Stage 2 Summary Document – V2

CAP1616 Stage 2 Develop and Assess

MAG Manchester Airport

Contents

Read more online:
manchesterairport.com/futureairspace

5

Next steps

PAGES 48–50

6

Glossary

PAGES 52–60

Document title:	Stage 2 Summary Document – V2	
Version:	Version 2	
Date:	03/03/2023	
Document history:	Version 1 –submitted to the CAA in November 2022 –*Where possible* amendments shown in black	
Amendments:	**Section**	**Amendment description**
	3	Changes to the text in Figure 1 reflect the extraordinary Gateway in March 2023.
	16	Changes to the text in Figure 27 to better reflect the consideration that was given to the Airspace Modernisation Strategy in the viability assessment.
	19	Changes to the process have altered the number of design options listed in 19.8. Changes to format of the DPE have altered the references to find more information in 19.9.
	21	Change in wording in 21.2 to reflect updated methodology for use of planned property development in the IOA
	22	Changes to the process have altered the description of 22.1 and 22.2. Changes to the text in Figure 31 to better reflect the considerations that process and outcomes of the IOA.
	23	'Next Steps' -Additional detail of the actions to be taken in Stage 3.
	Glossary	Included additional definitions and text (to a previous definition).

1. Introduction

1.1

The Government is committed to modernising airspace arrangements across the UK. Modernisation is intended to provide greater operational resilience, ensure the highest standards of safety, and realise improvements in efficiency and environmental impact. The national strategy is set out in the Airspace Modernisation Strategy (AMS)[1]. The Manchester Airport (MAN) Future Airspace project is consistent with the AMS and is intended to deliver the required transition to modern flying techniques at the airport. The MAN Future Airspace project is part of a coordinated series of projects undertaken by airports and National Air Traffic Services (NATS), which are collectively known as the Future Airspace Strategy Implementation programme.

1.2

Airspace change is regulated by the Civil Aviation Authority (CAA), using the process set out in CAP1616. MAN is at Stage 2 of this process. This document provides a summary of the work undertaken by MAN to address the requirements of Stage 2 of the process. It accompanies the following reports, which are also being submitted to the CAA and which collectively constitute the MAN submission for Stage 2 gateway approval.

1.2.1. **Design Options Report (DOR)**, which sets out MAN'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 design options identified and describes how those options were refined to provide a comprehensive list of design options to be progressed to the Design Principle Evaluation.

1.2.2. **Design Principle Evaluation (DPE)**, which assesses how the design options have responded to the design principles, which were established at Stage 1 of the CAP1616 process and identifies those design options that warrant further analysis at the next step.

1.2.3. **Initial Options Appraisal (IOA)**, building on the results of the DPE, the IOA is the first iteration 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.

1.2.4. **The 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.

1.2.5. **Design Options Evolution (DOE)**, Appendix A to this 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.

1.3

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

[1] The Airspace Modernisation Strategy (CAP1711) is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace (www.caa.co.uk/cap1711).

2. Requirement for change

2.1
Airspace is a critical part of the national infrastructure. Like the road and rail network, it plays a vital role in facilitating the movement of people and products quickly, safely 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 several 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, our passenger numbers were significantly affected by the COVID-19 pandemic. However, we remain confident that traffic levels will continue to recover, with the airport handling 200,000 movements per year (as we did in 2019) and playing a major role in the UK and regional economy. Pre-pandemic we served over 29 million passengers per annum and contributed £1.6 billion to the UK economy[2]. Our passenger operations also support a busy cargo operation, bringing in valuable supplies and supporting the export of UK goods.

[2] Economic Impact of the MAG Airports, CSR Update 2019 – York Aviation, June 2019

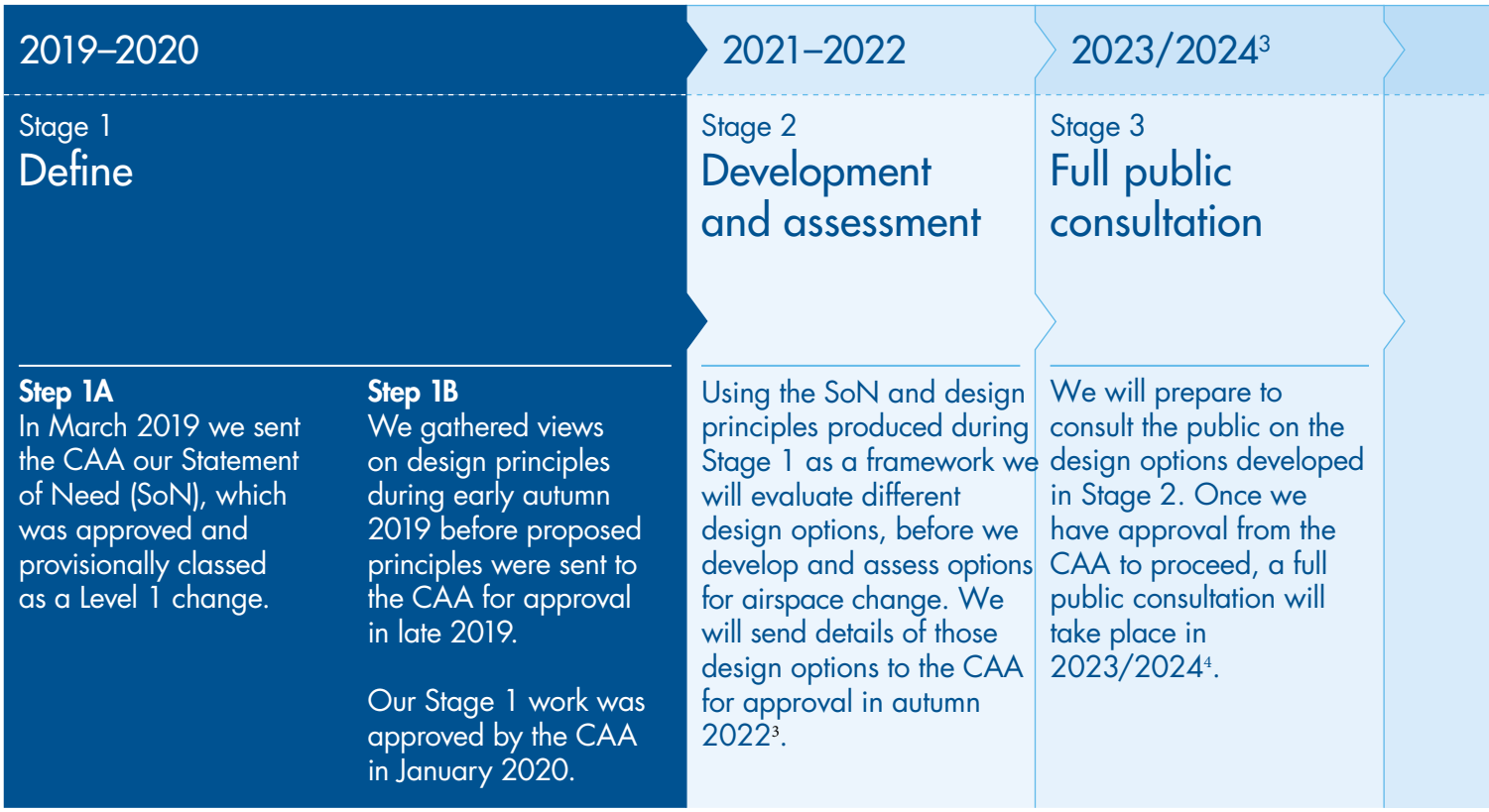
3. The CAP1616 change process

3.1
As the national regulator, the CAA has responsibility for approving all changes to airspace. In December 2017, the CAA published its 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.*

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, together with local communities, when developing change proposals.

3.3
CAP1616 includes four 'gateways' where the CAA will assess the work undertaken by the change sponsor before allowing them to progress to the next stage of the process. MAN received CAA approval for Stage 1 at the 'Define' gateway in January 2020.

Figure 1: The seven stages of airspace change



3.4

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

3.5

MAN's progress to date and anticipated future activity is shown on the timeline below[3]. 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.

3.6

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 national Masterplan. Iteration two of the Masterplan[4] 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. MAN forms part of the Manchester Terminal Manoeuvring Area (MTMA). There are only three other airports within the MTMA that are also following a CAP1616 airspace change process. Liverpool John Lennon Airport (LPL) is paused at Stage 4 and both Leeds Bradford Airport (LBA) and East Midlands Airport (EMA) are also preparing their Stage 2 submissions.

2024–2025[4]	Late 2025[4]	2026[4] onwards	2027[4] onwards
Stage 4 **Update and submission of 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 in 2024[4].	We expect the CAA's decision on whether to approve any airspace change in 2024[4].	If approved, any airspace changes could be put in place in 2025[4].	The CAP1616 process gives the CAA and airports 12 months to review any change that has been made to airspace.

[3] In December 2022 we received notification from the CAA that we need to consider and address several clarifications and questions, as part of our Extraordinary Stage 2 Gateway, these will be submitted in March 2023.

[4] All future dates are provisional pending CAA approval and alignment with the wider AMS.

[5] See: www.acog.aero/airspace-masterplan/masterplan/.

4. Stage 1 overview

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

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

Step 1A – Assess Requirement

4.2
In March 2019, MAN completed Step 1A by submitting a SoN[6] to the CAA, setting out why an airspace change was necessary. The reasons provided included:

- *'introducing new technologies… while phasing out the old ground-based navigational aids.*
- *'seek[ing] to deliver benefits to passengers, by reducing delays, and to the environment, by facilitating more efficient operations, including reducing unnecessary aircraft holding'.*
- *'to deliver an airspace design that will enable Manchester Airport to continue to grow to make best use of its available runway capacity, while balancing the needs of communities and the environment.'*

In July 2019, the CAA approved the SoN, agreeing that MAN 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 design options that address the issues and opportunities identified in the SoN.

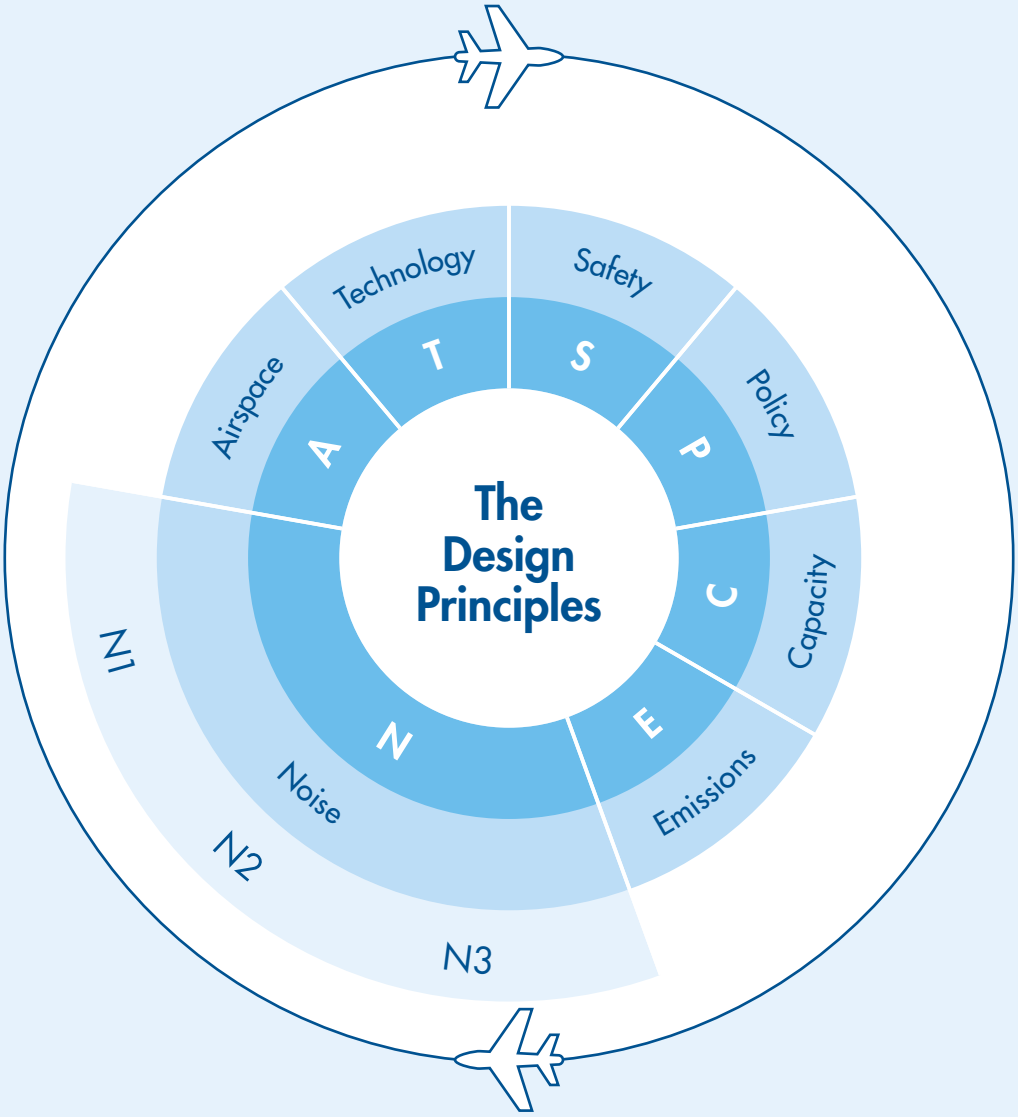
4.4
The process followed at MAN to develop the design principles through engagement with affected stakeholders is set out in full in the report *'Step 1B Design Principles Report'*[7] and its appendices. The report includes details of the stakeholders engaged with, the feedback provided and how the design principles took account of that feedback. The report was submitted to the CAA in December 2019 and approved in January 2020.

4.5
The final design principles, as approved by the CAA, are set out overleaf.

[6] SoN can be accessed through www.manchesterairport.co.uk/futureairspace, airspacechange.caa.co.uk or directly at https://assets.live.dxp.maginfrastructure.com/f/73114/x/b16a1e2945/statement-of-need-as-sent-to-caa-march-2019.pdf

[7] Report can be accessed through www.manchesterairport.co.uk/futureairspace, airspacechange.caa.co.uk or directly at https://live-webadmin-media.s3.amazonaws.com/media/8300/33494_mag_future_airspace_mcr_template_v8b.pdf

Figure 2: The design principles



Safety

Our routes must be safe and must comply with industry standards and regulations.

Policy

Any changes must accord with the Civil Aviation Authority's Airspace Modernisation Strategy. Any airspace change must also allow connection to the wider UK en route network and be aligned with the Future Airspace Strategy Implementation for the North programme and take into consideration the needs of other airports.

Capacity

Our future airspace must enable best use of the capacity of our existing runways, in line with Government policy.

Emissions

We will minimise and where possible, reduce emissions when we design routes. This may be achieved by selecting the most direct routes.

Noise

N1 Our route designs should seek to minimise, and where possible, reduce the number of people affected by noise from our flights.

N2 Where practical, noise effects should be shared. The use of dispersion and/or respite, especially at night, will be considered to achieve this.

N3 Where practical, our route designs should avoid, or limit effects upon, noise sensitive areas. These may include cultural or historic assets, tranquil or rural areas, sites of care or education.

Airspace

Our route designs should minimise the impacts on other airspace users by limiting Controlled Airspace (CAS).

Technology

Our route designs should be based on the latest aircraft navigational technology widely available.

