Phase one Engagement Materials

CAP1616 Stage 2 Develop and Assess

November 2021

Manchester Airport Future Airspace

Stage 2 – Develop and assess

Thank you for taking part in our discussions about the future of airspace at Manchester Airport. As we develop our plans, the feedback we receive from stakeholders and other respondents influences the decisions we make.

This document provides useful background information for the upcoming discussions. It also gives details of where you can get further information. You can ask questions at our discussion sessions.

Why is airspace changing?

The Government has set out a programme, called the Airspace Modernisation Strategy (AMS), to modernise airspace across the whole of the UK. This is linked to similar initiatives across Europe and provides a once-in-a-generation opportunity to update the way millions of flights are managed across the country.

The way airspace is currently managed in the UK has changed little since the 1950s, despite the huge increase in air traffic over that time. Although advances in technology have brought improvements to help manage operations safely, a lot of how our skies are managed was designed for a different era. To manage current and future levels of air traffic more efficiently, and benefit from new technologies (including satellite navigation), it is essential that the way we manage our airspace is modernised.

Despite the effect the COVID-19 pandemic has had on the aviation industry, the need to modernise the UK's airspace remains unchanged and is still a clear priority for the Government. The potential benefits are significant. Upgrading airspace is essential for taking advantage of new technologies and can offer opportunities to reduce noise and emissions, increase passenger numbers and the number of flights, reduce delays, and make sure that aircraft continue to meet the highest levels of safety.

The importance of airspace modernisation at Manchester

Manchester Airport sits within a busy airspace network and is relatively close to Liverpool Airport, which means there is a lot of complex interaction between departing and arriving aircraft. This increases the workload of air- traffic controllers and can result in delays and inefficient flight paths.

Airspace modernisation will simplify this situation. It may also offer a wide range of benefits to our local communities and passengers. For example, it might help to:

- reduce the amount of fuel burnt;
- reduce carbon emissions;
- help us to better manage how noise affects local communities;
- reduce the need for aircraft to stay circling (flying in a 'holding pattern' before landing or moving to the next stage of their journey); and
- reduce delays for passengers.

Due to the complexity of airspace in the North West of England, it is important that any changes to airspace are co-ordinated with nearby airports. For this reason, we are part of a co-ordinated programme of change, as part of the Future Airspace Strategy Implementation North (FASI-N) group of airports (which includes Liverpool, Leeds-Bradford and East Midlands). Each airport must modernise the airspace at heights of up to 7,000ft in its local area. NATS (the UK's provider of air-traffic control) will be re-designing the routes in all airports' airspace above 7,000ft, so that the entire air-traffic system is improved.

The airspace change process

In 2018, the Civil Aviation Authority (CAA), the aviation industry's regulator, published a new process, (CAP1616), to manage changes to airspace. This process consists of seven stages with CAA approval required at the end of certain stages to progress to the following stage.

We are here

2019	Late 2021 to mid 2022	Late 2022 in to 2023				
Stage 1 **Define** — In January 2020 the CAA reviewed and signed off the documentation relating to Stage 1 and we passed through the 'Define' Gaetway.	Stage 2 **Develop and assess**	Stage 3 **Consult**	Stage 4 **Update and submit**	Stage 5 **Decide**	Stage 6 **Implement**	Stage 7 **Post-implementation review**
Step 1A We sent our Statement of Need to the CAA in March 2019. **Step 1B** We gathered views on Design Principles over the summer (up to 6 October) before proposed Principles were sent to the CAA for approval in late 2019.	Taking the Design Principles produced during Stage 1 into account, we will develop and assess a series of options for changes to flight paths. The options will be sent to the CAA after seeking feedback from our stakeholders.	We will prepare to consult the public on these options late in 2022. Once we have approval from the CAA to proceed, a formal consultation will take place.	Taking the stakeholder feedback received during Stage 3 into account, we will finalise our Airspace Change Proposal and send it to the CAA .	It will be for the CAA to decide on whether to approve any airspace change.	If approved, any airspace change would then need time for Air Traffic Control training before coming in to force.	The CAP1616 process gives the CAA and airports 12 months to review any change that has been made to airspace.

Progress so far

In 2020 we completed 'Define' Gateway' of stage 1, which required us to get approval for a statement of need that set out the need for change (step 1A) and then produce a set of design principles (step 1B). The design principles will guide the development of the options for routes (the route options). We engaged with stakeholders on various design principles, to make sure the ones we chose reflected the priorities and concerns that were most important to those potentially affected by airspace change at Manchester. The design principles that were developed are set out on the right. Those highlighted in dark blue are design principles against which our route options "must" comply. Any option that does not comply with these principles will not be taken forward.

The CAA assessed and approved the work we carried out at stage 1 in January 2020, allowing us to proceed to stage 2, develop and assess. As a result of the COVID-19 pandemic, we then paused the process until this summer.

S – Safety
Our routes must be safe, and must comply with industry standards and regulations.

P – Policy
Any change 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.

C – Capacity
Our future airspace must enable best use of the capacity of our existing runways, in line with government policy.

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

N1 – Noise
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.

A – Airspace
Our route designs should minimise the impacts on other airspace users by limiting Controlled Airspace.

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

Stage 2 – Develop and assess

This stage focuses on developing route options that are in line with our design principles. It consists of two steps.

- At step 2A, comprehensive route options will be developed, refined, and evaluated against the design principles.
- At step 2B, preferred route options are more closely assessed to understand their likely effects, both positive and negative.

The discussion session you will shortly be attending is part of the first phase of discussions with stakeholders. You will also be invited to take part in a second phase in spring 2022.

We have appointed expert route designers, Osprey, to help us consider the route options. At the discussion you will be attending, we will explain how we have identified areas where it may be appropriate for us to have routes for aircraft arriving at and departing from the airport. We will also set out those areas which we will not consider further, explaining our reasons. We will share with you the work we carried out to identify these areas. We would then like your feedback, so we can consider whether we have interpreted the design principles appropriately, and to identify factors we should take account of as we develop and refine route options.

Your feedback will contribute to further design work, which will identify specific route options. These specific route options will then be assessed to see how well they meet the design principles. This work will then be shared for feedback at the next phase of discussion, planned for spring 2022.

A narrowed-down list of route options will then be taken forward for further assessment.

Once we have completed the further assessment, we will send details of the work carried out at stage 2 to the CAA for approval at the end of July 2022[1]. If we get approval from the CAA, we will then proceed to stage 3 of the airspace change process, where our design options will be further refined and subject to full public consultation.

What to expect from the discussion session

Each of the online discussion stakeholder sessions will be held on Microsoft Teams and is expected to run for one and a half hours. You will be sent a link to the session. Sessions have been grouped by stakeholder category and so you will attend with other persons from your stakeholder category. There are also two overflow sessions for anyone who cannot attend one of the bespoke sessions offered. Each session will include video content, illustrations, and a narrative from the Manchester Airport Future Airspace team. At crucial points we will pause for question-and-answer intervals, so we can collect your thoughts on what we have presented. On completion we will pause to allow you to record your overall thoughts or pose any questions not yet addressed. We will follow up by circulating a collection of the frequently asked questions (and their answers) and invite you to send in any thoughts or questions that occur to you on reflection after your session.

Please note that the sessions will be recorded so feedback can be analysed.

If you have any questions or concerns before the session, or if there is anything, we can do to help you take part, please let us know by contacting future.airsapce@manairport.co.uk

[1] This date is currently still to be confirmed by the CAA

How aircraft currently arrive and depart

In order to assess the potential effect of any airspace change, it is important to understand how the airport currently operates.

Manchester Airport has two runways running from a north-easterly direction to a south-westerly direction. Runway 1 opened on 17 May 1937 and Runway 2 came into use on 5 February 2001.

For safety reasons, aircraft take off and land flying into the wind and in the UK, the wind usually comes from the west. So, aircraft usually land from the north-east and take off to the south-west. Flights in these directions are referred to as 'westerly operations'. Each year, an average of 80% of arrivals and departures are westerly operations.

When the wind is coming from the east or north-east the flight patterns are reversed. So, aircraft instead land from the south-west and take off to the north-east. Flights in these directions are 'easterly operations'. An average of 20% of arrivals and departures are easterly operations. As the wind direction varies, in 2010 there were 180 days when there was at least one easterly operation (32% of operations were easterly through the year), whereas there were just 94 days in 2017 (15% of operations).

When we are using a single runway, aircraft both land and depart from Runway 1, which is the closest to the airport terminals.

We use two runways when large numbers of aircraft need to arrive and depart. When we use two runways, air- traffic control uses one runway for arrivals and the other one for departures. In westerly operations, Runway 1 is used to land aircraft and Runway 2 for is used for departures. In easterly operations Runway 2 is used by landing aircraft and Runway 1 is used for departures.

Departures

Aircraft flying out of the airport follow a set of routes called standard instrument departures (SIDs). A SID is a series of navigational instructions, laid out in a diagram with text. They simplify the departure process by providing the pilot and the aircraft's computer system with several waypoints, which are geographical locations defined by coordinates, and a climb profile (how much to increase height according to distance travelled) that the aircraft needs to follow. This makes sure that flights can accurately follow the SID and stay safe.

The SIDs at Manchester rely on ground-based navigation aids (a marker, signal or device that guides and navigates an aircraft). These aids are operating significantly beyond their design life, and commercial aviation – which has always funded the upkeep of these aids– now relies almost exclusively on the use of satellite navigation. UK and European aviation rules require these ground-based navigation aids to be withdrawn over the next few years and for all airports and commercial aviation to transition to the use satellite navigation. So, in future, departing aircraft will use routes based on satellite navigation to depart from or arrive at Manchester Airport.

The current SIDs do not represent a precise "railway line in the sky." In aviation navigation terms everything has a tolerance, much the same as the way in which a road you drive down is normally wider than the car you are driving. These tolerances take into account the accuracy of the ground based navigational facilities and the accuracy with which the aircraft navigation systems can recognise the signals. At Manchester, the lines of tolerances extend from the runway ends and extend to 1½

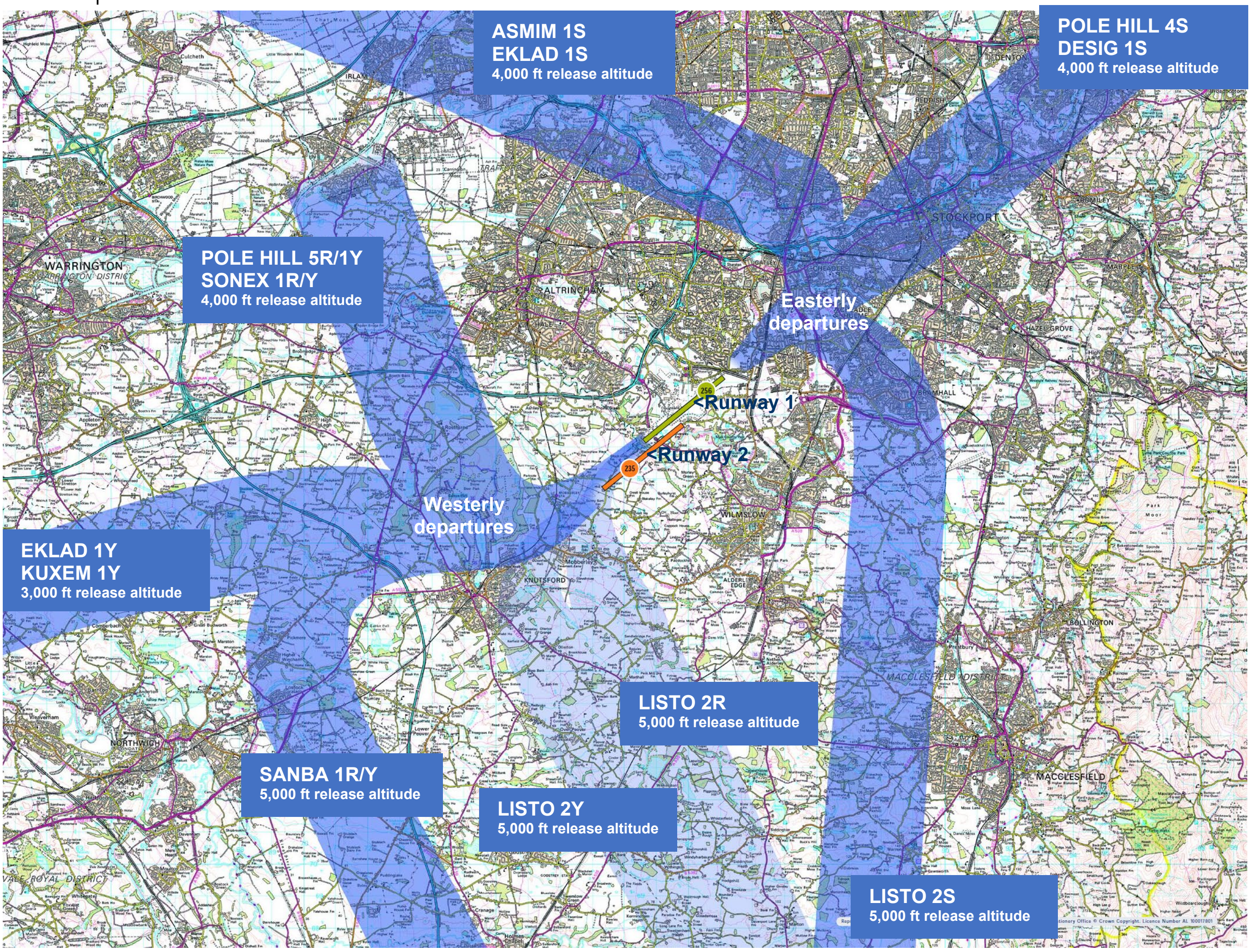
Kilometres on each side of the SIDs route. Given the accuracy of navigational equipment, it is reasonable to expect aircraft to maintain a path between these tolerances. The area encompassed by these 3 Kilometre tolerances is that commonly recognised as the preferred noise route (PNR).

The SIDs at Manchester have been carefully designed to minimise the effect of aircraft noise close to the airport by taking aircraft away from built-up areas whenever possible, for the initial, potentially more noisy stages of flight. We monitor how each aircraft flies, and we expect aircraft to stay within the PNR until they reach the 'release altitude', (the height at which they can leave the SID). Each SID has a release height of 3,000, 4,000 or 5,000 ft, see map below. This applies unless Air Traffic Control instruct otherwise. There are eight PNRs (four from each runway) used by aircraft departing to the south-west during westerly operations, and six (three from each runway) used by aircraft departing to the north-east during easterly operations, although, departures to the northeast are rare from Runway 2.

The Preferred Noise Route issued to an aircraft will depend on the runway in use, as well as the destination and flight routing of the aircraft. Once the aircraft has reached the necessary altitude above sea level, known as the release altitude, (see map below for details) the aircraft will be given an onward instruction by Air Traffic Control. This may divert them away from the PNR and onwards to the main air 'highways'. The release altitude relates to how the airspace currently operates, rather than how routes are designed under CAP1616. Our design responsibility under the CAP1616 process for this project is from surface to 7,000ft.

The track followed by departing aircraft is closely monitored. In 2019, which was our last year of normal operations, 92% of departing aircraft accurately flew within their PNR until they reached the minimum release altitude.

The map below shows where the current PNRs are and the release altitudes.

