Summary Document

Stage 2 Develop and Assess

MAG East Midlands Airport

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1 Introduction

1.1

The Airspace Change Proposal (ACP) in relation to departures from and arrivals to East Midlands Airport (EMA) forms part of the UK Government's Airspace Modernisation Strategy (AMS)[1]. The ACP at EMA is part of a coordinated series of projects undertaken by a number of UK airports and NATS (the air navigation service provider for the UK) which are collectively known as the Future Airspace Strategy Implementation (FASI) programme. Airspace modernisation is intended to provide greater operational resilience, ensure the highest standards of safety, and realise improvements in efficiency and environmental impact.

1.2

Airspace change is regulated by the Civil Aviation Authority (CAA) under the process set out in CAP1616. This document provides a summary of the work undertaken by EMA as change sponsor to address the requirements of Stage 2 of the CAP1616 process. It is one of the reports which collectively constitute the EMA submission to the CAA for Stage 2 gateway approval. The full suite of Stage 2 submission documents is:

- This report, the **Stage 2 Summary Document,** which draws together the key points from the Stage 2 submission and provides details of the Government's national process of airspace change, the CAP1616 process and the progress to date of the ACP at EMA.
- **Design Options Evolution (DOE),** Appendix A to the Stage 2 Summary Document shows the evolution of the design options through Steps 2A and 2B of the CAP1616 process. The resulting shortlist of design options will be considered in the Full Options Appraisal (FOA) at Stage 3.
- **Design Options Report (DOR),** which sets out EMA's approach to the design process and the output of that process in the form of design options for both departures and arrivals at the airport. It presents the options identified and describes how those options were refined to provide the comprehensive list of options to be progressed to the Design Principle Evaluation (DPE).
- **Design Principle Evaluation (DPE),** which assesses how the design options have responded to the design principles established at Stage 1 of the CAP1616 process and identifies those design options that warrant further analysis at the next step.
- **Initial Options Appraisal (IOA),** building on the results of the DPE, the IOA is the first of three option appraisals required as part of the CAP1616 process. The purpose of the IOA is to provide, at a minimum, a qualitative assessment of each design option providing stakeholders and the CAA with the relative differences between impacts, both positive and negative; and
- **Stakeholder Engagement Report (SER),** which explains how engagement has been used in the processes described in the other Stage 2 documents and records its outputs.

These reports, together with their supporting appendices, will be published on the CAA Airspace Change Portal www.airspacechange.caa.co.uk.

1 CAP1711: Airspace Modernisation Strategy 2023-2040 Part 1: Strategic objectives and enablers

2 Requirement for change

2.1
Airspace is a critical part of national infrastructure. Like the road and rail network, it plays a vital role in enabling movement of people and products quickly and efficiently, enabling connectivity and driving economic growth.

2.2
Although the UK has some of the most congested and complex airspace in the world, the way it is managed has changed little since the 1950s. In 2017, the UK Government established a national programme through the CAA to modernise UK airspace and to make better use of the technology which is available on today's aircraft, enabling UK aviation to meet future challenges and opportunities.

2.3
Modernising UK airspace has the potential to bring a number of benefits, including reduced delays, greater reliability, more efficient operations and the chance to build on the UK's already world-class aviation safety record. In addition, it presents an opportunity to address some of the wider impacts of aviation such as noise and emissions.

2.4
Despite the effect COVID-19 has had on the aviation industry, the need to modernise the UK's airspace is unchanged and remains a clear priority for the Government. In common with the rest of the aviation sector, EMA's passenger numbers were significantly affected by the COVID-19 pandemic. However, we remain confident that traffic levels will continue to recover to pre-pandemic levels (where the airport handled almost 75,000 movements per year, as we did in 2019), playing a major role in the UK and regional economy. Pre-pandemic EMA connected just under five million passengers per annum. In addition to its passenger operations, EMA is the UK's largest air cargo operation, processing and transporting over 400,000 tonnes of cargo a year, making it the country's most important airport for express freight.

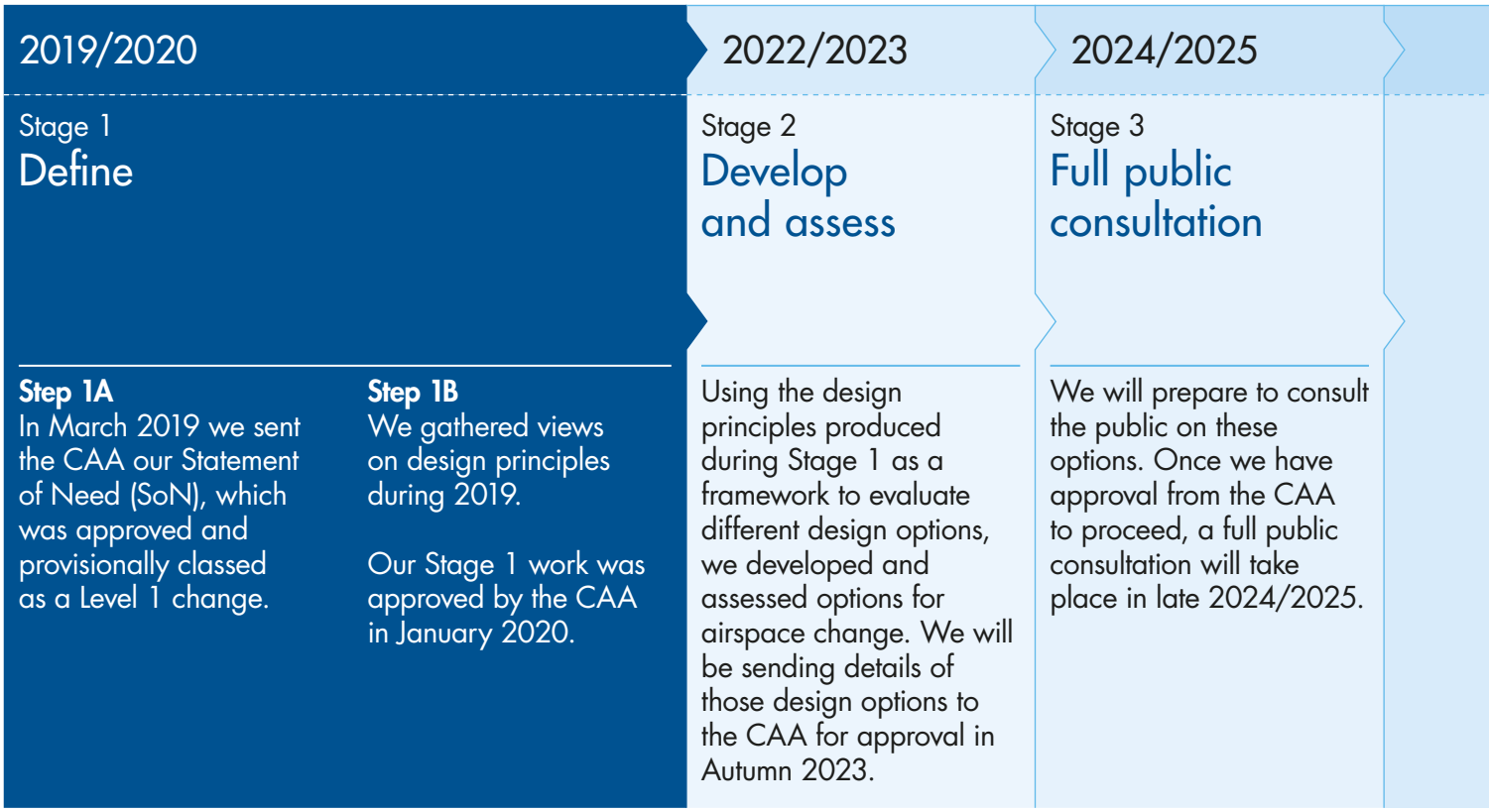
3 CAP1616

3.1
As the national regulator, the CAA has responsibility for approving all changes to airspace. In December 2017, the CAA published its Airspace Modernisation Strategy (AMS) and created a change process called CAP1616: guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information. The AMS was refreshed in January 2023.

3.2
CAP1616 was most recently updated in March 2021. It sets out the seven stages that the CAA requires airports to complete to carry out modernisation of their airspace, including detailed guidance on the involvement of stakeholders, including local communities, when developing change proposals.

3.3
CAP1616 includes four 'gateways' at which the CAA assesses the work undertaken by airports before allowing them to progress to the next stage of the process. EMA received CAA approval for Stage 1 at the Define gateway on 10 January 2020.

Figure 1: The seven stages of airspace change[2]



2 All future dates are subject to change. Until iteration three of the Masterplan has been assessed and accepted by the CAA and DfT, the full indicative timeline for the ACP cannot be confirmed.

3.4
This document and the four accompanying reports submitted to the CAA alongside it detail the work carried out at EMA to satisfy the requirements of Stage 2 of the CAP1616 process. Together, they form EMA's submission at the Develop and Assess gateway.

3.5
EMA's progress to date and anticipated future activity is shown in the timeline below.

3.6
As shown in the timeline, there will be further opportunities for more detailed engagement with stakeholders through the remainder of the CAP1616 process. This will include a full public consultation at Stage 3.

3.7
The Airspace Change Organising Group (ACOG) was set up by the CAA and the Department for Transport (DfT) in 2019 to coordinate the national programme of change and create a strategic Masterplan[3]. Iteration two of the Masterplan was published in January 2022. This sets out the four geographical clusters of change, determined by the location of airports' airspace structures, known as Terminal Manoeuvring Areas (TMAs). Airports within each cluster currently have routes which interact to varying degrees, creating inefficiency. The Masterplan identifies and sets out the approach to addressing these regional interdependencies. EMA forms part of the Manchester Terminal Manoeuvring Area (MTMA). There are three other airports within the MTMA that are also following a CAP1616 airspace change process. At the time of preparing this document, Manchester Airport are at Stage 3, Liverpool John Lennon Airport (LPL) were paused at Stage 4 but have now revisited Stage 2 (their revised Stage 2 submission has recently received Stage 2 gateway approval) and Leeds Bradford Airport (LBA) are preparing their Stage 2 submission.

TBC	TBC	TBC	TBC
Stage 4 **Update and submit proposals**	Stage 5 **Decision**	Stage 6 **Implementation**	Stage 7 **Post-implementation review**
We will update our airspace change proposal, taking stakeholders' feedback into account, before sending it to the CAA.	We expect the CAA's decision on whether to approve any airspace change.	If approved, any airspace changes could be put in place.	The CAP1616 process gives the CAA and airports 12 months to review any change that has been made to airspace.

3 UK Airspace Change Masterplan Iteration 2.

4 Stage 1 overview

4.1
Stage 1 (Define) is divided into two Steps:

- Step 1A – Assess Requirement; and
- Step 1B – Design Principles

Step 1A – Assess Requirement

4.2
In June 2019, EMA completed Step 1A by submitting a SoN[4] to the CAA, setting out why an airspace change was necessary. The reasons provided included taking the opportunity to fully utilise the capability of modern aircraft technology and techniques 'potentially increasing efficiency, reducing fuel burn and CO_2 emissions, enhancing safety and reducing the impact of aircraft noise.'

The CAA subsequently approved the SoN, agreeing that EMA could initiate an airspace change.

Step 1B – Design Principles

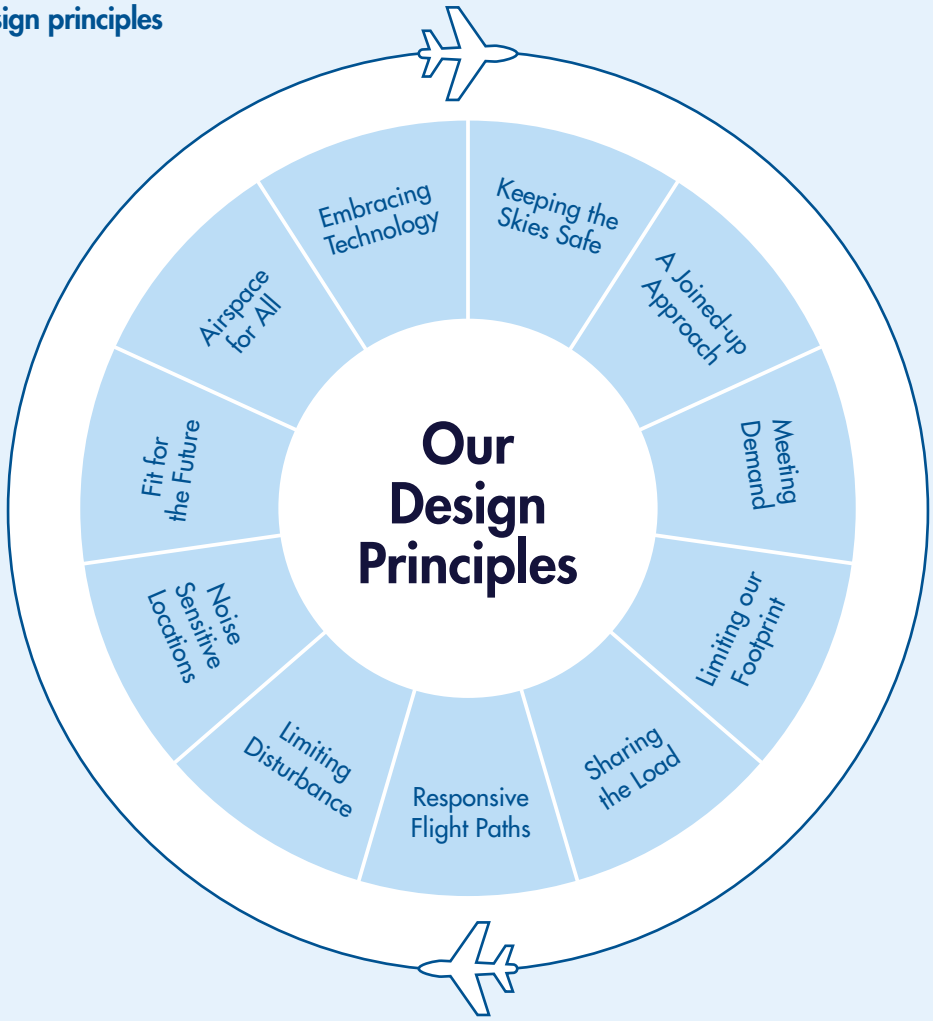
4.3
Step 1B requires the change sponsor to identify design principles to provide a framework for the subsequent design and evaluation of the options that address the issues and opportunities identified in the SoN.

4.4
The process followed at EMA to develop the design principles through a two-way engagement with affected stakeholders is set out in full in the report 'Listening to Stakeholders – Our Proposed Design Principles for Airspace Change' and its appendices[5]. The report includes details of the stakeholders engaged with, the feedback provided and how the design principles responded to that feedback. The report was submitted to and approved by the CAA in January 2020.

4.5
The final design principles are set out overleaf.

4 Statement of Need – https://airspacechange.caa.co.uk/PublicProposalArea?pID=176
5 Listening to Stakeholders, Our Proposed Design Principles – https://airspacechange.caa.co.uk/documents/download/1387

Figure 2: The design principles



Keeping the Skies Safe
Safety must take precedence over all other factors. Flight paths must be safe for airspace users, the airport and communities on the ground.

A Joined-up Approach
Any changes must align with the broader national airspace modernisation strategy, comply with national, international and industry regulations and legislation, and align with current and future Airspace Change Programmes in the north and south of the UK through involvement in the Future Airspace Strategy Implementation groups.

Meeting Demand
New flight paths must ensure the continuation of services offered today and meet any future demand, in keeping with local and national planning policy, and the Government's policy on 'making best use' of existing runway capacity.

Limiting our Footprint
Flight paths that limit and, where possible, reduce emissions should be implemented.

Sharing the Load
Flight paths should, where practical, be spread out to avoid concentration of aircraft activity to share any noise impacts.

Responsive Flight Paths
Where flight paths have overfly communities, we will consider existing noise in the local area, and will select flight paths to mitigate effects on areas with relatively low levels of ambient noise.

Limiting Disturbance
Flight paths should seek to limit and, where possible, reduce noise disturbance to communities – especially at night.

Noise Sensitive Locations
Flight paths should, where practical, avoid locations that are especially sensitive to noise.

Fit for the Future
Flight paths should be designed to futureproof our airspace and cannot be constrained by existing arrangements.

Airspace for All
Our controlled airspace should be open to all authorised users; however, priority will be given to airport traffic over other airspace users, except for emergency aircraft.

Embracing Technology
Flight paths should be designed using the latest, widely available navigational technology and flying techniques.

5 Stage 2 overview

5.1
Stage 2 (Develop and Assess) of the CAP1616 process focuses on the development of route options and is divided into two Steps:

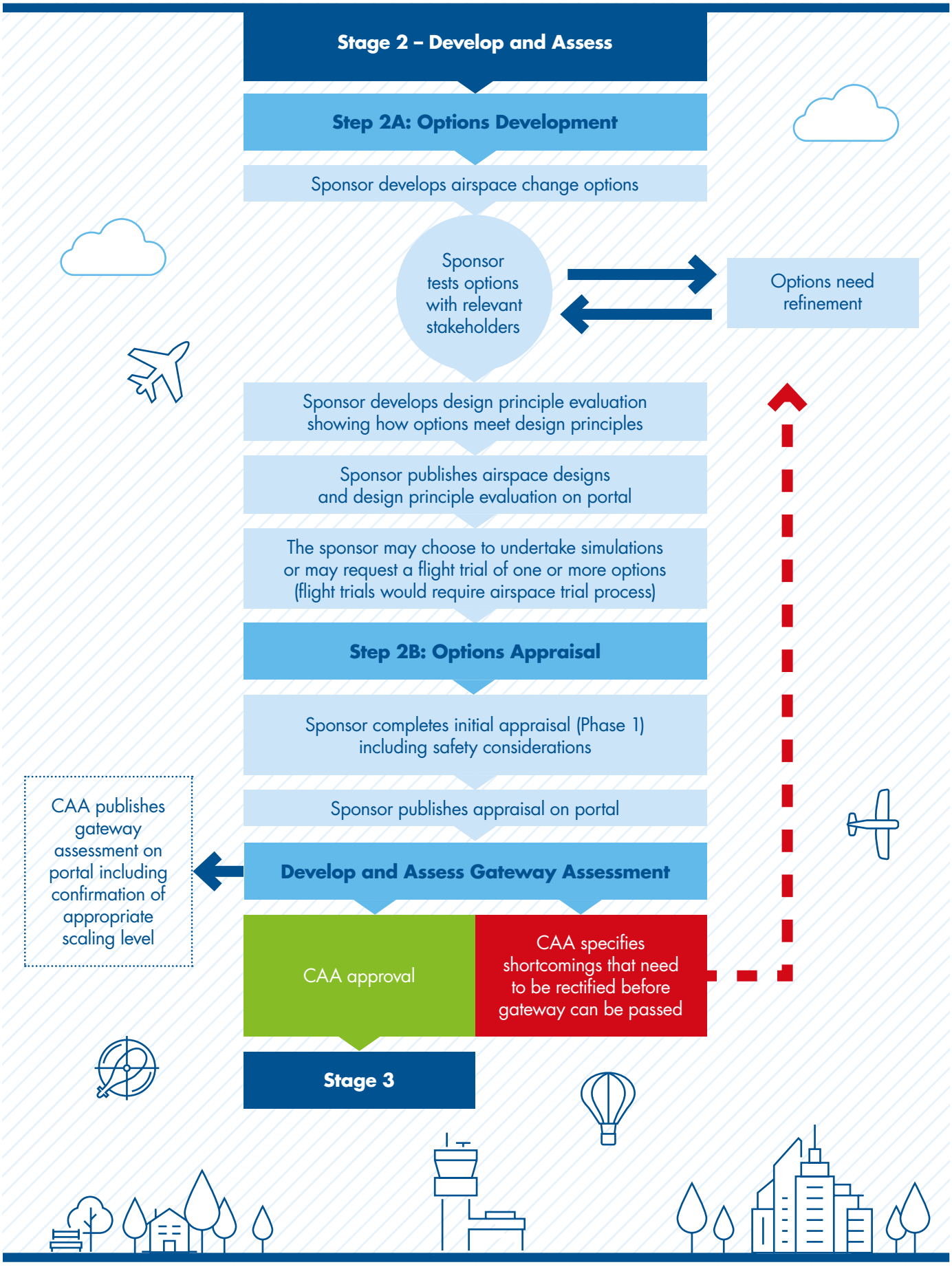
- Step 2A – Options Development; and
- Step 2B – Options Appraisal

5.2
Step 2A requires the creation of a comprehensive list of route options to address the SoN and respond to the design principles established at Stage 1. These options must then be tested with stakeholders and evaluated against the design principles. In Step 2B, the options are assessed to understand their wider impact, as part of the IOA. This is followed by a FOA at Stage 3.