5. Stage 2 overview

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

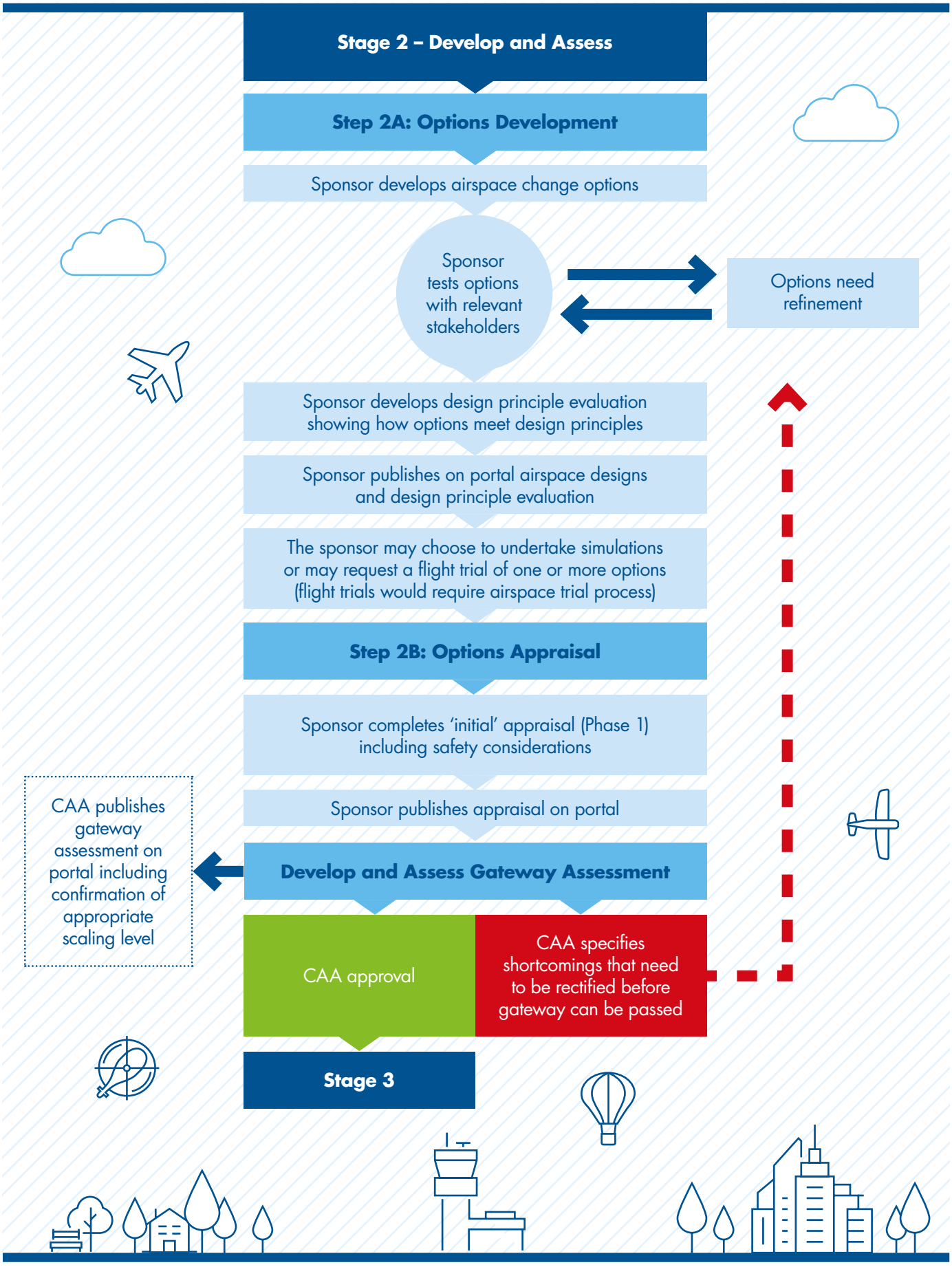
- Step 2A – Options Development
- Step 2B – Options Appraisal

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

5.3
As at 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 design options. A full description of the engagement activities completed by MAN 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 MAN 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 at www.airspacechange.caa.co.uk.

Figure 3: Stage 2 process



Step 2A – Design Options Report

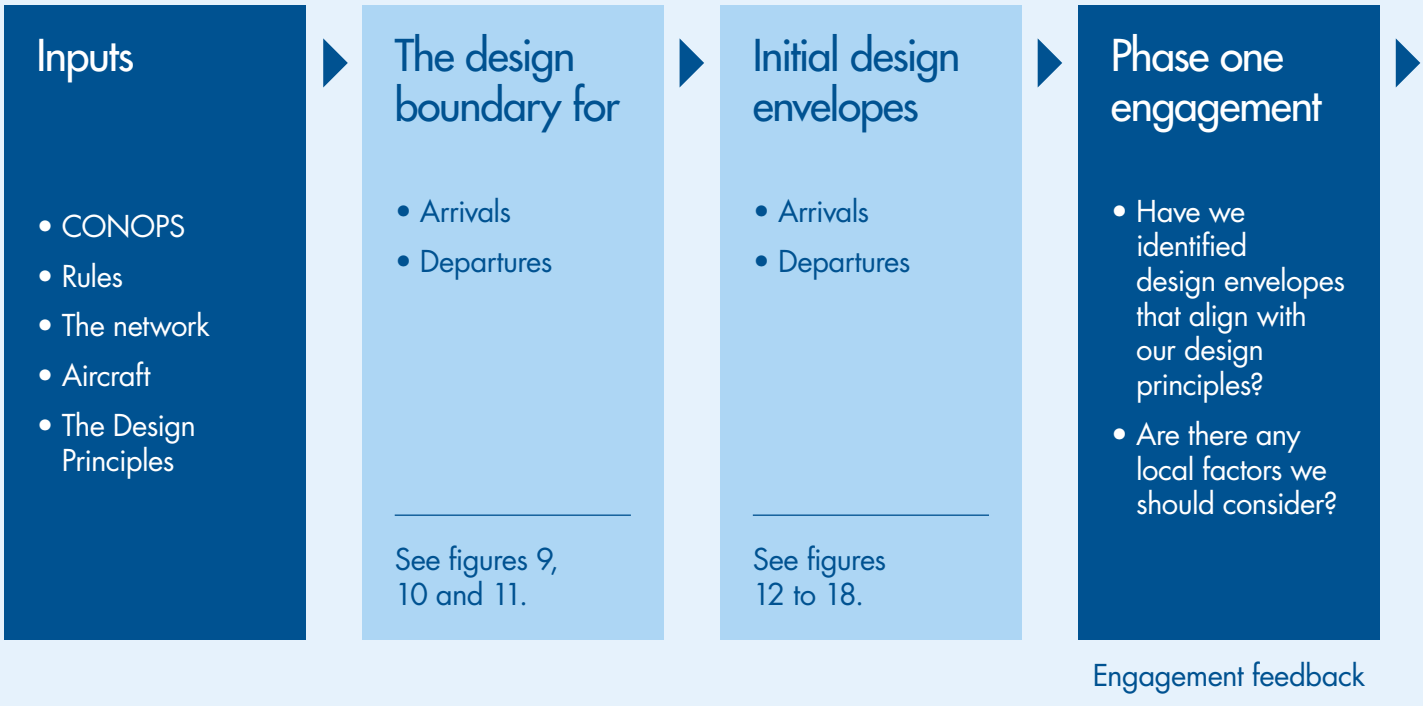
6. Introduction

6.1
CAP1616 Step 2A requires the development of a comprehensive list of design options that address the SoN and that align with the design principles. The DOR is MAN's response to that requirement and sets out the process followed to arrive at a comprehensive list of design options for evaluation against the design principles, as illustrated in the flowchart below.

6.2
This process allowed us to refine the identified design options and ensured that the design 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 arrival and departure design options.

6.3
The initial stage of the design process considered the current operations at MAN, 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), then the design envelopes were developed within that boundary. The design envelopes formed the broad areas where it would be possible to draw design options for departures and arrivals.

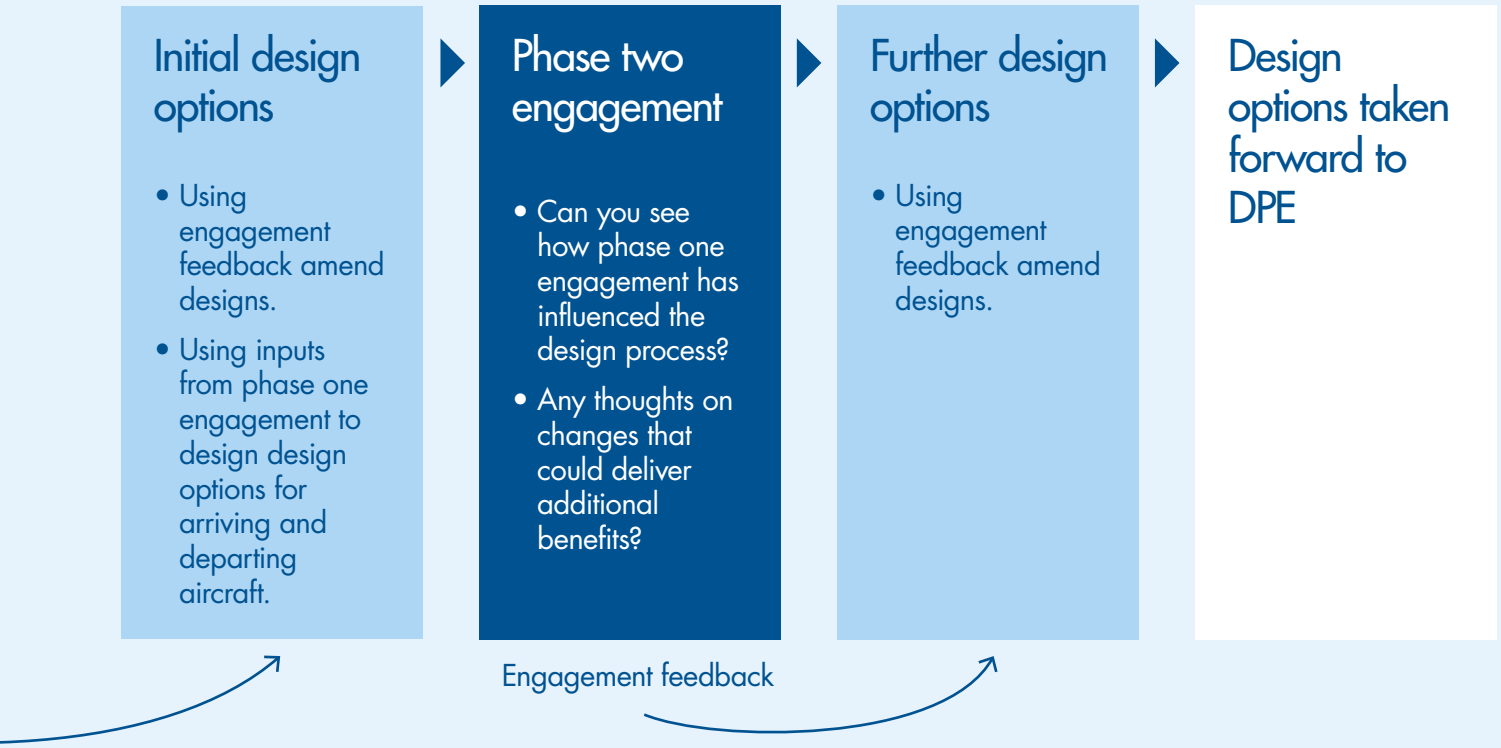
Figure 4: Design option process



6.4
A second phase of design work was then undertaken to create specific design options within each of the design envelopes, as amended following the feedback from stakeholders, with an initial assessment of viability applied to ensure that only those design options that could align with the design principles were taken forward to the DPE.

6.5
The design options were tested with stakeholders, including the general public, to gather feedback on the alignment with the design principles and allow a further opportunity for any concerns and suggestions to be raised as part of the ongoing engagement with MAN. To support Stage 2 of the CAP1616 process, we undertook two distinct phases of stakeholder engagement, testing first the initial design envelopes and then the design options developed within those envelopes. The feedback we received was an important part of the process.

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 the Summary Document Appendix A – Design Option Evolution.



7. Statement of Need

7.1

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

- removal of the reliance on ground-based DVOR 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;
- enabling MAN to continue to grow to make best use of its available runway capacity, while balancing the needs of communities and the environment; 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 considered in the development of the design envelopes and design options.

8. Baseline

8.1

Before developing the design options, the existing departure and arrival operations at MAN were considered and this provided a baseline against which to compare the comprehensive list of design options required by CAP1616.

Aircraft arrivals/departures in 2020 and 2021 have been distorted by the pandemic with a greatly reduced number of movements, no dual runway operations (the two runways were not used together from March 2020 until April 2022) and a distorted mix of short/long-haul operations/destinations. The calendar year and summer of 2019 represent the last experience of 'normal' operations and have therefore been used as the most appropriate baseline.

The existing operations at MAN are described below.

Departures

8.2

Figure 5 shows the distribution of departing aircraft from Runways 23R and 23L over a typical summer's day. There are eight (four from Runway 23R and four from Runway 23L) Preferred Noise Routes (PNRs) which encompass the 14 Standard Instrument Departures (SIDs) from Runways 23R and 23L. A SID is a pre-determined flightpath that aircraft follow when departing and the PNR marks lines of tolerance around the SID within which the aircraft is expected to fly, see the Glossary for further detail. 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 05L over a typical summer's day. There are three PNRs encompassing the five SIDs from Runway 05L. Departures from Runway 05R are rare, representing just 0.05% of all 2019 departures, and there were none on the day depicted.

Figure 5: Typical summer's day departures from Runways 23R and 23L, in 2019 (westerly departures)

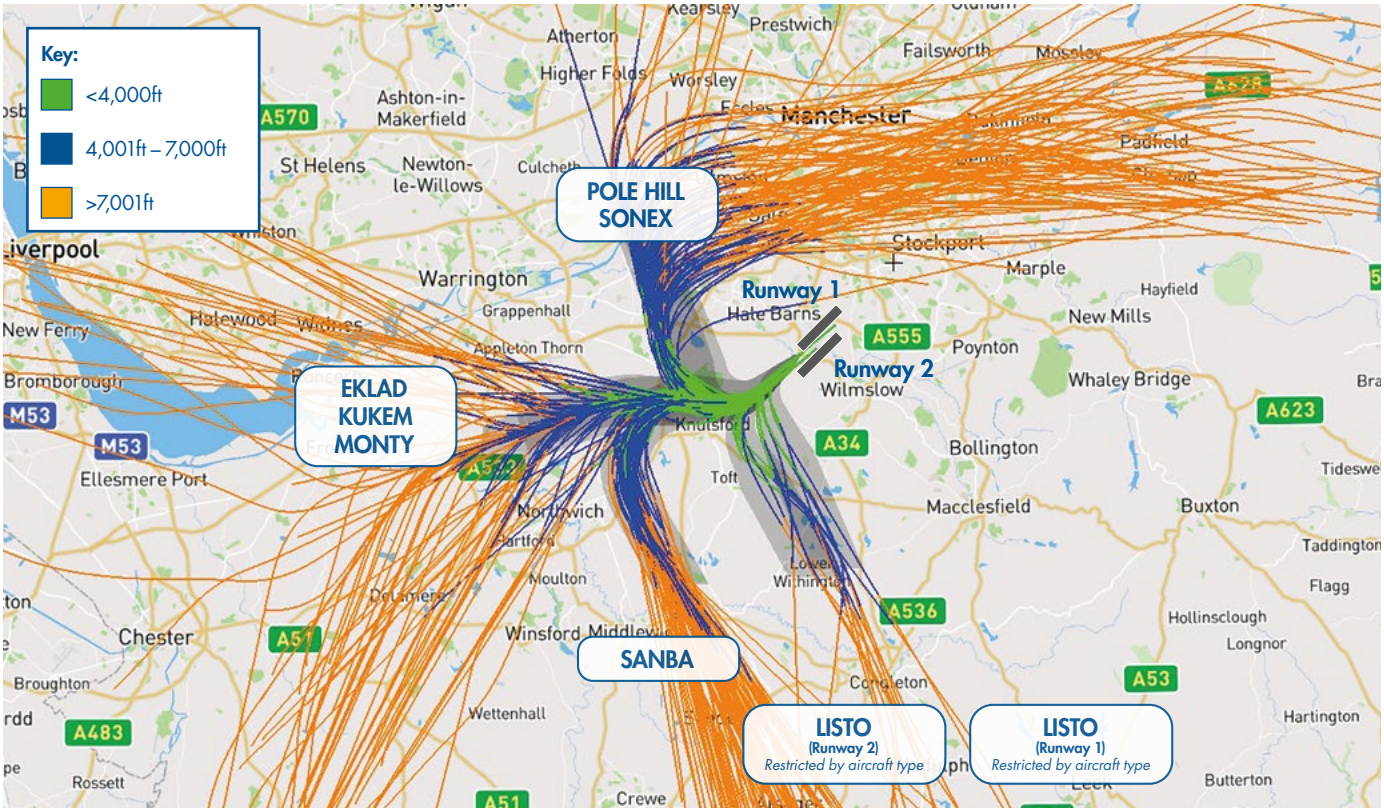
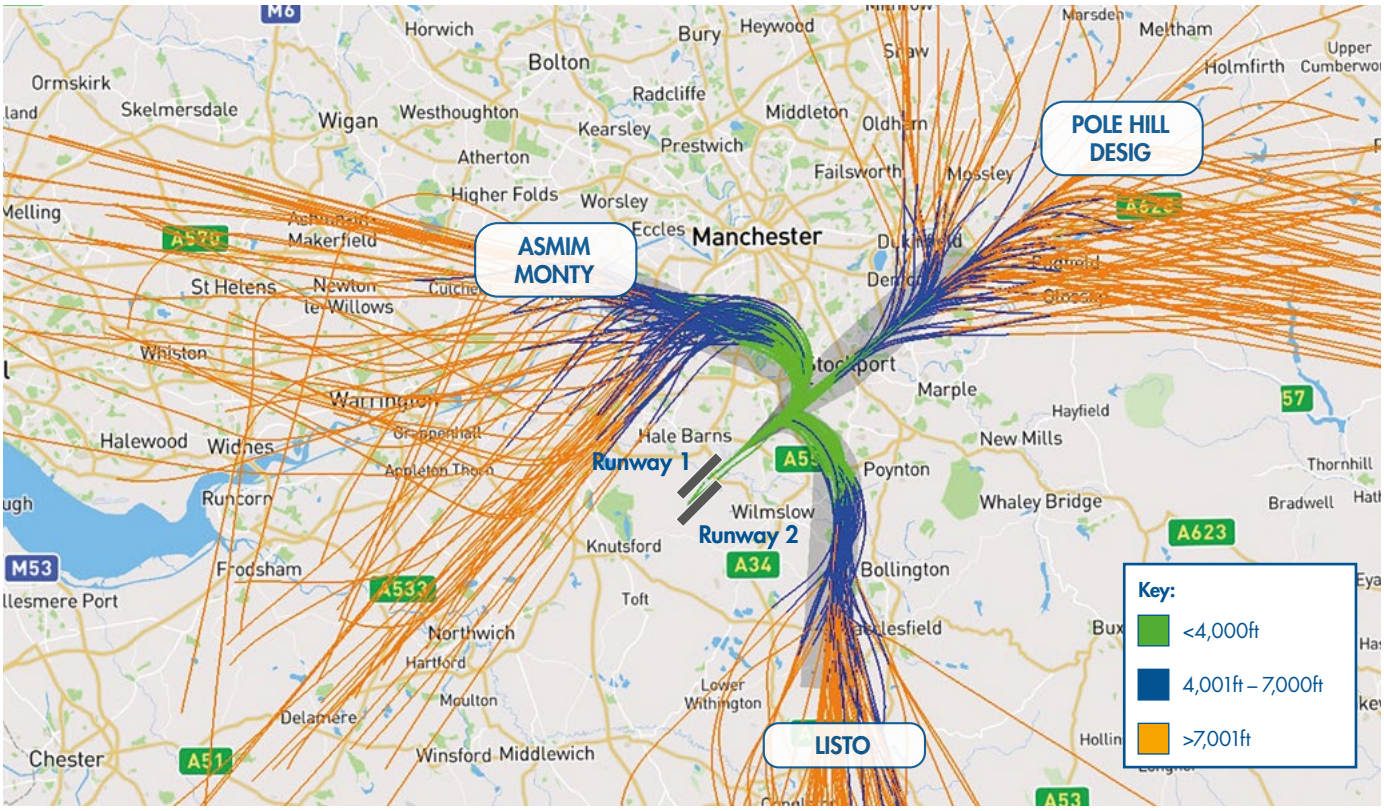