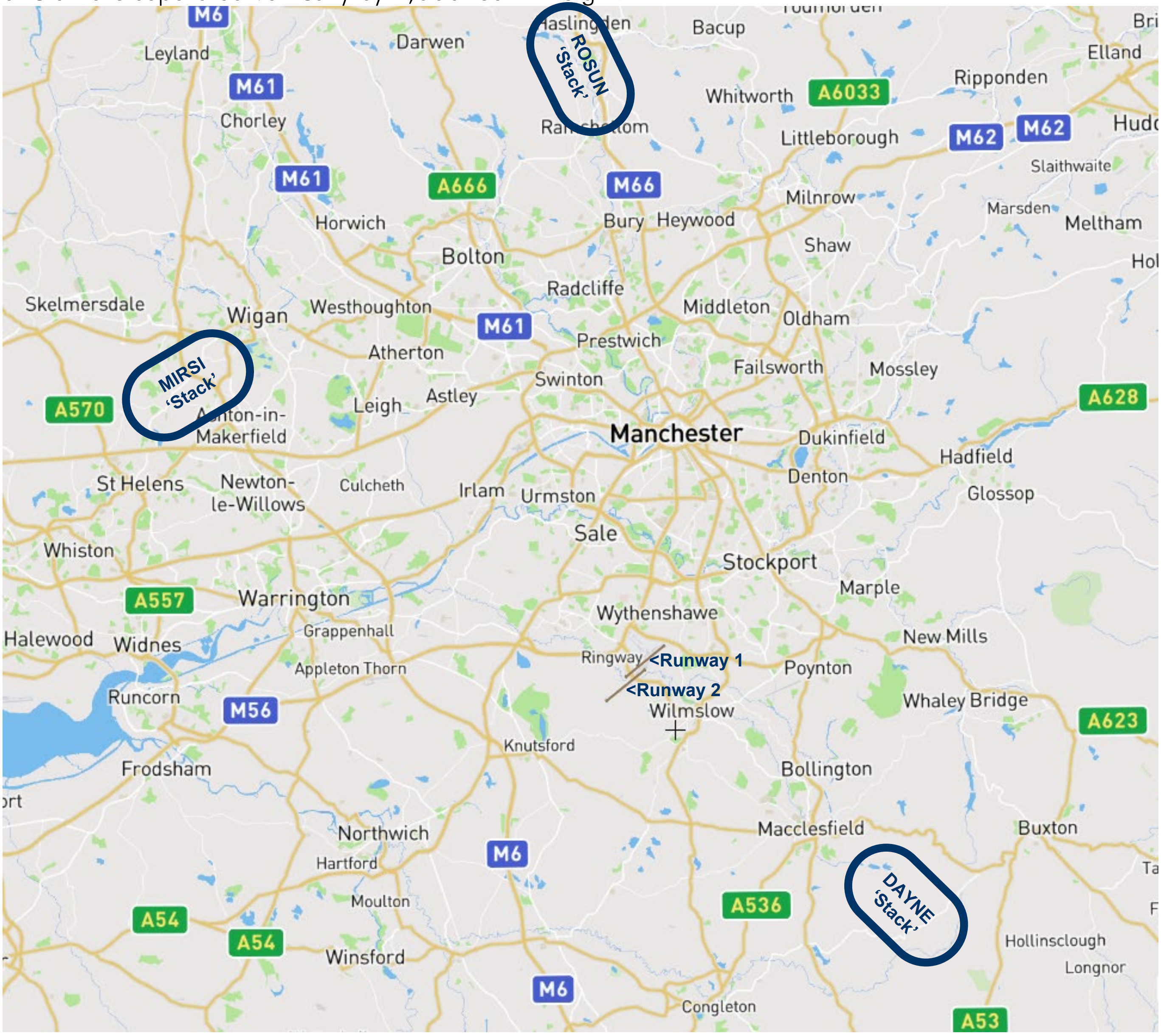


Arrivals

Aircraft arrive at Manchester Airport from a wide range of destinations. Aircraft arriving at Manchester usually follow a set route known as a standard arrival route (STAR), which is a series of instructions direct the aircraft towards a holding area.

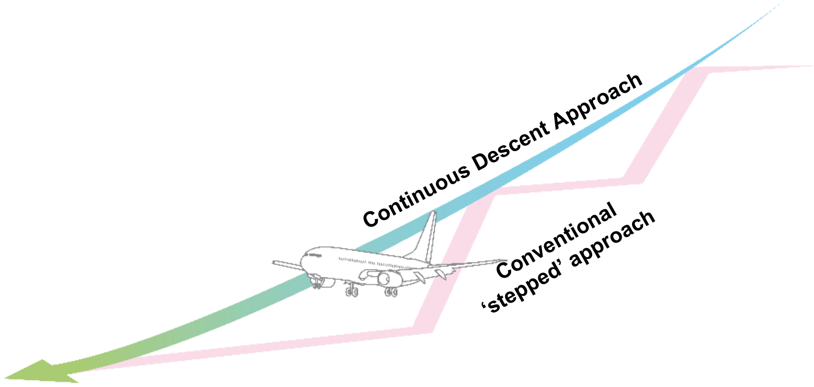
There are three high-level oval shaped holding areas, which are a racetrack pattern commonly referred to as 'stacks'. One stack, called MIRSI, is to the west of the airport (south of Wigan), one called ROSUN is to the north (over the Rossendale Valley), and one called DAYNE, is to the south-east (over Macclesfield Forest).

If the airport is busy, there can be a build-up of aircraft instructed to hold in one of stacks, where aircraft are separated vertically by 1,000 feet in height.

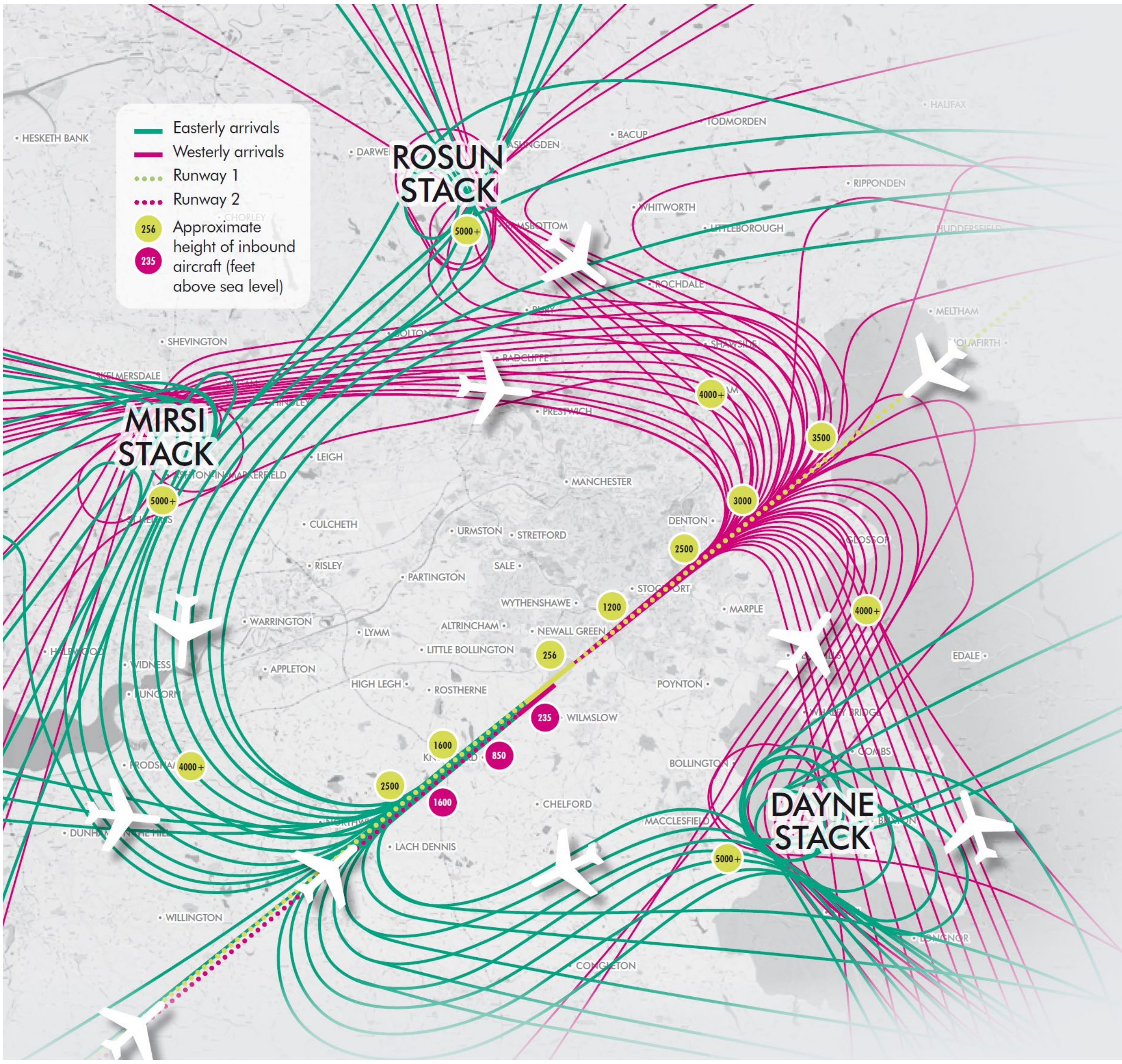


When an aircraft can land, Air Traffic Control will instruct the pilot to leave the stack and will use a process called vectoring to direct the aircraft to the final approach. Vectoring involves air-traffic controllers giving the pilot instructions to change their height and speed and to turn left or right. This process is necessary to guide aircraft and make sure there is a safe distance between arrivals, so it tends to spread aircraft across a relatively wide area. However, as an aircraft gets closer to the airport, and begins its final approach the vectoring process ends and instead it is guided by a navigational beam known as the instrument landing system (ILS). From this point all aircraft follow the same straight line on to the runway.

Wherever possible Air Traffic Control will provide the aircraft with a 'continuous descent approach' (CDA). This is a technique where arriving aircraft descend on a smooth, continuous path from the holding stacks, which avoids the need for them to use thrust (force from the engines) to either level out or maintain a specific height. CDAs keep aircraft higher for longer and are better for the environment because they reduce the amount of fuel burnt and, by not applying thrust during the descent, reduce noise.



In 2019, which was our last year of normal operations, 92% of arrivals used a CDA and the remainder used less efficient 'stepped' approaches. The policy (P), technology (T) and emissions (E) design principles highlight the importance of designing route options that will permit an increased use of CDAs in the future.



The map above shows typical tracks of arriving aircraft in easterly/westerly operations.

Future airspace design

As explained at the start of this document, the changes that are being proposed at Manchester Airport are part of a national programme of change, so our new airspace designs must be in line with the CAA's AMS. This is reflected in the policy (P) design principle from stage 1.

One of the main foundations of the modernisation strategy is the use of Performance Based Navigation or PBN. PBN means that aircraft utilise a form of satellite-based navigation, rather than relying on ground-based navigational beacons, many of which are being taken out of service. The AMS requires us to create PBN procedures for departures and arrivals. This means that aircraft will use satellite-based navigation rather than ground-based navigational aids. PBN technology enables aircraft to fly along flightpaths more accurately and to be less dispersed. This change has the potential to disturb fewer residents, but those people who are directly overflown may experience more frequent disturbance. Whether more frequent disturbance can be offset by allowing more routes to be used will be part of the subsequent option development as part of the Future Airspace project. These types of change, and any balance required, are covered under our N2 design principle which relates to creating noise relief or respite.

The route options we will be designing through stage 2 will consider several factors, including the use of PBN technology, UK and international aviation rules, our agreed design principles, and interactions with other airports in the vicinity of Manchester Airport. Under the AMS, our design responsibility is from ground to 7,000ft. Above 7,000ft is the responsibility of the provider of UK en-route Air Traffic Control services, NATS. They will design a network to accommodate aircraft from Manchester and other airports such as Liverpool and Leeds Bradford:

- For Departures that means we will design the route options from the runway until 7,000ft where the route joins with the NATS upper airspace network.
- For Arrivals the reverse applies, and NATS will design the Standard Arrival Route (STAR) and the holding stacks above 7,000ft, and we will create the route options that take the aircraft from that point to the runway.

Further information

You can clink on the links below for more information on the topics covered in this document.

- Full details on the Airspace Modernisation Strategy (AMS).
- The CAA's CAP1616 guidance on the regulatory process for airspace change.
- Further details on the work Manchester Airport completed at stage 1.
- Further details on current operations at Manchester Airport.

NOTES

THANK YOU FOR JOINING US TODAY

We look forward to sharing our work with you and hearing your views, please stand by we will start shortly.

Stage 2 – Develop and Assess
Comprehensive route options discussion

November & December 2021

MAG Manchester Airport

MANCHESTER AIRPORT FUTURE AIRSPACE

Stage 2 – Develop and Assess
Comprehensive route options discussion

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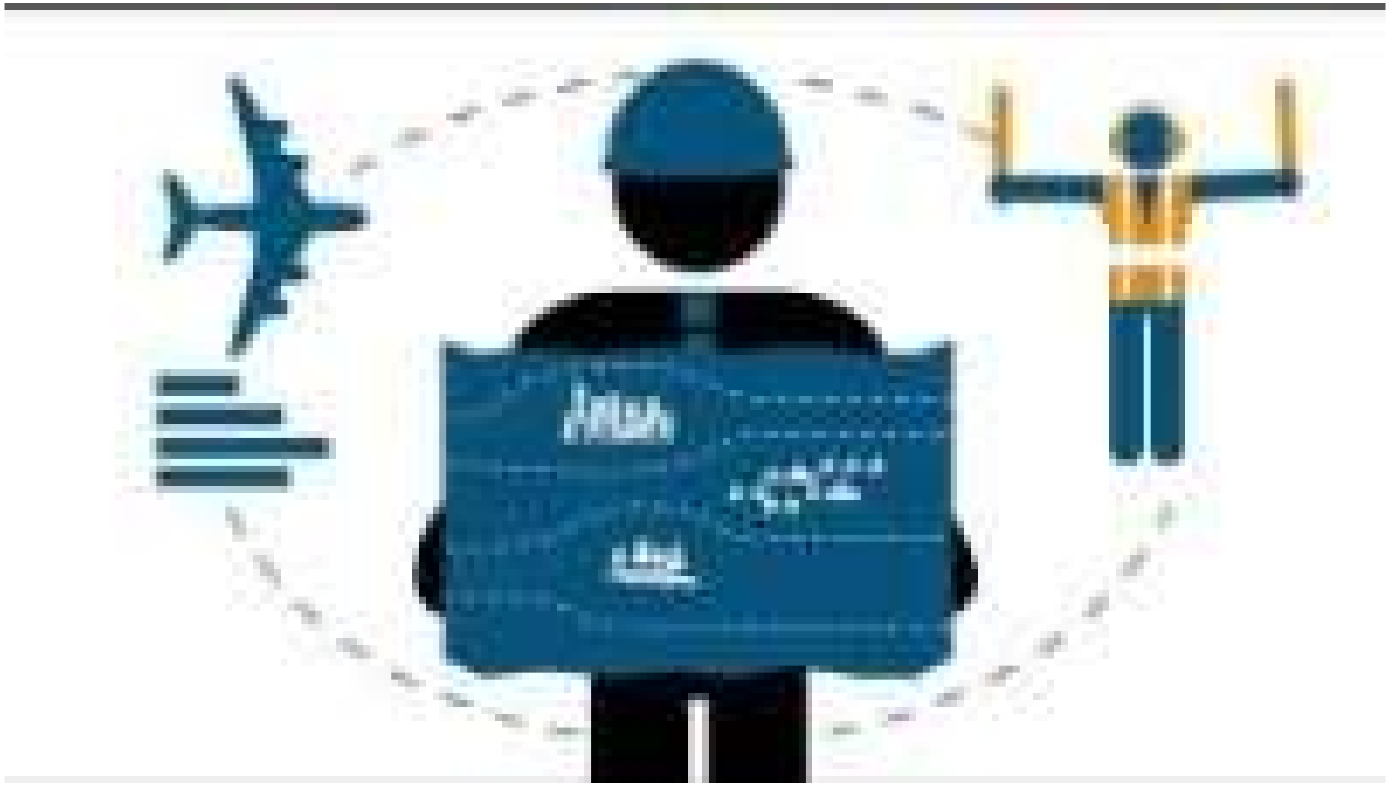
Contents

