Airspace Change Organising Group (ACOG)

Description of the proposed system-wide design for the Scottish (ScTMA) Cluster of the Airspace Change Masterplan

October 2025

ACOG

Contents

The purpose of this document

This document has been produced by ACOG to sit alongside the sponsors detailed consultations for their Airspace Change Proposals (ACPs). It provides background on the modernisation plans, an overall description of the cluster-wide design being proposed for Scottish airspace and a summary of the overall impacts that are expected as a result of the proposed changes.

Description of the proposed system-wide design for the Scottish (ScTMA) cluster of the Airspace Change Masterplan

Airspace in parts of Scotland is being modernised as part of the Government's plans to upgrade airspace. Individual Airspace Change Proposals (ACPs) are being developed by Edinburgh and Glasgow airports, as well NATS En-Route Plc (NERL), the UK's main navigation service provider, to improve efficiency in the Scottish Terminal Control Area (ScTMA). These individual proposals are being consulted on as a group, to understand the overall impacts of the collective changes, as well as the local impacts. Scottish airspace modernisation is expected to deliver a range of benefits for a variety of stakeholder groups.

1. Introduction to airspace modernisation

The basic design of the UK's airspace is largely predicated on an aging network of ground navigation beacons. The design has remained largely unchanged since the 1950s when there were only around 200,000 flights per year in UK airspace, compared with 2.5m in 2019 and projections of 3m by 2030.

The Department for Transport (DfT) and Civil Aviation Authority (CAA) co-sponsor airspace modernisation in the UK, meaning they work together to deliver a shared vision for, "*Quicker, quieter, cleaner journeys and more capacity for the benefit of those who use or are affected by airspace.*"

The objectives of airspace modernisation are described by the CAA in the Airspace Modernisation Strategy (AMS).[1] This includes a requirement for the main airports to redesign their airspace below 7,000ft to make the most of the capabilities of modern aircraft and navigational technologies that have been developed in recent years. NERL is responsible for modernising the airspace above 7,000ft. The Airspace Change Organising Group (ACOG) was set up by the DfT and CAA in 2019 to coordinate the changes around airports and create a strategic coordinated Airspace Change Masterplan (the Masterplan).

The Masterplan is being developed in iterations that will each be assessed separately by the co-sponsors (DfT and CAA) of the AMS. The Masterplan will show more detail about the individual ACPs being developed by the airports and NERL (the airspace change sponsors) as the iterations are developed. Based on the co-sponsors' assessment, the CAA must decide to formally accept each iteration of the Masterplan into the AMS. Once accepted, each iteration of the Masterplan becomes, together with the airspace change process (CAP1616), the legal basis on which individual airspace change decisions are made by the CAA.

There are 18 airports included in the Masterplan. Iteration 2 of the Masterplan organised the ACPs into regional clusters so that simpler airspace changes can be deployed sooner, realising benefits earlier. A single nationwide change would be too big to manage. The clusters are based on the interdependencies between the airports and analysis into areas of the existing airspace where inefficiencies in the use of airspace and delays are expected to worsen as traffic levels grow.

[1] Airspace Modernisation Strategy 2023 to 2040, CAP1711, CAA (2023)

The four clusters are:

- the South of Scotland, also known as the Scottish Terminal Control Area (ScTMA)
- the North of England, also known as the Manchester Terminal Control Area (MTMA)
- the West of the UK, also known as the West Terminal Airspace (WTA)
- the Southeast of England, also known as the London Terminal Control Area (LTMA), which is significantly larger and more complex than the other regional clusters so the ACPs will need to be developed and implemented in a series of phased deployments.

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

The first cluster of airports to develop their Airspace Change Proposals (ACPs) as part of the airspace change programme is the ScTMA cluster. The Masterplan ACPs for the ScTMA cluster are summarised in table 1, along with links to the CAA's Airspace Change Portal that hosts all relevant documentation and information about the development of the individual proposals. All sponsors of ACPs must follow the CAA's airspace change process, set out in CAP1616. It involves several stages and requires ACP sponsors to engage and consult with a wide range of stakeholders throughout the process.

Table 1: Strategically important ACPs included in the scope of the ScTMA cluster

#	ACP ID	Title	Sponsor	Scope
1	2019-46	Glasgow Airport Airspace Change	Glasgow Airport Limited	Arrival and departure routes serving Glasgow Airport and the controlled airspace that contains them below 7,000ft.
2	2019-32	Edinburgh Airport Airspace Change	Edinburgh Airport	Arrival and departure routes serving Edinburgh Airport and the controlled airspace that contains them below 7,000ft.
3	2019-74	Future Airspace Implementation – ScTMA	NERL	Route network in the ScTMA above 7,000ft and interfaces with Glasgow and Edinburgh arrival and departure routes below 7,000ft.

The ScTMA sponsors have now reached the third stage of the CAP1616 process – the consultation stage. This is an important part of the process and gives ACP sponsors the opportunity to understand and consider stakeholder views and feedback on their separate proposal(s). While the ACPs are separately sponsored, all three sponsors are required to coordinate their public consultations to ensure that stakeholders understand the overall impacts of the collective changes, as well as the local impacts.

Figure 2 illustrates the volumes of airspace that are potentially affected by the ScTMA cluster ACPs, sourced from the CAA Airspace Change Portal.

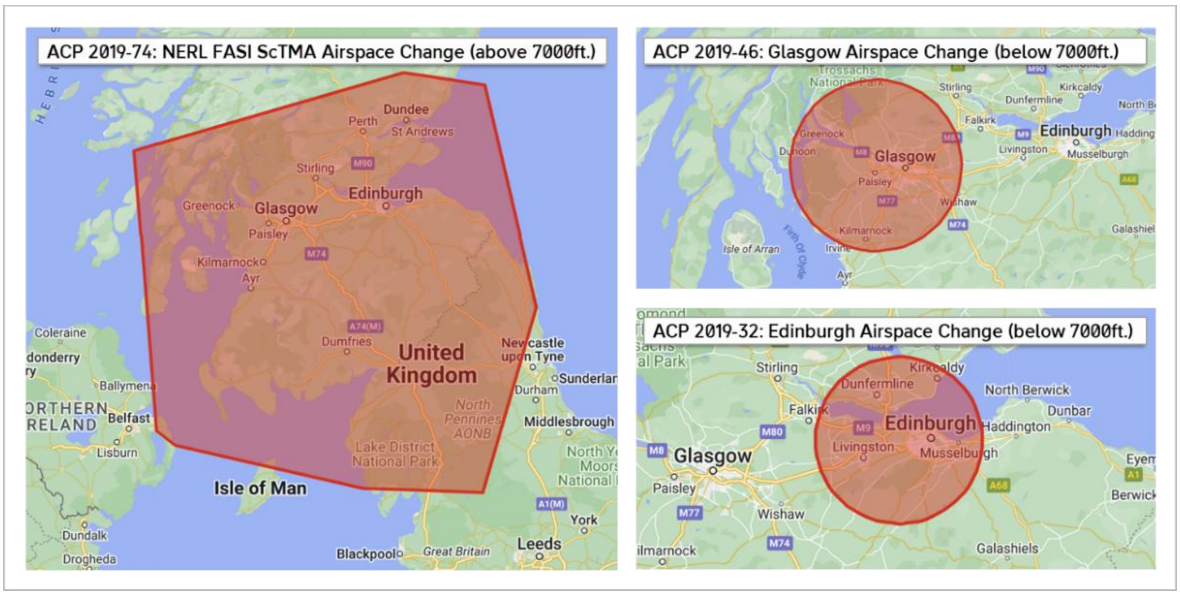

Figure 2: Illustration of the broad geographical areas that are potentially affected by ScTMA cluster ACPs