Figure 6: Typical summer's day departures from Runway 05L, in 2019 (easterly departures)



Arrivals

8.4

There are no fixed flightpaths for arriving aircraft until they are established on the Instrument Landing System (ILS), or 'final approach' at an altitude 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 23R over a typical 2019 westerly summer's day. Figure 8 shows the distribution of aircraft as they arrive to Runways 05L and 05R over a typical 2019 easterly summer's day.

8.5

Arriving aircraft approach UK airspace from several entry points before routing towards MAN's airspace. Air Traffic Control (ATC) sequence aircraft to ensure they remain safely separated controlling the speed, direction, and height of the aircraft prior to them being turned on to the ILS. When MAN is busy, arriving aircraft may be held by ATC in a 'holding stack' before being instructed to make their final approach. The three holding stacks serving MAN are DAYNE, MIRSI and ROSUN and are shown on Figures 7 and 8 overleaf.

Fleet Equipage Survey

8.6

In addition to the review of the current departures and arrivals at MAN, a Fleet Equipage Survey was carried out to assess the capabilities of the current and projected (to 2028) aircraft fleets operating. 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 the design process included design options that would be flyable by all aircraft operating out of the airport.

Figure 7: Typical summer's day arrivals onto Runway 23R, in 2019 (westerly arrivals)

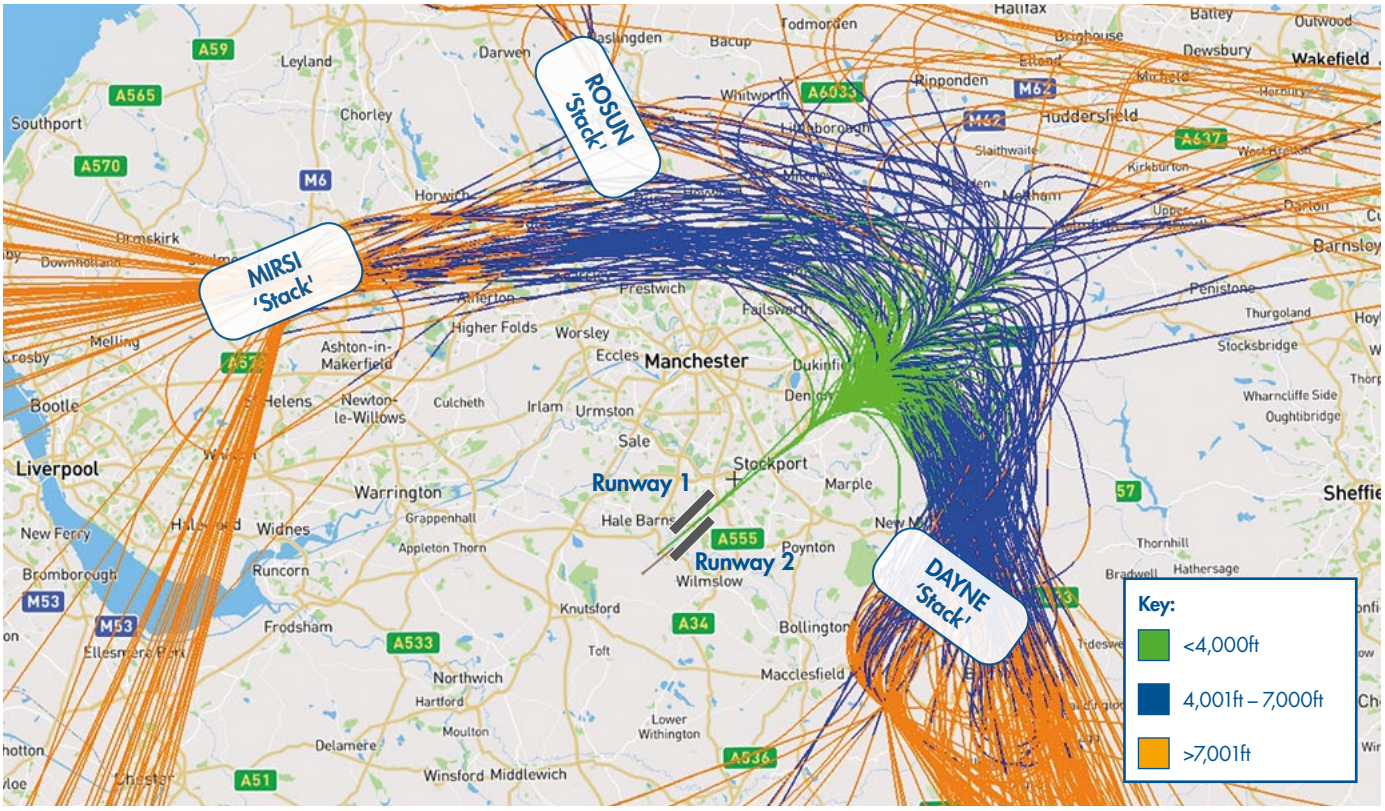


Figure 8: Typical summer's day arrivals onto Runways 05L and 05R, in 2019 (easterly arrivals)

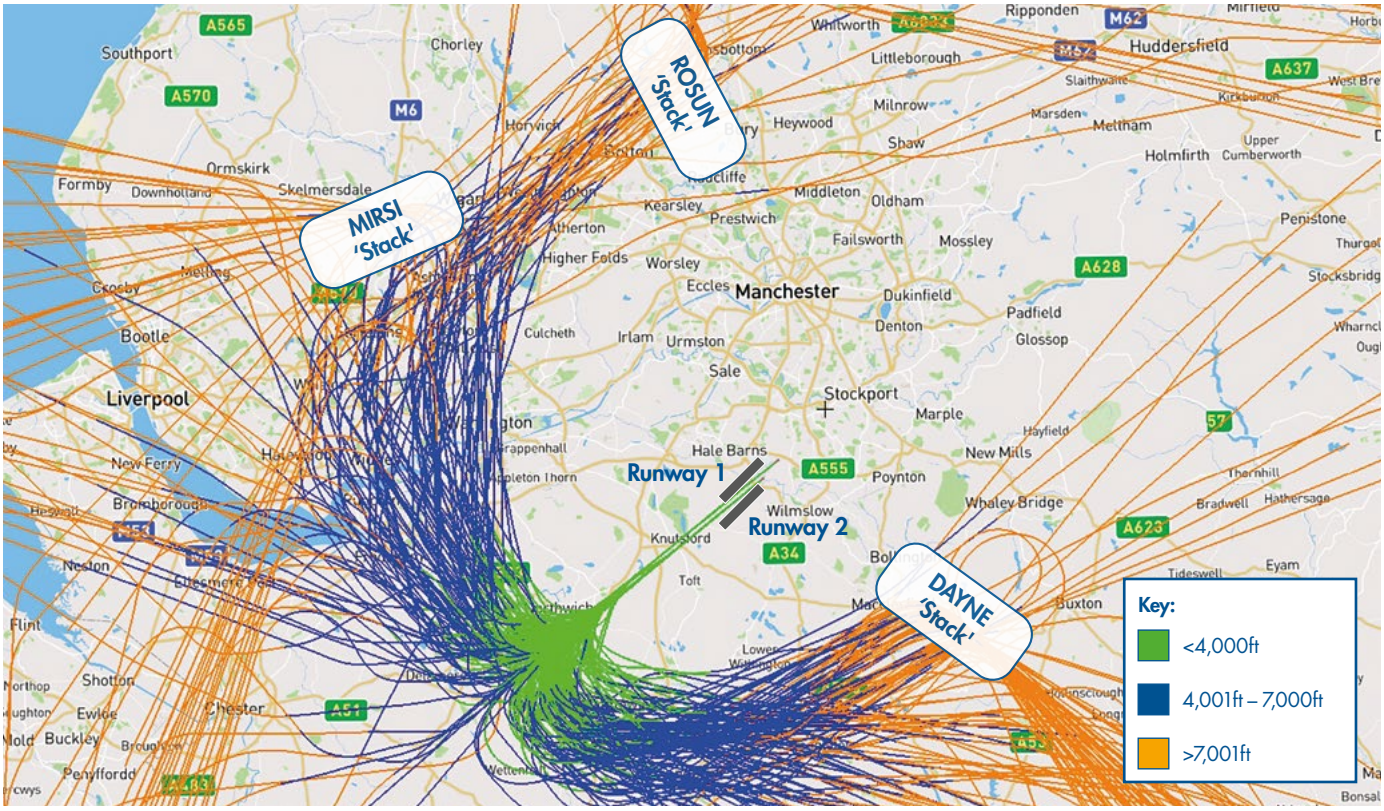
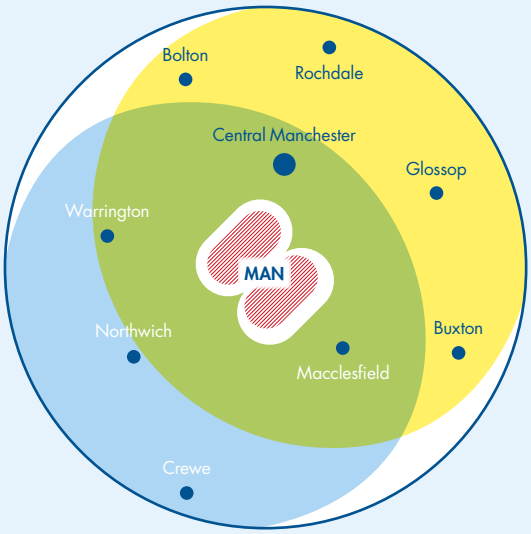


Figure 9: Viable design boundaries for continuous climb departures

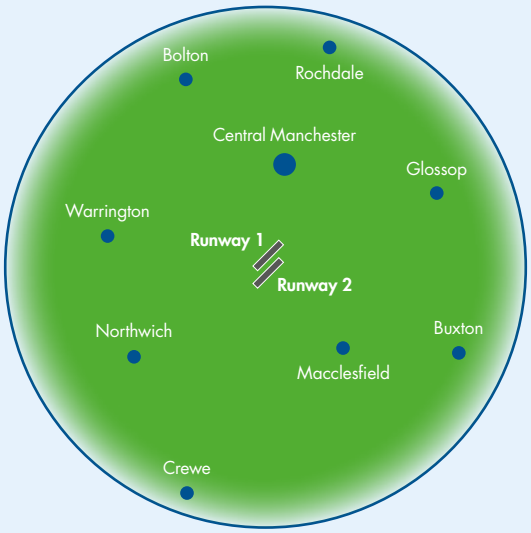


Area where departure routes can't be designed

Area where 23R and 23L departures routes can be designed to 7,000ft

Area where 05L and 05R departures routes can be designed to 7,000ft

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 a departures design boundary, the ICAO PANS-OPS rules and regulations were applied, together with information from the Fleet Equipage Survey, to understand the capability of aircraft operating at the airport. A gradient of climb of 6% was chosen, as this is achievable by all aircraft. The ICAO PANS-OPS rules then provided the maximum boundary based on this gradient, assuming a constant climb, as well as the area within which it would not be possible to draw design options. These areas are indicatively illustrated in Figure 9, overleaf.

Arrivals

9.2

The arrivals design boundary was established by reference to the distance from MAN 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 aligning with design principles Policy, Emissions and Noise N1. The PANS-OPS recommended range for CDAs is a descent gradient between 3.5° and 1.5°. This also encompasses the optimal descent gradient identified within CAA Low Noise Arrival Metric CAP2302[8] and the capabilities of aircraft using MAN gathered from the Fleet Equipage Survey.

Figure 10, overleaf, indicatively illustrates the area within which it would be possible to draw design options that would allow arriving aircraft to adopt 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 a risk of some aircraft having to 'level out' from this area, which would mean a CDA was not achieved. This is illustrated in Figure 10 by the shading. Design options starting a little closer to the airport are more likely to consistently facilitate a CDA. This is illustrated by the darker shade of green in Figure 10.

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

[8] 'A Low Noise Arrival CAP2302'. A report that makes recommendations to implement low noise arrivals. (www.caa.co.uk/cap2302).