5.3
As for Stage 1, stakeholder engagement is an important component of Stage 2, CAP1616 requires the demonstration of how stakeholders' views and feedback have informed the development of the route options. A full description of the engagement activities completed by EMA during Stage 2, including engagement with the general public, is set out in the separate SER and SER Appendix 2 Chronology of Engagement.

5.4
The work carried out by EMA at Step 2A is described in full in the DOR, SER and the DPE. The work carried out at Step 2B is detailed in the IOA. These documents, together with supporting appendices and this document, will be published on the CAA Airspace Change Portal www.airspacechange.caa.co.uk.

Figure 3: Stage 2 process



Step 2A – Design Options Report (DOR)

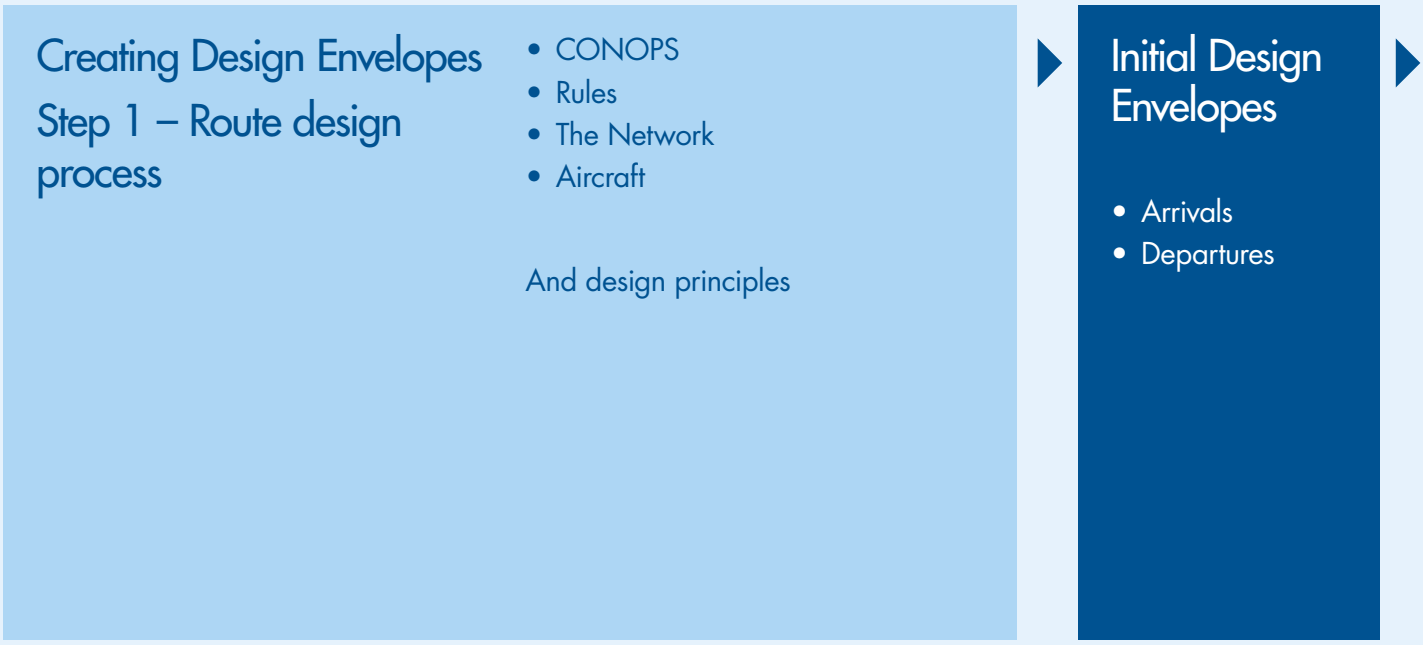
6 Introduction

6.1
CAP1616 Step 2A requires the change sponsor to develop a comprehensive list of design options that address the SoN and that align with the design principles. The DOR is the EMA response to that requirement and presents the process followed to arrive at a comprehensive list of route options for evaluation against the design principles, as illustrated in the flowchart below.

6.2
This process allowed EMA to refine the possible route options to ensure that the options progressed to the full DPE addressed the SoN and were capable of aligning with the design principles. This process was carried out for both arrivals and departures route options.

6.3
The initial stage of the design process considered the current operations at EMA, as well as the requirements identified in the SoN. A design boundary was established based on technical requirements (such as the International Civil Aviation Organisation (ICAO) and the UK CAA rules governing airspace and flight procedure design) with design envelopes then developed based on that boundary. The design envelopes formed the broad areas where it would be possible to design options for departures and arrivals.

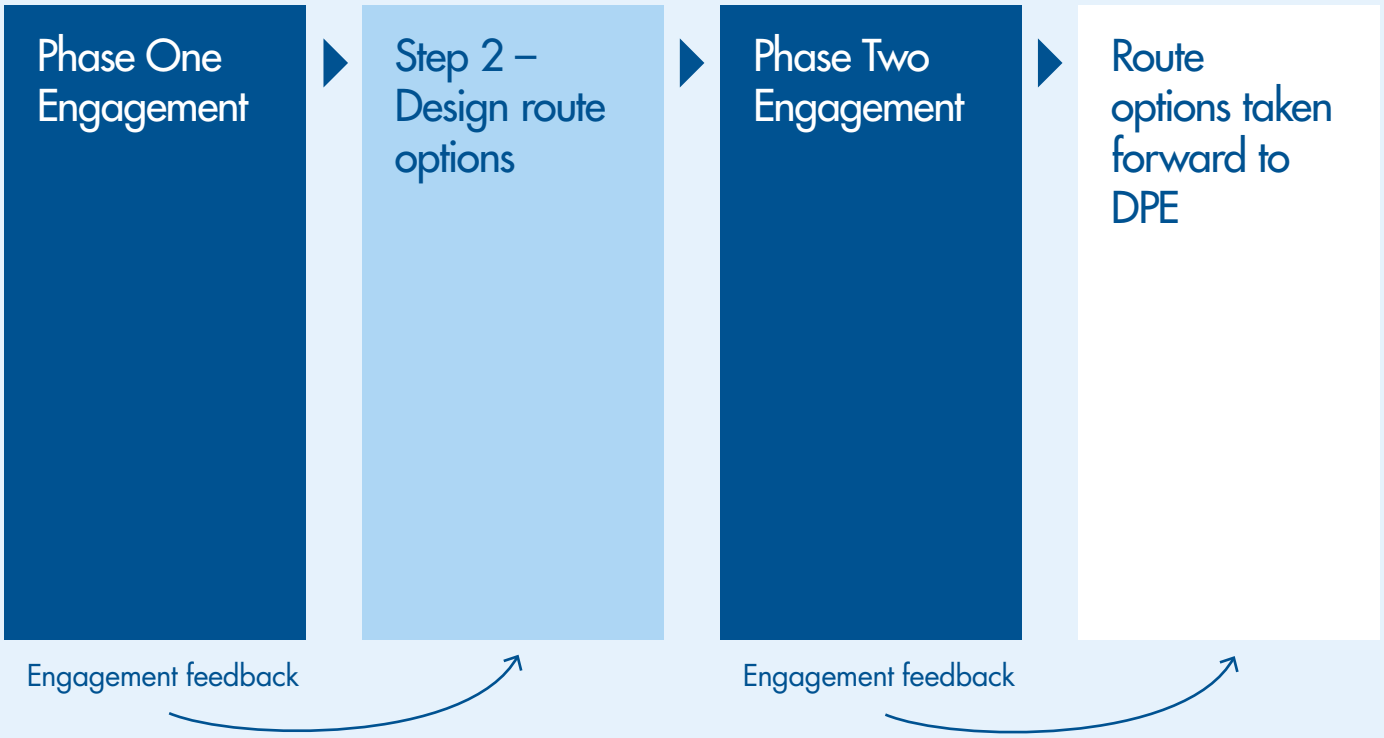
Figure 4: Design option process



6.4
A second phase of design work was then undertaken to create specific route options from the design envelopes, with an initial assessment of viability applied so as to ensure that only those route options that were capable of aligning with the design principles were taken forward to the full DPE.

6.5
As required by CAP1616, the route options were tested with potentially affected stakeholders to gather feedback on the alignment with the design principles and allow further opportunity for any concerns and suggestions to be raised as part of the ongoing two-way engagement at EMA. The airport opted to undertake two distinct phases of stakeholder engagement during Stage 2, testing first the initial design envelopes and then the route options developed from those envelopes. In addition to engaging with those stakeholders required by CAP1616, EMA also engaged with members of the general public.

6.6
Sections 8 to 18 of this document summarise the design process and the engagement exercise undertaken. For the full details, please refer to the DOR and Summary Document Appendix A – Design Options Evolution.



7 Statement of Need (SoN)

7.1

CAP1616 requires the change sponsors to identify a comprehensive list of route options that could potentially address the SoN and align with the design principles. To ensure that the route options proposed in the DOR addressed the SoN, the following key requirements from the SoN were considered:

- removal of the reliance on ground-based navigational aids.
- modernisation of airspace arrangements for aircraft operating to and from the airport at altitudes of 7,000ft and below.
- making best use of new navigational technologies, so that the operational efficiency and environmental benefits that modern aircraft offer can be fully realised; and
- integration with other airports and the wider changes to the airspace system being pursued through the national airspace modernisation programme.

7.2

Section 6 of the DOR provides further detail as to how these requirements were taken into account in the development of the design envelopes and route options.

8 Baseline

8.1

Before developing the route options, the existing departure and arrival operations at EMA were considered. This provided a baseline against which to develop the comprehensive list of route options required by CAP1616. The number of aircraft arrivals and departures in 2020 and 2021 was significantly affected by the pandemic with a reduced number of passenger aircraft movements and an increased number of cargo movements. Whilst 2022 showed a return towards pre-pandemic trends, instability in the industry continued to impact operations in both passenger and cargo movements. During 2023, passenger operations have shown a steady recovery towards pre-pandemic levels. The number of cargo movements has reduced compared with 2020 and 2021 levels. As EMA operations continue to stabilise, we expect this trend to continue albeit with some cargo growth retained, and for 2023 to be a more representative year. However, in the meantime, the calendar year of 2019 represents the last full year of (pre-pandemic) normal operations and has therefore been used as the baseline as it most closely reflects 'normal' operations. The existing operations at EMA are described below.

EMA has a single runway orientated in an east-west direction. Aircraft take off and land into wind and because of the UK's dominant wind direction, westerly operations are predominant. Over the last 20 years the split is approximately 75% westerly using Runway 27 and 25% easterly using Runway 09.

Departures

8.2

Figure 5 shows the distribution of departing aircraft from Runway 27 over a typical day. There are two Noise Preferential Routes (NPRs) which encompass the Standard Instrument Departure routes (SIDs) from Runway 27. The proportion of total departure movements is shown by the percentage figures, while the colours distinguish the altitude reached by aircraft along each of the routes.

8.3

Figure 6 shows the distribution of departing aircraft from Runway 09 over a typical day. There are four NPRs which encompass the SIDs from Runway 09. The proportion of total annual departure movements is shown by the percentage figures, while the colours distinguish the altitude reached by aircraft along each of the routes[6].

6 A small percentage of departures fly visual flight rules (VFR) and therefore do not follow any of the NPRs. This applied to 1.4% of total departures in 2019.

Figure 5: Typical departures from Runway 27, with percentage of total departures over the year 2019

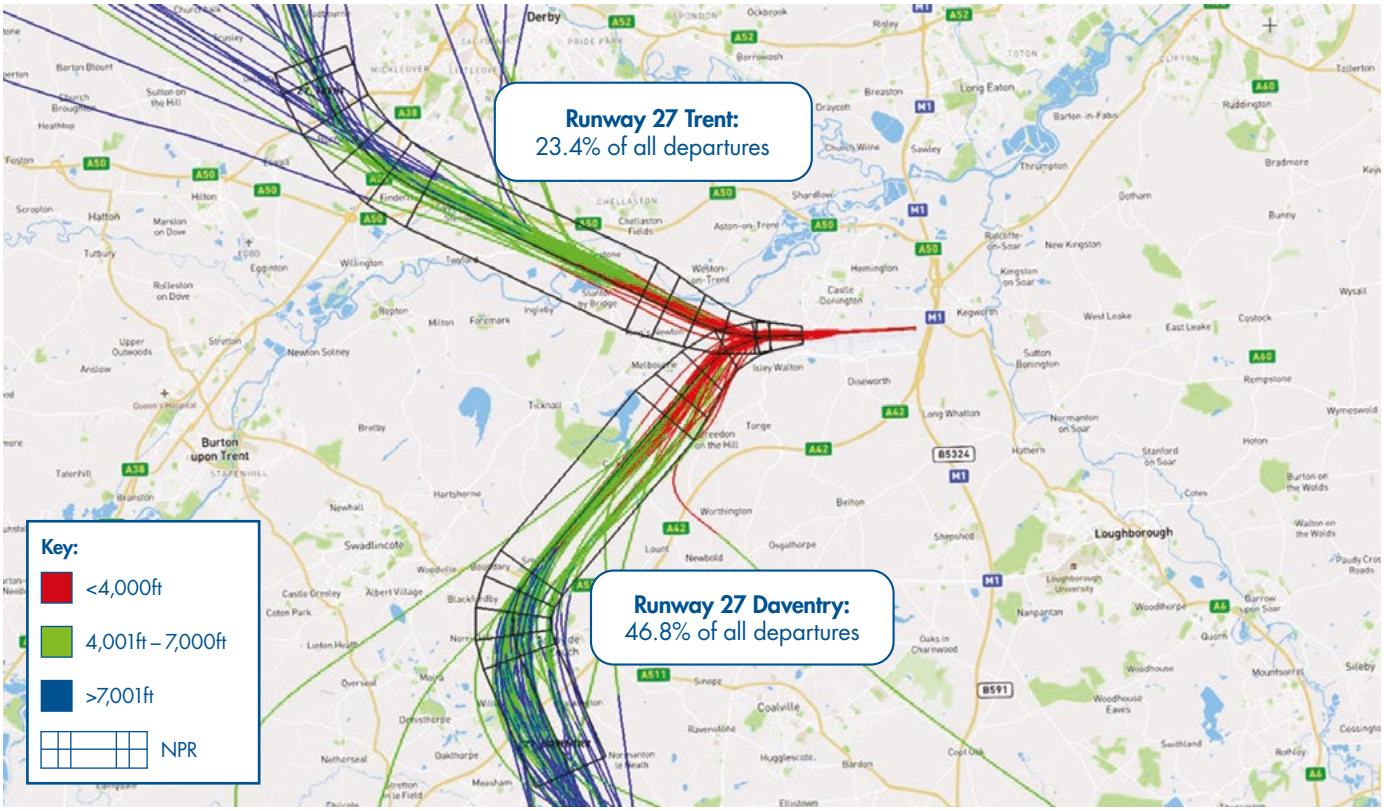
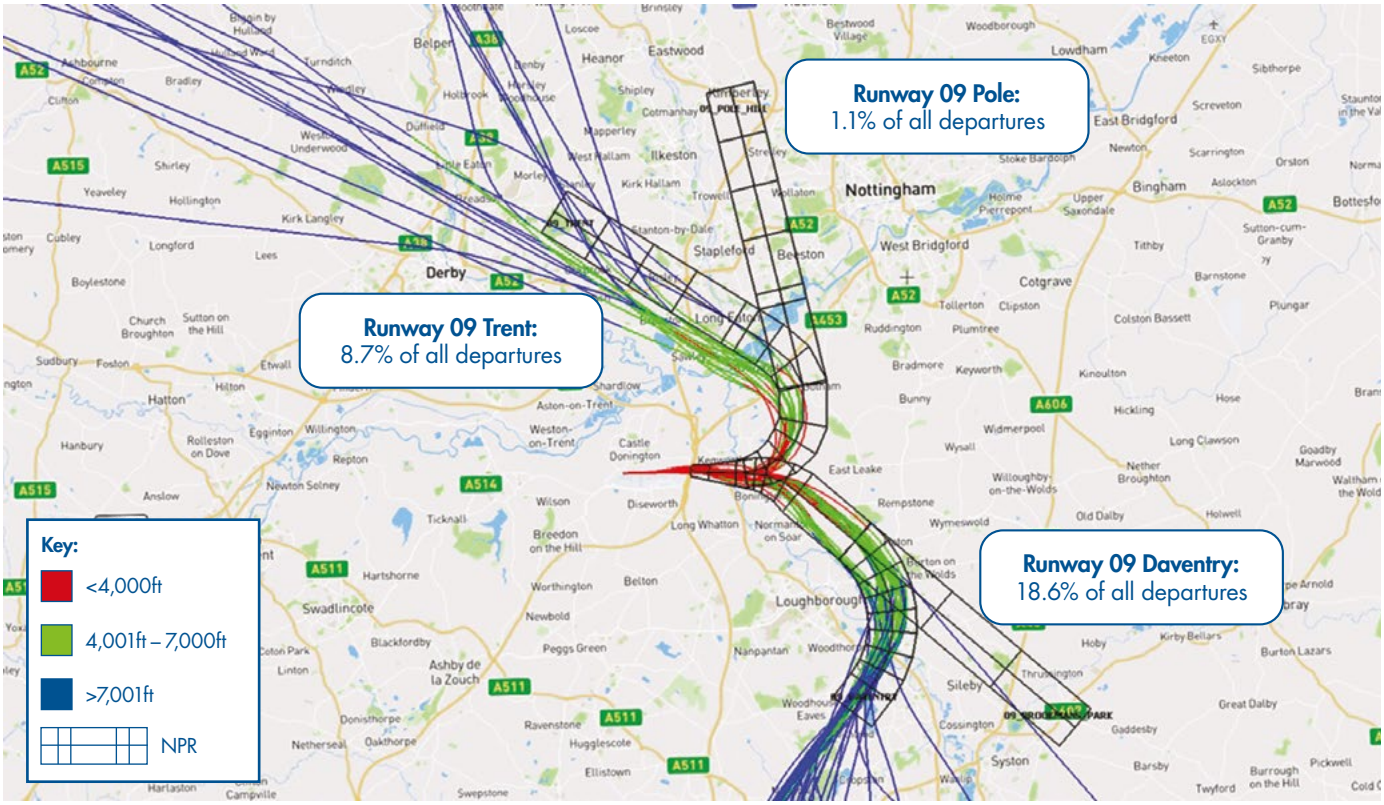


Figure 6: Typical departures from Runway 09, with percentage of total departures over the year 2019



Arrivals

8.4

There are no fixed flight paths for arriving aircraft until they are established on the Instrument Landing System (ILS), or 'final approach' at a height of at least 2,000ft. This is approximately six miles from the runway. Figure 7 shows the distribution of aircraft as they arrive to Runway 27 over a typical 2019 day. Figure 8 shows the equivalent for arrivals onto Runway 09.