Welcome – Stage 2 video



Manchester Airport – Airspace Change Timeline

We are here

2019	Late 2021 to mid 2022	Late 2022 in to 2023				
Stage 1 **Define** Civil Aviation Authority In January 2020 the CAA reviewed and signed off the documentation relating to Stage 1 and we passed through the 'Define' Gateway.	Stage 2 **Develop and assess**	Stage 3 **Consult**	Stage 4 **Update and submit**	Stage 5 **Decide**	Stage 6 **Implement**	Stage 7 **Post-implementation review**
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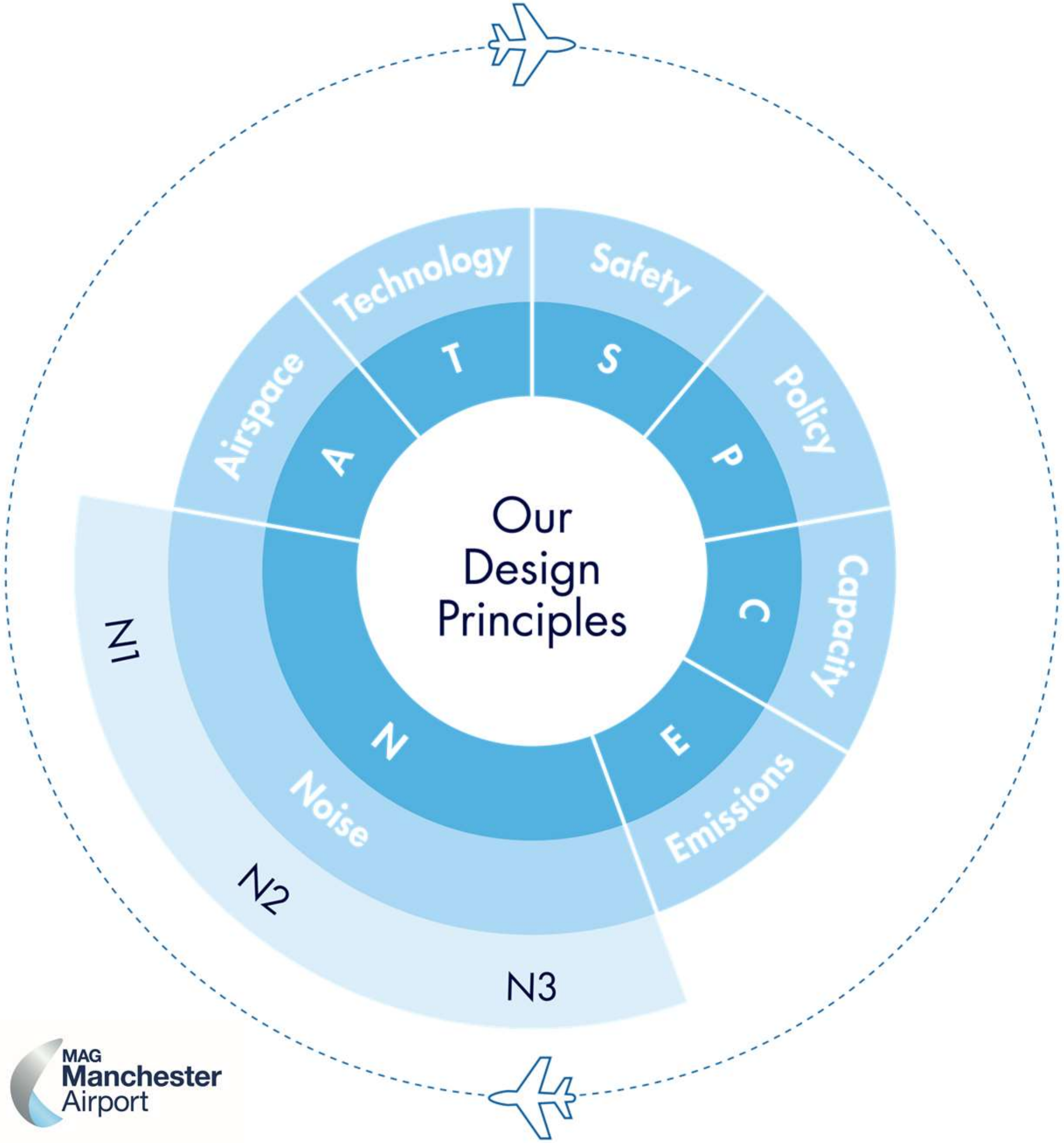
All future dates are provisional pending CAA approval and alignment with the wider Airspace Modernisation Strategy

Step 1B – Our Design Principles



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S	**Safety** Our routes must be safe, and must comply with industry standards and regulations.
P	**Policy** Any change 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.
C	**Capacity** Our future airspace must enable best use of the capacity of our existing runways, in line with government policy.
E	**Emissions** We will minimise, and where possible reduce, emissions when we design routes. This may be achieved by selecting the most direct routes.
N1	**Noise** 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.
A	**Airspace** Our route designs should minimise the impacts on other airspace users by limiting Controlled Airspace.
T	**Technology** Our route designs should be based on the latest aircraft navigational technology widely available.

Stage 2 Process – Gathering Views

We are here

1 Step 2A	2 Step 2A	3 Step 2A	4 Step 2A	5 Step 2B
Engagement one - Sharing the design envelopes	Feedback considered, routes developed	Engagement two – sharing route designs and design principles assessment	Feedback considered, options further developed	Initial options appraisal
November – December	**January – March 2022**	**March – April 2022**	**May 2022**	**June – July 2022**
In discussion sessions like this one, we will be sharing the design envelopes together with details of how these have been developed, for feedback and input.	Taking account of feedback, design envelopes will be considered further, and specific route options will be developed.	Potential route options will be shared at another round of discussion sessions in March/April. We'll also share the assessment of how each option performs against the design principles, for feedback.	Taking account of feedback, options will be refined further.	The route options will be subject to an Initial Options Appraisal to determine the likely impact of each. Once complete, full details of all the work undertaken at Stage 2 will be submitted to the CAA for assessment.

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ANY QUESTIONS?

HOW AIRCRAFT CURRENTLY ARRIVE AND DEPART

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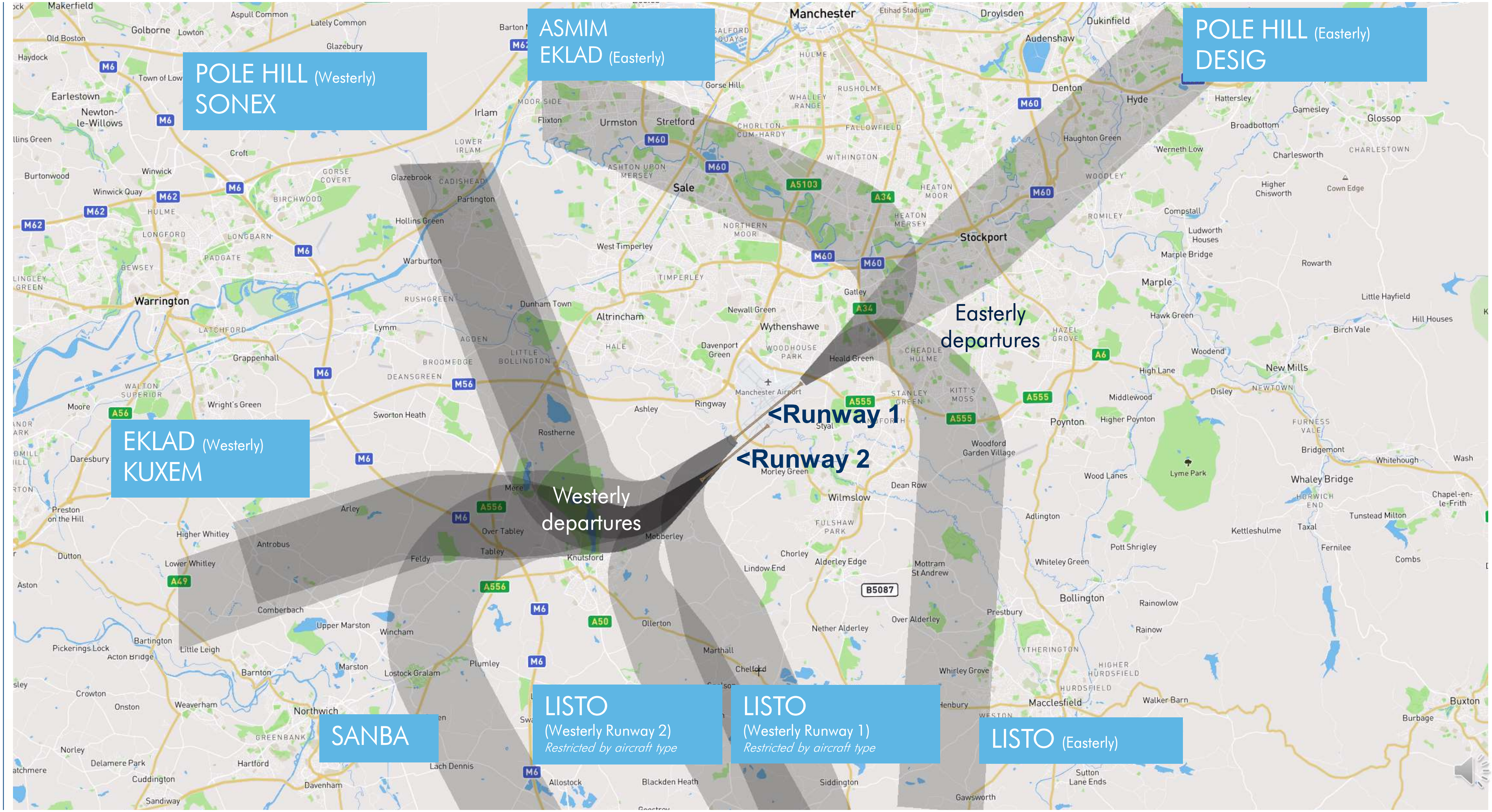
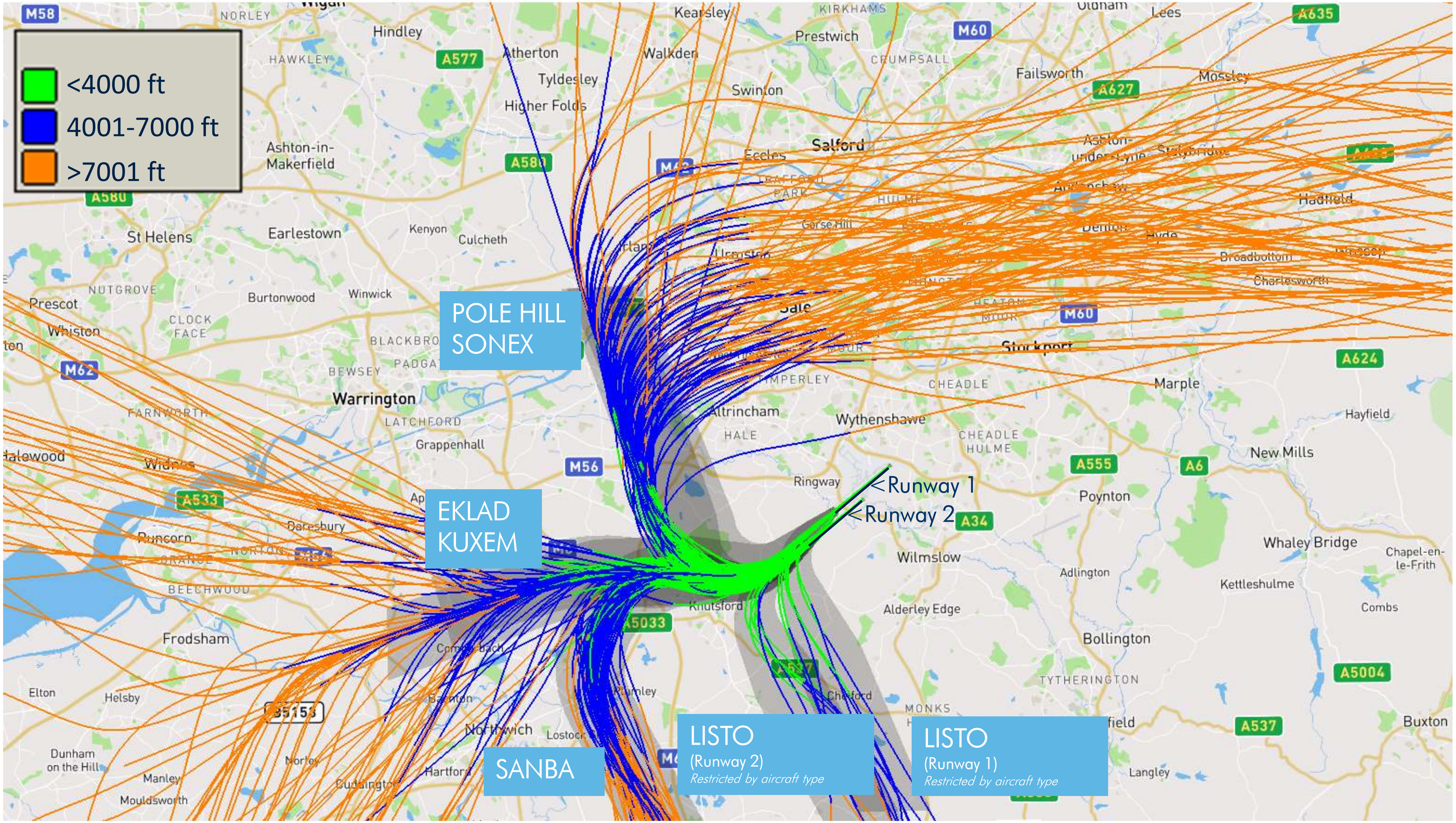
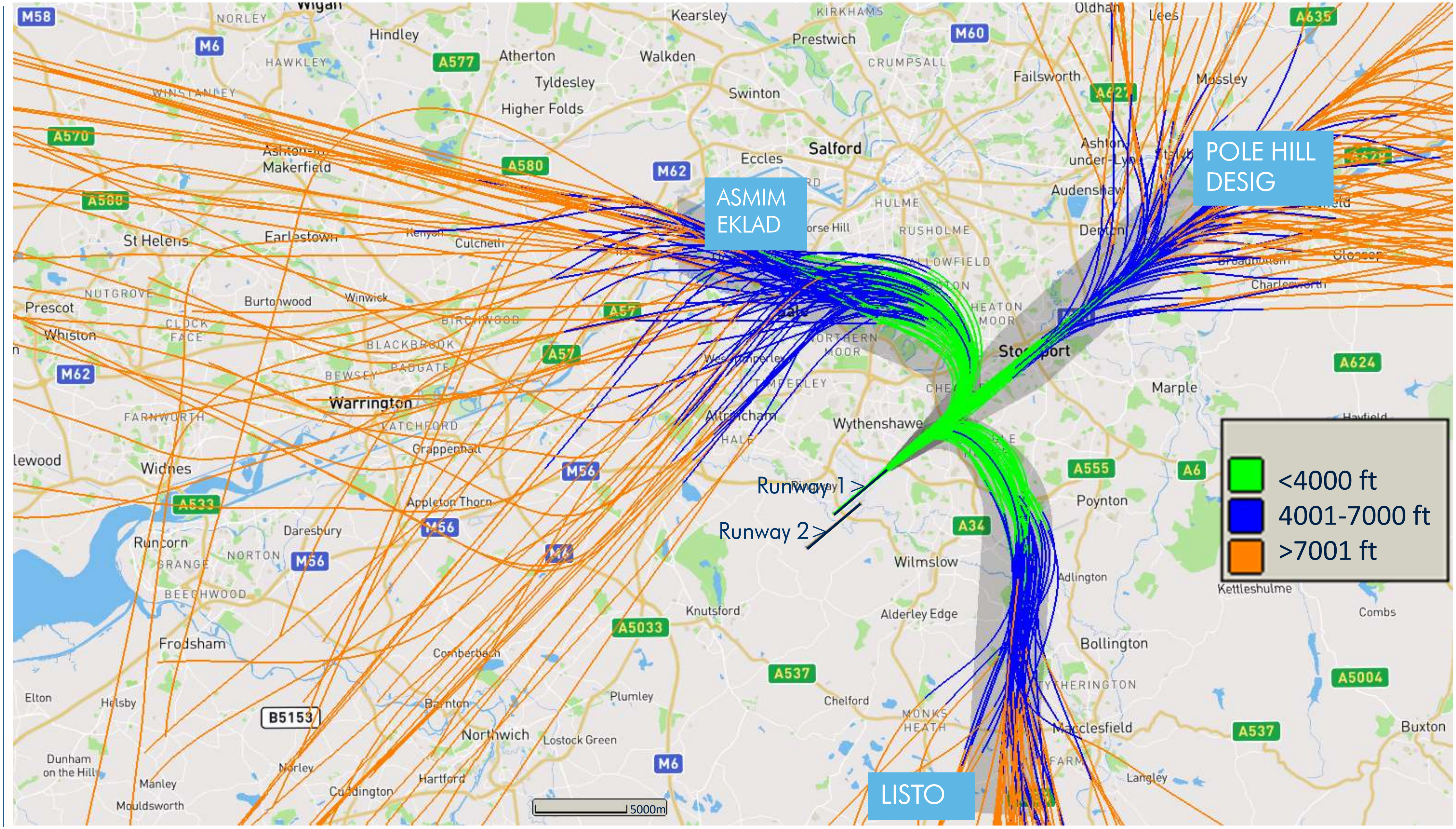
Manchester Airport Standard Instrument Departures (SIDs)