2. Issues with the existing ScTMA airspace

The ScTMA airspace was designed to support operations to and from Glasgow and Edinburgh Airports. The ScTMA also serves flights to and from several other airports including Glasgow Prestwick, Dundee, Cumbernauld and Leuchars Station (formerly RAF Leuchars Airfield), and on the region's periphery, flights to and from Aberdeen Airport. The ScTMA airspace has remained relatively unchanged for the past 50 years. When the airspace was originally designed, the ScTMA was not expected to cope with the number and complexity of flights operating today. Analysis conducted by NERL indicates that traffic demand in the busiest hours of the day is likely to exceed maximum capacity in parts of the ScTMA by 2040 if the airspace is not modernised.

Figure 3 illustrates the existing ScTMA airspace, including the current location of the airborne holds (where arriving aircraft fly in a racetrack pattern at assigned altitudes and speeds waiting for instructions from controllers to begin their approach for landing) and the position of the main inbound and outbound traffic flows when the prevailing wind is from the west.[2] The yellow arrows indicate the general position of the current departure flows from both airports. The blue arrows indicate the general direction of the current arrival flows into the existing airborne holds. The yellow and blue shaded areas indicate the broad swathes of airspace where inbound and outbound flights are currently vectored by controllers on arrival and departure.

Figure 4 illustrates the same information as figure 3 when the prevailing wind is from the east.

Airbourne hold

A standardised flight path that an aircraft follows when it is required to delay its landing or other phase of flight

Vectoring

A specific instruction given by a controller to a pilot to fly a particular compass heading and altitude to keep aircraft safely separated and maintain an expeditious flow of traffic

[2] Aircraft usually take-off and land into the wind. The prevailing wind in Scotland is from the west for approximately 70% of the time. Figure 2 shows flights departing and arriving in a westerly direction (known as westerly operations), illustrating the most common case in the ScTMA. When the prevailing wind is from the east, flights arrive and depart in an easterly direction using a different configuration of routes and procedures (known as easterly operations), as shown in figure 3.

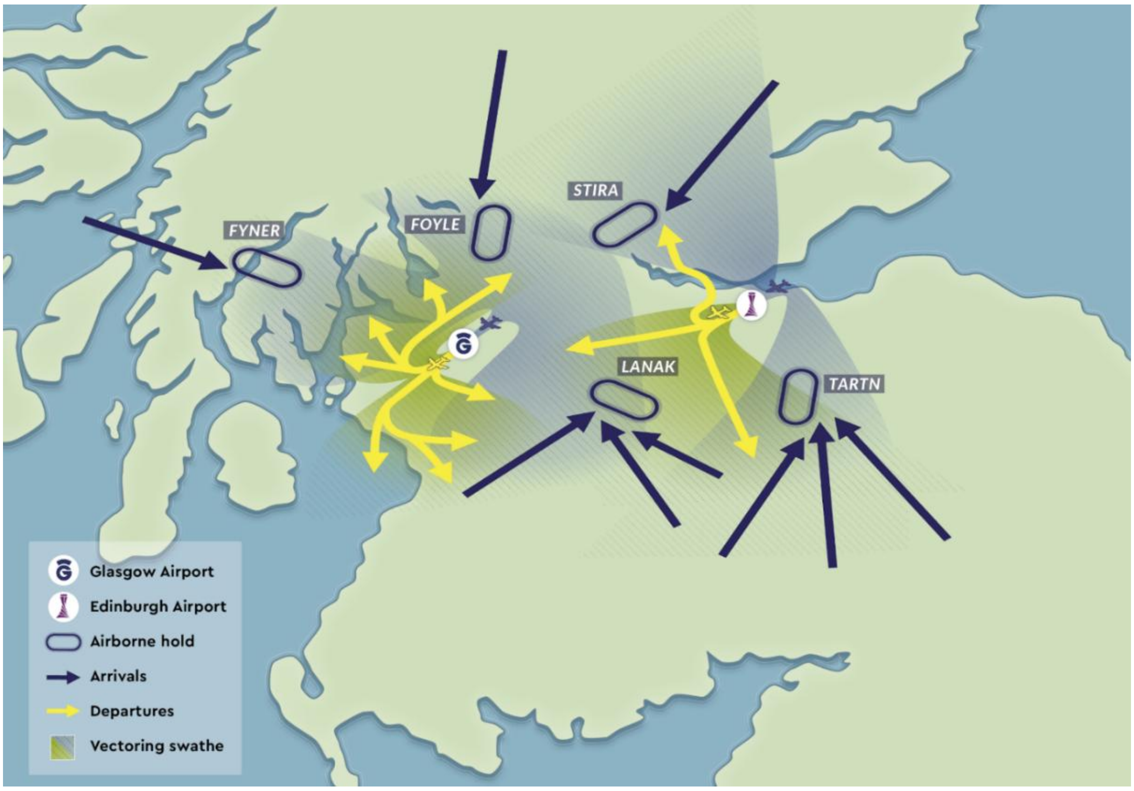

Figure 3: Illustration of the existing ScTMA airspace and air traffic flows during westerly operations