8.5

Arriving aircraft approach UK airspace from several entry points before routing towards EMA's airspace. Air Traffic Control (ATC) ensure that aircraft are sequenced for safe separation by controlling the speed, direction, and height of the aircraft prior to them being turned on to the ILS. When EMA is busy, arriving aircraft may be held by ATC in a 'holding stack' before being instructed to make their final approach. The two holding stacks serving EMA are ROKUP to the north and PIGOT to the south. The position of the holding stacks is shown in figures 14 and 15.

Fleet Equipage Survey

8.6

In addition to the review of the current departures and arrivals operations at EMA, a Fleet Equipage Survey was carried out to assess the capabilities of the current and projected 2028 aircraft fleets operating from EMA. This provided information including each airline's capability to fly different standards of satellite navigation routes, the climb performance of aircraft and the types of on-board navigation equipment. This approach ensured that, consistent with our design principles, we took account of aircraft capability when designing our options.

Figure 7: Typical arrivals onto Runway 27, with percentage of total arrivals over the year 2019

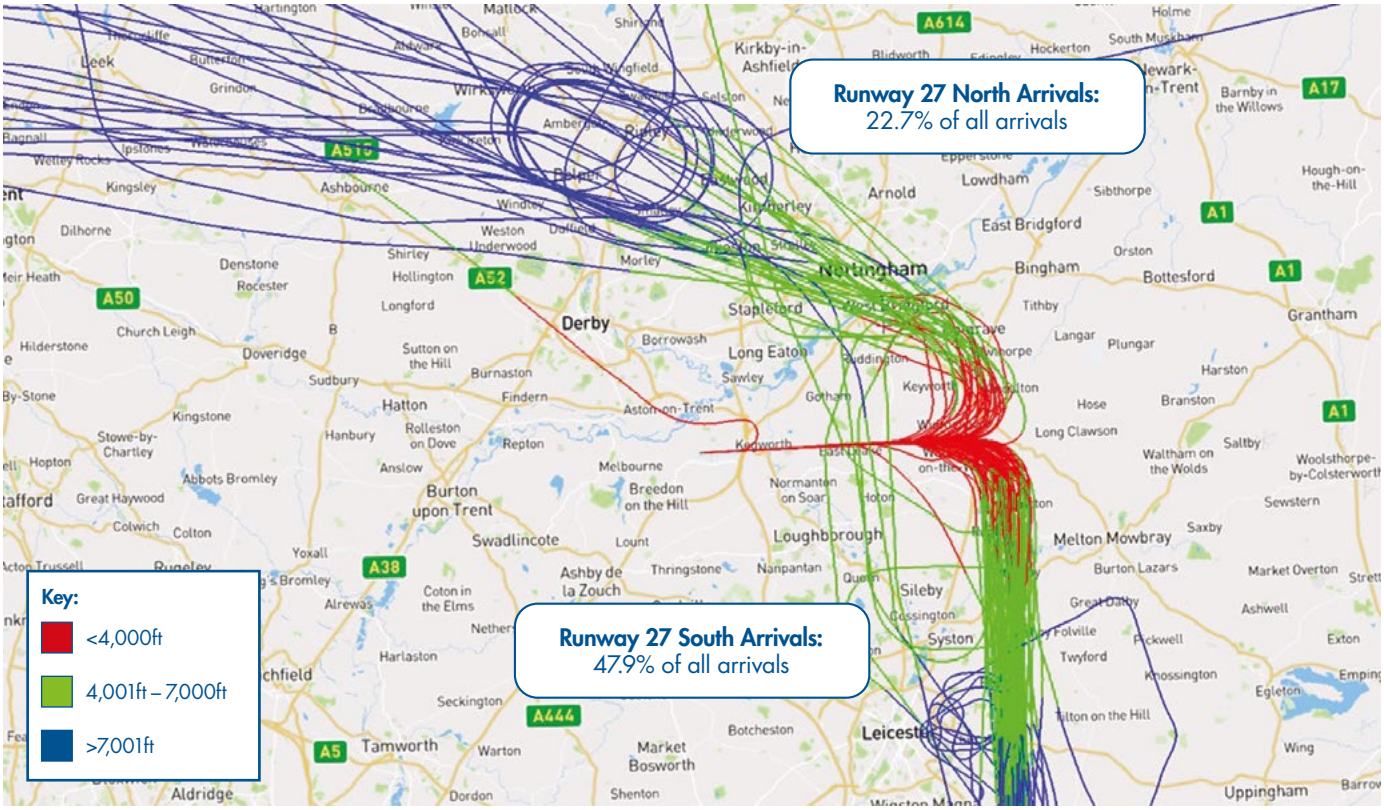


Figure 8: Typical arrivals onto Runway 09, with percentage of total arrivals over the year 2019

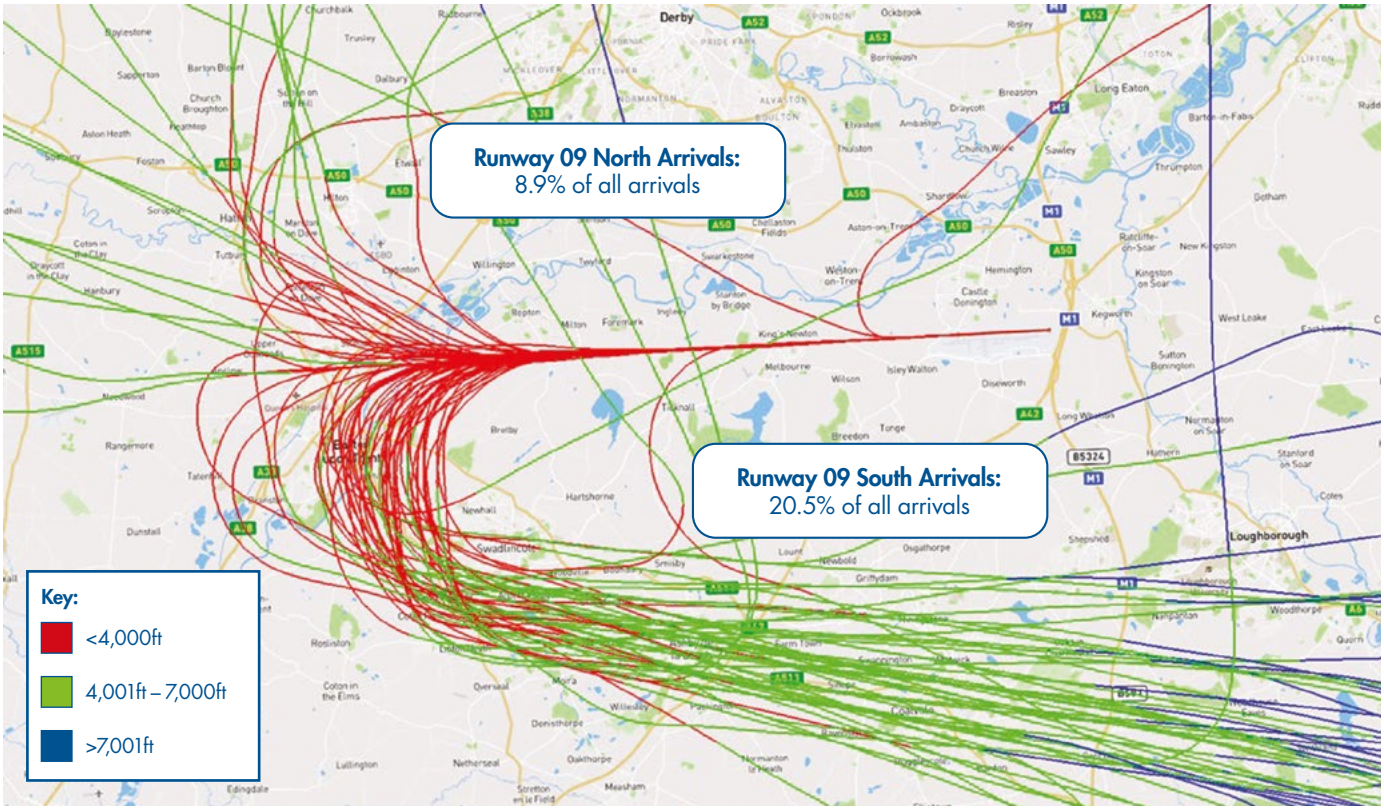
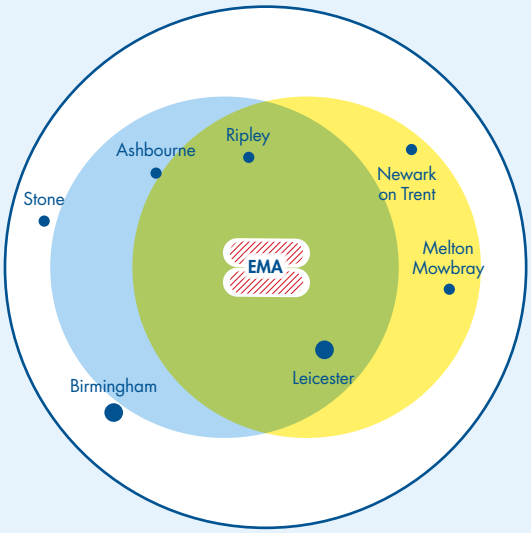


Figure 9: Viable design boundaries for continuous climb departures

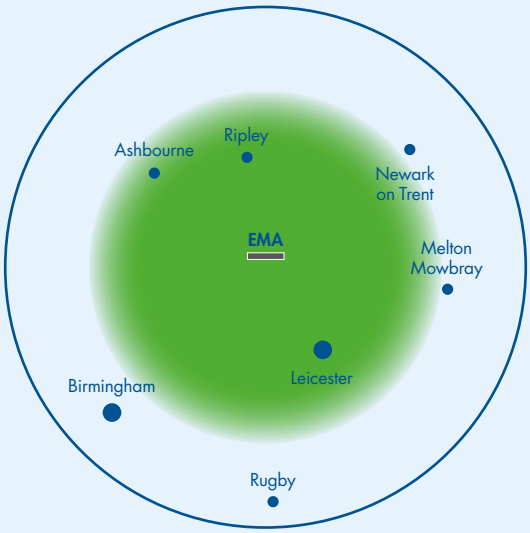


Departure routes not possible

Runway 27

Runway 09

Figure 10: Viable design boundary for Continuous Descent Approach



Runway

Viable area of arrival designs

Less viable area of arrival designs

9 Design Boundary

Departures

9.1
To establish the departures design boundary, the ICAO PANS-OPS rules and regulations and the information from the Fleet Equipage Survey were applied to understand where aircraft could fly. A gradient of climb of 6% was applied as this was demonstrated by the Fleet Equipage Survey to be achievable by all aircraft operating at EMA. The ICAO PANS-OPS rules then provided the design boundary based on this gradient, assuming a constant climb, as well as the areas within which it would not be possible to place options. These areas are indicatively shown on Figure 9, opposite.

Arrivals

9.2
The arrivals design boundary was established by reference to the distance from EMA that would allow for Continuous Descent Approach (CDA) from 7,000ft. A CDA is designed to reduce fuel consumption and noise compared to other conventional 'stepped' descents and aligns with our Design Principles Programme, Emissions and Noise 3. The PANS-OPS recommended range for CDAs is a descent gradient of between 3.5° and 1.5°. This also encompasses the optimal descent gradients identified within the CAA Low Noise Arrival Metric CAP2302[7] and the capabilities of aircraft using EMA gathered from the Fleet Equipage Survey.

Figure 10, opposite, indicatively illustrates the area within which it would be possible to design options that would allow arriving aircraft to achieve a CDA. The outer edge of the circle is the furthest point away with the shallowest gradient that would still facilitate a CDA. However, as aircraft performance in descent varies, there is risk of some aircraft having to 'level out' from this area, which would mean a CDA was not achieved. This area is illustrated in figure 10 by the shading. Options in the area closer to the airport (illustrated in darker green) are more likely to consistently facilitate a CDA.

Full details of the development of the departures and arrivals design boundaries are set out at section 5 of the DOR.

7 CAP2302: A Low Noise Arrival Metric.

10 Constraints

10.1

Having determined the design boundary, local factors that could impact on safety were identified by analysing the airspace and current operations in the vicinity of EMA. Where factors were identified, they were categorised as either a constraint or a consideration:

- Constraints were defined as aspects that have a direct impact on designs or limit the placement of arrival and departure route options.
- Considerations were defined as aspects that do not limit designs, but which needed to be taken account of when designing options.

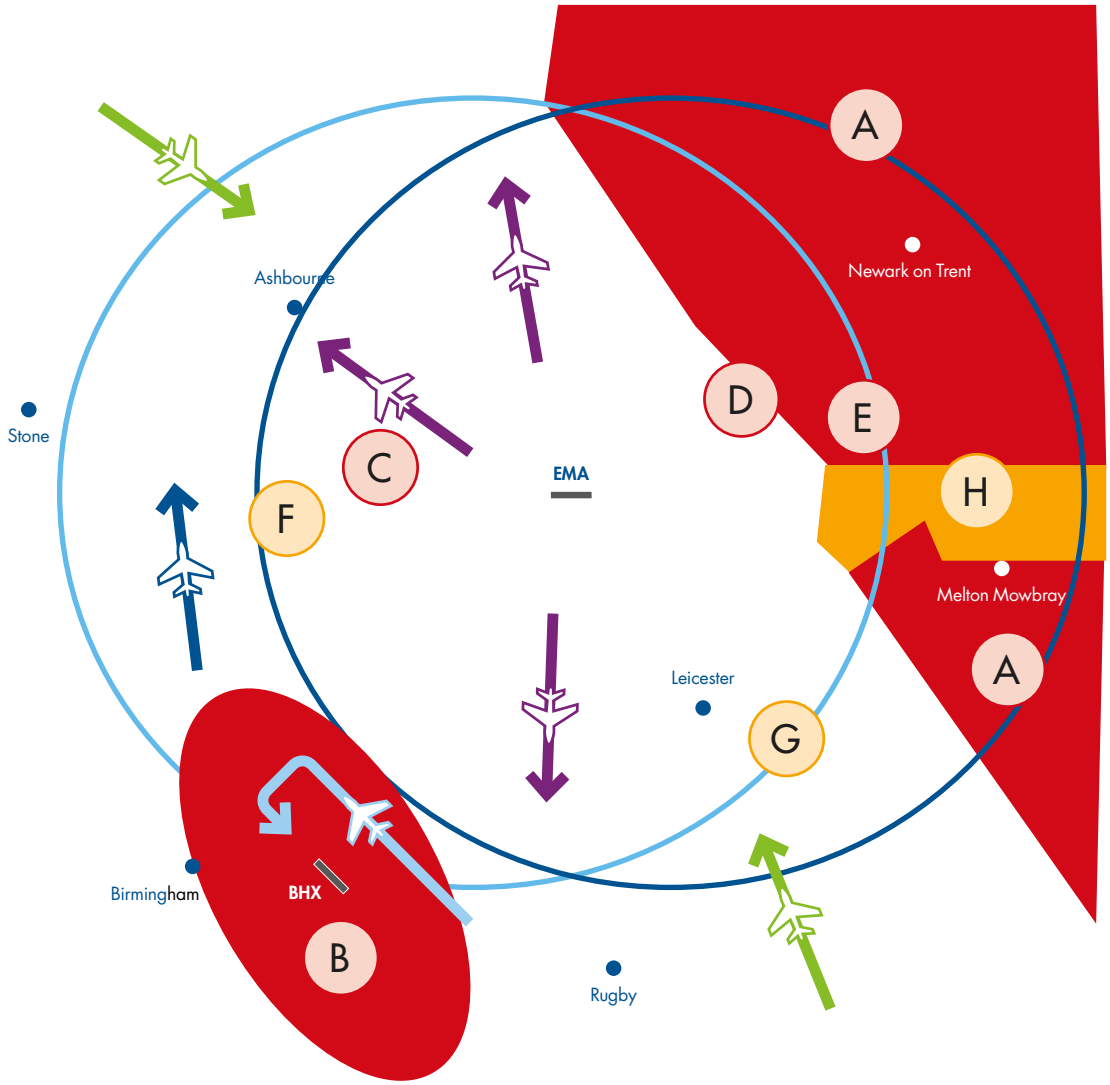
10.2

Full details of the constraints and considerations identified are set out in section 5 of the DOR, and summarised below and in Figure 11:

- The following were identified as constraints;
  - The proximity of Birmingham and Nottingham airports and Derby airfield and their operations.
  - Areas of uncontrolled airspace to the east, north east and south east.
  - Langar parachute site.

- The following were identified as considerations;
  - The airfields at Tatenhill and Leicester Airport.
  - An area of uncontrolled airspace to the east which may become available for commercial flights and which is expected to create fuel savings for flights from EMA and other airports.

Figure 11: Constraints and considerations mapping



Key:

- Airspace constraints
  - (A) Uncontrolled airspace
  - (B) Birmingham Airport
  - (C) Derby Airfield (surface to 2,000ft)
  - (D) Nottingham Airport (surface to 2,000ft)
  - (E) Langar parachute site
- Airspace considerations
  - (F) Tatenhill (surface to 2,000ft)
  - (G) Leicester Airport (surface to 2,000ft)
  - (H) Uncontrolled airspace but potentially viable subject to NATS airspace reclassification
- **EMA** East Midlands Airport
  - Departure
  - Arrival
  - Runway 27 boundary
  - Runway 09 boundary
- **BHX** Birmingham Airport
  - Departure
  - Arrival

11 Design envelopes

11.1
The design boundary and the relevant constraints and considerations outlined above enabled the development of design envelopes. These are broad swathes of airspace within which it would be possible to place routes.

11.2
For departures, design envelopes were constructed to start at the runway and finish at 7,000ft. These were designed taking into account the SoN, the design principles, the current airspace network including the constraints and considerations, and the information contained in the Fleet Equipage Survey, which informed the navigation standard being applied and the climb gradient being used.

11.3
The design envelopes were designed such that they expand in a linear fashion until they are at least 8,000m wide (or approximately 4.5 nm) at the point they reached 7,000ft. The width of the design envelopes provided the flexibility to design route options that responded to different elements of the design principles, ensuring that a comprehensive list of options could be compiled. The majority of the design envelopes were based on the current SIDs. However, four additional envelopes were also created for each runway end. These were designed to act as possible respite options for four of the main envelopes in response to our Noise 1 Design Principle.

11.4

For arrivals, a similar approach was used, taking into account the SoN, the design principles, the constraints, and the information contained in the Fleet Equipage Survey. An arrivals design envelope was constructed to encompass the area where a CDA to both runway ends was possible. CDAs offer benefits in terms of both noise and emissions and by creating options that are capable of a CDA, the options aligned to the EMA Programme, Emissions and Noise 3 Design Principles and with the overarching principle of environmental sustainability which is one of the 'ends' that airspace change must achieve within the AMS. The starting point was to consider the position of the current conventional approach procedures from the current holding stacks at ROKUP and PIGOT. In addition to considering the position of the existing holding stacks, alternative areas where the 7,000ft starting point could be located were considered as shown in Figures 14 and 15.

11.5

Full details of the approach taken to the development of the design envelopes are set out at sections 6 to 19 of the DOR.

Departures

11.6

By applying the above process, a total of 24 departure design envelopes were established. These initial departure design envelopes are shown in Figures 12 and 13 for each runway end.

