MANCHESTER AIRPORT FUTURE AIRSPACE

Stage 2 – Develop and Assess
Comprehensive route options discussion

November & December 2021

MAG Manchester Airport

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.

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.

Stage 2 Develop and assess

Steps 2A & 2B
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.

Stage 3 Consult

Steps 3A, 3B, 3C & 3D
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.

Stage 4 Update and submit

Steps 4A & 4B
Taking the stakeholder feedback received during Stage 3 into account, we will finalise our Airspace Change Proposal and send it to the CAA .

Stage 5 Decide

Step 5A & 5B
It will be for the CAA to decide on whether to approve any airspace change.

Stage 6 Implement

Step 6
If approved, any airspace change would then need time for Air Traffic Control training before coming in to force.

Stage 7 Post-implementation review

Step 7
The CAP1616 process gives the CAA and airports 12 months to review any change that has been made to airspace.

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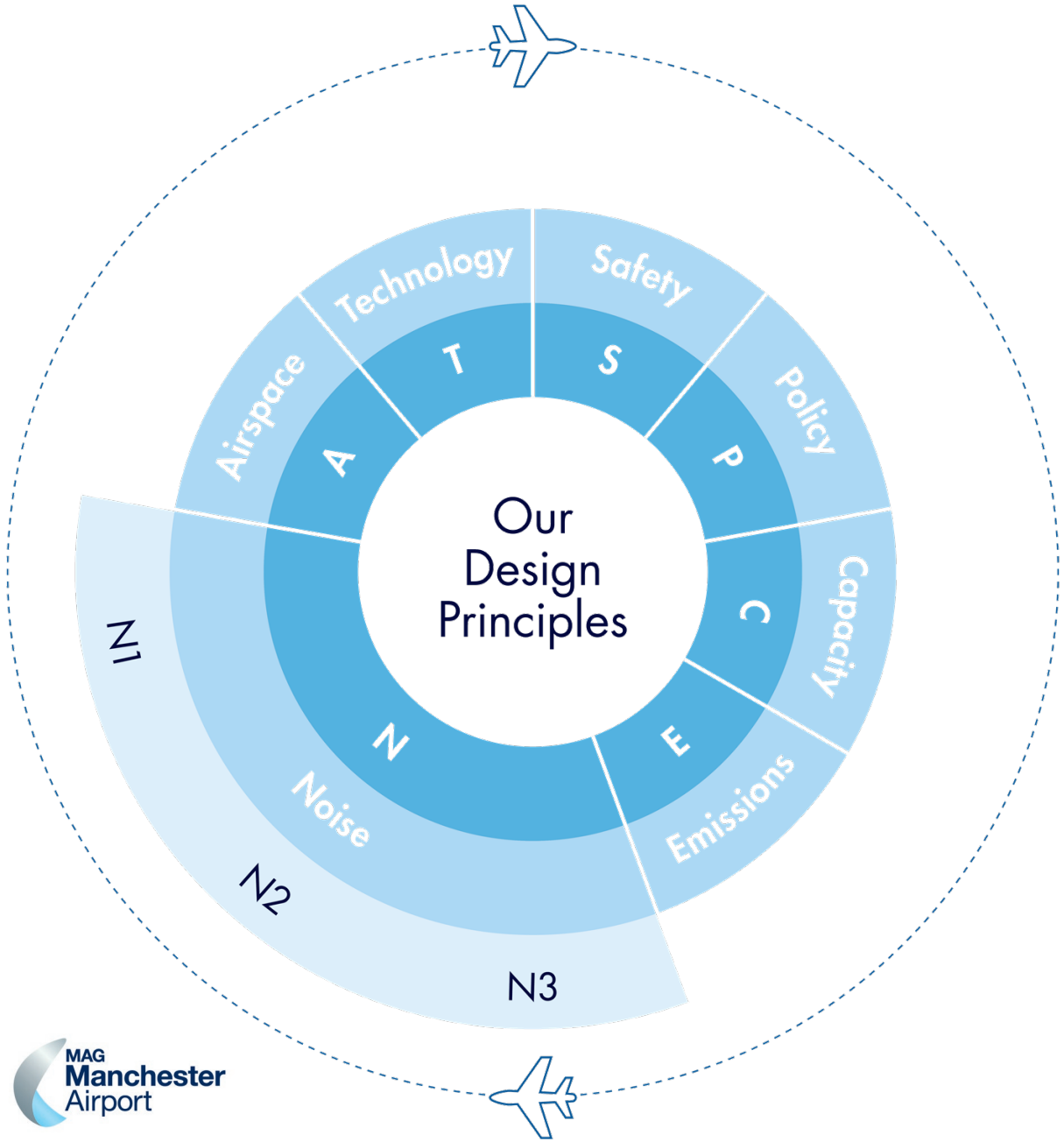
All future dates are provisional pending CAA approval and alignment with the wider Airspace Modernisation Strategy

Step 1B – Our Design Principles



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.

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Stage 2 Process – Gathering Views

We are here

Step 2A
1
Engagement one - Sharing the design envelopes

Step 2A
2
Feedback considered, routes developed

Step 2A
3
Engagement two – sharing route designs and design principles assessment

Step 2A
4
Feedback considered, options further developed

Step 2B
5
Initial options appraisal

November – December

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.

January - March 2022

Taking account of feedback, design envelopes will be considered further, and specific route options will be developed.

March – April 2022

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.

May 2022

Taking account of feedback, options will be refined further.

June – July 2022

The 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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HOW AIRCRAFT CURRENTLY ARRIVE AND DEPART

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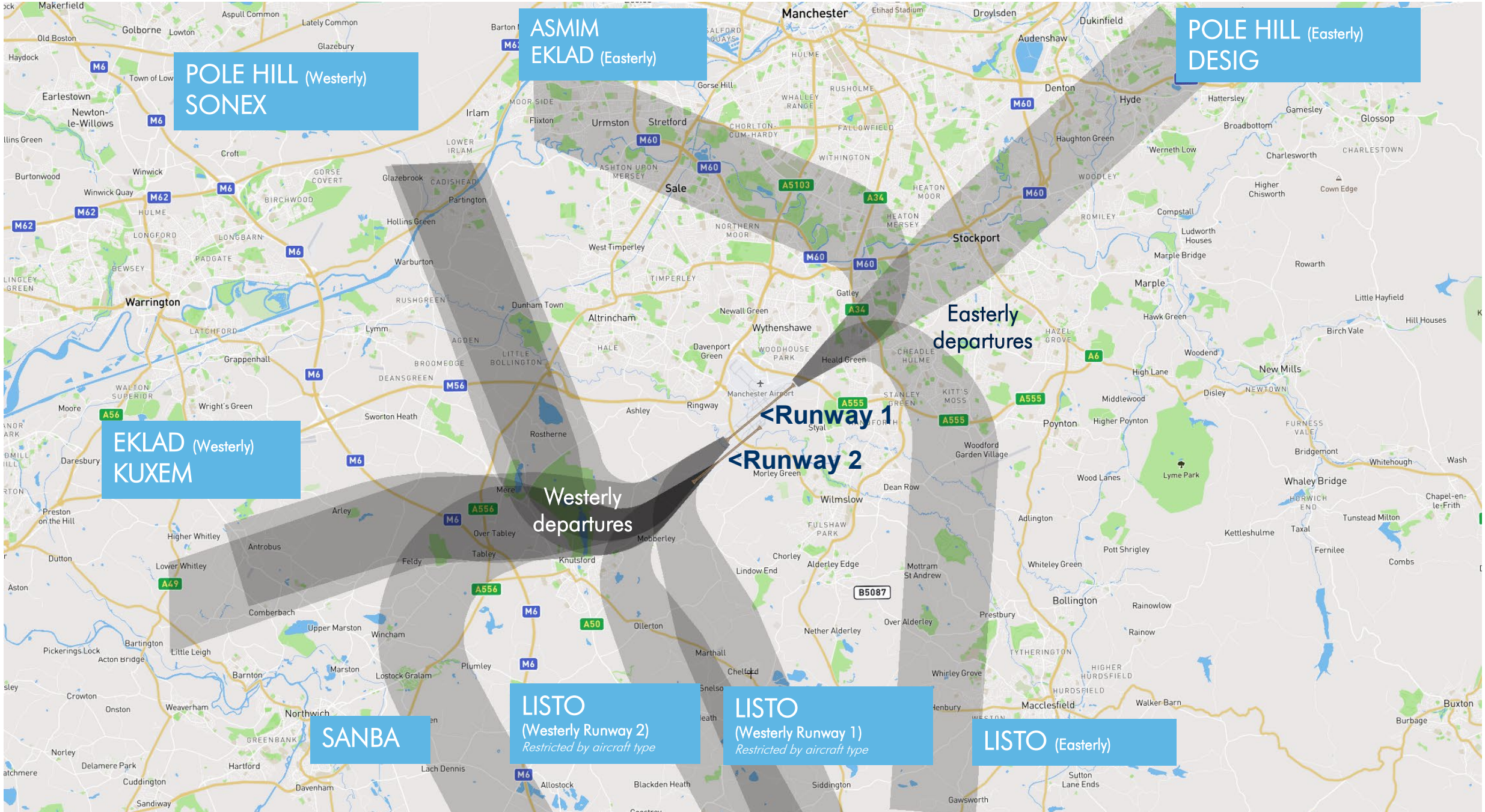
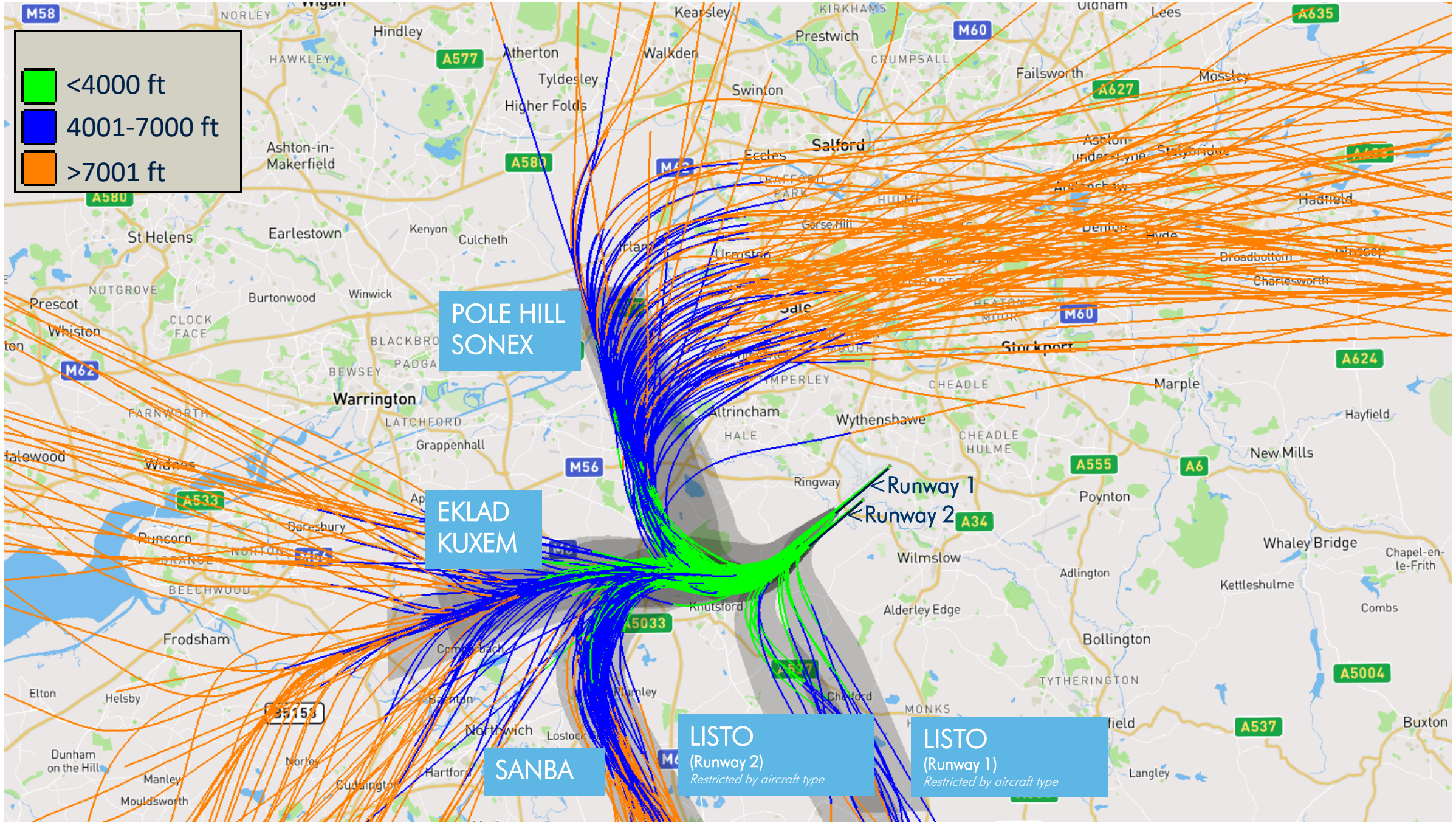
Manchester Airport Standard Instrument Departures (SIDs)