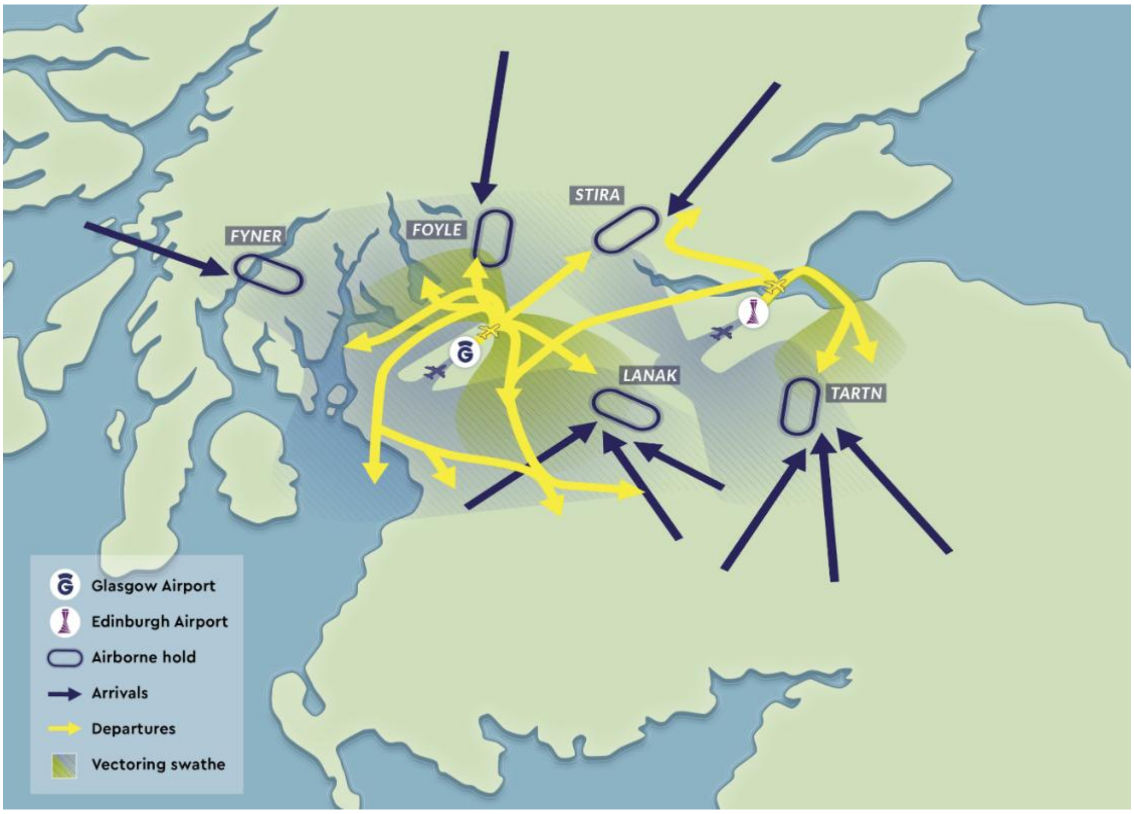

Figure 4: Illustration of the existing ScTMA airspace and air traffic flows during easterly operations

In the existing ScTMA airspace (during both westerly and easterly operations), outbound flights follow one of several Standard Instrument Departure (SID) routes immediately after take-off and are then vectored (in the shaded yellow areas) by controllers as they climb towards the cruise. Inbound flights follow one of several Standard Arrival Routes (STARs) that terminate at the airborne holds. Arriving aircraft are then vectored (in the shaded blue areas) from the hold or the end of the STAR onto the intermediate and final approach for landing.

There are four main issues with the **existing** ScTMA airspace design:

1. The outdated design of existing arrival and departure routes that serve Glasgow and Edinburgh airports are configured around the locations of ground navigation beacons rather than following shorter, more efficient flight paths. In addition, the existing routes typically converge at the same points over the ground, creating bottlenecks that constrain capacity and lead to traffic congestion at busy times.
2. The position and orientation of the airborne holds are not optimised to manage the main inbound traffic flows to the ScTMA as efficiently as possible. In addition, some of the holds also interact with some of the existing departure routes, meaning outbound traffic must fly longer and climb less efficiently to avoid them en-route to the cruise.
3. A lack of route connectivity to/from the east of the ScTMA means that most flights to and from the east and southeast are channelled through a single point to the southeast of the ScTMA (in the Newcastle area), which creates bottlenecks and congestion during busy times.
4. The constraints created by areas of special use airspace that can be reserved by the Military for training and exercises. Civil flights often plan to avoid these areas even when they are not in use, flying longer, less efficient routes around them.

3. Objectives of ScTMA airspace modernisation

The redesign of airspace aims to deliver four main objectives in line with the Government's vision for airspace modernisation.

The ScTMA cluster ACP objectives are to:

- Maintain and where possible improve high levels of aviation safety, simplifying the airspace design and reducing the complexity of the flight paths.
- Increase 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.

4. Description of the changes being proposed at a system level

The proposed changes by the ScTMA sponsors can be organised into four themes:

- Reviewing and amending the airborne holds serving arrivals into the ScTMA.
- Redesigning airspace pinch points affecting flights to and from the south of the ScTMA.
- Introducing new departure and arrival routes to and from the east of the ScTMA.
- Optimising airspace sharing with the Military and minimising controlled airspace.

Reviewing and amending the airborne holds serving arrivals into the ScTMA

Flights inbound to the ScTMA currently route towards one of five airborne holds dependent on the destination airport. The ScTMA holds are used by controllers to manage the flows of inbound traffic, especially during busy periods. Over 80% of flights inbound to the ScTMA arrive from the south. As a result, the LANAK hold that serves Glasgow arrivals and the TARTN hold that serves Edinburgh arrivals are by far the busiest. The STIRA hold in the northeast that serves flights inbound from northern Scotland, Europe and beyond, is shared by both Glasgow and Edinburgh traffic making it complicated for controllers to use efficiently. The position of flights in the hold are assigned on a first come first basis, creating an imbalance in the flow of inbound traffic to both airports during busy periods.

As part of the proposed ScTMA design, the ACPs are proposing options to change the position and orientation of the holds so that they are better aligned with the main flows of inbound traffic. Changes to some or all of the holds creates opportunities to redesign the departure routes at lower altitudes, so they are separated from the arrival flows, enabling more flights to climb continuously in the most efficient way possible. The proposed ScTMA design also considers the potential to introduce a new hold in the east of the ScTMA so that inbound traffic flows to Edinburgh from the east and southeast would have a dedicated airspace structure for managing arrivals.

Optimising the position of the airports arrival and departure routes also resolves most of the interactions of flights between them, enhancing safety and reducing both complexity and air traffic controller workload. This in turn creates airspace capacity, meaning predicted growth can be accommodated with less delay.

Redesigning airspace pinch points affecting flights to and from the south of the ScTMA

The portion of airspace in the south of the ScTMA is the most capacity constrained and inefficient in the current operation because it is used by the majority of arriving and departing flights. Departing aircraft are routinely required to level off when climbing to the south to remain safely separated from the arrival flows, leading to inefficiencies. Similarly, arriving aircraft are often instructed to follow longer less efficient flight paths and descend sooner than necessary to avoid the departing traffic.

As part of the proposed ScTMA design, the ACP sponsors are consulting on options to deconflict the arrival and departure routes using PBN standards to optimise the use of the available airspace. The new routes would be positioned so they are broadly parallel and safely separated by design (rather than multiple routes converging and creating pinch points as they do today). This is expected to reduce the reliance on controller vectoring and help to ensure that the departures flows heading south cross the arrival flows heading north in a simpler more ordered way, adding capacity and increasing efficiency.