Figure 12: Initial design envelopes for Runway 27 departures

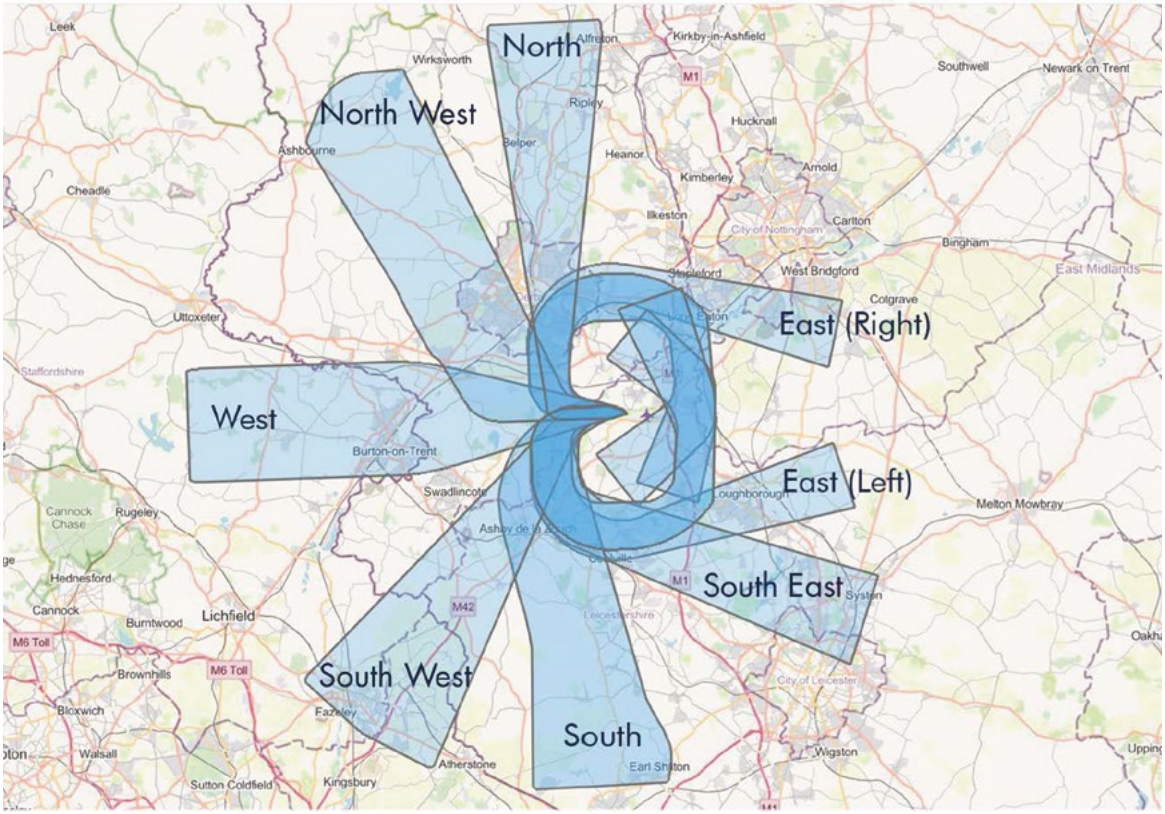
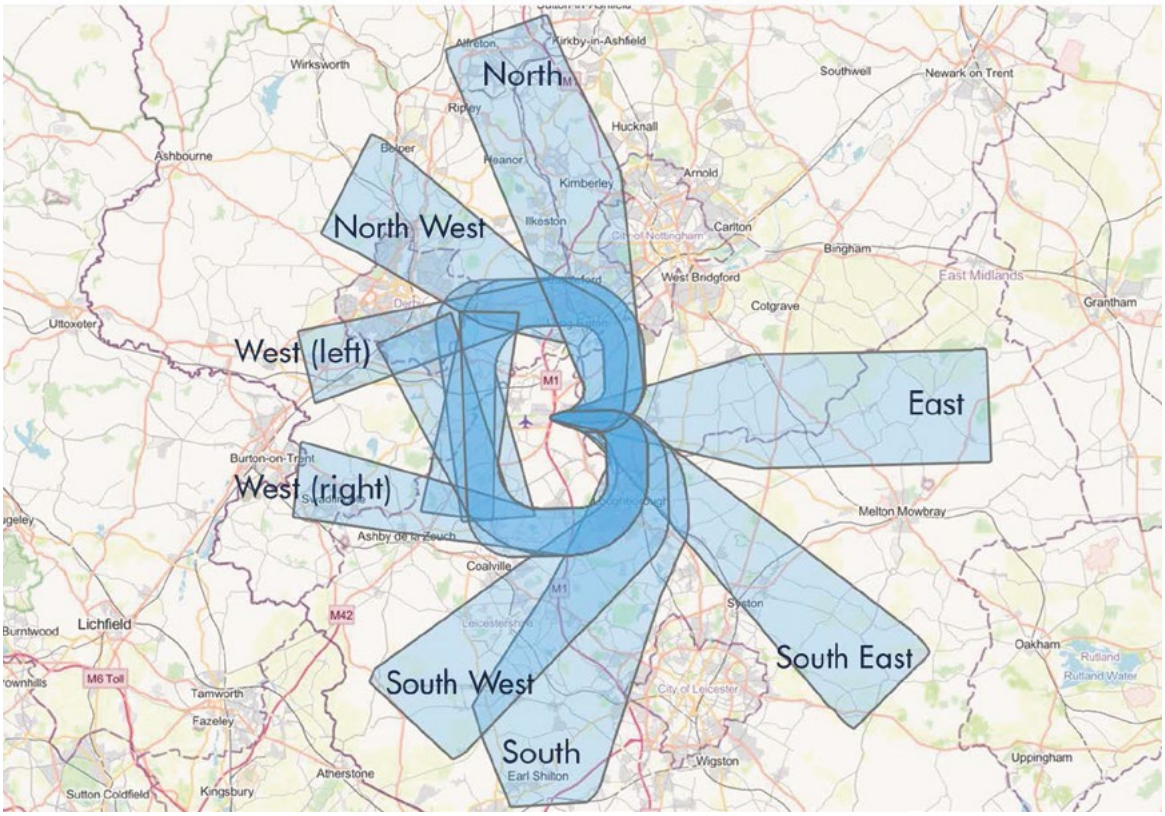


Figure 13: Initial design envelopes for Runway 09 departures



Arrivals

11.7

As outlined in 11.4, the initial arrivals design envelopes were based on the existing holding areas ROKUP and PIGOT but also considered the potential for these areas to be relocated as part of NATS' redesign of airspace above 7,000ft. The initial arrivals design envelopes were then constructed where a CDA to both runway ends would be possible. This resulted in four areas from which the 7,000ft starting point could be located, including a design envelope that incorporated the existing ROKUP hold area. However, the position of the PIGOT holding stack is outside of the viable CDA area for both runway ends. As a result, an arrivals starting point from this position could not be exactly replicated as shown in figure 15.

11.8

The initial arrivals design envelopes are shown in Figures 14 and 15.

Figure 14: Runway 27 arrival design envelope

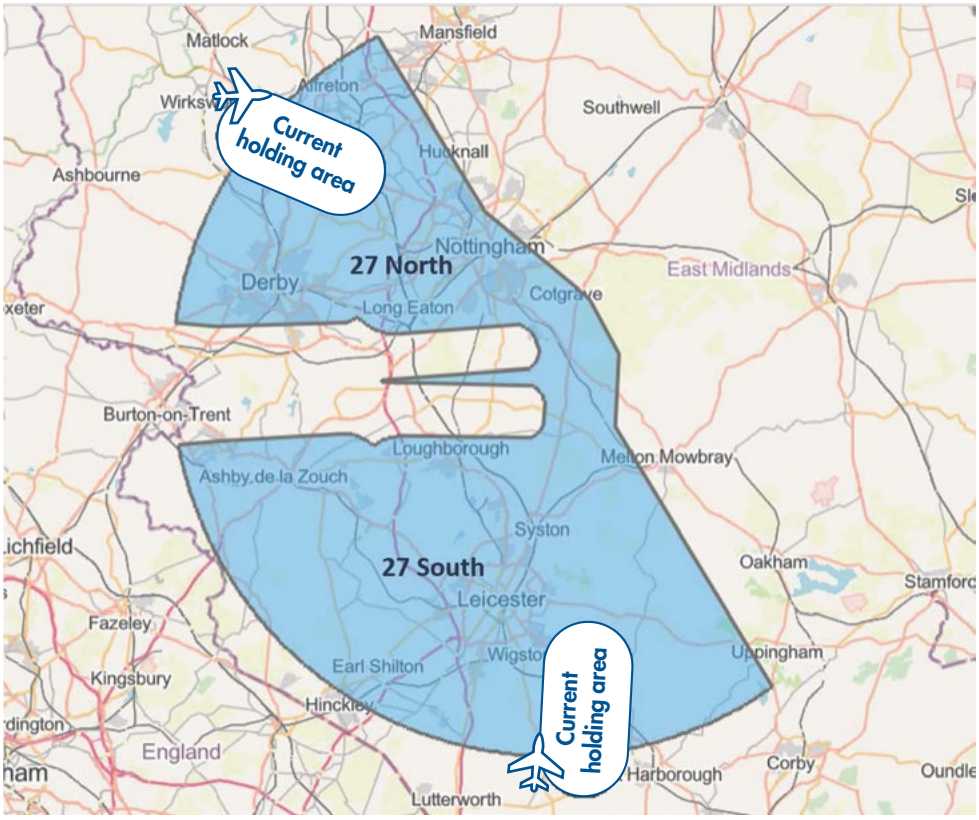
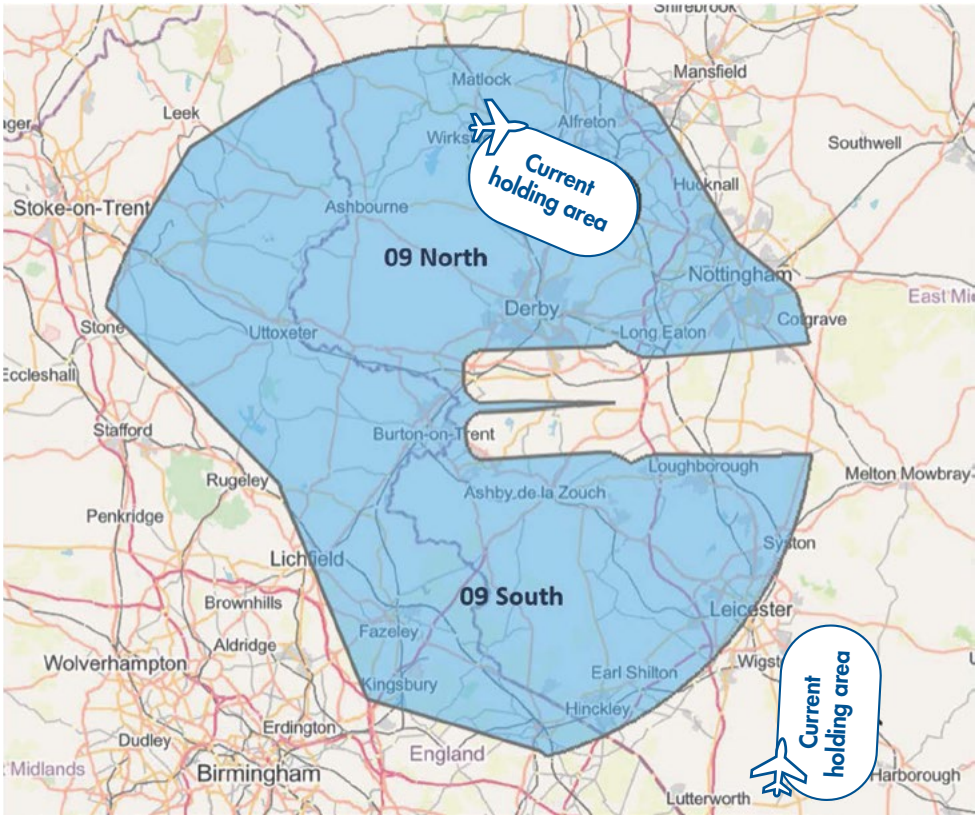


Figure 15: Runway 09 arrival design envelope



Change to the Potentially Affected Area

11.9

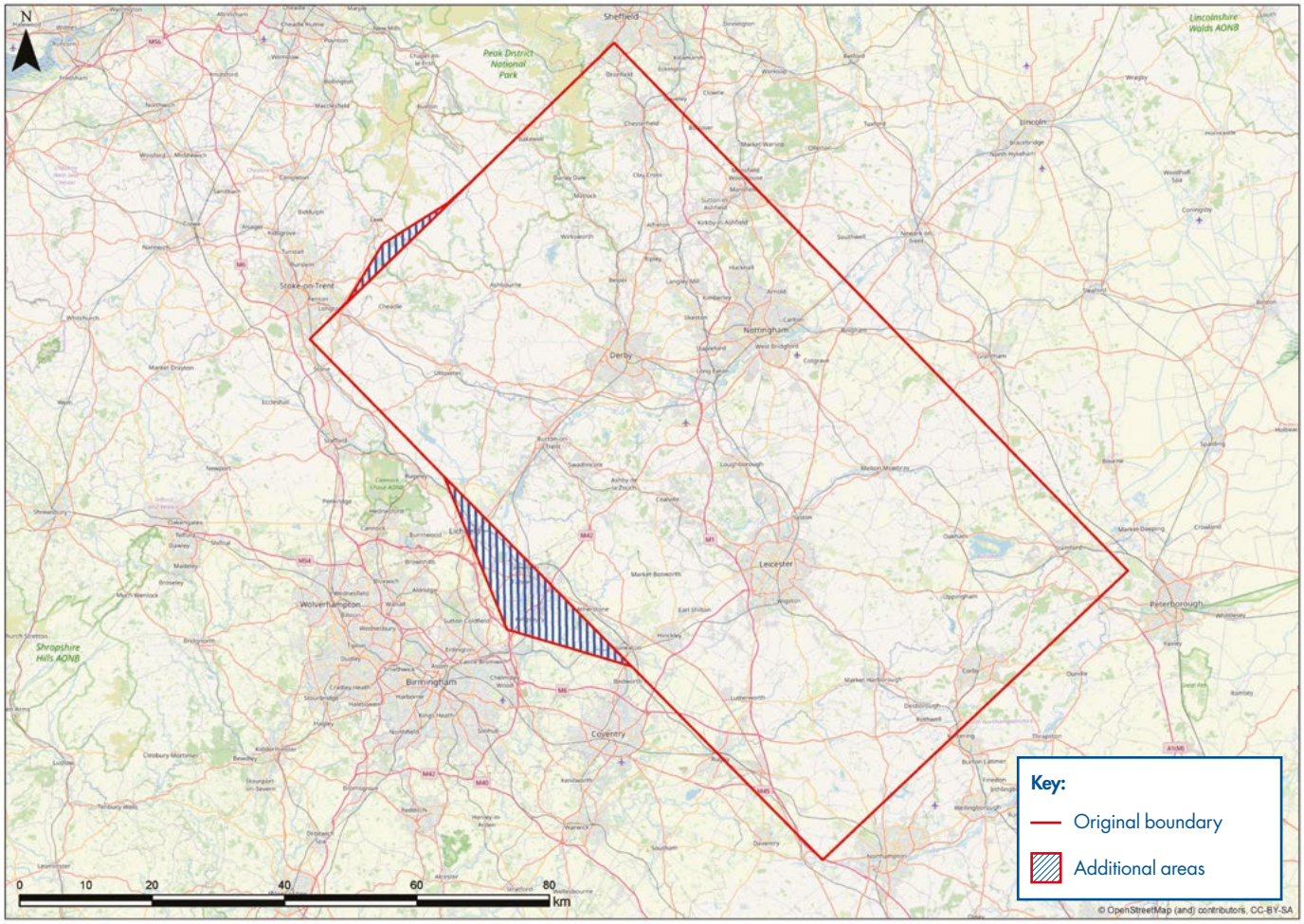
At Stage 1 of the CAP1616 process, a potentially affected area was defined; an area which may be affected by airspace change depending on its development[8]. As part of the development of the design envelopes, it was established that there were two areas where it could be possible to design route options that would extend marginally beyond the area that had been previously identified as potentially affected. Whilst these options would not necessarily be carried forward in the process, it was considered prudent to expand the potentially affected area to account for these options. The extent of this change is illustrated in Figure 16.

A further process of stakeholder identification to take account of these additional areas was completed prior to the first phase of engagement. As a result, a small number of additional stakeholders within the categories defined in CAP1616 were identified. These comprised 14 parish councils and one city council, all of which were added to our stakeholder list and invited to take part in both phases of engagement activity during Stage 2. While none of these stakeholders accepted our invitation to engage, they received regular information on our progress through Stage 2 and details of where to access further detail on the work completed so far.

A revised map of the potentially affected area has been uploaded to the CAA Airspace Change Portal[9], along with the Stage 2 submission.

8 Further information is available in the EMA Step 1B Submission Document which can be found on the CAA Airspace Change Portal.
9 CAA Airspace Change Portal.

Figure 16: Revised area of potential impact

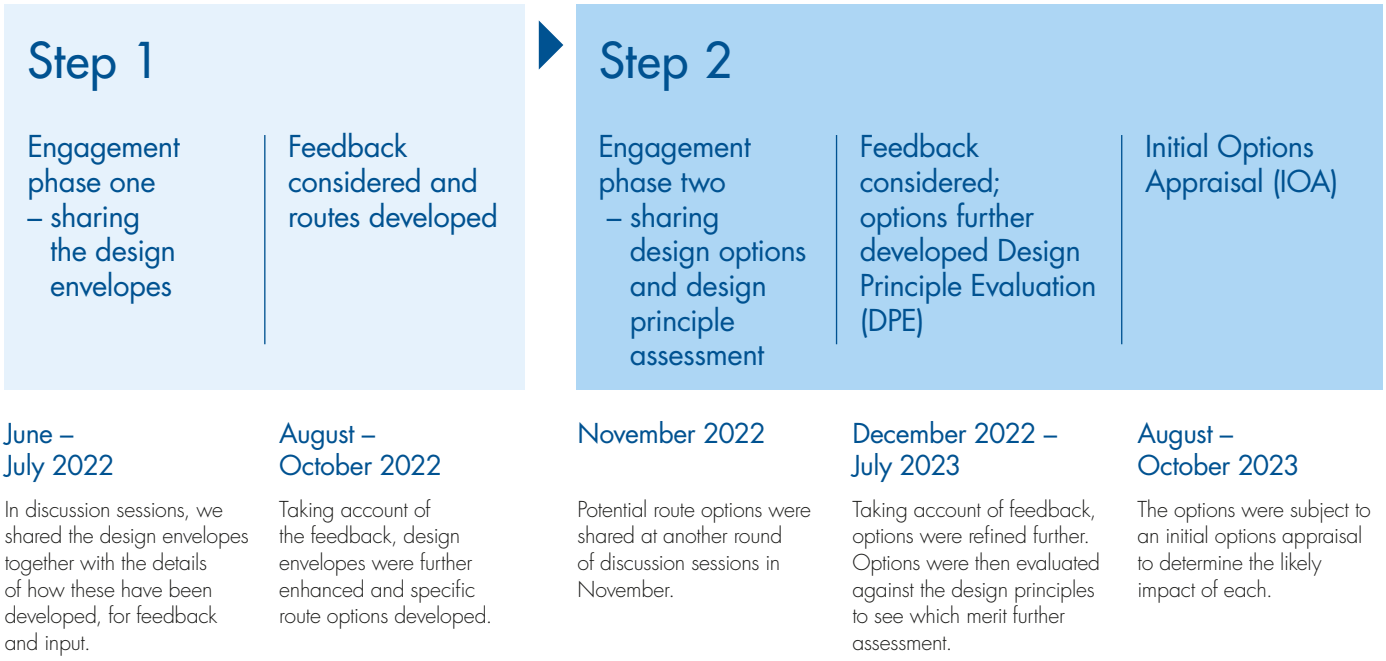


12 Phase one engagement

12.1
Stakeholder engagement to support Stage 2 was split into two phases to enable to allow the initial design envelopes to be tested with stakeholders (during the first phase of engagement) before the design envelopes were refined and specific route options developed. The second phase of engagement then allowed the specific route options to be tested with stakeholders, before the options were updated to take account of stakeholder feedback. In addition to engaging with those stakeholders required by CAP1616, EMA also engaged with members of the general public.