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



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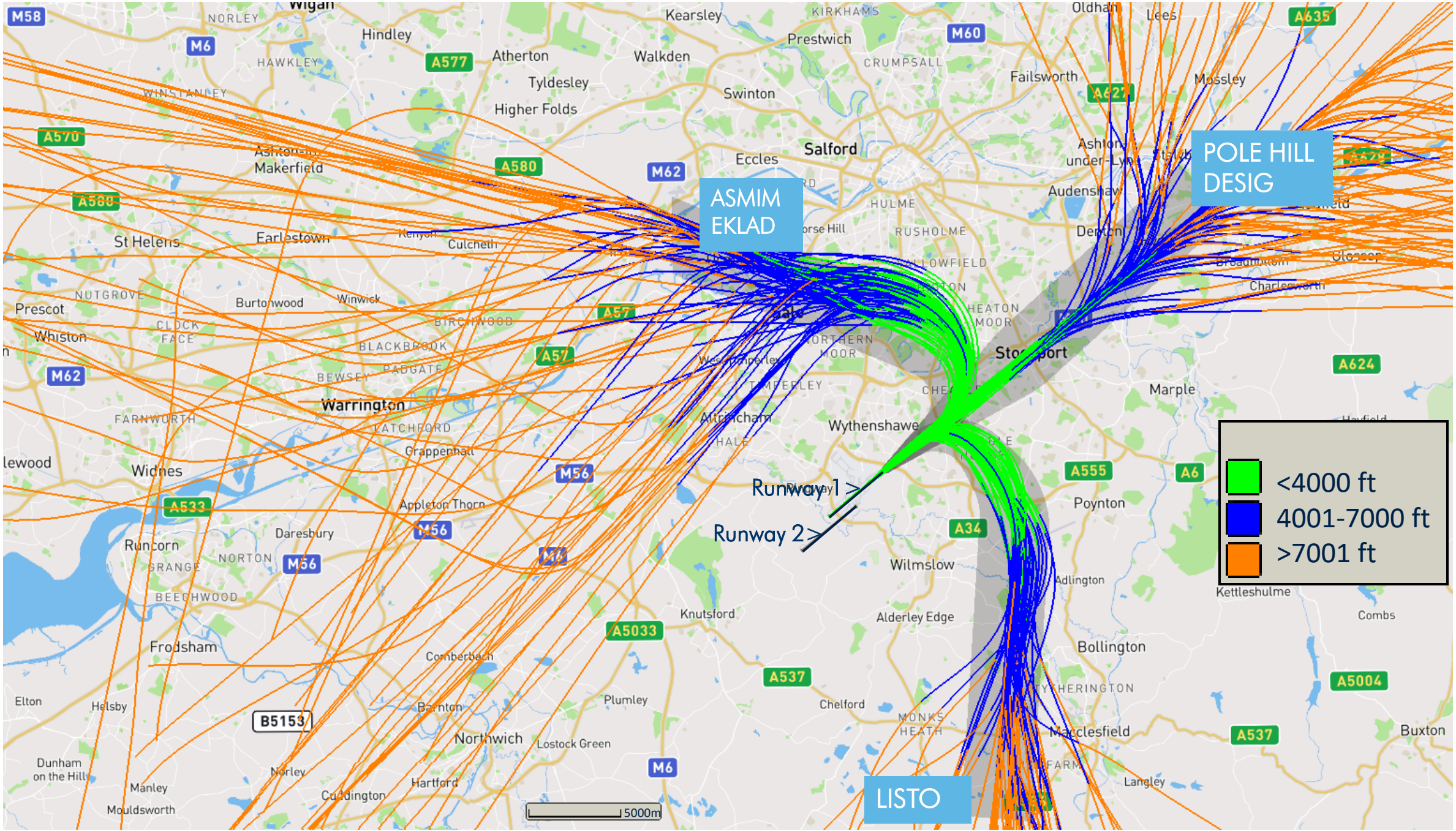

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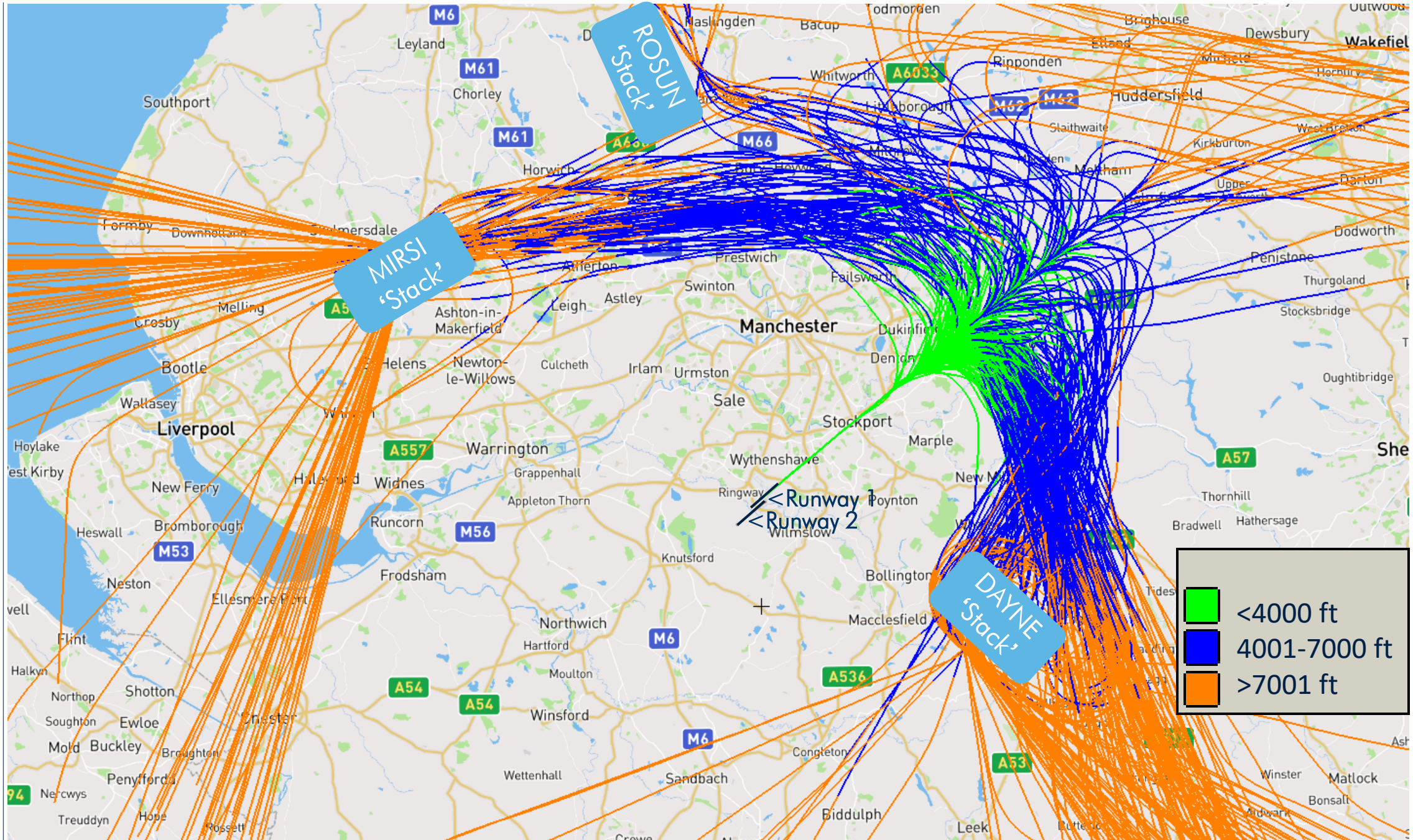