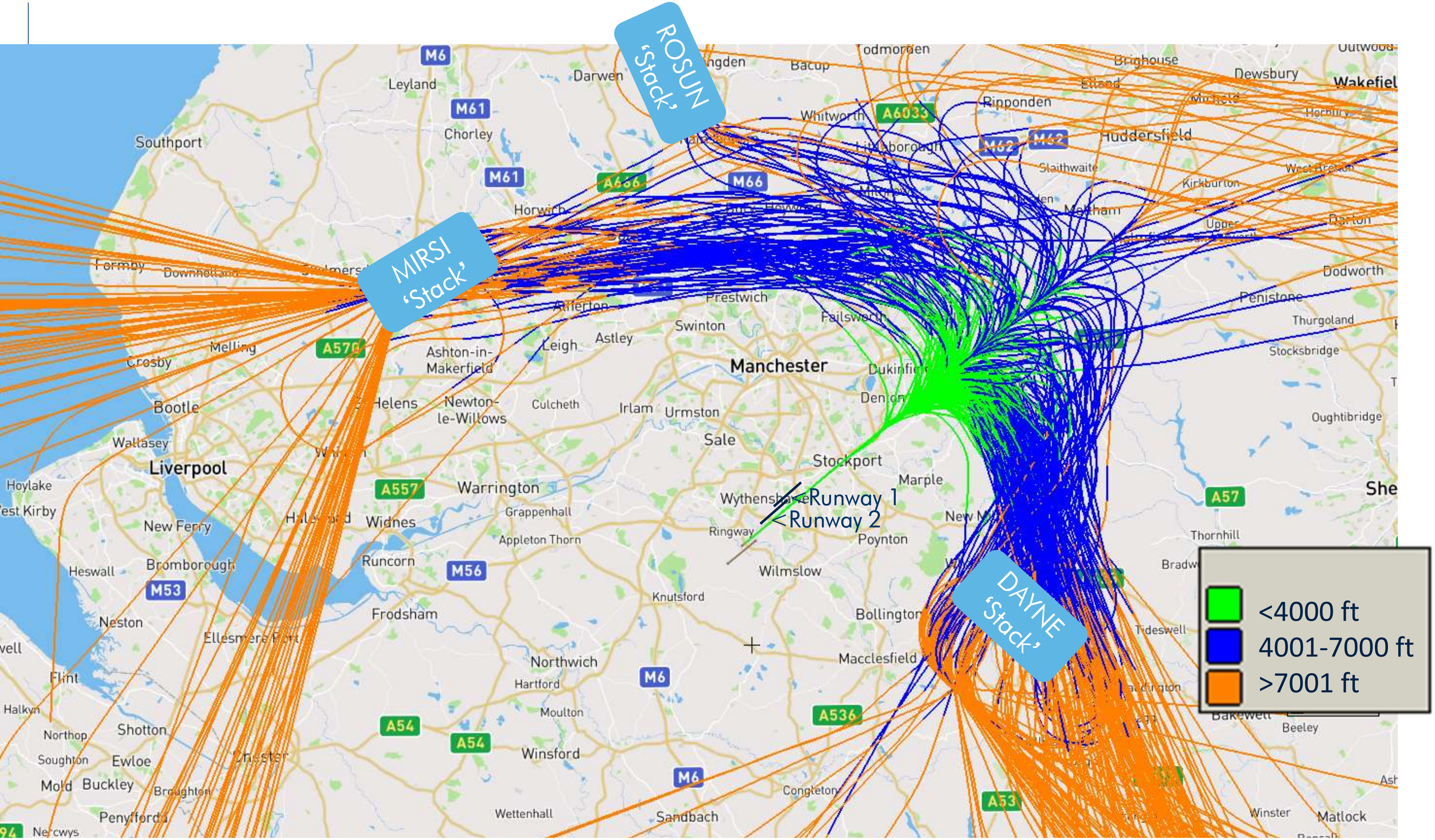
Current Operations - A typical summer's day of westerly departures (August 2019)



Current Operations - A typical summer's day of easterly departures (April 2019)



Current Operations - A typical summer's day of westerly arrivals (August 2019)



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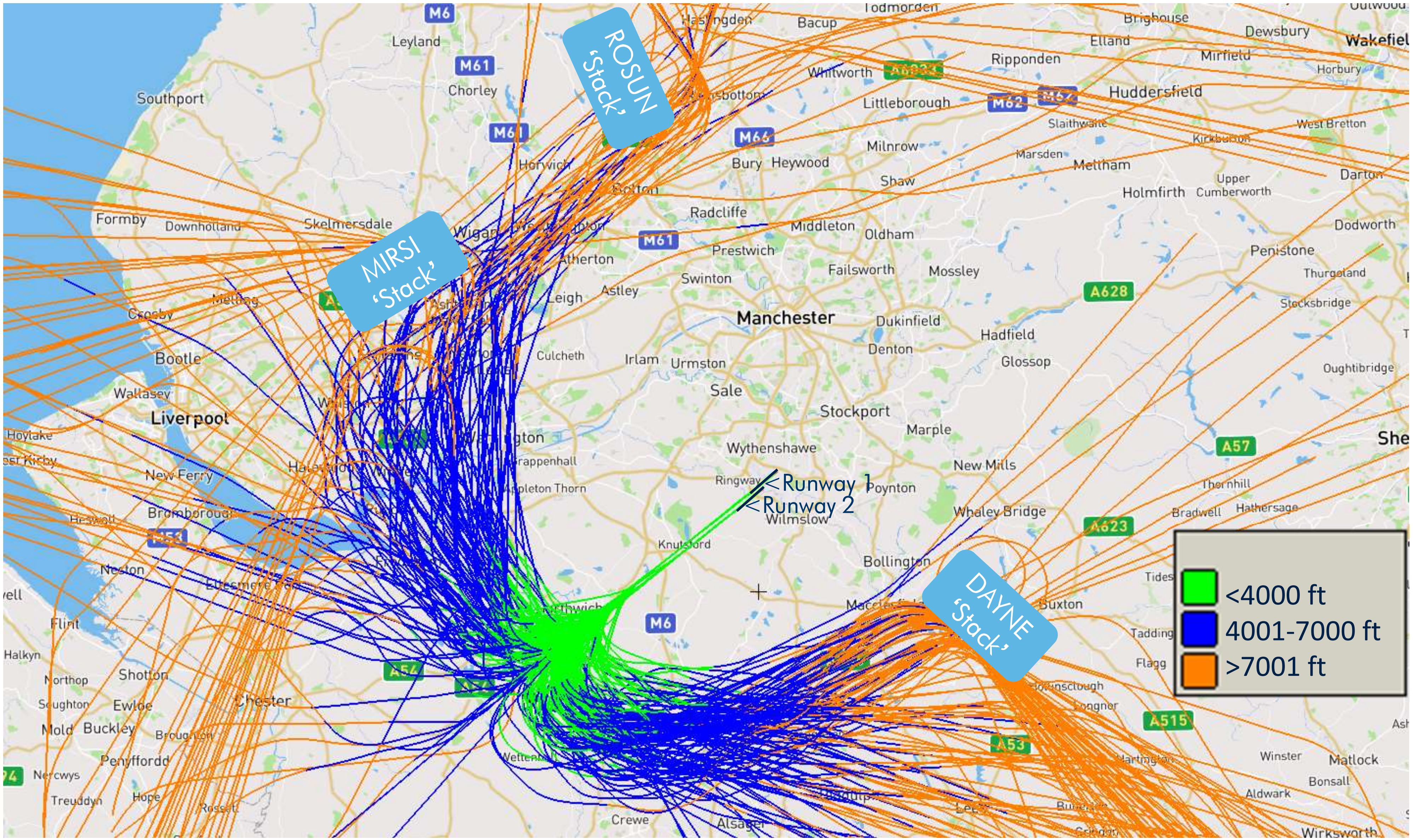

ANY QUESTIONS?

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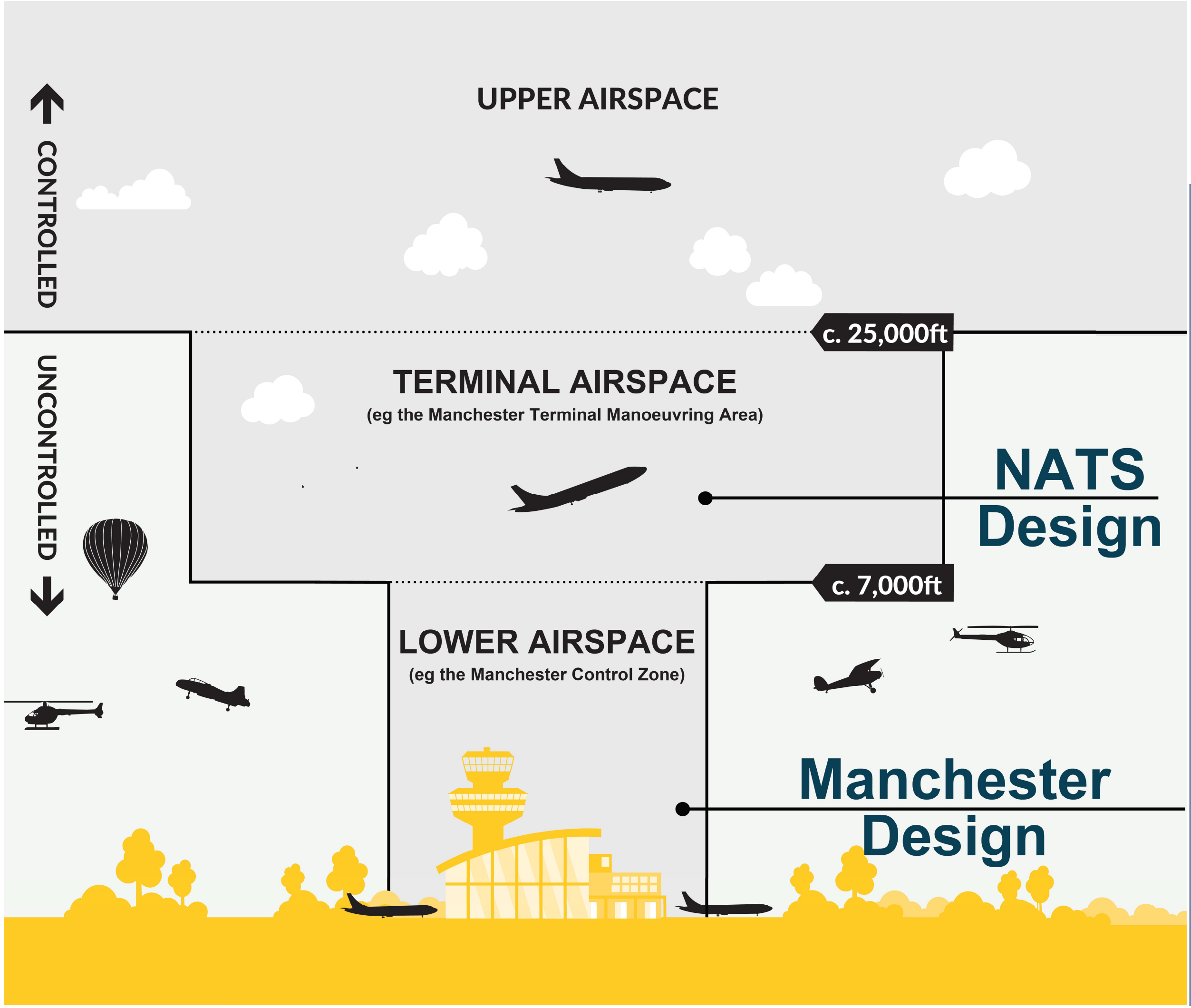
DEVELOPING A COMPREHENSIVE LIST OF OPTIONS

Andy Sampson

MAG Manchester Airport

What is Airspace?



Airspace is:

- 3 dimensional and divided into a number of layers
- Used by commercial flights, general aviation and the military

Manchester Airport has its own controlled airspace which sits under the Manchester Terminal Manoeuvring Area.

Our future designs will need to integrate with this airspace and the other airports within it such as Liverpool.

Our responsibility is from ground to 7,000ft above sea level.

NATS are redesigning the terminal airspace and the upper network above this.

The Foundation of our Route Design

The policy for airspace change is in the CAA Airspace Modernisation Strategy (AMS).

The process we follow is in CAP1616 Airspace Change.

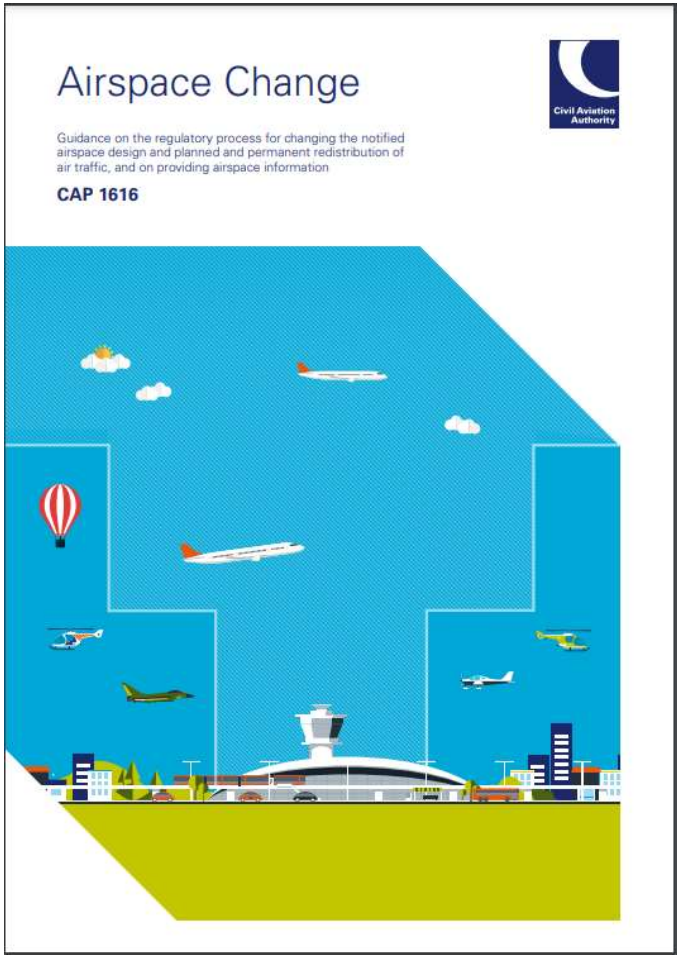
Each departure route option has two points which define the start and finish of each route

- The start point is the runway
- The finish is at 7,000ft above sea level where the route option joins with the NATS terminal airspace

For arrivals the reverse applies:

- The start point is at 7,000ft above sea level (i.e. where the arrival leaves the NATS terminal airspace
- The finish is the runway

Our route options will be using Performance Based Navigation (PBN) technology in line with the requirements of the Airspace Modernisation Strategy.