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 MTMA. Where factors were identified, they were categorised as either a constraint or a consideration:

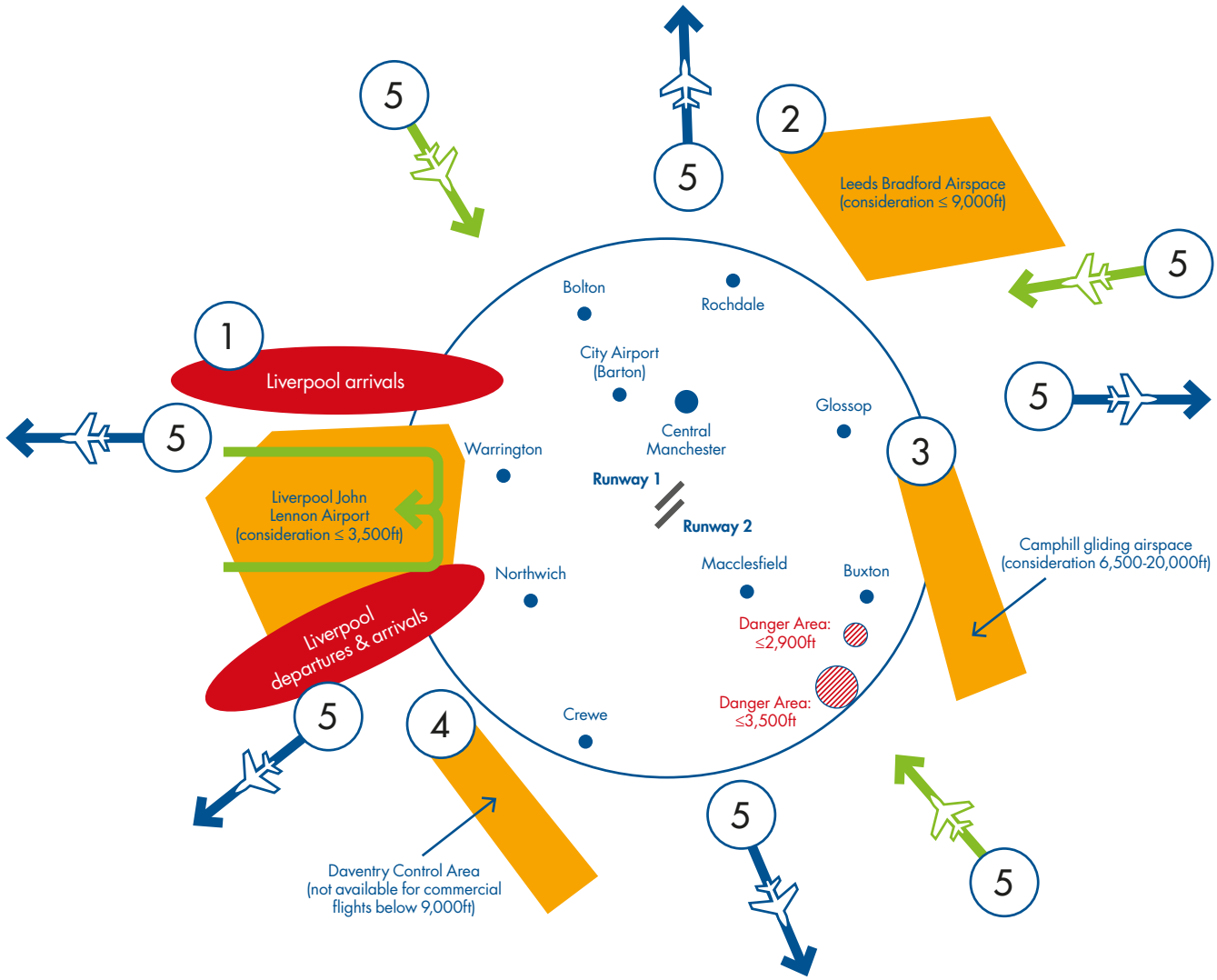
- Constraints were defined as aspects that have a direct impact on designs or would limit the placement of arrival and departure design options.
- Considerations were defined as aspects that do not limit designs, but which needed to be taken into account when drawing design options.

10.2

The full list of constraints and considerations identified is set out in section 5 of the DOR and summarised below and in Figure 11, overleaf:

- The major constraint identified was the proximity of other airports and aircraft operations.
- Two danger areas were identified as considerations – however, the vertical ceiling of the restrictions posed no significant limitation on the planning process because both arriving or departing aircraft would pass some distance above these ceilings.
- A further important consideration was that all design options developed need to be aligned to the traffic flows within the NATS upper airspace network (shown by the blue and green arrows in Figure 11).

Figure 11: Constraints and considerations mapping



Key:

1. Liverpool Traffic Area
2. Leeds airspace to the north-east
3. Camphill gliding airspace (6,500ft – 20,000ft)
4. Area to the south-west (Not available for commercial flight below 9,000ft)
5. NATS en-route traffic orientation scheme

Colour coding:

- Airspace constraints
- Airspace considerations
- Danger areas

NATS Upper Airspace Network – traffic Flows:

- Outbound
- Inbound

11. Design envelopes

11.1

The design boundary and the relevant constraints and considerations enabled the development of design envelopes. These are broad swathes of airspace within which it would be possible to place routes that correspond with the direction of the NATS network flows for outbound and inbound aircraft as labelled '5' in figure 11 on the previous page.

11.2

For departures, design envelopes were constructed to start at the runway and finish at 7,000ft. They were designed whilst considering the SoN, the design principles, the constraints, and the information contained in the Fleet Equipage Survey, which informed a range of technical considerations such as the navigation standard applied, and the climb gradient used.

11.3

The design envelopes were constructed to create sufficient width to provide the flexibility to draw design options that respond to different elements of the design principles, ensuring that a comprehensive list of options could be developed.

Most of the design envelopes were based on the current routes (SIDs) but additional design envelopes were created to provide for a comprehensive list of options and to address Design Principle Noise N2, which seeks respite options to share noise. The additional design envelopes would allow the sharing of noise between routes, potentially providing the opportunity to create predictable noise respite.

11.4
For arrivals, a similar approach was used, considering the SoN, the design principles, the constraints, and the information contained in the Fleet Equipage Survey.

The starting point was to use the position of the existing conventional approach procedures from the DAYNE, MIRSI and ROSUN holding stacks, to provide for the 'do minimum' options, which would reflect the minimum level of change.

Using these positions, an arrivals design envelope was constructed to encompass the area where a CDA to at least one runway end was possible. In addition to the use of the existing holding stacks as a start point, alternative areas where the 7,000ft starting point could be located were considered, as shown in Figures 15 to 18.

11.5
Full details of the approach taken to the development of the design envelopes are set out in sections 6 and 19 of the DOR.

Departures

11.6
By applying the above process, 11 departure design envelopes were defined. Figure 12 shows the design envelopes from Runways 23R and 23L (westerly operations) and Figure 13 from Runways 05L and 05R (easterly operations).

Figure 12: Initial design envelopes Runway 23R and 23L departures

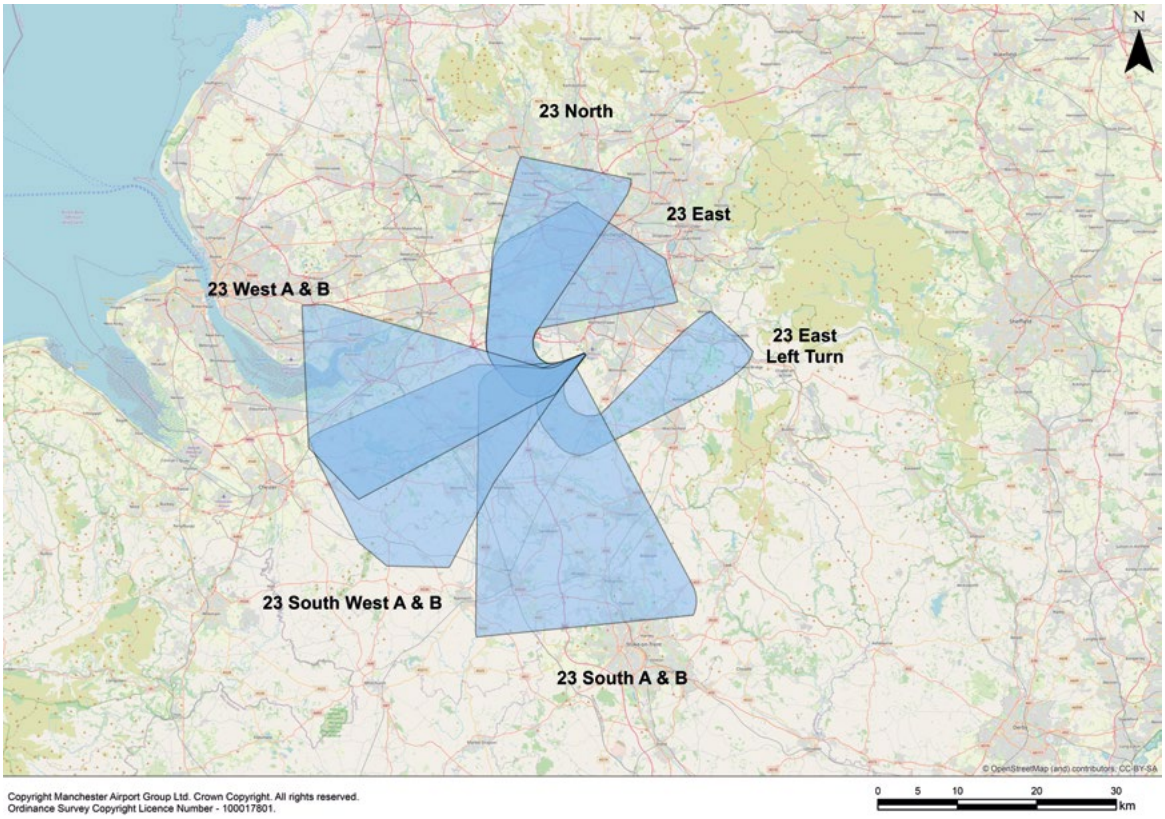
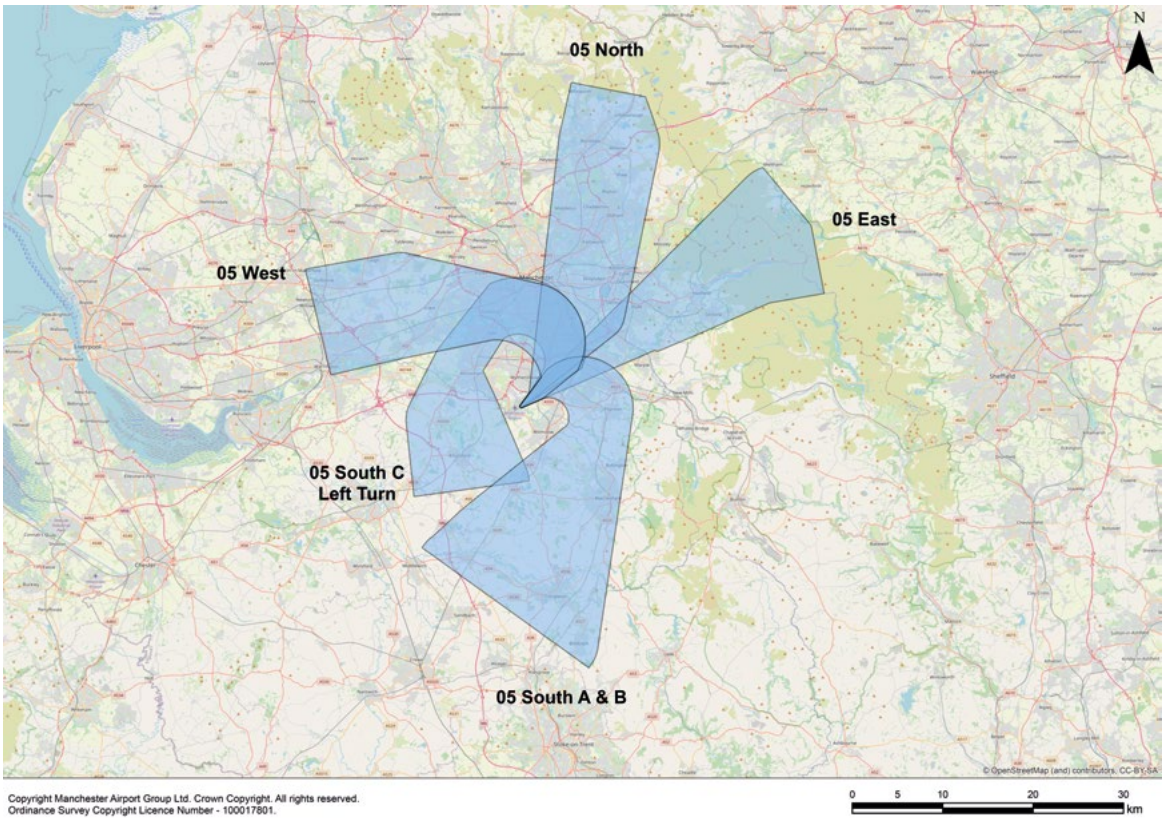


Figure 13: Initial design envelope for Runways 05L and 05R departures



Arrivals

11.7

As outlined in 11.4 the arrivals design envelopes emanated from the existing holding areas DAYNE, MIRSI and ROSUN, as well as including the potential for these areas to be relocated as part of NATS' redesign of airspace above 7,000ft. The arrivals design envelopes were constructed from an area where a CDA was possible. This resulted in four envelopes where a 7,000ft starting point could be located, including designs for each of the three existing hold areas.

11.8

The initial arrivals design envelopes are shown in Figures 14 to 17.