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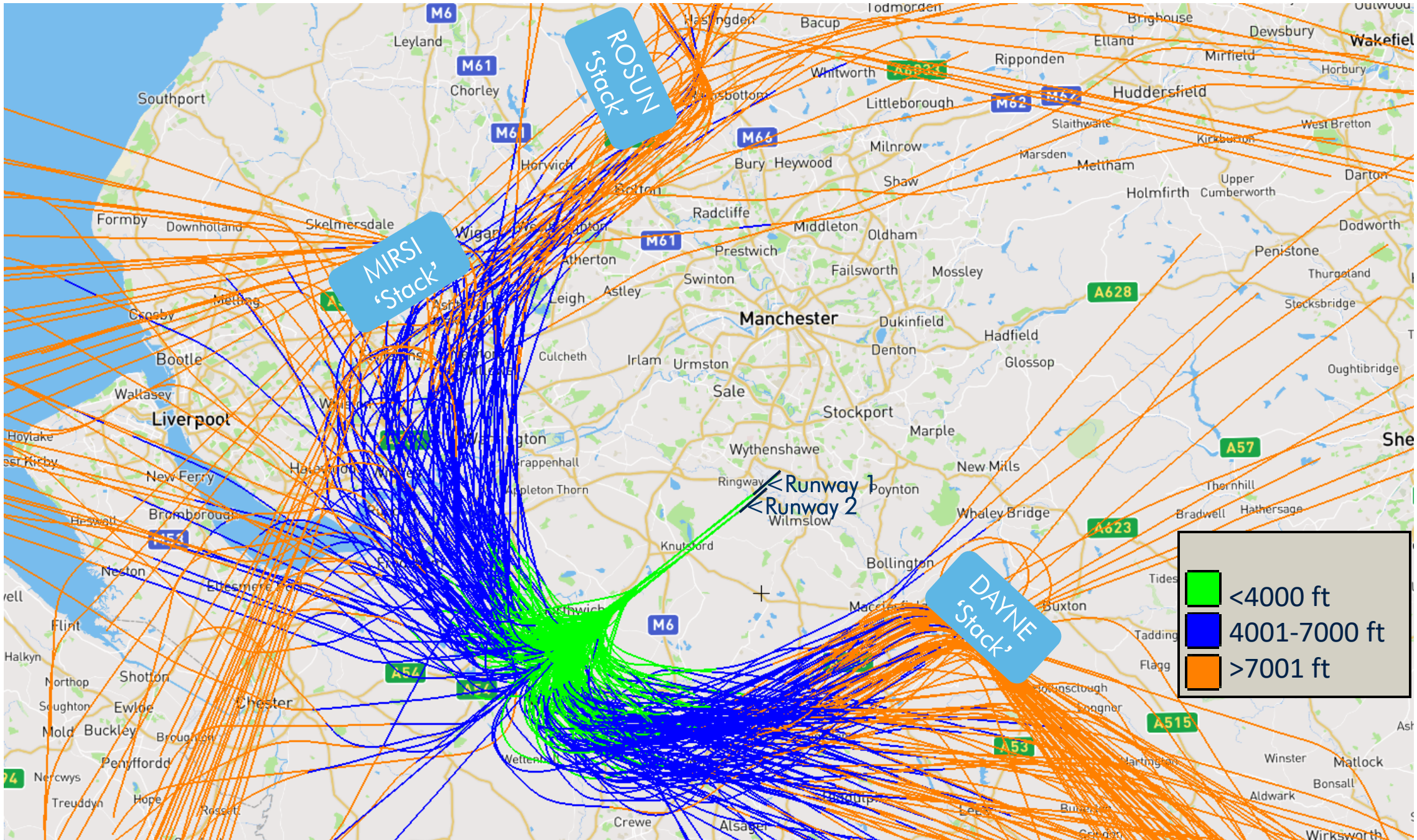

DEVELOPING A COMPREHENSIVE LIST OF OPTIONS

Andy Sampson

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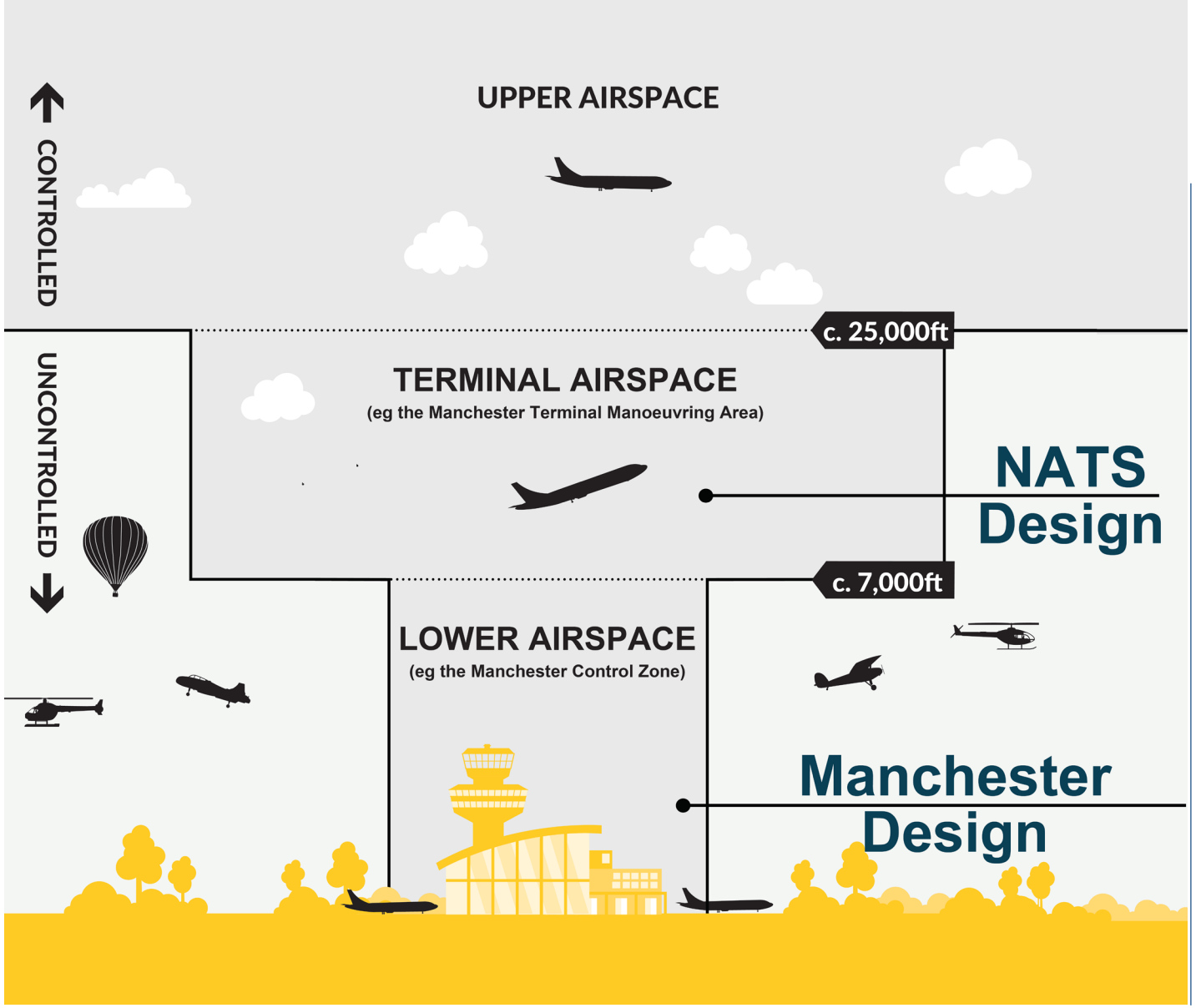
What is Airspace?



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.

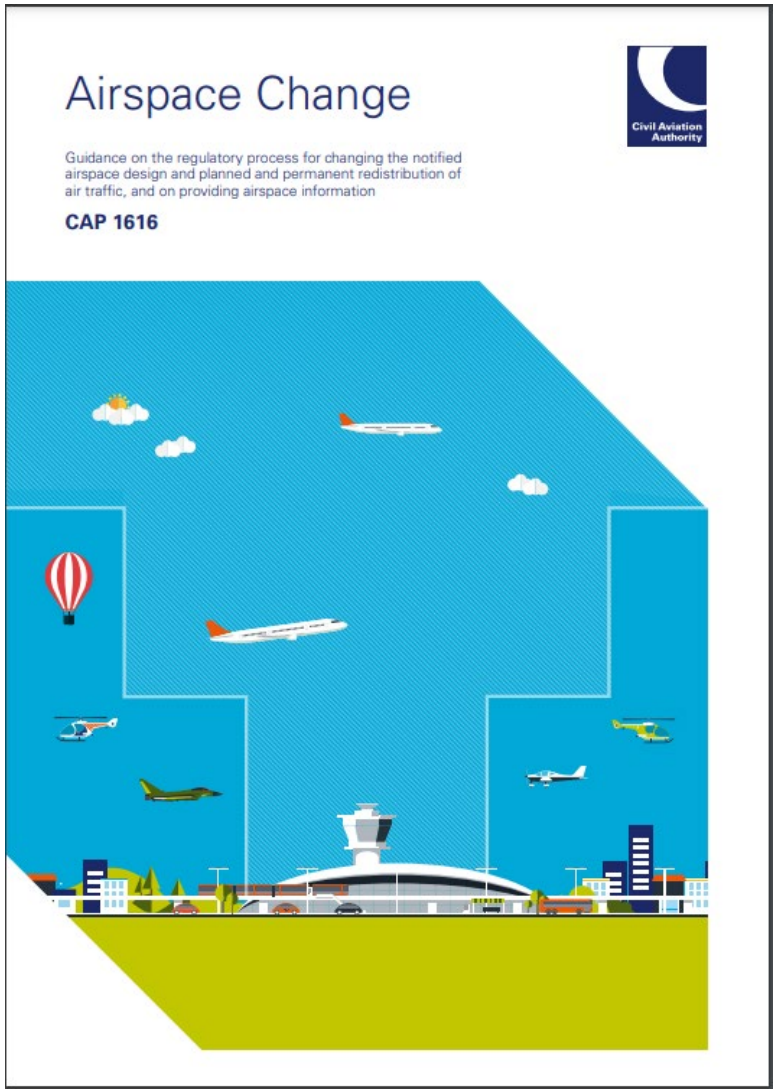
Each Departure route option has two points which define the start and finish of each route