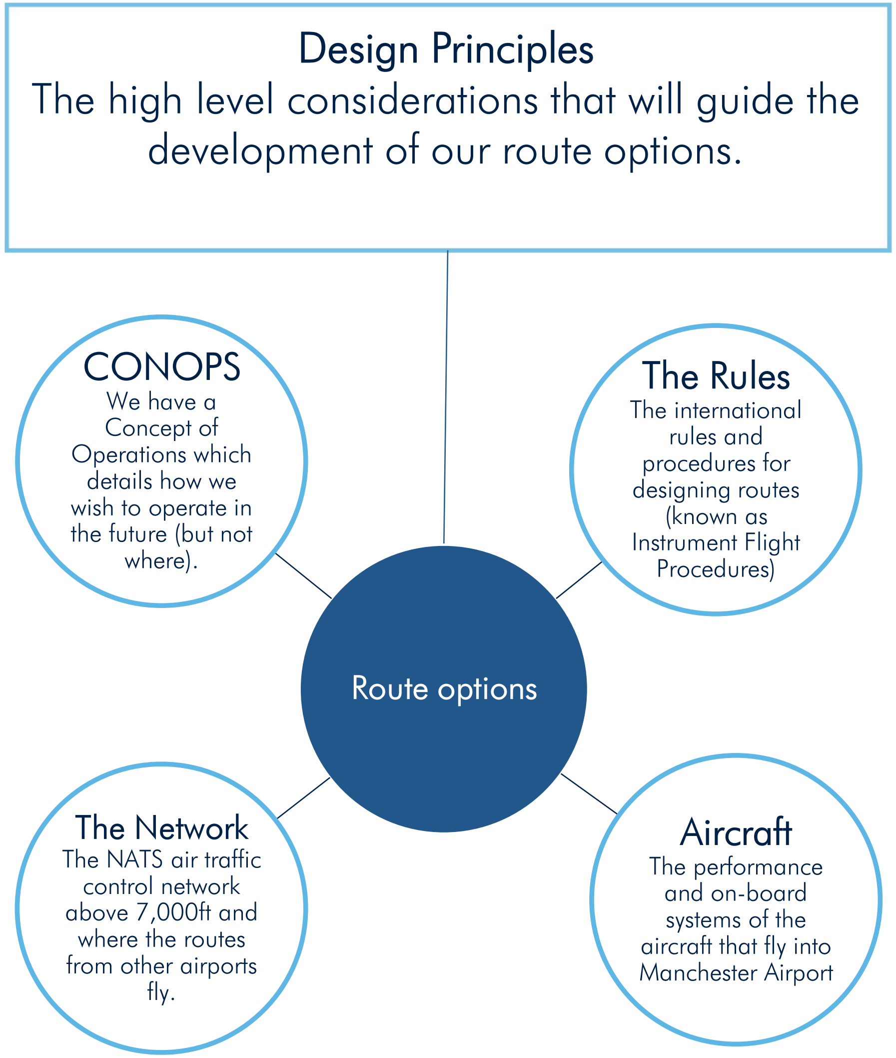
Route Design Considerations

Our route options need to take several things into consideration.

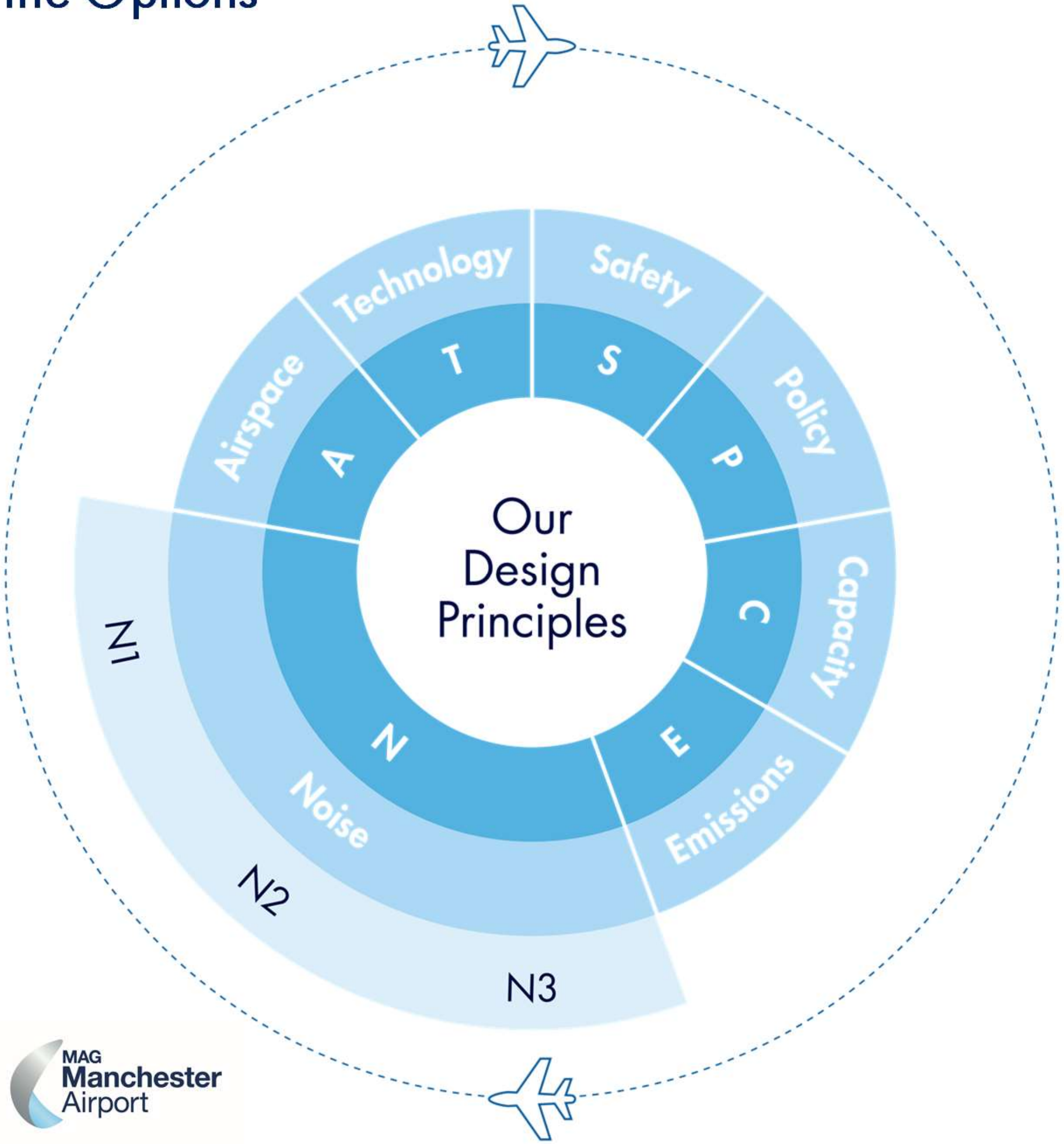
Each of the considerations aligns with our agreed design principles and contribute to our design in a different way;

- Some are “must haves” with which we must comply
- Others provide guidance or an opportunity
- Others create a constraint

We cannot ignore any of them if we are to get a balanced design.



Design Principles – Guide the Development of the Options



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Design Consideration – The Rules

Policy Safety
Design Principle

INTERNATIONAL RULES

The rules for route design are governed by the International Civil Aviation Organisation (ICAO) under a document called PANS-OPS 8168.

This stands for Procedures for Air Navigation Services – Aircraft Operations and sets out aspects such as:

- Minimum clearances between aircraft and obstacles (such as buildings or masts)
- Climb and descent gradients
- When an aircraft can turn, and how tightly and at what speed
- The standards that apply to aircraft using satellite based navigation

UK RULES

The UK rules are driven by ICAO and regulated by the Civil Aviation Authority (CAA).

In addition to CAP1616, they have also set policies and guidance on many aspects of route design.

These include the Airspace Modernisation Strategy which the design principle Policy requires us to align with.

Design Consideration – Aircraft

Airspace
Technology
Design Principle

The design principle Technology states we should make use of the latest widely available aircraft technology.

We conducted a Fleet Equipage Survey which asked airlines questions about current and future aircraft fleets.

This gave us information on:

- Their ability to fly different types of satellite navigation routes
- Climb performance
- The types of onboard navigation equipment they have

Most importantly of those that responded we confirmed:

- All aircraft can use the more accurate Performance Based Navigation (PBN) technology
- Departing aircraft can all climb at a rate that is above the PANS OPS minimum

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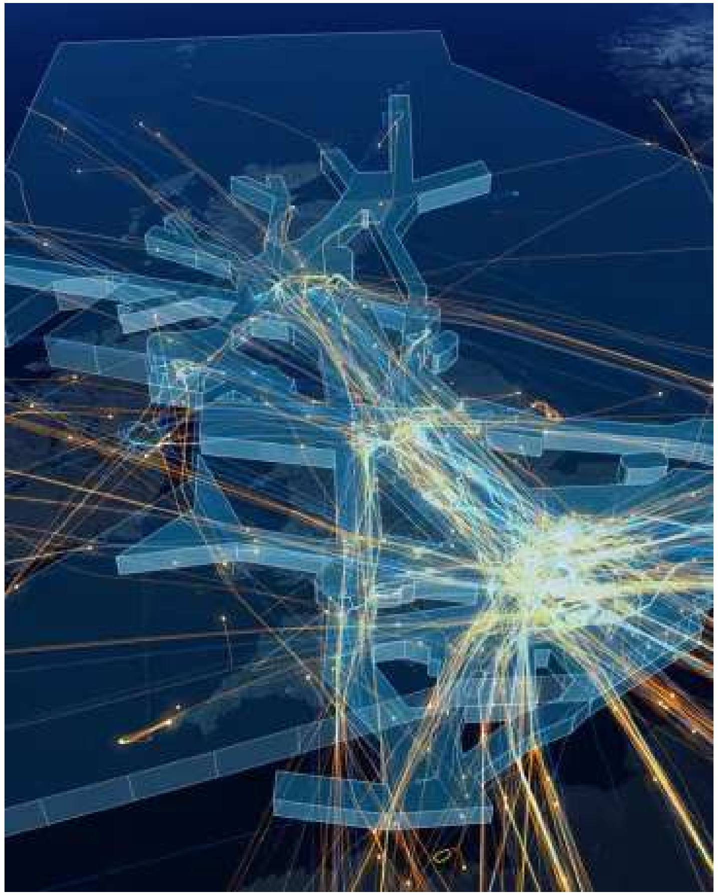
Design Consideration – The NATS Network

Emissions Policy Safety

Design Principle

The NATS upper airspace structure is like motorways in the sky.

- Our route options need to consider the airspace structure (who uses different parts of the airspace) and where flights to and from other airports are flying
- This aligns with the design principles Safety and Policy; the CAA Airspace Modernisation Strategy requires us to design as part of a system
- This creates some constraints on our designs, based on where other airports have routes (or where we expect them to be)
- We are already engaging with NATS and other airports to work together to resolve interactions



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Design Consideration – The CONOPS

CONOPS (Concept of Operations) is a technical document that guides us on how we wish to operate (but not where).

It takes input from:

- The Fleet Equipage Survey
- The expected demand at Manchester Airport
- Design principles
- The CAA Airspace Modernisation Strategy

It provides a specification for the designers to create the route options.

Capacity Technology Policy

Design principle

Some of our CONOPS criteria

- Routes designed to Performance Based Navigation (PBN) Principles
- Minimum departure climb gradients of 6%
- CAT IIIB ILS (Instrument Landing System) to be used for final approach
- No reliance upon ground based navigation aids (DVOR)
- Design routes to ensure minimum ATC intervention, with Continuous Descent and Continuous Climb Operations
- Routes to be independent of other airports below 7,000ft

ANY QUESTIONS?

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So how have these contributed to the Design Option development?

The Rules
The international rules and procedures for designing routes (known as Instrument Flight Procedures)

Aircraft
The performance and on-board systems of the aircraft that fly into Manchester Airport

Step 1
Determine where we could fly between the ground and 7,000ft. To do this we look at aircraft performance and the rules and regulations. This creates a 'design boundary'.

→ **Design boundary**

The Network
The NATS air traffic control network above 7,000ft and where the routes from other airports fly.

Step 2
Consider the airspace around us, identifying constraints, with a particular focus on safety.

→ **Constraints**

CONOPS
We have a Concept of Operations which details how we wish to operate in the future (but not where).

Design Principles
The high level considerations that will guide the development of our route options.

Step 3
Using our design principles and supporting CONOPS, consider what we want to achieve.

→ **Design options**

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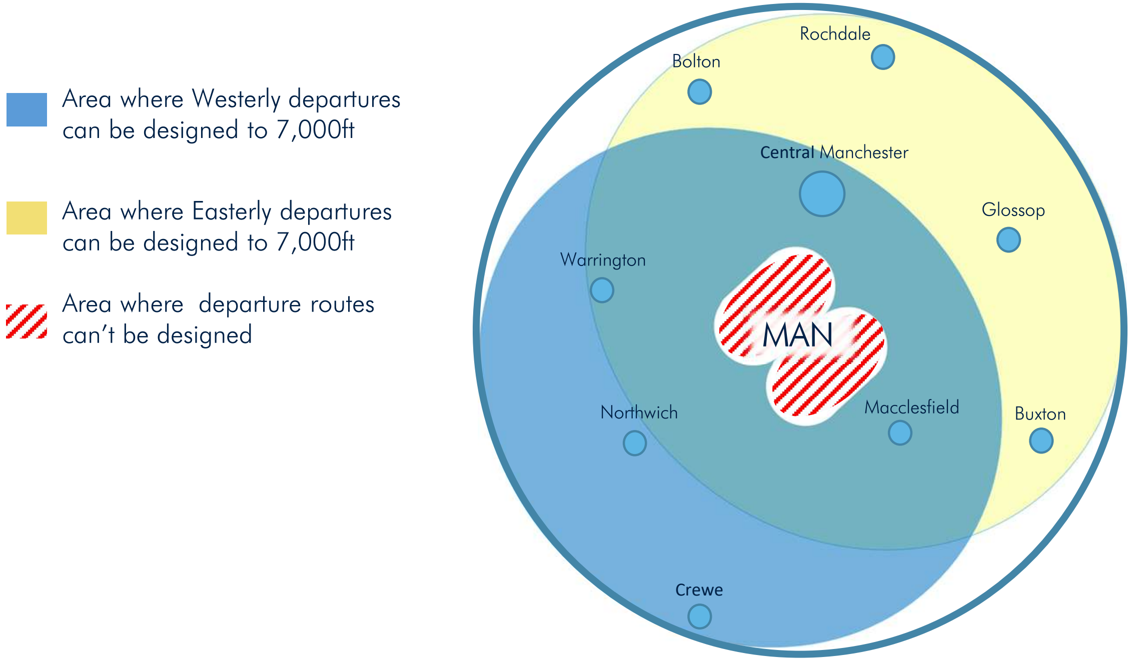
Step 1– The Boundary for Departures



This doesn't define where aircraft will fly, just the viable design area below 7,000ft.