Figure 14: Arrival envelope north approach envelope to Runway 23R

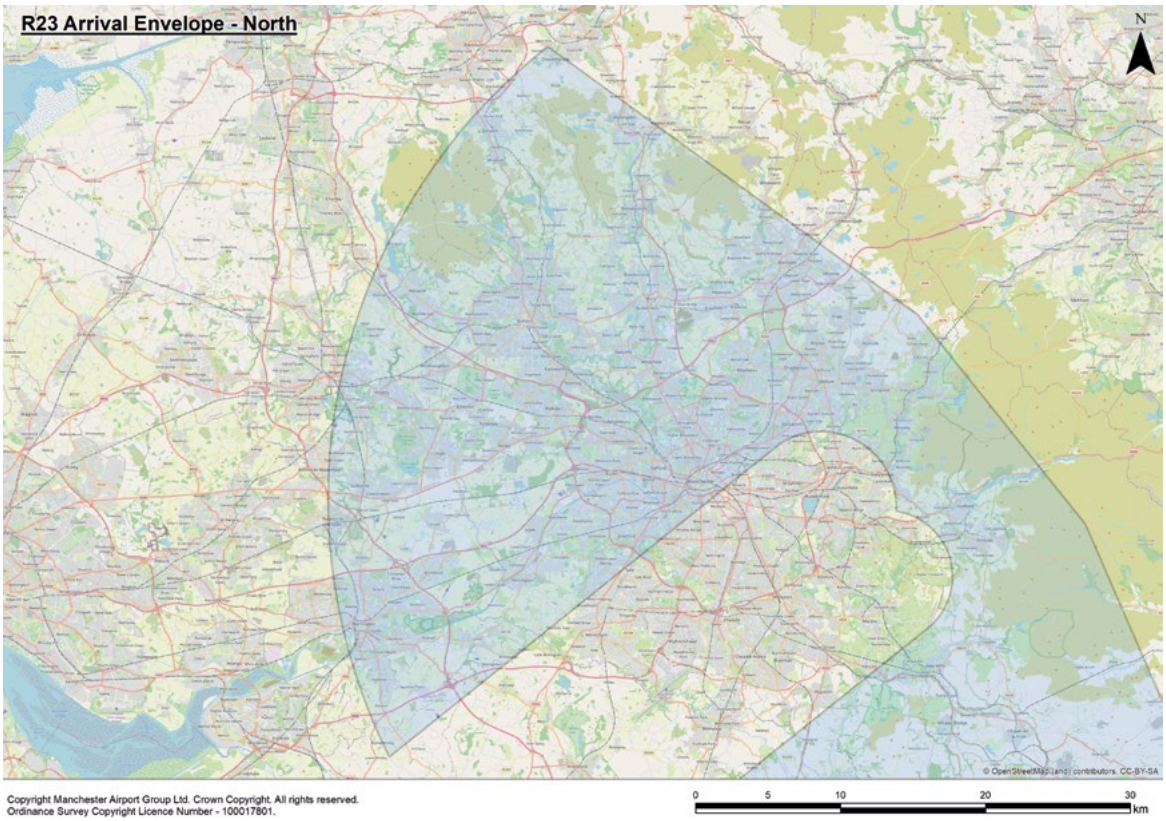


Figure 15: Arrival envelope south approach envelope to Runway 23R

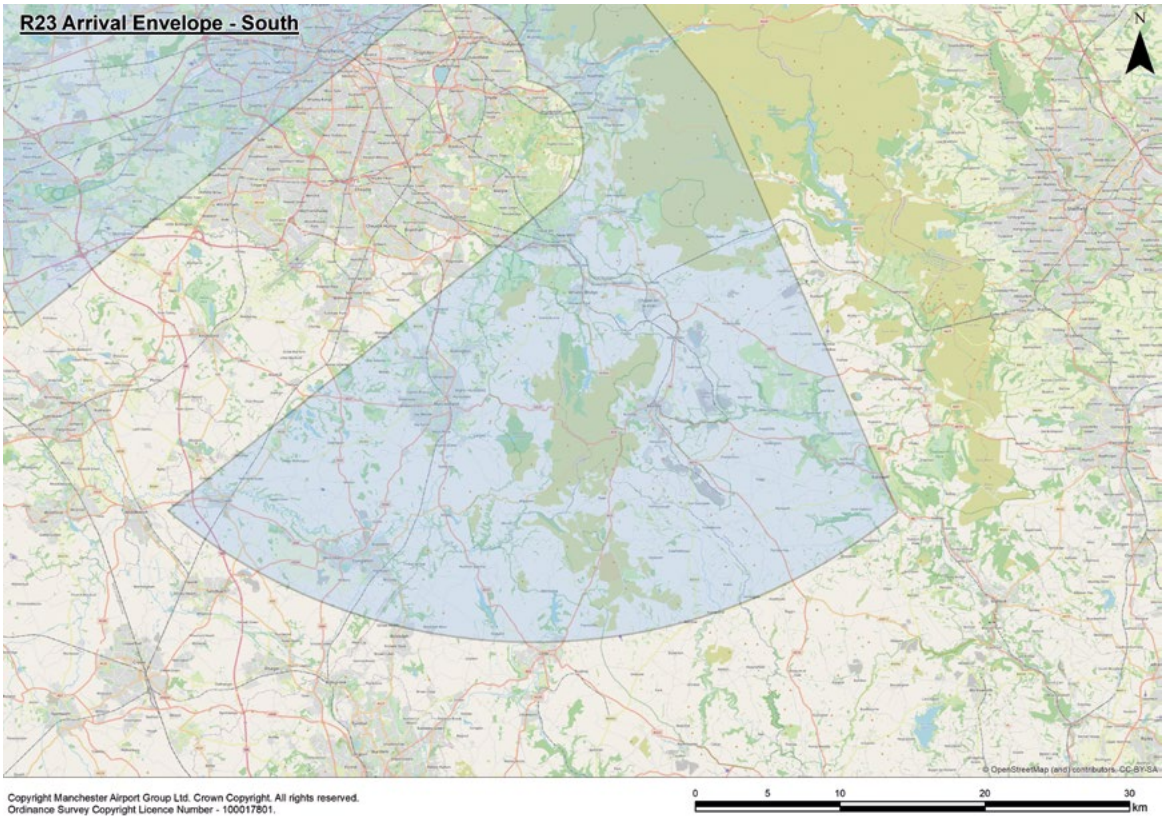


Figure 16: Arrival envelopes north approach envelope to Runways 05L and 05R

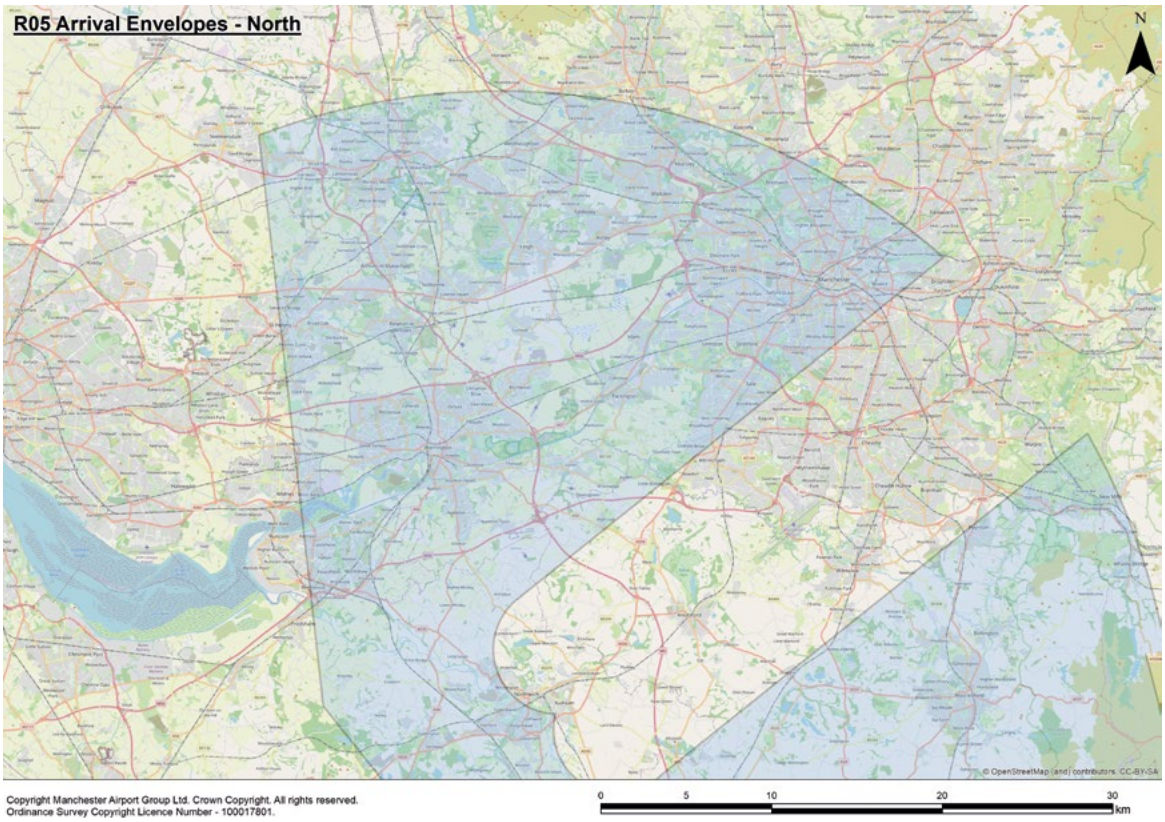
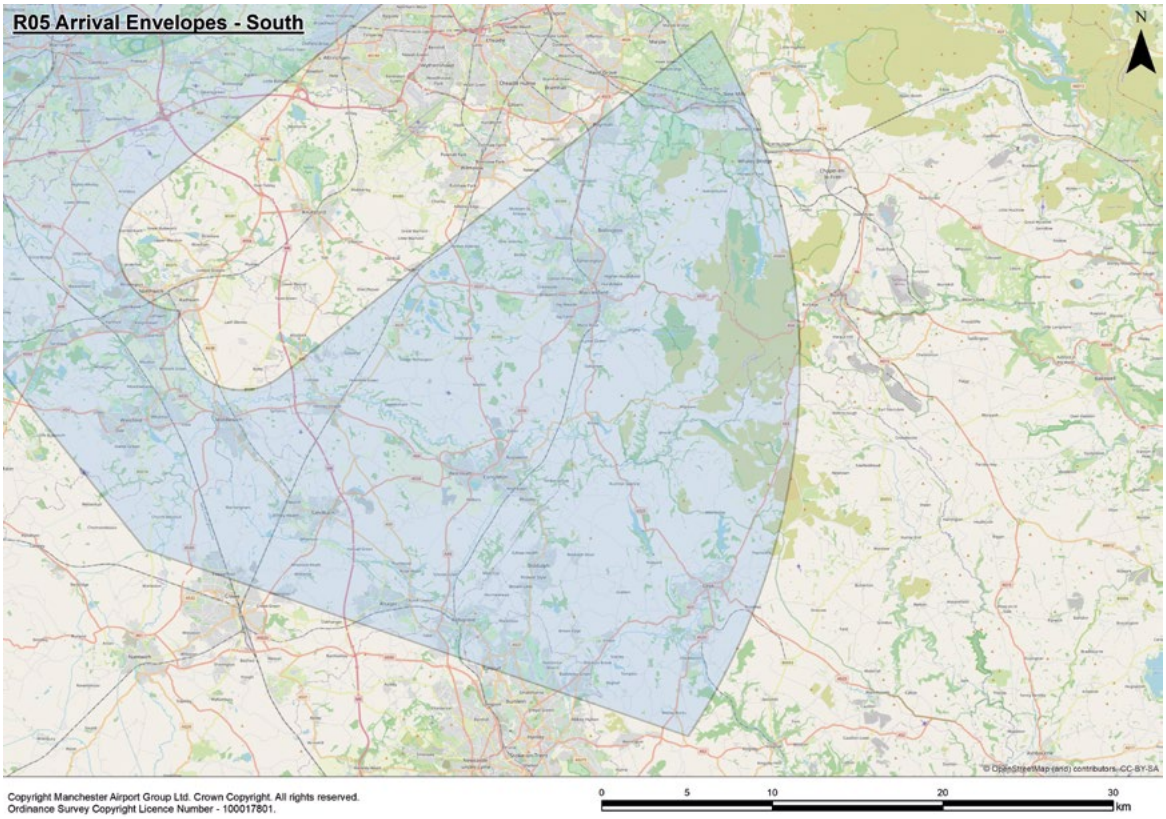


Figure 17: Arrival envelopes south approach envelope to Runways 05L and 05R



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 (see the *'Step 1B Design Principles Report'*[9] for more information). The creation of envelopes, as described, established that there were viable arrival and departure design options that would extend beyond the Potentially Affected Area. Whilst these design 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 the changes is illustrated in Figure 18.

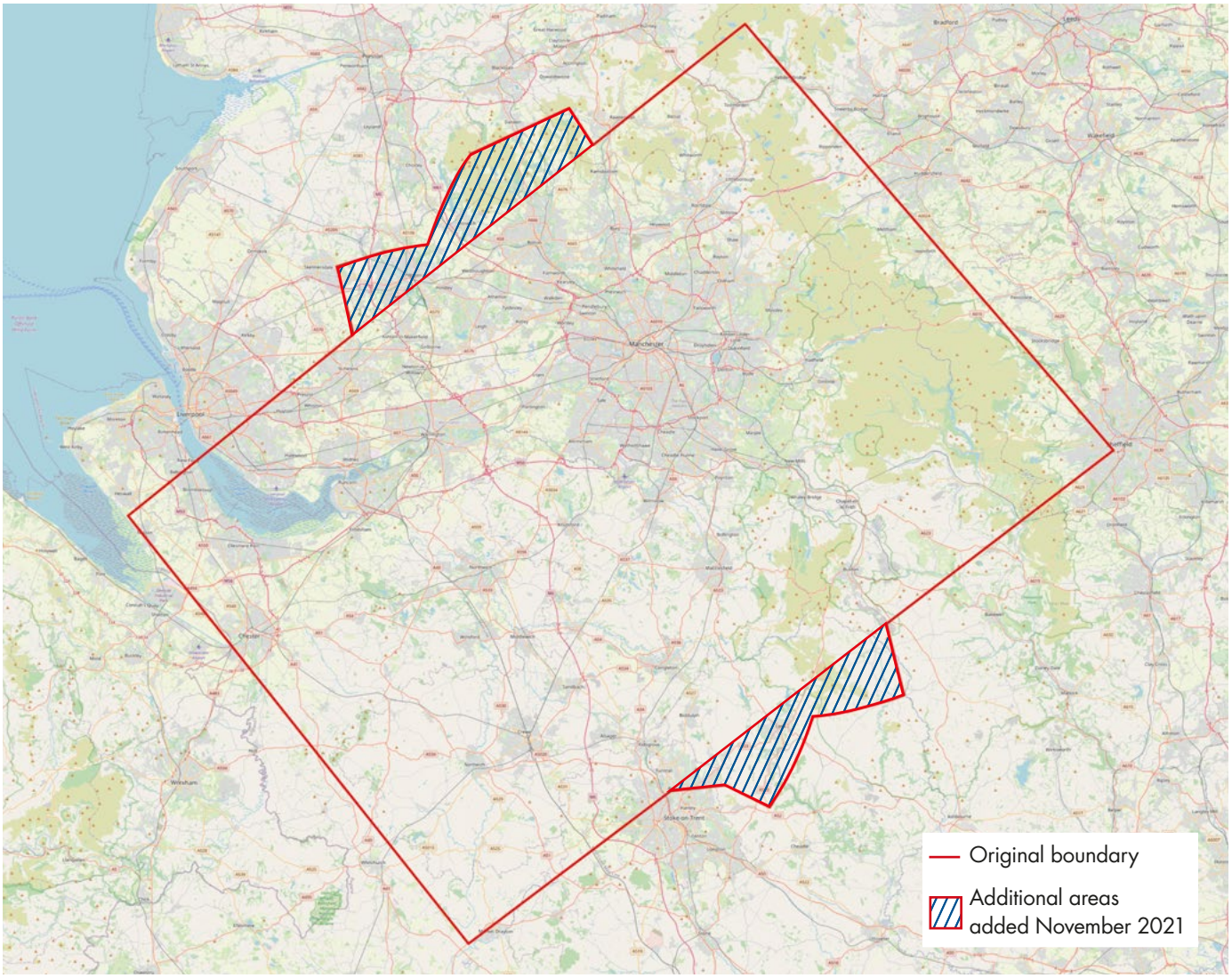
As this change was identified at the start of the phase one engagement, a further process of stakeholder identification, within the Potentially Affected Area, was completed and invitations sent as engagement commenced. A small number of additional stakeholders were identified within the categories set out in CAP1616, including 44 Ward Councillors (from City, Borough and County Councils) and 18 additional Parish/Town Councils. These additional stakeholders were invited to the phase one engagement sessions, with no Ward Councillors and only one Parish/Town Council representative attending. As part of the phase one engagement process these stakeholders were brought up to date with the MAN Future Airspace project and the CAP1616 processes completed so far. This is explained fully in section 3.2 of the SER.

A revised map of the Potentially Affected Area has been uploaded on to the CAA Portal[10], along with the Stage 2 submission.

[9] Report can be accessed through www.manchesterairport.co.uk/futureairspace, airspacechange.caa.co.uk or directly at https://live-webadmin-media.s3.amazonaws.com/media/8300/33494_mag_future_airspace_ mcr_template_v8b.pdf

[10] Accessed from through airspacechange.caa.co.uk page: airspacechange.caa.co.uk/PublicProposalArea?pID=159

Figure 18: Revised area of potential impact

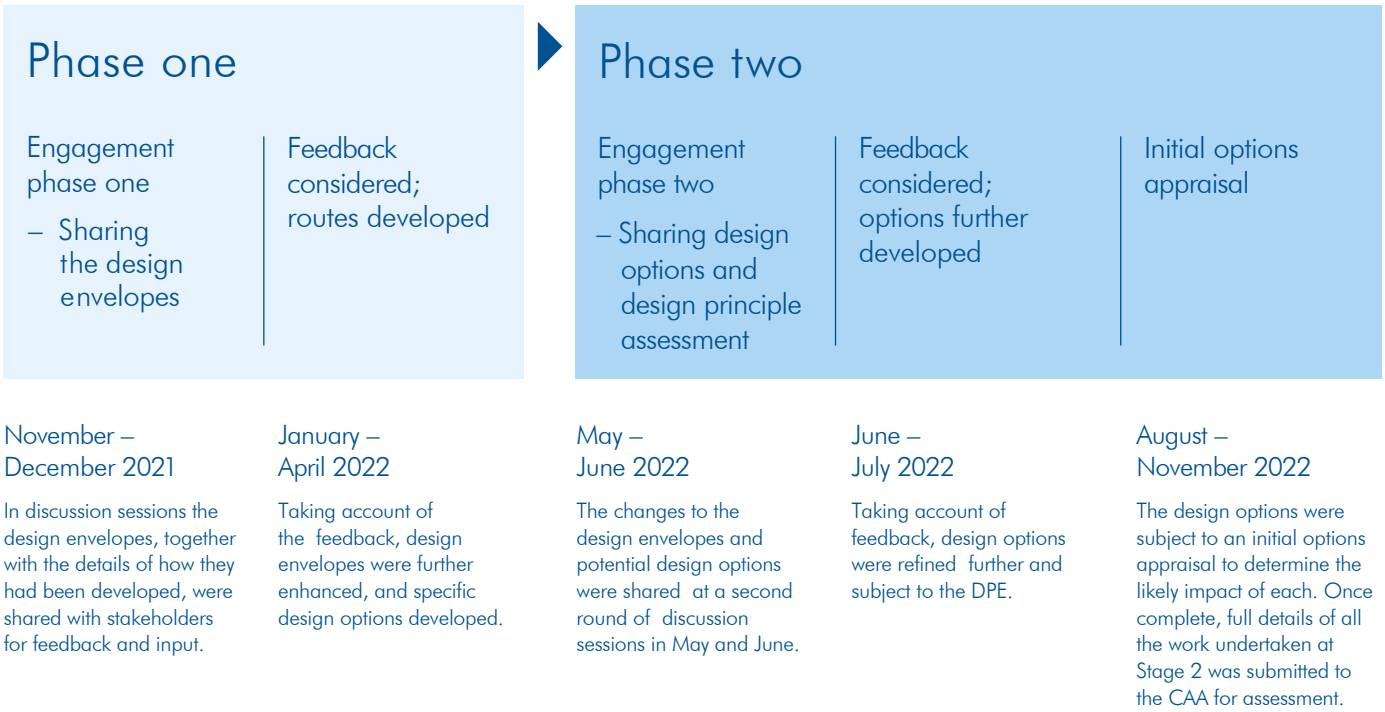


12. Phase one engagement

12.1

Stakeholder engagement to support our Stage 2 'Develop and Assess' submission was split into two phases. This was to allow the design envelopes to be tested with stakeholders and the general public (during the first phase of engagement) before they were refined, and detailed design options could then be developed. The second phase of engagement allowed the specific design options to be tested with stakeholders, including the general public, before being updated to take account of feedback.

Figure 19: Stage 2 engagement process



12.2

The engagement generated a list of actions, considerations, changes, and guidance to assist in the development of design options. We then generated a 'you said, we did' list to provide a transparent guide to the actions we had taken following feedback and reported this as part of the phase two engagement.

