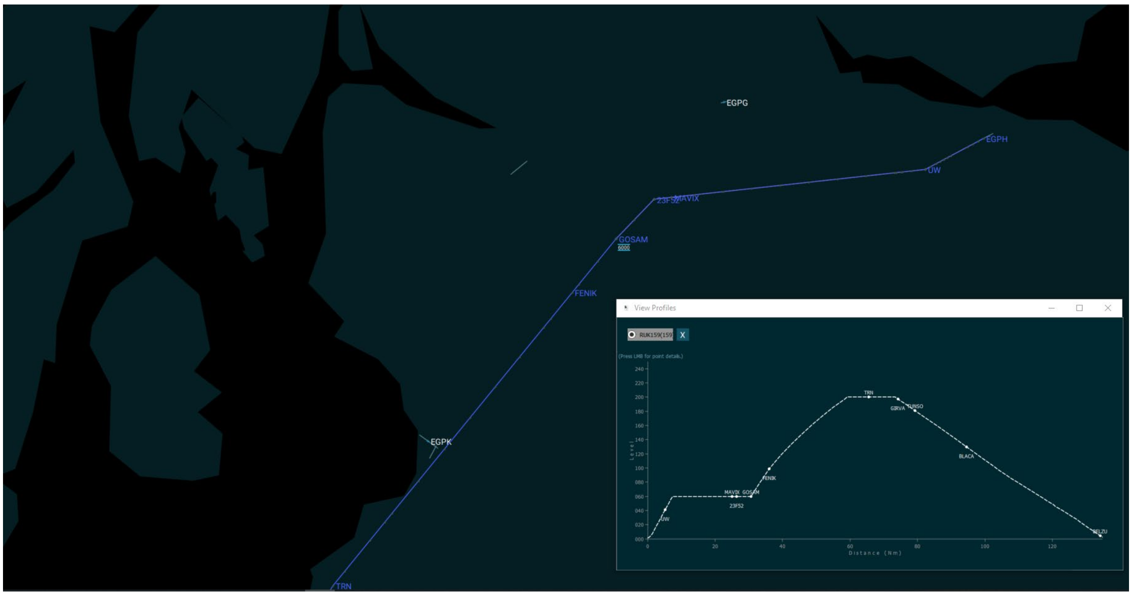
Example 3 Edinburgh to Amsterdam proposal restricted BERRY1B TRACK LENGTH 326.27NM



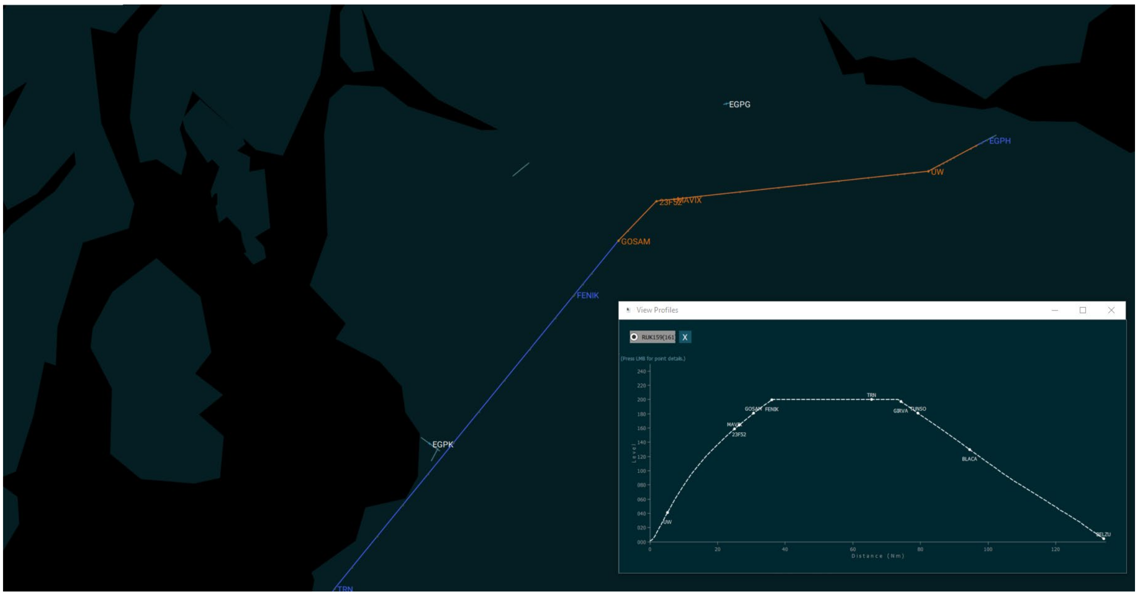
Example 3 Edinburgh to Amsterdam proposal unrestricted BERRY1B TRACK LENGTH 326.27NM