The first stage is creating our viable design area;

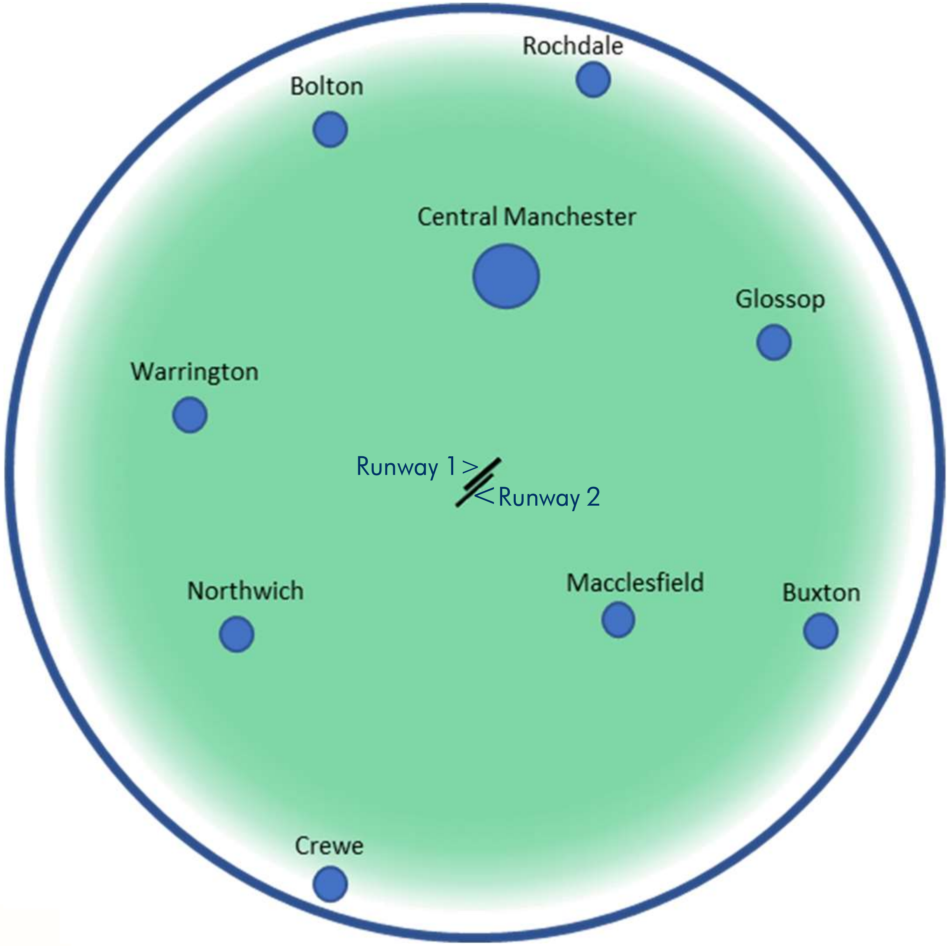
- From the Fleet Survey we know all aircraft can climb at a gradient of at least 6%
- We need to understand when an aircraft would reach 7,000ft above sea level based on this gradient

This establishes the outer blue line and aligns with the design principle Technology on constant climb operations.

Next we apply the ICAO Rules on procedure design.

- This uses the rules on turns to create a more realistic design area
- It also shows where we cannot design departures

Step 1 – The Boundary for Arrivals



We apply a similar logic on arrivals

In line with our design principles Policy, Emissions, Noise and Technology, all arrivals should facilitate Continuous Descent Approach (CDA) from 7,000ft above sea level.

- These are both more fuel efficient and reduce noise

If we apply known information on aircraft performance we can plot how far out an aircraft would need to start its decent to the runway.

This has created a theoretical boundary:

- The outer edge is the furthest point away, with the shallowest gradient to facilitate a CDA
- The closer to the airport, the more realistic a CDA becomes

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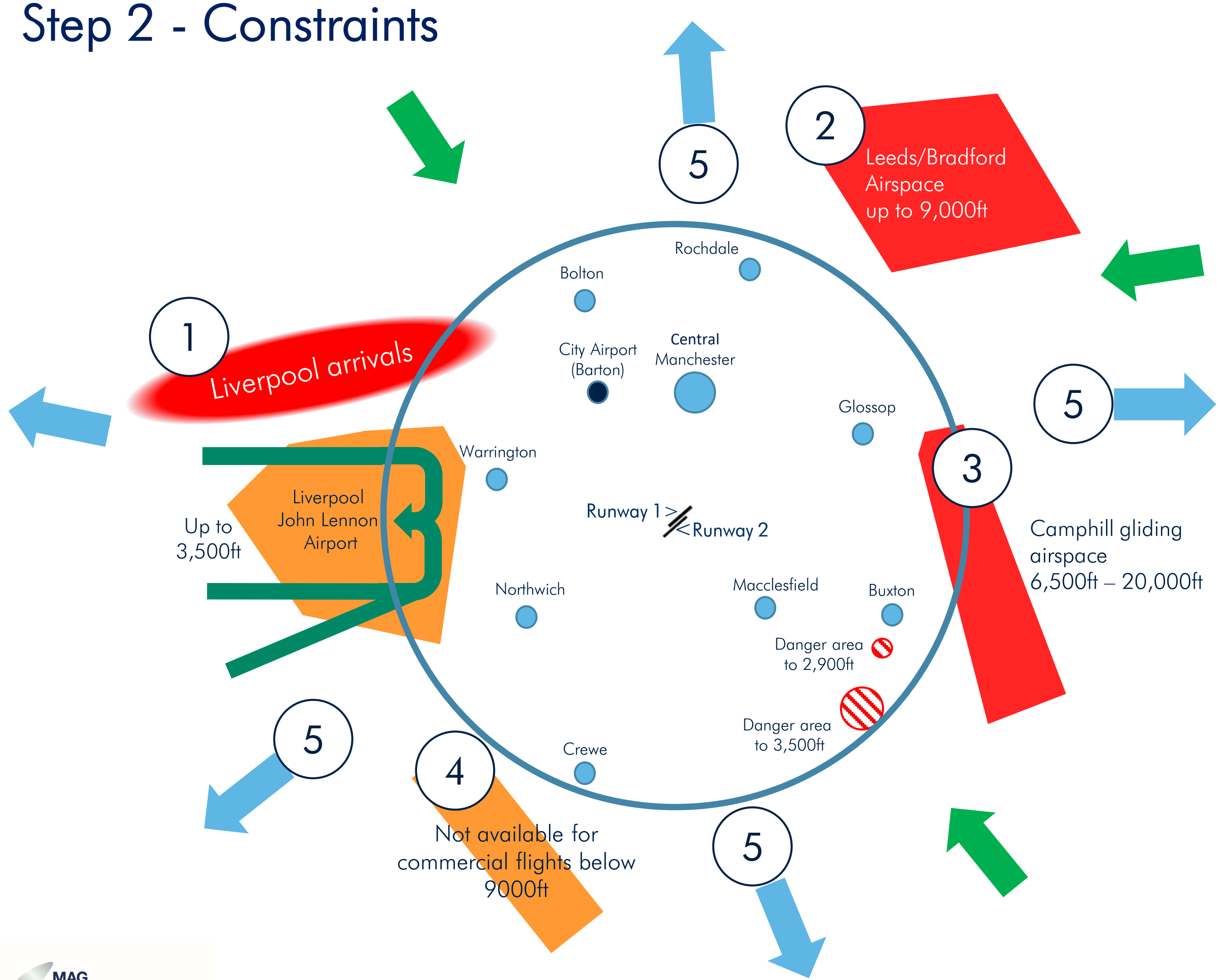
Step 2 - Constraints



Key

- Airspace constraints
- Airspace considerations
- Danger areas
- NATS Airspace Network - traffic flows Blue outbound and Green inbound

1. Liverpool arrivals area
2. Leeds airspace to the NE
3. Camphill gliding area
4. The area to the SW (there's no controlled airspace below 9000ft)
5. NATS en-route traffic orientation scheme

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Step 3 – Design Options

- At step 1 we established a **design boundary** for departures and arrivals
- We then identified our **constraints** at step 2
- At step 3 we have used all the design principles and the supporting CONOPS document to develop **design options**

Some of our CONOPS criteria

- Routes designed to Performance Based Navigation (PBN) Principles
- Minimum departure climb gradients of 6%
- CAT IIIB ILS (Instrument Landing System) to be used for final approach
- No reliance upon ground based navigation aids (DVOR)
- Design routes to ensure minimum ATC intervention, with Continuous Descent and Continuous Climb Operations
- Routes to be independent of other airports below 7,000ft

ANY QUESTIONS?

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The Design Options

We are required by the CAA to :

- Develop a comprehensive list of options to meet the Statement of Need and the design principles.
- This includes the possibility of both the 'do-nothing' and 'do-minimum' scenarios.

The do-nothing option would mean that, when the ground-based beacons are taken out of service, Air Traffic Control will need to issue individual clearances and vectors to aircraft.

- This would not be in line with the design principle Policy

The do-minimum option would involve replicating the current routes using satellite guidance to Performance Based Navigation (PBN) standard.

- This would be partially in line with the design principle Policy
- However this would not be in line with the design principle Noise N1 as it would not allow us to minimise noise or create routes that provide relief or respite from noise

We are therefore pursuing the option of change and creating a future airspace structure that responds to the design principles we have agreed.

Our Range of Options

Our future airspace departure route options are based on:

1. Aligning with all our "must have" design principles Safety, Policy and Capacity
2. Updating routes to Performance Based Navigation PBN standards
3. Identifying design envelopes around current routes where it is possible to create options
4. Creating additional envelopes where there could be a benefit
5. Designing routes within the envelopes based upon the design principles

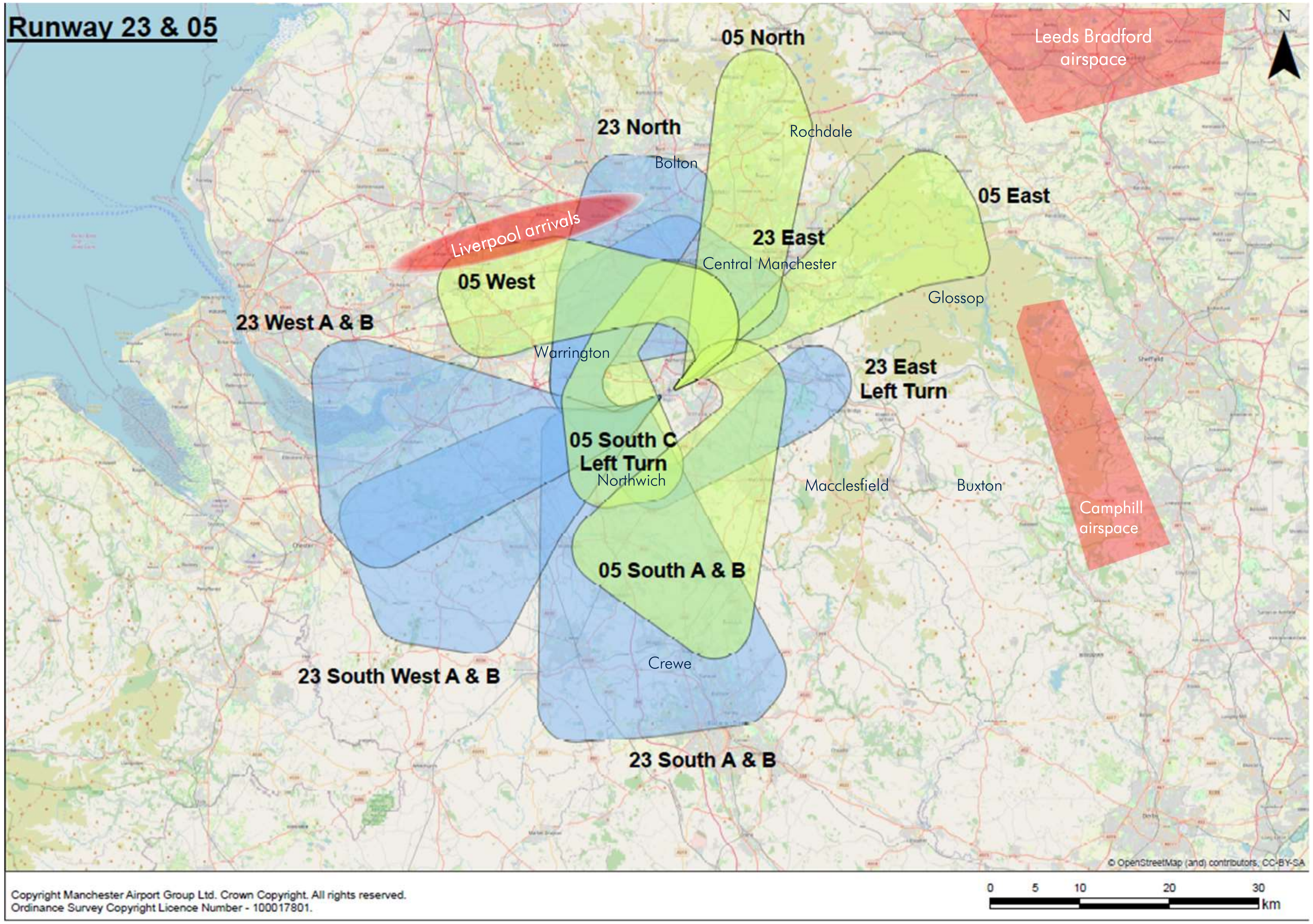
In this first phase we are taking you through points 1-4.

Your feedback will help inform point 5 which we will address in the next engagement phase.

What is a Design Envelope?

- A “swathe” or wide area of airspace that goes from the runway to 7,000ft above sea level
  - Our baseline envelopes are based on a 6% climb gradient which all airlines can fly
- Based around current routes where they exist
  - New envelopes have been created if there may be a benefit
- Based around aircraft flying Continuous Climb Departures
  - Less noise and improved fuel efficiency
- At least 8km wide (4.5nm) at 7000ft
  - This helps to provide a noise difference between the edges
- Illustrates an area within which we can design route options.