New arrival and departure routes to and from the east of the ScTMA

The existing airspace does not include departure and arrival routes that connect to the east side of the ScTMA over the Firth of Forth and out over the North Sea. This means that outbound flights from Glasgow and Edinburgh airports with onward destinations in the east and southeast must fly south before turning east adding unnecessary track miles, CO_2 emissions, and in the case of Edinburgh Airport, positioning more low-level flights over land. Inbound flights from the east and southeast must approach the ScTMA from either the north or south, again resulting in additional track miles, emissions and flights over land.

As part of the proposed ScTMA design, the ACP sponsors are consulting on the introduction of new arrival and departure routes to the east that would enter and exit the ScTMA over the Firth of Forth. These routes would require additional controlled airspace to manage the safe, orderly flow of flights through this new area.

The area to the south is the most congested in the ScTMA, so in addition to the environmental benefits described above, these proposed new routes over the Firth of Forth and the North sea enable the both departures and arrivals to/from the east and southeast to avoid this congested area. This both improves safety and reduces complexity, which will ultimately mean precited growth can be accommodated with less delay.

Optimising airspace sharing with the Military and minimising controlled airspace

There are several areas of special use airspace within and surrounding the ScTMA that can be reserved by the Military for training and exercises. Civil flights avoid these areas when they are in use by flying longer, less efficient routes around them. As part of the proposed ScTMA design, the ACPs are seeking to take maximum advantage of existing joint Civil-Military procedures for the Flexible Use of Airspace (FUA). Under these arrangements, civil traffic may fly directly through certain areas of special use airspace en-route to and from their destination, when they are not being used by the Military. FUA procedures for airspace sharing are already used effectively in the ScTMA today.

The proposed ScTMA design is considering route options that are configured to deliver the greatest potential efficiency improvements through airspace sharing, for example the new routes to the east and southeast mentioned above are only possible with effective airspace sharing arrangements with the Military.

The proposed ScTMA design also includes a comprehensive review of the existing structure of controlled airspace. Portions of controlled airspace that are no longer required will be reclassified as uncontrolled airspace (Class G) that is accessible to other airspace users. Where possible, the base of controlled airspace will be lifted, releasing portions at lower altitudes for other airspace users to access.

5. Expected benefits of Scottish Airspace Modernisation

The various benefits expected from achieving the ScTMA airspace modernisation objectives fall to a range of different stakeholder groups, as summarised in table 2.

Table 2: Expected benefits of airspace modernisation in the ScTMA organised by stakeholder group

For local communities	The priority for airspace modernisation at lower altitudes is to limit and, where possible, reduce the total adverse effects of aircraft noise on people. Modernisation is expected to deliver an overall reduction in adverse effects from noise by moving flight paths to where they effect fewer people. However, as this overall benefit can only be achieved by the redistribution of noise between different areas, it may lead to disruption for some communities living under new flight paths.
For the environment	Airspace modernisation is expected to reduce the average environmental impact of each flight in the ScTMA. This is to help the UK to move towards its commitment to net zero emissions while maintaining the aviation sector in Scotland. The Government set out its proposed approach to reach net zero aviation by 2050 in its 2021 Jet Zero consultation and expects a significant proportion of the required emissions reductions will come from improving the efficiency of the existing aviation system, including aircraft, airports as well as airspace.
For airlines	Additional airspace capacity will accommodate predicted growth with less delay, while maintaining and enhancing high levels of safety. Modernisation will also improve flight efficiency, enabling the airlines to capitalise on the performance of their modern fleets of aircraft.
For airports	Modernisation is expected to reduce delays on the ground pre-departure caused by capacity constraints in the airspace and for Glasgow Airport to increase runway throughput during busy periods.
For passengers and the wider economy	Fewer flight delays and service disruptions are expected to save time and improve the passenger experience. The capacity to accommodate predicted growth with less delay will lead to more choice, better value, and enhanced global connections.
For other airspace users	Modernisation offers opportunities for other airspace users to access volumes of airspace that are not required by commercial air transport through the reclassification of unused controlled airspace as uncontrolled, and by more effective airspace sharing.
For the Military	Airspace modernisation will continue to ensure that Military operators have access to suitably sized and sited areas of airspace to fulfil defence and national security objectives, recognising that new Military aircraft and weapons platforms often require larger volumes of airspace in which to train and maintain operational readiness.

6. Overall impact of the proposed changes in the ScTMA cluster

The Masterplan Iteration 3 (Scotland) helps stakeholders and the CAA understand how the options in each ScTMA ACP relate to each other (i.e. their interdependencies) and the treatment of any design conflicts, potential solutions and proposed trade-off decisions. ACOG sets the methodology that the ACP sponsors apply, and the evidence required when identifying interdependencies and proposing trade-offs to resolve any design conflicts. The methodology is described in the Cumulative Analysis Framework (CAF) that is published alongside the Masterplan Iteration 3. The CAF methodology is supported by 5 technical annexes (consolidated into Masterplan Appendix 2) that provide detailed guidance on the use of data and metrics to support the evaluation of potential solutions and proposed trade-offs. You can find these documents by following this link www.acog.aero/sctma.

The CAF methodology considers where *cumulative* impacts from interdependent design options below 7,000 ft. may affect stakeholders on the ground and the *collective* impacts of all the ACPs in the cluster when they are added together. More information about the definitions and types of cumulative and collective impacts are provided in Masterplan Appendix 1.

Cumulative impacts only arise when two or more routes from different ACPs are positioned in the same portion of airspace below 7,000 ft., creating impacts for people on the ground in a specific location from more than one flight path.

Collective impacts on the other hand, incorporate all the impacts (both positive and negative) of the ACPs contributing to the overall design when they are added together consistently, regardless of their effects on specific stakeholders or locations. In other words, specific areas of cumulative impact within the design can be described as a subset of the overall collective impact. When considering solutions to resolve a design conflict, ACP sponsors examine both cumulative impacts below 7,000 ft. (affecting people in specific locations) and the summation of collective impacts generated by the overall design.

The CAF incorporates the outputs that are available from the Initial Options Appraisals conducted by ACP sponsors on their design options in Stage 2 of the CAP1616 process, the Full Options Appraisals conducted in Stage 3 and the Final Options Appraisals in Stage 4. The CAF methodology is organised into three parts that broadly align with these stages. The Full Options Appraisals are a more rigorous quantitative analysis of the options than the qualitative Initial Options Appraisals. The Final Options Appraisals update the Full Options Appraisals, taking into account modifications to the design as a result of the ACP consultations conducted during Stage 3. Importantly, the CAF does not tell the ACP sponsors what the solutions of different design conflicts and trade-offs should be. Rather, it guides sponsors through a three-part methodology to ensure

Interdependency

Two or more ACPs that are linked together in some way. For example, there is a potential conflict in their design options or there is a potential cumulative impact on stakeholders on the ground

Conflict

Two or more ACPs that cannot both proceed in their proposed form because their design options are not compatible

Trade-off

The decision to resolve a conflict and could be between two or more sponsors of separate ACPs, or between two or more objectives (such as achieving noise reduction and achieving fuel efficiency improvements) they gather the necessary evidence in a robust, coherent and transparent way as the CAP1616 process progresses.