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

Departures

13.1

Feedback from the first phase of engagement informed the revision of the design envelopes and the creation of design options. The changes made to the departure design envelopes in response to this feedback and the development process are set out in full in section 4 of the SER and summarised in the table below and maps overleaf.

Summary of changes to the departure design envelopes following phase one engagement
The initial design envelopes included existing routes for Runways 23R/23L South-west that were duplicated as part of the Runway 23R/23L West envelope. In line with the design principles Safety and Capacity, and to make the use of the envelopes clearer the west and south-west envelopes were separated to create two distinct envelopes. As detailed at section 6.2 of the DOR each design envelope is approximately 4.5nm wide, and this process of creating two separate areas resulted in an area between these two envelopes. Figure 20 shows this as the small triangular area marked with a thick black line between Runways 23R/23L South-west and Runway 23R/23L West envelopes. In line with the Design Constraints and Considerations detailed (detailed in section 5.8 of the DOR) this area was not deemed to be a viable area to create design options because of the potential interaction with both the CAS and flights to and from LPL and this was therefore removed from the westerly envelopes. This change resulted in a clear distinction between the two new envelopes and created separation between the design options for traffic heading either south-west or west.
In response to stakeholder feedback concerning the operations of LPL a new departure design envelope was created to remove potential conflicts during easterly operations. This new Runway 05L/05R South-west Design Envelope also enabled the creation of shorter routes to the south-west aligning to the design principles Safety and Emissions.
There have been other minor changes, shown in Figures 21 and 22, in response to stakeholder feedback and aligning to the design principles Safety, Policy, Capacity, Emissions and Noise N1. For more information see section 4 of the SER.

13.2

Figures 20 and 21 show the change to the departure design envelopes summarised in the table above. The blue hatching identifies the expansion of a design envelope and red hatching signifies a reduction of a design envelope. For more information, please see section 4.5 of the SER and sections 6.4.1 and 6.4.2 of the DOR.

Arrivals

13.3

We received no feedback that requested changes to the arrival design envelopes.

Figure 20: Revised departure design envelopes – Runways 23R and 23L

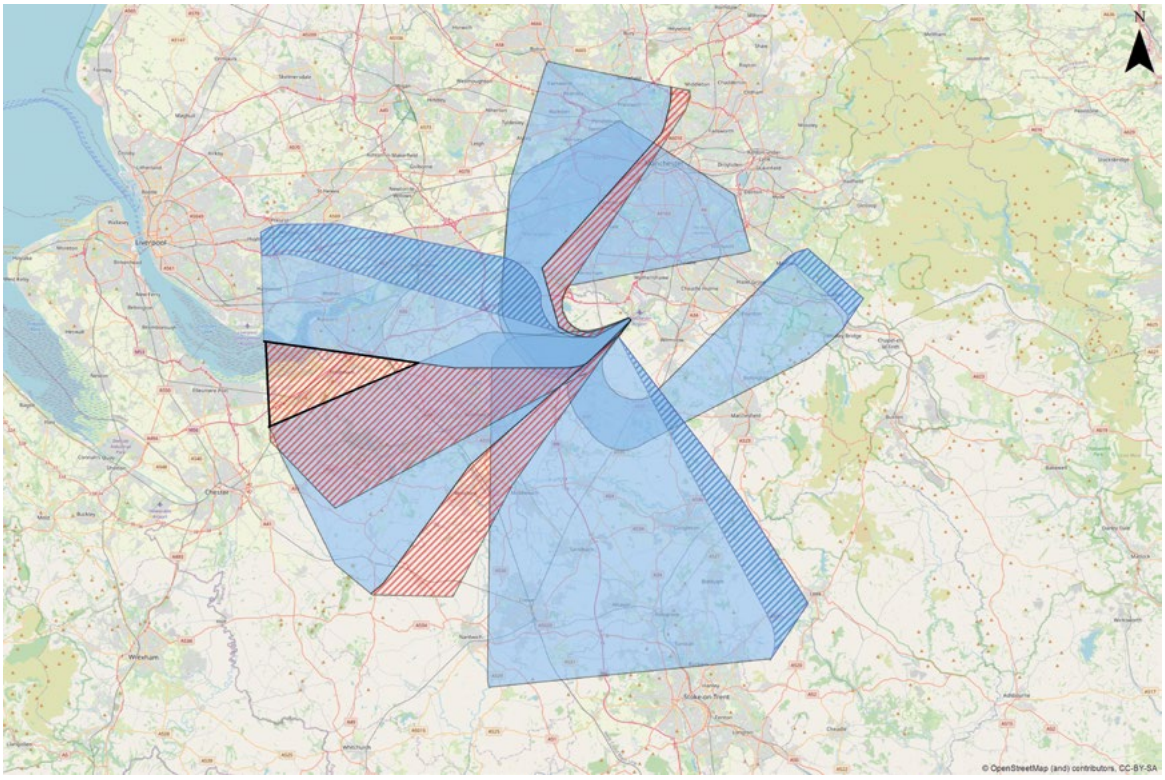
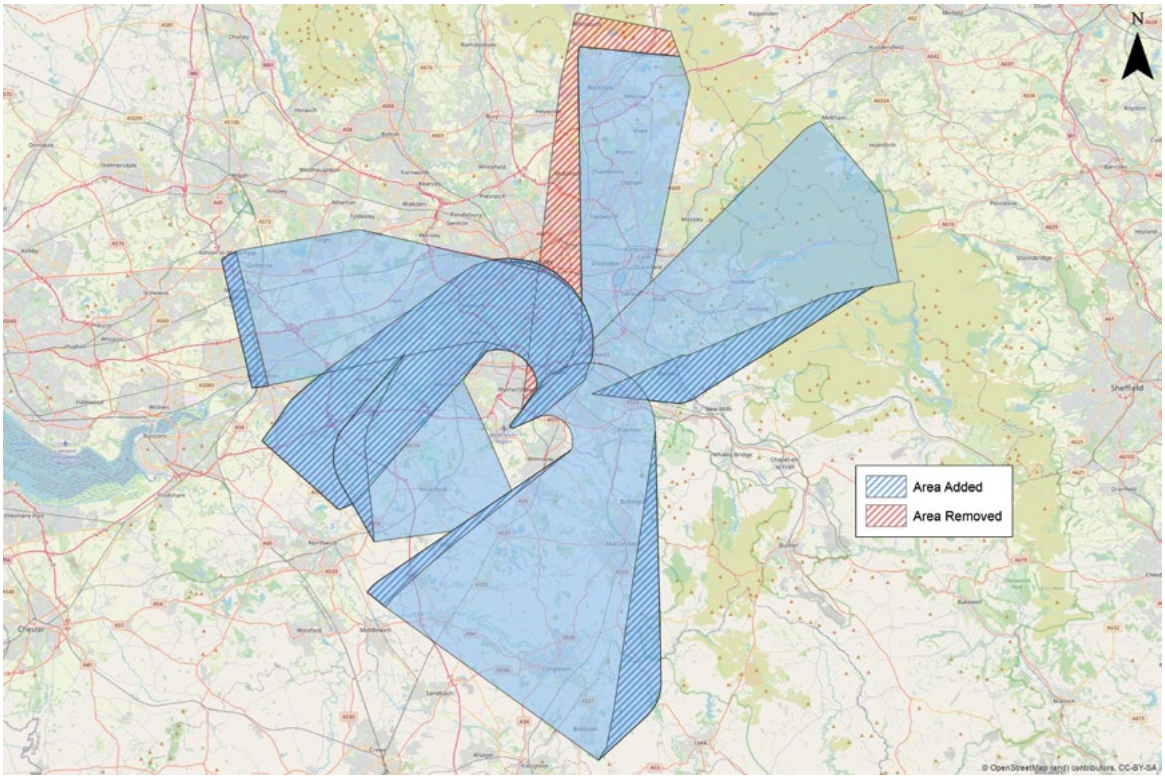


Figure 21: Revised departure design envelopes – Runways 05L and 05R



14. Departures design options

14.1

An initial comprehensive list of design options was created within the revised design envelopes for departing aircraft.

14.2

Where a design envelope contained existing routes (that relied on ground-based DVOR navigation aids) these routes were replicated, as far as practicable, by applying modern Performance Based Navigation (PBN) standards (which rely on satellite guidance rather than ground-based DVOR navigation aids). These provided the basis for a 'do minimum' option for each of the existing routes.

However, if the 'do minimum' option were to be limited to a replication of the current routes, there would be a number of limitations. These would mean that the 'do minimum' option would not represent an 'informed view of the future' or describe the minimum changes required to address both the issues with the 'do nothing' scenario or the issues identified in the SoN.

- The Design Principle Capacity requires us to design airspace that enables the best use of the capacity of our existing runways, in line with Government policy. The current SID designs are not optimised for capacity, and one minute departure separations are not possible between certain combinations of routes, particularly on Runways 23R/23L. The `do minimum' for departures would result in this sub-optimal SID structure being implemented for the future, resulting in this restriction on capacity being continued which is not aligned to this design principle.
- At present, during westerly operations, there are two departure routes that can take traffic to the south, they are the SANBA and the LISTO routes. The initial track of the SANBA route is also used by aircraft using four other routes, specifically the SONEX, EKLAD, MONTY and KUXEM. Having a common track for the first part of the flight means the separation between subsequent departures cannot be reduced to the minimum of one minute and runway flow is affected.
- Because it turns south earlier, the LISTO departure does not interact with other departure routes, and therefore aircraft using this route do not have an impact on runway flow. However, MAN limits the use of LISTO to aircraft of less than 35 tonnes. This long-standing restriction is a voluntary control, it is not required by any planning agreement or other similar condition. The voluntary restriction was always envisaged to apply in the short to medium term, as was communicated to the Consultative Committee's Technical Advisory Group and reported in the Community Relations Annual Report (published) 2003.
- Continuing to apply the current restriction to the use of the LISTO, in the `do minimum' would constrain runway flow and prevent the airport from making best use of its runway capacity, which is both a requirement of the SoN and the foundation behind the Design Principle Capacity.

To address these issues with the 'do minimum' option, such that the 'do minimum' meets the requirements of CAP1616 outlined above, the 'do minimum' option incorporates the removal or relaxation of the restriction that is currently applied to the use of LISTO.

While there are potential issues with the 'do minimum' option from the perspective of alignment with the design principles, as detailed in the DPE, this option replicates today's operation and the existing departure procedures to PBN standards. The 'do minimum' for departures is therefore a feasible option and was designed for further assessment in the DOR, DPE and IOA.

14.3

Having established the 'do minimum' option for each design envelope containing existing routes, further design options were developed within the design envelope 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 and threading through less populated areas to reduce the number of people overflown. Where a design envelope did not contain an existing route, a new set of design options were developed using the same design 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). The key difference between RNAV1 and RNP1 is the requirement for on-board performance monitoring and alerting that is included in the more advanced RNP systems. The Fleet Equipage Survey showed that all aircraft flying into MAN could use RNAV1 and over 90% could utilise the more advanced RNP1. By applying these standards, the use of modern technology can be realised, whilst still providing alternatives so all aircraft using MAN could be accommodated.

14.5

Full details of the initial comprehensive list of departure design options are set out in sections 6 to 18 of the DOR.

14.6

Overleaf, Figures 22 and 23 show the design options from Runways 23R and 23L and Runways 05L and 05R, respectively. The red lines show the 'do minimum' replications of existing routes and the black lines show the design options developed to respond to the design principles.

The Manchester Doppler VHF Omni-directional Range (MCT DVOR). A ground-based radio navigation beacon used by pilots to assist in aircraft navigation.

Figure 22: Stage 2 design options using the Runways 23R and 23L (westerly) departure envelopes

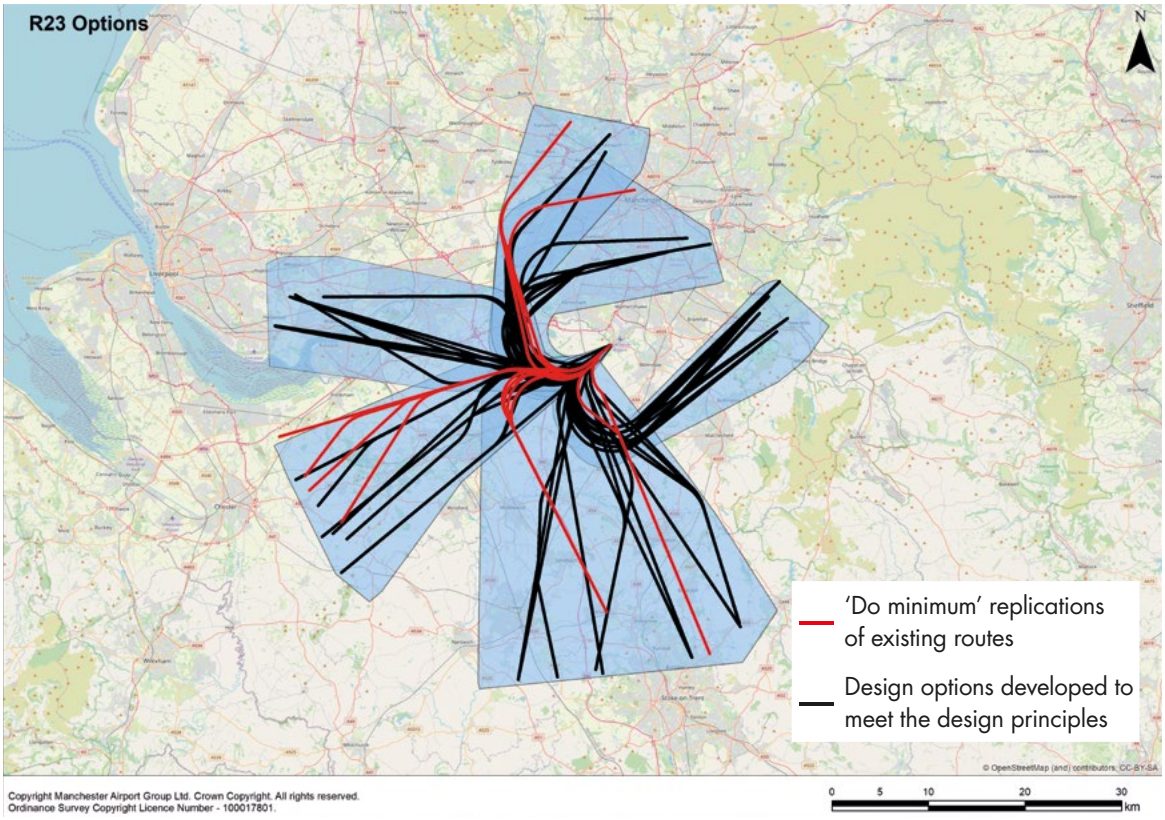
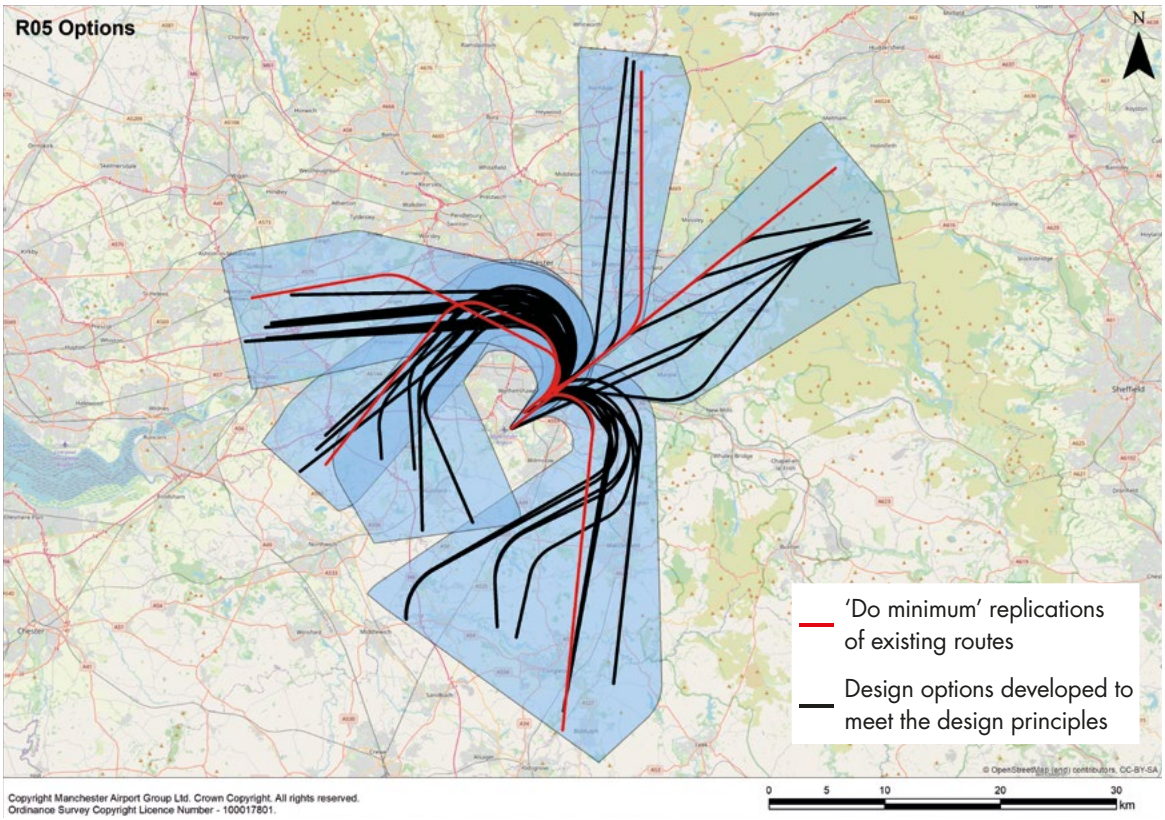


Figure 23: Stage 2 design options using the Runways 05L and 05R (easterly) departure envelopes




virginatlantic
UNITED

15. Arrivals design options

15.1
When the initial design envelopes shown in Figures 14 to 17 were considered together, they covered a wide area where CDA was possible. The CAA's AMS provides objectives on environmental aspects and managing noise, and both this and the DfT Air Navigation Guidance 2017 document, specifically highlight the use of CDA as a means of achieving these objectives. The 'must-have' Design Principle Policy, which states that airspace changes must be consistent with the AMS, reduced arrival design options to those that could achieve a CDA.