Initial Design Envelopes: Departures Options

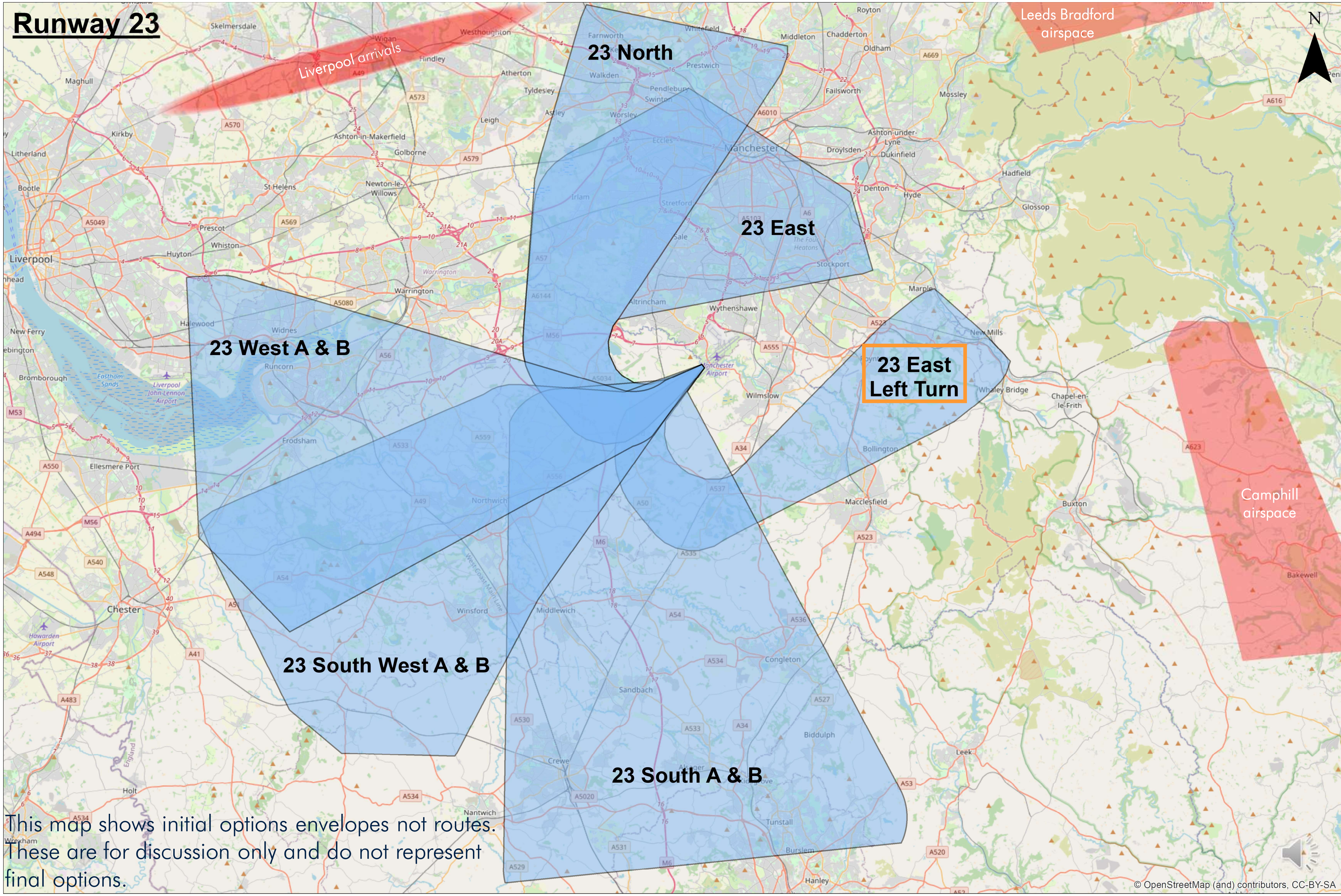


Easterly

Westerly

This map shows initial options envelopes not routes. These are for discussion only and do not represent final options.

Initial 23 Design Envelopes (Westerly Departures)



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Initial 05 Design Envelopes (Easterly Departures)

N
W E
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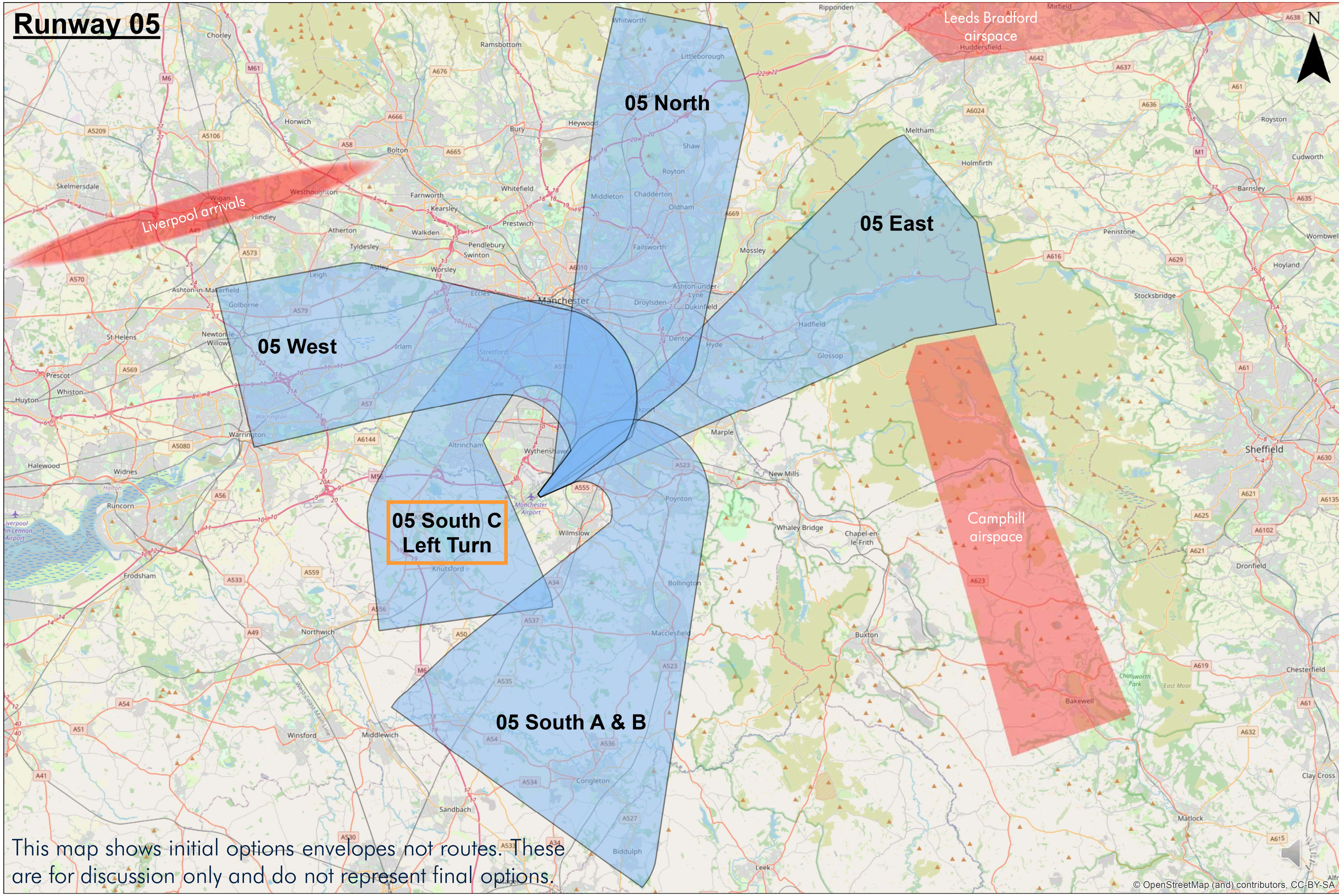

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ANY QUESTIONS?

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FEEDBACK – DEPARTURES?

Q1. Taking account of the identified constraints and design considerations, have we identified design envelopes for departures that align with the design principles?

Q2. Within the design envelopes, are there any local factors we should be aware of when designing routes?

Q3. If we were to replicate our current routes (do-minimum scenario) how could we improve them?

Q4. Is there any other feedback on the initial options of envelopes identified?

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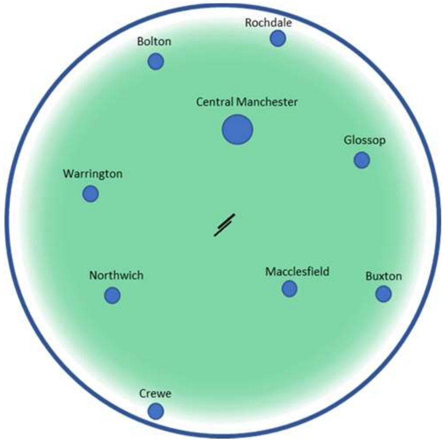
The Design Options: Arrivals Options

- Our starting points for arrivals is at 7,000ft above sea level, and we've looked at 2 main criteria for the position of these:
  - The ability to provide a Continuous Descent Approach (CDA) in line with the design principles Policy, Emissions, Noise and Technology
  - A flow of traffic that interfaces with the NATS network in line with the design principle Airspace
- The design principle Technology also requires us to use the latest technology
  - Our arrivals will therefore be based on Performance Based Navigation (PBN)
  - These remove the need for significant vectoring by air traffic control
  - PBN routes would result in less dispersed aircraft tracks than currently
- The theoretical areas where arrivals could descend from 7,000ft were shown earlier but we've also built in some constraints.



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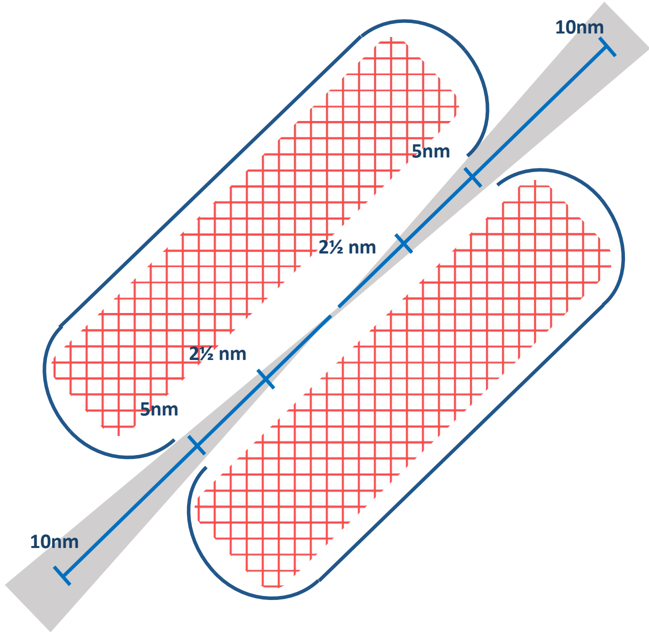
Applying Design Principles to Arrivals

- The design principle Safety requires us to design to industry standards and regulations.
- These provide guidance on the joining point onto final approach and create an area within which we can't design an arrival procedure
  - This is because of safety rules on turn radius, speed and the minimum height for final approach
- Similarly the design principle Policy requires us to consider 2 documents:
  - The Air Navigation Guidance 2017 and the CAA Airspace Modernisation Strategy (AMS)
- Both highlight the use of Continuous Descent Approaches as a means to reduce the environmental impact of arriving aircraft
  - Our arrivals designs will therefore provide continuous descents to both runway ends to meet the design principle Policy



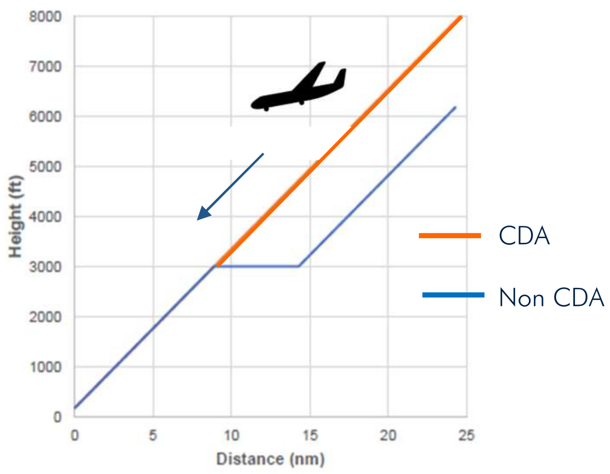
What are Continuous Descent Approaches?

- Continuous Descent Approaches (CDA) involve arriving aircraft using minimum thrust and avoiding prolonged level flight.

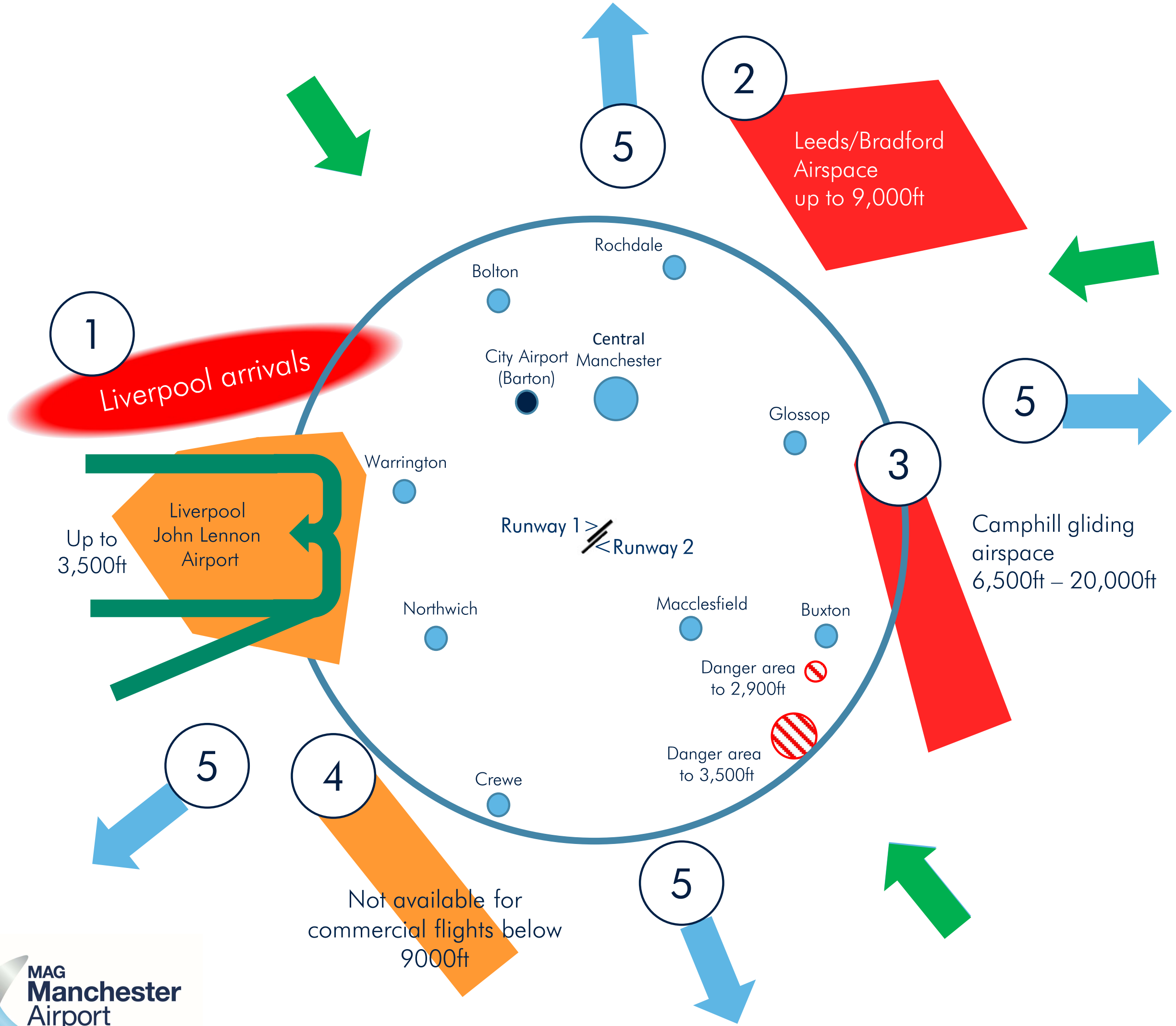
- The objective of a CDA is to reduce the environmental impact of the arrival by:
  - Reducing noise (**Noise N1**)
  - Minimising CO_2 (**Emissions**)

- There is a range of descent gradients for a CDA which will provide benefits
  - The optimal is between around 3½% and 5¼%
  - Below this may require engine power, creating noise
  - Above this may result in air brakes being needed, which also create noise

- We've therefore created a design area for arrivals that provides a CDA within this optimal range
  - This equates to an arrival track of between 25-32 miles from 7,000ft



The Design Options – Arrivals Constraints



Key

- Airspace constraints
- Airspace considerations
- Danger areas
- NATS Upper Airspace Network - traffic flows Blue outbound and Green inbound