12.2
Phase one engagement focused on the initial design envelopes, giving participants the opportunity to comment on the process followed and the envelopes created. The early engagement of stakeholders and general public participants enabled the airport to use their feedback to influence subsequent amendments to the design envelopes and take account of the views in the next stage of the design process, where the specific route options were developed.

Figure 17: Stage 2 engagement process



12.3

Full details of the phase one engagement undertaken, including the engagement materials, the feedback received from participants and the resulting changes to the design envelopes, are set out in the SER and supporting appendices.

13 Revised design envelopes

13.1

Feedback from the first phase of engagement informed the revision of the design envelopes and the creation of route options. The changes made to the departure design envelopes in response to this feedback are summarised in the table below. Further detail on the feedback received, our response to it and the changes made to the design envelopes are set out in full at section 4 of the SER.

Changes to the design envelopes following phase one engagement feedback
The alternative 'wrap around' envelopes were discounted on the basis that these would not align with our Noise 1, Noise 2 and Emissions Design Principles and following stakeholder requests that we consider different ways of building in respite opportunities close to the airport. To account for this removal, a number of envelopes were extended in order to enable us to create additional respite opportunities.
The Runway 27 North departure envelope was extended to the east and west to enable the creation of route options that avoid overflight of specific locations and provide additional options to enable connectivity to the upper airspace network.
The Runway 27 North West departure envelope was extended to facilitate the inclusion of route options that avoid the west side of Derby and the creation of route options that closely follow major road networks in line with our Responsive Flight Paths Design Principle.
The Runway 27 East (right) envelope was extended to the south to enable the creation of route options that would take a tighter initial turn. The south east departure envelope was widened to the south to enable the creation of additional route options that aim to follow the road network in line with our Responsive Flight Paths Design Principle. Both the south and south west envelopes were extended to the north to enable the creation of route options that would depart aircraft in a northerly direction initially before heading south in order to provide further noise relief to communities close to the airport.
The Runway 27 East (Left) departure envelope was discounted as it was determined that it would not align with the Continuity Design Principle due to the interaction with the other Runway 27 departure envelopes which would reduce the ability to deliver one minute departure separation.
The Runway 27 South East departure envelope was widened to the south to enable the creation of additional route options that aim to follow the road network in line with our Responsive Flight Paths Design Principle.
The Runway 09 North departure envelope was reduced slightly to the east to ensure the route options in this envelope would comply with CAA guidance[10] on distance from the boundary of controlled airspace.
The Runway 09 North West departure envelope was widened in response to feedback asking that we consider additional options for respite and relief between Derby and Nottingham.
The Runway 09 West (Right) envelope was removed as all options in this envelope were considered 'viable but poor fit' with the Meeting Demand Design Principle during the viability filter process. This classification was determined due to the envelope's proximity to the southerly departures which would result in an increase in departure separation. The Runway 09 West (Left) envelope was retained to provide connectivity to the west.
The Runway 09 South, south west and parts of the south east envelope were combined to form one southern envelope. Parts of the original Runway 09 South East envelope were discounted in order to ensure separation from arriving traffic in line with our Safety Design Principle. In addition, the gap between the original south and south east envelopes was incorporated into the new combined southern envelope to provide additional opportunity for respite options.

10 Policy for the design of controlled airspace structure – CAA Policy Statement, August 2022.

13.2

Figures 18 and 19 show the changes to the departure design envelopes outlined in the above table. The green hatching identifies the expansion of the envelope by including additional areas and red hatching signifies a reduction by excluding areas from consideration for development of route options.

Figure 18: Revised design envelopes Runway 27

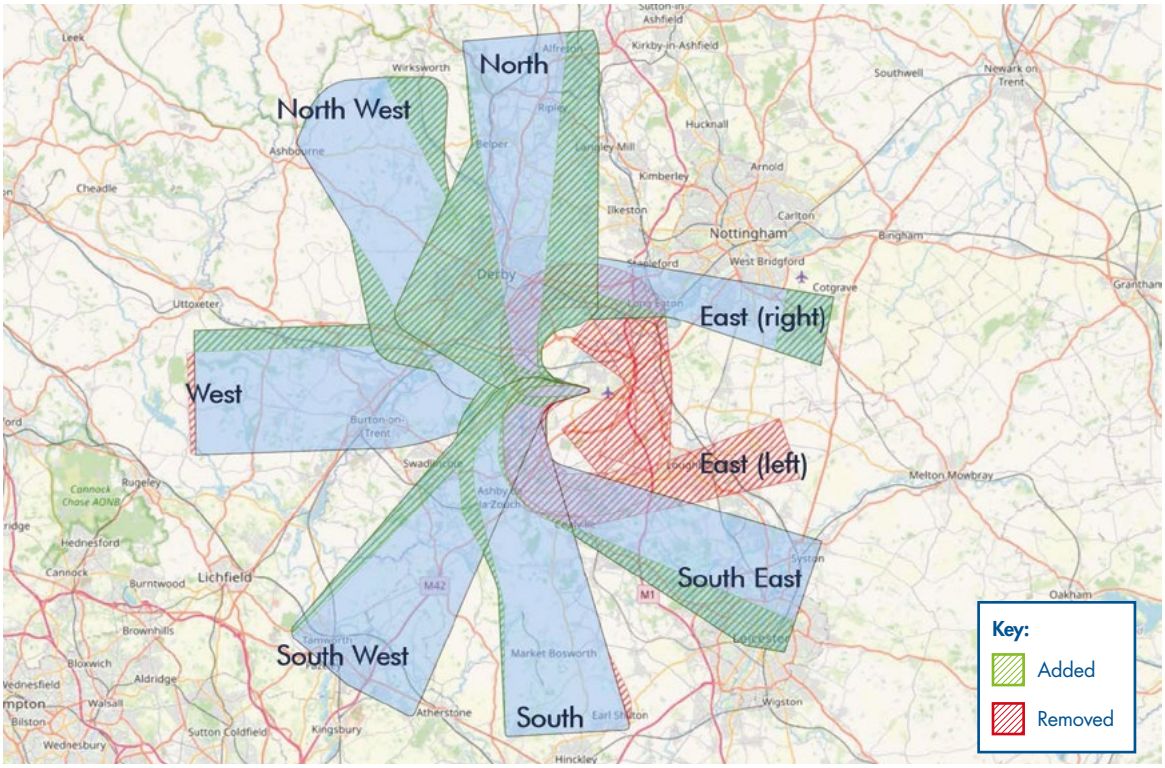
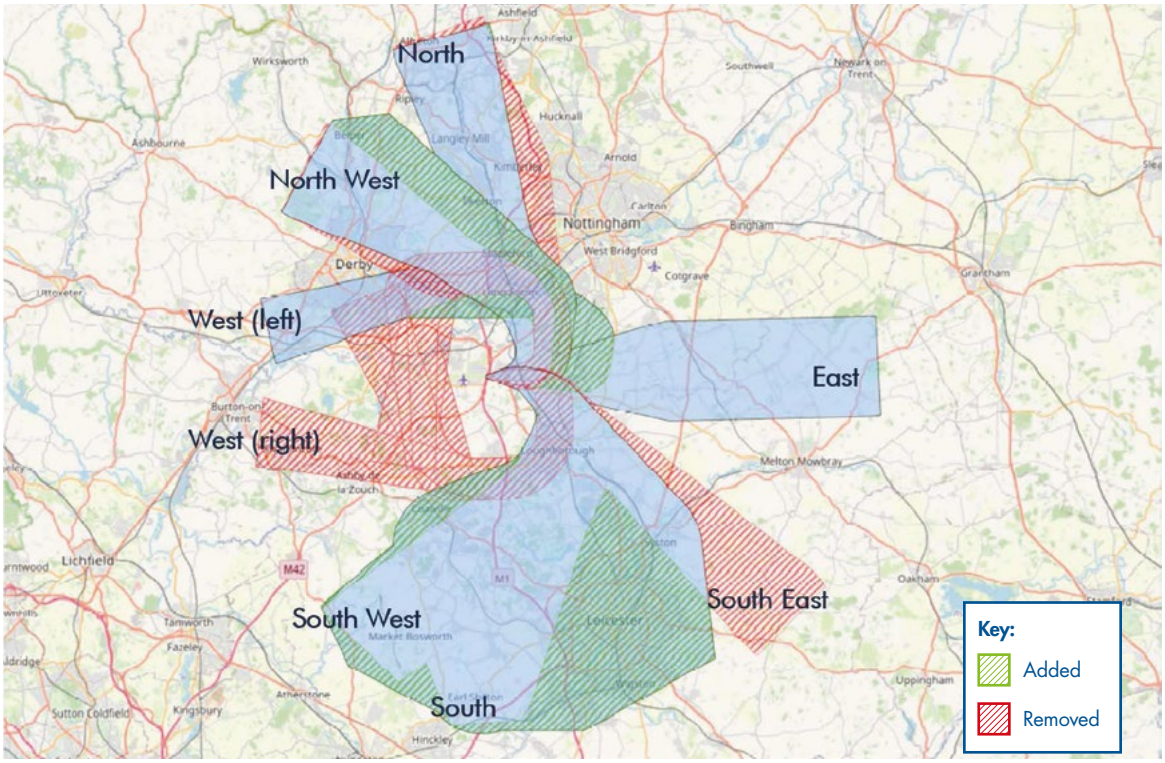


Figure 19: Revised design envelopes Runway 09



14 Departure route options

14.1
The revised design envelopes for departing aircraft were then used to develop an initial comprehensive list of route options within those envelopes.

14.2
Where a design envelope contained an existing route that relied on ground-based navigation aids, these routes were replicated as far as is practicable by applying ICAO PANS-OPS design standards for designing Performance Based Navigation (PBN) routes, which rely on satellite guidance rather than ground-based navigation aids. This provided a 'do minimum' option for each of the existing routes in their respective envelope.

14.3
Having established the 'do minimum' option for the design envelopes containing existing routes, further route options were developed within the design envelopes where it was likely they could provide a benefit that responded to one or more of the design principles. Examples include creating a more direct routing to reduce emissions, reducing the number of people overflown or avoiding noise sensitive areas. Where a design envelope did not contain an existing route, a new set of route options was developed using the same principles.

14.4

PBN standards allow for higher levels of navigational accuracy. Two PBN technologies were applied to departure route design, Area Navigation 1 (RNAV1) and Required Navigation Performance (RNP1). This was due to the Fleet Equipage Survey having shown that 100% of aircraft flying into EMA could use RNAV1 and 82% could utilise RNP1. Whilst the technologies are largely the same, the slightly different design rules achieve differing levels of consistency and accuracy so that in practice aircraft flying RNAV1 will show a slightly broader spread of tracks than those flying RNP1. By applying both standards, the comprehensive list of options contained routes that made best use of modern technology widely available, whilst providing alternatives for all aircraft identified in the Fleet Equipage Survey.

14.5

Full details of the development of the comprehensive list of departure route options are set out at sections 6 to 18 of the DOR.

15 Arrival route options

15.1
When the initial design envelopes shown in Figures 14 and 15 were considered together, they covered a wide area within which a CDA was possible to at least one runway end. We refined this area by applying the 'must-have' A Joined-up Approach Design Principle which states that airspace changes must be consistent with the CAA's AMS. This document provides objectives on environmental aspects and managing noise, and both this and the DfT Air Navigation Guidance 2017, specifically highlight the use of CDAs as a means for achieving these objectives.

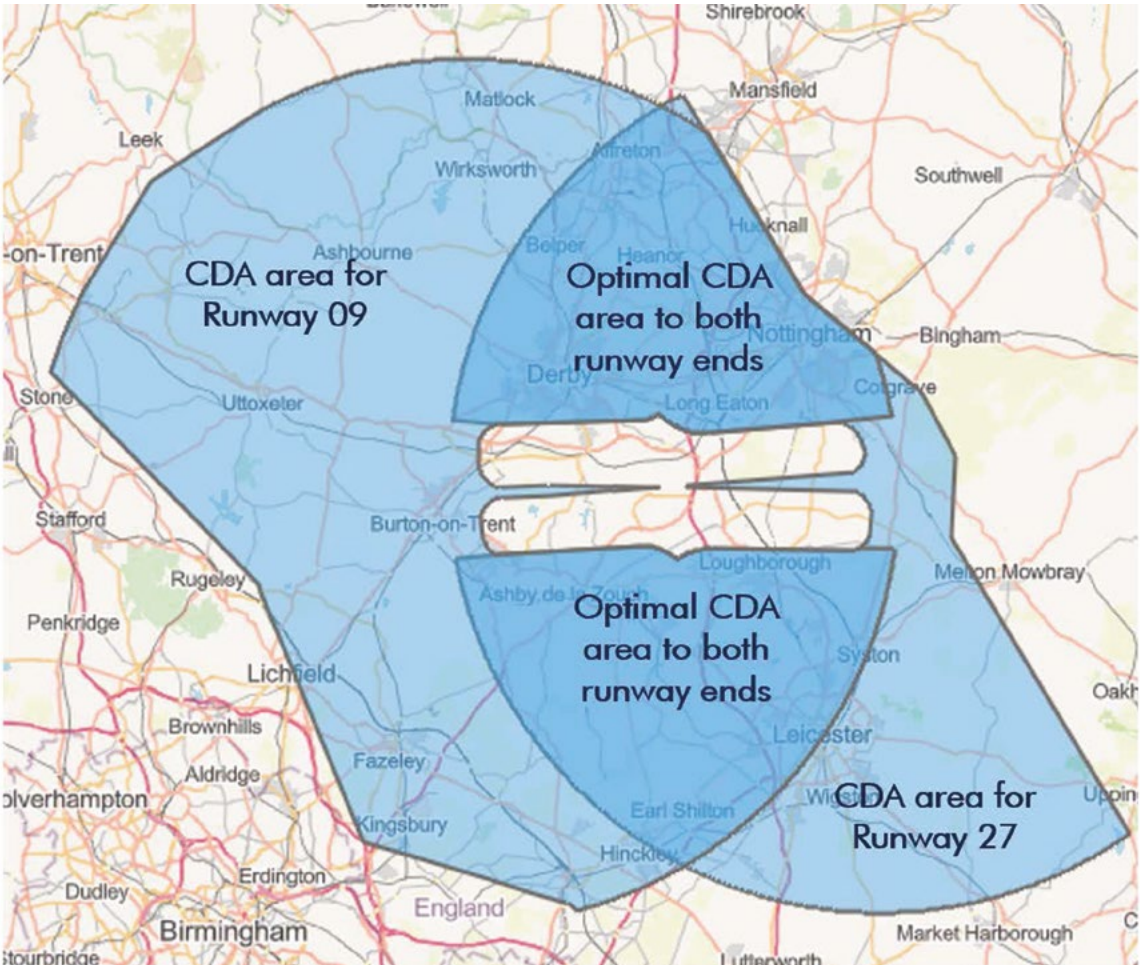
15.2
Options were designed within these design envelopes, commencing at an Initial Approach Fix (IAF) of 7,000ft. Any option unable to provide for CDAs for both runway ends was not fully aligned to the A Joined-up Approach Design Principle and could only be classed as 'viable but poor fit', with reference to the route classification exercise summarised at section 16, below.

15.3
As a result of the above exercise, our arrivals design envelope and options were based on design parameters which will allow CDAs to both runway ends. The criteria used were based upon ICAO PANS-OPS guidance for continuous descent approaches and the optimal descent gradient identified in the UK CAA Low Noise Arrival Metric (CAP2302). Further detail of these can be found in the DOR.

15.4
The application of these design criteria results in two overlapping arcs. Within the overlap area, a CDA to both runway ends is achievable (based upon the criteria above) and options in this area are deemed 'viable and good fit'. Outside of these arcs, a CDA to only one runway is possible and designs in this area were classified as 'viable but poor fit'.

15.5
Figure 20 shows the overlapping arcs for options with a 2,000ft joining point (or approximately five miles from touchdown) onto final approach which was chosen as the minimum in line with ICAO guidance.

Figure 20: CDA design area for arrival route options



16 Viability classification

16.1
In line with CAP1616, a comprehensive list of route options was created using the design principles and feedback from engagement to guide the placing of route options within the design envelopes. This created a balanced set of options with each route option responding to at least one of the design principles.

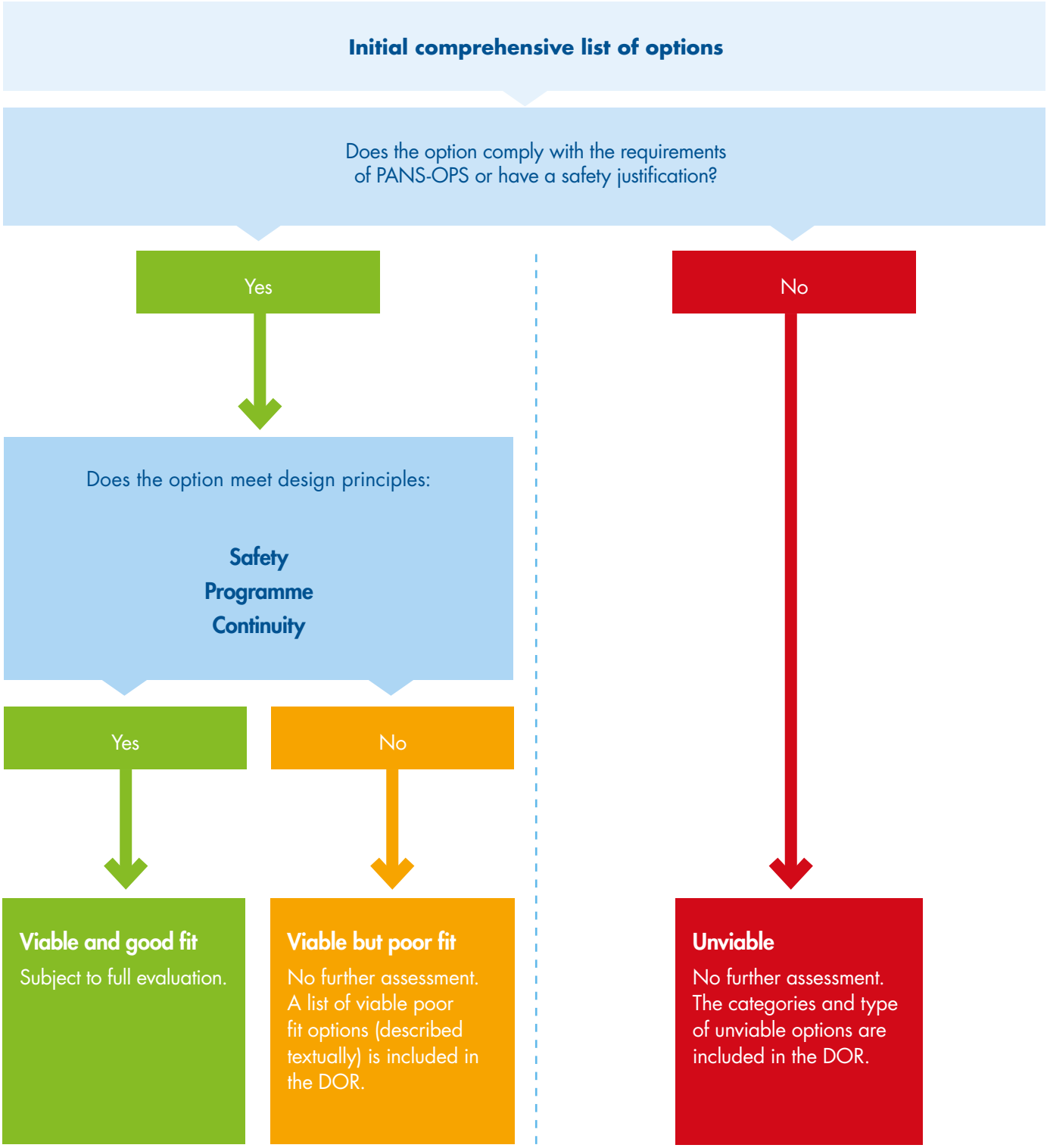
However, because of the width of the design envelopes and the initial need to create a comprehensive list of options, not all of the route options initially created were feasible options that would align with the 'must have' design principles.