Table 3: Summary of the three parts of the CAF methodology

#	Title	Summary
CAF part 1 (linked to the Initial Options Appraisals)	Review of route interdependencies, design conflicts and trade-offs	Before the Full Options Appraisals are carried out, ACOG coordinates a joint ACP sponsor review of the interdependencies between the shortlisted options from the Initial Options Appraisals to identify design conflicts, consider the potential solutions and where required describe the proposed trade-offs.
CAF part 2 (linked to the Full Options Appraisals)	Full cumulative analysis	ACOG collates the data from the individual Full Option Appraisals carried out by the ACP sponsors in the cluster to describe the collective cluster-wide performance and makes this information available for sponsors to present in their ACP submissions and consultation materials.
CAF part 3 (linked to the Final Options Appraisals)	Final cumulative analysis	ACOG collates the data from the individual Final Option Appraisals undertaken by the ACP sponsors in the cluster to describe the collective cluster-wide performance and makes this information available for sponsors to include in their final ACP submissions.

Glasgow Airport, Edinburgh Airport and NERL conducted the CAF part 1 review for the proposed ScTMA design. The review identified 18 specific areas across the proposed ScTMA design where interdependencies may arise between the specific options developed by the ACPs (i.e. where one sponsor's design options had the potential to affect the options included in another's ACP). Figure 5 indicates the approximate location of each identified interdependency.

Figure 5: Approximate location of each identified interdependency in the ScTMA CAF part 1 review

Eight of the interdependencies arose from the possibility of interactions between the proposed low-level arrival and departure routes in the Edinburgh and Glasgow Airport ACPs. However, the CAF1 analysis demonstrated that none of these potential interdependencies would result in a specific design conflict between the airports. In other words, all the design options for low-level arrival and departure routes that are considered for inclusion in the proposed ScTMA design are compatible in their current form. This conclusion was based on one of two reasons:

- The departure route options climbed quickly enough to jump the arrival route options without a design conflict; or
- The arrival route options all remained high enough for the departure route options to climb continuously beneath them without the need to level off.

As a result, the CAF part 1 review concluded that there are no design conflicts, proposed trade-offs or cumulative impacts below 7,000 ft. created by the ScTMA ACPs.

Design conflicts arising from the interdependencies and potential solutions

The remaining ten interdependencies concerned the proposed locations and orientations of the airborne holds and the possibility that they may affect the position of new PBN arrival and departure route options. During the CAF part 1 review, design conflicts did not arise for 8 out of the 10 interdependencies because the preferred positions of the proposed PBN arrival and departure routes were vertically or laterally separated from the preferred hold locations (allowing for continuous climb and descent operations where appropriate), and both options were compatible in their current forms.

The CAF part 1 review did identify two interdependencies that resulted in design conflicts. These are the interdependencies at locations 1 and 14 in figure 5. Both interdependencies concerned the location of airborne holds serving traffic inbound to Glasgow Airport (that were developed as part of the NERL ScTMA ACP above 7,000 ft.) and the position of PBN arrival route options (that were developed as part of the Glasgow Airport ACP below 7,000 ft.). The first design conflict involved an option to locate a new hold to the west of Glasgow. The second involved an option to locate a new hold to the north of Glasgow.

ACOG coordinated a qualitative assessment of the potential solutions available to resolve the conflicts, working with subject matter experts from NERL and Glasgow Airport. The qualitative assessments were sufficient to demonstrate that one solution was clearly preferrable to resolve the conflicts in both scenarios, because the chosen design delivered better outcomes than the alternatives when considering the collective impacts across all categories (e.g. noise, CO_2 emissions, airspace capacity, airspace access etc.).

The trade-offs associated with these conflicts are described in section B5. Following acceptance of the Masterplan, the ACP sponsors will include the proposed trade-offs as part of the consultations, and clearly highlight them so that stakeholders can influence the final proposed design. More detail about the interdependencies and design conflicts are set out in Appendix 3 of the Masterplan.

Proposed trade-offs to resolve the design conflicts

Trade-offs associated with the design option to introduce a hold to the west of Glasgow

Interdependency #14 in figure 5 refers to a design option in the NERL ScTMA ACP to introduce a new airborne hold to the west of Glasgow airport with the working name LARGO. The option created a design conflict with the Glasgow ScTMA ACP because the proposed LARGO hold could influence the options to modernise Glasgow's arrival and departure routes in this portion of airspace below 7,000 ft.

Two potential solutions were identified to resolve the design conflict:

- Solution 1: Arrivals above 7,000 ft. inbound to Glasgow from the south west would route to a hold positioned to the south east of the airport, in the vicinity of today's LANAK hold (the position of the existing LANAK hold is indicated on figures 3 and 4).

- Solution 2: Arrivals above 7,000 ft. inbound to Glasgow from the south west would route to a new hold - LARGO - to the west of the airport, in the vicinity of existing and proposed Glasgow departure routes to the west of the airport.

A CAF part 1 review of the trade-offs associated with the proposed solutions was conducted qualitatively by subject matter experts (SMEs) provided by the ACP sponsors and coordinated by ACOG. Table 4 summarises the outputs of the CAF part 1 trade-off review for the LARGO design conflict, comparing the expected outcomes of solution 2 against solution 1. A full review of the trade-offs associated with the proposed LARGO hold are set out in Appendix 3 of the Masterplan.

Table 4: Summary outputs of the CAF part 1 trade-off review for the LARGO design conflict

	Noise	CO_2 and Fuel Burn	Capacity & Resilience	Airspace Access
Solution 1 (without LARGO)	In solution 1 Glasgow departures and arrivals below 7,000 ft. have been designed to provide continuous climb/descent operations where possible – this helps minimise the area overflown below 7,000 ft.	The continuous climb/descent operations offered in solution 1 will provide fuel/CO_2 efficiency benefits below 7,000 ft.	The continuous climb/descent operations offered in solution 1 will enable aircraft to fly routes with minimal ATC intervention	The continuous climb/descent operations offered in solution 1 helps to minimise the impact of controlled airspace requirements because aircraft have shorter track segments at lower levels
Solution 2 (with LARGO)	The LARGO hold would require level segments to be introduced/extended on a number of departure and arrival routes below 7,000 ft.	The LARGO hold would be more fuel/CO_2 efficient for the network above 7,000 ft. than solution 1	The LARGO hold would require extended level segments which would lead to more ATC intervention and workload than solution 1	The LARGO hold would require additional controlled airspace to contain the level segments required below 7,000 ft.
Solution 2 (with LARGO) vs Solution 1 (without LARGO)	Solution 1 is better than solution 2 from an overflight perspective (considering that overflight is a proxy for noise in areas beyond those captured in noise contours)	Overall it was qualitatively assessed that the fuel/CO_2 benefits to the network of solution 2 were likely to be greater than the solution 1 fuel/CO_2 costs of introducing levels offs below 7,000 ft. However, the assessment was that the scale of any net CO_2 impacts would not be sufficiently disproportionate to justify the added noise/overflight impacts below 7,000 ft.	Solution 1 is better than solution 2 from an airspace capacity perspective, because solution 2 would increase workload and reduce the effective capacity of Glasgow Airport ATC managing flights below 7,000 ft.	Solution 1 is better than solution 2 from an airspace access perspective because it would require less controlled airspace below 7,000 ft.