1. Liverpool arrivals area
2. Leeds airspace to the NE
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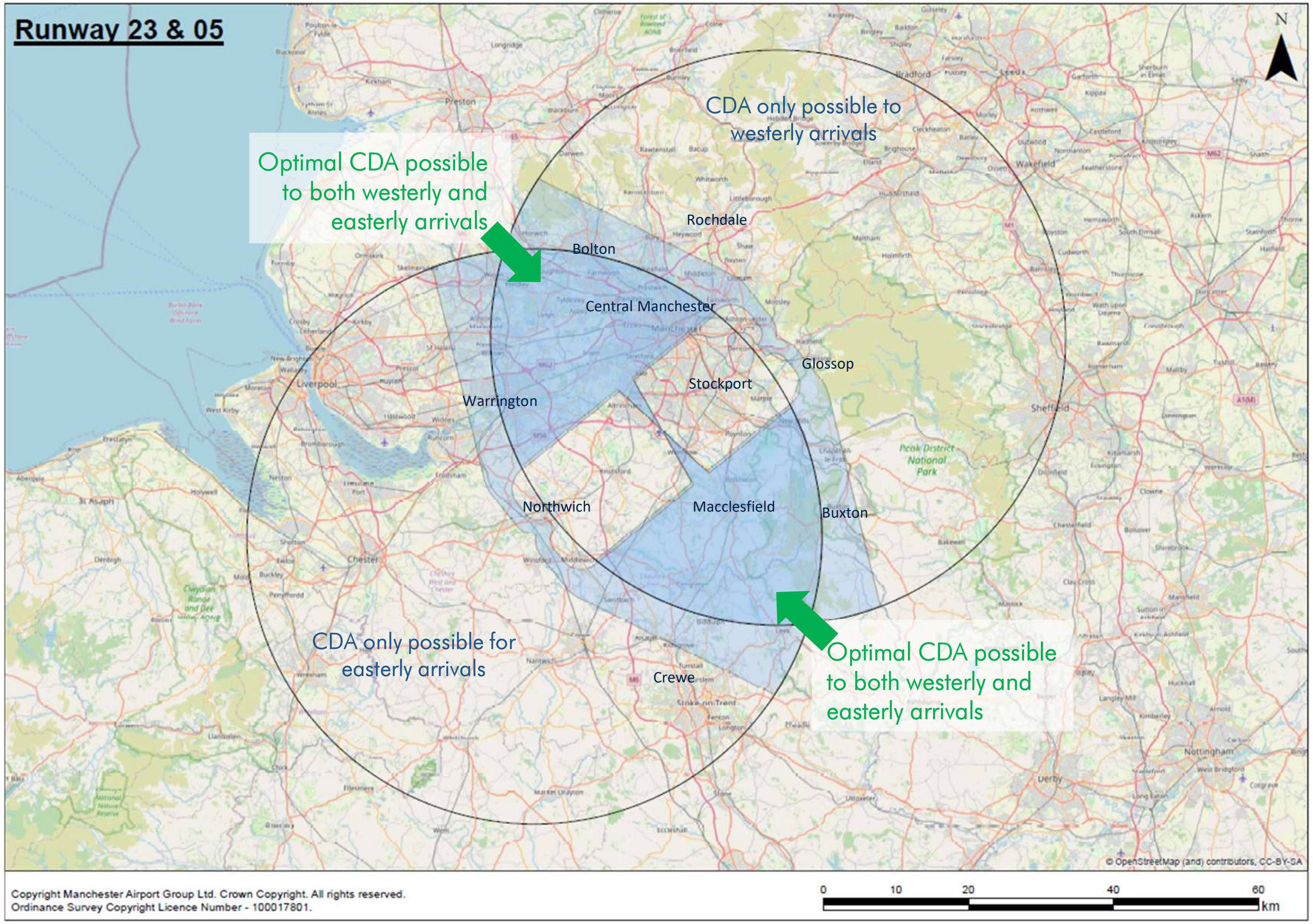
Arrivals Design Area – Initial Arrival Design Envelopes



This map show initial options envelopes not routes. These are for discussion only and do not represent final options.

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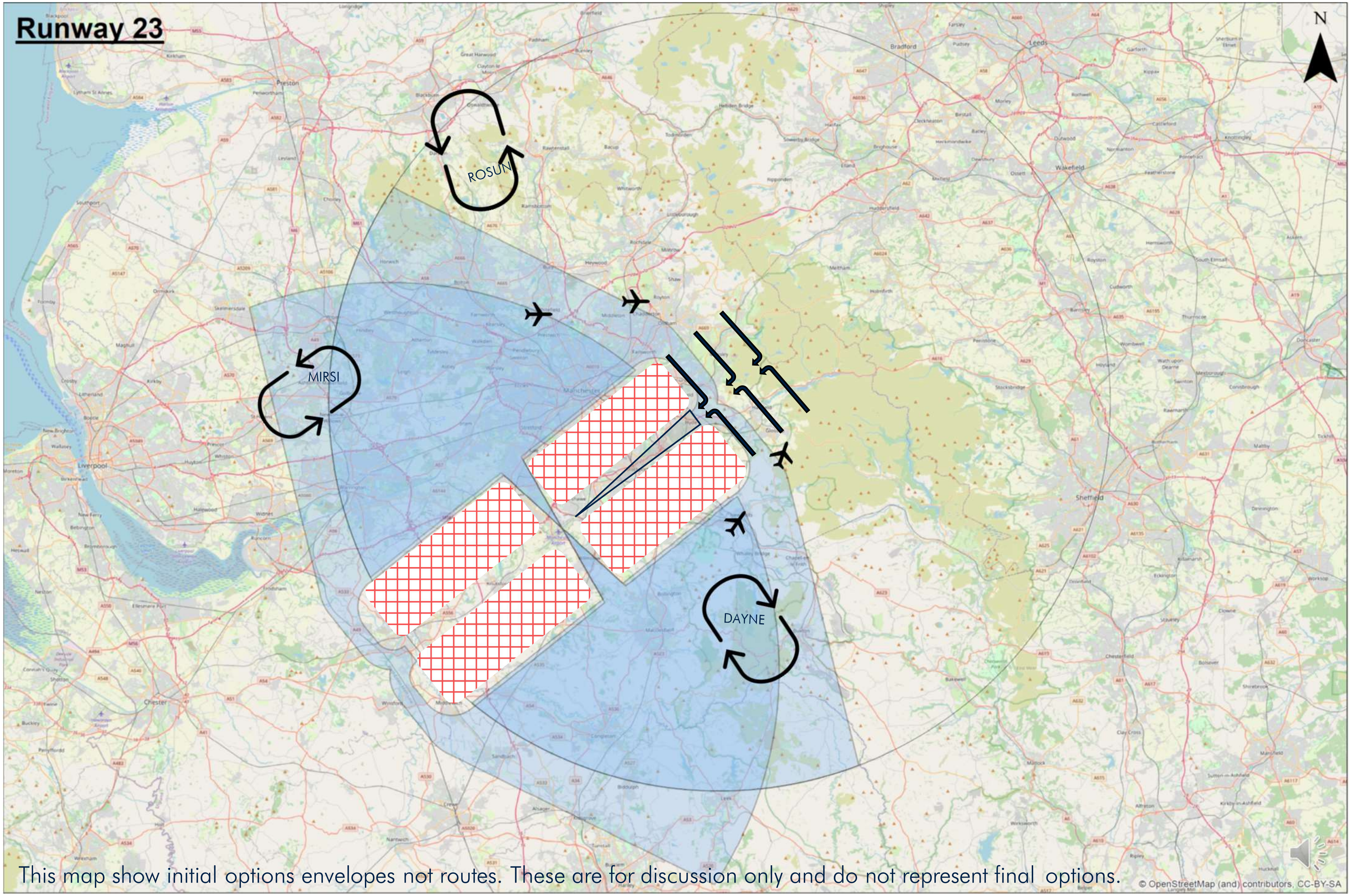
Initial Arrival Design Envelopes, Runway 23 –Westerlies



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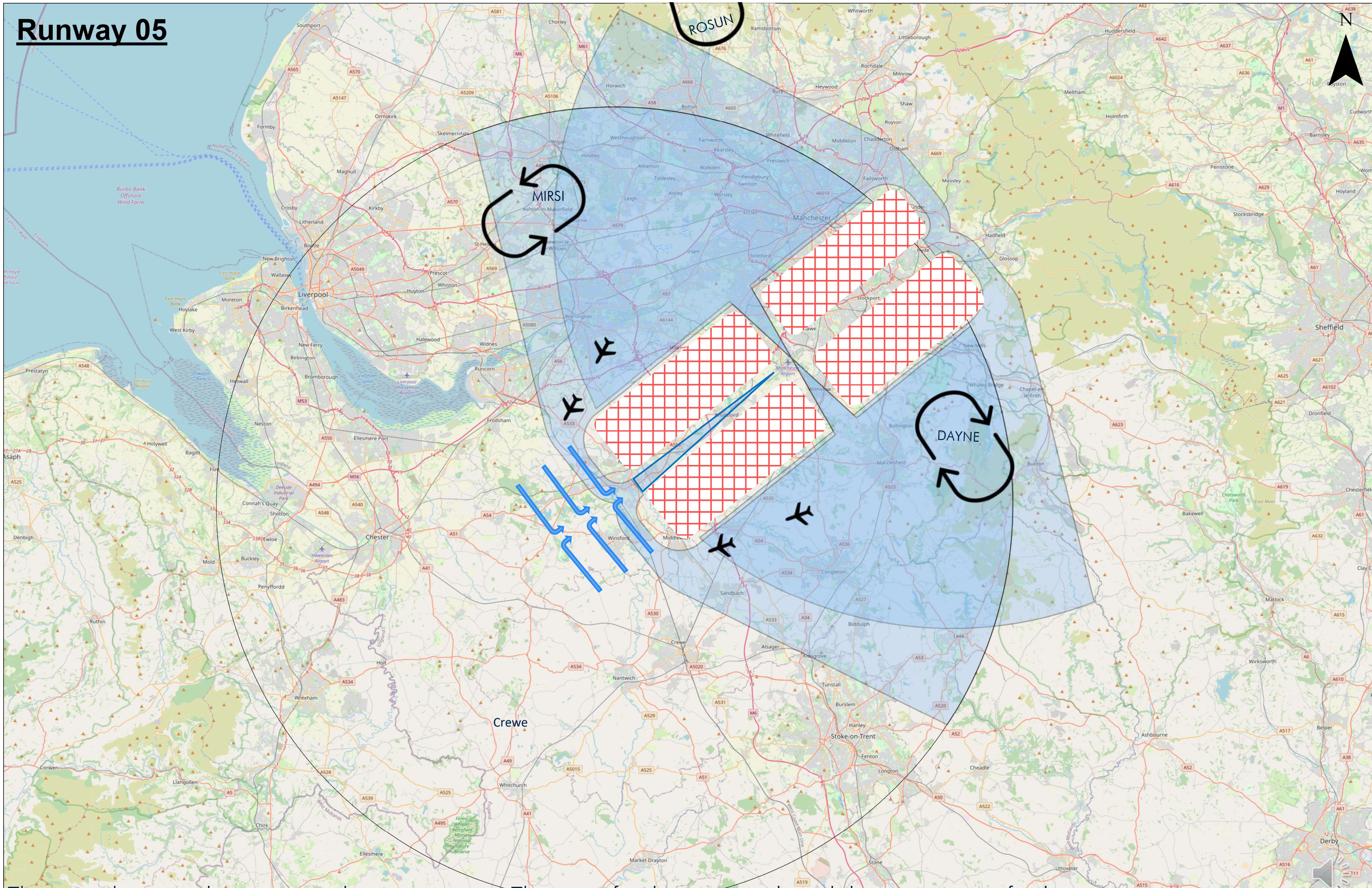
Initial Arrival Design Envelopes, Runway 05 –Easterlies



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ANY QUESTIONS?

FEEDBACK – ARRIVALS?

Q1. Taking account of the identified constraints and design considerations, have we identified design envelopes for arrivals that align with the design principles?

Q2. Within the identified areas, are there any local factors we should be aware of when designing options for the position of the arrival route?

Q3. Is there any other feedback on the initial options of envelopes identified?

Q4. Are there any comments/feedback on the do-nothing scenario? If we were to replicate our current routes (do-minimum scenario), how could we improve them?

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NEXT STEPS

Please send any additional feedback to

futureairspace@manairport.co.uk

by 17:00 hrs on Friday 10th December 2021

Manchester Airport Future Airspace

Glossary

November 2021

MAG Manchester Airport

Glossary

Term	Definition
Airspace Change Organisation Group (ACOG)	A newly established body set up by the Government and the CAA to co-ordinate airspace-change projects across airports and upper airspace.
Airspace Modernisation Strategy (AMS)	The CAA's strategy and plan for the use of UK airspace, including the modernisation of airspace.
Air Traffic Control (ATC)	Air traffic control make sure aircraft fly safely within airspace, often issuing commands to aircraft to climb, descend or turn.
Air traffic movement (ATM)	An air transport movement is a landing or take-off of an aircraft operating a scheduled or non-scheduled service
Above Sea Level (ASL)	When this is stated, the measure of altitude given is above mean sea level. Runway 1 is 256 ft and Runway 2 is 235 ft above sea level.
Civil Aviation Authority (CAA)	The industry's regulator.
CAP1616	The CAA's guidance document which sets out the regulatory process which all airspace change proposals must follow.
Climb profile	The rate at which to increase height by distance travelled.
Concept of Operations (CONOPS)	Document describing how we want our airspace system to work. Acts as a guide to our airspace designers.
Continuous Descent Approach (CDA)	Method by which arriving aircraft descend on a smooth continuous glide path, therefore staying higher above the ground for longer and reducing the level of arrival noise heard on the ground.
Design envelopes	Broad areas where it may be appropriate for us to place routes for arriving and departing aircraft.

Design Principles (DP's)	High level considerations that will guide the development of our route options. Manchester Airport has nine design principles that were developed through stakeholder engagement as part of Step 1B of the airspace change programme.
Future Airspace Strategy Implementation North (FASI-N)	Group accountable for delivering airspace changes (includes airports and NERL (NATS En Route)) in the north of Britain.
Holding stack	If an approach delay is expected instructions may be given to enter a holding pattern or 'Stack'. Aircraft in the holding pattern circle at different heights around a central point until the way is clear for them to be guided into sequence for landing. Aircraft in the stack are separated vertically by 1,000 feet. The lowest level of the stack is 6,000 feet. There are three Stacks in use at Manchester Airport, DAYNE, MIRSI, and ROSUN.
International Civil Aviation Organisation (ICAO)	A United Nations organisation responsible for international standards for civil aviation, including the rules for route design.
Instrument Landing System (ILS)	A precision runway approach aid based on two signals which provide vertical and horizontal guidance to aircraft on approach to land.
NATS	The UK's air traffic navigation service provider, formerly known as National Air Traffic Services.
NERL	NATS (En Route) Public Limited Company. The sole provider of air traffic control services for aircraft flying 'en route' in UK airspace and the eastern part of the North Atlantic.
Preferred Noise Route (PNR)	Lines of tolerances widen from the runway ends out to 1½ Kilometres to each side of the Standard Instrument Departure route (see below). The area encompassed by these 1½ Kilometre tolerances is that commonly recognised as the Preferred Noise Route (PNR).
PAN-OPS 8168 – Procedures for Air Navigation Services	ICAO document which defines the rules for designing approach and departure procedures.
Performance Based Navigation (PBN)	Satellite based navigation system designed to improve track keeping accuracy for aircraft.

Respite	Planned periods where overflight or noise impact are reduced or halted for the purpose of providing communities with periods of undisturbed time.
Standard Instrument Departure (SID)	In common with other large airports aircraft departing from Manchester are directed to fly Standard Instrument Departures (SID's). A SID is a series of navigational instructions, laid out with a diagram and text that simplify departure. These simplify the departure process by providing the pilot and/or the aircraft's computer system with several waypoints and a climb profile (the rate at which to increase height by distance travelled) they need to follow to make sure they accurately follow the SID and remain safe.
Statement of Need	A statement setting out the airspace issue or opportunity that a sponsor seeks to address and what it hopes to achieve. Change sponsors are required to submit this to the CAA at Step 1A of the airspace change programme. Manchester Airport submitted a Statement of Need in March 2019.
Vectoring	Navigational guidance given to aircraft by air traffic control in the form of specific directional headings.