16.2
To account for this, our design process adopted an approach that identified a long list of options and then refined this list to focus on the viable options to be progressed to the full DPE. This viability assessment resulted in the route options being assigned one of three classifications, as shown in Figures 21 and 22. This assessment was not intended to identify those options that responded well to the design principles but identified where an option clearly failed to align to one or more of the three 'must have' design principles.

Figure 21: Viability classification

Classification	Criteria	Outcome
Unviable	Would not comply with PANS-OPS design criteria or did not have a supporting safety justification for non-compliance.	Not progressed to DPE.
Viable but poor fit	Failed to meet the requirements of the three design principles with which all design options 'must' comply (Safety, Programme and Continuity).	Not progressed to full DPE, although a rationale and initial evaluation against the three 'must have' design principles is included in both the DOR and the DPE.
Viable and good fit	Expected to meet the three design principles with which all design options 'must' comply (Safety, Programme and Continuity).	Progressed to full DPE.

Figure 22: Generating route options



16.3

Full details of the viability assessment are set out at section 5 of the DOR, while the list of viable route options progressed to the phase 2 engagement is provided in the DOR at section 7 to 19 for departures and 21 to 29 for arrivals.

17 Phase two engagement

17.1
The purpose of the second phase of engagement was to update stakeholders and general public participants on the development of the design envelopes following the phase one engagement and to present the route options that had subsequently been developed. As well as being presented with the viable route options, the process to determine how route options were 'viable and good fit', 'viable but poor fit' or 'unviable' was explained.

17.2
Full details of the engagement undertaken, and the engagement materials presented are set out in section 3 of the SER.

18 Revised route options

18.1

Feedback from the second phase of engagement informed the revision of the route options. The changes made to the route options in response to this feedback are summarised in the table below. Further detail on the feedback received, our response to it and the changes made to the route options are set out in full at section 4 of the SER.

Changes to the route options following phase two engagement
In response to feedback requesting that the replicated routes for departures more closely match the current departure routes, new replicated routes were designed. These do not fully meet the first turn distance described in the UK CAA document, CAP778 but are within ICAO PANS-OPS design requirements and, consistent with our viability filter, are included on the basis that they have a proven safety case based on being operated safely currently. These are included in addition to the original replicated routes which were designed to ICAO PBN standards.
Additional options were created in the Runway 27 South, Runway 27 South West, Runway 09 North West, Runway 09 North and Runway 09 East departure envelopes. These were created with the maximum possible offset in response to feedback asking us to design options that would track further away from communities close to the runway centreline.
Following bilateral engagement with NERL and the results of simulation exercises to progress their network designs, the position of the Runway 27 North West departure design envelope was amended and additional options were created. In addition, two options within the Runway 09 departure design envelope were also amended. This change was intended to improve connectivity and environmental performance for EMA departures to the north west and efficiency within the overall MTMA.
Engagement with NERL also identified that options within the Runway 27 South East envelope could interact with northbound traffic to Leeds and Newcastle airports above 7,000ft. Given this may have potential safety implications or limit the ability of EMA traffic to obtain continuous climb, a further seven routes were designed that route aircraft further east in order to avoid this potential interaction. These seven options were based on the existing easterly options within the Runway 27 South East envelope with modifications towards the end of the route.
In response to feedback requesting the provision of further opportunities for noise relief for communities close to the airport, an additional 36 routes were designed to ensure that each IAF offered at least a direct and indirect route option, to create further opportunities for noise respite or relief.
An additional transition to final approach was created at 2,500ft for Runway 09 to increase the opportunity for noise relief, in response to feedback around creating further opportunities for noise relief for communities close to the airport.
In response to feedback requesting a more direct arrival route from the east, an additional IAF was created north of Leicester to provide an option with a shorter track for arrivals from the east.

18.2

Figures 23 and 24 show the departure route options for Runway 27 and 09 respectively incorporating the changes made following the second phase of engagement. Figures 25 and 26 show the equivalent for arrivals.

Figure 23, Runway 27 departure route options

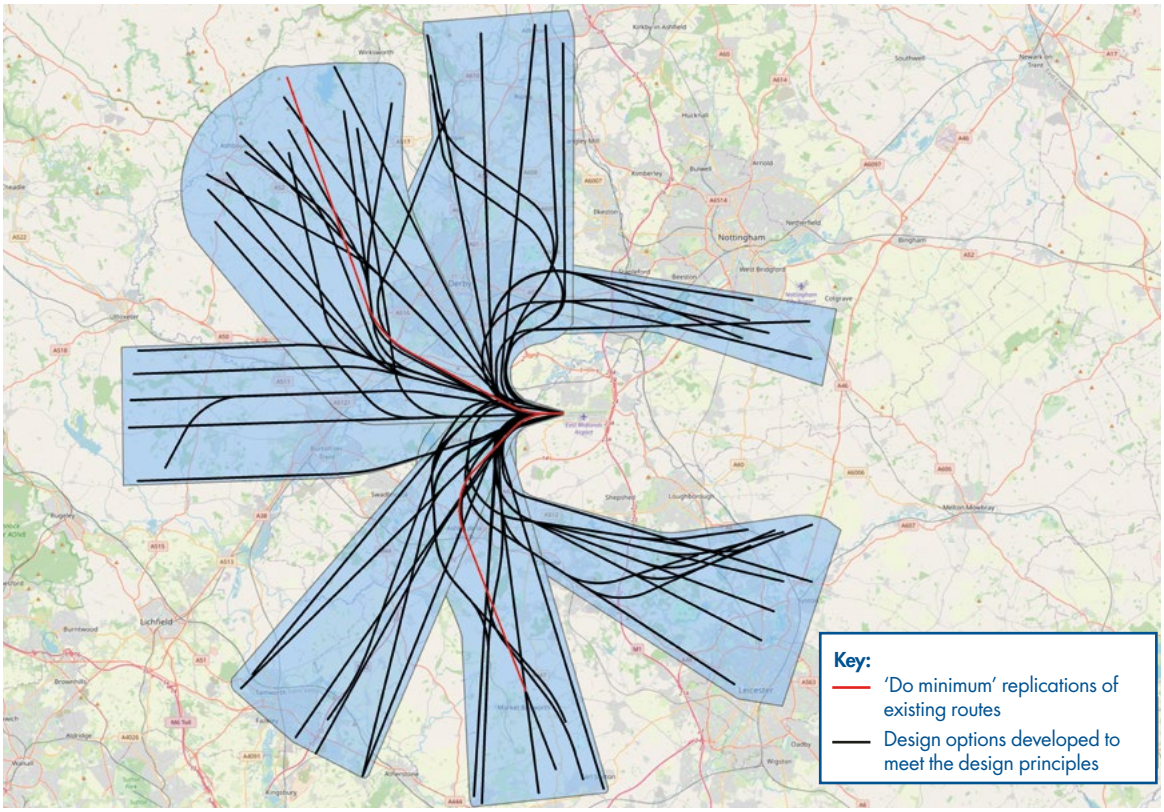


Figure 24, Runway 09 departure route options

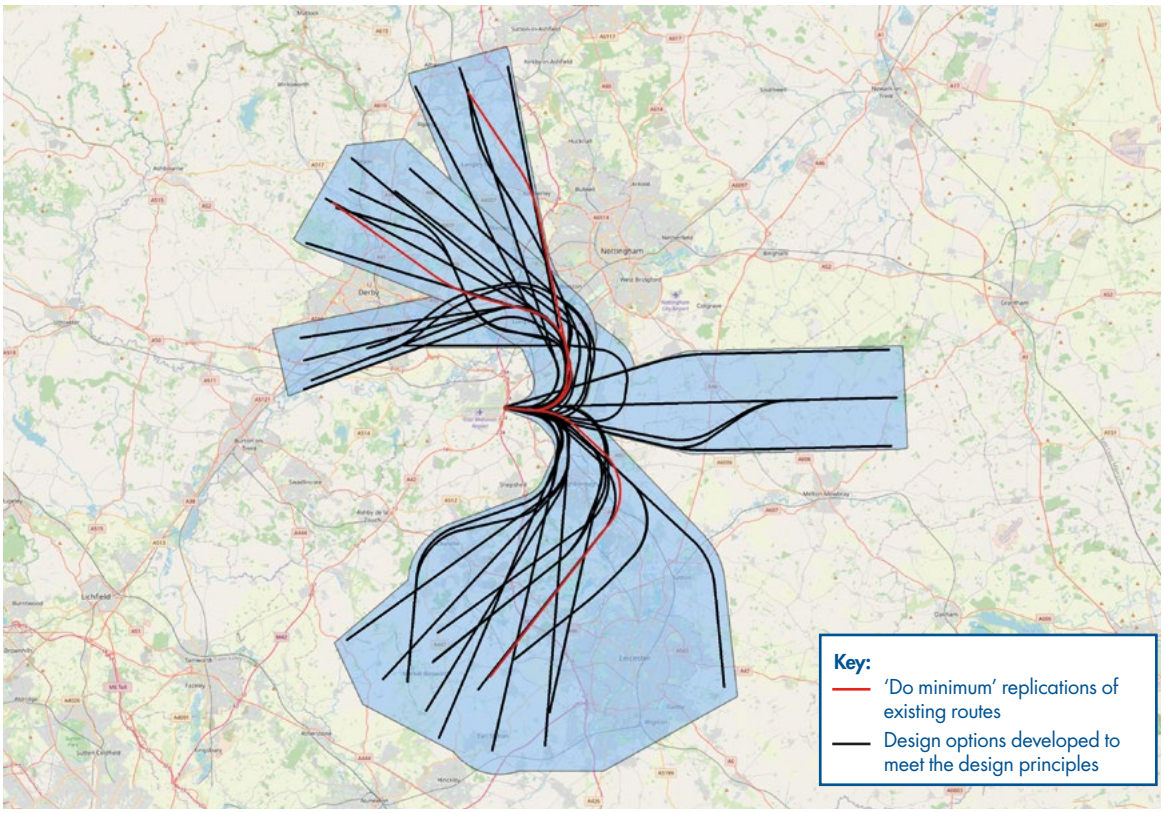


Figure 25, Runway 27 arrival route options

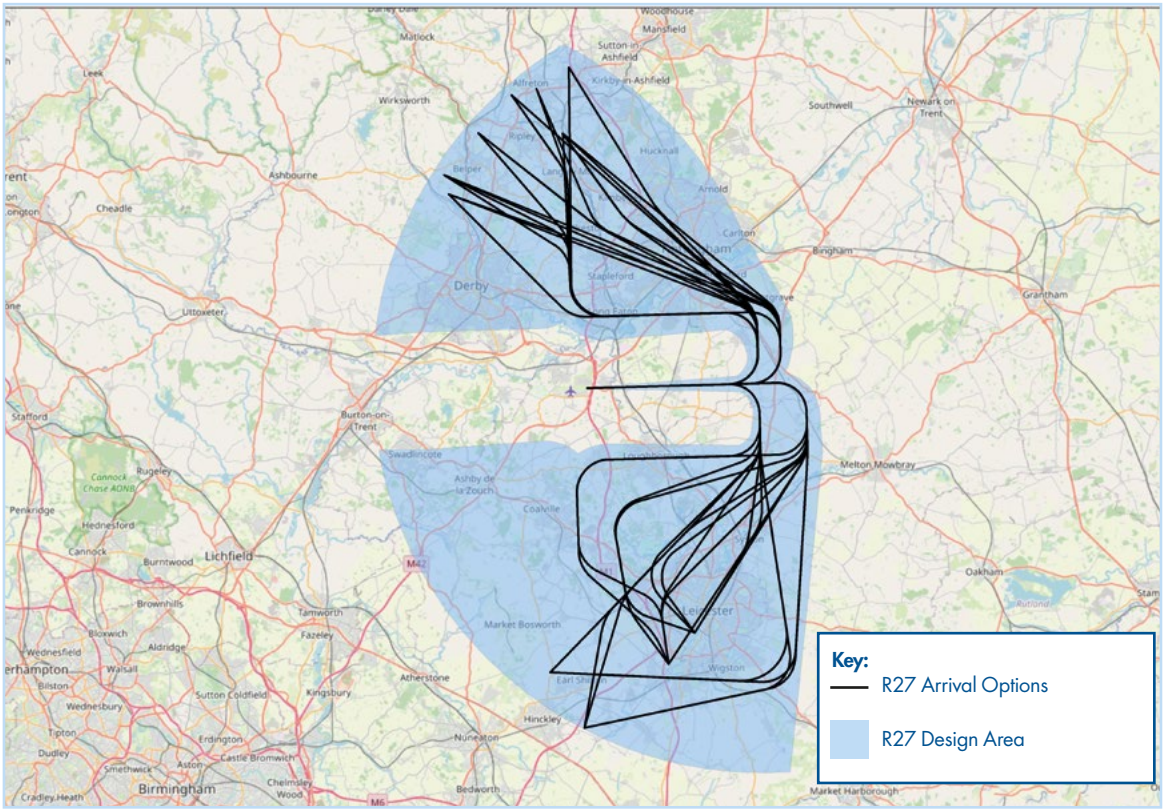
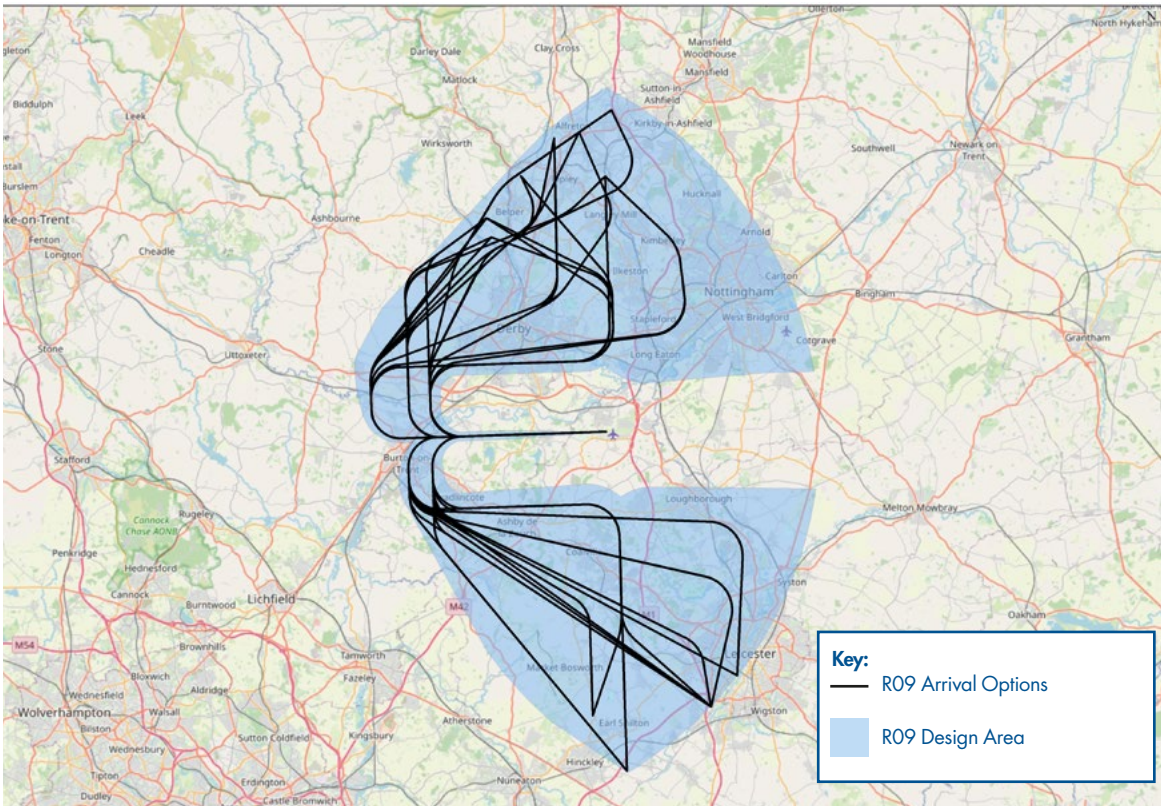


Figure 26, Runway 09 arrival route options



19 Comprehensive list of options

19.1

As a result of the process summarised above, a comprehensive list of options that address the SoN and respond to the design principles was compiled. This list of options reflected feedback received during both phases of stakeholder engagement and took account of the developing national masterplan for airspace change, including stakeholder feedback from other sponsors of airspace change. The list of options progressed to the full DPE were those evaluated as 'viable and good fit' from the viability assessment described in section 16 and these are described in sections 7 to 19 and 21 to 29 of the DOR. Any option that was classified as 'viable but poor fit' following initial evaluation against the 'must have' design principles was not progressed to the DPE.

Step 2A – Design Principle Evaluation (DPE)

20 Design Principle Evaluation

20.1
As required by the CAP1616 process, the list of route options arising from the DOR were considered in a DPE.

20.2
The purpose of the DPE was to evaluate how each of the viable route options aligned with the design principles. The process identified which of the route options merited further analysis in Step 2B of the CAP1616 process, the IOA, on the basis of the ability of each route option to meet the requirements of the design principles.

20.3
To ensure consistency in how each route option was evaluated, detailed criteria were devised for each of the design principles. The full criteria for each design principle are set out at section 4 of the DPE.

20.4
Each viable route option was assessed against the design principles, using the criteria established for each. As part of that assessment, the compliance of each route option with each of the design principles was categorised as follows:

- Met
- Partially met
- Not met

As set out in section 3 of the DPE, where our design principles require a comparator (Limiting our Footprint, Limiting Disturbance and Noise Sensitive Locations), the 'do nothing' scenario has been considered to be the appropriate baseline for the DPE.

20 continued

20.5
Full details of the evaluation of each viable route option are presented at sections 5 to 29 of the DPE, including an analysis as to whether each design principle is 'met', 'partially met' or 'not met' by each route option.

20.6
As some of the design principles, particularly Continuity, Noise 1 and Airspace Users 2, can only be fully considered when individual route options are combined together into operating systems, the assessment of these design principles was limited at this stage.

However, unless there was clear evidence to suggest a route option would perform poorly, no routes were excluded from being carried forward to Step 2B as a result of their assessment against these design principles. As a result, the routes carried forward for further consideration provided a flexible range of options that can achieve an integrated network that aligns with the design principles and responds to the emerging designs of other airspace change sponsors, as their separate airspace change proposals mature. As detailed at section 24 of this document, further evaluation will be carried out as required in Stage 3.

20.7
In addition to detailing the evaluation of each route option against the design principles, the DPE also considered the ability of each route option to respond to the technical criteria at Appendix F of CAP1616. This analysis is set out in sections 5 to 24 of the DPE.