15.2
Design options were designed within the design envelopes, commencing at an Initial Approach Fix (IAF) of 7,000ft. All IAFs are within the area of potential impact (Figure 18). Any option unable to provide CDAs for both runway ends was not fully aligned to the Design Principle Policy and could only be classed as 'viable but poor fit', which meant that it was unable to align with all of the three 'must have' design principles of Safety, Policy and Capacity. Full details of the viability filter applied to the design options are set out in section 16 of this Summary and section 5.14 of the DOR.

15.3
As with departures, design options for arrivals were developed to respond to one or more of the design principles. Full details of the process followed for the design of arrivals options and the list of arrivals options are set out in sections 19 to 36 of the DOR.

15.4
All design options for arriving aircraft have to incorporate a period of straight flight onto the runway, where aircraft can ensure they are stable, as they descend gradually towards the runway. The point at which they begin this final approach to the runway is known as the 'joining point'. Figures 24 and 25 overleaf show routes for joining point options between 2,000ft and 3,500ft (or between 6 and 11 miles from touchdown) onto final approach. These distances match the minimum height permitted by PANS-OPS.

For Runways 23R/23L Final Approach Fix (FAF) options have been created to join at 3,500ft and 3,000ft. It would not be possible to create a joining point at either 2,500ft or 2,000ft because the dimensions of the surrounding controlled airspace. 3,000ft is therefore the minimum altitude for joining on Runways 23R/23L.

For Runways 05L/05R FAF options have been created at 3,000ft, 2,500ft and 2,000ft. It would not be possible to create a joining point at 3,500ft for Runways 05L/05R because of the interaction with Liverpool airspace. The maximum joining point altitude is therefore 3,000ft which creates the required separation from Liverpool airspace.

A joining point of 2,000ft is the minimum height possible for this runway direction and was created in response to the consideration of LPL design options described in section 15.5.

15.5
Figure 25 also shows additional design options for a 2,000ft joining point. These additional design options were created in response to the Manchester phase two stakeholder feedback (specifically after consideration of the LPL design options – see section 6 of the SER). This equates to the shortest distance that we elected to design, approximately 6 miles from the runway in line with ICAO guidance.

Figure 24, Stage 2 design options using the Runways 23R and 23L (westerly) arrival envelopes

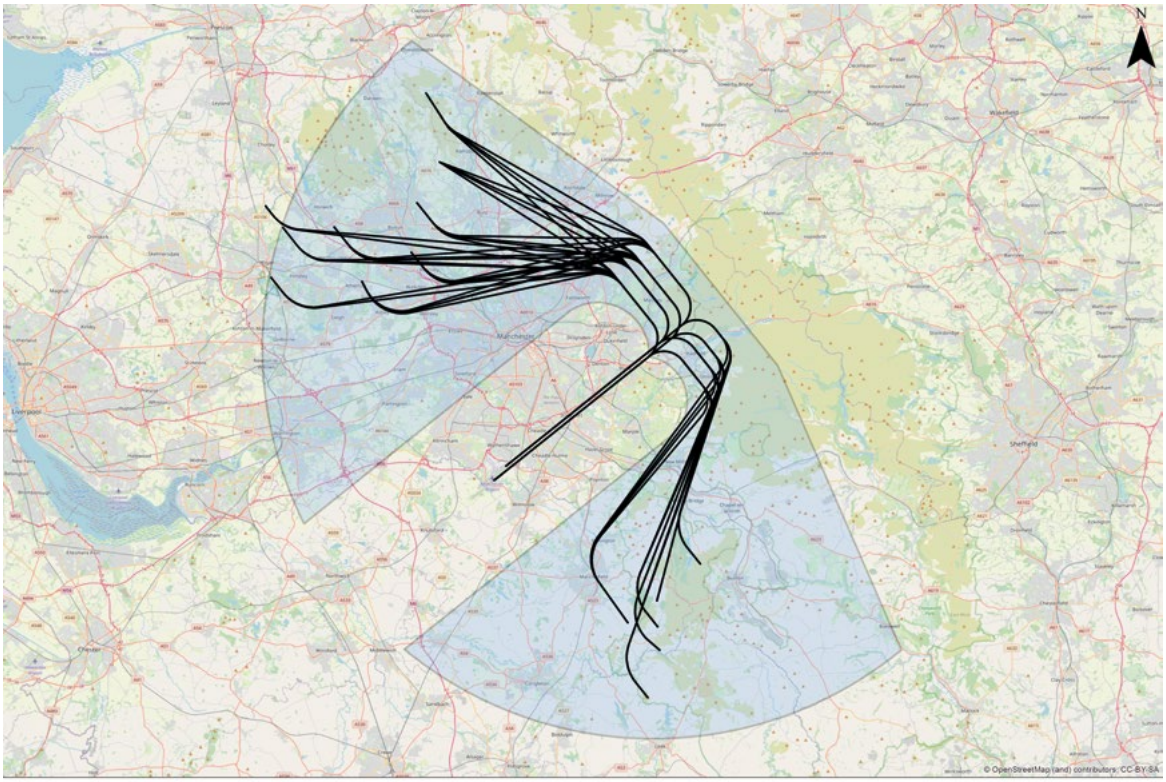
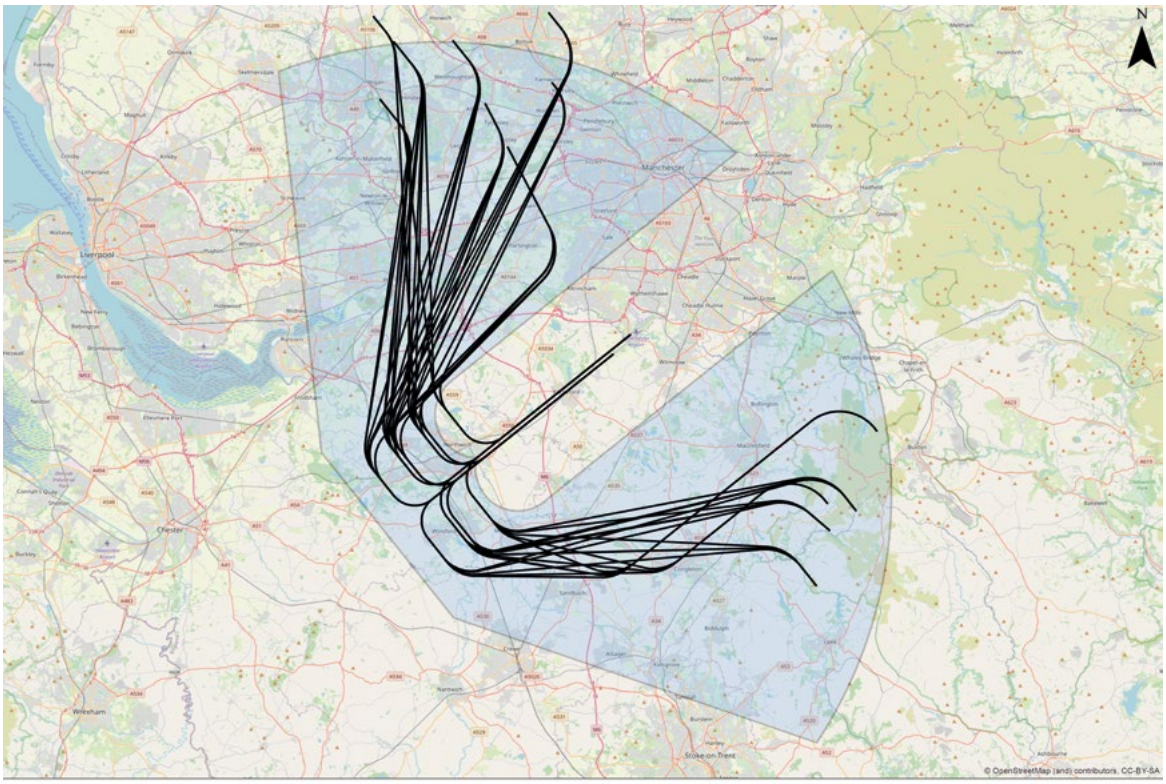


Figure 25, Stage 2 design options using the Runways 05L and 05R (easterly) arrival envelopes



16. Viability classification

16.1

Having established the initial comprehensive list of design options for both departing and arriving aircraft, a viability filter was applied to determine which design options should progress to the DPE. The viability filter relied on the requirement in CAP1616 for the list of design options to address the SoN, align with the design principles and take account of international standards.

16.2

The viability filter resulted in the design options being assigned one of the following classifications, as shown in Figures 26 and 27.

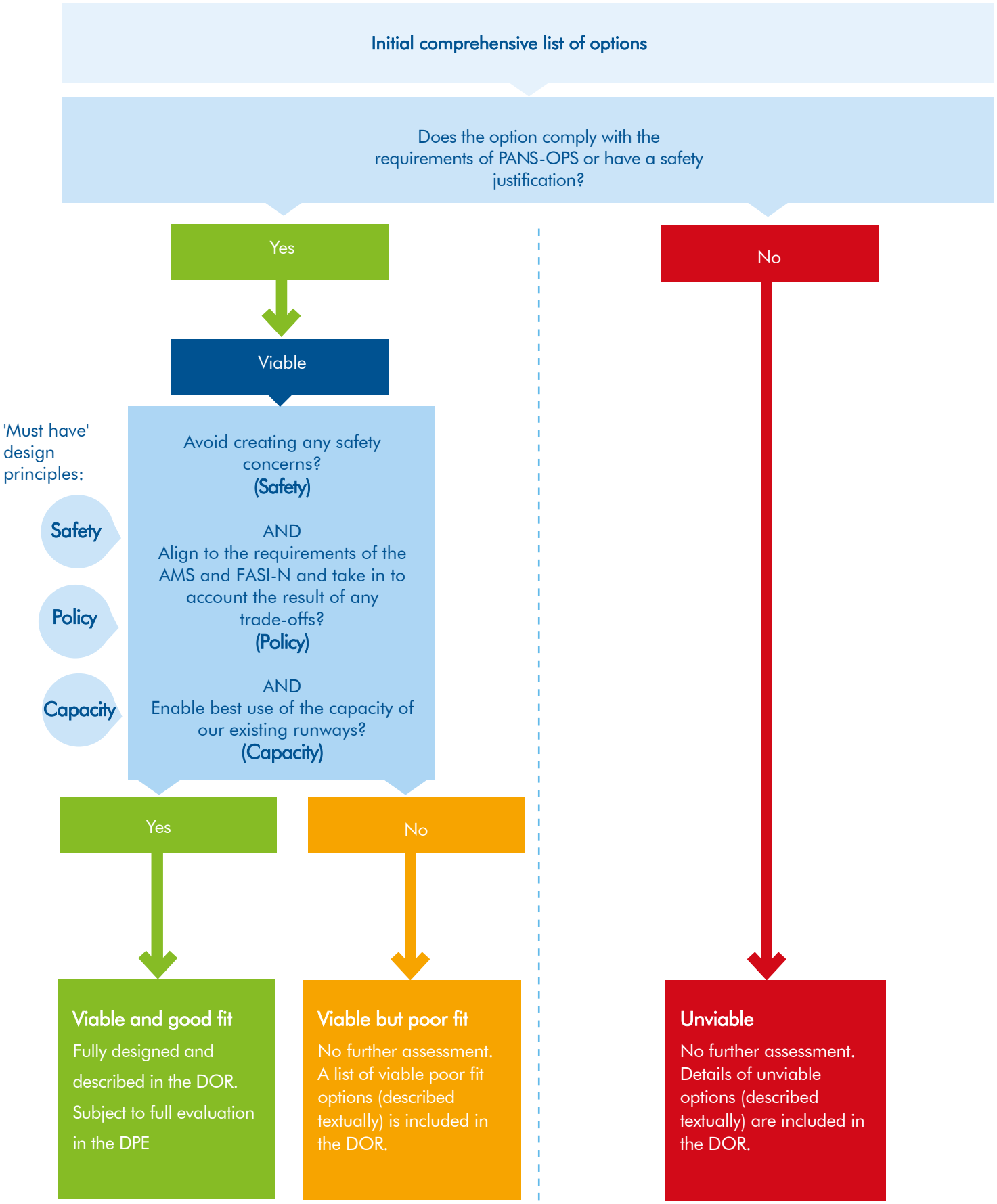
Figure 26: Viability classification

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, Policy and Capacity).	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, Policy and Capacity).	Progressed to full DPE.

16.3

The full details of the viability assessment are set out in section 5 of the DOR, while the list of viable design options progressed to the phase two engagement is provided in the DOR in sections 7 to 19 for departures and 21 to 36 for arrivals.

Figure 27: Generating design options



17. Phase two engagement

17.1

The purpose of the phase two engagement was to update stakeholders, including the general public participants, on the refinement of the design envelopes following phase one engagement and to present the design options that had subsequently been developed. The process to determine whether design options were 'viable and good fit', 'viable but poor fit' or 'unviable' was also explained. The 'viable and good fit' options were then shown on a detailed map base for comments and feedback.

17.2

Full details of the engagement undertaken, the engagement materials, the feedback received from stakeholders and the resulting changes to the design options are set out in section 5 of the SER and the accompanying appendices.

18. Comprehensive list of options

18.1

As a result of the process summarised in sections 12 to 17, a comprehensive list of design options that address the SoN and respond to the design principles was compiled. This list of design options reflected feedback received during both phases of stakeholder engagement and took account of the developing national masterplan for airspace change, including feedback received from other sponsors of airspace change. The list of options progressed to the full DPE is described in sections 7 to 19 and 21 to 36 of the DOR.

Step 2A – Design Principle Evaluation

19. Design Principle Evaluation

19.1
As required by the CAP1616 process, the list of design options arising from the DOR was considered in a DPE. In addition, as outlined in section 16, the design options identified as 'viable but poor fit' were evaluated against the three 'must have' design principles Safety, Policy and Capacity. However, as they did not comply with one or more of the 'must have' design principles, they were not evaluated further. See section 5 of the DOR for further information.

19.2
The purpose of the DPE was to evaluate how well each of the viable design options aligned with the design principles. The process identified which of the design options merited further analysis in Step 2B of the CAP1616 process (the IOA) based on the ability of each design option to meet the requirements of the design principles.

19.3
To ensure consistency in how each design option was evaluated, detailed assessment criteria were devised for each of the design principles. The full criteria for each design principle are set out in section 4 of the DPE.

19.4
Each viable and good fit design option was assessed against the design principles, using the criteria established for each. As part of that assessment, the compliance of each design option with each of the design principles was categorised as follows:

- Fully met
- Partially met
- Not met

As set out in section 3 of the DPE, where the design principles require a comparator (design principles Noise N1, N2, N3 and Emissions), the 'do nothing' option has been considered to be the appropriate baseline for the DPE.

19.5
The full details of the evaluation of each viable design option are presented in section 5 to 29 of the DPE, including an analysis as to whether each design principle is 'fully met', 'partially met' or 'not met' by each design option.