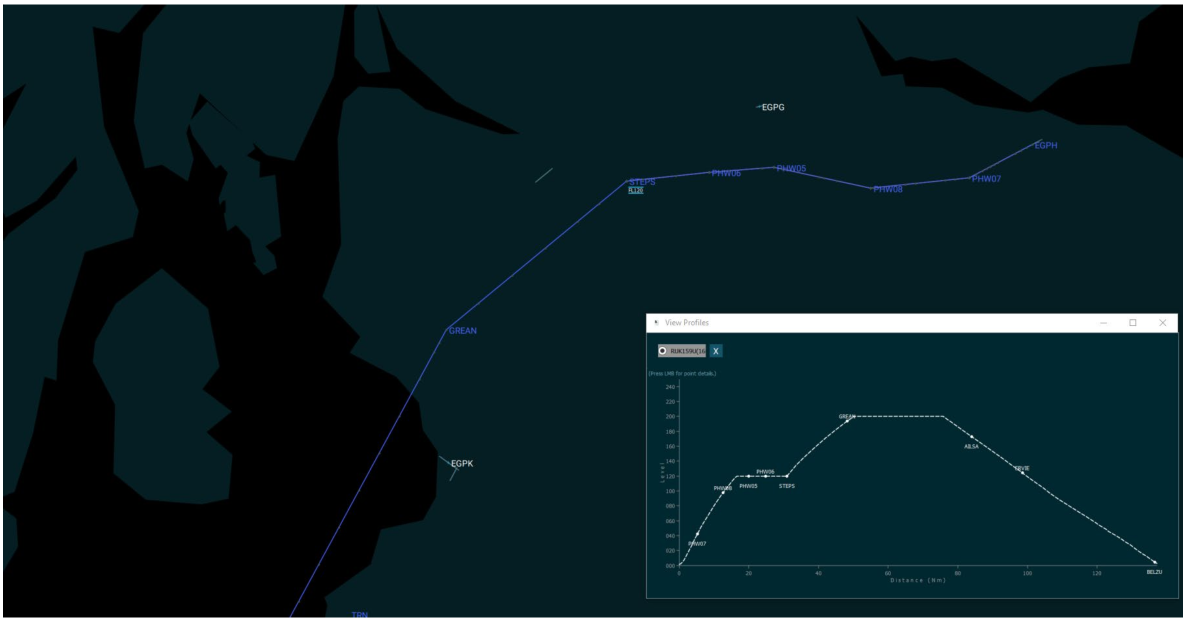
Example 4 Edinburgh to Belfast baseline restricted GOSAM1C TRACK LENGTH 134.41



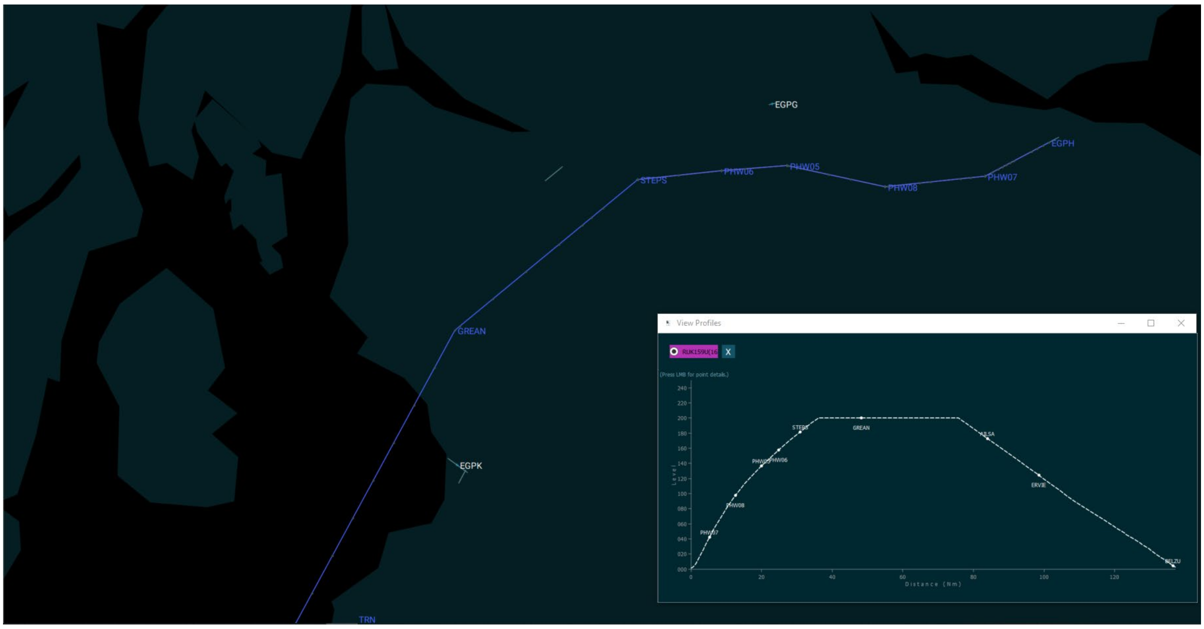
Example 4 Edinburgh to Belfast baseline unrestricted GOSAM1C TRACK LENGTH 134.41



Example 4 Edinburgh to Belfast proposal restricted STEPS1A TRACK MILEAGE 136.74



Example 4 Edinburgh to Belfast proposal unrestricted STEPS1A TRACK MILEAGE 136.74



End of Future Airspace Strategy Implementation- ScTMA Stage 3 Full Options Appraisal including Safety Assessment