20.8
Of the 118 departure route options identified, the DPE demonstrated that 69 had sufficient merit to be progressed to Step 2B – Initial Options Appraisal. Of the 110 arrival route options identified, 107 were carried forward to Step 2B.

20.9
Full details of the analysis conducted for each route option together with the summary assessment of whether the design principle is either not met, partially met, or fully met can be found in the DPE. The list of route options progressed to Step 2B is set out at sections 18 and 24 of the DPE.

Step 2B – Initial Options Appraisal

21 Introduction

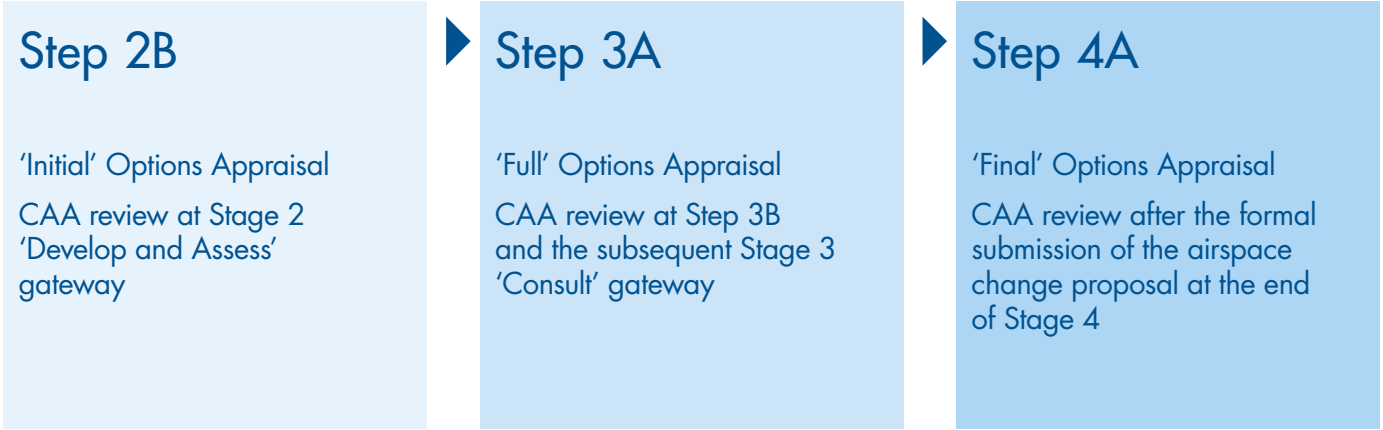
21.1
CAP1616 requires sponsors to complete an IOA process that assesses the benefits of the various route options compared to a baseline. At EMA, the 'do nothing' scenario was used as the baseline with 'do minimum' options assessed against that baseline.

21.2
At the IOA, the minimum requirement is to determine the high-level criteria and then conduct a qualitative assessment against each route option. This serves as the foundation for a fuller and more quantitative assessment later in the CAP1616 process. The key elements of this process are as follows:

- High-level objective and assessment criteria.
- Baseline definition – current operations.
- Longlist of options (including a do-nothing/minimum option).
- Shortlist of options.
- Preferred or final option(s).

The options appraisal requirement of CAP1616 evolves through three iterations as shown in Figure 27. The IOA forms part of the submission to the CAA at the Stage 2 Develop and Assess gateway.

Figure 27: Options appraisal phases



21.3
The design options appraised within the IOA are the outputs from the DPE undertaken within Step 2A of Stage 2, which itself identified those routes which best align with the design principles.

21.4
The IOA undertaken by EMA meets the requirements for the initial appraisal as defined within CAP1616, which are summarised in Figure 28 (replicated from Table E1, CAP1616).

Figure 28: CAP1616 requirements for inclusion at each phase of the options appraisal

Requirement	Initial	Full	Final
High-level objective and design principles	✓	✓	✓
Comprehensive list of viable options	✓	✓	✓
Qualitative assessment of comprehensive list of viable options	✓	✓	✓
Shortlist options	✓	✓	✓
Qualitative assessment of shortlist	✓	✓	✓
Full analysis of shortlist options	✓	✓	✓
Preferred options	✓	✓	✓
Modifications following consultation		✓	✓
Proposed options			✓

22 Methodology

22.1
EMA has reviewed the requirements for IOA within CAP1616 in detail and has adopted a clear and consistent methodology for assessing design options against a defined baseline. This methodology is set out in full at section 2 of the IOA.

22.2
The assessment, which included some early quantitative elements in addition to the qualitative assessments required by CAP1616, considered the impacts identified in CAP1616, as replicated in the table below. The quantitative assessments were used to estimate the number of households and planned property developments to derive an estimate of the number of people overflown; the number of noise sensitive buildings overflown; and the number of and names of National Parks, Areas of Outstanding Natural Beauty (AONBs) and country parks potentially impacted.

Figure 29: Impacts assessed within the options appraisal

Affected group	Impact
Communities	Noise impact on health and quality of life
	Air quality
Wider society	Greenhouse gas impact
	Capacity and resilience
General aviation	Access
General aviation/commercial airlines	Economic impact from increased effective capacity
	Fuel burn
Commercial airlines	Training costs
	Other costs
Airport/air navigation service provider	Infrastructure costs
	Operational costs
	Deployment costs
Safety assessment	Safety assessment
Wider society	Tranquillity
	Biodiversity

23 Outputs

23.1

The IOA categorised the individual options which were progressed from the DPE, as either: the preferred option; favourable option; acceptable; alternate (arrivals only); rejected; or baseline, as shown in the table below. Options awarded a classification of preferred, favourable, acceptable or alternate will be further considered and assessed during Stage 3.

Figure 30: Option classification

Option classification	
Preferred	This option is preferred as it is best performing within the departures design envelope or transitions from the IAF.
Favourable	This option is considered favourable as it is second best performing within the departures design envelope or transitions from the IAF.
Acceptable	This option is considered acceptable as it is third best performing within the departures design envelope or transitions from the IAF.
Alternate (arrivals only)	As the preferred, favourable and acceptable arrival options were either 'direct' or 'indirect', this option has been included as the next best performing option and provides the change sponsor with the potential to achieve an element of noise respite in the case of arrivals.
Rejected	This option is rejected as it is not preferred, not considered favourable nor considered acceptable within the departures design envelope or transitions from the IAF.
Baseline/Previously rejected	Option included for completeness but, in the case of previously rejected options, not subject to IOA shortlisting.

23.2

The assessment of each route option against the assessment criteria, and the categorisation of route options in accordance with the above criteria, is set out in the IOA at section 7.5.

Next steps

24 Developing and assessing operating networks

24.1
Consistent with the requirements of Step 2A of CAP1616, we have undertaken a design process to identify a comprehensive list of route options. In Step 2A, these route options have been evaluated against the design principles that we identified through stakeholder engagement in Stage 1. This work is reported separately in the DOR and the DPE. Those that best align with the design principles were carried forward in the process to Step 2B.

24.2
Route options carried forward to Step 2B have been subject to an initial appraisal. The findings of that appraisal are set out in the IOA and the accompanying assessment tables. The IOA has enabled us to identify a shortlist of design options.

24.3
The shortlist of route options has benefited from extensive engagement with stakeholders, including the general public. Among these stakeholders were other sponsors of airspace change including NATS as the en route airspace provider. Therefore, there is confidence that our proposals are flexible enough to provide compatibility with proposals emerging from other change sponsors, in so far as they are known at this time.

We will continue to work with other change sponsors, including NATS, to ensure that, consistent with the UK's Future Airspace Strategy, we realise the benefits of modernising airspace arrangements. This will include:

- Further work to understand and resolve interdependencies and design conflicts with NATS and adjacent airports as part of the Cumulative Assessment Framework (CAF) process, particularly routes to the west, south west and south east.
- Supporting NATS in any work to create new CAS to the east of EMA.
- Detailed design work to combine individual EMA design options into networks of routes as part of the wider network system.
- Providing information to NATS to inform their development simulations for the MTMA, which will test these emerging system concepts.
- Commencing detailed design work with NATS and other design teams involved with the FASI project for EMA routes to and from the south.

This work will allow us to combine our options into operating networks. Defining networks of routes that support operations to and from EMA will allow us to undertake the more detailed assessment at Stage 3 and allow us to understand the extent to which we are able to provide noise respite and relief to those that are most impacted. The introduction of PBN which, consistent with the requirements of the AMS, is integral to our proposals, will increase the accuracy with which aircraft fly and is likely therefore to lead to greater concentration on any single flight path. In exploring different combinations of routes and their role in a network, we will be guided by the Government's objective to minimise the total adverse effects on people on routes below 4,000ft.

24.4
Options appraisal

The IOA that we have completed is the first of three appraisals required under CAP1616. The operating networks that result from the steps we set out at 24.3 will allow us to undertake the more detailed FOA required at Stage 3. This further assessment will make much greater use of quantitative data. As the FOA will consider fewer options, it will allow us to explore local factors including tranquillity and biodiversity in greater detail than has been possible to date, though this more detailed assessment will benefit from the data we have collated and reported at Stage 2.

Whilst the IOA considered the characteristics of each route option, the FOA will also consider operating networks. This assessment will require an estimate of the numbers and types of aircraft that will fly each route in a network. To facilitate this assessment, we will prepare detailed air traffic forecasts.

The assessment of operating networks will also allow greater consideration of some important factors, reflected in our design principles and for which the assessment in the IOA was limited due to routes not being developed as a system, or combined with the designs of the en route network and adjacent airports. These include noise, emissions, capacity and safety. In defining the full range of criteria that we assess in the FOA we will be guided by CAP1616 and will take account of the information in Appendices B and E.

Our approach to the FOA and the way we will consider and collect the key information is set out in greater detail in the IOA at section 8.

24.5
Policy for the Design of Controlled Airspace Structures

On 12th October 2023, the CAA published an updated version of SARG Policy 126 (Policy for the Design of Controlled Airspace Structures), replacing the former policy statement dated 11 August 2022. This policy provides technical design criteria for controlled airspace structures and has been used to inform both the creation of the comprehensive design options, and to assess these options within the DPE and IOA process. The updated policy statement has a number of changes, including reductions to the design criteria and separation standards that ensure containment of instrument flight procedures, and which therefore may have a bearing on the design options created as part of this ACP.

The EMA Stage 2 submission including the DPE and the IOA assessed alignment of the design options with the August 2022 policy on the design of controlled airspace structures, which was in force at the time those assessments were carried out. As this policy was so recently superseded, the change sponsor has therefore undertaken a preliminary review of the updated October 2023 policy and the design options. It has concluded that, although the changes may impact a number of arrivals options and departure options, no design options would be prematurely discounted as a result of not having applied SARG Policy 126. It was concluded that the application of the up-to-date policy in substitution for the 2022 policy would not materially change any of the outcomes in the DPE and IOA. Consequently, it is unnecessary to revise the EMA Stage 2 submission.

This EMA Stage 2 Gateway submission is therefore based on the previous iteration of the SARG Policy 126, dated 11 August 2022. However, further work to confirm alignment with the new 12 October 2023 policy will be conducted within Stage 3a and beyond. Similarly, all future work will be conducted in line with this revised October 2023 policy – or any successor.

24.6
Controlled airspace

As there is the potential for routes to be refined or amended, as referred to above, it would be premature to define future CAS requirements at this stage. As such, we will identify CAS requirements for groups of options during Stage 3. All stakeholders will be provided with an indication of the CAS requirements within our Step 3C Consultation material, and the comments received will be taken into account and considered as part of the consultation analysis activities in Step 3D. More details of this approach are provided in the DOR at section 4.5.

24.7
RNAV substitution of existing routes

The proposals being developed by MAG and other sponsors within the MTMA cluster are complex and will not be implemented for several years. Given the intention to rationalise the network of DVORs (Doppler VHF Omni Directional Range) across the UK, it will be important that aircraft are able to continue to operate safely and efficiently in the intervening period between this rationalisation and the new arrangements being introduced. EMA intend to use the CAP1781 process provided by the CAA to provide a temporary solution using RNAV substitution, which will maintain the current network of routes with no change in aircraft behaviour, pending the full implementation of this airspace change. CAP1781 allows new technology – RNAV – to be used to maintain existing routings (SIDs). To support this, we will work with airlines to ensure they implement the appropriate technical changes to their systems. The CAP1781 process has begun and will run in parallel to this airspace change. We expect to conclude this separate change process in 2024.

25 Updating stakeholders

25.1

The completion of the work required at Stage 2 has developed and refined the route options available at EMA, as well as expanding the understanding of stakeholders' views on those options. While it is not a requirement of the CAP1616 process, all stakeholders will be provided with the information submitted to the CAA at the conclusion of Stage 2 and given the opportunity to discuss the content and ask questions. This will include details of the feedback gathered at phase two of engagement, the revised route options and the assessments undertaken as part of Step 2B. This will ensure that they remain informed of the development of the Airspace Change Proposal at EMA ahead of the full public consultation exercise at Stage 3.

Glossary

ACOG	Airspace Change Organisation Group formed in 2019 as a fully independent organisation within NATS under the direction of the UK Government Department for Transport and Civil Aviation Authority, who are the co-sponsors of the AMS.
ACP	Airspace Change Proposal.
ADWR	Airspace Development Workshop Record – the output from bilateral discussions with NERL to record and inform their comprehensive list of options for the network that interfaces with EMA traffic.
AgI	Above ground level.
AIAA	Area of Intense Aerial Activity – Airspace within which aircraft, singly or in combination with others, regularly participate in unusual manoeuvres, not constrained by a formal route network.
AIP	The UK Aeronautical Information Publication – a document published by the UK CAA which contains information essential to air navigation. (www.aurora.nats.co.uk/htmlAIP/Publications/2022-07-14-AIRAC/html/index-en-GB.html).
Altitude Based Priorities	The ANG sets out a framework of 'Altitude Based Priorities', to be taken into account when considering the potential environmental impact of airspace changes.
AMS	Airspace Modernisation Strategy (CAP1711) – this is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace (www.caa.co.uk/cap1711). The original AMS was published in December 2018 and a refreshed version in January 2023. All references to the AMS are to this January 2023 version.
AMSL	Above mean sea level.
ANCON	The UK civil Aircraft Noise Contour Model. A computer model developed and maintained by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority which calculates contours of aircraft noise exposure levels around airports.
ANG	Air Navigation Guidance 2017 – Guidance to the CAA (from DfT) on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management. (www.gov.uk/government/publications/uk-air-navigation-guidance-2017).
ANSP	Air Navigation Service Provider – an organisation which operates the technical system, infrastructure, procedures, and rules of an air navigation service system, which includes air traffic control.
AONB	Area of Outstanding Natural Beauty – an area of countryside which has been designated for conservation because of its significant landscape value, recognising its national importance.
AQMA	Air Quality Management Area – designated by a local authority and subject to a Local Air Quality Management Plan.
ATC	Air Traffic Control – service from an air navigation service provider providing guidance to aircraft through Controlled Airspace.
ATCC	Air Traffic Control Centre. There are two air traffic control centres in the UK both operated by NERL. The London ATCC deals with aircraft operating to the south of EMA and the Scottish ATCC deals with flights to the north of EMA.
ATCO	Air Traffic Control Officer – Air Traffic Controllers who monitor the flow of aircraft into and out of the airport airspace by providing instructions and information to pilots so they fly safely and efficiently. ATCOs manage flights at both airports and within the en-route (upper) airspace network.
ATM	Air Transport Movement – an aircraft operation for commercial purposes, as opposed to a flight for recreational or personal reasons.
ATS	Air Traffic Services.

ATZ	Aerodrome Traffic Zone – An airspace of defined dimensions established around an aerodrome for the protection of aerodrome traffic.
BHX	The three letter IATA code for Birmingham Airport.
BKY	Abbreviation for the Barkway DVOR navigation beacon and routes that use that as a navigation point.
Biodiversity	The variability among living things from all ecosystems (including terrestrial, marine, and aquatic amongst others) and the ecological complexes of which they are part, including diversity within species, between species and of ecosystems.
CAA	Civil Aviation Authority – the aviation industry's regulator.
CAP	Civil Aviation Publication – a document published by the UK CAA which can provide information, guidance or policy depending on the subject covered. The list of all CAPs is published on the CAA website (www.caa.co.uk/our-work/publications).
CAP1385	The CAA's PBN enhanced route spacing guidance (www.caa.co.uk/cap1385).
CAP1498	The CAA's Definition of Overflight – this defines overflight as it relates to airspace regulation and provides an overflight metric which may be used to quantitatively compare different airspace options (www.caa.co.uk/cap1498).
CAP1616	The CAA's airspace change guidance document – it sets out the regulatory process which all airspace change proposals must follow (www.caa.co.uk/cap1616).
CAP1616a	A technical annex to CAP1616 – guidance on the regulatory process for changing airspace design including community engagement requirements. This annex outlines relevant methodologies for use in environmental assessments relating to airspace change (www.caa.co.uk/cap1616a).
CAP1711	Airspace Modernisation Strategy – this is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace (www.caa.co.uk/cap1711).
CAP1781	The CAA's DVOR/DME/NDB Rationalisation – guidance for the use of RNAV Substitution (www.caa.co.uk/cap1781).
CAP1926	General Requirements and Guidance Material for the use of RNAV Substitution (www.caa.co.uk/cap1926) and which supports airlines in the implementation of RNAV substitution under CAP1781
CAP1991	Procedure for the CAA to review the classification of airspace (www.caa.co.uk/cap1991).
CAP2091	CAA Policy on Minimum Standards for Noise Modelling – document defines categories of noise modelling sophistication and sets out requirements of the minimum category which different stakeholder or sponsor groups should use when providing noise calculations to the CAA. (www.caa.co.uk/cap2091).
CAP2156A	Airspace change Masterplan – CAA acceptance criteria: the criteria against which the CAA will make the decision whether to accept the airspace change masterplan into the Airspace Modernisation Strategy (www.caa.co.uk/cap2156A).
CAP2302	A Low Noise Arrival CAP2302 – a report that makes recommendations to implement low noise arrivals (www.caa.co.uk/cap2303).
CAP493	Manual of Air Traffic Services – contains procedures, instructions and information which are intended to form the basis of air traffic services within the United Kingdom (www.caa.co.uk/cap493).
CAP725	The CAA's airspace change process guidance document that preceded CAP1616 (www.caa.co.uk/cap725).
CAP760	CAA's Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases (www.caa.co.uk/cap760).
CAP778	The CAA's Policy and Guidance for the Design and Operation of Departure Procedures in UK Airspace (www.caa.co.uk/cap778).