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



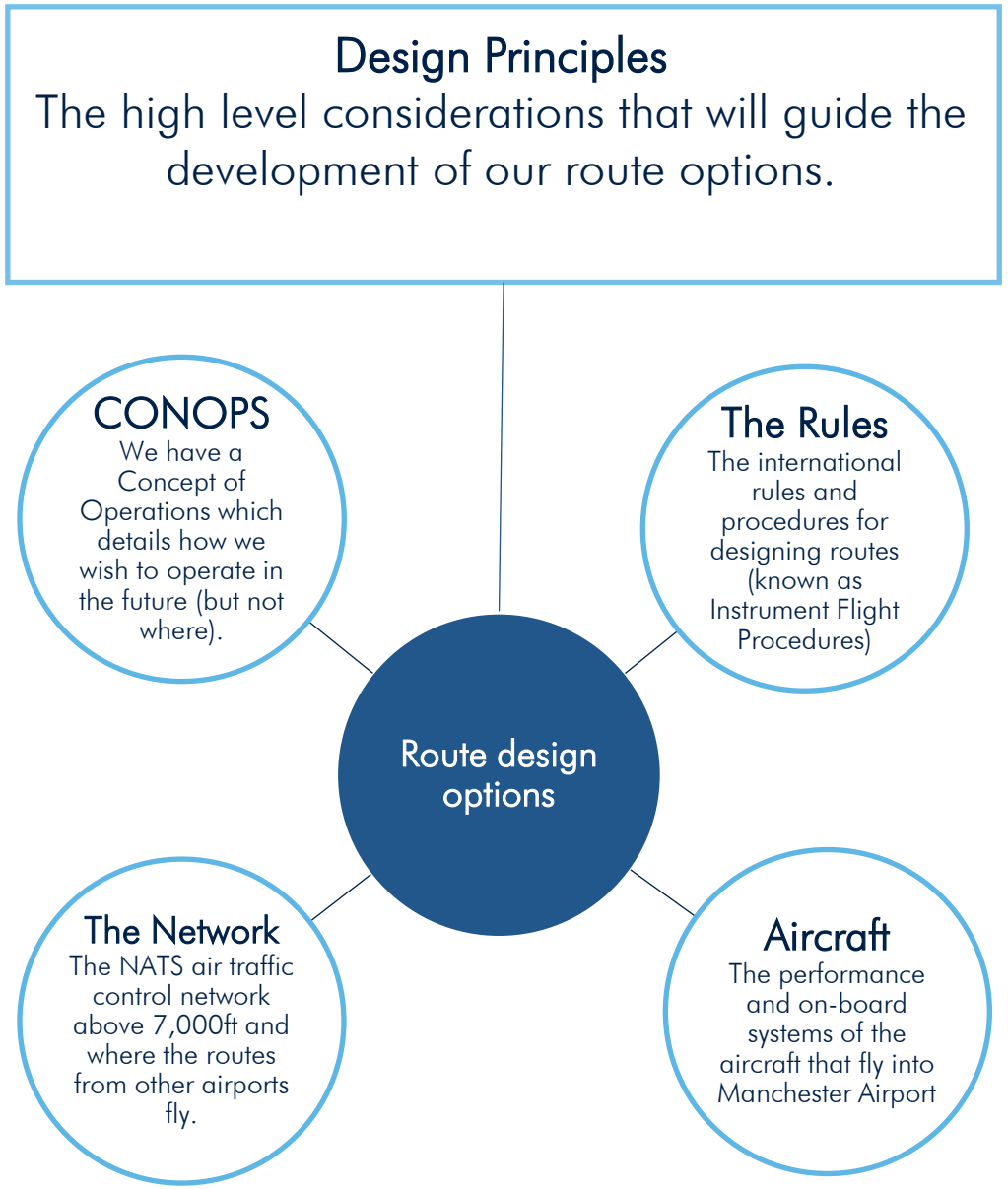
Route Design Considerations

Our route options need to take several things into consideration.

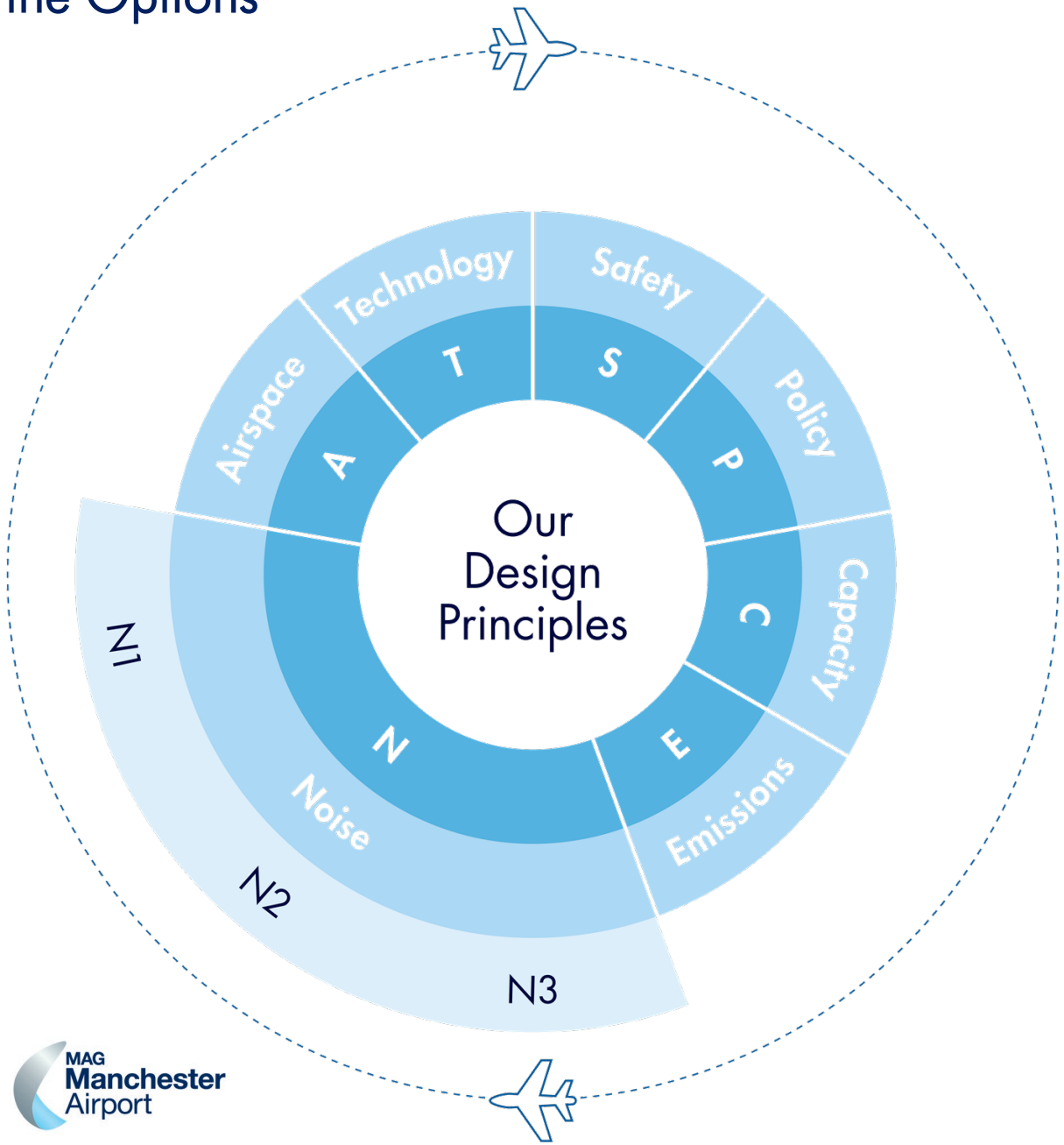
Each of the considerations aligns with our agreed design principles and contribute to our design in a different way;

- 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

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 our 'Policy' design principle requires us to align with.

Design Consideration – Aircraft

Airspace Technology

Design Principle

Our Technology principle 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:

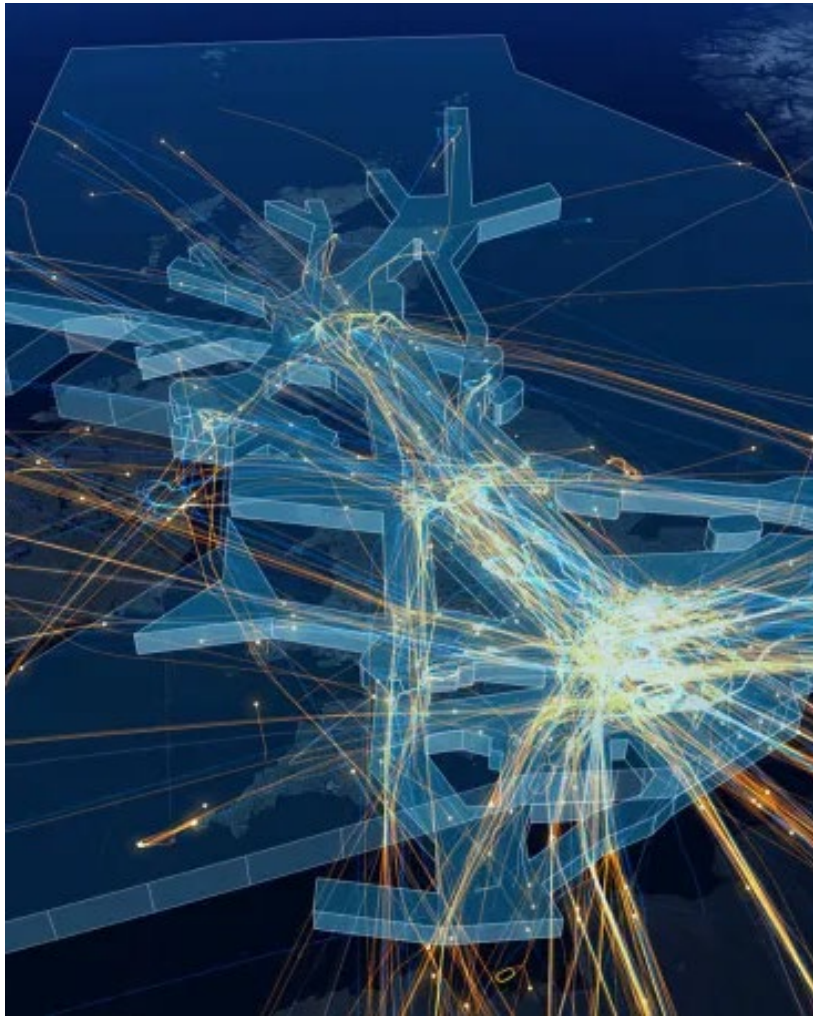
- All aircraft can use the more accurate Performance Based Navigation (PBN) technology
- Departing aircraft can all climb at a rate that is above the PANS OPS minimum

Design Consideration – The NATS Network

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 our design principles on 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



Manchester Airport Future Airspace - Stage 2, Develop and Assess

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Design Consideration – The CONOPS

Design principle

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.