19.6

As some of the design principles, particularly design principles Noise N2 and Emissions, can only be fully considered when individual design options are combined into operating systems, the assessment of these design principles was limited at this stage. However, unless there was clear evidence to suggest a design option would perform poorly, no routes were excluded from being carried forward to Step 2B because of their assessment against these design principles. The routes carried forward for further consideration provided a flexible range of design options that can achieve an integrated network that aligns with the design principles. These routes also provide flexibility to respond to the emerging designs of other airspace change sponsors, as their separate airspace change proposals mature. As detailed in section 24 of this document, further evaluation will be carried out in Stage 3.

19.7

In addition to detailing the evaluation of each design option against the design principles, the DPE also considered the ability of each design option to respond to the technical criteria in CAP1616 Appendix F 'Submission of a formal proposal'. This analysis is set out in sections 5 to 29 of the DPE.

19.8

Of the 208 departure design options identified, the DPE demonstrated that 133 had sufficient merit to be progressed to Step 2B – Initial Options Appraisal. Of the 106 arrival design options identified, 80 were carried forward to Step 2B.

19.9

Full details of the analysis conducted for each design option together with the summary assessment of whether individual design principles are either not met, partially met, or fully met can be found in the DPE. The list of design options progressed to Step 2B is set out in the tables at the end of each design envelope in sections 5 to 29 of the DPE.

Step 2B – Initial Options Appraisal

20. Introduction

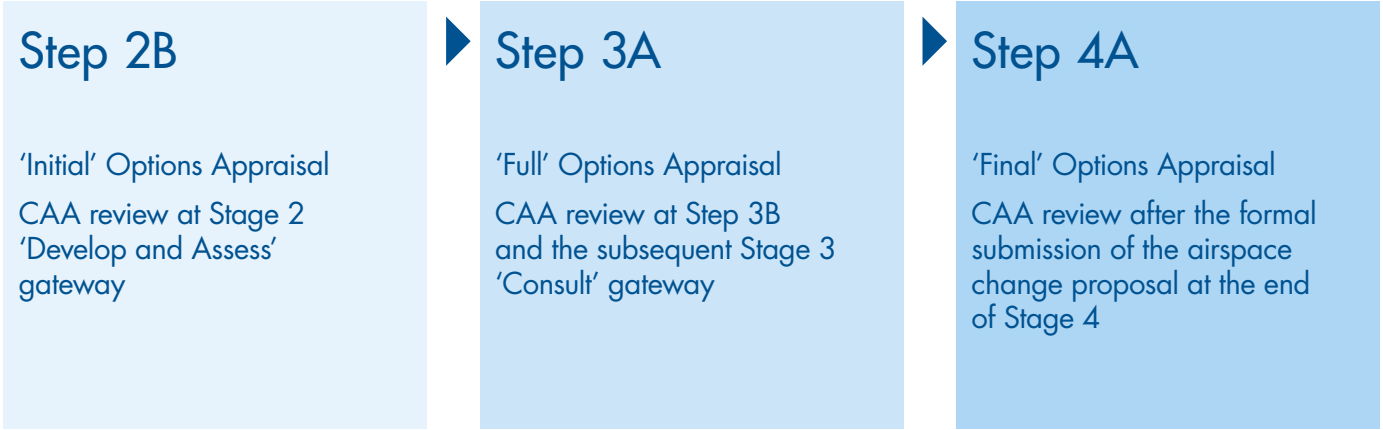
20.1
Following the process set out in CAP1616 sponsors are required to complete an IOA process that assesses the benefits and impacts of the various design options compared to a baseline. At MAN, the 'do nothing' scenario was used as the baseline, with 'do minimum' options assessed against that baseline.

20.2
At the IOA, the requirement is to determine the high-level criteria and then conduct a qualitative assessment against each design option. This serves as the foundation for a full quantitative assessment later in the 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 evolves through three iterations as shown in Figure 28 and the IOA forms part of the submission to the CAA at the Stage 2 'Develop and Assess' gateway.

Figure 28: Options appraisal phases



20.3

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

20.4

The IOA undertaken for MAN meets the requirements for the initial appraisal, which are summarised in Figure 29 (replicated from Table E1, CAP1616).

Figure 29: 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			✓

21. Methodology

21.1

We have adopted a clear and consistent methodology for assessing design options against a defined baseline. This methodology is derived from the requirements of CAP1616 and is set out in full in section 2 of the IOA.

21.2

The assessment, which included some early quantitative elements in addition to the qualitative assessments required, 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 and Areas of Outstanding Natural Beauty (AONBs) and country parks potentially impacted.

Figure 30: 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

22. Outputs

22.1

The IOA assessed and classified the individual options which were progressed from the DPE, as either: the preferred option; favourable option; acceptable; rejected; or baseline, as shown in the table below.

Figure 31: Option clasification

Option classification	
Preferred	This option is preferred as it is best performing within the departures design envelope or transitions FAF altitude group.
Favourable	This option is considered favourable as it is second-best performing within the departures design envelope or transitions FAF altitude group.
Acceptable	This option is considered acceptable as it is third-best performing within the departure design envelope or transitions FAF altitude group.
Rejected	This option is rejected as it is not preferred, not considered favourable nor considered acceptable within the departures design envelope or transitions FAF altitude group.
Baseline/Previously rejected	Option included for completeness but, in the case of previously rejected options, not subject to IOA shortlising.

22.2

The assessment of each design option against the assessment criteria, and the categorisation of design options in accordance with the above criteria, is set out in the Initial Options Appraisal Section 7.5.

Next steps

23. Developing and assessing operating networks

23.1

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

23.2

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

23.3

The shortlist of design options has benefited from extensive engagement with stakeholders, including the general public. Amongst the stakeholders were other sponsors of airspace change including NATS as the en route airspace provider. Therefore, there is confidence that the proposals are flexible enough to provide compatibility with proposals emerging from other change sponsors, in so far as they are known at this time. However, it is still likely that some of our design options will be difficult to integrate with the proposals from other sponsors.

Therefore, we will continue to work with other sponsors, including NATS, to ensure that collectively we optimise operations with the MTMA. This will include providing information to NATS to inform their visualisation and development simulations, which will test the emerging concepts. It is likely that to optimise the MTMA trade-off decisions will need to be made between incompatible airport design options and where this is the case, we will undertake the necessary cumulative assessment of options in accordance with emerging guidance from ACOG. This process may mean that our consideration of some options shortlisted at Stage 2B is discontinued, or some options previously classified as rejected may be reconsidered or require modification in order to continue in the process. Where this is the case, we will set out our rationale and supporting evidence so that stakeholders have the opportunity to comment during the consultation exercise at Stage 3.

This work will allow us to combine our design options into operating networks. Defining networks of routes that support operations to and from MAN will allow us to undertake the more detailed assessment required at Stage 3 and it will also 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 4,000 feet.

23.4

The IOA that we have completed is the first of three appraisals required under the CAP1616 process. The operating networks that result from the steps we set out at 23.3 will allow us to undertake the more detailed Full Options Appraisal (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 also 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 design 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 that estimate aircraft activity at the year of implementation and the ten years after implementation. To allow the networks that we are considering to be compared to today's operations, we will also prepare air traffic forecasts for a 'do nothing' scenario, that reflects the way we operate today and a 'do minimum' scenario, that reflects an informed view of the future and the minimum changes required to address the issues that mean "doing nothing" is not a feasible option in reality, as well as the issues identified in our statement of need.

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 enroute network and adjacent airports. These include noise, emissions, capacity and safety. In defining the full range of criteria that we will assess in the FOA we will be guided by CAP1616 and will take account of the information in Appendices B and E.

Our proposed 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 8.3.

23.5

Our Design Principle Airspace states that the amount of Controlled Airspace (CAS) required should be minimised, to ensure the needs of other airspace users are considered. This requirement is also reflected in our Design Principle Policy, which considers the ends of the AMS, including the Integration end, which calls for a transition towards greater integration of air traffic including GA and the military. However, due to the potential for routes to be refined or amended, as referred to in 23.3, it would be premature to define future CAS requirements at this stage. As such, CAS requirements for groups of design options will be identified during Stage 3. All stakeholders will be provided with an indication of the CAS requirements within the Step 3C consultation material, and the comments received will be considered as part of the consultation analysis activities in Step 3D. More details of this approach are provided in the DOR section 4.5.

23. Developing and assessing operating networks networks continued...

23.6

The CAA published its refreshed Airspace Modernisation Strategy (AMS) in January 2023. The refreshed AMS pulls together the ICAO Global Air Navigation Plan, the 2018 AMS and new requirements that the CAA has identified through stakeholder engagement.

This MAN Stage 2 Gateway submissions, including the Viability Filter within the DOR, the Design Principles Evaluation (DPE) and the Initial Options Appraisal (IOA) that assessed alignment to Design Principle Policy (P), were based on assessments carried out against the requirements of the previous iteration of the AMS, which was in force at the time those assessments were carried out.

MAG have reviewed the refreshed 2023 AMS. This review concluded that no material change would result had the refreshed AMS been applied to this MAN Stage 2 submission. It has therefore been agreed with the CAA that it would not be practical or proportionate to revise the MAN Stage 2 submissions to refer to the 2023 AMS for the purpose of this resubmission. However, our assessment work within Stage 3A and beyond will align to the refreshed 2023 AMS.

23.7

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 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. MAN 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 routeings (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.

24. Updating stakeholders

24.1

The completion of the work required at Stage 2 'Develop and Assess' has developed and refined the design options available at MAN, as well as expanding the understanding of stakeholders' views on those options. While it is not a requirement of the CAP1616 process, all stakeholders that have participated in engagement activities to date, will be provided with the information submitted to the CAA at the conclusion of Stage 2, to ensure that they remain informed of the development of the Airspace Change Proposal at MAN ahead of the full public consultation 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 MAN traffic.
Agl	Above ground level.
AIP	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. Unless otherwise stated, all references to the AMS are to the December 2018 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.
ASMIM[11]	A navigation fix to the north-west of Manchester used by departing aircraft.
ATC	Air Traffic Control – service from an air navigation service provider providing guidance to aircraft through Controlled Airspace.
ATM	Air Transport Movement – an aircraft operation for commercial purposes, as opposed to a flight for recreational or personal reasons.
ATS	Air Traffic Services.
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).

[11] The language to communicate between a pilot and an Air Traffic Controller needs to be clear and avoid misunderstanding. Names need to sound different and be incapable of confusion with others, particularly others close by.

CAP1385	The CAA's PBN enhanced route spacing guidance (www.caa.co.uk/cap1385).
CAP1498	The CAA's definition of overflight – the report defines overflight as it relates to airspace regulation; and 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).
CAP1781	The CAA's DVOR/DME/NDB Rationalisation – guidance for the use of RNAV Substitution (www.caa.co.uk/cap1781).
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).
CAP1926	General Requirements and Guidance Material for the use of RNAV Substitution (www.caa.co.uk/cap1926).
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.
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.
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.
DAYNE	One of three existing hold stacks used at Manchester 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.
DESIG	A navigation fix to the north-east of Manchester used by departing aircraft.
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 and in Manchester's case – members of the public. The design principles at Manchester 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.

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.
EGCC	The four-letter ICAO code for Manchester Airport.
EU	The European Union – an economic and political union of 27 countries.
EKLAD[11]	A navigation fix to the west of Manchester used by departing aircraft.
ERCD	The Environmental Research and Consultancy Department of the Civil Aviation Authority.
FAF	Final Approach Fix – The point at which an 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 Manchester, that is implementing the Governments Airspace Modernisation Strategy.
FIR	Flight Information Region – airspace delegated to a country by ICAO. In the UK there are two FIRs, London and Scottish.
FL85	FL means 'Flight Level' and uses the standard international pressure (1013.2 hPa) to express altitude in hundreds of feet. FL85 equates to 8,500ft calculated according to the 'constant' pressure altitude rather than local pressure (QNH). So FL90 would mean 9,000ft.
Flat segment	A defined period of level flight as required by a PANS-OPS PBN Approach procedure.
Flightpath	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, reducing the workload on the flight crew.
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.
Future housing sites	Future housing sites 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 MAN on 17th March 2022 with updates included to the Cheshire East Borough Council and Staffordshire Moorlands District Council areas in July and August 2022.
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.
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 aircrafts' 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 radionavigation system owned by the United States government and operated by the United States Space Force.
HAZID Workshop	Hazard Identification workshop – held with air traffic control experts from the Future Airspace team, NATS Manchester, NATS En Route and Liverpool John Lennon Airport as well as airline representatives operating from Manchester Airport.
HON	Abbreviation for the HONILEY DVOR navigation beacon that is to the south of Manchester and is used by departing aircraft as a navigation point.
IAF	Initial Approach Fix – the start of the approach phase of flight. For the Manchester arrival design options, the IAF is at 7,000ft unless stated otherwise.
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.
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.
KUXEM[11]	A navigation fix to the south-west of Manchester used by departing aircraft.
LAeq	Equivalent continuous sound level, or Leq/LAeq, is the average sound level for a specific location, over a given period.
LISTO[11]	A navigation fix to the south of Manchester used by departing aircraft.
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.
LLR	Low-Level Route – the Manchester LLR is Class D airspace within which the CAA have exempted aircraft from requiring an ATC clearance to fly within the route (http://publicapps.caa.co.uk/docs/33/ORS4%20No.1545%20Correction.pdf).
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.
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 occasions, 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 on to the arrivals path for another approach.

MAN	The three letter IATA code for Manchester Airport.
MANTIS	Manchester Airport Noise and Track Information System – a system that monitors and records the path and noise of aircraft arriving and departing from 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.
MCT	Abbreviation for the Manchester DVOR navigation beacon and routes that use that as a navigation point.
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.
MIRSI	One of three existing hold stacks used at Manchester Airport.
Modal average path	The path over the ground most commonly flown, derived from radar data samples.
MONTY[10]	A navigation fix to the south-west of Manchester used by departing aircraft.
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 for Manchester Airport.
NANTI	A navigation fix to the south-west of Manchester used by Liverpool aircraft.
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.
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.
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 outlines the rules and criteria for designing aircraft flying procedures – commonly shorted 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.
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, Baptistery, Cathedral, Church, Chapel, Citadel, Gurdwara, Kingdom Hall, Methodist, Mosque, Minster, Stupa, Succah, Synagogue, Tabernacle or Temple.
PNR	Preferred Noise Route – lines of tolerances widen from the runway ends out to 1.5km each side of the Standard Instrument Departure route. The area encompassed by these 1.5km tolerances is commonly recognised as the PNR.
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.
POL	Abbreviation for the Pole Hill DVOR navigation beacon and routes that is to the north of Manchester and is used by departing aircraft as a navigation point.
Q&A	Question and Answer – a list of questions (and their answers) that help the reader understand the subject material.
Radius to fix	Radius to Fix (RF) is defined as a constant radius circular path around a defined turn centre that terminates at a fix.
RAG	Red, Amber, Green – a means of assessing a project's status using the traffic light colours.
RF	Radius to Fix is defined as a constant radius path around a defined turn centre. It is a type of waypoint used in PBN procedures and provides highly accurate track keeping in a turn.
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.
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.
ROSUN	One of three existing hold stacks used at Manchester Airport.
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.
SANBA[11]	A navigation fix to the south of Manchester used by departing aircraft.

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 flightpath 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. Manchester Airport's SoN can be found online (airspacechange.caa.co.uk/documents/download/602).
SONEX[10]	A navigation fix to the east of Manchester used by departing aircraft.
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 flightpath set by Air Traffic Control that aircraft follow when arriving at an airport.
Step 1B Design Principles Report	A document that formed part of Manchester Airport's Stage 1 submission to the CAA (https://airspacechange.caa.co.uk/documents/download/1382).
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.
TABLY	A navigation fix to the south-west of Manchester used by departing aircraft.
Technical Coordination Group	Created by ACOG the Group regularly meet to discuss and resolve policy and technical issues affecting airspace design across all airports.
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.
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, Policy, and Capacity).
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, Policy and Capacity.
VNAV	Vertical Navigation – a term for vertical (up/down) navigation used within Performance Based Navigation.
VRP	Visual reference point.
WAL	Abbreviation for the Wallasey DVOR navigation beacon that is to the west of Manchester and is used by departing aircraft as a navigation point.
XORBO[11]	A navigation fix to the north-east of Manchester used by departing aircraft.
XUMAT[11]	A navigation fix to the north of Manchester used by departing aircraft.

MAG Manchester Airport

The contents of this publication are the sole responsibility of Manchester Airport and do not necessarily reflect the opinion of the European Union.

Co-financed by the Connecting Europe Facility of the European Union.