CAA Controlled Airspace Containment Policy Statement	The CAA Controlled Airspace Containment Policy Statement (January 2014 superseded in August 2022) sets out the minimum criteria applicable to containment of instrument flight procedures for airports already within Controlled Airspace (CAS). Annex B provides the design criteria that have been applied to the arrival and departure routes in this ACP. (https://publicapps.caa.co.uk/docs/33/Policy%20for%20the%20Design%20of%20Controlled%20Airspace%20Structures%20110822.pdf).
CAS	Controlled Airspace is airspace within which air traffic services are provided. There are different classifications which define the air traffic control service provided and the requirements of aircraft flying within it. All commercial (passenger) flights fly within Controlled Airspace.
CATI & CATIIIB (approaches)	Categories of precision approach and landing (including Instrument Landing System (ILS) and Autoland) operations are defined according to the applicable Decision Altitude/Height and Runway Visual Range/visibility. A category I (CATI) approach requires a higher decision height and better visibility than a category IIIB (CATIIIB) approach. The technical apparatus for CATIIIB approaches allow an airport to maintain operations in very poor visibility.
CCO	Continuous Climb Operations – allows departing aircraft to climb continuously, which reduces the level of noise heard on the ground, reduces fuel burn and emissions.
CDA	Continuous Descent Approach – allows arriving aircraft to descend continuously which reduces the level of noise heard on the ground, reducing fuel burn and emissions.
CF	Course to Fix – a path that terminates at a fix with a specified course at that fix.
Change sponsor	An organisation that proposes, or sponsors, a change to the airspace design in accordance with the CAA's airspace change process.
CHASE	The northerly of the two holds used for arrivals at Birmingham Airport.
Class G airspace	Class G airspace is also referred to as uncontrolled airspace and is airspace where an ATC service is not deemed necessary or cannot be provided for practical reasons. This means there are no restrictions on which aircraft can enter it, what equipment the aircraft must carry, or the routes taken by the aircraft.
Comprehensive list	The full list of design options that are viable designs as required by Stage 2 of the CAP1616 process and which are detailed in the Design Options Report.
CONOPS	Concept of Operations – a document that outlines how we want the airspace system to work in the future and the standards that we will use.
CO_2	Carbon dioxide, one of the gases produced when burning aviation fuel.
COVID-19	Coronavirus disease 19 is a contagious disease caused by a virus that was identified in 2019 and which resulted in a pandemic in the year 2020.
CP	Country Park – areas of land designated and protected by local authorities to provide access to the countryside.
Cumulative Impact	Where an environmental topic/receptor is affected by impacts from more than one source/project at the same time and the impacts act together.
CTA	Control Area – the controlled airspace that exists in the vicinity of an airport.
dB	Decibels – a unit used to measure noise levels.
DEFRA	Department for the Environment, Food and Rural Affairs (UK Government).
DER	Departure End of Runway – a term that, when used in PANS-OPS 8168, determines the start point for the design of a departure procedure.
Design envelopes	Broad areas where it is possible to design routes and which are the areas where we have created design options for arriving and departing aircraft.
Design option	An output from the route design process that responds to the design principles and the Statement of Need (SoN). Design options are a requirement of the CAP1616 process. During the engagement carried out at Stage 2, design options were also referred to as route options.
Design principles	The principles encompassing the safety, environmental and operational criteria, and the strategic policy objectives that the change sponsor seeks to achieve in developing the airspace change proposal. They are an opportunity to combine local context with technical considerations and are therefore drawn up through discussion with affected stakeholders. The design principles at East Midlands Airport were established during Stage 1 of the CAP1616 process.
DF Coding	Direct to Fix coding – type of waypoint used in the design of PBN procedures.

DfT	Department for Transport.
DME	Distance Measuring Equipment – a ground-based beacon that allows aircraft to measure their precise distance from its location, often used to define a turn point.
DOE	Design Options Evolution – shows the evolution of the design options through Stages 2A and 2B of the CAP1616 process. Included as Appendix A to the Stage 2 Summary Document.
DOR	Design Options Report – this responds to the requirements of CAP1616 to develop a comprehensive list of options that address the SoN and that align with the design principles. It details the design process and the output of that process in the form of design options for both departures and arrivals.
DPE	Design Principle Evaluation – the document that undertakes an evaluation of the Viable and Good Fit options described in this report against the design principles.
DTY	Abbreviation for the Daventry DVOR navigation beacon and routes that use that as a navigation point.
DVOR	Doppler VHF Omni-directional Range – ground-based radio navigation beacon used by pilots to assist in aircraft navigation.
EASA	European Union Aviation Safety Agency.
Education (facilities)	For our analysis we have used the 'Ordnance Survey Address Base' count of educations facilities, details of which they receive from the local government contributing authority. These include all educational services including College, Further Education, Higher Education, Children's Nursery/ Crèche, Preparatory/First/Primary/Infant/Junior/Middle School, Non State Primary/Preparatory School, Secondary/High School, Non State Secondary School, University, Special Needs Establishment and Other Educational Establishments.
EU	The European Union – an economic and political union of 27 countries.
EMA	The three letter IATA code for East Midlands Airport.
ERCD	The Environmental Research and Consultancy Department of the Civil Aviation Authority.
FAF	Final Approach Fix – The point at which the aircraft starts its final approach to land.
FASI-N	Future Airspace Strategy Implementation – North: The programme of airspace changes across the northern part of the UK, including East Midlands Airport, that is implementing the Government's Airspace Modernisation Strategy.
FASI-S	Future Airspace Strategy Implementation – South: The programme of airspace changes across the southern part of the UK including London that is implementing the Government's Airspace Modernisation Strategy. Whilst the East Midlands Airport ACP will de deployed as part of FASI-N programme, the route structures to and from EMA to the south result in the need to align with the network being developed as part of FASI-S.
FIR	Flight Information Region – airspace delegated to a country by ICAO. In the UK there are two FIRs, London and Scottish.
FL	FL means 'Flight Level' and uses the standard international pressure (1013.2 hPa) to express altitude in hundreds of feet. For example, FL90 equates to 9,000ft calculated according to the 'constant' pressure altitude, rather than local pressure (QNH).
Flat segment	A defined period of level flight as required by a PANS-OPS PBN Approach procedure.
Flight path	The routes taken by aircraft within airspace.
Flight Level	A means to separate aircraft (above the transition altitude) by using a standard pressure setting for all aircraft.
FMS	Flight Management System – a specialised computer system that automates a wide variety of in-flight tasks, and which encompasses a data base to allow SID and arrivals routes to be pre-programmed and flown.
FOA	Full Options Appraisal – the options appraisal carried out at Stage 3 of the CAP1616 process.
Focus group	Group of representative stakeholders brought together to discuss proposals and offer feedback.
Ft	Feet.
GA	General Aviation – defined by ICAO as 'all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire'.
GANP	The ICAO Global Air Navigation Plan provides a global strategy to modernise the air traffic management system. The GANP provides the foundation for the delivery of the UK AMS (CAP1711). (https://www.icao.int/airnavigation/documents/ganp-2016-mobile.pdf).

GBAS	Ground Based Augmentation System – augments the existing GPS by providing corrections to aircraft in the vicinity of an airport to improve the accuracy of, and provide integrity for, the aircraft's GPS navigational position.
GDPR	The General Data Protection Regulations.
GIS	Geographic Information System.
GNSS	Global Navigation Satellite System – a term used to describe a system that uses satellites for position fixing.
GPS	Global Positioning System – a satellite-based radio navigation system owned by the United States government and operated by the United States Space Force.
HAZID Workshop	Hazard Identification workshop – the first part of the safety assurance process which identifies the safety requirements and potential interactions that may have a safety impact. It is held with air traffic control experts as well as airline representatives operating from East Midlands Airport.
IAF	Initial Approach Fix – the start of the approach phase of flight. For the East Midlands Airport arrival design options, the IAF is at 7,000ft.
IF	Intermediate Fix – a defined point on an arrival procedure, where the aircraft speed and configuration are adjusted, shortly before the aircraft starts the final approach.
IATA	The International Air Transport Association – a trade association that supports aviation with global standards for airline safety, security, efficiency and sustainability.
ICAO	International Civil Aviation Organisation – an agency of the United Nations.
IFP	Instrument Flight Procedure.
ILS	Instrument Landing System – a radio navigation system that provides vertical and horizontal guidance to arriving aircraft to help them land safely, especially in bad weather.
Instrument Approach Procedures (IAPs)	A series of predetermined manoeuvres for the orderly transfer of an aircraft operating under instrument flight rules from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.
Intermediate segment	The element of the approach between the IF and FAF where the descent gradient is either minimised or where a portion of level flight is designed into the procedure to assist with aircraft stabilisation.
IOA	Initial Options Appraisal – the document that is the first iteration of the three option appraisals required by CAP1616 – the design options appraised within the IOA are the outputs from the DPE.
KIAS	Knots of indicated airspeed – the number shown on the airspeed indicator.
km	Kilometres.
KTS	Knots – nautical miles per hour.
LAeq	Equivalent continuous sound level, or Leq/LAeq, is the average sound level for a specific location, over a given period.
LBA	The three letter IATA code for Leeds Bradford Airport.
LDA	Localiser Directional Aid – an assisted approach not aligned with the landing runway, used in places where terrain or other factors prevent the localiser antenna from being aligned with the runway that it serves.
LOAEL	Lowest Observed Adverse Effect Level – below this level, there is no detectable effect on health and quality of life due to the noise.
LNAV	Lateral Navigation – a term for lateral (left/right) navigation used within Performance Based Navigation.
LPL	The three letter IATA code for Liverpool John Lennon Airport.
LTMA	London Terminal Manoeuvring Area – the designated area of Controlled Airspace that deals with air traffic in the London area.
m	Metres.
MAGIC map	Interactive map managed by DEFRA containing authoritative geographic information about the natural and built environment from across Government.
MAP	Missed Approach Procedure – on occasion, inbound aircraft are unable to land successfully on their first approach and perform an action known as a 'Go-Around'. The Missed Approach Procedure outlines a mechanism to route the aircraft, without conflict with departing or arriving aircraft, and re-establish it on to the arrivals path for another approach.
MAN	The three letter IATA code for Manchester Airport.

Masterplan	The strategic plan for the coordinated national programme of airspace change, created by the ACOG under the direction of the CAA and DfT. The criteria the CAA will apply to accept the Masterplan are contained in CAP2156a (www.caa.co.uk/cap2156A).
Medical (facilities)	For our analysis we have used the 'Ordnance Survey Address Base' count of 'Medical', details of which they receive from the local government contributing authority. These include Dentist, General Practice Surgery/Clinic, Health Centre, Health Care Services, Hospital, Hospice, Medical/Testing/ Research Laboratory, Professional Medical Service, Assessment/Development Services. Not all of these are 'noise sensitive' receptors and in Stage 3 those which are not 'noise sensitive' will be removed from future analysis.
Mean track	For noise modelling purposes, an average track over the ground, derived from radar data samples.
Modal average path	The path over the ground most commonly flown, derived from radar data samples.
MSD	Minimum Stabilisation Distance – a design criteria within PANS-OPS 8168 that ensures aircraft stability when flying a procedure.
MTMA	Manchester Terminal Manoeuvring Area – the designated area of Controlled Airspace that deals with traffic to the north of East Midlands Airport.
NATS	The air navigation service provider for the UK, formerly National Air Traffic Services. NATS 'En Route' manage the traffic in the upper airspace and climbing and descending to land in the Manchester area.
NDB	Non-Directional Beacon – a ground based radio beacon that emits a signal in every direction, used as an instrument approach aid for some airport procedures, including contingency procedures at EMA.
NERL	NATS En Route Ltd – the part of NATS that delivers en route air traffic control.
Nm	Nautical miles.
NNR	National Nature Reserves – designated under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 to protect important habitats, species or geology.
Noise abatement	Activity to reduce the emission of noise from a given source (aircraft operations).
Noise-sensitive receptors	Specific locations or developments identified as likely to be adversely affected by noise from or due to aircraft operations. Individual locations will have varying degrees of sensitivity (measured noise exposure levels) depending upon their use. These provide a useful reference to the design principles N1, N2 and N3 where the number of people affected by noise, noise effects and noise sensitive areas are referenced.
NP	National Park – designated areas under the National Parks and Access to the Countryside Act 1949 to protect landscapes because of their special qualities.
NPR	Noise Preferential Route – initial flight path corridor around the SID that departing aircraft are required to remain within until they reach a minimum height of 5,000ft. Each NPR at EMA is 2.4km wide (1.2m either side of the SID).
NWMTA	North Wales Military Training Area: A designated area of airspace used extensively by the RAF for military training flights and which restricts use by civil air traffic.
Overflight	According to CAP1498, the definition of overflight is 'an aircraft in flight passing an observer at an elevation angle (approximately the angle between the horizon and the aircraft) that is greater than an agreed threshold, and at an altitude below 7,000ft.'
PANS-OPS	An ICAO document that stands for Procedures for Air Navigation Services Document 8168 that outlines the rules and criteria for designing aircraft flying procedures – commonly shortened to PANS-OPS.
PBN	Performance Based Navigation – a range of specifications that requires aircraft to navigate to specific accuracy standards, mainly by using satellite-based navigation systems. It is designed to improve track-keeping accuracy for departing and arriving aircraft. The transition to PBN is a UK and international policy requirement and a foundation of the AMS and this ACP.
PBN IR	The PBN IR introduces the gradual implementation of PBN flight procedures to support safer, greener, and more efficient aircraft operations. The regulation is binding in its entirety and directly applicable in all EU Member States.
Peak District	The Peak District – an upland area in England at the southern end of the Pennines. Mostly in Derbyshire, it extends into Cheshire, Greater Manchester, Staffordshire, West Yorkshire and South Yorkshire.
PDG	Procedure Design Gradient.

PIGOT	The southerly of the two existing holding stacks used for arriving aircraft at EMA. It is situated south east of Leicester.
Places of Worship	For our analysis we have used the 'Ordnance Survey Address Base' count of 'Places of Worship', details of which they receive from the local government contributing authority. These include any Abbey, Baptistry, Cathedral, Church, Chapel, Citadel, Gurdwara, Kingdom Hall, Methodist, Mosque, Minster, Stupa, Succah, Synagogue, Tabernacle or Temple.
Planned Property Developments	Property developments with a reasonable prospect of being developed based on Local Plan allocations and Local Authority five-year Housing Land Supply Assessment data. During engagement we have used the term 'Future Housing Sites' to represent the broader phrase of planned property development as we are not aware of other future noise sensitive developments that would sit within this category. Data was collated by CBRE and supplied to East Midlands Airport in December 2022.
Point Merge	Is based on a specific precision-area navigation (P-RNAV) route structure, consisting of a point (the merge point) and pre-defined legs (the sequencing legs) equidistant from this point. The sequencing is achieved with a 'direct-to' instruction to the merge point at the appropriate time.
Q&A	Question and Answer – a list of questions (and their answers) that help the reader understand the subject material.
RAG	Red, Amber, Green – a means of assessing a project's status using the traffic light colours.
RF	Radius to Fix (RF) is a constant radius PBN turn around a defined turn centre which produces a highly accurate track over the ground.
RNAV1	Area Navigation 1 is one of the specifications within PBN. Aircraft must maintain specific navigational accuracy within the flight. The '1' suffix refers to the accuracy requirement in the procedure, in this case aircraft must fly within +/-1 nautical mile of the centreline of the designed route.
RNP APCH	Required Navigation Performance Approach – a type of RNP procedure used in the descent phase of flight.
RNP-AR	Required Navigation Performance-Authorisation Required – a specialist type of PBN arrivals procedure, which requires suitably equipped aircraft, and crews to be trained in its use.
RNP1	Required Navigation Performance – one of the specifications under PBN. Aircraft must maintain specific navigation accuracy, and in RNP are aided by on-board performance monitoring and alerting. It provides slightly more predictable track-keeping when compared to RNAV1. The '1' suffix refers to the accuracy requirement in the procedure, in this case aircraft must fly within +/-1 nautical mile of the centreline of the designed route.
RNP1+RF	Required Navigation Performance with Radius to Fix turns.
ROKUP	The northerly of the two existing holding stacks used for arriving aircraft at EMA. It is situated close to Belper.
Route option	A term used in engagement to describe the design options that have been created in this step of the Airspace Change Process.
SAC	Special Area of Conservation – Designated under the Conservation of Habitats and Species Regulations 2017 as making a significant contribution to the conserving of the habitats of protected species.
Safety Case	A written demonstration of evidence and due diligence provided by a corporation to demonstrate the ability to operate safely and effectively control hazards.
SARG	Safety and Airspace Regulation Group which drives UK Civil Aviation Authority (CAA) safety standards including overseeing aircraft, airlines and air traffic controllers. They are also responsible for the planning and regulation of UK airspace.
Secretary of State	The title typically held by Cabinet Ministers in charge of Government Departments.
SESAR	The Europe-wide Single European Sky Air Traffic Management Research programme – a joint undertaking is an institutionalised European partnership between private and public sector partners set up to accelerate through research and innovation the delivery of the Digital European Sky (www.sesarju.eu).
SID	Standard Instrument Departure – pre-determined flight path set by Air Traffic Control that aircraft follow when departing an airport.
SME	Subject Matter Expert(s) is a person (are people) who has (have) accumulated great knowledge in a particular field or topic.

SoN	Statement of Need – the means by which the change sponsor sets out what airspace issue or opportunity it is seeking to address and what outcome it wishes to achieve, without specifying solutions, technical or otherwise. East Midlands Airport's SoN can be found online (https://airspacechange.caa.co.uk/documents/download/773).
SPA	Special Protection Area – protected areas for birds classified under the Wildlife and Countryside Act 1981 and protected under the Conservation of Habitats and Species Regulations 2017.
SSSI	Sites of Special Scientific Interest – areas of importance designated and protected by Natural England under the Wildlife and Countryside Act 1981 to recognise the land's wildlife, geology or landform is of special interest.
STAR	Standard Terminal Arrival Route – a pre-determined flight path set by Air Traffic Control that aircraft follow when arriving at an airport.
Step 1B Design Principles Report	A document that formed part of East Midlands Airport's Stage 1 submission to the CAA (https://airspacechange.caa.co.uk/documents/download/5447).
T-Bar	A name given to a type of RNAV final approach procedure. There is a final approach based on an extended centreline from the runway and then perpendicular to that, two Initial Approach Segments are connected to form a 'T' shape.
Technical Coordination Group	Created by ACOG the Group regularly meet to discuss and resolve policy and technical issues affecting airspace design across all airports.
TNT	Abbreviation for the Trent DVOR navigation beacon and routes that use that as a navigation point.
TODA	Take off Distance Available – the length of the paved surface of the take-off runway plus the length of the clearway.
TOS	Traffic Orientation Structure ensures smooth traffic flows and decrease the safety risks associated with crossing traffic.
Track to fix	A Track to Fix (TF) leg is used in PBN procedures to create a line between two waypoints. It is defined by the flight track to the following waypoint and Track to a Fix leg are sometimes called point-to-point legs for this reason.
Tranquillity	There is no universally accepted definition of tranquillity and therefore no accepted metric by which it can be measured. In general terms it can be defined as a state of calm. The consideration of impacts upon tranquillity for airspace change is with specific reference to National Parks and Areas of Outstanding Natural Beauty (AONB), plus any locally identified 'tranquil' areas that are identified through community engagement and are subsequently reflected within an airspace change proposal's design principles.
Transition	The part of the arrival route from the IAF at 7,000ft where aircraft are descending prior to joining the final approach at the FAF.
Transition Altitude	The altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes. Above this, the reference is to a Flight Level.
Transport Act 2000	The Transport Act 2000 is an Act of the Parliament of the United Kingdom. The Act provided for a number of measures across the transport industry. In the aviation sector, the Act set a framework for creation of a public-private partnership of National Air Traffic Services.
Uncontrolled airspace	Uncontrolled airspace is airspace where an ATC service is not deemed necessary or cannot be provided for practical reasons. This means there are no restrictions on which aircraft can enter it, what equipment the aircraft must carry, or the routes taken by the aircraft. In airspace classification terms this is also referred to as Class G airspace.
Unviable	Options which would not comply with the rules or for flight procedure design, specifically the requirements of ICAO PANS-OPS 8168, or if they are not compliant with these rules, did not have a supporting safety justification.
VHF	Very High Frequency.
Viable and Good Fit	Options that are viable to design and which would be expected to meet the three design principles with which all design options 'must' comply (design principles Safety, Programme and Continuity).
Viable but Poor Fit	Options that are viable to design, but which would not be expected to meet the requirements of the design principles Safety, Programme and Continuity.
VNAV	Vertical Navigation – a term for vertical (up/down) navigation used within Performance Based Navigation.
VRP	Visual reference point.

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