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

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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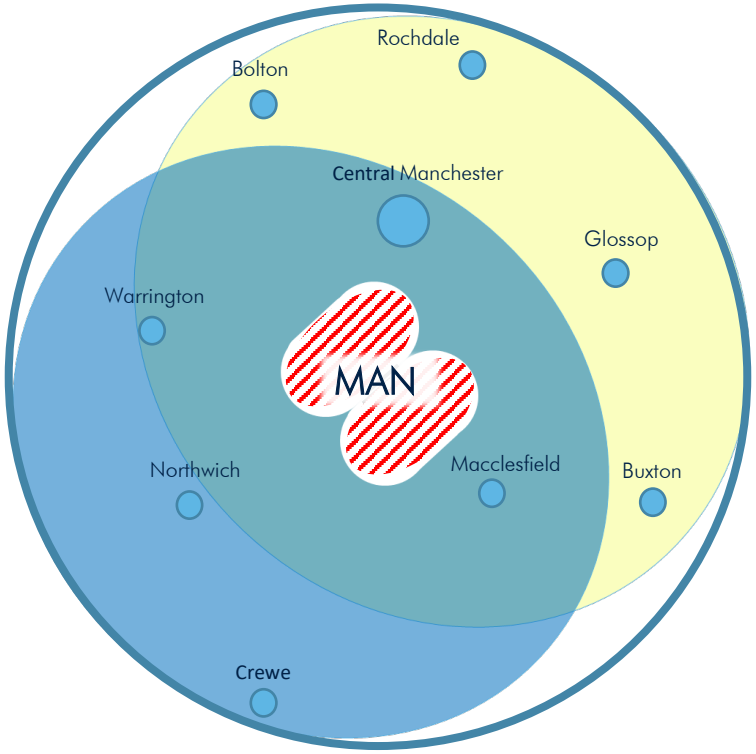
Step 1– The Boundary for Departures

Area where Westerly departures can be designed to 7,000ft

Area where Easterly departures can be designed to 7,000ft

Area where departure routes can't be designed



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

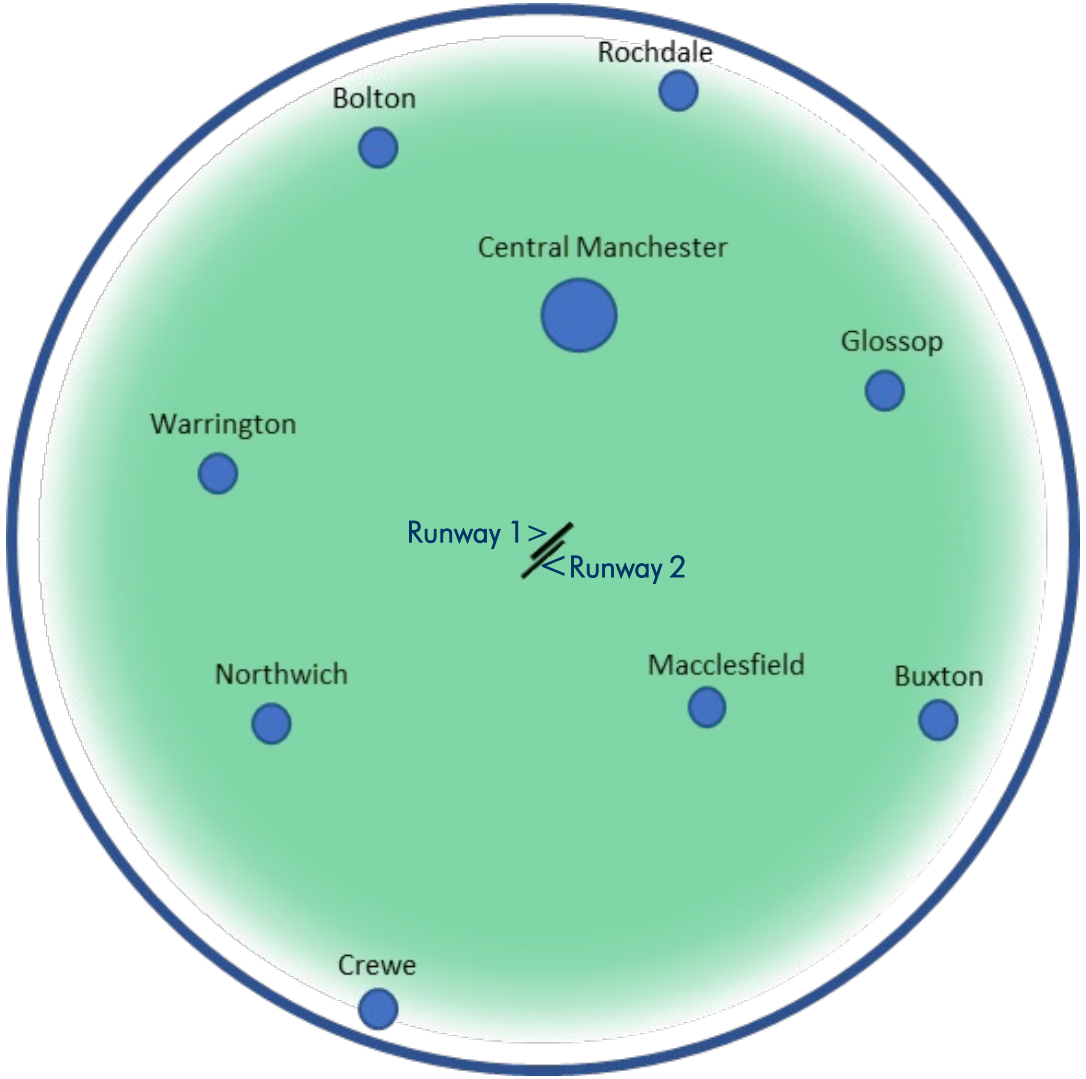
- From the Fleet Survey we know all aircraft can climb at a gradient of at least 6%
- We need to understand when an aircraft would reach 7,000ft above sea level based on this gradient

This establishes the outer blue line and aligns with the Technology (T) design principle 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 Policy, Emissions, Noise and Technology DPs, all arrivals should facilitate Continuous Descent Approach (CDA) from 7,000ft above sea level.

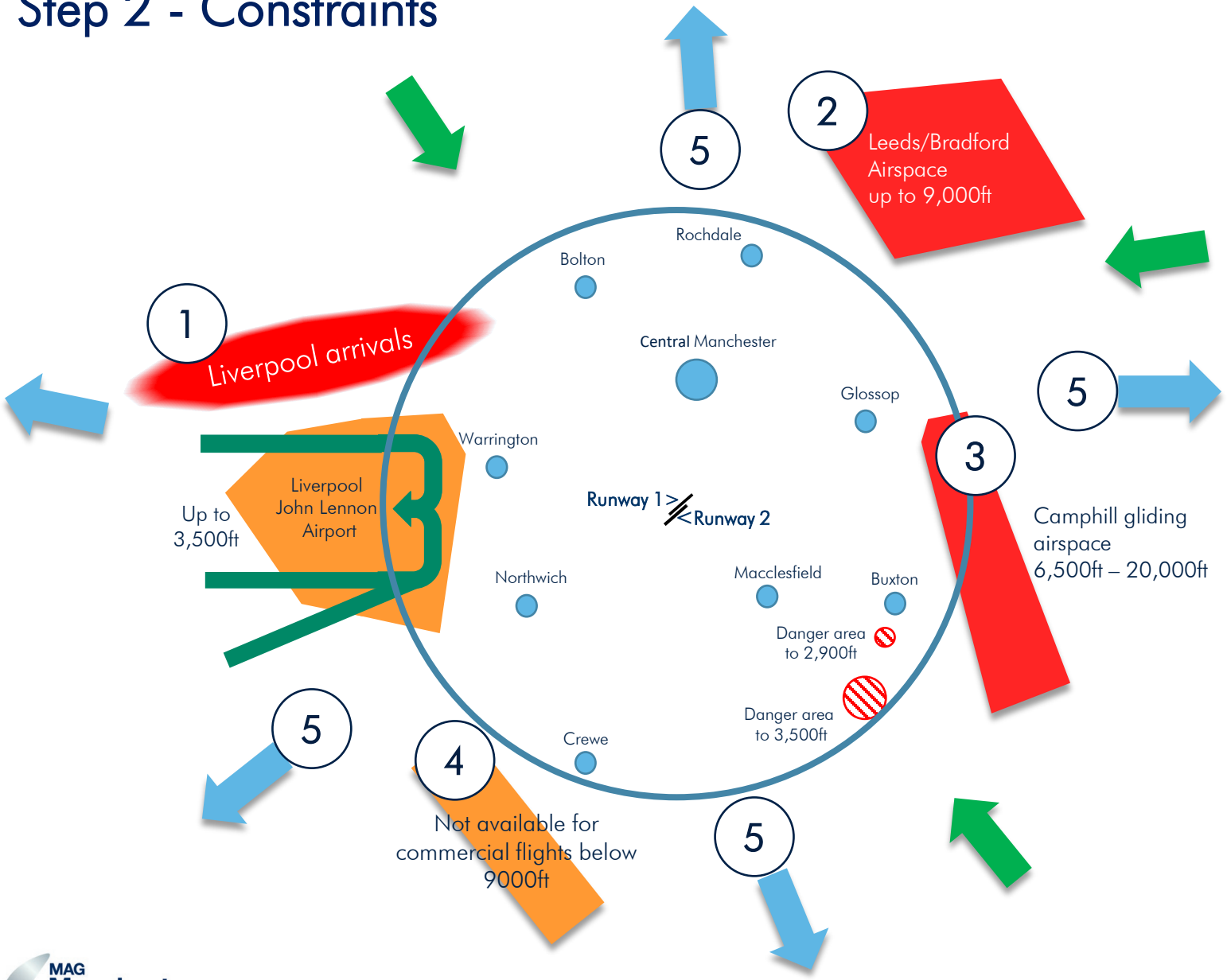
- These are both more fuel efficient and reduce noise

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

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
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- CAT IIIB ILS (Instrument Landing System) to be used for final approach
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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 Principle.
- 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 Principles on Policy and is therefore not being pursued an option

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

Because it is not consistent with our design principles, this is not being pursued as an option

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 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