The review of trade-offs highlighted that although the LARGO design option could provide some benefit for the NERL sponsored ACP above 7,000 ft. in terms of fuel and CO_2 efficiencies, negative changes to the Glasgow departure route options below 7,000 ft. would be necessary to accommodate the new hold, in particular:

- Introducing and/or extending level segments in the route design, interrupting continuous climb operations and worsening continuous descent approach performance below 7,000 ft.

- The requirement for additional portions of controlled airspace below 7,000 ft. to contain the extended level segments.

- An increase in Glasgow ATC workload, reducing effective capacity, which could not be overcome through the use of systemisation.

Based on the CAF part 1 qualitative review of impacts, the ScTMA ACP sponsors agreed that the expected impacts on noise, flight efficiency and controlled airspace at lower altitudes, and ATC workload would exceed the network benefits. Consequently, at this stage NERL discontinued the LARGO design option from the ACP. Further quantitative analysis of the CO_2, noise or airspace access impacts was not required at this stage to inform the proposed trade-off.

Trade-offs associated with the design options to change the Glasgow holds to the north

Interdependency #1 in figure 5 refers to design options in the NERL ScTMA ACP to change the location and orientation of airborne holds serving Glasgow arrivals to the north of the airport.

Glasgow airport currently operates with four airborne holds: these are currently referred to as FYNER for flights from the west, FOYLE for flights from the north, STIRA (shared with Edinburgh arrivals) for flights from the north east and LANAK for flights from the south and east. FYNER, FOYLE and STIRA are all positioned to north of the airport, with only LANAK to the south. However, due to prevailing traffic patterns most flights inbound to Glasgow Airport approach from southerly directions, which can contribute to congestion in these portions of airspace to the south of the ScTMA.

A key feature of the proposed ScTMA design is rebalancing the inbound traffic flows by bringing arrivals in from the east, through new network route structures above the Firth of Forth, into a hold to the east of the ScTMA. The existing STIRA hold was found to be undesirable for servicing these new inbound traffic flows from the east because, as a shared hold servicing both airports, it is complex for controllers to operate during busy times.[3] The STIRA hold is also not available when NERL permit airspace use northeast of the ScTMA by the Scottish Gliding Centre at Portmoak.

An alternative design option for the management of Glasgow arrivals from the north and east was therefore sought, which concentrated on removing the STIRA hold and combining and/or realigning the remaining northerly holds. Two potential solutions were considered as part of the CAF 1 review:

- Solution 1: a replacement for both the STIRA and FOYLE holds, with the working name COYLE. This design option would position a new hold near where the existing FOYLE hold is positioned, with a realigned orientation to more efficiently accommodate the new

[3] The position of flights in the hold are assigned on a first come first basis, creating an imbalance in the flow of inbound traffic to both airports during busy periods.

flow of traffic from the east. Solution 1 also aims to minimise impact on General Aviation operations (the controlled airspace for the proposed COYLE hold is located in areas less frequently used by GA than the existing controlled airspace that protects FOYLE).

- Solution 2: a single replacement for the STIRA, FOYLE and FYNER holds, with the working name LOCHY positioned between the existing FOYLE and FYNER holds.

The potential solutions could impact the position of the Glasgow arrival routes below 7,000 ft. so a CAF part 1 trade-offs review was conducted. This was a qualitative exercise undertaken by the SMEs provided by the ACP sponsors and coordinated by ACOG. Table 5 summarises the outputs of the CAF part 1 trade-off review for the proposed changes to the holds to the north of Glasgow airport. A full review of the trade-offs associated with the proposed changes to the holds to the north of Glasgow is set out in Appendix 3 of the Masterplan.

Table 5: Summary outputs of the CAF part 1 trade-off review for changes to Glasgow holds to the north

	Noise & tranquillity	CO_2 and Fuel Burn	Capacity & Resilience	Airspace Access
Solution 1 (COYLE)	The position of the COYLE hold would not be expected to increase overflight of the National Parks	The position of the COYLE hold is relatively efficient as the hold positions do not require arrivals to make a significant detour	ATC workload was not a significant issue for solution 1	The position of the COYLE hold would enable the transition from the hold to remain within that main area of controlled airspace required by the change (which is largely existing already)
Solution 2 (LOCHY)	The position of the LOCHY arrivals would require aircraft to descend below 7,000 ft. over the Loch Lomon and Trossachs National Park	The LOCHY arrivals from some directions would require aircraft to fly past, or turn away from the airport to reach the hold location	ATC workload was not a significant issue for Solution 2	LOCHY would require additional new controlled airspace for the arrival transitions
Solution 2 (LOCHY) vs Solution 1 (COYLE)	Solution 2 creates no notable difference in the overflight of populated areas below 7,000 ft., but generates additional tranquillity impacts. Solution 1 is therefore favoured from a noise and tranquillity perspective.	A combined track length assessment conducted by NERL showed solution 2 generated significant additional track miles compared to solution 1; this would translate into additional fuel burn and CO_2	Solution 2 does not create a discernible difference in ATC workload, capacity and resilience	Additional low level controlled airspace would be required to accommodate the arrival transitions from the solution 2 LOCHY hold

Based on the CAF part 1 qualitative review of impacts the ScTMA ACP sponsors agreed that COYLE (solution 1) was the preferred design option and as a consequence, at this stage NERL discontinued the LOCHY design option (solution 2). Further quantitative analysis of the CO_2, noise or airspace access impacts was not required to inform the proposed trade-off.

The ACP sponsors will include the proposed trade-offs summarised in tables 13 and 14 as part of their public consultations, and clearly highlight them so that stakeholders can influence the final proposed design.

CAF Part 2

Following CAF1 each sponsor has undertaken a Full Options Appraisal in line with the CAA's CAP1616 requirements for airspace change. The sponsors' Full Options Appraisals provide detail at the local level, whereas this document provides an overview of cumulative and collective performance at a cluster-wide level.

Each of the three sponsors is presenting one option for consultation. This means there is one cluster-wide option for this document to consider comprising of the three component proposals.

CAF2 data has been generated by combining information from each sponsor's Full Options Appraisal to show how the combined 'with airspace change' option for the cluster compares to the combined 'without airspace change' baseline. The comparison is undertaken for a 10 year period from 2027 (the implementation year) to 2036. The result is a suite of tables and diagrams to match those presented in the individual ACPs, but which show performance for the whole cluster, rather than for single ACP.