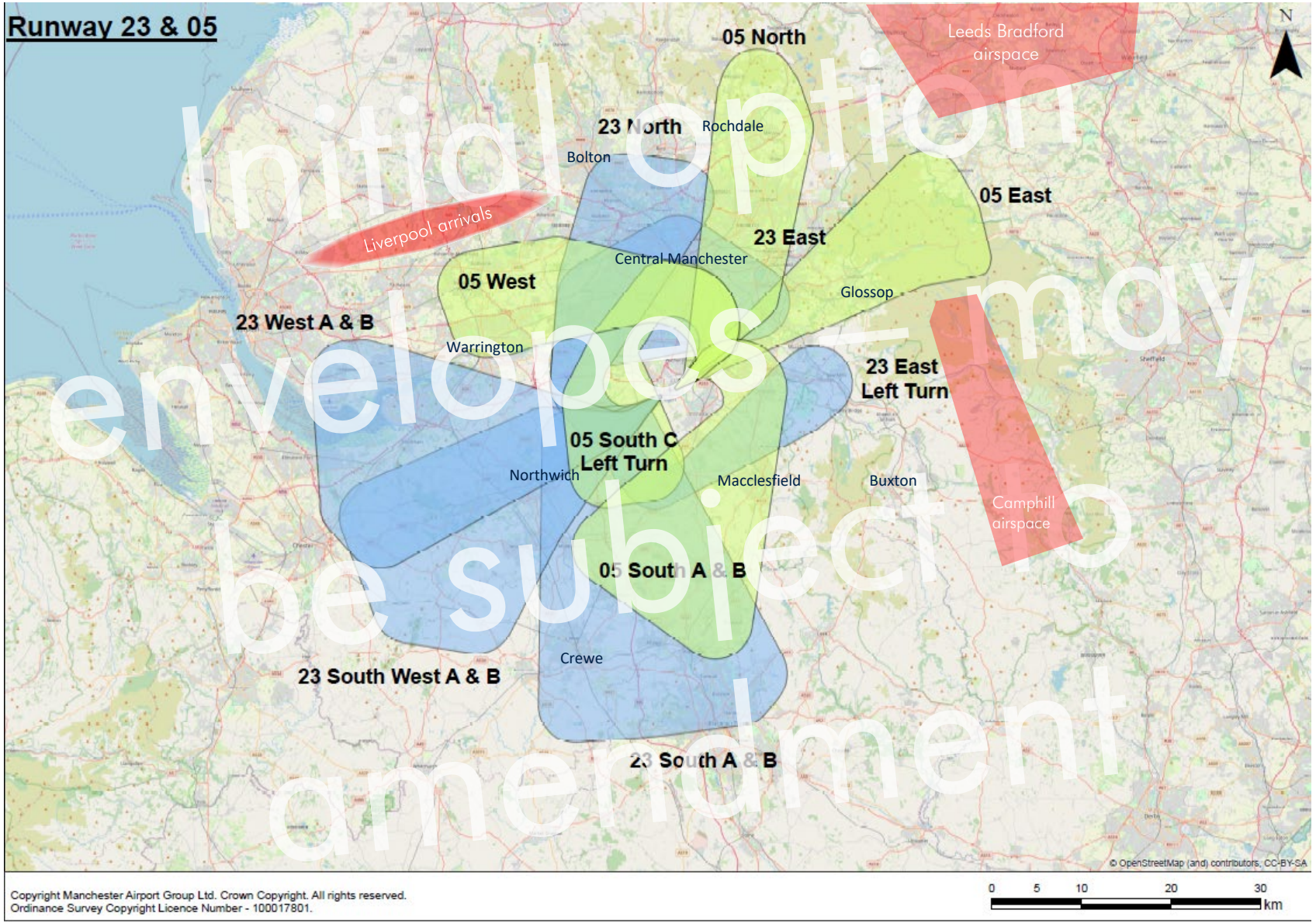
In this first phase we are taking you through points 1-4.

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



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

Easterly

Westerly

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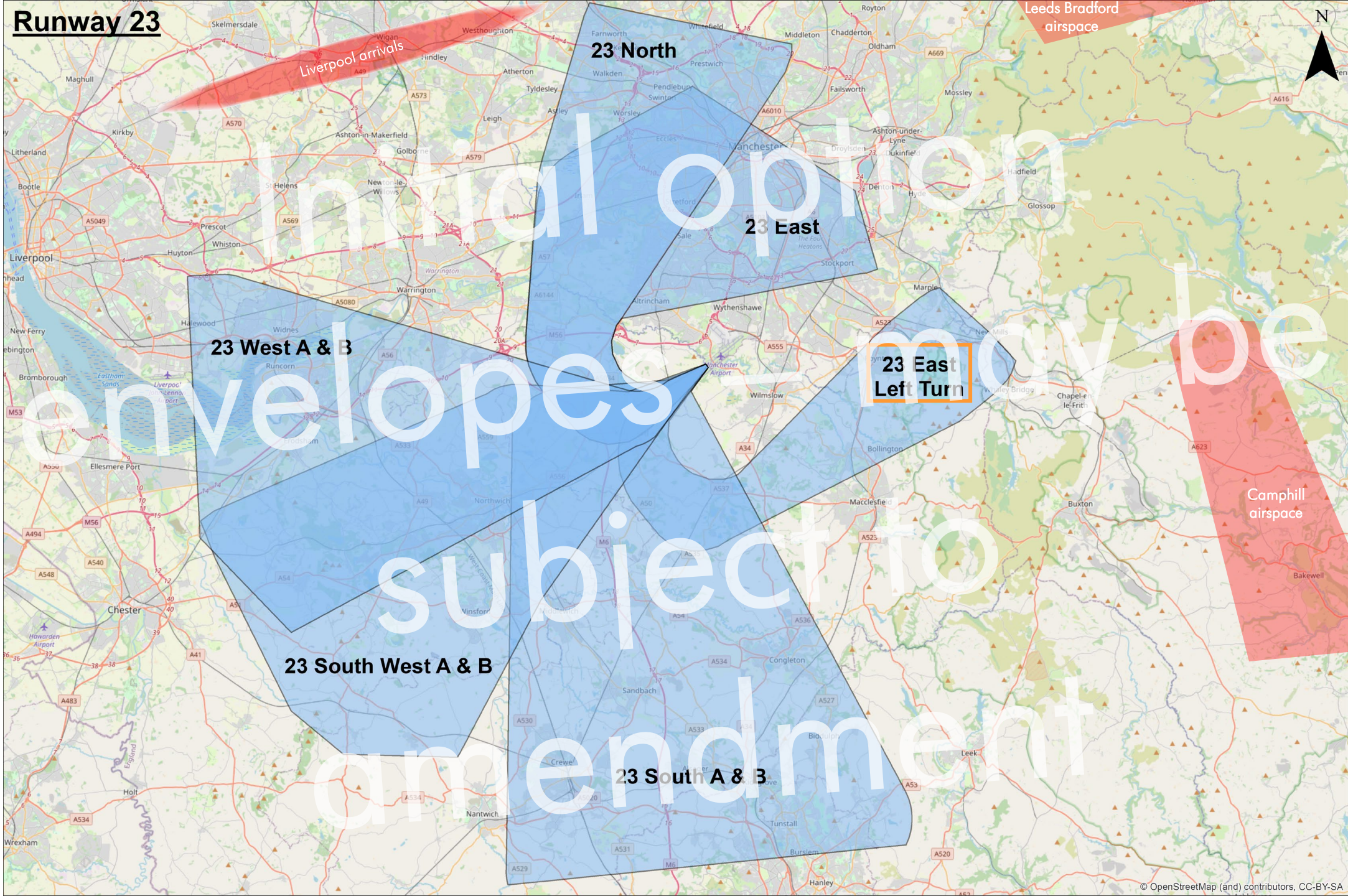
Initial 23 Design Envelopes (Westerly Departures)



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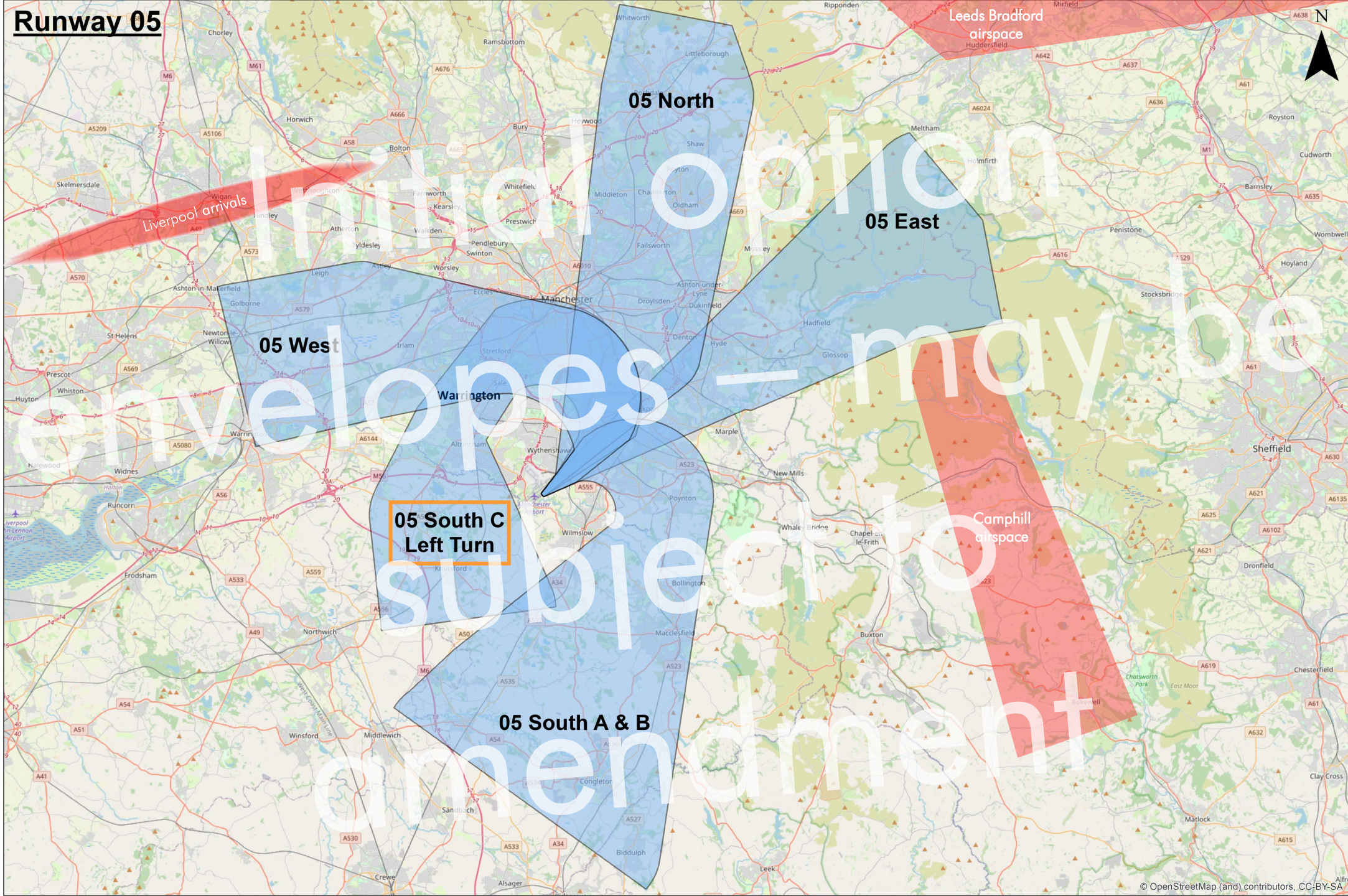
Initial 05 Design Envelopes (Easterly Departures)



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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 our 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?

Provide your answers at: https://forms.office.com/r/iNCwBydhmN

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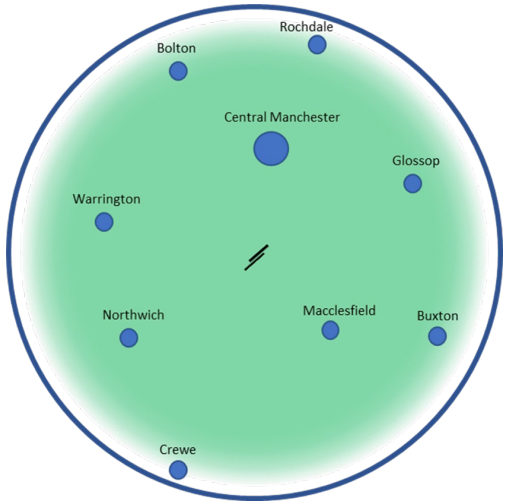
The Design Options: Arrivals Options

- 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 our Policy, Emissions, Noise and Technology DPs
  - A flow of traffic that interfaces with the NATS network in line with the Airspace DP
- The Technology design principle 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.



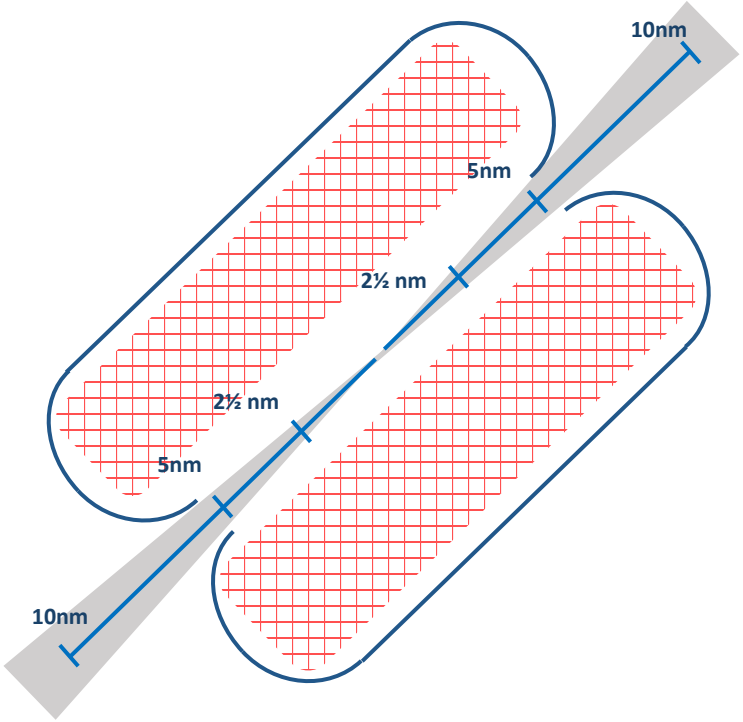
Applying Design Principles to Arrivals

- The **Safety** DP 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 **Policy** DP 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 this Policy design principle



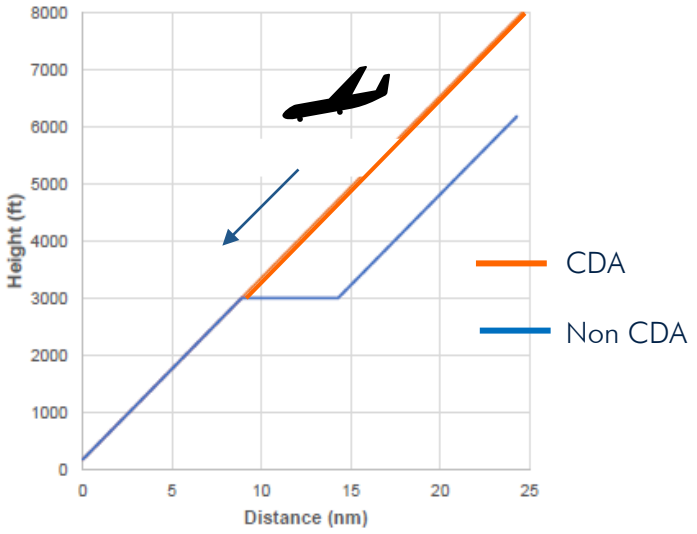
What are Continuous Descent Approaches?

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

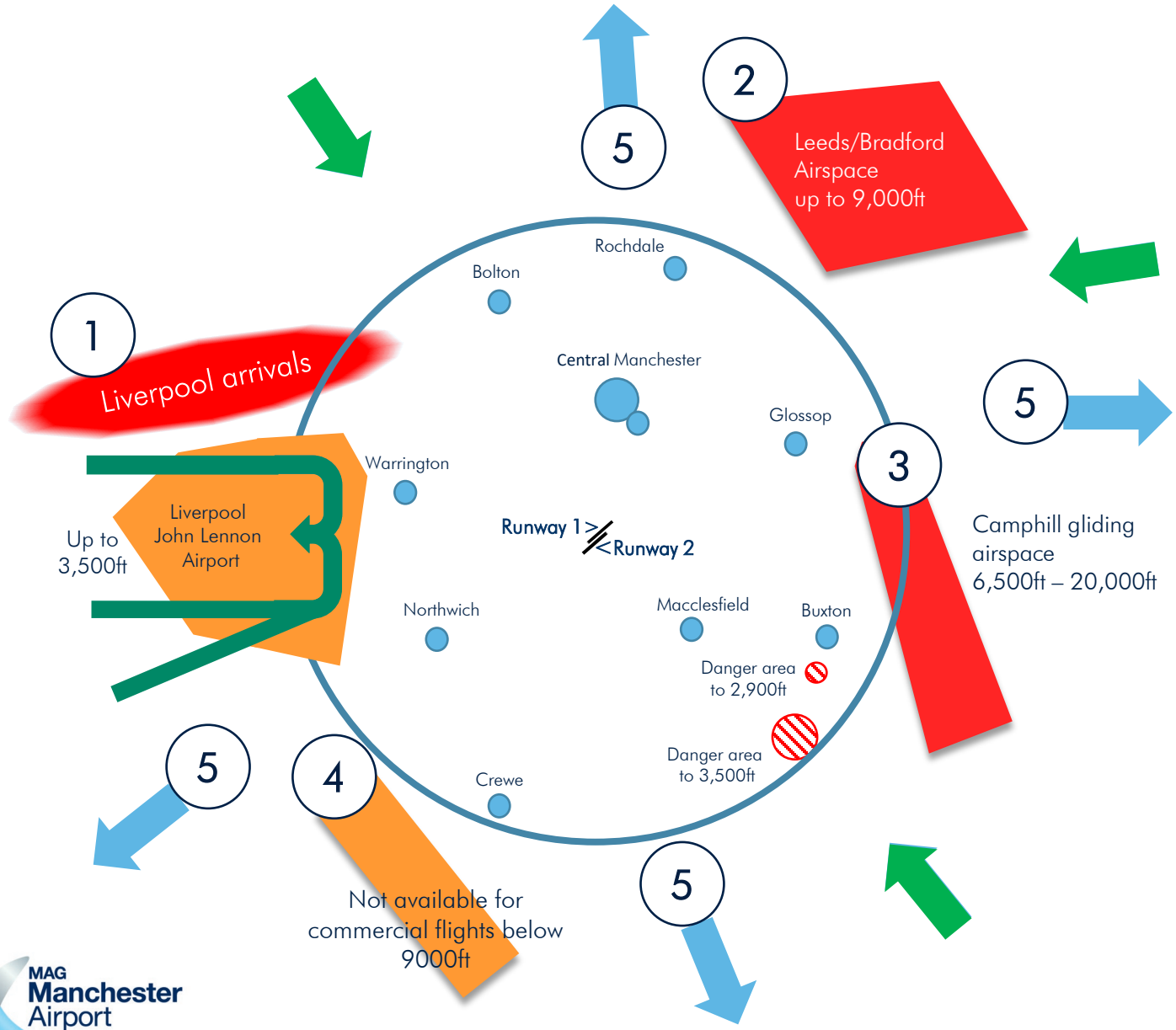
- The objective of a CDA is to reduce the environmental impact of the arrival by:
  - Reducing noise (**Noise N1**)
  - Minimising CO_2 (**Emissions**)