All the sponsors options are compatible with one another, so there are no interdependencies or trade-offs between the sponsors consultation options.[4]

There are no cumulative impacts from noise or overflights in the cluster-wide option. Cumulative impacts in this case would relate to the situation where a location is overflown by new flight paths below 7,000ft from both the Glasgow Airport and Edinburgh Airport proposed designs. The data shows there are no such cumulative impacts – this is demonstrated by the fact that there is no overlap between the noise and overflight contours for each airport's consultation options. Therefore, stakeholders with an interest in the noise or overflight effects from flights below 7,000ft in specific areas should consult the relevant local ACP where local impacts are described in more detail.

The CAF2 collective results for the cluster are summarised below. For details, regarding each ACP please see the separate Full Options Appraisal submissions/consultations.

Cost Benefit Analysis: The cost benefit analysis figures summarised Table show the cluster-wide option would provide an overall Net Present Value (NPV) benefit of c.£130m for the period 2027-2036.

Table 6: Cost benefit Analysis Summary for 2027-2036

Total NPV benefit	Noise NPV Benefit	CO_2e NPV Benefit	Fuel NPV Benefit	Delay NPV benefit	Infrastructure Costs	Operational Cost
£ 129,694,000	£ 31,566,000	£ 53,574,000	£ 36,473,000	£ 7,866,000	£ 244,000	-£ 29,000

[4] Interdependencies and trade offs identified during the design phase are captured in the CAF1 sections of the UK Airspace Modernisation Strategy Masterplan (Iteration 3 ScTMA).

Table 7 shows a summary of key collective statistics from the ScTMA cluster, which provide context for the monetised values in Table 6.

Table 7: CAF2 Summary Results for 2027-2036

Net people experiencing reduced daytime noise (LAeq)	Net people experiencing reduced nighttime noise (LAeq)	Greenhouse Gas Benefit (CO2e kT)	Fuel Benefit (kT)
39,973	53,358	219.8	69.1

CAF2 Summary of Collective Results for ScTMA Cluster in the Period 2027-2036

Noise: the government identifies a level of noise above which there are potential adverse effects on health and quality of life. These levels are defined in the 'L_{Aeq}' noise metric which is the primary decision-making metric for noise. The population data for the L_{Aeq} metric showed that, in the cluster-wide 'with airspace change' option, some people would experience more noise above the levels defined by government, but in these would be outnumbered by people experiencing less noise. Overall this results in a benefit from reduced noise which has been monetised at c. £32m over the 10 year analysis period (using the governments TAG workbook).

Greenhouse Gases (CO_2e) and Fuel Burn: these are both forecast to increase as a result of traffic growth in both the 'without airspace change' baseline and cluster-wide 'with airspace change' option. However, the CO_2e/fuel *per flight* is expected to fall, meaning that the rate of increase for overall CO_2e would be less as a result of the change. Overall, this results in a benefit from reduced CO_2e which is valued at c. £51m over the 10 year analysis period. There is also a benefit from reduced fuel costs of c.£36m over the same period.

It should be noted that the CO_2e results represent what is referred to as 'enabled benefit' derived from computer modelling which rely on forecasts and assumptions. The modelling used is industry-leading, but the level of accuracy cannot be confirmed until it is assessed at the post implementation stage. For some flights it results may be an overestimation, others may underestimate. However, overall it provides the best available evidence that proposed changes will, on average, reduce fuel and CO2e per flight and enable an overall all cluster-wide CO_2e benefit.

Capacity: Flight numbers in the region are expected to grow at an equal rate either with or without the cluster wide change. However, the cluster-wide 'with airspace change' option is forecast to result in fewer minutes of delay: 46,746 minutes fewer in 2027, rising to 60,818 minutes fewer in 2036.

General Aviation (GA): Overall, the cluster-wide 'with airspace change' option will require approximately 700 cubic nautical miles (NM^3) of additional controlled airspace. However, this is a net figure and relates to over 1,300 NM^3 of new controlled airspace that is required by the changes above 7,000ft. This is to provide more efficient en-route connectivity, and is predominantly at higher altitudes and over the sea. As such this airspace is not expected to have a significant impact on General Aviation operations. Below 7,000ft there is a reduction in CAS of over 600 NM^3. The sponsors believe that much of the released airspace is in areas that will be beneficial for General Aviation.

No cumulative effects are identified with respect to General Aviation access. That is to say that there are no negative changes described in the individual ACPs that would be considered worse than described, when considered alongside the proposals in neighbouring ACPs.

Additionally, over 5,000 NM^3 of airspace has had classification reduced from Class A, mostly to Class C or Class D. This reduces the requirements for aircraft to be granted clearance to enter the airspace. Access to temporary reserved areas for gliding has also been maintained.

In conclusion, the cluster-wide 'with airspace change' option represents a significant £130m overall benefit which comprises of net benefits across the key performance criteria of noise, CO_2e, fuel and capacity.

AIRSPACE CLASSIFICATION

In aviation, controlled airspace is managed by air traffic control (ATC), while uncontrolled airspace is not. Controlled airspace (Classified as A through to E) has specific rules and procedures, requiring pilots to communicate with ATC and follow their instructions. Uncontrolled airspace (Class G) generally allows more freedom but still requires pilots to adhere to regulations and maintain situational awareness.

CAF summary

Through the ScTMA CAF1 reviews, the ACP sponsors have gathered the necessary evidence for a robust, coherent and transparent design narrative that demonstrates how the proposed trade-offs have been considered and resolved where necessary. The supporting justification provided by the sponsors in selecting design options and proposing trade-offs is set out in their respective ACP consultations and ultimately in their ACP submissions. These justifications ensure that the proposed trade-offs are made in accordance with the AMS and that the outcomes are aligned with government policy. The evidence justifying how ScTMA ACP sponsors have proposed trade-offs taking stakeholders views into account will be laid out in the Consultation Response Documents published during Stage 4 of the CAP1616 process.

CAF2 describes the collective performance at the cluster wide-level, demonstrating that when considering the three ACPs as a whole system, there are significant regional benefits to be obtained through noise reduction, reduced CO_2e per flight and operational efficiencies that will mean less delay than there would be without airspace modernisation.

The ACP consultations are the opportunity for stakeholders to provide feedback on the ScTMA ACPs and influence the final design. As part of the consultation exercises, the ACP sponsors are providing more detail on their preferred options, outlining any design conflicts that may have arisen, presenting the cumulative and collective impacts of the changes, and including further detail on any proposed trade off decisions. The sponsors are each presenting the Full Options Appraisal with more rigorous evidence for the preferred option(s).

7. Next steps and more information

The ACP sponsors are consulting on their proposals between **20 October 2025 and 25 January 2026**. You can find more information on the proposals by following this link to the Scottish Airspace Modernisation website www.scottishairspacemodernisation.co.uk

Summary timeline

If approved by the CAA, the ScTMA ACP sponsors are working towards a target implementation date to deliver the airspace changes as a single integrated deployment in 2027.

There is more information about the airspace change programme on the CAA's website by clicking this link. You can also find out more on ACOG's website www.acog.aero

8. Glossary of Terms

Term	Description
Air Navigation Service Provider (ANSP)	An Air Navigation Service Provider is an organisation that provides navigation services to aircraft in the airspace or in the manoeuvring area.
ACP Sponsor	An ACP Sponsor is an organisation that proposes, or sponsors, a change to the airspace design in accordance with the CAA's airspace change process.
Airspace Change Organising group (ACOG)	The Civil Aviation Authority and Department for Transport, as co-sponsors of airspace modernisation in the UK required NERL to set up ACOG as a separate and impartial body to coordinate the airspace changes necessary to deliver airspace modernisation in the form of a masterplan.
Airspace Change Proposal (ACP)	A proposal (usually from an airport or air navigation service provider) to change the design of UK airspace, in line with the CAA's CAP1616 guidance.
Airspace Modernisation Strategy (AMS)	In 2017, the Secretary of State tasked the Civil Aviation Authority with preparing and maintaining a coordinated strategy and plan for the use of UK airspace up to 2040, including modernisation. The Airspace Modernisation Strategy (AMS) is based on four strategic objectives: Safety, Integration, Simplification and Environment. The AMS sets out the 'ends, ways and means' of modernising airspace through a series of 'delivery elements' that will modernise the design, technology and operations of airspace.
ATS route	An ATS route is a specified route designed for channelling the flow of traffic as necessary for the provision of air traffic services.
Civil Aviation Authority (CAA)	The Civil Aviation Authority (CAA) is responsible for the regulation of aviation safety in the UK, determining policy for the use of airspace, the economic regulation of Heathrow, Gatwick and Stansted airports, the licensing and financial fitness of airlines and the management of the ATOL financial protection scheme for holidaymakers. The Civil Aviation Authority (CAA) co-sponsor airspace modernisation and oversee ACOG's work. CAA is a public corporation of the Department for Transport.
Collective impact	Collective impacts incorporate all the impacts (both positive and negative) of the ACPs contributing to the overall design when they are added together consistently, regardless of their effects on specific stakeholders or locations. In other words, specific areas of cumulative impact within the design can be described as a subset of the overall collective impact. When considering solutions to resolve a design conflict, ACP sponsors examine both cumulative impacts below 7,000ft (affecting people in specific locations) and the overall collective impacts.
Conflict	A conflict can be described as two or more ACPs that cannot both proceed in their proposed form because their design options are not compatible.
Controlled airspace	Controlled airspace (CAS) Airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification.

Cumulative impact	Culminative impacts are where two or more routes from different ACPs are positioned in the same portion of the airspace below 7,000ft, creating culminative adverse effects for people on the ground in a specific location.
Cumulative Analysis Framework (CAF)	The CAF considers where cumulative impacts from interdependent design options below 7,000ft may affect stakeholders on the ground and the collective impacts of all the ACPs in a cluster when they are added together. The CAF incorporates the outputs that are available from the Initial Options Appraisals conducted by ACP sponsors on their design options in Stage 2 of the CAP1616 process, the Full Options Appraisals conducted in Stage 3 and the Final Options Appraisals in Stage 4.
Department for Transport (DfT)	The Department for Transport (DfT) work with agencies and partners to support the transport network that helps the UK's businesses and gets people and goods travelling around the country. DfT is a ministerial department, supported by 24 agencies and public bodies. The Department for Transport (DfT) along with the Civil Aviation Authority (CAA) co-sponsor airspace modernisation and oversee ACOG's work.
Design Principle	Design Principles encompass the objectives that the airport seeks to achieve through an airspace change, including safety, policy, environmental and operational factors. Design Principles are set through engagement with stakeholders at Stage 1 of the process, and they guide the airspace designers to create suitable flight path options at Stage 2.
Hold/holding stack	A published airborne hold, sometimes referred to as a holding stack, is a structure for arriving aircraft to fly in a racetrack pattern at assigned altitudes and speeds waiting for instructions from controllers to begin their approach for landing.
Habitats Regulation assessment (HRA)	Habitats Regulation assessment (HRA) is a process that determines whether or not development plans could negatively impact local plans on a recognised protected European site beyond reasonable scientific doubt. This is required by all competent authorities.
Interdependency	An interdependency can be described as two or more ACPs that are linked together in some way. For example, there is a potential conflict in their design options or there is a potential cumulative impact on stakeholders on the ground.
LAS	London Airspace South, the first phase of airspace modernisation proposed for deployment in the Southeast of England.
NATS	NATS is the UK's main navigation service provider and is sponsoring airspace change proposals to modernise the network that sits above 7,000ft, known as en-route airspace.
NATS En-Route Plc (NERL)	NATS En-Route Plc (NERL) provides Air Traffic Control services to aircraft flying in airspace above 7,000ft over the UK and eastern part of the North Atlantic.
Performance-based Navigation (PBN)	Performance-based Navigation (PBN) improves the accuracy of where aircraft fly by using satellite technology rather than ground navigation beacons. It is a cornerstone of airspace modernisation as

	it decouples routes from the location of the beacons and improves aircraft track keeping.
Regional cluster	Regional clusters are the geographical organisation of ACPs based on the interdependencies between the ACPs and analysis into areas of the existing airspace where inefficiencies and delays are expected to worsen as traffic levels grow.
Strategic environmental assessment (SEA)	A Strategic environmental assessment (SEA) is a systematic process for identifying, reporting, proposing mitigation measures and monitoring environmental effects of plans, programmes and strategies.
Standard Arrival Routes (STARs)	A Standard Arrival Route (STAR) is a standard ATS route identified in an approach procedure by which aircraft should proceed from the en-route phase to an initial approach fix.
Standard Instrument Departure (SID) routes	A Standard Instrument Departure Route (SID) is a standard ATS route identified in an instrument departure procedure by which aircraft should proceed from take-off phase to the en-route phase.
Terminal Control Area/Terminal Manoeuvring Area (TMA)	Terminal Control Area is designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.
The Masterplan	The Masterplan, developed by ACOG, is the single coordinated implementation plan for the ACPs needed to modernise airspace up to 2040.
Trade-off	A trade-off is the decision to resolve a conflict and could be between two or more sponsors of separate ACPs, or between two or more objectives (such as achieving noise reduction and achieving fuel efficiency improvements).
Uncontrolled airspace	This airspace is located away from airports and is not subject to ATC control. Pilots are still required to comply with certain rules and regulations, but they do not have to contact ATC when entering and exiting this airspace.
Vector	A vector is a specific instruction given by a controller to a pilot to fly a particular compass heading and altitude to keep aircraft safely separated and maintain an expeditious flow of traffic.