- 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



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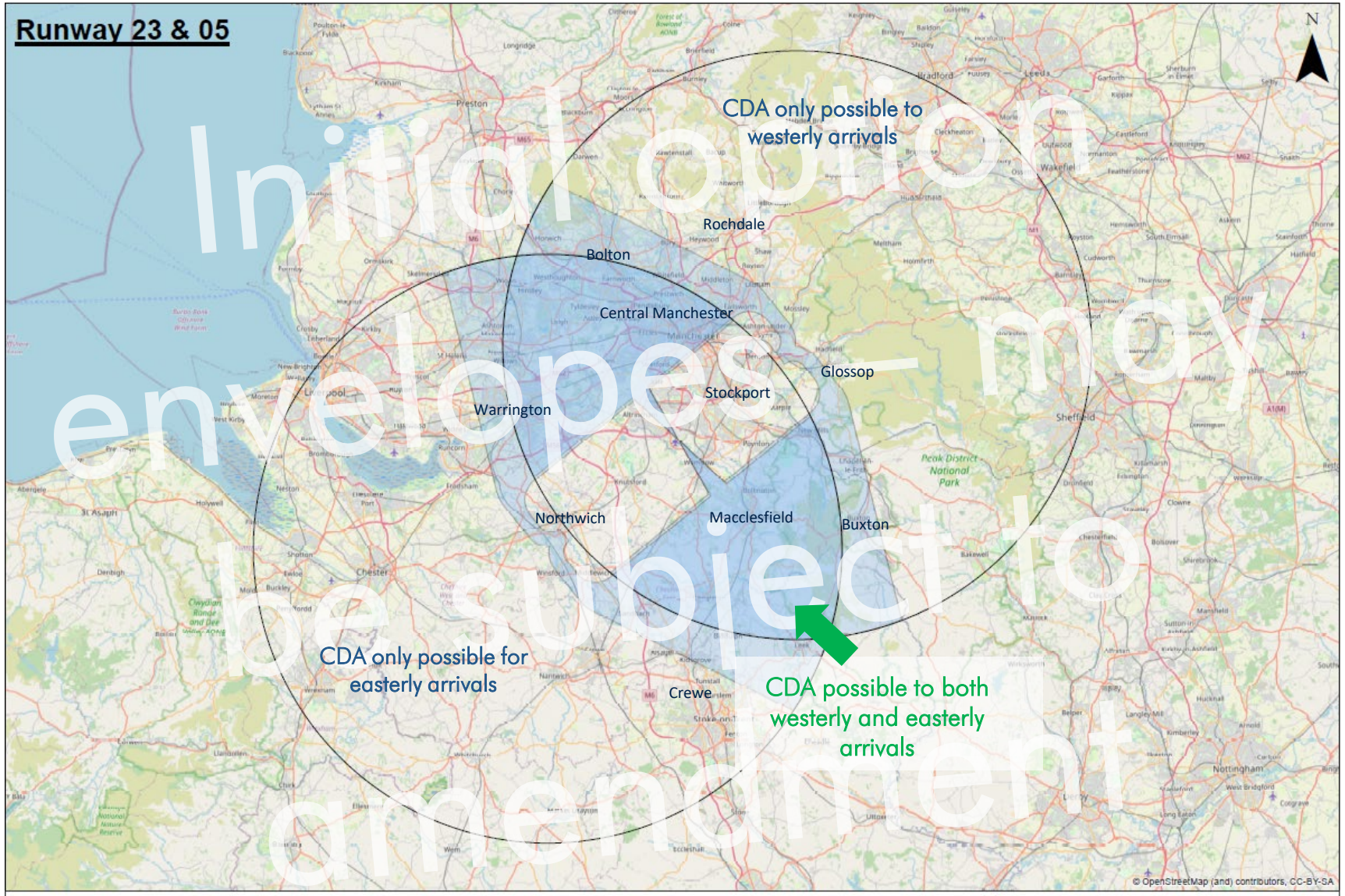
Arrivals Design Area – Initial Arrival Design Envelopes



0 10 20 40 60 km

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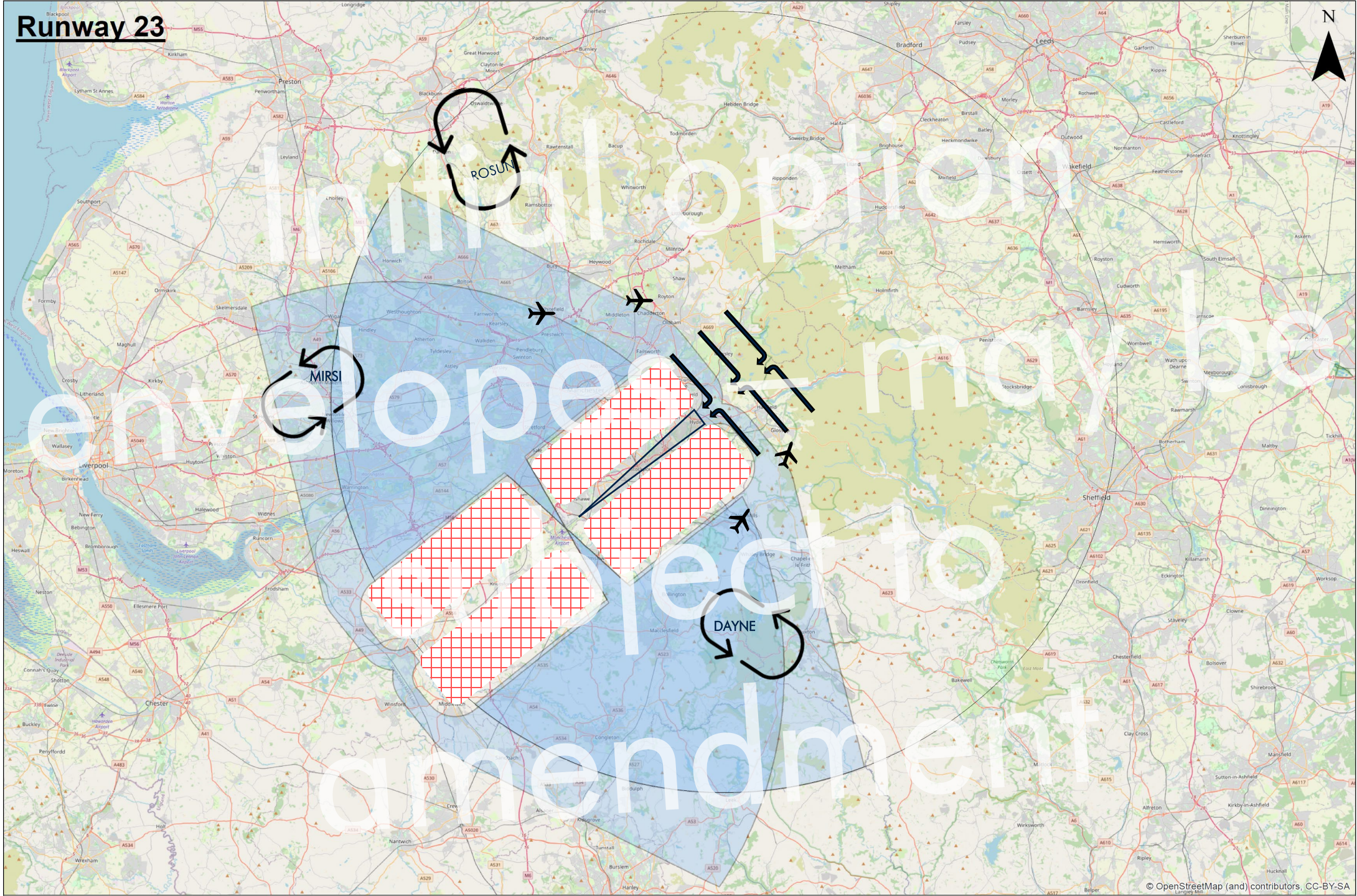
Initial Arrival Design Envelopes, Runway 23 –Westerlies



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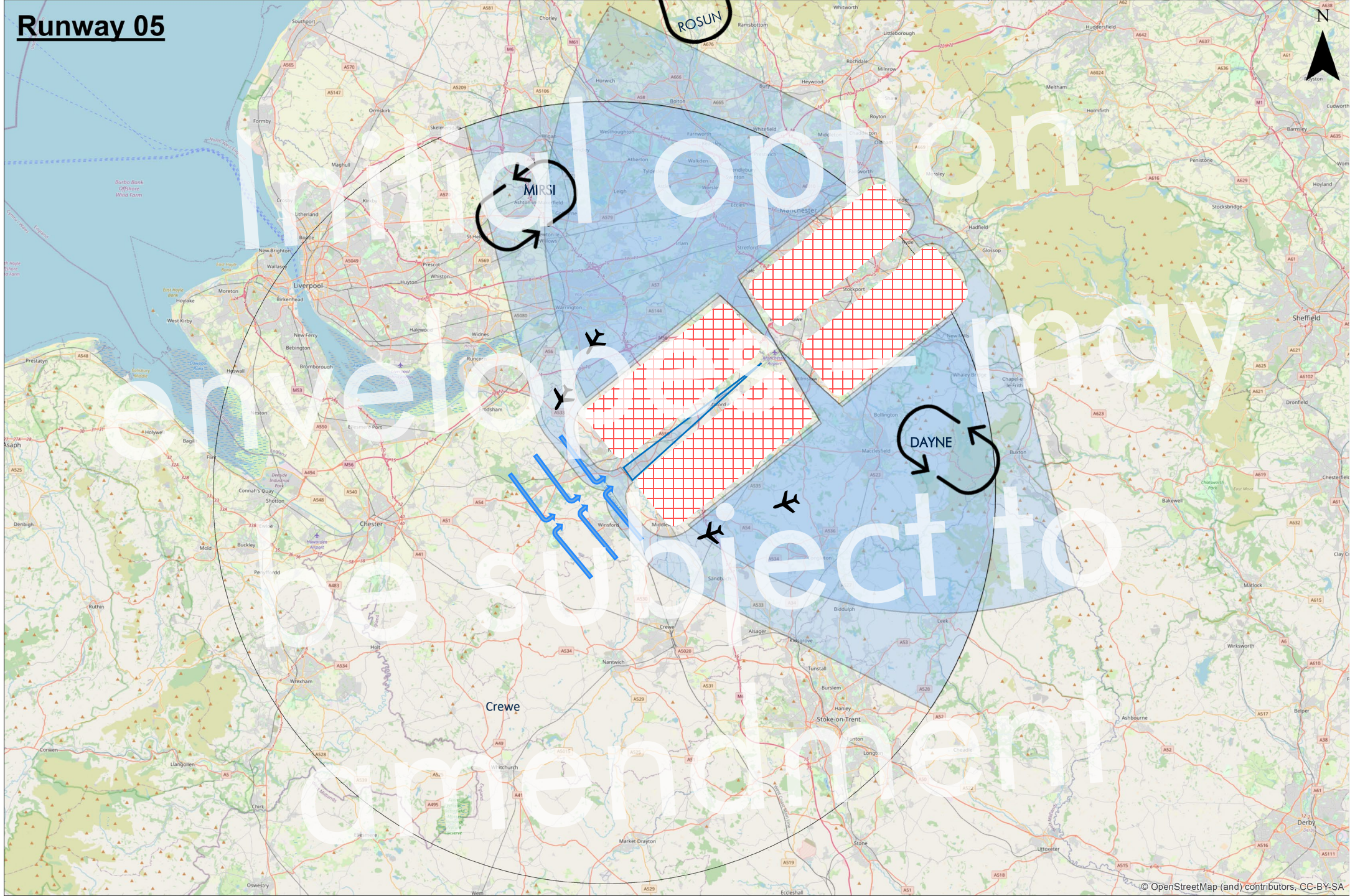
Initial Arrival Design Envelopes, Runway 05 –Easterlies



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FEEDBACK –ARRIVALS?

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

Provide your answers at: https://forms.office.com/r/iNCwBydhmN

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NEXT STEPS

Please provide any additional at:

https://forms.office.com/r/iNCwBydhmN

by 17:00 hrs on Friday 10th December 2021

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